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Performance Examination of Diesel Engine by Using Castor Oil Biodiesel

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ABSTRACT

The assets of petroleum as fuel are decreasing day by day and rising demand of fuels, as well as increasingly stringent emission regulations, attitude a challenge to science and technology. This aspect has drawn the attention to conserve and stretch the oil reserves by conducting research on alternative fuels. Therefore, in this paper the forecasts and openings of using methyl esters of castor oil as fuel in an engine are studied. In the present work tests were focused on a four stroke, single cylinder, D.I. diesel engine with Diesel and various blends of castor oil biodiesel. The results of tests are compared for various blends of castor oil biodiesel with that of neat diesel. The results indicate that at blend B20, Brake Specific Energy Consumption (BSEC) and Brake Specific Fuel Consumption (BSFC) is decreases as load increases as compared to other blends.

Keywords: Blend, Biodiesel, BSEC, BSFC etc.

I. INTRODUCTION

Current study focuses that biodiesel and its derivatives, have received much attention in recent years for diesel engines. Biodiesel is an oxygenated diesel engine fuel that can be obtained from vegetable oils or animal fats by conversion of the triglycerides to esters via transesterification. It has similar properties to those of fossil diesel. Therefore, research on biodiesel derived from vegetable oils and animal fats lead to the study of alternative to petroleum based diesel fuels [1][2]. It has been reported by the results of many studies that biodiesel can be used in diesel engines with little or no modifications, and with almost the same performance. Besides it reduces carbon monoxide (CO), unburned hydrocarbons (HC) and smoke emissions. However, a mainstream of results stated an increase in nitrogen oxides (NOx). The results vary according to the base vegetable oil or animal fats, the process of biodiesel production as well as biodiesel fuel properties. Therefore, different blends of biodiesels and neat diesel were tested in diesel engines at different engine loads [3][4].

On the other hand, biodiesel has high viscosity, high density, lower calorific value and poor non-volatility, which leads in pumping problem, atomization problem and poor combustion inside the combustion chamber of a diesel engine. In case of long-term use of vegetable oils in diesel engines, problems such as gumming,

injector fouling, piston ring sticking and contamination of lubricating oils are bound to occur [5][9]. All these problems are due to the high viscosity of vegetable oils. Hence, it is necessary to reduce the viscosity of vegetable oil to a more approximate value of diesel. The solution to the problems has been approached in several ways, such as preheating the oils, blending them with diesel, thermal cracking and transesterification [5][7].

Transesterification is a process of using an alcohol, viz. methanol, ethanol or butanol in presence of a catalyst, such as sodium hydroxide (Na OH) or potassium hydroxide (K OH), which chemically breaks the molecule of raw renewable oil into methyl or ethyl esters of the renewable oil with glycerol as a byproduct, reducing the viscosity of the oil. As the properties this oil are very much similar to that if petroleum diesel it is known as 'Biodiesel' [10].

In the present study the biodiesel derived from castor seed oil has been used. To find out the performance of biodiesel prepared from castor seed oil, testing was undertaken with single cylinder compression ignition engine at an average constant speed of 1500 rpm at different loads and for various blends of petroleum diesel and castor oil biodiesel.

II. EXPERIMENTATION

Experiments were carried out on a single cylinder, vertical, 4-stroke cycle, single acting, totally enclosed, water-cooled, compression ignition engine. Diesel, biodiesel (B100) and its blends B20, B40, B60, and B80 were used to test the engine of the specifications mentioned in Table.2. The performance and emission characteristics of the engine were studied at different engine loads (25%, 50%, 75% and 100% of the load corresponding to the load at maximum power at an average engine speed of 1500 rpm). At each load, the engine was stabilized for 20 minutes and then measurement parameters were recorded. The exhaust of the engine was tested using a Hartridge smoke-meter of Netel make. The engine was loaded using the eddy current dynamometer. According to the results obtained, the graphs between BSEC and BMEP, exhaust gas temperature and BMEP and Smoke opacity and BMEP are plotted.

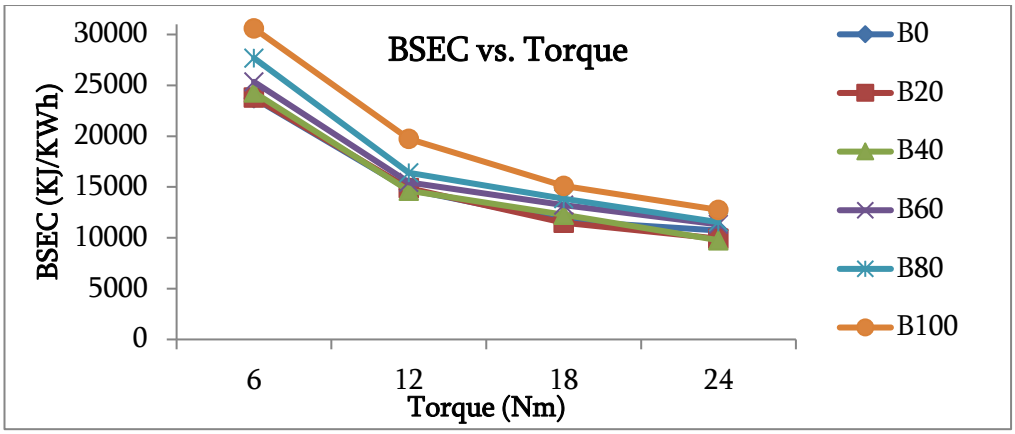
Table 1. Specifications of engine used

Make	Kirloskar
Type	Single-cylinder, four-stroke, compression ignition diesel engine
Stroke	110 mm
Bore	80 mm
Compression ratio	16.5:1
BMEP at 1500 rpm	5.42 bar
Rated output	3.7 Kw
Rated speed	1500 rpm
Dynamometer	Eddy current,water-cooled with loading unit

III. RESULT AND DISCUSSION

3.1. Break Specific Energy Consumption:

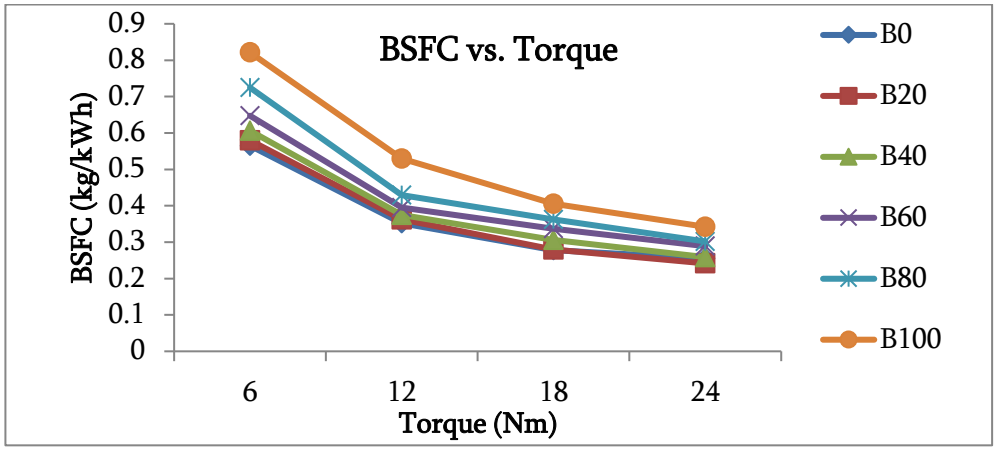
The energy used by the engine to developed unit power. The fuel having less calorific value the brake specific energy consumption is higher as compare to diesel [12]. From the graph no 3.1 as the load increases the brake specific energy consumption is decreases. The BSEC for blend B20 at full load is higher than B100.



Graph No.3.1: BSEC vs Torque

3.2. Brake Specific Fuel Consumption

The variation of brake specific fuel consumption is shown in graph 3.2. As showed in graphs, the BSFC generally increased with the increase in biodiesel percentage in the fuel blend. Because of advanced density, oxygen content of fuel resulting fewer heating value of bio diesel blends. So to provide same engine output more fuel mass flow rate is required due to lower energy content of biodiesel, causes higher mass injection for the same volume at same injection pressure which results in increase in BSFC.[11]



Graph No.3.2: BSFC vs Torque

IV. CONCLUSION

This research drive to study the performance of castor biodiesel and its different blends with diesel and find the best blend to be used in diesel engine. The blend B20 shows best performance for use in compression

ignition engines at atmospheric temperature. The complete features of castor oil biodiesel and diesel are similar. Hence biodiesel is a 'New Era Fuel' of tomorrow and which will reduce our dependence on oil producing countries.

V. REFERENCES

[1]. A.K.Babu, G. Devarao. 'Vegetable Oils and Their Derivatives as Fuels for CI Engine: An Overview": SAE 2003-01-0767.

[2]. M.V.Nagarhalli, V.M.Nandedkar, K.C.Mohite" Emission and Performance characteristics of Karanja Biodiesel and its blends in CI engine and its economics" ARPN journal of Engineering and Applied science, vol. no.5, issue no.2, Feb. 2010, pp.52-56.

[3]. M.A. Kalam, H.H. Masjuki,."Biodiesel from Palm Oil- an analysis of its properties and potential", Biomass and Bioenergy, vol. no.23, 2002 , pp.471-479.

[4]. N.L. Panwar , Hemant Y. Shrirame, N. S. Rathore, Sudhakar Jindal, A. K. Kurchania,"Performance evaluation of a diesel engine fueled with methyl ester of castor seed oil", Applied Thermal Engineering, vol. no.30, 2010, pp. 245-249.

[5]. Hanbey Hazar, Huseyin Aydin, "Performance and emission evaluation of a CI engine fueled with preheated raw rapeseed oil (RRO)–diesel blends" Applied Energy vol. no.87, 2010, pp.786–790.

[6]. JinlinXue,Tony E. Grift, Alan C. Hansen, "Effect of biodiesel on engine performance and emmisions",Renewable and Sustainable Energy Reviews vol. no. 15,2011, pp.1098 - 1116.

[7]. Sumedh Ingle, Vilas Nandedkar , Madhav Nagarhalli , "Performance Characteristics of Diesel Engine operating with preheated Palm Biodiesel" Emerging Trends in Science, Engineering and Technology, Lecture Notes in Mechanical Engineering, © Springer India 2012, pp.123-129, ISSN no. 978-81-322-1007-8.

[8]. Mohammed Harun Chakrabarti, Mehmood Ali," Performance of Compression ignition engine with indigenous castor oil Biodiesel in Pakistan", NED university Journal of research, Vol VI, issue no1, 2009, pp.10-19.

[9]. Devendra Vashist, Mukhtar Ahmad," A Comparative study of castor and Jatropha oil source and its Methyl ester test on the Diesel engine" International Journal of Engineering Science and Technology, vol.3, no. 6, June 2011, pp. 4765-4773.

[10]. Deshpande D.P, Urambkar Y.D and Thakare P. B ,"Production of Biodiesel from castor oil using acid and base catalyst" Research Journal of chemical science, vol. 2, no. 8, August 2012, pp. 51-56.

[11]. Hifijur Raheman, Prakash C Jena and Snehal S Jadav, " Performance of diesel engine with blends of biodiesel and high –speed diesel" International Journal of Energy and Environmental Engg.2013,4:6

[12]. C,Srinidhi, S.V.Channapatna, Dr. A.A.Pawar, "Performance And Emissions Of Diesel Engine Fuelled With Ethanol And Palm Oil Methyl Ester" (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 04 | Apr-2016 p-ISSN: 2395-0072

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Review On Design and Development of CNC Tube Bending Tool

Dipak D. Shelke[1], Tushar Devadiga[2], Rohan Phuge[2], Pratik Nalkar[2], Prajval Walve[2], Umaji Kolekar[2], Amol Gaikwad[2], Vinod Tirpude[2]

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ABSTRACT

The automotive industry at the time hadn't started the big push to lighten cars and make the more efficient. The tubing was 1.5-2mm thick, and if you were bending 1.5mm wall tubing in the '90s, some considered that "thin wall". Wiper shoe die and post from which the wipers we remounted to. With the tighter bend radii that have developed over the years and the thinner wall material being bent, the wiper towers and wipers realize more pressure than ever before. A mandrel is a tool that controls the flow of plasticizing material at the point of the bend in order to maintain the shape of the tube as it sets into the arc of the bend. There are many types of mandrels as the application dictates the type required to do the job. Design and development of CNC tube bending is one of the methods used for bending of thin wall tubes. In this process, the mandrel is positioned inside the tube, and the bend die, clamp die, pressure die, and wiper die surround the tube. The bending is conducted around the bend die.

Keywords: Pipe bending, rotary draw bending, ball mandrel, Wiper die

I. INTRODUCTION

One Nowadays, bending technology plays an important role in various fields such as automobile, aerospace, petroleum, and gas industries. Tube bending is a per-forming stage in tube hydro-forming. Various methods are applied for thin wall tube bending among which rotary draw bending and stretch forming are more noticeable than others. In rotary draw bending, it is necessary to use certain tools such as clamps, pressure die, mandrel, and wiper. Tube is located between clamp die and bend die, and it is bent around the Centre of the bend die. Pressure die prevents movement of the tube and also provides a better quality of bending by an action known as boosting. Mandrel is used inside the tube to prevent flattening of outer wall and wrinkling of inner wall of the tube. The mandrel and die positioning, the mandrel is located inside the tube, and the mandrel's ball segments support the bending zone during the bending process and prevent excessive tube's ovality which can result in failure of outer zone or wrinkling of inner zone. Pipe bends are taken into consideration crucial additives because of their particular deformation behavior that is characterized through improved flexibility

and strain intensification as compared with directly segments of the identical size and cloth. Flexibility and pressure intensification elements compare cease deflection and maximum stresses of a pipe bend to those of a instantly pipe of the same diameter, wall thickness and period respectively. Analytical, experimental, and numerical analyses of pipe bends underneath internal pressure and operating moments are available in literature. Analytical answers are primarily based on the belief of elastic material behavior and forget about geometrical imperfections [1]. In recent years, the rapid development of aerospace industry urgently requires large-diameter thin walled (LDTW) CP-Ti bent tubes with small bending radius (R≤2D, R-bending radius, D-outer diameter) to increase the flux and reduce the total weight of plane. However, both hexagonal close-packed crystal structure and the large size factor (D/t>20, t-wall thickness) restrict the bending formability of LDTW CP-Ti tubes at room temperature, and the over thinning and wrinkling easily occur during the cold bending process and the Researches have shown that cold bending process can raise the surrender strength by 20%- 30%. And also, the maturity of the NC technologies made it naturalness to use cold bending NC machine tools [8,10]. the implications of using CB as an alternative to RDB, as it can provide some benefits: • CB produces lower scrap rates, as there is no end clamp as needed for RDB, • CB enables the possibility to make a spline that translates into a small radius bend due to the lack of an end clamp, and • the CB process can act as redundancy in case of RDB tooling breakdown on a dual-stack setup [9].

II. PROBLEM STATEMENT

The product must be designed, which is a crucial step in the manufacturing process. It is thus because these factors—product quality, performance, and final price—have a greater impact at this point. The major goals of the work are to boost productivity, decrease cycle time, lower tooling and maintenance costs, and improve the quality of the finished product. According to data from our survey, the pipe with an OD of 10 to 38 millimetres and a thickness of 0.8 to 10 millimetres gets wrinkled while bending. However, with the help of our innovative solution, we can address this issue and achieve perfect finishing for our bending pipe

III. LITERATURE REVIEW

Sherif S. Sorour (2019) The work in this paper is focusing on the ovality of the pipe while pipe bending and the limit load acting on it and it causes residual stresses. the fabrication of pipe bending in rotary bending machine results in geometrical imperfection like sectional ovality and wall thickness which affect the load carrying capacity of pipe. Previous Studies ignored that and that Affect pipe Bending Shape. The objective of the objective of the present work is to investigate the effect geometrical imperfections as obtained from the rotary pipe bending process of 90° pipe bends. with including the presence of residual stresses on their load carrying capacity and the present work is conducted by of non-linear finite element modelling considering both material and geometrical non-linearity. Rotary pipe bending process is simulated with basic tooling configuration to obtain the as-fabricated 90° pipe bend the pipe bend was then subjected to different combinations of inplane moment and internal pressure in order to construct a comparative limit load diagram. The IB model for the pipe bend results in non-conservative results, while AS model results in acceptable results compared to results of the

as-fabricated shape. Results have also shown that presence of residual stresses improves the pipe performance under in-plane closing bending moment. The material used is carbonmanganese-silicon steel (ASTM A573-81 Grade 65) and the simulation procedure in three steps first was the simulation of pipe bending to obtain AF model, second is re-simulation of the manufacturing process to produce a 90° pipe bend after spring back the third step is the LLA and is conducted on the AF where results are compared against IB and AS models [1].

Gangyao Zhao, Yuli Liu & He Yang (2010) On this paper the primary attention is the clearance between tube and the various dies and have a tremendous and complicated effect on the onset of wrinkling at some stage in the rotary draw bending technique. To study the effect of clearance on wrinkling, a 3-d finite element (FE) model of the manner for thin-walled square aluminum alloy tube has been constructed the use of the explicit code ABAQUS/express and validated through evaluating the test. Then, simulation and analysis of the method have been achieved based at the version. The have an impact on legal guidelines of clearances among tube and numerous dies on wrinkling had been studied and the reasonable mixture of clearances acquired the use of the aggregate technique of 3-D FE simulation and orthogonal experimental design. The consequences show that with the boom of tube mandrel clearance, Δc m, and tube bending die clearance, Δc b, the wrinkling wave range decreases unexpectedly, while the wrinkling wave height increases sharply. The consequences of tube wiper die clearance, Δc w, and tube pressure die clearance, Δc p, on wrinkling aren't widespread. The reasonable aggregate of clearances is Δc m = 0.15 mm, Δc b = zero mm, Δc w = zero mm, and Δc p = zero mm. those achievements are useful to the design and optimization of the method [2].

J.E. Griffiths (1979) This paper considers the effect of defects or cracks on the collapse load of thin-walled pipe-bends under in-plane bending. Experimental work is described which was carried out to establish the limit moment for bends containing both circumferential and meridional defects. The results of the collapse tests on the bends without defects were in good agreement with limit analysis predictions, modified to take account of the stiffening effect of tangent pipes. Meridional defects do not substantially reduce the limit moment of short radius bends, whereas significant reductions can occur for cracks of length greater than one pipe diameter in long radius bends. The results for bends containing circumferential cracks indicate that a significant reduction in limit moment occurs for crack lengths greater than one pipe diameter [3].

G.Y. Zhao (2010) the main cognizance of this paper is rotary-draw bending procedure for skinny-walled rectangular tube of aluminum alloy may additionally produce a wrinkling phenomenon if processing parameters are inappropriate, in particular for tubes with thin wall and small bending radius. To predict this wrinkling rule rapidly and correctly, right here, a wrinkling wave feature become proposed and a wrinkling prediction model became developed based totally on the deformation theory of plasticity combined with the strength approach, and then the minimum bending radius without the incidence of wrinkling in the procedure was acquired. furthermore, the consequences of geometrical parameters and the cloth residences of the tube at the minimal bending radius were analyzed. The effects show that larger thicknessto-width ratio (t/b) and thickness-to-peak ratio (t/h) are useful to improve the wrinkling limit of the tube. The minimal bending radius turns into smaller with an boom in pressure-hardening exponent of the tube, whereas with the power coefficient decreasing. And the young's modulus has little effect at the wrinkling restrict. these achievements are helpful to broaden the bending approach and provide a guideline in rotarydraw bending method for skinny-walled square aluminum alloy tube [4].

A.H. Sofiyev (2019) This Paper offers facts about the stableness of FG-CNTRC conical shells underneath external pressures the use of FSDT is investigated alongside the primary equation of FG-CNTRC-CSs are derived and solved through the use of Galerkin approach and acquired the formulation for lateral and hydro static pressures of FG-CNTR-CSs. The pressures of FG-CNTR-CSs. a powerful analytical answer for the stability trouble of functionally graded (FG) carbon nanotube bolstered composite (CNTRC) conical shells (CSs) exposed to outside lateral and hydrostatic pressures is offered. The substances of functionally graded carbon nanotube reinforced composite conical shells (FG-CNTRC-CSs) are graded within the thickness route in line with linear distributions of the quantity fraction of CNTs. The powerful fabric properties of CNTRC-CSs are calculated the usage of the prolonged aggregate rule. The basic equations of CNTRC-CSs are derived using changed Donnell-type shell idea based totally on the first order shear deformation theory (FSDT). ultimately, numerical calculations are done to illustrate the outcomes of numerous graded profiles and extent fraction of CNTs and variation of CSs geometry at the vital external pressures for FGCNTRC-CSs [5]

Idir Kessai (2022) Failure analysis and lifetime assessment of drilling systems are very important to reduce maintenance costs. Of all the failure modes, coupled vibration due to the stick–slip phenomenon is the most common problem that can affect rotary drilling systems. the principle objective of this look at is to estimate the number of cycles earlier than failure (useful life) of the decrease part of rotary drilling gadget tool-string below axial and torsional vibrations. To attain this goal, a complete system based totally on extraordinary techniques and procedures, such as: finite detail technique (FEM), rain flow counting technique (RFM), Goodman method (GA), S-N diagram and Miner's rule, has been proposed. To this cease, the FEM has been used to decide the loading cycles (equivalent strain); while, the range of strain cycles in the loading cycle diagram has been counted the use of RFM. The GA has been used to choose the principle cycles that can purpose failure on the tool string and to calculate their amplitudes. Then, S-N diagram has been used to determine the number of cycles to failure of the tool string. sooner or later, Miner's rule has been applied to find the approximate time to failure of the drilling machine. concerning the estimation of the tool string lifetime, the effects received have proven a terrific settlement with actual information recorded in an oil field in Algeria [6].

Gholamali Naderi (2022) This paper investigates the bending of a good healthy Pipe (TFP). it's miles a double-walled pipe with a corrosion-resistant alloy (CRA) liner fitted internal a carbon metal outer pipe via thermal-hydraulic production. due to the effects of diverse variables, inclusive of the process of manufacturing of a double-walled pipe, the preliminary imperfections in the inner pipe, and the mandrel region in rotary draw bending (RDB) without defects, it isn't smooth to study TFP bending. For efficient system modeling, a new plugin is advanced. With this plugin, the production and bending are without problems simulated and gift the very last bending exceptional (separation, wrinkling, ovality, and spring back) in some diagrams entirely and concisely. A stress histogram is added to quantify the research of separation between pipes and wrinkling. The plugin evaluates the ovality diagram, and the quantity of spring back is offered without delay. Then the production and bending techniques are performed experimentally, and the functionality of the plugin is investigated. due to the variation of residual pressure in the production system and the plugin results, the simulation accuracy inside the manufacturing technique is showed. Then the contrast of wrinkling at the end of the procedure shows precise settlement among the effects of the provided plugin and the experimental effects [7].

Y.N. Lai (2007) the main consciousness of this paper is the numerical simulation approach is used to resolve the troubles of pipe bending production inclusive of die with fine cracks, ovality of pipe. The fanformed die is welded with metallic plate in circle and rib in radial direction by the evaluation of structural deformation. The surest design is provided with ovality of pipe as item variable and sliding slot dimensions as design variables. in comparison with experiential form groove of slot, ovality of optimized slot decreases about 10.5% in common. It significantly decreased the manufacturing value the use of laptop simulation method to update quite a few experiments improving tube-bending manufacturing [8].

Sigmund A. Tronvoll (2022) Because the first examine in the field regarding CB, this paper investigates the consequences of interchanging between RDB and CB via production bends with various angles and investigates the difference between the two strategies in form of spring back, move phase compression and widening, move segment form and wall thinning/thickening. The experiments conducted includes aluminum alloy 6060-T4 round tubes of 60 mm diameter and 3 mm wall thickness, bent around 222 mm radius tooling with numerous bend angles. In this case, we've got observed that CB is able to manufacturing bends with exceptional near the ones synthetic by means of RDB with less spring back, but with a dimensional penalty concerning expanded deformation of the go phase [9].

Zhiyong Zhang (2014) This paper recalls the heat rotary draw bending of massive-diameter skinnywalled (LDTW) business pure titanium (CP-Ti) tube is a incredibly nonlinear thermo-mechanical coupled physical procedure. growing a reliable finite element (FE) model for this technique is an powerful manner to investigate the warmth loading and the complicated bending behaviors. on this take a look at, thinking about the characteristics of multi-die constraints and nearby heating, a thermo-mechanical 3-D-FE version became hooked up for preheating and warmth bending of LDTW CP-Ti tube in terms of both accuracy and efficiency. First, using the static implicit set of rules, a preheating version changed into advanced to are expecting the temperature distribution of bending gear. in this model, the key problems together with the overall-sized geometry modelling, thermal interplay definition, and automatic heating manipulate were solved to growth the simulation accuracy and performance. Then, introducing the predictions of preheating version and using the dynamic specific set of rules, a thermo-mechanical coupled three-D-FE model become installed for the heat bending simulation through the geometry modelling simplification, temperature definition of bending tools, recognition of non-uniform temperature distribution, and so on. considering the temperature records of bending gear and wall thickness converting of bent tube, the reliability of preheating version and heat bending version become proven by way of numerous experiments [10].

IV. CONCLUSION

In the thesis, the design and development of cnc tube bending tool theory with all parameters performed on a form application designed. This application is designed in AutoCAD and solid works. Tube bending is carried really big importance in most of industrial applications such as automotive industry, aerospace industry, vehicle chassis, HVAC systems and so on. Thus, all companies work on this matter too much in their Research and Develop(R/D) department because of being the best in competitive sector and so good quality endproduct can be produced with less time spending and reaping a profit. All of these reasons, this thesis theory was researched

detailed to reach results which closer to reality. All results also have been also checked by several methods as mentioned in before chapters. Finally, matching of form application design output with reality of bending tube.

V. ACKNOWLEDGEMENT

I would like to thank GOD for his help and support. Without His help, it would have been impossible to succeed in this project. I want to express my deep gratitude to my project guide, Prof. D.D. Shelke for him patience guidance, encouragement, and helpful criticism on this research work.

VI.REFERENCES

[1]. Sherif S. Sorour, Mostafa Shazly, Mohammad M. Megahed, Limit load analysis of thick-walled asfabricated pipe bends under in-plane moment loading and internal pressure, International Journal of Pressure Vessels and Piping, (2019)

[2]. Zhao, G., Liu, Y. & Yang, H. Effect of clearance on wrinkling of thin-walled rectangular tube in rotary draw bending process. Int J Adv Manuf Technol 50, 85–92 (2010). https://doi.org/10.1007/s00170-009-2508-7.

[3]. J.E. Griffiths, the effect of cracks on the limit load of pipe bends under in-plane bending: Experimental study, International Journal of Mechanical Sciences, Volume21, Issue 2, (1979)

[4]. G.Y. Zhao, Y.L. Liu, C.S. Dong, H. Yang, X.G. Fan, Analysis of wrinkling limit of rotary-draw bending process for thin-walled rectangular tube, Journal of Materials Processing Technology, Volume 210, Issue 9, https://doi.org/10.1016/j.jmatprotec.2010.03.009.

[5]. A.H. Sofiyev, B. Esencan Turkaslan, R.P. Bayramov, M.U. Salamci, Analytical solution of stability of FGCNTRC conical shells under external pressures, ThinWalled Structures, Volume 144, (2019) https://www.sciencedirect.com/science/article/pii/ S0263823119306834

[6]. Idir Kessai, Samir Benammar, M.Z. Doghmane, Dynamic failure analysis and lifetime estimation of Tool-string in rotary drilling system under TorsionalAxial coupled vibrations, Engineering Failure Analysis, Volume 134, (2022) https://doi.org/10.1016/j.engfailanal.2022.106037

[7]. Gholamali Naderi, Seyed Houssain Dibajian, Seyed Ebrahim Moussavi Torshizi, Amirreza Masoumian, Martin Stockinger, An ABAQUS plugin for rotary draw bending of tight fit pipes, International Journal of Pressure Vessels and Piping, Volume 200, (2022) https://doi.org/10.1016/j.ijpvp.2022.104827

[8]. Lai, Yi Nan, et al. "Numerical simulation and optimal design of rotary draw bending pipe." Applied Mechanics and Materials. Vol. 10. Trans Tech Publications Ltd, 2008.

[9]. Tronvoll, Sigmund A., Jun Ma, and Torgeir Welo. "Deformation behavior in tube bending: a comparative study of compression bending and rotary draw bending." The International Journal of Advanced Manufacturing Technology (2022): 1-16.

[10]. Zhang, Zhiyong, et al. "Thermo-mechanical coupled 3D-FE modeling of heat rotary draw bending for large-diameter thin-walled CP-Ti tube." The International Journal of Advanced Manufacturing Technology 72.9 (2014): 1187-120

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A Comparative Study of Bamboo Reinforced Vs Steel Reinforced Concrete Structure

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ABSTRACT

The building industry is the leading consumer of energy and materials in the majority of nations. Concrete is strong in compression but weak in tensile strength. To obtain tensile strength, steel is added as reinforcement in concrete. Bamboo has a high compressive and tensile strength. As a result, the use of bamboo as a structural building material is gaining popularity, Bamboo is one of the oldest building materials on the planet. Bamboo is being used for bridges, scaffolding, dwellings, and other temporary structures from early times. This review paper is a theoretical demonstration of the extensive use of bamboo as reinforcement in construction and its detailed use in substitution for steel. The goal is to find ways to make the use of bamboo reinforced concrete beams simple, efficient, and cost-effective.

Keywords: Bamboo Reinforcement, Bamboo Reinforced Concrete, Tensile Behaviour, Cost Reduction

I. INTRODUCTION

As we all know, India is a developing country with a growing population which is driving up the housing demand. The construction industry is one of the most energy-intensive industries on the planet. Concrete, steel, wood, glass, plastic, and a variety of other materials are used in construction. Steel-reinforced concrete is usually used to construct housing structures. Several studies have begun in recent years to investigate the use of low-cost and low-energy substitutes for construction. Among the various possibilities for such substitutes. Bamboo's rapid growth and maturity rate, sustainability, aesthetics, acceptability, its strength properties and low cost makes it worth investigating as an alternative to steel. For thousands of years, bamboo has been used in the construction of bridges and homes. As described in [5] due to a unique rhizome dependent system of growth, bamboo is known to have over 1200 different species worldwide which makes it a common and easily available resource it is also known to have been widely used in building construction in different parts of the world. Some species of bamboo can grow as tall as 35 inches within a 24-hour period. Bamboo has a higher compressive strength than wood, brick, and concrete, as well as tensile strength relatively similar to steel.

According to [4] Bamboo has strong mechanics and adaptability, and it is simple to process, making it suitable for a wide range of architectural and industrial applications. Bamboo has a compressive strength 10% higher than wood but a comparative tensile strength.

Though steel has a tensile strength 2.5-3.0 times that of bamboo and a specific gravity 6-8 times that of bamboo, the tensile strength of bamboo is 3- 4 times that of steel when measured per unit weight (bamboo vs steel). The study compares the tensile strength of bamboo to steel as a structural engineering material.

A. Problem Statement

1) **Economy:** In recent years, steel prices have soared. For developing countries, steel is difficult to obtain because of expensive prices, and for the construction industry, usage of steel is currently limited heavily. The production of steel has high consumption of fossil fuels, so, the steel discharge in the construction of structures has been presented, showing the possibility of drastic reduction by research institutes. Meanwhile, for developing countries, it is important to make the development of buildings construction; low cost, no requirement of sophisticated technologies and reliable construction methods.
2) **Efficiency:** To clarify the differences of structural properties from steel reinforced concrete and bamboo reinforced concrete. mainly intended to check the possibility of employing bamboo as reinforcing material for concrete s substitute to steel bars. Bamboo is being used as scaffolding, floorings, rafters, posts, poles and member of trusses in building construction.

B. Objectives

1) To investigate the behavior of bamboo as reinforcement.
2) To study the evaluation of feasibility of the use of Bamboo as reinforcement in concrete members. The bamboo is to be used as concrete reinforcement it is necessary to understand how bamboo behaves in tension.
3) To study the strength of bamboo reinforced concrete beam with load.
4) To reduce the cost of construction material by using another material that can be found locally.
5) To compare the efficiency of bamboo reinforced concrete against conventional concrete and steel reinforced concrete.

II. LITERATURE REVIEW

Alvin Harrison, Akash Agrawal, Ashhad Imam (et.al); In this research steel is replaced by using bamboo and its mechanical properties were studied. Experiments were performed to check the compressive, tensile and flexural strength the results show the satisfactory anticipation and possibilities of using bamboo reinforcement as a replacement of steel reinforcement in concrete structures may be feasible in terms of low cost green construction.it also shows the significant enhancement in compressive strength and flexural strength of bamboo reinforced concrete as compared to plane cement concrete. The split tensile strength was slightly same

in bamboo reinforced concrete and plane concrete, the reason for slightly same result due to failure is taking place in concrete others wise the tensile strength of the bamboo is also high.[6]

Mahzuz H. M. A, Ahmed Mushtaq, Ashrafuzzaman M, Karim Rejaul and Ahmed Raju (et.al); The shear strength of bamboo reinforcement in concrete reveals that concrete members reinforced with sections of bamboo culms, which had been separated along their horizontal axes, developed considerably higher load capacities than unreinforced concrete beams of similar sections. The ductility of tension bamboo reinforcement is low and collapse of beams is distinguished by splitting of concrete from the tension reinforcement and brittle failure. The shear capacity is enhanced by increased amount tension reinforcement and addition of web reinforcement. [7]

Mark, A.A. and Russell (et.al); A study of the shear strength of bamboo reinforcement concrete reveals that concrete members strengthened with sections of bamboo culms, that had been split on their horizontal axes, developed significantly higher load capacities than unreinforced concrete beams of comparable sections. The plasticity of tension bamboo reinforcement is low and failure of beams is characterized by rending of concrete from the stress reinforcement and brittle failure. The shear capability is increased by increased quantity tension reinforcement and addition of net reinforcement. It is therefore recommended that bamboo reinforced concrete beams are reinforced with steel stirrups to improve on its load carrying behavior. [8]

Mritunjay Kumar Singh, Shiv Pratap Singh, Kaisar Jamal, Piyush Verma (et.al); In this study the focus was on the very special type of engineering reinforcing material like bamboo. Their property is well known to us by through upcoming decades and thus it is not yet properly utilized. In some extent bamboo contain some advantageous property like CO2 absorption as well as reduction in environmental pollution The property of bamboo is the reason for which it was selected as the material for reinforcing beams. It is a sure inevitability that the structural member that has been reinforced with bamboo will lose its strength up to a significant limit, so this project report has focused on providing a method by which steel and bamboo can be used as individual or together so that the strength of the member and thus the structure is not compromised with sighting a reduction in self weight and making the structure economical. [9]

III. METHODOLOGY

Bamboo reinforced concrete building follows same project, mix proportions and construction techniques as used for steel reinforced. Bamboo reinforcement is used in place of the original steel reinforcement. Specifically, as a strength bearing material. It is used to construct historical structures. This innovation was inspired by a study conducted at Clemson University's Agricultural College. Bamboo is a natural biodegradable and renewable material. It is energy efficient because it is natural and environmentally sustainable. For centuries, these properties have compelled their use in the construction field. When compared to other materials, including steel, bamboo has an appreciable tensile strength property, which is the main requirement of a reinforcing material. This property is due to the structure of bamboo from its origin. This hollow structure has high resistance against wind forces when it is in natural habitat Working on bamboo's weak points and developing bamboo as a structural steel replacement would be a fantastic alternative.

A. Material Preparation

Based on the previous studies [2], the following criteria have been measured in this research for the selection of bamboo for use as areinforcement in the concrete structures:

1) The bamboo showing a brown colour with at least three years old is selected.
2) The accessible biggest diameter of the culm is being selected.
3) The whole culm of green bamboo is not being used.
4) Avoid cutting the bamboo in spring or early summer because the bamboo is weaker due to increase in fibre and moisturecontent.

In this research, three years old bamboos plants of pronounced colour were selected. Samples (1 m each) were collected from the bottom of the plant having four or five nodes. The strength distribution is more uniform at the bottom of bamboo than at the top or at the middle of it since it is subjected to maximum bending stress due to wind at the top portion of the culms [1].

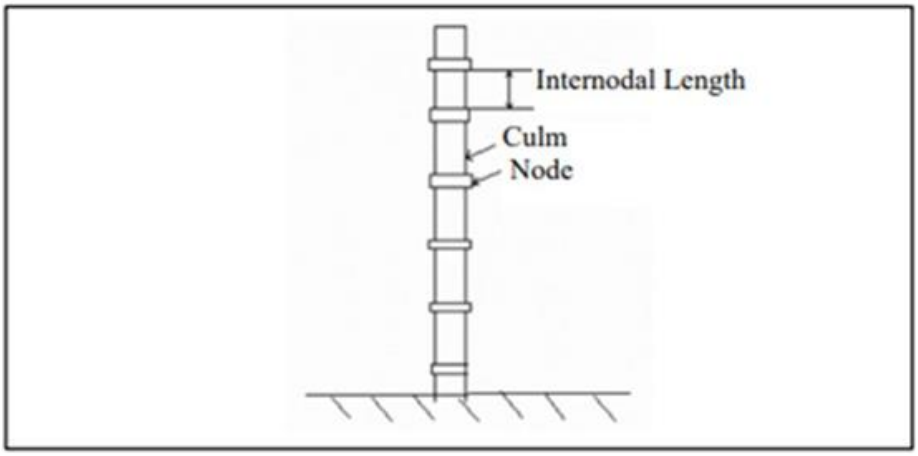

Fig -1: whole bamboo culm

By referring to the previous study [3], the characteristic of bamboos showed high water absorption and low bonding strength between bamboo's surface and concrete when used as a reinforcement in concrete. In order to prevent this problem, 'Tack coat' has been used to minimize the swelling of bamboo and to increase the bonding strength. The coated has been applied one day before the bamboos being used as a reinforcement in the beam sample.

Steel bar High yield steel deformed (HYSD) were used in this study in order to identify the performance of standard reinforcement used in concrete and to make a comparison with the bamboo reinforcement.

Concrete The concrete to be used in the beams was made using Ordinary Portland Cement, sand as the fine aggregate and stone chips as coarse aggregate with a maximum size of 20 mm. The concrete mix proportion (cement: fine aggregate: coarse aggregate) was 1:2:4 with 0.5 water cement ratio used in this study.

IV. RESULT

According to study Compression strength of round bamboo ranges from 47.9 to 69.9 Mpa and they are weak in shear [10]. Plain concrete and untreated bamboo columns showed brittle behavior in which, tiny cracks

occurred at the surface of the column at about 80% of maximum axial force [11, 12]. Use of bamboo as reinforcement may lead to economy as compared to structures reinforced with steel; thereby overall cost of construction can be reduced (10- 20%) [13]. Strength-Cost ratio of bamboo is more than nine times higher than that of steel [14].

V. CONCLUSIONS

The concept of sustainability in building construction has evolved over time as well. The issue of limited resources, particularly energy and how to reduce the impact on the natural environment received the most attention. Now, the attention is on more technical issues such as materials, building components, construction technologies, and energy-efficient design. bamboo as a potential material can be used as reinforcement. The load carrying capacity and flexural strength of the BRC beams are found much better with respect to plain cement concrete beam. Compression carrying capacity depends greatly on properties of concrete and bonding between reinforcements and concrete. BRC can resist more compression than PCC.

VI.REFERENCES

[1]. Ghavami K 1995 Cement & Concrete Composites 17 pp 281-288ahman M M 2011 International Journal of Engineering & Technology (IJET-IJENS) 11 pp 142-146
[2]. Ghavami K 2003 Cement & Concrete Composites 27 pp 637–649
[3]. Chinese Bamboo Research Council (CBRC), ―Cultivation of Bamboo,‖ Books 1&2, 2009.
[4]. D. Farrelly, ―The book of Bamboo,‖ San Francisco (CA), Sierra Club Books, 1984
[5]. Alvin Harison, Akash Agrawal, Ashhad Imam Bamboo as an Alternative to Steel for Green Construction Towards Low-Cost Housing, 2017
[6]. Mahzuz H. M. A, Ahmed Mushtaq, Ashrafuzzaman M, Karim Rejaul and Ahmed Raju, Performance evaluation of bamboo with mortar and concrete, Journal of Engineering and Technology Research, 2011.
[7]. Mark, A.A. and Russell,A comparative study of Bamboo reinforced concrete beams using different stirrup materials for rural construction. International Journal of Civil and Structural Engineering, 2011
[8]. Mritunjay Kumar Singh, Shiv Pratap Singh, Kaisar Jamal, Piyush Verma, BAMBOO REINFORCED CONCRETE: A Review, 2020
[9]. Ajinkya Kaware, Prof. U.R.Awari, Prof. M. R. Wakchaure,"Review of Bamboo as Reinforcement Material in Concrete Structure", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2
[10].Agarwal A. and Maity, D., "Experimental investigation on behaviour of bamboo reinforced concrete members", 16th International Conference on Composite Structures ICCS 16, 2011.
[11].M. B. Varma, "State of The Art: Bamboo as a Structural Material", International Journal of Engineering Research, Vol. 5, Issue 1 pp. 300-303, ISSN:2319- 6890, doi:10.17950/ijer/v5is1/ 071, 2016.

[12].Prajwal K., Trasha Maan, D.B. Nirmala. and Prashanth.V. P, "Feasibility Study on Locally Available Bamboo as Reinforcement Conventional RCC Structural Member", International Journal of Scientific Research, Vol. 5, Issue 11, ISSN No 2277 – 8179, 2016.

[13].H. M. A. Mahzuz, Mushtaq Ahmed, Jotan Dutta, and Rezwanul Haque Rose, "Determination of Several Properties of a Bamboo of Bangladesh", Journal of Civil Engineering Research, Vol. 3(1), pp. 16-21, DOI: 10.5923/j.jce.20130301.02, 2013.

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A Novel Approach for Inflation of a Vehicle Tire

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ABSTRACT

The main aim of this paper is to discuss an idea of a novel approach to the Inflation system. It is very important for every vehicle to be long lasting when driving distance Therefore, we have made this device to automatically turn on the air with only one control unit. The main purpose of this work is that when the air in the vehicle's tire reduces, the signal sensor warns the person to use the tire from the air tank to remove the air. Then the pressure increases. The increase in the tire of the car is similar to the process of showing the signal of the sensor by means of a person with an electric valve to reduce the excess air in the tire.

Keywords: Tire inflation, compressor

I. INTRODUCTION

This work of Automatic Air Inflation in Vehicle Tires is related to the difficulty of driving vehicles with low a high traffic. Improper and uneven printing causes difficulty in driving and leads to accidents. The program puts a lot of effort into keeping track of problems and thus reduces the problems of management.
This is done mechanically. The air can be inflated on the wheels without stopping the car. The air from the air cylinder is used to inflate the wheels. Air from the tank is sent to the wheels via a one-way valve. The twist made in the air hose is protected by a joint. The plan of the system is very simple and very economical. Therefore, the cars can be easily implemented. of the less room is needed for installation. Vehicle Tire Inflation Systems can save the day vehicle maintenance costs and improve fuel economy by nearly 1 percent, saving 100 liters of fuel and exhaust 1 metric ton of greenhouse gas emissions each year.

II. WORKING PRINCIPLE

It has a solenoid valve, control power, pressure Sensor, and tire model. Here we use a pressure sensor to detect the tire pressure level. The pressure level in the control unit is designed. When the pressure level drops, the sensor provides a signal to the control unit. If the pressure exceeds the required level, the control unit will switch the solenoid valve from air to air. When the required pressure is reached, the operation is stopped by the control unit.

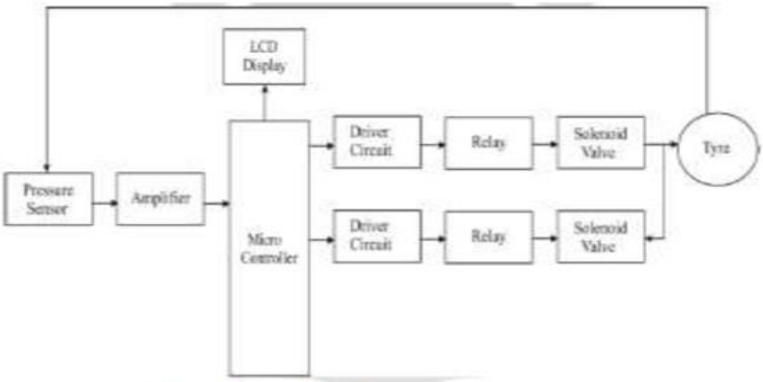

Fig -1: Block Diagram of System

III. COMPONENTS AND SPECIFICATION

3.1. Pressure Sensor

A pressure sensor usually acts as a transducer; it enerates a signal as a function of the pressure imposed. For the purposes of this article, such a signal is electrical. Pressure sensors are used for control and monitoring in thousands of everyday applications. Pressure sensors can also be used to indirectly measure other variables such as fluid/gas flow, speed, water level, and altitude**.** An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

3.2. ATMEGA16 Controller

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz.ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes.

3.3. LCD (Liquid-Crystal Display)

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images

(as in a general purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

3.4. Relay Switch

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

IV. RESULTS AND CONCLUSION

We applied all these techniques to reduce the process time and human efforts of the conventional manual air filling system. The system helps to reduce cost and friction between surface of tyre and road so that will reduce the wastage of tyre material. As a result, it will increase the life
of tyre. This can be used in all automobile vehicles. Existing project is designed for ideal condition tyre. In this system we have developed the next level of running condition of tyre when tyre is running at 30 to 40 rpm. Because of the vehicles in a running condition can sometimes causes puncturing the tyre. So, the alternative sensors are used to their process. Then the air will be filled in the tyre pressure per the seconds. Then calculate the air filling efficiency and find out the punctured tyre. So easily identified the punctured and to solve the problems. This process is an advanced technique of our project.
After fabrication of automatic air inflation in vehicle tyre, the result obtained that if the system utilization will be executed in proper by taking and concerning all the relevant according to the project demand the process time, cost and human efforts can be reduced in a great manner.
font.

V. REFERENCES

[1]. V. Jeeva Bharathi, Design And Fabrication of A. V.Wadmare , Automatic Tyre Pressure Controlling and Self Inflating System, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X PP. 01-05 www.iosrjournals.org (2017)
[2]. Automatic Tyre Inflation And Deflation System,Vol-2 Issue-3 2016 IJARIIE-ISSN(O)-2395-4396 (2016)
[3]. Indrajeet Burase: A Survey on Automatic Air Inflating System for Automobile,International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization),Vol. 5, Issue 10, October 2016
[4]. Kamlesh R. Patil: Self-Inflating Tyre System, Imperial Journal of Interdisciplinary Research (IJIR) Vol-3, Issue3, 2017 ISSN: 2454-1362, http://www.onlinejournal.in
[5]. P.A Pilavachi.:Power generation with gas turbine systems and combined heat and power,(2004).

[6]. Ming Zheng (est.al):A new advanced power-generation system using chemicallooping combustion-Masaru Ishida Diesel engine exhaust gas recirculation(2011)

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A Survey on Mirai Attacks

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ABSTRACT

The Internet of Things (IoT) allows humans to interact with everyday physical objects and facilitate information sharing. Limited computing and memory functions, heterogeneous nature, and lack of security mechanisms in the Internet of Things have caused concerns about security and privacy. Therefore, vulnerable IoT devices will entice attackers to use them and turn them into robots. A botnet is a collection of these bots, which are used to perform DDoS attacks later. Many IoT security vulnerabilities have been reported recently, which disrupted access to popular websites. In this article, we analyzed the latest Mirai malware, its utilization techniques and certain attacks on industrial equipment. Also studied some methods to prevent Mirai attacks on industrial devices.

Keywords – Mirai, Botnet, IIOT, DDoS, Malware, Telnet

I. INTRODUCTION

Mirai is a malware that turns networked devices running Linux into remotely controlled bots that can be used as part of a botnet in large-scale network attacks. In Japanese Mirai is known as “Future”. It primarily targets online consumer devices such as IP cameras and home routers.[1] The Mirai botnet was first found in August 2016[2] by MalwareMustDie[3] a white hat malware research group, and has been used in some of the largest and most disruptive distributed denial of service (DDoS) attacks, including an attack on 20 September 2016[4] on computer security journalist Brian Krebs' web site, an attack on French web host OVH,[5] and the October 2016 Dyn cyberattack.[6][7] According to a chat log between Anna-senpai and Robert Coelho, Mirai was named after the 2011 TV anime series Mirai Nikki.[8]

The software was initially used by the creators to DDoS Minecraft servers and corporations providing DDoS protection to aforesaid servers, with the authors exploitation Mirai to work a protection racket.[9] The source code for Mirai was afterward printed on Hack Forums as open-source.[10] Since the ASCII text file was published, the techniques are custom-made in alternative malware projects.[11][12]

Devices infected by Mirai will be continuously scanning the Internet to obtain the IP addresses of Internet of Things (IoT) devices. Mirai contains a list of IP address ranges that will not be infected, including private networks and addresses assigned to the U.S. Postal Service and the Department of Defense. [13]

Mirai then used a table containing more than 60 common factory default usernames and passwords to identify

vulnerable IoT devices and logged into it to infect them with Mirai malware. [5]. The infected device will continue to operate normally, except for occasional sluggishness [14] and increased bandwidth usage. The device will remain infected until it is restarted, which may involve simply turning off the device and waiting for a while before turning it back on. After restarting, unless the login password is changed immediately, the device will be re-infected within a few minutes. [13] After infection, Mirai will identify any "competitive" malware, delete it from memory, and block remote management ports.

Identify the victim by "first entering the fast scanning phase, and asynchronously and statelessly, sending the TCP SYN probe to the pseudo-random IPv4 address outside the hard-coded IP blacklist on Telnet TCP ports 23 and 2323 IoT device". [13] If the IoT device responds to the detection, the attack will enter the brute force login phase. At this stage, the attacker attempts to establish a Telnet connection using a predetermined username and password pair in the credential list. Most of these logins are default usernames and passwords from IoT vendors. If the IoT device allows Telnet access, the victim's IP and successfully used credentials are sent to the collection server.

There are hundreds of thousands of IoT devices with default settings, making them vulnerable to infection. Once infected, the device will monitor the command and control server that indicates the target of the attack. The reason for using a large number of IoT devices is to bypass certain anti-DoS software, which monitors the IP address of incoming requests and filters or sets to block specific IP addresses when it recognizes abnormal traffic patterns (for example, too many requests). Other reasons include being able to group more bandwidth than the perpetrators can assemble alone, and avoid being tracked.

II. LITERATURE SURVEY

After the actor was arrested, Mirai, a threat to Internet of Things (IoT) devices, did not stop. Some believe that other participants are using the Mirai malware source code on GitHub to evolve Mirai into a new variant. They speculate that the goal is to expand their botnet nodes (network) to more IoT devices.

On December 12, 2017, researchers discovered a variant of Mirai, which used the zero-day vulnerability of Huawei's HG532 router to accelerate Mirai botnet infections. [11] Two known types of SOAP were implemented on the router's web interface. Related vulnerabilities, CVE-2014–8361 and CVE-2017–17215. This Mirai version is called "Satori".

On January 14, 2018, a new variant of Mirai was called "Okiru". This variant has been for the first time for popular embedded processors based on ARM, MIPS, x86, PowerPC [16], and for Linux-based devices for the first time ARC processor. Argonaut RISC Core processor (abbreviation: ARC processor) is the second most popular embedded 32-bit processor, with more than 1.5 billion products delivered each year, including desktop computers, servers, radios, cameras, mobile phones, electricity meters, TVs, flash drives, cars, network devices (smart hubs, TV modems, routers, wifi) and the Internet of Things. Only a relatively small number of ARC-based devices run Linux and are therefore exposed to Mirai.According to reports, on January 18, 2018, Mirai's successor was designed to hijack the Cryptocurrency mining business. [1]

On January 26, 2018, it was reported that there were two similar Mirai variant botnets, and its more modified version used the EDB 38722 D-Link router to recruit more vulnerable IoT devices using weapons.

Vulnerabilities in the router's local network management protocol (HNAP) are used to perform malicious queries on the exploited router, thereby bypassing authentication and leading to arbitrary remote code execution. The less modified Mirai version is called "Masuta" (after the Japanese transliteration is "Master"), and the more modified version is called "PureMasuta".

In March 2018, a new variant of Mirai named "OMG" surfaced, which added a configuration for vulnerable IoT devices and turned it into a proxy server. New firewall rules that allow traffic to pass through the generated HTTP and SOCKS ports have been configured in the Mirai code. After these ports are opened, OMG will set up 3proxy-the open source software provided on the Russian website. [5]

Between May 2018 and June 2018, another variant of Mirai appeared, called "Evil", which added configuration to target at least three other vulnerabilities, including affecting Netgear routers and CCTV-DVR Vulnerabilities. Wicked scans ports 8080, 8443, 80, and 81 and tries to find vulnerable unpatched IoT devices running on these ports. The researchers suspect that the same author created the Wicked, Sora, Owari, and Omni botnets. [2].

In early July 2018, at least 13 versions of Mirai malware were reported to be actively infecting the Internet of Linux Internet of Things (IoT), three of which were designed to target specific vulnerabilities by using a proof-of-concept for exploits without launching Brute Force Attack-Forced attack on default credential authentication. In the same month, the report released a report on the infection activity of Mirai malware on Android devices through the Android debugging bridge on TCP/5555. The report is actually an optional feature in the Android operating system, but it seems that this feature was discovered It is enabled on some Android phones.

At the end of 2018, a Mirai variant named "Miori" began to spread through a remote code execution vulnerability in the ThinkPHP framework, affecting versions 5.0.23 to 5.1.31. This vulnerability was abused in January 2019 by the further developed Mirai variants (referred to as "Hakai" and "Yowai" respectively) and the variant "SpeakUp" in February 2019.

Mirai and BASHLITE [29] were used in a DDoS attack on the secure site Krebs on September 20, 2016, reaching a speed of 620 Gbit/s [3]. Ars Technica also reported a 1 Tbit/s attack on the French web host OVH. [5]

On October 21, 2016, using Mirai malware installed on a large number of IoT devices, multiple major DDoS attacks occurred in the DNS service of DNS service provider Dyn, many of which are still using their default usernames and passwords. [1] These attacks made it impossible to access several high-profile websites, including GitHub, Twitter, Reddit, Netflix, Airbnb, etc. [1] Level 3 Communications initially reported attributing the Dyn attack to the Mirai botnet. [9]

It was later discovered that Mirai was used in a DDoS attack against Rutgers University from 2014 to 2016, which prevented faculty, staff and students on campus from accessing the external Internet for several days. In addition, the failure of the university’s central accreditation service has made course registration and other services unavailable during critical periods of the semester. According to reports, the university spent US$300,000 on consulting and increased the university’s cybersecurity budget by US$1 million in response to these attacks. The university attributed the attack to its cause, which was the reason for the increase in tuition and fees in the 2015-2016 academic year. [4] The person with the alias "exfocus" claimed responsibility for the attack. In the Reddit AMA on the /r/Rutgers subreddit, it was pointed out that the user was a school student

and the DDoS attack was caused by frustration with the university's bus system.
Later, the user claimed in an interview with a New Jersey blogger that they falsely claimed to be connected to the university and that these attacks were funded by anonymous customers. Security researcher Brian Krebs later claimed that the user was indeed a Rutgers University student, and that the latter's visit was to distract the researchers. [8] Employees of the deep learning security department observed the steady growth of the Mirai botnet before and after the October 21 attack. [4] Mirai was also used to attack Liberia's Internet infrastructure in November 2016. [8] [10] [12] According to computer security expert Kevin Beaumont (Kevin Beaumont), the attack appears to have originated from an actor who also attacked Dyn. [6]

III. MIRAI ATTACKS FOR INDUSTRIAL SCENARIOS

Mirai attack exploits open and insecure network services (i.e., Telnet or SSH) in poorly protected devices to show them into bots controlled by the attacker. Insecure services, exposing production systems to the Mirai attack, are found running on over fifteen-thousand devices unfold around the World by our search on the Shodan program (cf. Table 2). Mirai's self-propagating abilities build it extraordinarily effective against several IoT devices [40]. It will infect tens of thousands of devices and to take advantage of them putting in DDoS attacks against a target victim. during a industrial scenario, connected devices could act as controllers. Once Mirai infects one amongst the devices, it will quickly spread Mirai to the complete network. Since the ASCII text file of Mirai is public, it's potential to change it to focus on a particular manufacturer's device for any misusing but DDoS.

3.1. Gaining control of actuators and stealing information through Mirai attack

The Mirai's source is modified code so that it can be downloaded from device, and gain control of system executors instead of performing DDoS attacks on the device system remote control center. The actuator is attacked to interfere with production tasks and cause business loss. Then, attacks on the remote control center may increase troubleshoot the attack to make it more effective. Despite this, DDoS cannot avoid attacks identified. Therefore, we turned Mirai into a stealth attack. A secret Mirai attack is unlikely was found and relieved. We have modified Mirai's source code so that it can be downloaded from device, and gain control of system executors instead of performing DDoS attacks on the device system remote control center. The actuator is attacked to interfere with production tasks and cause business loss. Then, attacks on the remote control center may increase troubleshoot the attack to make it more effective. Despite this, DDoS cannot avoid attacks identified. Therefore, we turned Mirai into a stealth attack. A secret Mirai attack is unlikely was found and relieved.

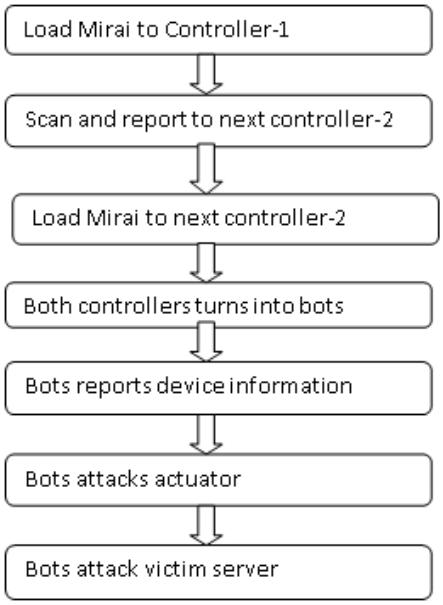

Fig.3.1 Steps of Mirai Attack

3.1.1. Steps of Mirai Attack

Step-1. : Load Mirai to Controller-1: Loader Server will try to log in with the default user name and password (such as root | 123456), or obtain the user name and password by forcibly obtaining the IIoT device, thereby attempting to log in to the IIoT device (Controller-1). However, even if IIoT devices do not use weak authentication credentials, attackers may also compromise them in other ways, such as threatening phishing attacks. After successfully logging in, the Loader Server will ask the device to download the Mirai main program from the attacker's file server to the device by using TFTP, so that the Loader server can enter the main program.

Step-2. : Scan and Report Controller-2: The bot starts to use Telnet to connect to the command and control (CNC) server. At the same time, the bot scans other devices in the LAN and reports the obtained results (Controller-2) to ScanListener.

Step-3. : Load Mirai to Controller-2: The Loader server retrieves the IP address, username and password of Controller-2 from Scan Listener. Then, the Mirai botnet was injected into Controller-2 using the same process as infecting Controller-1.

Step-4. : Bots report device information both controllers in the system turned into bots. Then they can gather sensitive information about the devices to report to the Mirai server. Inourcase, the Mirai botnet reads the configuration file of the device and report the detailed device configuration and its usage information.

Step-5. : Bots attack actuators: The bot will send commands to the actuator to force the machine to perform unsafe operations.

Step-6. : Bots attack victim server: Attackers can target the remote control interface to facilitate the installation of robots into DDoS attacks. A considerable number of DDoS software packages will make the remote control interface unable to work properly, thereby increasing the difficulty of troubleshooting. In turn, this provides more time for Mirai attacks to destroy physical actuators.

3.2. Making Mirai Attack Stealthy

Stealth attacks were carried out quietly, hiding the attacker's behavior (including processes, network connection and traffic. Rootkit is a special malware that can run invisible [5]. They can be used in conjunction with Trojan horses, backdoors and other malware program. LKM (Linux Kernel Module) allows dynamic expansion of the operating system kernel. LKM has the same permissions as the code compiled into the kernel, so many are given to them flexibility and strength. However, a maliciously written kernel module may disrupt the entire operation process system. The kernel module has the same privileges as any other kernel code: it may be hijacked Linux systems that either redirect the system call or replace the system call handler by using its own wrapper hide files, processes and network connections. We use LKM rootkit (suterusu) to hide the process and network connection used by the Mirai attack. LKM rootkit (such as suterusu) can insert the Linux kernel as a module. It aims to hide its existence. and so, system users cannot discover the existence of rootkits through any system tools and kernel modules list or kernel log. The rootkit runs secretly in the kernel space and provides hidden functions. Then, Mirai's "hide" is hidden from system users. Therefore, the system utility cannot find the running Mirai process, netstat cannot find the network connection established by Mirai. Hiding process and connection information is not enough to fully attack dark. Telnet service used for communication between robot and CNC server disclose the traffic information that the system can use for anomaly detection. The stunnel is used as an open source tool for providing general TLS/SSL tunnel services. It will convert a normal unencrypted Telnet connection is connected to a secure encrypted HTTPS connection.

Combining the LKM rootkit and Stunnel, Mirai process, network ports, network traffic information can be completely hidden. In addition, information about the existence of Rootkit and Stunnel can also hidden. Since the LKM rootkit runs at the same level as the kernel, it is difficult to pass use general detection methods [49]. Subsequently, the invisible Mirai attack may be hidden in an IIoT system for long-term attacks that can provide all the time an attacker may need to cause a physical attack damage the industrial system.

3.3. Evaluation of the proposed Mirai attack

The problems that the proposed Mirai attack variant poses to system availability are duality: One problem is strictly related to security, and the second problem is related to the security of the system. From a security point of view, the Mirai attack will flood the entire system, making the system unusable. This gives the attacker more time to execute the physical part of the IIoT system. This is necessary because the physical reaction time (For example, mechanical) processes are much slower than network operations. Therefore, the attacker may take extra time to attack. The proposed attack can provide such overtime the availability of system interfaces is compromised by flooding on the other hand, Mirai can compromise the availability of the system from a security perspective by forcing operations that cause physical damage to the system. For example, by moving the actuator to an unsafe location Configuration. It is important to pay attention to safety and the safety system availability issues are interrelated. In fact, the flooding system (Security issue) give the attacker time to incorporate the physical part of the system insecure configuration (security issue). This is due to the close relationship between security and security is a unique feature of the IIoT system. The proposed Mirai attack will damage the integrity of the system. As long as the actuator Controlled by malicious users, characterizing the real-time constraints of industrial systems cannot a longer time is guaranteed.

In addition, gain control of the physical components of the system, forcing them into an unsafe state will destroy the integrity of the system. It is worth noting that integrity issues are located at the intersection of system security and security, highlighted at one time close connection between the two concepts in the IIoT system. During experimental analysis, the Mirai attack allowed the theft of retained information of the device being attacked. Therefore, the confidentiality of the system is violated. Analyzing the stolen information is the device configuration, the device may contain more information. This is especially true for systems using the latest manufacturing technology trend.

IV. PROTECTION STRATEGIES

4.1. Defective system design

Vulnerabilities for Web management systems and remote software updates, that is, weak credentials, authentication bypass, cross-site scripting, cross-site request forgery, SQL injection, unrestricted file upload and plain text transmission are mainly due to flaws in the system design. In other words, these attack vectors can be reduced by improving system integrity. E.g, Developers can use a mechanism that forces users to use strong passwords, or optimize them code for database operations to protect the device from SQL or JavaScript injection. make sure proper authentication and encryption are effective methods to protect remote software update from the attack.

4.2. Malware Injection

Embedded devices usually do not have a mature malware detection mechanism and have been used on conventional computing platforms, such as servers and desktops [11]. This can be like Mirai malware can easily infect a large number of IoT devices without being detected. Implement a set of malware detection and protection mechanisms for IoT devices has become mandatory. Commonly used malware detection methods are software-based solutions using anti-virus software detect malicious files. Through signature-based technology or semantic-based detection method [15]. These solutions usually run at the operating system (OS) level and effectively find and remove most malicious software. In the experimental test it is possible by adopting a simple whitelist based on the whitelist, a non-invisible Mirai attack is identified as an abnormal system process detection method.

4.3. Stealthy Attack

By using LKM Rootkit, non-invisible Mirai attacks can evade OS-level antivirus software run at the same level as the operating system. Hypervisor-level detection methods, such as virtual machines hidden process detection based on monitor (VMM) has been proposed to overcome the following problems:

LKM rootkit [16]. this type of method introduces a hypervisor that is isolated from the actual OS of the device to prevent rootkit attacks at the operating system level. Regarding the protection of IoT devices discussed in this article, this solution has two limitations. First, add VMM negatively to each embedded device The complexity of the design is affected, making it unsuitable for practical applications. Second Management procedures the level of VMM itself can be a target of attack and may be attacked by rootkits. The disadvantages

of software-based solutions have led to the introduction of hardware-based solutions as a promising solution, the method is unlikely to be ignored. Based on the most advanced hardware Malware or Rootkit detection solutions can be divided into two categories: data-centric and Program-centric solutions. Data-centric approach detects data integrity at the hardware level by generating and verifying the fingerprint of the selected function. The common solution is to verify through control flow integrity (CFI), whether the redirection in the program control flow is legal view. Use custom hardware components to sign the kernel Rootkit detection solution system call routines have been proposed [9]. This method has been proven to detect a variety of LKMs
Rootkits are effective. These static signature-based methods provide lower overhead and are easy to will be executed. However, there are indirect jump instructions and inconsistencies the impact of operating system upgrades will affect its effectiveness [12]. Program-centric technology focuses on use low-level functions, such as micro architectural events collected by hardware performance counters model dynamic program behavior to distinguish malicious programs from benign programs. After Researchers have proven [8] that combining various machine learning methods, malware can effectively detect by collecting and modeling hardware performance counter data. Selected information about the underlying hardware architecture (for example, memory address references, instruction opcodes, etc.) can also be used by machine learning modeling methods to detect malware.

Although hardware-based detection technology is considered more efficient and less likely to escape, they usually need to add hardware components at the processor level these functions are usually not available in microcontrollers commonly used in industrial applications. Therefore, this method will lead to redesign and increase costs. Therefore, they did not has been practically used in industrial environments. The latest processors for IoT devices are equipped with hardware performance counters that can be used for malware detection. However, most detection methods that rely on this hardware function require a virtualization mechanism protection detection [14]. Therefore, most of the work in this area is directed at x86-based computers systems, and equipment used in industrial environments usually uses microprocessors, such as ARM Architecture processor.

These microprocessor-based systems behave quite differently, usually compared with x86-based resources, it has strict resource constraints. Therefore, develop specific a detection mechanism for IIoT devices that meet multiple goals (including efficiency, system) usability and safety will be crucial research directions in the future. Therefore, the overhead required the use of virtualization technology makes this method impractical in an industrial environment.

Trusted Execution Environment (TEE) may provide an effective alternative to virtualization equipped with different architectures, including the ARM architecture used to build IIoT systems [12]. TrustZone is an ARM architecture equipped with TEE. This is a technology that guarantees confidentiality and the integrity of the data and code running in the processor. It is designed to be isolated from traditional systems to establish a secure and trusted execution area in the processor. Such the environment is a promising alternative to VMM, which can be used to implement VMM-based detection methods analyze hardware events, such as those proposed for general-purpose computing systems [13]. Such a solution should allow the overhead to be kept low according to the requirements of the IIoT system, while increasing an opportunity to discover invisible malware.

V. CONCLUSION

Mirai is a malware that transforms contaminated gadget into bot for executing DDoS assaults. It contaminates IoT gadgets with empowered far off access by means of telnet and default username and secret phrase kept. Mirai is isolated in three sections. Controller gives virtual terminal for botnet clients, keeps proof of enrolled bots and passes assault order to them. Loader transfers and executes malware on revealed weak gadgets. Bot look for weak targets and executes DoS assault on request. Dynamic investigation showed how bot gets order and executes DoS assault. The industrial devices can be protected by using the protection stratergies like better system design, malware injection, stealthy attacks etc.

VI.REFERENCES

[1]. Xingbin Jiang, Michele Lora, and Sudipta Chattopadhyay, An Experimental Analysis of Security Vulnerabilities in Industrial IoT Devices. ACM Trans. Internet Technol., Vol. 1, No. 1, Article . January 2020

[2]. Jinesh Ahamed and Amala V Rajan. Internet of things (iot): Application systems and security vulnerabilities. In Proc. of the 5th International Conference on Electronic Devices, Systems and Applications (ICEDSA), 2016, pages 1–5. IEEE, 2016.

[3]. Haneen Al-Alami, Ali Hadi, and Hussein Al-Bahadili. Vulnerability scanning of IoT devices in Jordan using Shodan. In Proceedings of the 2nd International Conference on the Applications of Information Technology in Developing Renewable Energy Processes & Systems (IT-DREPS), pages 1–6. IEEE, dec 2017

[4]. Alasdair Gilchrist. Industry 4.0: the industrial internet of things. Springer, 20

[5]. Sujit Rokka Chhetri, Nafiul Rashid, Sina Faezi, and Mohammad Abdullah Al Faruque. Security trends and advances in manufacturing systems in the era of industry 4.0. In Proc. of IEEE/ACM International Conference on Computer-Aided Design (ICCAD), 2017.

[6]. Ahmad-Reza Sadeghi, Christian Wachsmann, and Michael Waidner. Security and Privacy Challenges in Industrial Internet of Things. In Proc. of the 52nd IEEE/ACM Design Automation Conference (DAC), page 54. ACM, 2015.

[7]. Hossein Sayadi, Hosein Mohammadi Makrani, Onkar Randive, Sai Manoj PD, Setareh Rafatirad, and Houman Homayoun. Customized machine learning-based hardware-assisted malware detection in embedded devices. In Proc. of 17th IEEE International Conference On Trust, Security And Privacy In Computing And Communications/12th IEEE International Conference On Big Data Science And Engineering (TrustCom/BigDataSE), pages 1685–1688. IEEE, 2018

[8]. Hossein Sayadi, Nisarg Patel, Sai Manoj PD, Avesta Sasan, Setareh Rafatirad, and Houman Homayoun. Ensemble learning for effective run-time hardware-based malware detection: A comprehensive analysis and classification. In Proc. of 55th ACM/ESDA/IEEE Design Automation Conference (DAC), pages 1–6. IEEE, 2018.

[9]. Hamdija Sinanovic and Sasa Mrdovic. Analysis of mirai malicious software. In Proc. of the International Conference on Software, Telecommunications and Computer Networks, pages 1–5, 2017.

[10].Emiliano Sisinni, Abusayeed Saifullah, Song Han, Ulf Jennehag, and Mikael Gidlund. Industrial internet of things: Challenges, opportunities, and directions. IEEE Transactions on Industrial Informatics, 14(11):4724–4734, 2018.

[11].Andrea Tundis, Wojciech Mazurczyk, and Max Mühlhäuser. A review of network vulnerabilities scanning tools. In Proceedings of the 13th International Conference on Availability, Reliability and Security (ARES 2018), pages 1–10, New York, New York, USA, 2018. ACM Press.

[12].Liwei Zhou and Yiorgos Makris. Hardware-based workload forensics: Process reconstruction via tlb monitoring. In Proc. of IEEE International Symposium on Hardware Oriented Security and Trust (HOST), 2016, pages 167–172. IEEE, 2016

[13].Wei Zhou, Yan Jia, Anni Peng, Yuqing Zhang, and Peng Liu. The effect of IoT new features on security and privacy: New threats, existing solutions, and challenges yet to be solved. IEEE Internet of Things Journal, 6(2):1606–1616, 2018.

[14].John A Stankovic. Research directions for the internet of things. IEEE Internet of Things Journal, 1(1):3–9, 2014.

[15].Constantinos Kolias, Georgios Kambourakis, Angelos Stavrou, and Jeffrey Voas. Ddos in the iot: Mirai and other botnets. Computer, 50(7):80–84, 2017.

[16].Nisarg Patel, Avesta Sasan, and Houman Homayoun. Analyzing hardware based malware detectors. In Proc. of the 54th Annual Design Automation Conference 2017, page 25. ACM, 2017.

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Analysis and Design of High-Rise Diagrid Structures

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ABSTRACT

As the world's population grows, so does the cost of accessible land. The lateral loads become more important than the gravitational loads as the building's height rises. Wind load and earthquake load are two forms of lateral loads that can be applied to high-rise buildings. Different forms of lateral load resisting structures used in high-rise buildings include shear walls, rigid framed structures, brace tubes, wall frames, outrigger systems, and diagrid systems.

For lateral load resistance, the diagrid structural system is an efficient and effective structural system. Diagrid structure is a type of exterior structural system in which all external columns are replaced by a sequence of triangular shaped diagonal grids, and inside columns are solely meant to support gravity loads.

Two forms of 48 story structures in seismic zone III are studied in this study: rectangular &L-shape. The total height of all the structures is 168 meters. There are four diagrid modules in the seismic zone. In the diagrid construction, two, four, six, and eight modules have been employed. E-TABS is used to analyses and simulate diagrid structure. IS 800:007 is used to design all structural members. For earthquake analysis, IS 1893 part1-2016 is utilized, and for wind load analysis, IS 875 part3- 2015 is employed. For dynamic analysis, the response spectrum approach is used. The maximum storey displacement and maximum storey drift of all the study findings are compared, and the ideal diagrid angle for all modules is calculated.

Key Words: Diagrid structure, Storey displacement, Storey drift, Optimum diagrid angle

I. INTRODUCTION

significant influence on the construction sector, which leads to an upward trend in building construction. However, when building heights rise, lateral load resisting systems become more critical than gravity load resisting structural systems. To withstand the lateral stresses. Rigid frame, shear wall, wall-frame, utilised braced tube system, outrigger system, and tubular system are some of the most prevalent systems. Because of the structural efficiency and aesthetic possibilities given by the system's distinctive geometric design, the diagonal grid structural system has recently become popular for tall structures. Rapid population expansion and high land costs have a significant influence on the construction sector, which leads to an upward trend in building construction. However, when building heights rise, lateral load resisting systems become more critical

than gravity load resisting structural systems. To be able to tolerate lateral strains. Some of the most common systems include rigid frame, shear wall, wall-frame, employed braced tube system, outrigger system, and tubular system. The diagonal grid structural system has lately become popular for tall structures due to its structural efficiency and aesthetic possibilities provided by the system's distinctive geometric form. he Diagrid system is made up of multiple diagonal components that join to produce a triangulated or grid-shaped design. The name "diagrid" is derived from the phrases "diagonal" and "grid." A diagrid structure is a sort of structural system that consists of diagonal grids connected by horizontal rings to provide a beautiful and redundant structure that is particularly useful for high-rise structures. Due to its triangulated configuration, diagrid structures differ from braced frame systems in that diagonals as key structural components contribute in supporting gravity load as well as lateral load, obviating the requirement for vertical columns. A diagrid system's column-free structure has various advantages, including great architectural freedom, elegance, and huge day illumination due to its small outside surface. Because of its structural efficiency, the diagrid system has recently been used on numerous tall steel structures.

II. OBJECTIVE OF STUDY

1. To assess the performance of a high-rise building equipped with a diagrid system.
2. To do static analysis, response spectrum analysis, and wind analysis in terms of story displacement and drift
3. Determine the diagrid system's optimal diagrid angle.

III. GEOMETRIC PARAMETERS OF THE BUILDING MODELS

Structural parameter	**Steel structure**
Shapes of building	rectangular and L- shape
Number of stories	48
Size of plan	
a). for rectangular shape	48m x 64m
b). for L-shape shape	48m x 48m
Spacing between bays	4m
Spacing between diagrid along perimeter	8m
Height of each storey	3.5m
Number storey per module	2, 4, 6, & 8 storey
Grade of structural steel (Fy)	Fe 500
Grade of concrete (Fck)	M40

3.1 Comparative analysis

Case-I : Comparison between each module for rectangular and L-shape shape of structure.

2-storey module 4-storey module 6-storey module 8-storey module

Case-II: Combination all storey modules rectangular and L- shape of structure.
2-storey, 4-storey, 6-storey and 8 storey

IV. RESEARCH METHODOLOGY

The analysis of a 48-story diagrid structure with rectangular and L-shaped building is offered in this work. As per Indian Standard, lateral forces owing to earthquakes and wind effects are taken into account. The structure was analyzed using IS 1893:2016 and IS 800:2007. The ETABS programme is used for modeling and analysis of diagrid systems. Earthquake loads are subjected to response spectrum analysis. The beams and columns are treated as flexural components for linear static and dynamic analysis. The major goal of this study is to investigate the behavior of high-rise buildings with Diagrid systems of various angles for rectangular and L-shape structures in seismic zone III, as well as to determine the best diagrid angle using static, dynamic, and wind analysis. In first phase, modeling of 48 storey high rise buildings with Diagrid systems by defining material and section properties & having same height with different diagrid angles which is done by using ETABS software.

In second phase, define several sorts of loads and their combinations on the rectangular shape of the structure in the second phase. Define the functions necessary for the response spectrum in dynamic analysis. Finally, using the findings of the study, verify the behavior of a rectangular shape structure with Diagrid systems of the same height and different angle in seismic zone III.

In third phase, define several sorts of loads and their combinations on additional L-shape structures for dynamic analysis in the third phase. Define the functions that will be used to create the response spectrum. Finally, using the findings of the study, examine the behavior of the L-shape of structure with Diagrid systems with the same height and different angle in seismic zone III.

In fourth phase, The collecting and analyzing data on two forms of structures in the form of several parameters such as Storey shear and Storey Drift is the fourth phase.

In the fifth step, evaluate all seismic zone-III factors to determine the best angle for rectangular and L-shaped structures, as well as combinations of 2, 4, 6, and 8-story modules.

V. MODELING AND ANALYSIS

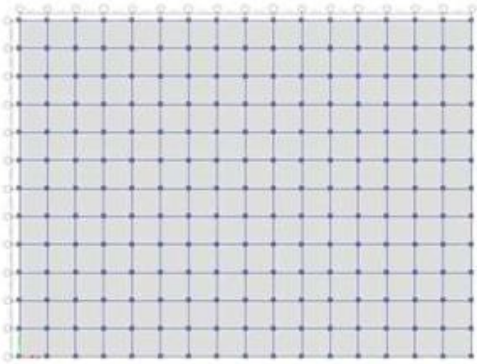

Fig -1: Plan of rectangular shape building model

Figure 1 shows the typical plan of rectangular shape building models which are Considered for the study as shown in figure and spacing between each bay is 4 meters.

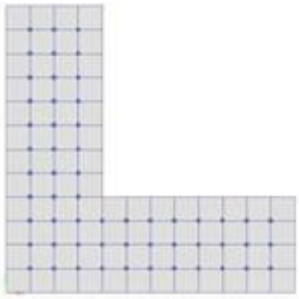

Fig -2: Plan of L- shape building model

The building is subjected to following Loads as per IS 875 (part 1 and 2)-2015:
Dead load: 2 kN/m2
Live Load: 3 kN/m2
The following table shows that basic design consideration in seismic zone III.

Zone	Zone factor	Location of building	Basic wind speed of city in m/s	Soil type
III	0.16	Pune	39	Hard(site type 1)

Table -1: Basic design consideration

Fig -3: 3D rendered view of rectangular shape structure

Fig -4: 3D rendered view of L- shape structure

Story	Beam	Column[tube section]	Diagrid [pipe section]
1-16	ISMB 550	750 X 750 X 50	750 X 25
17-32	ISMB 500	700 X 700 X 45	750X 25
33-48	ISMB 500	600 X 600 X 35	750 X25

Table -2: Section properties for rectangular & L-shape ofbuilding

Number storeys permodule	Angle (Degree)
2	41.18
4	60.25
6	69.14
8	74.05

Table -3: Diagrid angle for rectangular & L- shape ofbuilding

During the seismic zone III narrative module analysis, all load combinations are chosen as per IS 800. In ETABS, the load combinations shown in the table are selected using thedefault steel structure combination.

Wind parameter details: (AS PER IS 875-2015) in zone III.Terrain category – 3
Structure class – C Risk coefficient – 1.06Topography factor – 1
Importance factor- 1.30

VI. RESULT AND DISCUSSION

1. Analysis Result and its Discussion for **Rectangular shapeo**f building in Seismic Zone III.

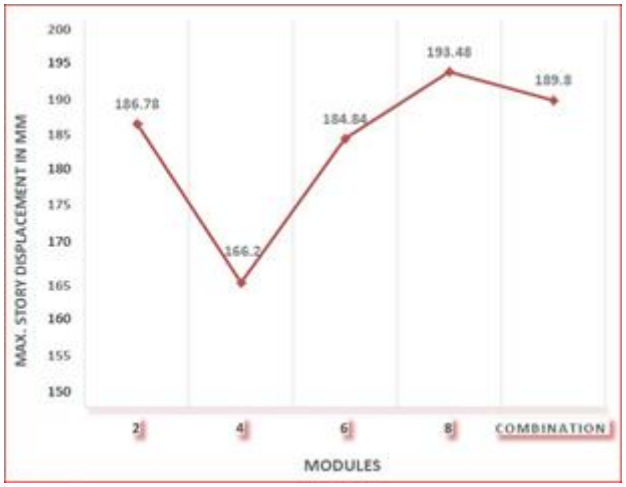

Fig -5: Maximum storey displacement for all modulesmodules in rectangular shape structure

The graphical representation of maximum storey displacement of 48 story rectangular building modules in zone III is shown in Figure: 5. In the 8 module diagrid, the maximum storey displacement is 193.48 mm. The greatest

storey displacement with the least value is 166.2 mm, which is recorded for a four-story module. The minimum value of maximum story displacement is found to be between 60 degree and 70 degree. The maximum allowable storey displacement is 336 mm, When comparing eight module diagrid to four module and six module diagrid, the maximum story displacement for four module and six module diagrid is reduced by 14.09 % and 4.46 % respectively.

The maximum storey drift of 48 story rectangular building modules in zone III is depicted graphically in Figure:6. This is the graphical representation for wind load analysis because, when compared to seismic and response spectrum analysis, wind load analysis offers the highest values of tale drift in zone III. The maximum storey drift in the combo module is 0.001532m, which is greater. The smallest maximum storey drift value is 0.001176 m, which may be found in the four- story module diagrid. The maximum allowable storey drift is

0.014 m. Maximum story drift for all modules in zone III is observed to be within this limit. Maximum story drift for four module and six module diagrid is reduced by 23.24% and 15.68% when we compare with combination module diagrid which gives maximum value of drift in zone III.

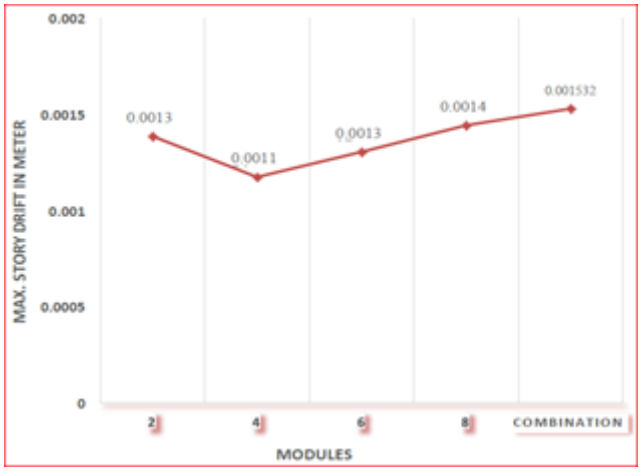

Fig -6: Maximum storey drift for all modules in rectangular shape structure

2. Analysis Result and its Discussion for **L-shape of building** in Seismic Zone III.

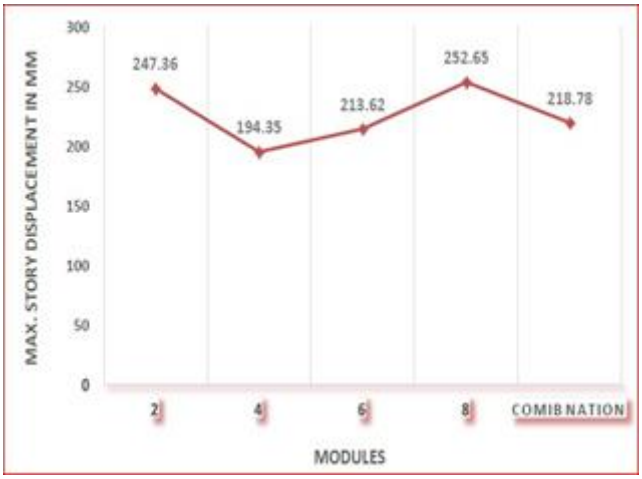

Fig -7: Maximum storey displacement for all modules in L-shape structure

The maximum storey displacement of 48 storey L-shaped building modules in zone III is depicted graphically in Figure 7. In 8 modules, the maximum storey displacement is 252.65mm. 194.35 is the smallest figure of maximum storey displacement mm, which may be seen in a four-story module. It has been discovered that the minimum value of maximum storey displacement ranges from 60 to 70 degree. The highest allowable storey displacement is 336 mm, and all modules in zone III have maximum story displacements that are within the allowable limit. When we compare the maximum story displacement of eight module diagrid to four and six module diagrid, the maximum story displacement of four and six module diagrid is lowered by 23.07 % and 15.44 % respectively.

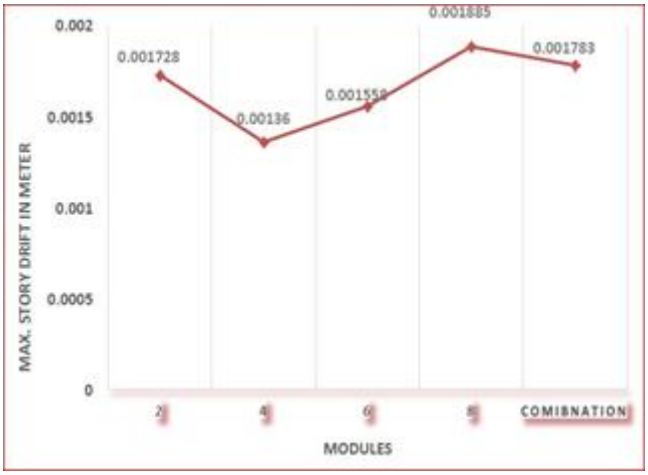

Fig -8: Maximum storey drift for all modules in L-shapestructure

The maximum storey drift of 48 storey L-shaped building modules in zone III is depicted graphically in Fig 8.In the 8 module diagrid, the maximum storey drift is 0.001885 m. The smallest maximum storey drift value is 0.001360 m, which may be found in The diagrid is a four-story module. The maximum allowable storey drift is 0.014 m, and maximum story drift for all modules in zone III is observed to be within this limit. When eight module diagrid is compared to four and six module diagrid, the maximum narrative drift for four and six module diagrid is lowered by 27.85 % and 17.34 % respectively.

VII. CONCLUSION

i). Wind load has the maximum story displacement and story drift in rectangular and L-shaped buildings as compared toearthquake load.

ii). 8-storey diagrid module has the maximum story displacement and story drift in rectangular and L-shaped buildings.

iii). Combination of all modules in rectangular building produces minimum value of maximum storey displacement and maximum storey drift than L-shape of structure. In the 60-70 degree range, maximum storey displacement and maximum storey drift decrease.

iv). In comparison to 2-storey, 6-storey, and 8-storey modules, the 4 storey module in any form of building delivers less value of maximum storey displacement and maximum storey drift.

VIII. REFERENCES

[1]. M. M. Ali and K. Moon. (2007). Structural developments in tall buildings: Currents trends and future prospects. Architectural Science Review, University of Sydney .

[2]. Berry Charnish and Terry McDonnell. (2008). The Bow: Unique diagrid structural systems for a sustainable tall building. CTBUH 2008 8th World Congress, Dubai.

[3]. K. S. Moon. (2011). Diagrid Structures for Complex- Shaped Tall Buildings. The 12th East AsiaPacific Conference on Structural Engineering and Construction.

[4]. K. Jani and Paresh V. Patel. (2013). Analysis and design of diagrid structural system for high rise steel buildings. Chemical, Civil and Mechanical Engineering Tracks of 3rd Nirma University International Conference on Engineering.

[5]. G.Milana, P. Olmati, K. Gkoumas and F. Bontempi. (2014). Sustainability concepts in the design of high-rise buildings: the case of diagrid systems. 3rd International Workshop on Design in Civil and Environmental Engineering.

[6]. F. M. Thomas, Binu M. Issac and Jessymol George. (2015). Performance evaluation of tall buildings with steel diagrid system. 2nd International Conference on Science, Technology and Management.

[7]. Manthan Shah, Snehal V. Mevada and Vishal B. Patel. (2016). Comparative study of diagrid structures with conventional frame structures. International Journal of Engineering Research and Application.

[8]. Dr. Mohammad T Bhuiyan and Dr. Roberto Leon. (2016). Preliminary design of Diagrid tall building. IAJC-ISAM International Conference.

[9]. U. A. Nawale and D. N. Kakade. (2016). Analysis of diagrid structural system by ETABS International Advanced Research Journal in Science, Engineering and Technology.

[10]. Dr.Gopisiddappa, M.Divyashree, Sindhuja. (2017). Performance study of high rise building with diagrid system under dynamic loading. International Research Journal of Engineering and Technology. rise construction. International Journal of Civil Engineering and Technology.

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Knowledge Base Completion via Search-Based Question Answering

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ABSTRACT

Over the past few years, massive amounts of world knowledge have been accumulated in publicly available knowledge bases, such as Freebase, NELL, and YAGO. Yet despite their seemingly huge size, these knowledge bases are greatly incomplete. For example, over 70% of people included in Freebase have no known place of birth, and 99% have no known ethnicity. In this paper, we propose a way to leverage existing Web-search–based question-answering technology to fill in the gaps in knowledge bases in a targeted way. In particular, for each entity attribute, we learn the best set of queries to ask, such that the answer snippets returned by the search engine are most likely to contain the correct value for that attribute. For example, if we want to find Frank Zappa's mother, we could ask the query who is the mother of Frank Zappa. However, this is likely to return 'The Mothers of Invention', which was the name of his band. Our system learns that it should (in this case) add disambiguating terms, such as Zappa's place of birth, in order to make it more likely that the search results contain snippets mentioning his mother. Our system also learns how many different queries to ask for each attribute, since in some cases, asking too many can hurt accuracy (by introducing false positives). We discuss how to aggregate candidate answers across multiple queries, ultimately returning probabilistic predictions for possible values for each attribute. Finally, we evaluate our system and show that it is able to extract a large number of facts with high confidence.

Categories and Subject Descriptors: H.2.8 [Database management]: Database applications—Data mining.

General Terms: Algorithms, Experimentation.

Keywords: Freebase; slot filling; information extraction.

I. INTRODUCTION

Large-scale knowledge bases (KBs)—e.g., Freebase [1], NELL [3], and YAGO [18]—contain a wealth of valuable information, stored in the form of RDF triples (subject–relation–object). However, despite their size, these knowledge bases are still woefully incomplete in many ways. For example, Table 1 shows relevant statistics for Freebase: in particular, it lists the fraction of subjects of type PERSON who have an unknown object value for 9 commonly used relations (also cf. Min et al. [12]); e.g., 71% of the roughly 3 million people in Freebase have no

known place of birth, 94% have no known parents, and 99% have no known ethnicity. As Table 1 further shows, coverage is quite sparse even for the 100,000 most frequently searched-for entities. This problem is not specific to Freebase; other knowledge repositories are similarly incomplete.

The standard way to fill in missing facts in a knowledge base is to process a large number of documents in batch mode, and then to perform named-entity disambiguation followed by relation extraction (see, e.g., Ji and Grishman [8] for a recent review). We call this a 'push' model, since it pushes whatever facts it can find across all documents into the knowledge base. By contrast, in this paper, we focus on a 'pull' model, whereby we extract values for specific subject–relation pairs by making use of standard Web-search– based question-answering (QA) technology.

There are several reasons to take such an approach. First, we can leverage mature Web-search technology to find high-quality and up-to-date information sources. Second, we can rely on the returned search snippets as a mechanism for focusing attention on the parts of the documents that are most likely to contain the answer. Third, this gives us a complementary signal to the standard 'push' approach. The 'pull' paradigm enables a targeted, on demand method for knowledge base completion; e.g., we could first run a 'push' method to collect as many facts as possible and then use our 'pull' system to retrieve facts that were not already found by the passive 'push' run. Finally, the world is constantly changing, and KBs must be kept up to date accordingly [19]; the 'pull' paradigm seems more appropriate than the 'push' paradigm for verifying whether specific previously entered facts are still valid.

The key question we address in this paper is which questions we should issue to the QA system. This is not obvious, since the QA system is expecting natural language as input, but we have no human in the loop who could formulate our queries. Furthermore, not all the queries are equally good. For example, suppose we want to determine the birthplace of the musician Frank Zappa. We could issue the search query where does Frank Zappa come from, but it is more effective to ask where was Frank Zappa born, because this query formulation will be more likely to match phrases appearing in the Web pages searched by the QA system.

As another example, consider the problem of determining Frank Zappa's mother. If we issue the query who is the mother of Frank Zappa, we will most likely get back snippets about 'The Mothers of Invention', which was the name of his band. In this case, we should add extra terms to the query, to try to steer the search engine to return snippets that mention his mother (cf. Collins-Thompson et al. [4]). One way to do so is to append to the query the name of the city where Zappa was born (namely, Baltimore), since the place where one was born is often mentioned in proximity to the names of one's parents.

Relation	Percentage unknown	
	All 3M	Top 100K
PROFESSION	68%	24%
PLACE OF BIRTH	71%	13%
NATIONALITY	75%	21%
EDUCATION	91%	63%
SPOUSES	92%	68%
PARENTS	94%	77%

CHILDREN	94%	80%
SIBLINGS	96%	83%
ETHNICITY	99%	86%

Table 1: Incompleteness of Freebase for some relations that apply to entities of type PERSON. Left: all 3M Freebase PERSON entities. Right: only the 100K most frequent PERSON entities.

The main contribution of this paper is to propose a way to learn which queries to ask the QA system for each kind of subject and relation. Our system is trained using search-query logs and existing facts in Freebase. We show that it is better to ask multiple queries and aggregate the results, rather than rely on the answers to a single query, since integrating several pieces of evidence allows for more robust estimates of answer correctness. At the same time, the number of queries to ask varies depending on the nature of the relation. On the one hand, relations that expect values from 'open' classes with large numbers of instances (e.g., CHILDREN, which expects values of type PERSON) are sensitive to the number of queries asked, and asking more than a certain number of queries decreases performance. The reason is that issuing more and more queries (of ever decreasing quality) increases the number of false positives, and if we ask too many queries, the negative impact of false positives will outweigh the positive impact of aggregating over several sources of information. On the other hand, if the relation expects values from a 'closed' class with only a limited number of instances (e.g., NATIONALITY, which expects values of type COUNTRY), the number of potential false positives is limited, and the performance will not suffer from asking more queries.

We evaluate our method by using it to fill in missing facts for 1,000 Freebase entities of type PERSON for each of the 9 relations shown in Table 1. This test set is chosen by stratified sampling from a larger pool of the 100,000 most frequently searched-for entities; thus, it contains a mix of head and tail entities. We show that we are able to reliably extract correct answers for a large number of subjects and relations, many of which cannot be extracted by conventional 'push'-type methods.

II. METHODOLOGY

In this section, we describe an end-to-end pipeline that uses a QA system in order to find new facts to add to Freebase. We first give a high-level overview—summarized in Fig. 1—before discussing each separate stage in detail.

In the knowledge base completion task [8], we are given a subject entity ID S and a relation ID R, and need to find the correct, previously unknown object entity IDs. For instance, we might be given subject ID /m/02whj (FRANK ZAPPA) and relation ID /m/01x3gb5 (PARENTS), and would be expected to return object ID /m/01xxvky

(ROSE MARIE COLIMORE) or /m/01xxvkq (FRANCIS ZAPPA).

In this paper, we propose to use an existing Web-search–based QA system to perform the KB completion task. Since our QA system expects as input a query string, we need a way of lexicalizing subject–relation pairs to query strings. It is easy to look up one or more names (aliases) for the subject; the tricky issue is how to lexicalize the relation. To solve this, we mine a set of query templates from search query logs in an offline

training phase (upper box of Fig. 1; Section 2.1), using a form of distant supervision [13] based on Freebase. For each relation R, this procedure constructs a set $Q^{-}R$ of templates. For example, parents of __ is a template for PARENTS; it can be instantiated for a subject S by looking up a name for S in Freebase and substituting it for the placeholder (e.g., parents of Frank Zappa). The same relation could also generate the template __ mother. We also estimate the quality of each such template using a labeled training set T R.

In the KB completion phase (lower box in Fig. 1), we process each subject–relation pair (S,R) in turn. We start by selecting NR templates $\{q^{-}1,...,q^{-}NR\} \subseteq Q^{-}R$, based on the estimate of template quality computed offline, and instantiate them for S, obtaining the queries {q1,...,qNR} (query template selection, Section 2.2). (A good value for NR is also found during offline training.)

In the subsequent question answering step, each query qi is fed to the QA system, which uses Web search to produce a scored list Ai of answer strings (Section 2.3).

In order to deal with the answers in Freebase, we must link them to the entities they refer to. This is done in the answer resolution step (Section 2.4), where each list Ai of answer strings is converted to a list Ei of answer entities.

In the next phase, answer aggregation (Section 2.5), we merge all answer rankings Ei—one per query—into a single ranking E.

It is desirable to have an estimate of the probability that the answer is correct. The QA system produces quality scores, but these are real numbers that cannot be directly interpreted as probabilities. Hence, in the final answer calibration step (Section 2.6), we translate the output scores to probabilities using a model ΘR that was fit in the offline training phase, via supervised machine learning.

We now describe the individual system components in detail.

2.1. Offline training

Query templates are constructed in an offline training stage. The simplest templates consist only of a lexicalization template, i.e., a search query in which a placeholder has been substituted for the subject, as in parents of __. We first describe how we construct the set of lexicalization templates from Web-search logs, and then introduce a class of slightly more complex templates that allow for appending additional terms to a query.

Mining lexicalizations from search logs. Since our search-based QA system is geared to work on search queries entered by humans, we mine the lexicalization templates from logs of such queries, using a version of distant supervision [13] on Freebase. Our goal is to count for each relation–template pair (R,q^{-}) how often the relation R is expressed by the lexicalization template ^{-}q in the search-engine logs. To do so, we iterate over the logs, performing the following steps for each query q (e.g., parents of Frank Zappa).

1. Perform named-entity recognition on q, and link the resulting mentions to entities using approximate string matching techniques. (Note that standard entity linkage methods are of limited use here, as queries have little disambiguating context.) If q does not contain exactly one entity, discard it.
2. Let S (e.g., FRANK ZAPPA) be the subject entity contained in q. The template ^{-}q is obtained by replacing the name of S with a placeholder string in q (e.g., parents of Frank Zappa becomes parents of __).

3. Run the QA system on q, obtaining the top-ranked answer string a (e.g., Francis Zappa). Link a to Freebase to get entity A. (When matching the answer entities, we have more sections in which the respective stages of the pipeline are described.
4. If (S,A) is linked by a relation R (e.g., PARENTS) in Freebase, increase the count of (R,q⁻) by one.

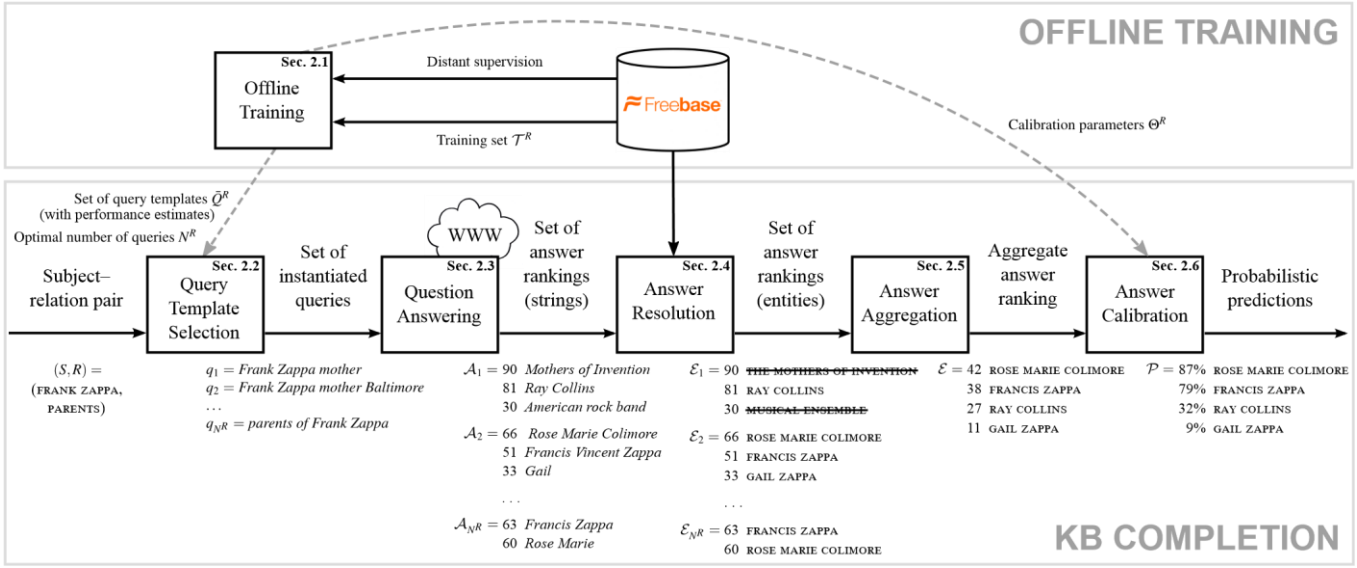


Figure 1: Overview of the pipeline for knowledge base completion, illustrated by the Frank Zappa example of Table 2. The set Q⁻R of query templates and the optimal number NR of queries to use are relation-specific. The square boxes contain references to the context, so we can use more sophisticated entity linkage methods, which we discuss in Section 2.4.)

For each relation R, we may then pick the most frequent templates as Q⁻R, the set of lexicalization templates for R. Some of the most frequent lexicalization templates for PARENTS and PLACE OF BIRTH are listed as the horizontal axis labels of Fig. 2.

Query augmentation. The quality of such templates may vary depending on the subject. For instance, the query Frank Zappa mother retrieves mostly snippets that do not contain the answer, since most snippets are included because they mention Zappa's band, which was called 'The Mothers of Invention' (cf. row 1 of Table 2). However, adding more words to the query can shift the focus to more relevant documents. For example, the query Frank Zappa mother Baltimore will produce results of much higher quality, since passages that mention where someone was born are more likely to also contain who they were born to (cf. row 2 of Table 2; Zappa was born in Baltimore). This is also useful for disambiguation; e.g., birthplace of Michael Jackson World Guide to Beer is more likely to find the birthplace of the renowned late beer sommelier (and author of the 'World Guide to Beer'; cf. row 4 of Table 2) than the plain query birthplace of Michael Jackson, which retrieves mostly snippets about the late King of Pop (cf. row 3 of Table 2).

We refer to the process of attaching extra words to a query as query augmentation. Henceforth, when speaking of a query template, we mean a pair of a lexicalization template and an augmentation template. Augmentation templates simply specify a property (relation) for which a value is to be substituted. For instance, the query template consisting of the lexicalization template __ mother and the augmentation template PLACE OF BIRTH

can be instantiated for the subject FRANK ZAPPA to Frank Zappa mother Baltimore. We also allow the empty augmentation template (i.e., no terms are appended to the lexicalization). If no value of the relation specified by the augmentation template is known for the subject, the query template cannot be instantiated.

Query specification	Top result snippets (candidate answer strings in bold)
Subject–relation pair: (FRANK ZAPPA, PARENTS) True answer: ROSE MARIE COLIMORE Template: (__ *mother*, [no augmentation]) Query: *Frank Zappa mother*	[1] *The Mothers of Invention – Wikipedia, the free encyclopedia* The Mothers of Invention were an American rock band from California that served as the backing musicians for Frank Zappa, a self-taught composer and performer [...] [2] *Ray Collins of Frank Zappa's Mothers of Invention Dies	Billboard* Ray Collins, a singer who co-founded the Mothers of Invention with Frank Zappa but left when "too much comedy" started appearing in the band's songs, died on Monday [...]
Subject–relation pair: (FRANK ZAPPA, PARENTS) True answer: ROSE MARIE COLIMORE Template: (__ *mother*, PLACE OF BIRTH) Query: *Frank Zappa mother Baltimore*	[1] *Frank Zappa – Wikipedia, the free encyclopedia* Frank Vincent Zappa was born in Baltimore, Maryland, on December 21, 1940. His mother, Rose Marie Colimore [...]; his father, Francis Vincent Zappa [...] [2] *Frank Zappa statue to be dedicated in September – The Baltimore Sun* Frank Zappa statue to be dedicated in September. [...] His mother, Rose Marie Colimore, was a librarian, and his widow, Gail, lobbied to have the bust placed near a city library.
Subject–relation pair: (MICHAEL JACKSON (WRITER), PLACE OF BIRTH)True answer: LEEDS Template: (birthplace of __, [no augmentation]) Query: birthplace of Michael Jackson	[1] Michael Jackson – Wikipedia, the free encyclopedia Michael Jackson was born on August 29, 1958, in Gary, Indiana. He was the eighth of ten children in an African-American working-class family [...] in Gary, an industrial city near Chicago. [2] Michael Jackson's House – Gary, IN – Yelp 8 Reviews of Michael Jackson's House "WTF. this place is kind of a bummer. Streets aren't labeled, potholes aren't filled. The house is the only place on the block that was properly painted.
Subject–relation pair: (MICHAEL JACKSON (WRITER), PLACE OF BIRTH) True answer: LEEDS Template: (*birthplace of* __,	[1] *Michael Jackson (writer) – Wikipedia, the free encyclopedia* Jackson was born in Leeds, West Yorkshire and spent his early years in nearby Wetherby. [...] Jackson, Michael (1977). The World Guide to Beer [...] [2] *The Unique Michael Jackson	Philly Beer Scene* He was born in Wetherby in the city of Leeds. [...] Compensation

WORKS WRITTEN) Query: *birthplace of Michael Jackson World Guide to Beer*	eventually was awarded in 1988, when his agent [...] negotiated a fee on the re-write as The New World Guide to Beer.

Table 2: Example queries for two subject–relation pairs, alongside top result snippets retrieved by the search-based QA system (candidate answer strings in bold). The FRANK ZAPPA queries demonstrate how augmentation can shift the focus to more relevant snippets, the MICHAEL JACKSON (WRITER) queries, how augmentation can be useful for disambiguation.

While we currently focus on augmentations as above, where we append the name of an entity the subject is known to be in relation to, several other kinds of augmentation are conceivable. We discuss some of them in Section 5.

Manual template screening. In practice, we manually select 10 lexicalization templates from the top candidates found by the logmining approach outlined above, and 10 augmentation templates from the relations pertaining to the subject type at hand; e.g., the augmentation templates for PARENTS and PLACE OF BIRTH are shown on the vertical axes of Fig. 2. Manual screening is not necessary but was done to reduce the number of queries during development and to facilitate ad-hoc result inspection.

2.2. Query template selection

Since query templates are defined as pairs of a lexicalization template and an augmentation template, the query space may be thought of as the Cartesian product of the set of lexicalizations and the set of augmentations. Many queries can be constructed in this two-dimensional space. We show individual examples of good vs. bad queries in Table 2. Below we discuss how to choose the good queries. But first we address the question: why not ask the QA system all the queries we can construct?

Dangers of asking too many queries. Issuing all possible queries is problematic, for two reasons. First, it is computationally challenging, since QA systems typically involve significant resources, such as CPU time, database lookups, or even, as in our case, Websearch queries. Second, it may be detrimental statistically: not all queries are equally good, so by asking all possible queries, we are likely to also ask many poor queries, which may dilute the result with false positives. It is worth pointing out that the notion of a query's being poor is conditioned on the QA system's quality. By construction (cf. Section 2.1), all queries are good from the perspective of human users, but some of them are poor for our purposes because the QA system does not do well on them.

Heatmap representation of template quality. A compact way of visualizing query quality is afforded by the heatmaps in Fig. 2, which shows the query space for the PARENTS and PLACE OF BIRTH relations. Lexicalization templates are shown on the horizontal axes, while augmentation templates span the vertical axes. (Note that we only show the manually selected subsets of lexicalization and augmentation templates, but many more are possible.) The color encodes the average quality of queries instantiating the respective template, computed on the supervised training set T R. Quality is measured in terms of mean reciprocal rank (MRR, cf. Section 3.1.2) of the true answer in the answer ranking (after the answer resolution phase, cf. Section 2.4), i.e.,

larger values (brighter colors) are better. We see that, on average, some lexicalizations are better than others (e.g., the colloquial __ mom performs worst for PARENTS) and that some augmentations increase query quality over augmentationless queries (e.g., PLACE OF BIRTH helps for PARENTS, as in the Frank Zappa example from Section 2.1), whereas others decrease it (e.g., CHILDREN hurts for PARENTS).

Query selection strategies. A heatmap as in Fig. 2 may be computed for every relation (based on a training set of subjects for which the ground-truth answers are known in Freebase) and may subsequently serve as the basis for deciding which queries to send to the QA system. Given a heatmap of query quality, the exact choice of queries is determined by two factors.

First, we can decide how to pick templates from the heatmap. One option is to act greedily, always picking the templates with the largest values in the heatmap. Another option would be to add some diversity to the queries. A simple way to do this is to sample (without replacement) from the heatmap, by converting it to a probability distribution. A standard way to obtain such a distribution is to pass the values through the softmax function:

$$\Pr(q^-) \propto \exp(\gamma \, \mathrm{MRR}(q^-)). \qquad (1)$$

In the above equation, γ is like an inverse 'temperature' parameter, which controls the degree of greediness. To set γ = 0 is to choose templates uniformly at random, and as γ is increased, ever more probability mass is shifted onto the highest-valued template.

Second, given γ, we can choose how many queries to pick. We are interested in finding the number NR that optimally trades off the advantages of many queries (more pieces of evidence) against those of few queries (fewer false positives) when aggregation is done. In practice, we run the full pipeline on the training set T R for a wide range of values and choose as NR the value that yields the aggregated answer rankings with the highest MRR (cf. Section 3.1.2).

An exploration of the effects of varying the degree of greediness and the number of queries is presented in Section 3.

2.3. Question answering

In this paper, we use an in-house natural-language QA system. Since the system is proprietary, we cannot give all the details, but we outline the basic approach below (see also Pas¸ca [14]).

Input. A search query that can be answered by short phrases. It may be a natural-language question, such as who was Frank Zappa's mother, or a terser query, as in Frank Zappa mother Baltimore (the latter is used as an example in this section).

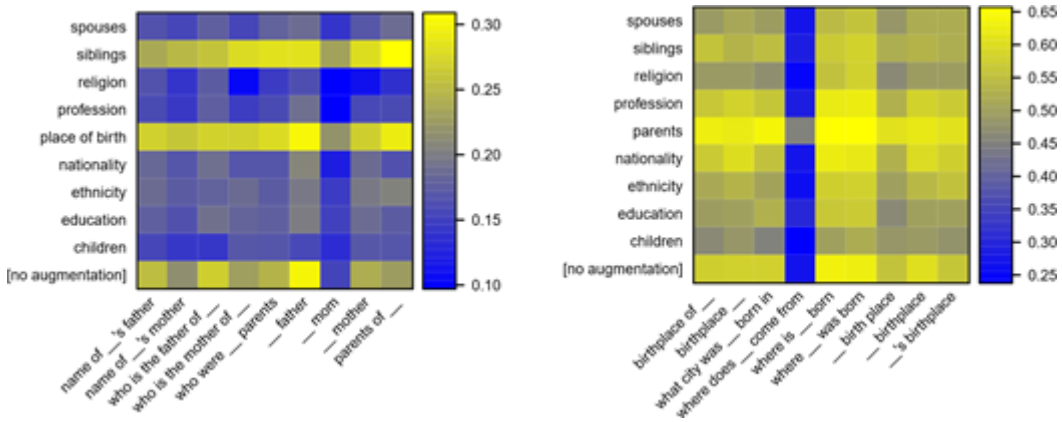
Output. A list of candidate answer strings, ranked according to an internally computed answer quality score.

Step 1: Query analysis. Find the head phrase of the query (mother). When applying the QA system in our pipeline, we can set the head phrase explicitly, as we generate the queries given a relation.

Step 2: Web search. Issue the input query to the search engine, retrieving the top n result snippets, where n is a tuneable parameter (we choose n = 50). Two snippets for the query Frank Zappa mother Baltimore are reproduced in row 2 of Table 2.

Step 3: Snippet analysis. Score each phrase in the result snippets with respect to how good an answer it is to the input query.

Step 4: Phrase aggregation. The same phrase may appear several times across all snippets (e.g., Rose Marie Colimore appears twice in row 2 of Table 2), and each instance is scored separately in step 3. This step computes an aggregate score for each distinct phrase, again via machine learning, based on features such as the number of times the phrase appears and the average and maximum values (over all instances of the phrase) of the features from step 3.



(a) PARENTS (b) PLACE OF BIRTH

Figure 2: Heatmaps for the (a) PARENTS and (b) PLACE OF BIRTH relations, capturing the performance (mean reciprocal rank; cf. Section 3.1.2) of a number of query templates on the training set. Each combination of lexicalization template (horizontal axes) and augmentation template (vertical axes) defines a query template. Brighter colors signify higher MRR, i.e., better performance.

Each phrase is represented as a vector of features, and the score is computed as a weighted sum of these features, with weights fitted ahead of time via supervised machine learning. For instance, Rose Marie Colimore is a good candidate because it is contained in a highly ranked snippet, is a noun phrase, has high inverse document frequency, appears close to the query term mother, and is highly related to the head phrase mother of the query (since both typically appear in person-related contexts in large text corpora).

2.4. Answer resolution

For each query qi, the QA system returns a list Ai of answer strings, but what we want is a list of entities Ei. For this, we use standard entity linkage techniques, such as [6], which takes into account the lexical context of each mention, and [7], which takes into account other entities near the given mention, using joint inference. For example, if we see the string Gail, it could refer to GAIL, a river in Austria, but if the context is Zappa married his wife Gail in 1967, it is more likely to be referring to the person GAIL ZAPPA (cf. Fig. 1). Since we know the type of answer we are looking for, we can use this as an additional constraint, by discarding all incorrectly typed answer entities (e.g., THE MOTHERS OF INVENTION and MUSICAL ENSEMBLE in Fig. 1).

2.5. Answer aggregation

After the answer resolution step, we have one ranking of correctly typed answer entities for each query. But since, in general, we issue several queries per subject–relation pair to the QA system, we need to merge all of their rankings into a single answer ranking.

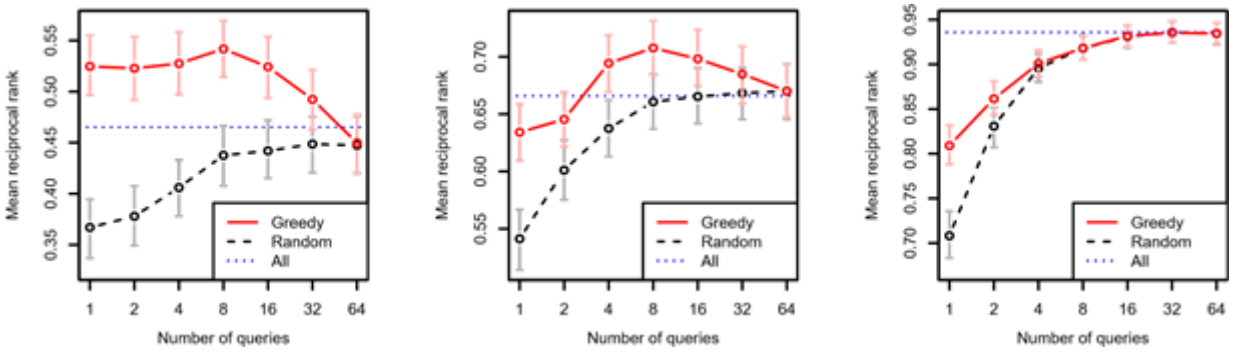
We adopt a simple yet effective approach, computing an entity's aggregate score as the mean of its ranking-specific scores. Assume we asked the QA system NR queries q1,...,qNR for the subject– relation pair (S,R), resulting in NR rankings E1,...,ENR. Let Ω be the set of entities occurring across all these rankings. Each entity E ∈Ω has a score in each ranking Ei, referred to as si(E); if E does not appear in Ei, we set si(E) = 0. Now, E's overall score s(E) is computed as its average score across all rankings, i.e., $s(E) = \frac{1}{N^R} \sum_{i=1}^{N^R} s_i(E)$. The answer entities Ω alongside the scores s define the aggregated ranking E for (S,R).

This eliminates false positives that are ranked high in a single ranking (e.g., RAY COLLINS in Fig. 1), possibly because the respective query was of low quality. On the contrary, entities appearing in many rankings, but not necessarily on top, are generally ranked high in the aggregate ranking, as they contribute fewer ranking-specific scores of zero (e.g., ROSE MARIE COLIMORE in Fig. 1).

2.6. Answer calibration

The goal of the answer calibration step is to turn the scores attached to entities in the aggregate ranking into probabilities that tell us how likely an entity is to be the true object. Such interpretable scores are important if we want to make informed decisions on how to act upon a proposed answer: whether we want to discard it immediately; how we should prioritize it for validation by humans; or what weight to give it in a knowledge fusion algorithm for merging evidence from different fact extraction methods.

To map QA scores to probabilities, we apply logistic regression to the QA scores (a standard technique called Platt scaling [16]); the model was trained on an independent development set. We investigated more sophisticated features, such as the number of times each entity appeared across multiple query responses, but this did not seem to help. Note that multiple answers can be correct (e.g., people can have multiple parents and spouses), so the probabilities do not sum to 1 across answers; rather, each individual calibrated answer is a number between 0 and 1.



(a) SPOUSES (b) PLACE OF BIRTH (c) NATIONALITY

Figure 3: Performance in terms of MRR for three representative relations (with bootstrapped 95% confidence intervals). For performance and curve shape of the remaining test relations, cf. Table 3. The (logarithmic) x-axes show the number of queries fed to the QA system. Solid red: Greedily selecting the query templates that perform best on the training set. Dashed black: Selecting queries uniformly at random. Dotted blue: Selecting all available queries.

III. EMPIRICAL EVALUATION

Having described the full pipeline in Section 2, we now evaluate it. We proceed by first introducing our test data and quality metrics. Then, we evaluate our answer rankings, and last, we investigate the quality and quantity of our final, probabilistic predictions.

3.1. Experimental setup

3.1.1. Training and testing data

For testing our method, we consider the 9 relations of Table 1. To be able to train and test our method, we need to have, for each relation R, a number of subjects alongside the ground-truth objects they are connected to by R. We obtain this ground truth from Freebase by sampling subjects with known values for R.

Hereby, we make what we call the 'local closed-world assumption': Assume Freebase has a non-empty set of objects O for a given subject–relation pair (S,R). The local closed-world assumption then posits that O contains all ground-truth objects for (S,R).

In selecting subjects, we restrict ourselves to the 100,000 most frequently searched-for persons. We repeat the following stratified sampling procedure twice, to construct (1) the training sets T R and (2) test sets for each R: For each relation, consider only the subjects (from the base set of 100,000 persons) for which the objects are known. Divide this subject set into 100 percentiles (with respect to frequency) and randomly sample 10 subjects per percentile, for a total of 1,000 subjects per relation.

The rationale for restricting ourselves to the top 100,000 persons was that such frequent entities tend to be of higher interest to the general user, while at the same time, Freebase is still rather incomplete even in this regime (cf. Table 1). Also, it is important to note that, although our base set encompasses only about 3% of Freebase's roughly 3 million person entities, most of them are likely to be unknown to most users (for example, the tail of the top 100,000 contains persons such as BIRTHE KJÆR, a Danish singer, or MO-
HAMMAD-REZA LOTFI⁻ , a Persian classical musician).

We manually select 10 lexicalization templates for each relation. As augmentation templates, we use 10 relations: our 9 test relations (see above) plus RELIGION. Of course, when testing on relation R, we are not allowed to use R itself for query augmentation, so there are 10×(10–1)= 90 candidate templates per subject–relation pair (not all of which can be necessarily instantiated for every subject, since the relation specified by an augmentation template might not be known for every subject).

3.1.2. Ranking metrics

Next, we introduce the ranking metrics used to quantify performance. Consider a subject–relation pair (S,R) with the set O = {O1,...,On} of ground-truth objects, and assume we want to evaluate an entity ranking E. Let r1 < ... < rn be the ranks of the elements of O in E, in ascending order. The rank of elements of O not appearing in E is defined as infinity. Then, the reciprocal rank (RR) of E is defined as the reciprocal of the rank of the highestranked true answer, i.e., as 1/r1. Averaging over several rankings yields the mean reciprocal rank (MRR). The reciprocal of the MRR is the harmonic mean rank of the highest-ranked true answers.

If the emphasis is on retrieving each, rather than any, true answer from O, another useful metric is average precision (AP), defined as ri. Averaging over several rankings yields the mean average precision (MAP).
For both RR and AP, the best possible value is 1, and the worst possible, 0. RR upper-bounds AP, and if n = 1 (e.g., because R is a functional relation), RR equals AP.

3.2. Quality of answer rankings

We previously stated the intuition that issuing too many queries to the QA system may be harmful because of the negative impact of false positives (answers that get ranked unduly high), and that we might counteract this effect by asking a smaller set of well selected queries. The goal of the first part of this section is to show that this is indeed the case, by evaluating different query selection methods. In the second part of this section, we illustrate the effects of query subselection in more detail by performing a more fine-grained analysis on a per-subject basis.

3.2.1. Subselecting queries for aggregation

We now perform an evaluation of the effects of subselecting queries for aggregation. Recall that query selection is based on heatmaps as in Fig. 2 (one per relation), which are computed in an offline training stage and which quantify, for each template, how well it performs on our set of 1,000 training subjects. Also recall from Section 2.2 that we can act at different degrees of greediness when selecting templates according to these heatmaps. Further, for each greediness level, we can ask the QA system any number of queries, up to the number of queries available for the input subject–relation pair (around 90, cf. Section 3.1.1).

Relation R	MRR (NR)	MRR (all)	MAP (NR)	MAP (all)	NR	Greedy-curve shape	Closedness
SPOUSES	0.54	0.47	0.50	0.43	8	inverted U	0.010
PARENTS	0.33	0.28	0.25	0.22	8	inverted U	0.013
SIBLINGS	0.30	0.27	0.24	0.23	8	inverted U	0.015
CHILDREN	0.25	0.20	0.18	0.14	8	inverted U	0.018
PLACE OF BIRTH	0.71	0.67	0.71	0.67	8	inverted U	0.026
EDUCATION	0.83	0.82	0.78	0.77	32	diminishing returns	0.063
PROFESSION	0.58	0.58	0.47	0.46	16	diminishing returns	0.21
NATIONALITY	0.94	0.94	0.93	0.93	32	diminishing returns	0.24
ETHNICITY	0.78	0.77	0.76	0.76	32	diminishing returns	0.28

Table 3: Performance of our system on 9 relations. We show MRR and MAP for two query selection strategies: (1) greedily selecting the optimal number NR of queries (corresponding to the highest values of the red curves

in Fig. 3); (2) selecting all available queries (corresponding to the horizontal lines in Fig. 3). We also show the closedness for all relations (cf. Section 3.2.1 for a definition).

Fig. 3 explores these combinations of greediness level and number of queries asked. Each panel pertains to one relation and contains one curve for each of two greediness levels: random in dashed black ($\gamma = 0$ in (1)) and greedy in solid red ($\gamma \to \infty$). The x-axes show the number NR of queries, the y-axes, performance for the respective combination of greediness and number of queries (measured as the MRR across all aggregate rankings, one ranking for each of the 1,000 test subjects). Finally, the blue dotted horizontal lines indicate the MRR achieved when aggregating over all available queries; i.e., if we extended the x-axes as far to the right as possible, the curves for all greediness levels would necessarily converge to the horizontal lines. For space reasons, we show plots for three representative relations only, but the observations that follow apply equally to the relations not shown in Fig. 3. The results for all relations are summarized in Table 3.

Greedy is best. The reason we restrict the plots to the two extreme greediness levels is that we found that intermediate levels lie strictly in between: the more we explore, the more we approach the performance of random selection. So the first observation is that greedy query selection works best for all relations (for performance metrics, cf. the MRR and MAP columns in Table 3).

Asking too many queries can hurt. As a second point, the greedy (red) curves also reveal that performance depends on the number of queries asked. In all cases, we do better by asking the QA system more than one query. In some cases, it is best not to ask too many queries, manifest in an inverted-U shape (SPOUSES and PLACE OF BIRTH in Fig. 3, but also PARENTS, SIBLINGS, CHILDREN). In these cases, we achieve the best performance by asking 8 queries. In other cases, asking more queries is always better, manifest in a diminishing-returns shape (NATIONALITY in Fig. 3, but also ETHNICITY, EDUCATION, PROFESSION). The columns 'NR' and 'Greedy-curve shape' of Table 3 summarize the shapes of the greedy (red) curves for all test relations. While this table indicates that NR is optimally chosen as 16 or 32 for the relations with diminishing-returns curves, the MRR and MAP achieved for those values is only marginally better than for NR = 8 (cf. Fig. 3(c)), so we conclude that issuing NR = 8 queries is a good choice for all R.

Open vs. closed relations. Whether a relation exposes an invertedU or a diminishing-returns shape has to do with the answer type it expects; e.g., SPOUSES expects an object of type PERSON, an 'open' type with a large number of instances. This means that there are many potential false positives, and by asking more and more queries of ever poorer quality, we introduce ever more of them into the aggregate answer ranking, which makes the greedy (red) curve decrease. On the other extreme, NATIONALITY expects objects of type COUNTRY, a 'closed' type with only around 200 instances, such that the number of potential false positives is very limited.

To put this intuition in numbers, we compute, for each relation, the number of unique answer entities contained in all rankings across all subjects and queries. Similarly, we compute the number of all unique ground-truth answers across all subjects and queries. Dividing the second by the first number yields the fraction of all distinct answers that are ever true answers (akin to the notion of precision), which we refer to as 'closedness'. The results of this calculation are displayed in the 'Closedness' column of Table 3. We see that the closedness is lowest for person-typed relations and highest for the predicates ETHNICITY and NATIONALITY.

The values are significantly larger for relations with a diminishing-returns shape than for those with an inverted-U shape.

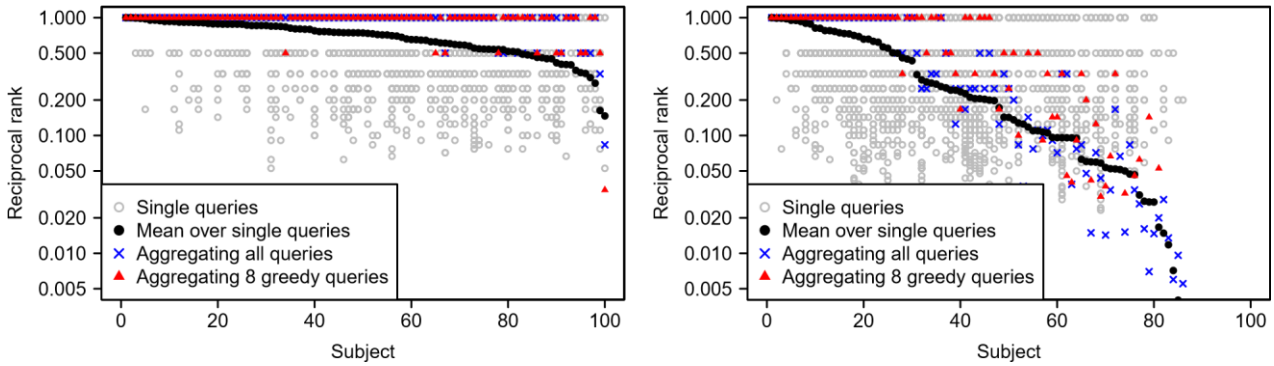
In conclusion, the answer to the question whether we can profit from the robustness of aggregation without injecting too many false positives is, Yes: by asking a small, well chosen fraction of all available queries, we do better than by asking a single query and at least as well as by asking all available queries.

3.2.2. Subject-level analysis

To better understand the effects of aggregating the rankings resulting from multiple queries, let us consider Fig. 4. In these plots, each column (x-value) represents one of 100 randomly sampled test subjects. Within each column, there is one gray circle per query, with the y-axis showing the corresponding RR (on a logarithmic scale, i.e., values of 0 do not appear). The per-subject MRR is obtained by taking column-wise averages, plotted as black dots. Subjects are sorted on the x-axis in order of increasing MRR (such that the black curve is descending by design). The blue crosses show the RR when aggregating over all queries available for the respective subject (around 90, cf. Section 3.1.1), while the red triangles show the RR when aggregating 8 greedily chosen queries (since NR = 8 was found to be a good value in Section 3.2.1). That is, the average of all black dots equals the value of the corresponding black curve in Fig. 3 at x = 1; the average of all blue crosses equals the value of the corresponding blue horizontal line; and the average of all red triangles equals the value of the corresponding red curve at x = 8.

We investigate two representative relations. Fig. 4(a) shows the results for NATIONALITY, a 'closed' relation (diminishing-returns shape in Fig. 3) on which we do nearly perfectly (MRR 0.94, or harmonic mean rank 1.1). Fig. 4(b) visualizes performance for SPOUSES, an 'open' relation (inverted-U shape in Fig. 3) on which performance, while still good (MRR 0.54, or harmonic mean rank 1.9), is well inferior to that on NATIONALITY.

We see that, in the case of NATIONALITY, aggregating all available queries (blue crosses, often occluded by the red triangles) is very effective, to the extent that for nearly all subjects, the aggregate ranking has an RR of 1 (for an MRR of 0.94 across all subjects). That is, aggregating over all available queries achieves virtually the same performance as if we chose the single best query for the respective test input—which is, of course, impossible, since we cannot know ahead of time which query will perform best (we only have estimates from the training phase).



(a) NATIONALITY (b) SPOUSES

Figure 4: Subject-level performance analysis (cf. Section 3.2.2).

As Fig. 4(b) demonstrates, the SPOUSES relation is considerably harder. While for about 40% of subjects, aggregating over all available queries (blue crosses) places a true answer at rank 1, there also is a considerable number of subjects for which aggregating does not outperform random query selection (where blue crosses lie beneath black dots). Although for many of these subjects there is at least one query for which a true answer gets rank 1 (gray circles), blindly aggregating all queries (blue crosses) often cannot recover it. The reason is that, among all available queries, there are many of poor quality, which overwhelm the aggregate ranking with false positives. In this case, more careful query selection helps: on average, the red triangles lie significantly above the blue crosses (MRR 0.54 vs. 0.46). In particular, note that several red triangles achieve an RR of 1, while their blue-cross counterparts lie further below.

3.3. Quality of calibrated predictions

As motivated in Section 2.6, it is desirable to know for each answer candidate how likely it is to be correct. Computing this probability (also called confidence) is the goal of the answer calibration step. In this section, we evaluate this step, followed by an analysis of the number of high-confidence predictions our system makes.

Quality of answer calibration. We proceed as follows, for each relation R separately. For each of the 1,000 test subjects for R, run the full pipeline (using greedy selection of NR = 8 queries, which was found to be near-optimal in Section 3.2.1), resulting in one aggregate ranking with calibrated scores per subject. Consider the set of all answer entities, across all subjects, and partition it according to the calibrated scores. For partitioning, we divide the range [0%,100%] into 20 buckets spanning 5% each. Under perfect calibration, the fraction of true answers in each bucket should lie within the range that defines the bucket.

Graphically, this translates to the following requirement. If we plot the 20 probability buckets on the x-axis and the fraction of true answers per bucket on the y-axis, we want the resulting curve to lie as close to the diagonal running through the origin as possible. Fig. 5 visualizes the results of this graphical test for the same three relations depicted in Fig. 3. For these relations (and equally for the ones not plotted) the diagonal is followed closely, which implies that calibration works well.

Number of high-quality answers. Eventually, we are interested in making a large number of high-quality predictions, since those are the best candidates to be suggested for Freebase. We can get an idea of the number of high-quality predictions by counting how many predictions we make with high confidence. The results for all 9 test relations are summarized in Table 4, which contains the numbers of facts extracted above different confidence thresholds. Since our test set contains 1,000 subjects for each relation, a value of 1,000 means that we predict one fact per subject on average with a confidence above the respective threshold, a value of 100 implies we predict one fact per 10 subjects, etc.

When evaluating the quality of answer rankings returned by our method (cf. Table 3), we found performance to be lowest on CHILDREN (MRR 0.25; for an explanation, cf. the discussion in Section 5). However, we also only extract 8 facts with a confidence above 50% for CHILDREN, so our system knows that its answers are poor in this case, which is crucial for making the output actionable. Our answer rankings are best for NATIONALITY (MRR 0.94), which is reflected in high confidence values: we extract 366 facts with a confidence over 90%, i.e., over one per three subjects.

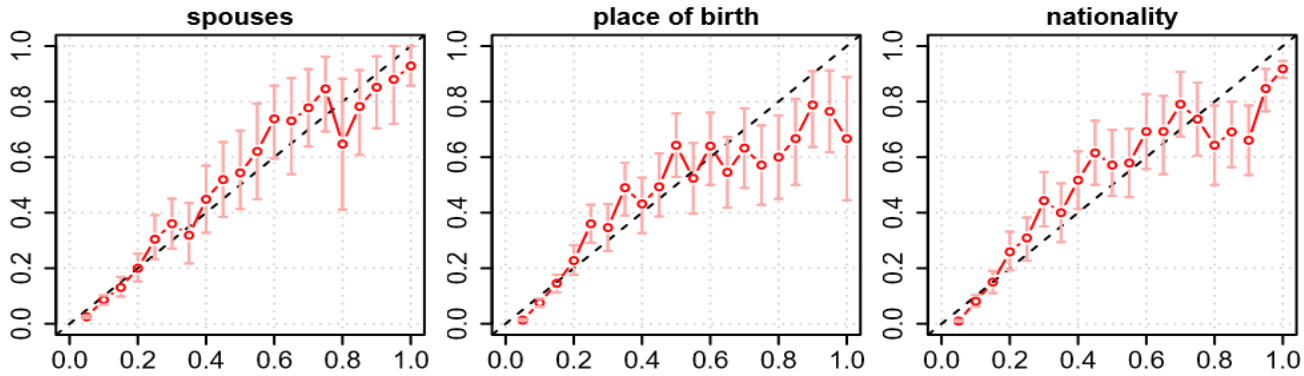


Figure 5: Calibration results (with bootstrapped 95% confidence intervals). Horizontal axes: Predicted probability, binned in 20 buckets of width 5%. Vertical axes: Fraction of positive examples in bucket.

For completeness, each number of extracted facts in Table 4 is followed (in parentheses) by the fraction of facts that are correct, such that multiplying the two numbers in each cell yields the total number of correct facts for the respective confidence threshold.

Relation	> 10%	> 30%	> 50%	> 70%	> 90%	Novel
SPOUSES	1,395 (0.37)	518 (0.64)	293 (0.79)	160 (0.84)	67 (0.91)	14%
PARENTS	1,278 (0.21)	213 (0.48)	78 (0.63)	35 (0.63)	7 (0.57)	38%
SIBLINGS	958 (0.21)	168 (0.50)	66 (0.65)	22 (0.73)	2 (1.00)	19%
CHILDREN	753 (0.20)	62 (0.48)	8 (0.62)	0 (—)	0 (—)	—
PLACE OF BIRTH	1,723 (0.38)	766 (0.57)	426 (0.62)	209 (0.67)	52 (0.73)	15%
EDUCATION	2,400 (0.44)	1,222 (0.66)	857 (0.74)	535 (0.78)	173 (0.82)	19%
PROFESSION	2,405 (0.31)	719 (0.53)	388 (0.62)	202 (0.65)	68 (0.65)	30%
NATIONALITY	1,747 (0.53)	1,061 (0.71)	748 (0.79)	557 (0.83)	366 (0.90)	15%
ETHNICITY	1,805 (0.44)	909 (0.63)	601 (0.70)	408 (0.75)	175 (0.85)	31%

Table 4: Numbers of facts extracted above different confidence thresholds, for 1,000 subjects per relation. Parentheses: Precision, i.e., fraction of correct facts. The column labeled 'Novel' contains the percentage of facts extracted with a confidence above 70% that are found by none of a collection of complementary methods (cf. Section 3.3).

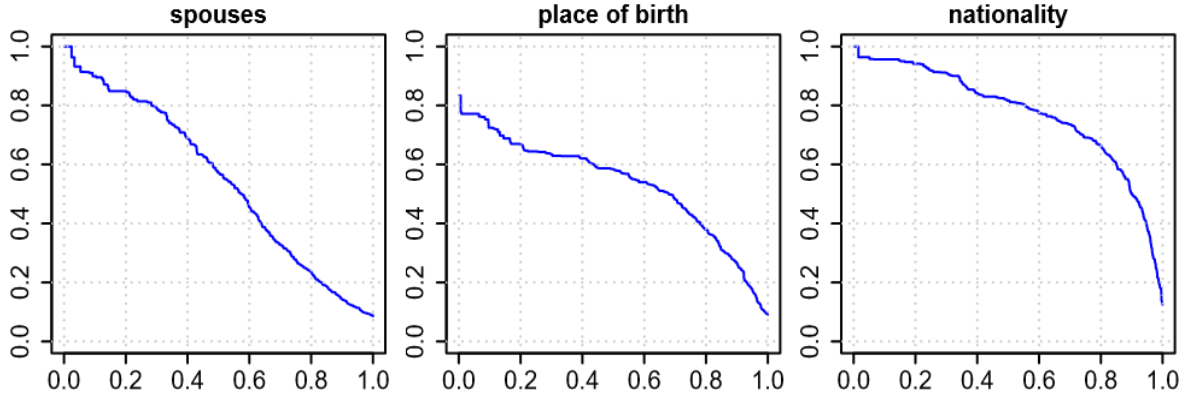


Figure 6: Precision–recall curves. Horizontal axes: Recall. Vertical axes: Precision.

Precison and recall. Fig. 6 shows precision–recall curves (interpolated [10]) for the three representative example relations (those also shown in Figs. 3 and 5). These curves were computed for a single ranking per relation, formed by listing all predictions for the relation (across subjects) in order of confidence. As expected, the curve for NATIONALITY looks best: since it is a closed relation (cf. Section 3.2), the impact of false positives is limited, and precision stays high even as recall is increased. Further, PLACE OF BIRTH is more closed than SPOUSES and achieves higher MRR and MAP (cf. Table 3). Therefore, it is not surprising that the precision–recall curve for PLACE OF BIRTH is more concave than for SPOUSES. Note, however, that at low levels of recall, SPOUSES achieves higher precision than PLACE OF BIRTH, i.e., our most confident predictions for SPOUSES are better than for PLACE OF BIRTH. This demonstrates that, even if the quality of the uncalibrated answer rankings for the average subject (which is what MRR and MAP capture) is worse, there still is value in our overall top predictions across all subjects when considering the calibrated answer scores.

Novelty of extracted facts. Finally, we compare the overlap of the facts extracted by the present system with facts extracted by our in-house state-of-the-art 'push' system [5] (which is similar to Ji and Grishman [8]). Concretely, we consider the predictions we make with a confidence above 70% and compute the fraction that are not found by the conventional 'push' methods (also with a confidence above 70%). The values range from 14% (SPOUSES) to 38% (PARENTS), with a mean of 23% over all 9 relations. (All values are listed in the right column of Table 4.) We conclude that our 'pull' method adds substantial value over existing 'push' methods.

IV. RELATED WORK

Related work can be divided into three main areas: papers about question answering (QA), papers about knowledge base completion (KBC), and papers about using QA to solve the KBC task. We briefly review each of these below.

The field of general QA has been popular for a long time. A milestone was the introduction, in 1999, of a specialized track related to QA into the annual competition held at the Text Retrieval Conference [20]. Many systems in this competition, as well as our own system, are based on the approach outlined by Pas¸ca [14]. However, our focus is not developing better QA technology, but rather addressing the issue of how to use such systems for KBC.

The KBC task has grown in popularity as a research topic after being introduced as an annual competition in 2008 to the Text Analysis Conference [11]. Good summaries of the standard approaches to this task are given by Ji and Grishman [8] and Weikum and Theobald [21]. Most of these methods process each document in turn according to a 'push' model (cf. Section 1), extracting as many facts as possible by using named-entity linkage and (supervised) relation extraction methods.

In this paper, we focus on a 'pull' model, whereby we try to retrieve individual documents to fill in specific facts, using QA technology. While this is a relatively new approach, there are some related works. The most similar is perhaps Kanani and McCallum's [9] work on using reinforcement learning to learn an optimal policy for efficiently filling in missing values in a KB (they focus on filling in the email address, job title, and department affiliation of 100 professors at UMass Amherst). The actions available are to perform one of 20 possible types of query (e.g., name, name + "CV", name + "Amherst"), to download one of the n resulting Web

pages, or to extract one of the three relations from the page. By contrast, we learn the value of each possible query formulation using a myopic strategy; we always process n = 50 snippets resulting from search; and we extract the values from each snippet independently.

OpenEval [17] focuses on classifying if a given subject–relation– object triple is true or not, based on retrieved Web pages, whereas we focus on returning all high-confidence object values for a given subject–relation pair based on snippets. A further difference is that OpenEval glosses over the distinction between entities and their names, or mentions, which can cause problems due to synonymy.

Another related approach is 'Conversing Learning' [15]. Here, the goal is to formulate natural-language questions about inference rules (e.g., 'Is it true that, if X and Y have children in common, then they must be married?') used by the NELL system [3], and to pose these questions to Twitter and Yahoo! Answers, hoping that humans will answer 'yes' or 'no' to the questions. By contrast, we do not ask humans, but instead perform targeted Web searches, and our questions are about specific facts rather than inference rules.

Finally, Byrne and Dunnion [2] formulate one query per subject– relation pair, using manually constructed templates, and search a small collection of documents to retrieve answers. By contrast, we learn how to formulate the queries, and we search the entire Web.

V. DISCUSSION

The main goal of this paper is to present and evaluate an end-toend pipeline for knowledge base completion based on search-based question answering. While it is fully functional and works well on our evaluation data, many more improvements can be made. The purpose of this section is to discuss the separate parts of the pipeline, pointing out common failure modes and highlighting potential directions for future work.

Query construction (Section 2.1). Several further kinds of augmentation beyond appending known properties are conceivable. For instance, we could add phrases that tend to co-occur with the correct answer on Web pages (e.g., the strings hospital or was born in could help in queries for PLACE OF BIRTH). Also, when choosing which properties to augment with, we could attempt to pick ones that disambiguate between entities with similar names; e.g., when the subject is called Michael Jackson (as in Table 2), appending the value of PROFESSION is better than appending the value of GENDER, since the latter is shared by the two ambiguous subjects, while the former distinguishes them.

Another interesting idea for query augmentation would be to admit the exclusion operator when constructing queries. This could provide a tool for explicitly reducing the number of bad snippets retrieved by the QA system. For instance, snippets containing the word music—most likely about Michael Jackson the singer rather than the beer sommelier—would be avoided by the query Michael Jackson birthplace –music.

Query selection (Section 2.2). Currently, query choice is done in batch mode: for each relation R, we first choose a predetermined number NR of queries and then feed them to the QA system all at once. An alternative approach could follow a sequential rather than a batch paradigm, asking one query at a time, and inspecting the aggregated and calibrated ranking after each query. This process could continue until the calibrated probabilities of the topranked answers are high enough or the ranking has stayed stable for a while. Such a

setup would be more adaptive with respect to the number of queries asked and could thus be potentially more effective at avoiding to ask too many queries (cf. [9]).

Question answering (Section 2.3). It is a strength of our method that it leverages powerful Web-search machinery for retrieving relevant and up-to-date information that is independent of Freebase. Nonetheless, in the evaluation (cf. Tables 3 and 4) it became clear that our system works better on some relations than others. We have already discussed the different properties of 'open' vs. 'closed' relations (Section 3.2.1). Still, there remain effects that are not explained by this distinction. Consider, e.g., the relations SPOUSES and CHILDREN, both expecting objects of type PERSON. Although

SPOUSES is arguably even more 'open' than CHILDREN (cf. Table 3, where SPOUSES has the lowest closedness), our performance is considerably better for SPOUSES than for CHILDREN (MRR 0.54 vs. 0.25). Error analysis led us to conclude that the effect is due to the QA system: result snippets that mention the subject's children often also mention their spouse, to the extent that, in some cases, the spouse appears more often in the snippets than the children themselves, so our QA system, which uses frequency of occurrence among its main features, may return the spouse in place of the children. It is also problematic that children are less frequently mentioned by name than other people the subject is related to.

We emphasize that we do not rely on the internal details of the QA system, but merely require that it take a query string as input and return a scored list of answer strings as output. Treating the QA system in this black-box fashion means we can in principle replace it with any QA system with the same input–output signature.

Answer calibration (Section 2.6). A fruitful addition, which could also help mitigate the problem of SPOUSES vs. CHILDREN from the previous paragraph, could be to inject world knowledge into the answer calibration step; e.g., if we know from Freebase that Y is subject X's husband, we would want the calibration model to learn that Y is unlikely to also be X's child. One way to enable this would be to augment the feature vectors that serve as input to the calibration step by binary features indicating all known relations between the subject and the candidate object. Then, the logistic regression used for calibration could learn which relations are mutually exclusive in Freebase (e.g., it could learn a large negative weight for the SPOUSES feature of the model for the CHILDREN relation).

Head vs. tail entities. Our test subjects were carefully sampled in a stratified manner, such that we are covering entities at all levels of popularity (from our base set of the 100,000 most frequently searched-for people; cf. Section 3.1.1). We originally hypothesized that performance would be better for more popular subjects. However, we could not confirm this intuition in our experiments: when ordering subjects according to popularity rather than MRR on the x-axis in Fig. 4, no correlation between MRR and popularity could be discerned. This is important for the following reason.

Recall that, to allow for automated evaluation, we sampled a test set of subjects for which the ground-truth objects are known in Freebase. Of course, for the system to be truly useful, it must be run on subjects for which the object is presently unknown. However, we found that Freebase is less complete for unpopular than for popular entities. Thus, and since there are more unpopular than popular entities in Freebase, it is important that our method works well on the less popular entities, too.

This being said, there are fundamental limits to any method for automated knowledge base completion—including ours—, stemming from the fact that many true facts are hard, or even impossible, to find on the Web.

For instance, Freebase lists ROSE MARIE COLIMORE as one of FRANK ZAPPA's parents, and our Web-search– based QA system successfully retrieves many documents that mention this fact. But what if we chose ROSE MARIE COLIMORE as the subject whose parents we want to find? Not only is the answer unknown in Freebase, there currently are not even any Freebase entities for Colimore's parents. The reason is that the vast majority of information on Colimore—whether in Freebase or on the Web in general—deals with her exclusively in her role as Zappa's mother and rarely discusses any other aspects of her life. As a consequence, it is very challenging even for humans—let alone for automated knowledge base completion methods—to answer the question who Colimore's parents were. This means that, beyond finding the answer, having it verified by humans is a difficult task, too.

VI. CONCLUSIONS

This paper presents a method for filling gaps in a knowledge base. Our approach is different from a number of prior projects in that it follows a 'pull' model that attempts to find the missing objects for a given subject–relation pair on demand, rather than as one of many facts discovered during a full pass over a large corpus (which we call a 'push' model).

Our system uses a question-answering system (as a black box), which in turn takes advantage of mature Web-search technology (also as a black box) to retrieve relevant and up-to-date text passages to extract answer candidates from. We propose an end-toend pipeline that lexicalizes subject–relation pairs to Web-search queries, chooses a good subset of queries, performs Web-search– based question answering, links candidate answer strings to Freebase entities, aggregates the results from all queries, and finally produces probabilistically scored rankings of answer entities.

We show empirically that choosing the right queries—without choosing too many—is crucial, especially for relations with objects from 'open' types with many instances (such as PERSON). Finally, we demonstrate that, for several relations, our system makes a large number of high-confidence predictions; e.g., we predict a nationality with a confidence above 90% for one in three test subjects.

VII. REFERENCES

[1]. K. Bollacker, C. Evans, P. Paritosh, T. Sturge, and J. Taylor. Freebase: A collaboratively created graph database for structuring human knowledge. In Proceedings of the 2008 ACM SIGMOD International Conference on Management of Data (SIGMOD), 2008.

[2]. L. Byrne and J. Dunnion. UCD IIRG at TAC 2010 KBP slot filling task. In Proceedings of the 3rd Text Analysis Conference (TAC), 2010.

[3]. A. Carlson, J. Betteridge, B. Kisiel, B. Settles, E. Hruschka, and T. Mitchell. Toward an architecture for never-ending language learning. In Proceedings of the 24th Conference on Artificial Intelligence (AAAI), 2010.

[4]. K. Collins-Thompson, J. Callan, E. L. Terra, and C. L. A. Clarke. The effect of document retrieval quality on factoid question answering performance. In Proceedings of the 27th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR), 2004.

[5]. X. L. Dong, K. Murphy, E. Gabrilovich, G. Heitz, W. Horn, N. Lao, T. Strohmann, S. Sun, and W. Zhang. Knowledge Vault: A Web-scale approach to probabilistic knowledge fusion. In submission, 2014.

[6]. M. Dredze, P. McNamee, D. Rao, A. Gerber, and T. Finin. Entity disambiguation for knowledge base population. In Proceedings of the 23rd International Conference on Computational Linguistics (COLING), 2010.

[7]. X. Han, L. Sun, and J. Zhao. Collective entity linking in Web text: A graph-based method. In Proceedings of the 34th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR), 2011.

[8]. H. Ji and R. Grishman. Knowledge base population: Successful approaches and challenges. In Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics (ACL), 2011.

[9]. P. Kanani and A. McCallum. Selecting actions for resource-bounded information extraction using reinforcement learning. In Proceedings of the 5th ACM International Conference on Web Search and Data Mining (WSDM), 2012.

[10]. C. D. Manning, P. Raghavan, and H. Schütze. Introduction to Information Retrieval. Cambridge University Press, 2008.

[11]. J. Mayfield, J. Artiles, and H. T. Dang. Overview of the TAC 2012 knowledge base population track. In Proceedings of the 5th Text Analysis Conference (TAC), 2012.

[12]. B. Min, R. Grishman, L. Wan, C. Wang, and D. Gondek. Distant supervision for relation extraction with an incomplete knowledge base. In Proceedings of the Conference of the North American Chapter of the Association for Computational Linguistics (NAACL), 2013.

[13]. M. Mintz, S. Bills, R. Snow, and D. Jurafsky. Distant supervision for relation extraction without labeled data. In Proceedings of the Joint Conference of the 47th Annual Meeting of the ACL and the 4th International Joint Conference on Natural Language Processing of the AFNLP (ACL–IJCNLP), 2009.

[14]. M. Pas¸ca. Open Domain Question Answering from Large Text Collections. CSLI Publications, 2003.

[15]. S. Pedro and E. Hruschka. Conversing learning: Active learning and active social interaction for human supervision in never-ending learning systems. In Advances in Artificial Intelligence–IBERAMIA. 2012.

[16]. J. Platt. Probabilistic outputs for support vector machines and comparisons to regularized likelihood methods. In A. Smola, P. Bartlett, B. Schölkopf, and D. Schuurmans, editors, Advances in Large Margin Classifiers. MIT Press, 1999.

[17]. M. Samadi, M. Veloso, and M. Blum. OpenEval: Web information query evaluation. In Proceedings of the 27th Conference on Artificial Intelligence (AAAI), 2013.

[18]. F. Suchanek, G. Kasneci, and G. Weikum. YAGO: A core of semantic knowledge. In Proceedings of the 16th International World Wide Web Conference (WWW), 2007.

[19]. Y. Takaku, N. Kaji, N. Yoshinaga, and M. Toyoda. Identifying constant and unique relations by using time-series text. In Proceedings of the 2012 Joint Conference on Empirical Methods in Natural Language Processing and Computational Natural Language Learning (EMNLP–CoNLL), 2012.

[20]. E. Voorhees and D. Tice. The TREC-8 question answering track report. In Proceedings of the 8th Text Retrieval Conference (TREC), 1999.

[21]. G. Weikum and M. Theobald. From information to knowledge: Harvesting entities and relationships from Web sources. In Proceedings of the 29th ACM SIGMOD–SIGACT–SIGART Symposium on Principles of Database Systems (PODS), 2010.

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Design, Analysis and Fabrication of Frame Sliders (Crash Guard) For Sports Bikes

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ABSTRACT

Increasing popularity of high performance engine technology into two-wheeler market segment has pushed the average speed of the motorcycle to a —higher limit which has already increased the possibility of motorcycle impacts causing major injuries. Vehicle manufacturers are going through a rigorous process of design, experimentation, and validation based on best of strength requirement, weight reduction, improved fuel efficiency etc. This paper is based on research to propose a new crash guard system for motorcycles which performs similar to the standard crash guards but are more effective and also provides an aesthetic look

Keywords: crash guard, safety, aesthetic, efficiency.

I. INTRODUCTION

Motorcycles have a higher rate of fatal accidents than cars or trucks and buses. With the increase in the commonness of motorcycling, the safety of the riders has become an issue. Hence crash guards have become a necessary safety measure for motorcycles. But the crash guards available have a fixed and broad frame, this makes manoeuvring through dense traffic difficult. Although subjective, some riders remove crash guards because it affects the motorcycle's appearance Crash guards are installed to reduce the damage to motorcycle engines and body panels when it falls on the side. The crash guards stick out a few inches extended than the motorcycle. When the motorcycle falls, these hit the ground and prevent the engine from also making contact with the ground. According to Prevalence and Patterns of Foot Injuries Following Motorcycle Trauma, motorcycle accidents continue to be a source of severe injury, especially to the foot. The crash guards prevent the motorcycle from falling and sliding on the rider's leg in low side crashes. Without crash guards, injuries in such accidents can lead to permanent disability. Motorcycle accidents have escalated over the years. Most of the injuries in such accidents are due to not using proper safety gear. According to the Accidental Deaths & Suicides in India (2015) report by the National Crime Records Bureau, 38,328 deaths were reported in road accidents, out of which 14,462 deaths were classified as motorcycle accidents. Motorcycle accidents took the maximum share (25.3%) of the total deaths reported in road accidents. Furthermore, the Road Accidents in

India (2018) report by the Ministry of Road Transport and Highways, reported 44,568 motorized two-wheeler accidents (including motorcycles, scooters, and mopeds).

To improve motorcycle safety many systems have been developed and proposed using machine learning, communication technology, and Internet of Things (IoT). These are generally implemented on motorcycle, rider, or helmets. • Donald have proposed a method based on self-organized neural networks that can deal with a large number of inputs from different types of sensors for collision and hazard detection for motorcycles via inertial measurements. The simulation test results can help to set an absolute threshold on the accelerometer measurements. Such a threshold can distinguish road anomalies from real hazards accurately. • Wan-Jung Chang and Liang-Bi Chen have designed an intelligent motorcycle helmet equipped with two miniature infrared transceivers, a miniature image sensor (camera), embedded computation processing (ECP) module, a battery charging module, a microphone, and earphones. The helmet can detect the vehicle registration plate of an approaching large truck/bus in real-time within a distance of 5 m.• Agung have proposed a smart helmet which enforces helmet usage and monitors the speed of the motorcycle. The proposed helmet can ensure the obeying of traffic regulations. • MCAS is a system proposed by Abdullah that gets triggered upon a crash and ensures that an alert containing the vehicle's location, identifying details about the rider and the motorcycle is passed to the nearest hospital, police station and guardian of the victim. This system helps provide aid to the rider in case of an accident with minimum latency. Although the above-mentioned studies offer accident prevention measures and head safety measures, they do not deal with the protection of the rider's lower body and the motorcycle's engine in case of an accident.

II. PROBLEMS IN TRADITIONAL CRASH GUARDS

In normal crash guard that it cannot be mounted on fully fared • Bikes or sports bike. There is no space or mountings for normal crash guards on sports bike. • E.g. – YAMAHA R15, TVS APACHE RR310, SUZUKI GIXXER 250, CBR250R etc. • If we customize the frame/chassis of sport bike and mount the normal guard on that bike ,the impact of accident directly acts on bikes chassis and engine. Also due to modifications in chassis it also reduces the life of bikes chassis. • Modifying and mounting normal guards on sports bike also disturbs the aesthetics of sports bike. Aesthetic is major factor of new generation to choose sports bike over normal cruiser bikes. Also increases the cost of manufacturing and mounting the normal crash guard on sports bike .

III. MATERIAL SELECTION

The material of which the impact plates is made of, says a lot about how well they work, and how much they cost. The three most common materials are aluminium, stainless steel, and mild steel, and all have their pros and cons. ALUMINUM • Very light, so it doesn't add much to the weight of the bike. • It's not as strong as either kind of steel. • It's harder to work with so it costs more. • The only real plus with aluminium is that it doesn't rust. STAINLESS STEEL • Doesn't rust, either, so if you live where it rains a lot, or you ride where river crossings are common, it's a good choice. • But stainless steel isn't very flexible • It's brittle and transfers more of the energy of an impact to the bike's frame or engine than a material with some give. • Brittleness makes it

more susceptible to cracks at the welds caused by engine vibration MILD STEEL • Is the best compromise, inexpensive to build, strong enough to protect the bike? • Flexible enough to bend without breaking. • Mild steel rusts is easily dealt with by treating the bars with a corrosion preventive before powder- coating them. 8.1 Engineering properties required for the crash plate • Geometric Stiffness – the geometry of the shape and how it impacts stiffness will the part bend? • Structural efficiency – the mass a structure can hold divided by the bass of the structure. Hardness – the relative resistance that its surface imposes against the penetration of a harder body • Strength – the amount of force a material can withstand and still recover to its original shape • Toughness – the amount of energy that a material can absorb before fracture. • Stiffness – A mechanical property of linear elastic solid materials. • Deflection – Beam or load condition of a material with a fixed end Geometric Stiffness of plates • The geometry of the plates needs to have a design so that the strength, toughness, geometric stiffness, and structural • Efficiency are distributed not only amongst the armor but through the vehicle. • The geometric stiffness of the product should be designed equally into each product whether it's steel or aluminum. Both will fail with improper geometric properties (and installation). • Steel has a slight benefit when it comes to parts that need to be thinner as the stiffness and strength will be higher than aluminum. Structural Efficiency • With regards to structural efficiency – the ratio of a material's stiffness to its density, aluminum is shown to have a structural efficiency much greater than steel. • An aluminum plate of equal thickness will weight 57% the equivalent steel plate and designed to the same stiffness; an aluminum plate will weigh ~ 45% of the same steel plate. • If you're resting on an object and the mass of your vehicle is resting on your skid plate, then the structural efficiency by weight scales in the factor of aluminum but thickness it scales in favor of steel

IV. DESIGN CRITERIA

Placement The most easily accessible place for mounting the guard was on the engine But due to several cases of engine casing cracking and unbalancing the natural vibration of the engine that thought was rejected. The next place was located on the cross-beam chassis of the bike, which was a bit complicated than expected to work on Since the height from ground in more to the chassis mounting point, the force sustainability of the sliders increases for the same material. • It also doesn't interferes with the resting posture of the rider The closer to the ground the shorter extension must be used ,to avoid contacting with ground on minimum lean angle • Shorter extension= maximum load bearing capacity, which means use of much stronger material which will eventually result in costlier manufacturing cost • Also it may interfere will the riders seating posture

Fig 1Damage engine case

Fig 2 Chasis mounted frame

V. DESIGN CALCULATIONS

Direction of force Here we are going to analyses aluminium 5052 which is existing material & and then aluminium 6061 as a new material. Now initially for aluminium 5052 following conditions are considered For design of a leg guard we will consider Different loading conditions as 3000N, 5000N, 7000N etc. Then the compressive as well as bending forces have to calculate.

To obtain such result here we are going to design the existing material & then new material, and then we will compare their result to obtain the best material for leg guard. Conditions considered- For aluminium 5052 Length l = 186 mm Outer diameter d0 = 31 mm Inner Diameter di = 30 mm Young's modulus = E = 67 Gpa = 67 x 103 N/mm Conditions considered- For aluminium 6061 Length l = 186 mm Outer diameter d0 = 31 mm Inner Diameter di = 30 mm Young's modulus = E = GPa = 70 x 103 N/mm2 Force considered a) P1 = 300 Kg = 3000N b) P2 = 500 Kg = 5000N c) P3 = 700 Kg = 7000N Deflection on leg guard Initially we calculate the cross sectional area A = π (do2 – di2) / 4 a) a) Deflection dl = Pl/AE = Load x length / Area x young's modulus b) Bending force Initially we calculate the moment of inertia for the section I = π (do4 – di4)/64 Deflection dl = Wl3/3EI = Load x length3 / 3 x Young's modulus x Moment of inertia c) Stresses Consideration Initially we calculate the cross sectional area Area A = π (do2 – di2 Stress s = P/A = Force / Area d) Bending force W = π (do4 – di4)/32 d0 Moment = Mb = P x l = Force x Length Stress s = Mb / W = Moment / Axial sectional module

Fig 3 Actual Image

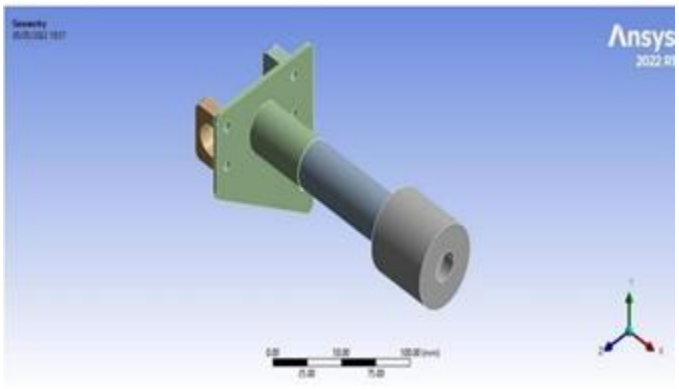

Fig 4 Gaurd

Meshing and quality of meshing • Meshing is the process of dividing the work field in finite number of cells .These cells provide the points were the values are supposed to be calculated. Flow field is divided in 3 dimensions. • The quality of the mesh plays a significant role in the accuracy and stability of the numerical computation. In general aspects mesh quality can be assured by Mesh skewness. • Skewness is defined as the difference between the shape of the cell and the shape of an equilateral cell of equivalent volume. Highly skewed cells can decrease accuracy and destabilize the solution. • A general rule is that the maximum skewness for a triangular/tetrahedral mesh in most flows should be kept below 1.00, with an average value that is less than 0.33. A maximum value above 1.00 may lead to convergence difficulties and may require changing the solver controls, such as reducing under-relaxation factors and/or switching to the pressure-based coupled solver. • From the above slide we can find the maximum, minimum and average value of skewness is acceptable and the amount of elements generated ensure a linear and accurate computation of the input data. • Max:0.99983 min:1.6679*10-4 • average:0.29474 • Just by ensuring that the mesh quality and skewness is up to the limit the quality of final result drastically improves

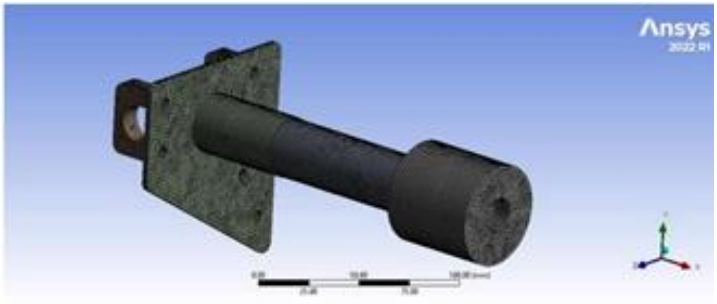

Fig5 Mesh

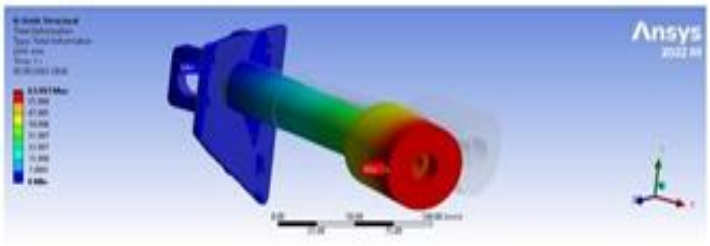

Fig 6Total deformation

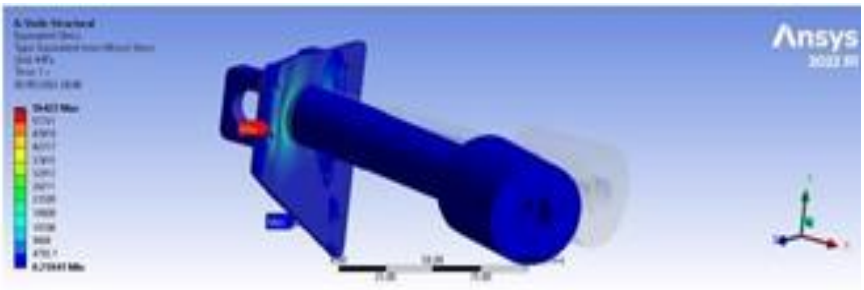

Fig 7Von misses stress

VI. CONCLUSION

A systematic review of the system has been presented • Various engineering parameter shave been defined for different material with its comparison • The designed system is effective, reliable and has minimum weight without any compromise in its safety standards and performance

- The work presented in this paper is in the initiation stage and it is important to note these hopeful results will strongly depend on more detailed analysis as mentioned in further scope for study

VII. FUTURE SCOPE

This product has a great scope in all automobile industry as it increase rider safety and reduces the effect of crash impact on the vehicle. • Motorcycle crash bars won't stop a rider from getting thrown from their bike in a collision. However, the frame slider can prevent the bike from falling on a rider. This can help to prevent one of the leading causes of debilitating trauma among riders: leg injuries • Studies suggest that motorcycle crash bars can help to minimize: - Ankle injuries and Lower leg injuries.

VIII. REFERENCES

[1]. J.P.Badgujar & R.B.Barjibhe "Design of a Leg Guard at Different Loading Conditions", International Journal of Latest Trends in Engineering and Technology, Vol. 3,no. 4, pp.166- 169,2014.

[2]. R.Balamurugan & S.Mohamed Abdul Sukkoor, S.Madhankumar & A.Tamilselvan, "Design and Crash Analysis of Scooter Front Guard", International Journal of Creative Research Thoughts, Vol. 5, no.3, pp.1783-1790, 2018.

[3]. Javad Marzbanrad, Masoud Alijanpour & Mahdi Saeid Kiasat, "Design and Analysis of an automotive bumper beam in low-speed frontal crashes", Thin□ Walled Structures, Vol.47, no.8-9, pp.902- 911, 2009.

[4]. Berg, F & Rücker, Peter & Gärtner, Marcus & König, Jens & Automobil, Dekra & Germany, Gmbh & Grzebieta, Raphael & Zou, Roger. "Motorcycle impacts into roadside barriers-real word accident studies, crash tests, and simulations carried out in Germany and Australia", Proceedings of the 19th International Conference on the ESV, pp.1-13, 2005.

[5]. Government of India ministry of road transport and highways transport research wing –New Delhi. Available online: www.morth.nic.in

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Passive Viscoelastic Constrained Layer Damping for Structural Application

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ABSTRACT

The purpose behind this study is to predict damping effects using method of passive viscoelastic constrained layer damping. Beams are modeled for passive viscoelastic damping to predict damping effects in constrained layer sandwich cantilever beam. This method of passive damping treatment is widely used for structural application in many industries like automobile, aerospace, etc. In this method of damping a simple cantilever beam is treated by making sandwich structure to make the beam damp, and this is usually done by using viscoelastic material as a core to ensure the damping effect. Since few years in past viscoelastic materials has been significantly recognized as the best damping material for damping application which are usually polymers. Here some viscoelastic materials have been used as a core for sandwich beam to ensure damping effect. Due to inherent complex properties of viscoelastic materials, its modeling has been the matter of talk. So, in this modeling of viscoelastic materials has been shown. The experimental results will be shown how the amplitude decreases with time for damped system compared to undamped system and further its prediction has been extended to finite element analysis with various damping material.

Keywords – Finite element analysis, Damping, Viscoelastic

I. INTRODUCTION

The damping of structural components and materials is often a significantly overlooked criterion for good mechanical design. The lack of damping in structural components has led to numerous mechanical failures over a seemingly infinite multitude of structures. For accounting the damping effects, lots of research and efforts have been done in this field to suppress vibration and to reduce the mechanical failures.

Since it was discovered that damping materials could be used as treatments in passive damping technology to structures to improve damping performance, there has been a flurry of ongoing research over the last few decades to either alter existing materials, or develop entirely new materials to improve the structural dynamics of components to which a damping material could be applied. The most common damping materials available on the current market are Viscoelastic materials. Viscoelastic materials are generally polymers, which allow a wide range of different compositions resulting in different material properties and behaviour. Thus, Viscoelastic damping materials can be developed and tailored fairly efficiently for a specific application.

Finite element analysis has emerged as a very efficient tool for solving complex problem in field of design engineering. The experimental procedure is a very tedious task and lots of assumption must be taken care off for precision of the work and using finite element method we can reduce this complexity of the problem and get rid of calculations. In this a finite element analysis will be done for both undamped and damped sandwich structures and frequency response for the same will be shown.

Vibrations in structures have become increasingly problematic in low margin design, where structures are built to have a minimum amount of material or weight. Frequently, solutions have poor modal characteristics due to other constraints on the system, such as geometry or weight. In many cases poor modal characteristics can be mitigated with the use of passive, active or hybrid damping techniques.

Much experimental work has been completed to study the effects of incorporating passive, active or hybrid damping materials to structures. Experimental modal analysis indicates that while damping treatments have a small effect on the modal frequencies; they have a significant effect on the amount of damping and the modal amplitude. Due to these effects, all three types of damping treatments have been applied to many structures and have great potential in the future. Currently, active damping treatments have been well studied analytically, numerically, and experimentally; while passive damping treatments have primarily been experimentally studied.

A proper material understanding is essential for damping to occur. There is need to study the complex behaviour of viscoelastic materials before material selection for particular application. Based on a literature review, there is a need to develop and implement a solution/ method that can predict the effects of applying passive damping treatments to structures.

The main focus of this is to study the complex behaviour of the viscoelastic materials. To predict damping effects using method of passive viscoelastic constrained layer damping technology experimentally and to show the nature of response of structures. The main objective is to model the viscoelastic sandwich beam for the modal analysis using the Finite Element Method. The face and core layers are varied to model the different configuration of the sandwich beams and these modeled sandwich beams are investigated for natural frequencies using FEA and Experiment for cantilever boundary condition. The damping effect on the sandwich beams has to be studied by increasing the core layer thickness.

Vibration control [1] is a major concern in several industries such as aeronautics and automobiles. The reduction of vibrations is a major requirement for performance, sound quality, and customer satisfaction. Passive damping technology [2, 3] using viscoelastic materials are classically used to control vibration. The steel industry proposes damped sandwich sheets in which a thin layer of viscoelastic material is sandwiched between two elastic face layers. In the early, Kerwin et. al. [4] presented damping effective of the constrained viscoelastic layers and mentioned that the damping effect depends on the wavelength of bending waves, thicknesses and elastic moduli and formulated the complex shear modulus for the damping layer and he predicted that the heat dissipation takes place through the shearing phenomenon. For a number of constraining layers damping factors have determined experimentally by neglecting the boundary condition. Ditoranto [5] has derived auxiliary equation for the effect of viscoelastic layers. The use of this equation with the ordinary bending equation formed for homogeneous beams for solving static and dynamic bending problems. They

formed the six orders, complex, homogeneous differential equation of the viscoelastic layered finite length beam and determined the natural frequencies and loss factors for the freely vibrating beam. Mace
[6] modeled the viscoelastic sandwich beams by using the finite element model, in the layer wise displacement field for studying the dynamic behaviour. The model developed is applicable duly to the very thin core layer of viscoelastic sandwich beam and the model which he made was in 3D model approach it is very difficult and costly for the implementation and it also generates the difficulties in the mesh for the analysis.

Basically, damping refers to the extraction of mechanical energy from a vibrating system, mainly by converting the mechanical energy into heat energy by means of some dissipation mechanism. Mostly all materials exhibit some amount of internal structural damping. Most of the time it is not substantially effective to minimize the vibration around resonant frequencies. Hence, by bringing these materials in contact with the highly damped and dynamically stiffed material it is possible to control the vibration.

Viscoelastic materials are one such that they are capable of storing strain energy when they are deformed; these types of materials exhibit the material characteristics of both viscous fluid and elastic solid. Viscoelastic damping property was exhibited by the large variety of polymeric materials ranging from synthetic/natural rubbers to various thermoset/thermostat materials used in different industries. Here polymers display rheological behaviour intermediate between a simple fluid and crystalline solids, due to having tangled molecules and large molecular order. This type of Viscoelastic materials offers a wide range of possibilities for developing a desire damping level provided by the designer to completely comprehend their mechanical behaviour. In Viscoelastic material the mechanical energy is released through normal deformation and cyclic shear.

Normally Sandwich construction includes a relative thick core of low-density material, sandwiched between the bottom and top face sheets (face layers) of relatively thin in size.

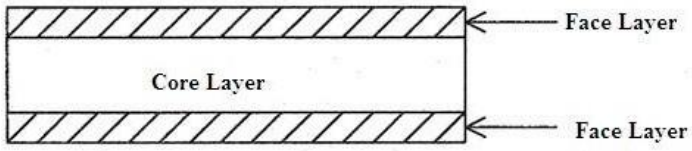

Fig. 1 Sandwich beam model

The fundamental work in this field was pioneered by Ross, Kerwin and Ungar (RKU) [7], who used a three-layer model to predict damping in plates with constrained layer damping treatments. Kerwin was the first to present a theoretical approach of damped thin structures with a constrained Viscoelastic layer. He stated that the energy dissipation mechanism in the constrained core is attributable to its shear motion. He presented the first analysis of the simply supported sandwich beam using a complex modulus to represent the Viscoelastic core.

In practice it is often necessary to design damped structures with complicated geometry, so it is natural to look to the finite element method (FEM) for a solution. Of course, the accuracy of the FEM is determined mainly by the element model. A few authors have developed finite element techniques to predict the performance of constrained-layer damped shell structures of general shape. An earlier review on this subject can be found in various references by Nakra. [8]

II. FINITE ELEMENT METHOD

Finite element method has become a very powerful tool for a wide range of engineering problems. Applications range from deformation and stress analysis of automotive, aircraft, building and bridge structures.

In this method of analysis, a complex region defining a continuum is discretize into simple geometric shapes called finite elements. The element material property and the governing relationships are considered over these elements and expressed in terms of unknown values at nodes. An assembly process, duly considering the loading and constraints, results in the set of equations. Solution of this equation gives an approximate behaviour of the continuum. The main rule that involved in finite element method is "DIVIDE and ANALYZE". The greatest unique feature which separates finite element method from other methods is "It divides the entire complex geometry into simple and small parts, called "finite elements".

Steps in FEM

1. Modeling
2. Discretization of the structure
3. Derivation of element displacement models
4. Derivation of element stiffness matrix
5. Assemblage of elemental equations to obtain overall equilibrium equations
6. Solution of unknown nodal displacement / Field variables
7. Computation of results
8. Interpret the results

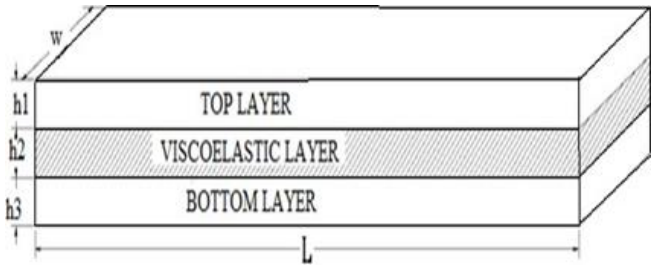

Fig. 2 Sandwich Beam model

Table 1 CAD Models

Sr. No.	Specimen Name	Dimensions of Specimen (in mm)		
		Length	Width	Thickness
1	A0	450	50	0
2	A15NR	450	50	1.5
3	A20NR	450	50	2
4	A30NR	450	50	3
5	A15NP	450	50	1.5
6	A20NP	450	50	2
7	A30NP	450	50	3

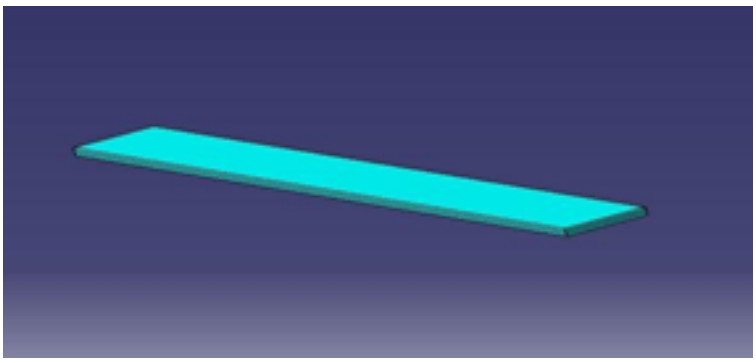

Fig. 3 Undamped Aluminium Plates

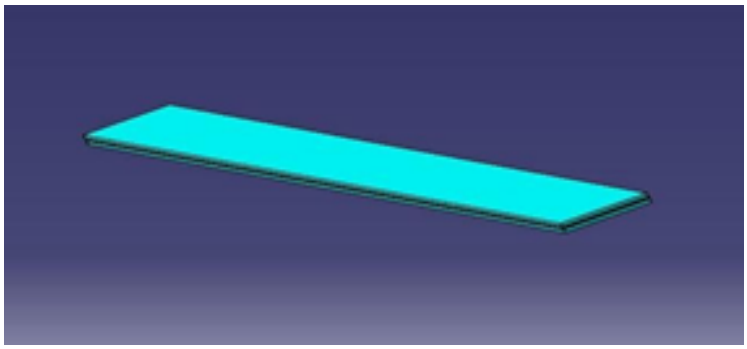

Fig. 4 Aluminium Plates with Sandwich Material Thickness 1.5 mm.

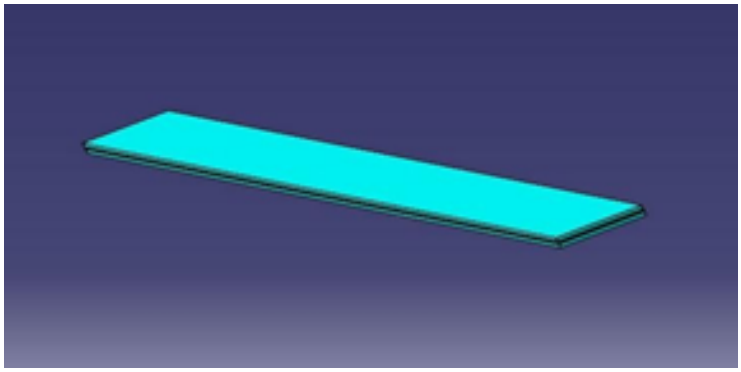

Fig. 5 Aluminium Plates with Sandwich Material Thickness 2.0 mm

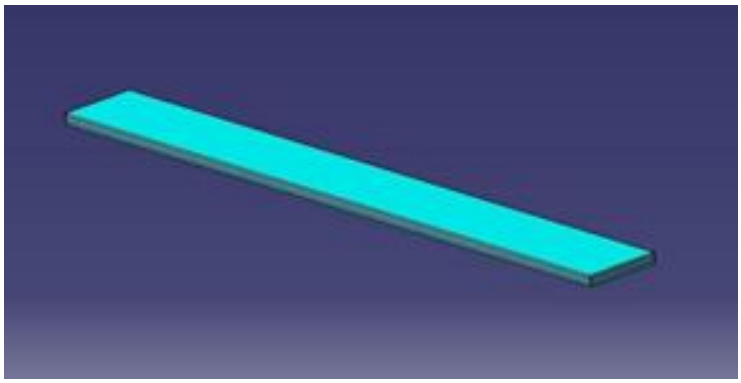

Fig. 6 Aluminium Plates with Sandwich Material Thickness 3.0 mm

Meshing of Sandwiched Beam

The meshing of sandwich beam is done using solid elements. Hex elements are used to mesh the beam and the meshing quality and connectivity are maintained as per meshing standards. Then the material properties are applied as shown in the below table.

Table 2 Material Properties

Sr. No.	Type of Material	Young's Modulus (GPa)	Shear Modulus (GPa)	Density (Kg/m³)	Poisson's Ratio
1	Aluminium	71	27.3	2700	0.33
2	Nat. Rubber	0.00154	0.005	950	0.45
3	Neoprene	0.0008154	0.000273	960	0.49

Table 3 Mesh Details for A0 specimen

Type of Element	Hex
Element size	3
No of elements	5100
No of nodes	8154

Meshing on Model A0

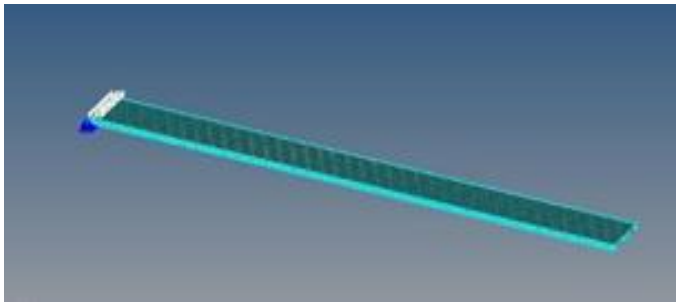

Fig. 7 Final meshed specimen with application of boundary condition

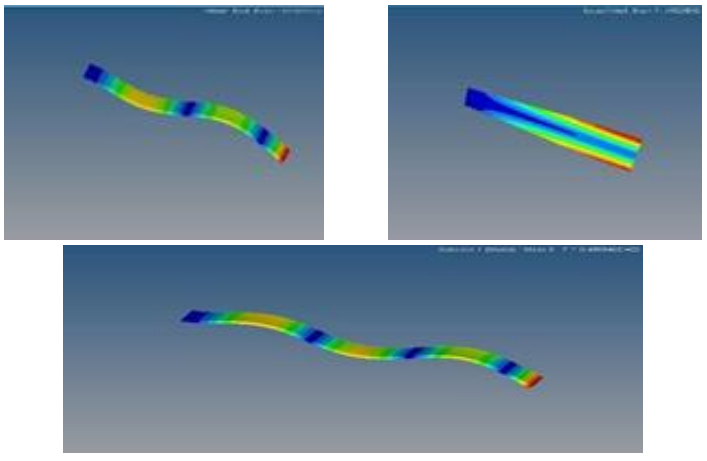

Fig. 8 Modes Shapes for A0

Likewise, modes shapes for all the seven beams were found out.

III. EXPERIMENTATION

The experimental test rig was built at "Star Balancing" Company, Pune.

The experimental setup consists of:

1) Vibscanner
2) Hammer
3) Accelerometer
4) Vice

The experimental vibscanner system consists of three main components; (i) portable data collectors (ii) accelerometer (iii) data acquisition system. The vibscanner is used for the diagnosis and recording of conditions of test specimens. The accelerometer is used to convert the mechanical motion of the structure into an electrical signal. The data acquisition system is used to convert the analog signals into digital format. Software called OMNITREND is then used to execute signal processing and analysis.

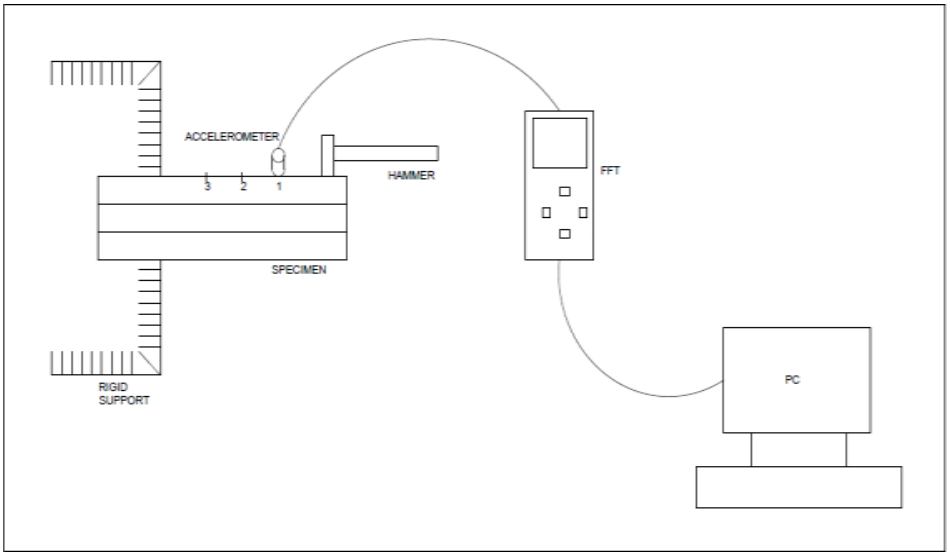

Fig. 9 Schematic Experimental Set-up

Three different types of sandwich beam combinations of varying thicknesses were made for experimental investigation which consists of Combination1: Aluminum – Aluminum (Damping Layer Absent)

Combination 2: Aluminum-Neoprene- Aluminum Combination 3: Aluminum-Natural Rubber- Aluminum

The natural frequencies for all the specimens were determined experimentally for the cantilever boundary conditions.

Fig. 10 Neoprene Beams

Fig. 11 Natural Rubber Beams

Fig. 12 Specimen held as Cantilever Beam

The natural frequencies obtained from the experimental analysis are as follows:

For A0

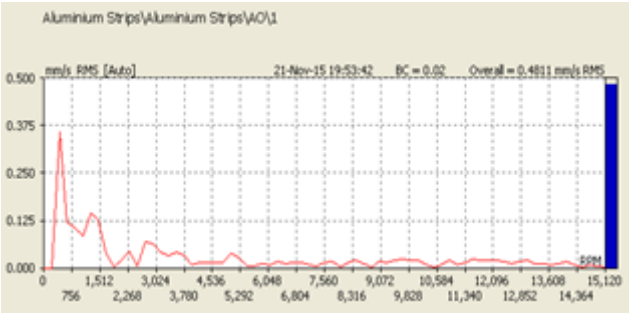

Fig. 13 Reading at point 1

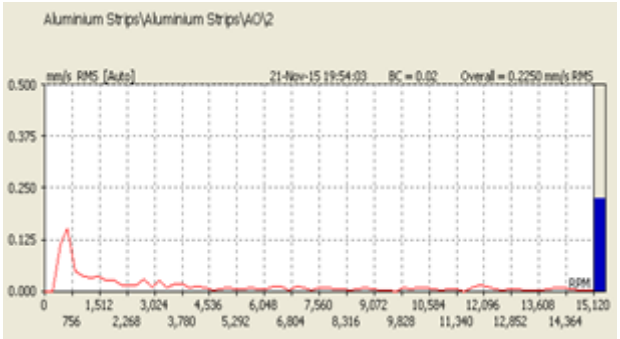

Fig. 14 Reading at point 2

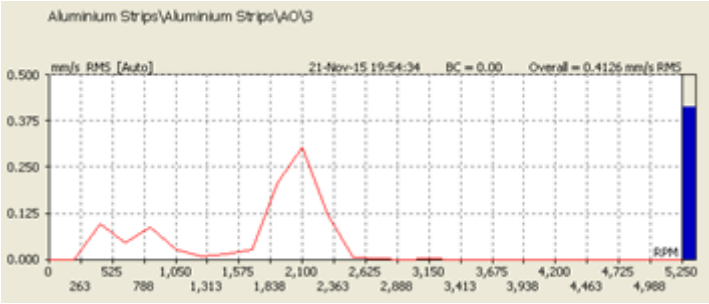

Fig. 15 Reading at point 3

IV. RESULTS AND DISCUSSION

In this section the thickness of the damping layer has varied to study the damping effect on the sandwich beam for the specimens which are modeled. It represents the natural frequencies obtained by FEA. The results are compared for 4th, 5th & 6th modes ignoring 1st three modes.

Comparison of Natural Frequencies of Natural Rubber & Neoprene on the basis of FEA

Natural Rubber

Table 4 Natural frequencies of Natural Rubber for various thicknesses

Mode No.	0mm	1.5mm	2mm	3mm
4	411.627	287.480	282.585	597.916
5	433.657	433.314	438.519	647.973
6	849.69	745.761	742.131	1205.593

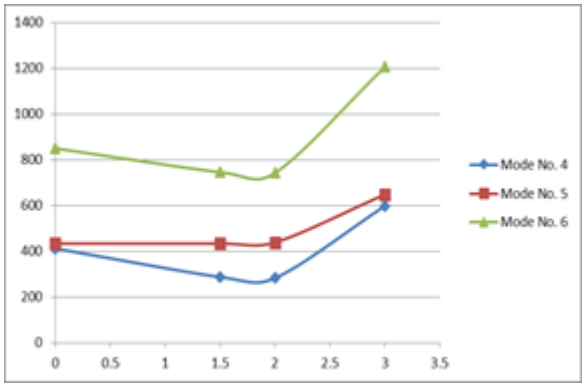

Fig. 17 Comparison of Natural frequencies of Natural Rubber for various thicknesses

Table 5 Natural frequencies of Neoprene for various thicknesses

Mode No.	0mm	1.5mm	2mm	3mm
4	411.627	256.418	251.889	246.987
5	433.657	381.007	379.708	380.856
6	849.69	645.423	635.117	625.233

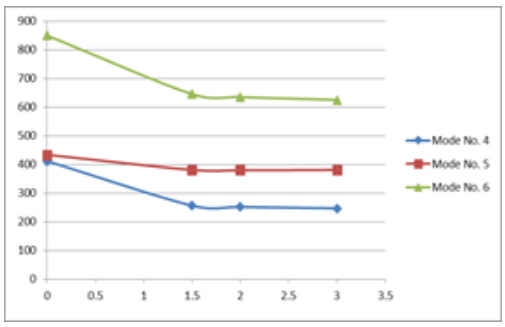

Fig. 18 Comparison of Natural frequencies of Neoprene for various thicknesses

Observations made: -

1. As the thickness of damping material increases, the natural frequency goes on decreasing, except for Natural Rubber for 3mm case.
2. The natural frequency of undamped specimen is higher as compared to damped specimen suggesting that damping in material decreases natural frequency, thereby minimizing vibrations induced.
3. The results obtained clearly shows that the beams modeled with Neoprene as a core layer has more damping effect as compared to the rubber for the cantilever boundary conditions.

V. EXPERIMENTAL RESULTS

Validation of FEA Results with Experimentation

Specimen 1: - A0

Table 6 Comparison of Natural Frequencies for A0

Modes	FEA Results (Hz)	Experimental Results (Hz)	% Variance
Mode 4	411	430	4.42
Mode 5	433	500	13.4
Mode 6	849	2100	59.57

Specimen 2: - A15NR

Table 7 Comparison of Natural Frequencies for A15NR

Modes	FEA Results (Hz)	Experimental Results (Hz)	% Variance
Mode 4	287	325	11.7
Mode 5	433	480	9.8
Mode 6	745	750	0.66

Specimen 3: - A20NR

Table 8 Comparison of Natural Frequencies for A20NR

Modes	FEA Results (Hz)	Experimental Results (Hz)	% Variance
Mode 4	282	350	19.42
Mode 5	438	452	3.09
Mode 6	742	770	3.63

Specimen 4: - A30NR

Table 9 Comparison of Natural Frequencies for A30NR

Modes	FEA Results (Hz)	Experimental Results (Hz)	% Variance
Mode 4	231	350	34
Mode 5	597	470	21.27
Mode 6	647	650	0.46

Specimen 5: - A15NP

Table 10 Comparison of Natural Frequencies for A15NP

Modes	FEA Results (Hz)	Experimental Results (Hz)	% Variance
Mode 4	256	350	26.85
Mode 5	381	360	5.51
Mode 6	645	672	4.02

Specimen 6: - A20NP

Table No. 11 Comparison of Natural Frequencies for A20NP

Modes	FEM Results (Hz)	Experimental Results (Hz)	% Variance
Mode 4	251	440	42.95
Mode 5	379	441	14.05
Mode 6	635	500	21.26

Specimen 7: - A30NP

Table 12 Comparison of Natural Frequencies for A30NP

Modes	FEA Results (Hz)	Experimental Results (Hz)	% Variance
Mode 4	246	400	38.5
Mode 5	380	420	9.52
Mode 6	625	630	0.793

From the tabular results one can infer that the values obtained using experiment and theoretical are in good agreement with acceptable errors except for some cases where % variance is above 20%. This may be due to improper meshing, improper mounting of specimens into the vice, etc.

VI. CONCLUSION

The developed model has been validated with the experiment performed. Experimental verification has been done for the different types of sandwich beams modeled. The sandwich beams are modeled here with varying of core layers.

The sandwich beams modeled here are carried out for modal analysis using finite element method by varying the core thickness to study the damping effect on the beams for the cantilever boundary conditions.

The natural frequency of undamped specimen is higher as compared to damped specimens which suggest damping in the form of VEM helps in reduction of vibration. The results obtained from the modal analysis

clearly shows that with increase in the thickness of the core layer there is a decrease in the natural frequency for the same mode except in some cases which may be due to improper meshing, incorrect mounting of specimen into the vice etc. From the results one can infer that damping characteristics for neoprene viscoelastic material has significant effect when compared with the rubber viscoelastic material. Finally, the frequency responses of the modeled sandwich beams have been plotted for the cantilever boundary conditions. Results show that the viscoelastic constrained layer damping treatment has a great significance in controlling the vibration of structures like beams, etc.

VII. REFERENCES

[1]. Clarence W. de, Silva, Vibration: Fundamentals and Practice, Boca Raton, FL: CRC Press, cop. [2000].
[2]. Jones, D. I. G. 2001. Handbook of Viscoelastic Vibration Damping. West Sussex, England: John Wiley and Sons, LTD.
[3]. Nashif A.D., Jones D.I.G. and Henderson J.P., Vibration Damping, Wiley, New York, 1985.
[4]. Kerwin EM. Damping of flexural waves by a constrained viscoelastic layer. J Acoust So Am 1959; 31: 952–962.
[5]. Di Taranto RA. Theory of vibratory bending for elastic and viscoelastic layered finite length beams. ASME J. ApplMech 1965; 32: 881–886.
[6]. Mead DJ and Markus S. The forced vibration of a three-layer damped sandwich beam with arbitrary boundary conditions. J Sound Vib 1969; 10: 163– 175.
[7]. Ross, D., Ungar, E., and Kerwin, E., 1959, "Damping of Flexural Vibrations by means of Viscoelastic Laminate," Structural Damping, ASME, New York.
[8]. Nakra B. C., Vibration controls in machines and structures using viscoelastic damping, Journal of Sound and Vibration (1998),211(3)449-465.

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Energy Conservation, Carbon Neutralization and Carbon Inventory of Ajeenkya Dr D.Y. Patil Campus

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ABSTRACT

Carbon neutrality is an essential goal for mitigating climate change and reducing greenhouse gas emissions. Educational institutions are among the significant sources of carbon emissions, which require attention and prompt action. Ajeenkya D Y Patil Campus is a premier educational institute in India and is committed to achieving carbon neutrality. The purpose of this review paper is to provide an overview of the ongoing process of carbon neutralization at Ajeenkya D Y Patil Campus and the future steps required for achieving complete carbon neutrality. The paper also evaluates energy management techniques and strategies implemented by the campus to reduce energy consumption and improve energy efficiency

Keywords: Ajeenkya, DY Patil, campus, education, carbon, neutralization, energy, global

I. INTRODUCTION

Climate change is one of the most pressing issues facing the world today, and reducing carbon emissions is crucial to mitigate its impact. Educational institutions have an important role to play in this regard, given their large carbon footprints. Ajeenkya D Y Patil Campus, a leading educational institution in India, has taken significant steps towards reducing its carbon emissions and achieving carbon neutrality.

This review paper aims to provide an overview of the ongoing process of carbon neutralization at Ajeenkya D Y Patil Campus and the future steps required for achieving complete carbon neutrality. The paper will evaluate the energy management techniques and strategies implemented by the campus to reduce energy consumption and improve energy efficiency. It will also examine the potential of renewable energy sources such as solar, wind, and biomass for meeting the energy requirements of the campus and achieving carbon neutrality.

Moreover, the paper will highlight the importance of carbon offsetting and the role it can play in achieving carbon neutrality. It will discuss various carbon offsetting options available to the campus, such as afforestation, renewable energy projects, and energy efficiency projects.

Finally, the paper will outline the future steps required for the campus to achieve its carbon neutrality goals. It will emphasize the need for continued efforts towards energy management and the adoption of renewable

energy sources. The paper will also highlight the importance of monitoring and reporting of carbon emissions and the need for stakeholder engagement in the carbon neutralization process.

II. CARBON INVENTORY

Total consumption of electricity

Meter Serial Number					TOTAL GENERATION	MSEB READING	Convert KW TO MW	Total CONSUMPTION	% of green energy	Carbon Emissions MSEB READING*0.81
Date	555-X1448813	055-X1375986	055-X1375987	055-x1375988						1MW=0.81 TCo2
3/31/2023	10355	46986	17386	8690	83417	78347	78.347	161764	51.56709775	63.46107
2/28/2023	8855	50262	15396	6356	80869	77080	77.08	157949	51.19943779	62.4348
1/31/2023	10270	46190	13929	5997	76386	80365	80.365	156751	48.7307896	65.09565
12/31/2022	8070	40182	13342	5991	67585	89736	89.736	157321	42.95993542	72.68616
11/30/2022	11040	49144	15469	7013	82666	73258	73.258	155924	53.01685436	59.33898
10/31/2022	14755	33287	14850	7069	69961	69967	69.967	139928	49.99785604	56.67327
9/30/2022	8225	38030	11217	5712	63184	85582	85.582	148766	42.47207023	69.32142
8/31/2022	10720	39127	12811	5763	68421	69759	69.759	138180	49.51584889	56.50479
7/31/2022	6920	33422	9507	4965	54814	74200	74.2	129014	42.48686189	60.102
6/30/2022	7795	38957	14061	6618	67431	69745	69.745	137176	49.156558	56.49345
5/31/2022	7060	45320	15940	1604	69924	78505	78.505	148429	47.10939237	63.58905
4/30/2022	5050	39080	15056	32	59218	83494	83.494	142712	41.49475867	67.63014
TOTAL	109115	499987	168964	65810	843876	930038		1773914		753.33078

Overall, this review paper aims to provide insights into the ongoing process of carbon neutralization at Ajeenkya D Y Patil Campus and to provide recommendations for the future steps required to achieve complete carbon neutrality.

Carbon emissions from transportation

Average distance travel by per person per day for college is 40Km
Average of bikes 40Km/liter
Average No. of bikes enter campus gate = 3000 units
Collage working days = 220 days per year
One liter petrol produces approximately 2.3 Kg of carbon dioxide
Per day fuel consumption is 40/40 that is One litre per day

Total carbon emissions = 3000*220*2.3*1 = 1518000 Kg or 1518 Ton of Co2
For four wheelers
Average distance travel by per person per day for college is 40Km
Average of four wheelers 15Km/litre
Average No. of four wheelers enter campus gate 350 units
Per day fuel consumption is 40/15 that is 2.67 litre per day
One liter diesel produces approximately 2.6 Kg of carbon dioxide
Total carbon emissions = 350*220*2.67*2.6 = 534534 Kg or 534.534 Ton of Co2
Total carbon emissions of transportation by campus activities per year = 1518+535 = 2053 Ton of Co2

Carbon emissions from food

Carbon emissions by food court, hostel canteen, dental canteen, and laboratories
Take shop = 3 shops use LPG gas cylinders and monthly consumption is 16 cylinders
Hostel canteen monthly consumption is 28 cylinders
Dental canteen monthly consumption is 10 cylinders
Laboratories use 2 cylinders per month
Weight of commercial gas cylinder is 19 Kg
Total cylinders consume by campus per month is 55 to 56 cylinders and yearly 672 cylinders
1.5 Kg carbon dioxide emitted by 1KG LPG
Yearly carbon emissions by LPG are 672*19*1.5 = 19152 Kg or 19.152 Ton

Carbon sequestration trees

Tree planted in campus area
Palme Trees
School Parking =125
Dental Area = 54
Football Ground = 58

DG = 8
Staff Area =27
Bambu =5
Total = 277
Trees
School Parking = 135
Out Gate = 167
Oval ground = 92
Dental = 93
Football Ground = 271
DYP University and DG = 168
DG College = 37
Near Mandir = 16
Boundary Wall = 297
Water Lake = 204
Technical Campus = 210
Staff Area = 180
Total = 2147
Shrubs = 1095
Over one year a mature tree will take up about 22 Kilograms of Carbon dioxide and Shrubs carbon sequestration is 10 Kg per year
2147*22 = 47234 Kg or 47.234 Ton carbon dioxide capture by trees
1095*10 = 10950 Kg or 10.950 Ton carbon dioxide capture by Shrubs
Total carbon sequestration = 47.234+10.950 = 58.18 TON

The overall Carbon emissions by electricity, transportation, and other activities
= 753.33 Ton by MSEB electricity + 2053 Ton by transportation + 19.152 Ton by LPG = 2825.482 Ton per year
And only 58 TON per year carbon sequestration by trees and up to 45% of electricity is generated by solar system.
A potential up to 100% renewable energy by solar adaptation and battery storage technology

III. METHODS

There are several methods to make an institute carbon neutral, which are as follows:

1. Renewable Energy Sources: The Ajeenkya DY Patil University can shift to renewable energy sources like solar, wind, and biomass energy to reduce carbon emissions. A study conducted by Yang et al. (2021) on the feasibility of solar energy in higher education institutions found that solar energy can reduce energy costs and carbon emissions. The study suggests that higher education institutions can adopt solar energy

as a feasible solution to achieve carbon neutrality. The Ajeenkya DY Patil University can also consider installing wind turbines and biomass plants to provide clean energy and reduce dependence on non-renewable energy sources.

2. Energy Efficiency Measures: The Ajeenkya DY Patil University can adopt energy-efficient technologies like LED lighting, smart thermostats, and energy-efficient appliances to reduce energy consumption. A study conducted by Balaras et al. (2018) on the energy-efficient retrofit of buildings found that energy-efficient measures can significantly reduce energy consumption and carbon emissions. The study suggests that energy-efficient buildings can save up to 40% of energy and lead to significant reductions in carbon emissions. The Ajeenkya DY Patil University can also consider implementing building automation systems that can optimize energy use.
3. Carbon Offset Projects: The Ajeenkya DY Patil University can invest in carbon offset projects like afforestation and renewable energy projects. A study conducted by Arvin et al. (2020) on the impact of renewable energy on carbon reduction found that renewable energy projects can significantly reduce carbon emissions. The study suggests that renewable energy projects can offset the institute's carbon footprint and help in achieving carbon neutrality.
4. Waste Reduction: The Ajeenkya DY Patil University can reduce its waste production by implementing measures like waste segregation, composting, and recycling. A study conducted by Das et al. (2018) on the impact of waste management practices on carbon emissions found that waste management practices can significantly reduce carbon emissions. The study suggests that waste reduction measures can significantly reduce the amount of waste that goes to landfills and reduce the carbon footprint of the institute.
5. Carbon Capture Technologies: The Ajeenkya DY Patil University can explore carbon capture and storage (CCS) technologies that capture carbon dioxide emissions from industrial processes and store them underground. A study conducted by Zhang et al. (2018) on the feasibility of CCS in higher education institutions found that CCS can significantly reduce carbon emissions. The study suggests that higher education institutions can adopt CCS as a feasible solution to achieve carbon neutrality.
6. Sustainable Transportation: The Ajeenkya DY Patil campus can encourage sustainable transportation methods like cycling, carpooling, and using electric vehicles to reduce carbon emissions from transportation. A study conducted by Li et al. (2020) on the impact of electric vehicles on carbon emissions found that electric vehicles can significantly reduce carbon emissions.
7. Education and Awareness: The institute can educate students, staff, and faculty members on the importance of carbon neutrality, sustainability, and environmental protection. Creating awareness and involving the entire community can help in achieving carbon neutrality goals.
8. New technologies can be used such as the light duct and Urban SkyTree, also known as the FutureSic Tree, is an innovative structure designed to help reduce air pollution and improve air quality in urban areas. It is a man-made, tree-like structure that uses a combination of moss, algae, and other materials to absorb pollutants and convert them into clean air.

The Urban SkyTree was developed by a team of researchers at the University of Applied Sciences in Dresden, Germany. The team was inspired by the natural ability of plants to absorb carbon dioxide and other pollutants from the air, and they set out to create a technology that could replicate this process in an urban environment.

The structure of the Urban SkyTree consists of a series of vertical cylinders, each containing a layer of moss and algae. The moss and algae are able to absorb pollutants such as carbon dioxide, nitrogen dioxide, and particulate matter from the air through a process called phytoremediation. This process involves the absorption of pollutants by the roots of the plants, which are then broken down and converted into clean air through photosynthesis.

In addition to its air-purifying capabilities, the Urban SkyTree also has other benefits for urban environments. Its structure provides shade and helps to regulate temperatures in urban areas, which can help to reduce energy consumption and improve overall environmental conditions. The structure is also designed to be self-sustaining, requiring minimal maintenance and input from humans.

The Urban SkyTree has been installed in several cities around the world, including Berlin, Paris, and Hong Kong. It has been shown to be an effective tool for reducing air pollution and improving air quality in urban environments. It has also sparked interest in other similar technologies, such as green walls and living roofs, which use plants to help purify the air and improve environmental conditions in urban areas.

In conclusion, the Urban SkyTree is a promising technology that has the potential to significantly improve air quality and reduce air pollution in urban areas. Its innovative design and use of natural materials make it a cost-effective and sustainable solution for improving environmental conditions in cities around the world.

Achieving carbon neutrality is a significant challenge, but it is necessary for mitigating climate change and reducing carbon emissions. The above-mentioned methods can help an institute to reduce its carbon footprint and achieve carbon neutrality.

And, the use of light pipes in Ajeenkya Dr. DY Patil campus can be a great way to reduce energy consumption and make the campus more sustainable. Light pipes are designed to capture natural daylight from the roof and redirect it into interior spaces, thereby reducing the need for artificial lighting during the daytime.

By installing light pipes in appropriate locations throughout the campus, natural light can be used to illuminate hallways, classrooms, offices, and other areas, reducing the amount of energy consumed by electric lighting. This can not only reduce the carbon footprint of the campus but also save on energy costs.

Furthermore, the use of natural light can have a positive impact on the well-being of students and staff, by providing a more natural and comfortable environment. The implementation of light pipes is a relatively low-cost and easy-to-install solution that can contribute to the overall sustainability and energy efficiency of Ajeenkya Dr. DY Patil campus.

Using Solar tube technology in corridors is cost saving and reduces carbon footprint as follows
Total no. of bulbs is 45 and all bulbs have 20 Watts per hour
No. of floors of soe building is 6
Working hours of college 12 hour a day
Total consumption per hour 45*20*6*12 = 64800 watts
= 64.800 KW
Working day of college is 220 days

Therefore, total year consumption = 64.800*220

= 14256 KW

Electricity charges per unit is 13 rupees then total cost per year is 185328 rupees

IV. CHALLENGES

Making a campus carbon neutral is a complex and challenging process that involves significant changes to energy consumption and production, as well as a shift in attitudes and behaviours among students, faculty, and staff. Some of the key challenges that may arise during this process include:

1. Financial Constraints: The transition to carbon neutrality often requires significant investments in new technology, infrastructure, and energy-efficient systems. These investments can be costly, and it can be challenging to secure the necessary funding, especially for smaller institutions.
2. Energy Generation: In order to become carbon neutral, campuses must generate their energy through renewable sources such as wind, solar, or geothermal. However, these sources can be inconsistent and unpredictable, and it can be challenging to ensure a reliable and consistent supply of energy.
3. Behaviour Change: Becoming carbon neutral requires a significant shift in attitudes and behaviors among students, faculty, and staff. This includes changes in energy use, transportation, and waste management. Getting buy-in from all stakeholders can be challenging, and it can be difficult to sustain these changes over time.
4. Limited Space: Many campuses have limited space to install renewable energy systems or to implement energy-efficient measures. This can make it difficult to achieve carbon neutrality without significant alterations to existing buildings or infrastructure.
5. Technological Limitations: While renewable energy technologies are rapidly advancing, there are still limitations to their efficiency and scalability. This can make it challenging to generate enough energy to meet the demands of a campus community.
6. Regulatory Hurdles: There may be regulatory hurdles to overcome, such as building codes or zoning restrictions, that can limit the implementation of renewable energy systems or energy-efficient measures.

In order to overcome these challenges, campuses may need to develop innovative solutions that involve partnerships with local communities, businesses, and government entities. Additionally, it may be necessary to develop comprehensive strategies that address not only energy use but also transportation, waste management, and other areas that contribute to carbon emissions. Finally, continued research and investment in renewable energy technologies will be essential to achieving carbon neutrality on a larger scale.

V. RESULTS AND DISCUSSION

Based on the suggested measures for carbon neutralization and energy conservation in Ajeenkya Dr. DY Patil campus, Pune, several positive outcomes can be expected.

Firstly, the campus is likely to reduce its carbon footprint significantly, thus contributing to the overall efforts to combat climate change. This reduction can be achieved by implementing various measures, such as using

renewable energy sources, reducing energy consumption through energy-efficient buildings and appliances, and promoting sustainable transportation options.

Secondly, the campus can expect to save significant costs in the long run by reducing its energy consumption and reliance on non-renewable energy sources. The cost savings can be further enhanced by implementing measures such as energy-efficient lighting, HVAC systems, and building insulation.

Thirdly, the campus can promote environmental sustainability and awareness among its students, faculty, and staff. This can lead to a culture of sustainability that can be carried forward beyond the campus into the larger community.

Overall, the suggested measures for carbon neutralization and energy conservation in Ajeenkya Dr. DY Patil campus can result in a positive impact on the environment, cost savings, and the promotion of sustainable practices.

VI. CONCLUSION

In conclusion, the review paper has highlighted various measures that can be implemented to make Ajeenkya Dr. DY Patil campus carbon neutral and energy-efficient. The suggested measures include the use of renewable energy sources, energy-efficient buildings and appliances, sustainable transportation options, and promoting a culture of sustainability among students, faculty, and staff.

By implementing these measures, the campus can significantly reduce its carbon footprint and contribute to the global efforts to combat climate change. The cost savings resulting from reduced energy consumption and the use of renewable energy sources can also have a positive impact on the campus's finances.

Furthermore, the promotion of sustainable practices among students, faculty, and staff can lead to a culture of sustainability that can be carried forward beyond the campus and into the larger community. This can have a significant impact on the environment and promote a more sustainable future.

In conclusion, the implementation of the suggested measures for carbon neutralization and energy conservation can have a positive impact on the environment, the campus's finances, and the promotion of sustainable practices. Therefore, it is imperative to continue exploring and implementing measures to make Ajeenkya Dr. DY Patil campus carbon neutral and energy-efficient.

VII. REFERENCES

[1]. “Comparative Analysis of Non-prestressed and pre-stressed hangar buildings” by Prof. Amruta J. Killol, Prof. Hariom Khungar.

[2]. “Analysis of Steel Hangers with the effect of Prestressing” by Prof. Amruta J. Killol.

[3]. “Investigation of physical properties of Al2O3 using waste eggshell-reinforced composite material” Rahul Mishra a, Amruta Jagdish Killol b, Ruchi Chandrakar c, Dr. S.P. Pandey d, Nuresh Kumar Khuntee

[4]. Yang, X., Jin, C., Gao, J., Xie, J., & Wang, X. (2021). Feasibility of solar energy utilization in higher education institutions: A case study of a university in China. Journal of Cleaner Production, 315, 128254. https://doi.org/10.1016/j.jclepro.2021.128254

[5]. Balaras, C. A., Gaglia, A. G., Georgopoulou, E., Mirasgedis, S., & Sarafidis, Y. (2018). The energy-efficient retrofit of buildings: Technical, economic and environmental considerations. Renewable and Sustainable Energy Reviews, 82, 3802-3816. https://doi.org/10.1016/j.rser.2017.10.097

[6]. Arvin, M. B., Dey, A. K., Marzband, M., & Zare, K. (2020). The impact of renewable energy on carbon reduction: Evidence from selected South and Southeast Asian countries. Renewable and Sustainable Energy Reviews, 132, 110070. https://doi.org/10.1016/j.rser.2020.110070

[7]. Zhang, S., Tian, L., Gao, J., Song, X., & Li, X. (2018). The feasibility of CCS application in higher education institutions: A case study of a university in China. Journal of Cleaner Production, 201, 1041-1048. https://doi.org/10.1016/j.jclepro.2018.08.285

[8]. Li, X., Hao, Y., & Wang, R. (2020). The impact of electric vehicles on carbon emissions in China: Evidence from a synthetic control method. Energy Economics, 91, 104861. https://doi.org/10.1016/j.eneco.2020.104861

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Carbon Capturing and Storage in India

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ABSTRACT

This project is all about Carbon capture and removal or separation is a three tier process- carbon capture, transport and storage. The capture consists of pre-combustion, mid combustion (oxy-combustion) and post-combustion capture. At a district level 641 datasets are analised out of which 64 accounted for 60% of the total co2 emission. India is good location for the development of carbon capturing plant because of the Relevance potentiality basaltic rock sedimentary basin, deep saline aquifers, soils, depleted oil reserves, coal seams. Currently there is no storage and capture or development project are functioning in india

Keywords: Carbon capture storage (CCS), CO2, Pollution, Air quality, Global Warming

I. INTRODUCTION

Because of the increasing of population energy demand is also increasing day by day to meet this demand of the world are largely met by burning fossil fuels On the other hand, the global energy demand is predicted to double by 2030 w.

According to British Petroleum (BP) (2020), 84% of these consumptions consist of fossil fuel-based energy the growth in motorized vehicles and industrial activities were considered as the major emission sources of air pollution and resulting the emission of particulate matter, nitrogen oxide, sulfur oxides, carbon monoxide, ammonia, ozone, volatile organic compounds, polycyclic aromatic hydrocarbons etc . It has been observed that, the atmospheric concentrations of CO2, CH4, and N2O have grown by about 31%, 151%, and 17%, respectively between 1750 and 2000. Since the early 20th century, the earths mean surface temperature has increased by about 0.8°C (1.4°F), with about two-thirds of the increase occurring since 1980.

This effect is termed as global warming which has a direct impact on the global climatic conditions, termed as Climate Change. The present-day concentration of CO2 in the atmosphere is responsible for 26% of global warming. Warming of the climate system is unequivocal, and scientists are more than 90% certain that it is primarily caused by increasing concentrations of GHGs produced by human activities, such as the burning of fossil fuels and deforestation. The earth has atmospheric energy which supports life. The chemical composition of the atmosphere is nitrogen (78%); about 21% is oxygen, which all animals need to survive; and only a small percentage (0.0379%)7 is made up of carbon dioxide which is required by plants for photosynthesis.

To maintain life-sustaining conditions on earth, each day, energy from the sun largely in the visible part of the spectrum, but also some in the ultraviolet and infrared portions is absorbed by the eaths atmosphere . India is a climate leader that has delivered on its commitments. It has already installed more than 40 per cent of the non-fossil fuel electricity generation capacity target proposed under earlier NDCs. Now, the ambition has been set to 500 GW by 2030

II. METHODS AND MATERIAL

Carbon capture and storage (CCS) is a process that involves capturing carbon dioxide (CO2) emissions from industrial processes, power plants, or other sources, and then storing them in underground geological formations. Here are some of the materials and methods used for carbon capturing storage:

Materials:

1. Absorbents: These are materials that can absorb CO2 from flue gas. Examples of absorbents include activated carbon, zeolites, and amine solutions.
2. Membranes: These are thin, selective barriers that allow certain gases to pass through while blocking others. Membranes can be used to separate CO2 from flue gas.
3. Solvents: These are liquids that can dissolve CO2 from gas streams. Examples of solvents include amine solutions and ionic liquids.
4. Adsorbents: These are materials that can adsorb CO2 from gas streams. Examples of adsorbents include activated carbon and zeolites.

Methods:

1. Post-combustion capture: This involves capturing CO2 from flue gas after it has been generated by a combustion process. The captured CO2 can then be compressed and transported to a storage site.
2. Pre-combustion capture: This involves capturing CO2 before the fuel is burned. This is typically done by converting the fuel into a gas, removing the CO2, and then burning the remaining gas.
3. Oxy-fuel combustion: This involves burning fuel in a mixture of oxygen and recycled flue gas, which produces a concentrated stream of CO2 that can be captured more easily.
4. Direct air capture: This involves capturing CO2 directly from the atmosphere using materials such as absorbents or membranes.
5. Geological storage: This involves storing captured CO2 in underground geological formations such as depleted oil and gas reservoirs, saline formations, or coal seams.
6. Ocean storage: This involves injecting captured CO2 into deep ocean waters, where it can be stored for centuries or longer.

Overall, the choice of method and materials will depend on the specific application and the characteristics of the source of CO2 emissions.

when writing Figure axis labels to avoid confusing the reader.

Current Status of CCS Projects in India:

As of 2021, there are four operational CCS projects in India, with several others in various stages of development. The operational CCS projects are located in Tuticorin, Assam, Kerala, and Gujarat. These projects

use various methods of storage, such as saline formations, depleted gas fields, methanol production, and enhanced oil recovery. The total CO2 capture capacity of these projects is around 93,000 tons per annum. Additionally, several other CCS projects are in various stages of development, including the Bhavnagar and Jamnagar projects in Gujarat, the Nagapattinam project in Tamil Nadu, and the Barmer project in Rajasthan.

Challenges in CCS Technology:

Despite the progress made in CCS technology, several challenges still exist in India. One of the most significant challenges is the high cost of CCS technology, making it economically unviable for many industries. Additionally, the lack of suitable geological formations for storing CO2 in many parts of India is a major challenge. The lack of a robust legal and regulatory framework for CCS projects is also a significant challenge in India.

Opportunities in CCS Technology:

There are significant opportunities for the growth of CCS technology in India. The Indian government's commitment to reducing carbon emissions and its focus on clean energy sources provide an ideal environment for CCS projects. Furthermore, the large number of coal-fired power plants in India presents a significant opportunity for the deployment of CCS technology. Finally, CCS projects can also provide a new revenue stream for industries, such as enhanced oil recovery.

III. CONCLUSION

The implementation of CCS technology in India has gained momentum in recent years, with several operational and planned projects. While there are significant challenges in CCS technology, there are also significant opportunities for its growth in

IV.REFERENCES

[1]. "Comparative Analysis of Non-prestressed and pre-stressed hangar buildings" by Prof. Amruta J. Killol, Prof. Hariom Khungar.
[2]. "Analysis of Steel Hangers with the effect of Prestressing" by Prof. Amruta J. Killol.
[3]. "Investigation of physical properties of Al2O3 using waste eggshell-reinforced composite material" Rahul Mishra a, Amruta Jagdish Killol b, Ruchi Chandrakar c, Dr. S.P. Pandey d, Nuresh Kumar Khunte e
[4]. "Assessment of Carbon Capture and Storage Technology in India" by K. Srinivas and V.V.N. Kishore
[5]. "Carbon Capture and Storage Technology for India's Power Sector: An Assessment of Costs and Benefits" by Lourdes Sanchez and Ananth Chikkatur
[6]. "Carbon Capture and Storage in India: Opportunities and Challenges" by Shikha Gupta and Subrata Kumar Majumder
[7]. "Overview of CO2 Capture and Storage Technology in India" by Anil Kumar, Pankaj Kumar, and Suman Kumar.
[8]. "Carbon Capture and Storage in India: A Review" by Rishi Bhatnagar, Suman Kumar, and Anil Kumar.

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Inertial Sensors Based Road Condition Monitoring & Alternate Route Suggestion

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ABSTRACT

Nowadays maintenance of road is major problem in developing countries. Major portion of country's economy is put up for well maintenance of roads. Here the detection of pothole and bumps is done which will be useful to government authorities to maintain the road condition. Also it helps the drivers to get aware about potholes and bumps & suggest the alternate route which are without potholes and bumps using the ultrasonic sensor and GPS sensor in the smart phone. The data collected using sensor is sent to the cloud storage and heat map is generated. This would be very useful to the government bodies for maintenance purpose as well as for driver safety point of view. For displaying the road condition the android application and web application is developed and according to the data the alternate route would be suggested to driver.

Keywords: GPS Sensor, Pothole, Ultrasonic Sensor, Heat map

I. INTRODUCTION

The quality of the road is mostly judged from the conditions of road. The classification of road are done as safe or dangerous according to road condition, as road conditions are judged using the potholes and bumps. The main reason for damage of vehicle and aging faster are surface conditions of roads. These unfavourable road conditions of the road lead harm to the driver, vehicle, surrounding people and property. Accordingly this proposed system is upgrading the road condition and avoid the road accidents. Government spends millions of money for maintenance of road. With this proposed system the government would not require special officers and road inspection person as the system would spot the pothole and it will be uploaded on the map. So the government can directly get access to potholes on the road and maintain the road at that particular pothole location. This is done using advanced and smart technology and its implementation using the mobile and web user interface, so the road condition can be easily maintained. This proposed system will beneficial in the present as well as in future. As nowadays everyone has smart phone and the reporting of potholes and bumps can be done easily by everyone which will be helpful for the people while travelling. The process of getting the output is as data collection, storage analysis, processing and transmission in an efficient way.

Driving the vehicle on the road having bad condition is very dangerous to the driver. Due to rains, oil spills

quality of the road decreases Such hurdles may cause road accidents. To overcome such problem, proposed this system Pothole Detection and Notification System. In this system sensor is used to sense the pothole, road quality.GPS system finds the position of pothole and rough road, and store the Latitude and longitude in database. Based on Latitude and Longitude User can see the location of detected pothole and rough road area on map, and also suggest alternate path for this. All the data is saved in the database. This collected information of bad condition roads is helpful for recovery of the road. Android phones gives best use of GPS sensor , internet connectivity, etc. i.e. its inbuilt features. Day to day life problems of user can be solved by using various android applications. Traffic congestion, Road accidents, Pothole detection are the major problems in urban areas as well as rural area. So in order to provide solution for pothole problem, we developed an android application which detects pothole automatically as well as sends notification to user. User can see location of detected pot hole on map on web as well as he can find alternate best route suggestion on Android app .

II. LITERATURE REVIEW

According to the review, there are various methodologies for pothole detection. The system which is proposed in this paper is beneficial to identify the pothole and bumps. Also the system captures the location of pothole and bumps with the help of mobile phone sensor and the collected data will be sent to cloud storage for further processing. The display of the road condition is done using android and web user interface, as well as alternate route would be suggested.

In 2017, Amr S. El-Wakeel, Jin Li, Muhammed T. Rahman, Aboelmagd Noureldin and Hossam S. Hassanein proposed system using acceleration sensors and GPS of Tablet and VTI. Here recognition of the condition of roads were done. They also proposed multilevel decision tree classifier to differentiate between various anomalies[1].

In 2017, Andrew Fox, B.V.K. Vijaya Kumar, Jinzhu Chen and Fan Bai designed a system using a accelerometer data using vehicle sensors. Here the road angle data is calculated for the multilane pothole data and single lane results are compared [2].

In 2016, Guangtao Xue, Hongzi Zhu, Zhenxian Hu, Wen Zhuo, Chao Yang, Yanmin Zhu, Jiadi Yu, Yuan Luo proposed a system for detecting a pothole in dark using the 3D accelerometer and Smartphone. The average error occurrence in this system is 14% in detecting the pothole [3].

In 2018, Huaijun Wang, Na Huo, Junhuai Li, Kan Wang and Zhixiao Wang proposed a detection of pothole using Mahalanobis-Taguchi System. Here it plots the potholes on the map so the next upcoming vehicle can get pothole information. [4]

In 2017, Sultan Basudan, Xiaodong Lin, Karthik Sankaranarayanan designed a system using Fog computing which will inform the Road surface condition in the bad weather. In this the data is uploaded to the cloud and then the information regarding the road condition is share between the vehicle drivers. [5]

In 2017, Azza Allouch, Anis Koubˆaa, Tarek Abbes, and Adel Ammar proposed a system using Gyroscope and tri-axial accelerometer which plots the potholes using GPS system. Here the accuracy of system in locating the potholes is 98.6% [6].

III. METHODOLOGY

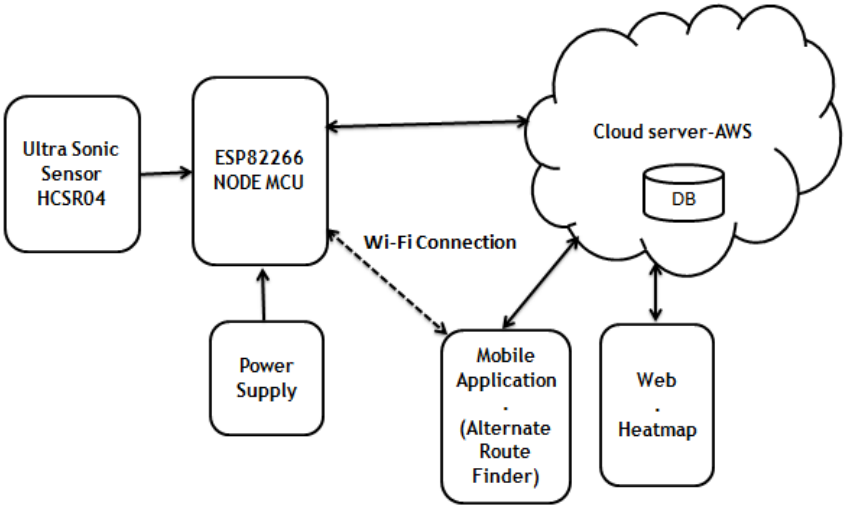

Fig. 1: Block diagram of proposed system

A. Hardware design description

The components used in the proposed system are: Ultrasonic sensor HC-SR04, ESP82266 Node MCU, power bank for power supply purpose and driver's Android phone. The hardware is mounted on the 2- wheeler vehicle in such a way that it measures the height of the pothole, manhole or speed bump; basically it detects these anomalies with help of mentioned components. Ultrasonic sensor is connected to the module which has ESP82266 micro controller of whose self-contained Wi-Fi is connected with the driver's Android phone's Hotspot. Through this connectivity the readings taken by sensor are stored in database of server to which the server responds JavaScript Object Notation (JSON).

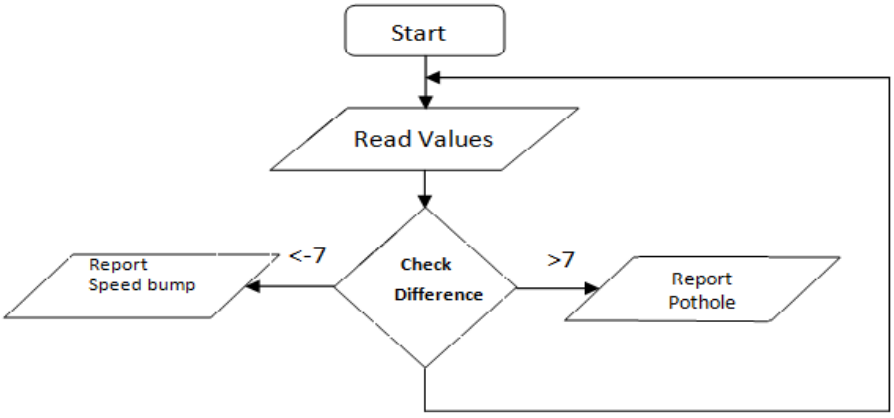

Fig. 2: Flowchart for hardware design

B. Software Design Description

Software requirements include Operating system Windows or Ubuntu, etc through which user can access the system. Java, Java Script, etc software packages can be used for development of system. The software interface

to the project is Android application. Also the communication interface between the Android application and Services Internet which is provided by the Global Standards for Mobile Communication (GSM) of which fourth Generation (4G) cellular network is used.

Machine learning is also included, i.e. reading of dataset is done which is given to the classifier for training from which x, y and z are read probabilities are calculated and data gets sorted, if it gets classified then it is reported to the server if not then whole process repeats. Also the Android application which is developed cautions the driver before hand; as the condition is set for speed, if it goes above O Km/hr location is reported to the server, from database it is checked whether pothole is present or not, if it is present it flash the message on screen of the phone and also audio message is evoked which alerts the driver almost from 100 meters prior.

IV. TECHNOLOGIES/COMPONENTS TO BE USED

A. Ultrasonic sensor HC-SR04

Sensor including transmitter and receiver is active HC-SR04 ultrasonic sensor. After placing objects in front, this sensor is used to measure the distance. After sending the large frequency sound waves it holds till same is reflected back towards the receiver. Ultrasonic pulse travels a particular distance and time taken by this pulse is used to calculate the distance. Following figure explains how this sensor works. Based on different ranges of transmission and angles of detection there are different types of ultrasonic sensors. The working frequency of HC-SR04 is 40 KHz and distance calculated will be from range 2cm to 400cm with 15o angle of detection

B. GPS Receiver

A satellite navigation system which is used to identify geographic location as well as time, whatever might be the weather conditions is known as Global Positioning System(GPS). Anyone having GPS receiver, can avail this facility freely which is owned by US government. National Marine Electronics Association (NMEA) format is the format in which GPS information is obtained from satellite. It is the standard format for this information, which is followed by all satellites.

C. ESP8266 NODE MCU

Espressif Systems designed the micro controller named ESP8266. Self contained applications can be run on this micro controller which has self contained Wi-Fi network, this is used to bridge from current micro controller to Wi-Fi. Good assortment of pin outs and USB connector are built-in properties of this module. Just similar to Arduino, this node MCU devkit can be connected to the laptop with help of micro USB cable and flash easily. As the chip is basic Wi-Fi/Serial transceiver, this module can be used with serial commands.

V. RESULTS

For machine learning purpose this 'Pothole' named application has been generated as seen in figure 3, where we manually marked the potholes, the application consists of screen having 'start service' and 'stop service' select buttons, also it shows service status either 'stopped' or 'running'.

Fig. 3: Android application- Pothole

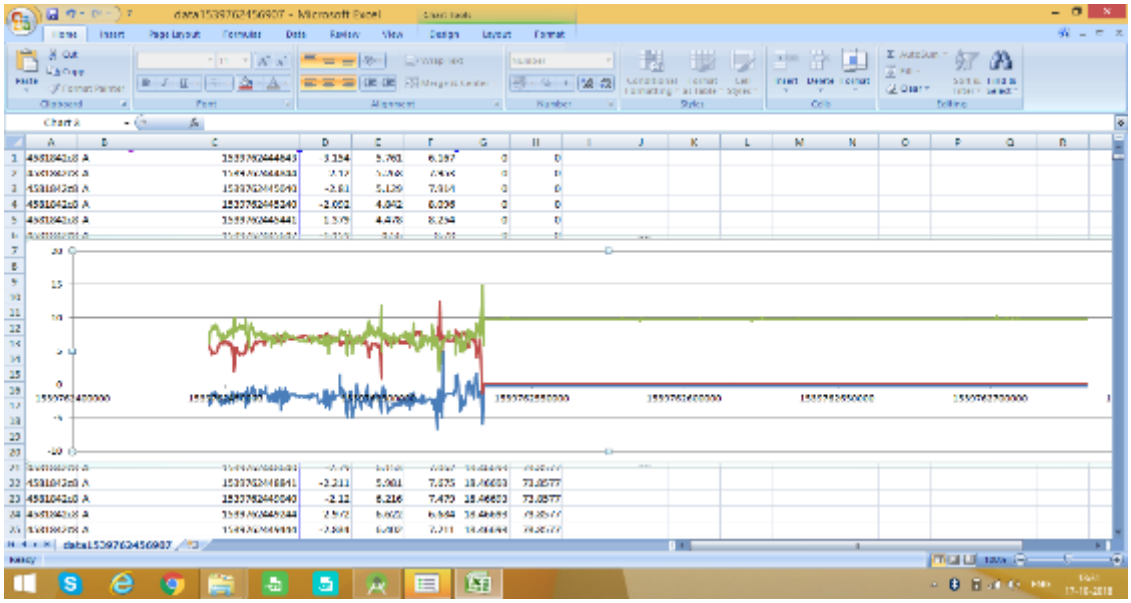

Fig. 4: CSV file showing Vibrations

With the help of Gyroscope and GPS the motion of the smart phone has been detected and comma- separated values (CSV) file has been generated which includes 'Android ID', 'accelerometer data', 'x, y, z coordinates' , 'latitude' and 'longitude' ; Vibrations are noted from this data obtained from CSV file as shown in figure 4. In

such way from another smart phone same data has been noted and sensitivity average is been calculated and one standard for different types of potholes has been set.

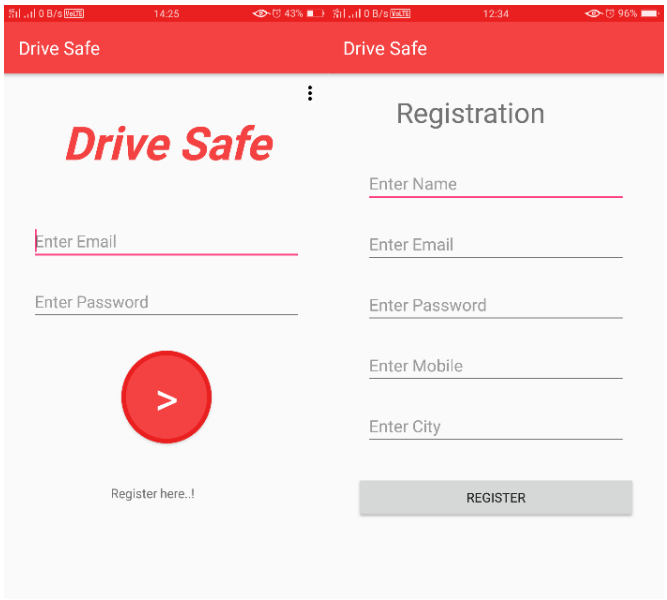

Fig. 5: Android application - Drive Safe

In figure 5, 'Drive Safe' named another android application is been developed which is the main application the driver would be using while driving the vehicle. This application includes the registration of the user whose details are saved to the database, these includes Name, Mail ID, Password, Mobile no. and city. After registration user needs to login.

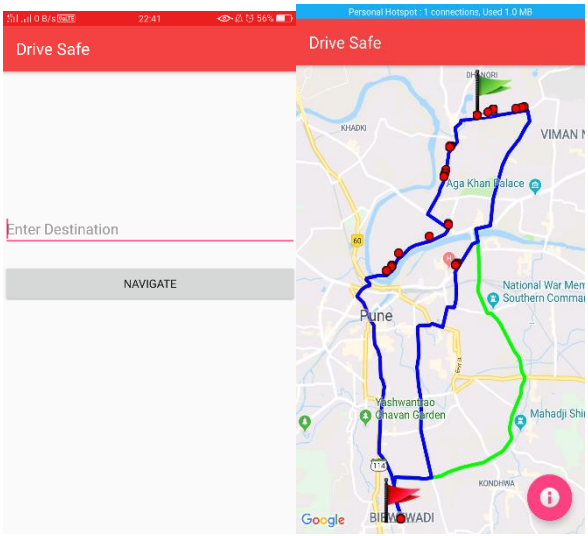

Fig. 6: Drive Safe application - Navigation window and result

After login the application asks for the destination to be navigated, after entering the navigation user may get the results as shown in figure aside. In figure 6. Source and destination can be seen as well as detected potholes can be seen and with proper examination best alternate route is been suggested to the user.

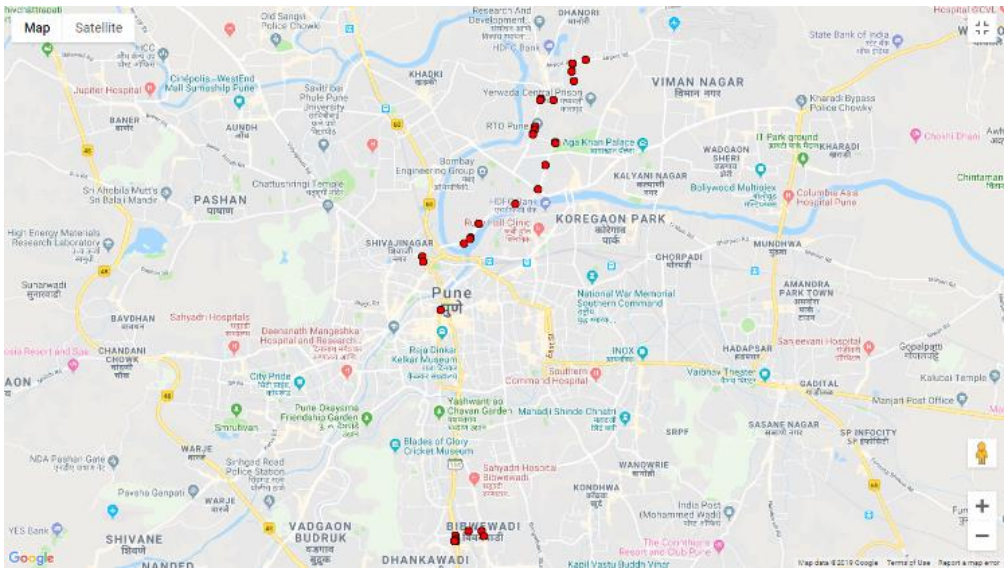

Fig. 7: Heat Map generated on web

As seen in figure 7, web application is also been generated to show the heat map of the detected potholes.

VI. CONCLUSION

Proposed system is able to detect the potholes, speed bumps, deceleration strips i.e. the surface of road. That means two major issues are solved, First one is automatic detection of all these road anomalies is been done and second the driver is cautioned beforehand by giving him alert voice message of such anomalies which are within 100 metres. The potholes, speed bumps surface of road are detected using inertial sensor and ultrasonic sensor. The GPS is used to locate the area. All the gathered data is stored in the database. Using this database heat map is generated and the best alternate route is suggested to the user on the android application. Future scope would be; gathered information can be transferred to the government bodies which will help them to look after wear and tear of the roads, hence the system will help to minimize the unavoidable circumstances on road and economy wasted on it as well as it would be of great support to a developing city indeed country.

VII. REFERENCES

[1]. Amr S. El-Wakeel, Jin Li, Muhammed T. Rahman, Aboelmagd Noureldin and Hossam S. Hassanein, "Monitoring Road Surface Anomalies Towards Dynamic Road Mapping For Future Smart Cities".

[2]. Andrew Fox, B.V.K. Vijaya Kumar, Jinzhu Chen and Fan Bai, "Multi-lane Pothole Detection from Crowdsourced Undersampled Vehicle Sensor Data" IEEE Transactions on Mobile Computing

[3]. Guangtao Xue, Hongzi Zhu, Zhenxian Hu, Wen Zhuo, Chao Yang, Yanmin Zhu, Jiadi Yu, Yuan Luo, "Pothole in the Dark: Perceiving Pothole Profiles with Participatory Urban Vehicles" IEEE Transactions on Mobile Computing

[4]. Huaijun Wang, Na Huo, Junhuai Li, Kan Wang and Zhixiao Wang, “A Road Quality Detection Method Based on the Mahalanobis-Taguchi System” IEEE Access

[5]. Sultan Basudan, Xiaodong Lin, Karthik Sankaranarayanan, “A Privacy-preserving Vehicular Crowdsensing based Road surface Condition Monitoring System Using Fog Computing” IEEE Internet of Things Journal

[6]. Azza Allouch, Anis Koubˆaa, Tarek Abbes, and Adel Ammar, “RoadSense: Smartphone Application to Estimate Road Conditions using Accelerometer and Gyroscope” IEEE Sensors Journal

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Bitcoin Price prediction using Deep Learning

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ABSTRACT

In recent years, Bitcoin is rising and become an attractive investment for traders. Unlike stocks or foreign exchange, Bitcoin price is fluctuated, mainly because of its 24- hours a day trading time without close time. To minimize the risk involved and maximize capital gain, traders and investors need a way to predict the Bitcoin price trend accurately. However, many previous works on cryptocurrency price prediction forecast short-term Bitcoin price, have low accuracy and have not been cross-validated

This paper describes the baseline neural network models to predict the short-term and the long-term Bitcoin price change. Our baseline models are the Multilayer Perceptron (MLP) and the Recurrent Neural Networks (RNN) models. Data used are Bitcoin's block chain from August 2010 until October 2017 with 2-days period and the total amount of 1300 data. The models generated are predicting both for short-term and long-term price change, from 2-days until 60-days.

The result shows that long-term prediction has a better result than short-term prediction, with the best accuracy in Multilayer Perceptron when predicting the next 60-days price change and Recurrent Neural Networks when predicting the next 56-days price change. Multilayer Perceptron outperforms Recurrent Neural Networks with accuracy of 81.3 percent, precision 81 percent, and recall 94.7 percent.

Keywords: cryptocurrency, neural networks, multilayer perceptron and recurrent neural networks

I. INTRODUCTION

Market prices forecasting is very interesting and challenging both for investors and researchers due to the many uncertainties involved and lots of variables that influence the market, such as economic conditions and political events [1]. In recent years, the market is not only about the stock and foreign exchange (forex) but also about cryptocurrency. ODO defines cryptocurrency as a digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank.

The first cryptocurrency was Bitcoin, which began trading in January 2009 [2]. Bitcoin is the largest cryptocurrency in the world. It is a peer-to-peer electronic cash system that allows online payments to be sent directly from one party to another without going through a financial institution [3].

Reference [4] analyzed the Bitcoin block chain data to predict the price of Bitcoin using SVM and ANN (Multilayer Perceptron), which score 55% accuracy. Random Forest, SVM, and Binomial Logistic algorithms are used in to Predict short-term Bitcoin price and achieve high accuracy result of 97% in [5], but it is stated in [6] that this research has one limitation, in which the result was not cross- validated so that it may have over fit the data and one cannot be sure if the model will generalize. Therefore, [6] uses LSTM (Long Short-Term Memory) network and achieves an accuracy of 52%. Most of the previous works on cryptocurrency price prediction forecast short-term Bitcoin price, have low accuracy, and have not been cross-validated, which gives a high risk for traders to trust the model.

Unlike cryptocurrency prediction, stock market prediction research had many satisfying results, mainly because they focused not only on a short-term prediction but also on long-term prediction. Reference [7] uses the Random Forest algorithm with the result of 75% in Precision, Recall, and F-score to predict the 'good' and 'bad' stocks in a one- year period. Similarly, [1] achieves really high accuracy using Random Forest and achieve accuracy in the range of 85-95% for long term price prediction. Also, [8] uses SVM, QDA, Logistic Regression, and GDA to predict the future price change and compare the result to predict both short- term and long-term price change with their short-term result only achieves 58% accuracy but their long-term result with time-ahead of 44-days achieve accuracy of 79.3%.

Inspired by works done on stock market price prediction field that achieve better accuracy than the cryptocurrency price prediction field by predicting the long-term price, this research tries to generate neural networks model that can be used to predict the price movement of Bitcoin not only in the short-term but also in the long-term. This research is part of the first author's undergraduate thesis [9].

II. METHODOLOGY

The purpose of this study is to generate baseline neural network models that can predict the future price change of Bitcoin both in short-term and long-term. In predicting the future price in the market, traders and investors used technical analysis or fundamental analysis. In this research, fundamental data used are the Bitcoin block chain data obtained from blockchain.info. There are 35 possible block chain features that can be used for the input of the neural network, but this research only used 14 of them based on research by [5], as shown in Table I.

Each feature downloaded from blockchain.info is a single CSV file. Each file contains two columns, the first column is timestamp, and the second column is the feature value. The number of rows in each file 1324, in which the time stamp starts from 02 August 2010 and ends on 30 October 2017 with a 2-days period. In order to create a training data file, these 14 CSV files are merged, the resulting file contains 1324 rows and 15 columns (timestamp and 14 features).

TABLE I. FOURTEEN INPUT FEATURES SELECTED

	Feature	Definition
1	Block Size	Average block size in MB

2	Cost per Transaction	Miners revenue divided by the number oftransactions in USD.
3	Difficulty	A relative measure of how difficult it is tofind a new block.
4	Hash Rate	The estimated number of tera hashes persecond the Bitcoin network is performing.
5	Market Capitalization	The total USD value of bitcoin supply incirculation.
6	Median ConfirmationTime	The median time for a transaction to beaccepted into a mined block.
7	Miners Revenue	The total value of coin base block rewardsand transaction fees paid to miners in USD.
8	Number of OrphanedBlocks	The total number of blocks mined but ultimately not attached to the main Bitcoin blockchain.
9	Number of Transaction	Total number of confirmed transactions perday.
10	Number of Transaction perBlock	The average number of transactions perblock.
11	Unique Addresses	The total number of unique addresses usedon the Bitcoin blockchain.
12	Bitcoins inCirculation	The total number of bitcoins that havealready been mined.
13	Trade Volume	The tradingexchanges. volume on major bitcoin
14	Transaction Fees	The total value of all transaction fees paidto miners.

Both input and output datasets are grouped into various time-window, that is, 3, 5, and 7. There are 1324 timesteps in the data, but only 1300 of them are actually predicted because of the time-window grouping. Z-score normalization is applied to the input dataset to standardize the data. Before training the model, the data were split using a k-fold cross- validation method with k = 5.

Algorithm 1 Output Label Calculation

if $MarketPrice(t+x) \geq 1.01 * MarketPrice(t)$ **then**
  $label \leftarrow [1, 0]$
else
  $label \leftarrow [0, 1]$
end if

Fig. 1. Output label pseudocode

The output label is binary and represented using one-hot encoding value. If the future market price increases, the label is [0, 1]; if it decreases, the label is [1, 0]. The algorithm used to assign the label shown on Fig. 1, where t is the current time, and x is the time ahead.

The neural network models were trained using various epochs values, with different time-windows, and are used to predict the price change for both short-term and long-term. There is 30 predicted value (time-ahead) from 2-days until 60-days with 2-days period. Learning rate, hidden state, and learning algorithm were experimented to find the best value by looking at the lowest validation loss they produce.

III. NEURAL NETWORK MODELS

In this research, Multilayer Perceptron (MLP) and Recurrent Neural Network (RNN) were used as baseline models because both models already used in previous research with MLP [4] and RNN [6] show that the networks were capable of predicting Bitcoin price change, but both research only achieve accuracy less than 60% which still need improvement.

A. Multilayer Perceptron

The model used for MLP is based on research by [10], which uses 2-hidden layer feedforward networks with a formulated number of hidden nodes.

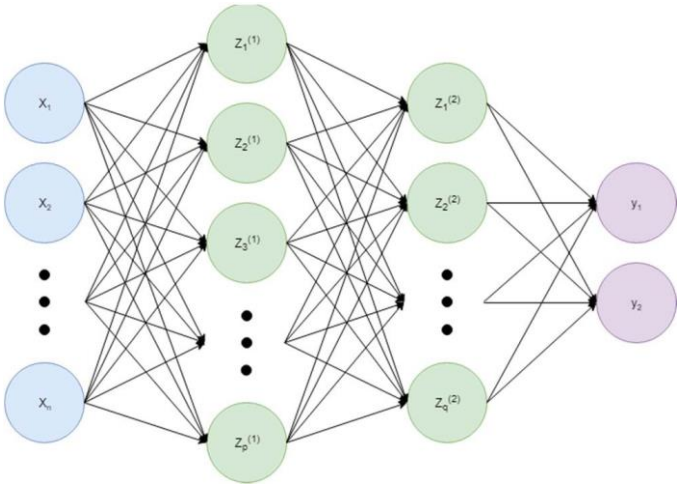

Fig. 2. Multilayer Layer Perceptron architecture

Fig. 2 visualizes the architecture of MLP with X as input layer, Z1, and Z2 as the hidden layer and y as output layer.

- The input layer has n nodes with n = the number of features x time-window. Since there are 14 features (Table I), if the size of time-window = 3, then the input layer has n = 42 nodes.
- The number of nodes in the hidden layer is calculated using formulas based on the number of input node n and output node m. For example, if the first hidden layer has p nodes, and the second hidden layer has q nodes, then p and q can be calculated using (1) and (2), respectively. An activation function used in the hidden layer is ReLu.

$$p = \sqrt{(m+2)}\, n + 2\sqrt{n}/(m+2) \quad (1)$$

$$q = m\sqrt{n}/(m+2) \quad (2)$$

- Output layer has 2 node representing one-hot encoding value of decrease [1, 0] or increase [0, 1]. Softmax is used as an activation function in this layer.

B. Recurrent Neural Network

Recurrent Neural Network (RNN) allows the network to learn from its previous state, which makes this network really useful for time-series data. The architecture used was many-to-one with various experimented time-window.

Fig. 3 visualizes the architecture of RNN with X as input layer, Z1, and Z2 as the hidden layer and y as output layer.

- The input layer has 14 nodes (feature dimension).
- Hidden layer nodes were varied between 10, 20, 30, and 40 to find the hidden nodes with the lowest validation loss using ReLu as an activation function. The identity matrix was used for RNN initial weight in hidden nodes, which works well with long-term dependencies [11].
- Output layer has 2 nodes, representing one-hot encoding value of decrease [1, 0] or increase [0, 1]. Softmax is used as an activation function in this layer.

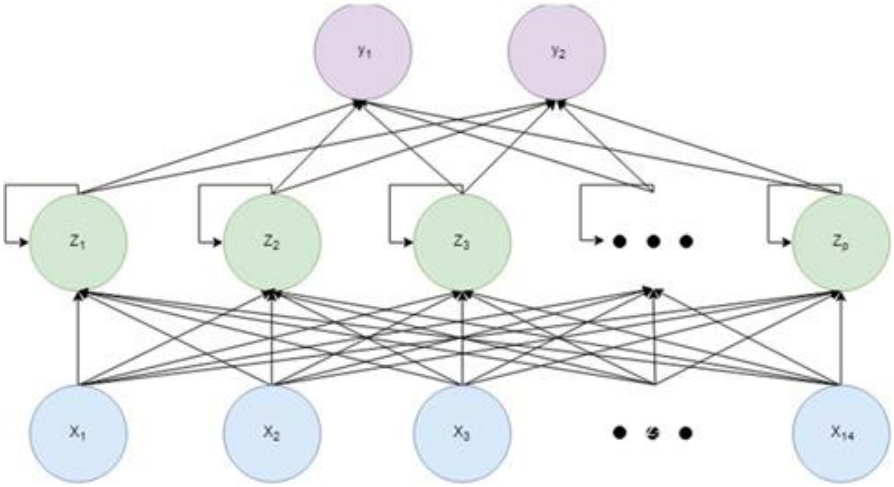

Fig. 3. Recurrent Neural Network architecture

IV. EXPERIMENTS AND DISCUSSION

The experiment is performed in two steps. The first step is to find the best hyperparameters. Then, based on the best hyperparameters, the second step is used to compare the models with various time-windows and time-ahead.

A. Hyperparameter Experiment

Hyperparameters that were experimented are learningrate, hidden node, and learning algorithm.

1) Learning rate: in the experiment, the value learning is varied to 0.01, 0.001, and 0.0001 for both MLP and RNN algorithms. Other hyperparameter values are constant, as follows: the value of epoch is 50, the number of hidden nodes for RNN is 10, the learning algorithm used is Adam. The results of this experiment show that the best learning rate for both MLP and RNN is 0.01, with validation loss 0.58 and 0.62, respectively.
2) Hidden node: the experiment on the number of hidden nodes is only for RNN. The number of nodes

used in MLP is determined using the formula. The constant hyper parameters are learning rate, epoch, and learning algorithm, with a value of 0.01, 50, and Adam, respectively. Lowest validation loss is found with 20 hidden nodes with a value of 0.611.

3) Learning algorithm: There are four learning algorithms that are compared, that is, Adam, AdaDelta, RMSProp, and Stochastic Gradient Descent (SGD). The learning rate and the hidden unit are set to 0.01 and 20, respectively. Adam shows the lowest validation loss for both MLP and RNN, with a value of 0.58 and 0.611, respectively.

Hyper parameter used is summarized in Table II for MLP and Table III for RNN. There are constants that are already defined in this research, such as dropout rate and batch size. These hyper parameters are used to find the accuracy, precision, and recall for epoch 50, 100, 150, and 200.

TABLE II. MLP HYPERPARAMETER

Hyperparameter	Value
Learning Rate	0.01
Learning Algorithm	Adam
Batch Size	128
Hidden Layer 1 Node Size	$\sqrt{(m+2)N} + 2\sqrt{N/(m+2)}$
Hidden Layer 2 Node Size	$m\sqrt{N/(m+2)}$
Dropout	0.5

TABLE III. RNN HYPERPARAMETER

Hyperparameter	Value
Learning Rate	0.01
Learning Algorithm	Adam
Batch Size	128
Hidden State Size	20
Dropout	0.5

B. Result and Discussion

In the second step of our experiments, the performance of the model is measured by the model's accuracy, precision, and recall, for each time-window of 3, 5, and 7, and time- ahead of 2-days, 4-days, 6-days until 60-days. In this research, short-term price prediction is defined as time-ahead between 2-days and 30-days and long-term price prediction from 32-days until 60-days. The highest result for each epoch is compared as in Table IV for short-term and Table V for the long-term; the highlighted row is used to show the epoch with the highest accuracy for each model.

Table IV shows the highest accuracy is 70.04% on MLP and 67.56% on RNN. Both MLP and RNN achieved their highest short-term accuracy using a time-window of 3. It means that increasing the time-window does not always the case to increase the accuracy of short-term prediction.

Table V shows the highest accuracy for long-term price prediction, with 81.3% on MLP and 77.2% on RNN. The

results also show a similar pattern with short-term prediction on Table IV, with both highest accuracy achieved using a time-window of 3.

Table VI put together the highest accuracy for short-term and long-term prediction both for MLP and RNN. Long-term prediction achieved better accuracy than the short-term one, both in MLP and RNN. This result shows that long-term prediction is easier to predict and can achieve better accuracythan the short-term one.

TABLE IV. SHORT-TERM HIGHEST ACCURACY

Neural Network	Epoch	Highest Accuracy		
		Time-window	*Time-ahead*	*Value*
Multilayer Perceptron	50	5	2-days	67.68%
	100	3	26-days	70.04%
	150	7	28-days	68.77%
	200	7	26-days	69.61%
Recurrent Neural Networks	50	5	2-days	67.31%
	100	3	28-days	66.70%
	150	5	2-days	66.74%
	200	3	2-days	67.56%

TABLE V. LONG-TERM HIGHEST ACCURACY

Neural Network	Epoch	Highest Accuracy		
		Time-window	*Time-ahead*	*Value*
Multilayer Perceptron	50	7	58-days	78.0%
	100	5	60-days	80.0%
	150	5	58-days	80.0%
	200	3	60-days	81.3%
Recurrent Neural Networks	50	5	60-days	75.2%
	100	3	60-days	74.8%
	150	5	58-days	76.2%
	200	3	56-days	77.3%

TABLE VI. MLP AND RNN HIGHEST ACCURACY

Neural Network	Group	Highest Accuracy
Multilayer Perceptron	Short-term	70.04%
	Long-term	81.3%
Recurrent Neural Networks	Short-term	67.56%
	Long-term	77.3%

Accuracy alone is not really good evaluation benchmark for imbalanced dataset. The model probably suffers the accuracy paradox in which it can only predict the majority of the output label that fed into its networks in training session. The solution to finding out whether our model suffer from accuracy paradox is to calculate the precision and recall score for both networks.

Table VII shows the highest accuracy for each model with its precision and recall. Both precision and recall have value matching its accuracy. Thus, it can be certain that the models do not suffer from accuracy paradox. In this research, the highest accuracy is achieved by MLP with accuracy of 81.3%, precision of 81.0% and recall of 94.7%.

TABLE VII. FINAL RESULT

Neural Network	Accuracy	Precision	Recall
Multilayer Perceptron	81.3%	81.0%	94.7%
Recurrent Neural Networks	77.3%	76.6%	95.8%

V. CONCLUSION

In this research, we have studied the performance of MLP and RNN models for prediction of bitcoin price change. The long-term price prediction achieves higher result than the shorter one both in MLP and RNN. Just like in stock market price prediction, long-term price prediction also shows high accuracy in cryptocurrency price prediction with result of accuracy in range of 60-80%. The performing model in this research is Multilayer Perceptron with time- window of 3 and 200 epochs with accuracy of 81.3%, precision of 81% and recall of 94.7%.

Further research can be done by feature engineering to make neural networks learn faster and better, for example, by combining multiple features into a single feature, and removing unwanted features. There are various hyperparameters that can be tweaked, such as dropout rate, weight initialization, and batch size. Other direction in our future research is to explore more advance deep learning models, especially sequences to sequence models and temporal convolutional neural networks along with their architectural variants.

VI.REFERENCES

[1]. L. Khaidem, S. Saha, and S.R. Dey, "Predicting the direction of stock market prices using Random Forest," arXiv preprint arXiv:1605.00003, 2016.

[2]. E. Dourado and J. Brito, Cryptocurrency, The New Palgrave Dictionary of Economics, 2014.

[3]. Cryptocurrency, In Oxford Dictionaries, 2019. [online] Available at: https://www.oxfordlearnersdictionaries.com/definition/english/crypto currency

[4]. A. Greaves and B, Au, Using the Bitcoin Transaction Graph to Predict the Price of Bitcoin, Stanford University, 2015.

[5]. I. Madan, S. Saluja, and A. Zhao, Automated Bitcoin Trading via Machine Learning Algorithms, Stanford University, 2015.

[6]. S. McNally, Predicting the price of Bitcoin using Machine Learning, Doctoral Dissertation, Dublin, National College of Ireland, 2016.

[7]. N. Milosevic, "Equity forecast: predicting long term stock price movement using machine learning," arXiv preprint arXiv:1603.00751, 2016.

[8]. Y. Dai and Y. Zhang, Machine Learning in Stock Price Trend Forecasting, Stanford University, 2013.

[9]. R. Albariqi, Predicting Bitcoin Price Change Using Neural Network, Undergraduate Thesis, Universitas Gadjah Mada, 2017.

[10]. G.B. Huang, "Learning capability and storage capacity of two- hidden-layer feedforward networks," IEEE Trans. Neural Netw., 14(2), pp.274-281, 2003.

[11]. Q.V. Le, N. Jaitly, and G.E. Hinton, "A simple way to initialize recurrent networks of rectified linear units," arXiv preprint arXiv:1504.00941, 2015.

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IOT Based Smart Kitchen System

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ABSTRACT

In today's world fuel demand is increasing day by day. Liquefied Petroleum Gas (LPG) is most used fuel in Kitchen. This is filled in cylinder in liquid state. These cylinders blast sometimes, the main reason of cylinder blast is gas leakage. So, to avoid this we need to detect the leakage of gas. For this we need automatic gas leakage detection system which detect leakage of gas and gives alert. This type of automatic security system can save people from dangerous blasts and prevent accidents. Now a days IOT (Internet of Things) is widely used in day-to-day life.

There are many home appliances which are based on IOT thus it becomes easier to manipulate them. As we know the kitchen is the most important part of our home, but we also heard about the disasters happens in the kitchen due to various reasons and many people lost their lives. there might be various reasons behind the cause of these disasters but the main and mostly happens is due to the leakage of LPG gas from the cylinder. As LPG gas is highly inflammable gas, a small leakage of gas can be costly for human life. So, if we can detect these leakages of gas before it causes any serious issue then we might save many lives.

Key Words: MQ2 gas sensor, LM35 temperature sensor, Arduino, Node MCU ESP8266, LCD, GSM module.

I. INTRODUCTION

In India LPG (Liquefied Petroleum Gases) is most used for the cooking purpose. In this paper we proposed a system for detection of leakage of gas which is based on IOT. thissystem is helpful to detect the gas leakage so that the action can be taken before it causes any hazardous issue. the system consists of MQ2 gas sensor which will detect the leakage of gas. as soon as it detects the gas an alert message in send to the user, the LED will be on, the warning message is to be displayed on the LCD screen and exhaust fan will be automatically switched on. We have interface additional sensors which will continuously monitor the oxygen level and the temperature of the room.

In this paper, we present the design and implementation of IOT Based Smart Kitchen System. Gas leakage and cylinder blast is a big problem in today's world. If gas leakage is not detected fast it leads to explosion. So, we design and implement a system which prevent such type of accidents. This system is a wireless and includes GSM for communication purpose, Arduino UNO (which work as a microcontroller), also has a friendly user

interface including LCD (Liquid Crystal Display). This system also uses MQ-2 (gas sensor) and buzzer. This system response rapidly to alarm incidents also it is low-cost system, and it consumes low power. Even in the absence of people in home its alert people.

1.1. Block Diagram

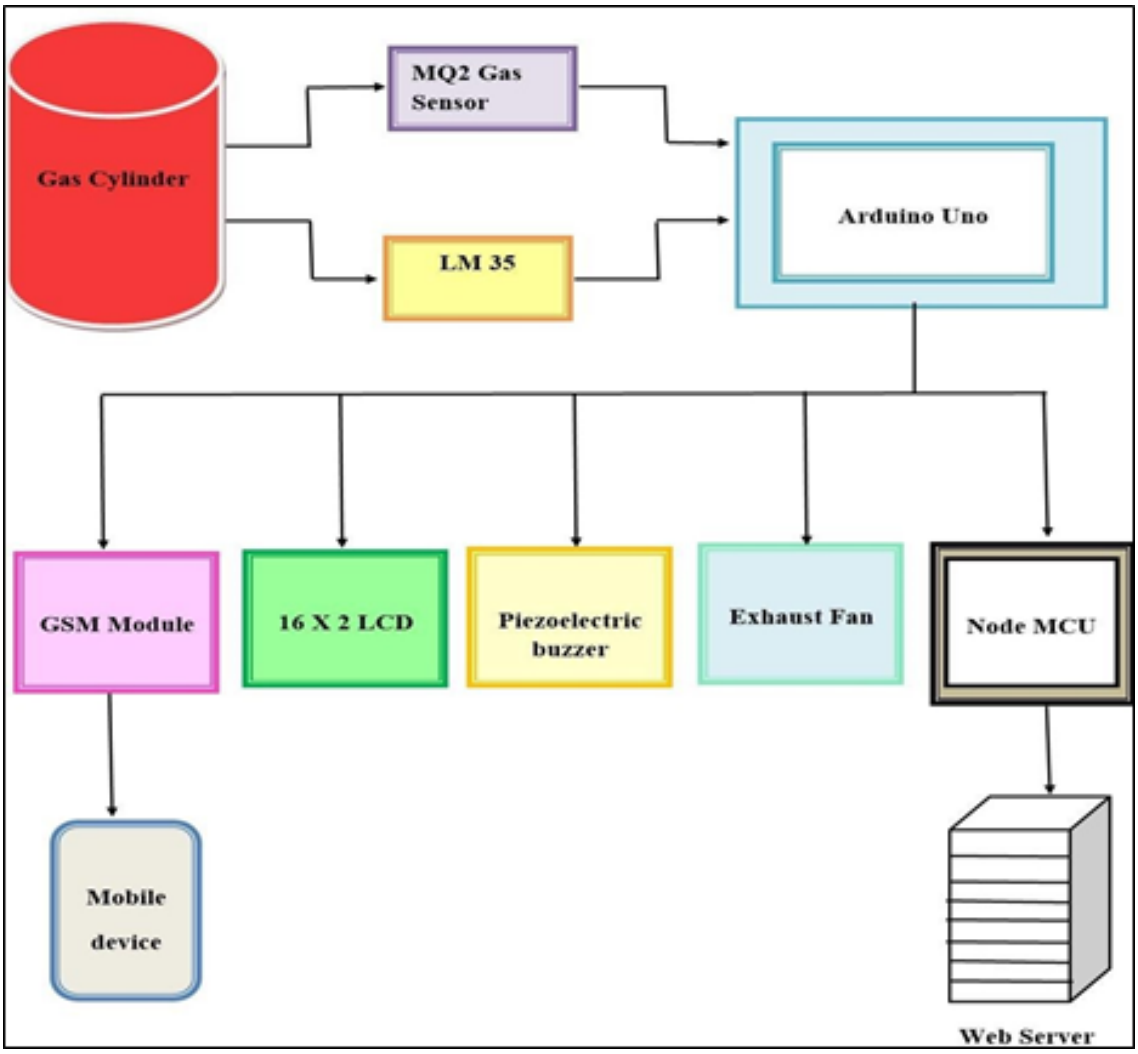

Fig – 1: Block Diagram

1.2. Specification

◆ Arduino UNO:

Operating voltage: 5VDC
DC Current per IO pin: 120 mA
DC Current for 3.3V pin: 50 mA
No. of pins: 28 pins

◆ Node MCU ESP8266:

Operating voltage: 3.3V DC
DC Current per I/O pin: 12 mA
No. of pins: 17 pins

◆ G.S.M. GPRS SIM900A Modem:

Operating voltage: 3.4V DC
No. of pins: 3
Current: For
Sleep mode: 1 mA
Stand by: 18 mA
Call: 199mA

◆ MQ2 Gas Sensor:

Operating voltage: +5V DC
No. of pins: 4 pins
Analog output voltage: 0 t0 5 V
Digital output voltage: 0 V or 5 V (TTL Logic)

◆ LM35 Temperature Sensor:

Operating voltage: 5V DC
No. of pins: 2
Drain current: less than 60uA

II. HARDWARE DESIGN

Arduino UNO Micro controller:

- Arduino UNO is a micro-controller board based on the ATmega328P.
- Frequency (Clock speed): 16 MHz
- Flash program memory: 32KB (0.5 KB is used for Boot loader)
- Operating voltage: 5V
- Recommended input voltage: 7-12 V
- Digital I/O pins: 14(Out of which 6 provide PWM output)
- DC current on I/O pins: 40 mA
- DC current on 3.3 V pin: 50 mA
- SRAM: 2 KB
- EEPROM: 1KB

Node MCU ESP8266:

- Node MCU is an open-source Lua based firmware and development board specially targeted for IOT based applications.
- Clock speed: 80 MHz
- Operating voltage: 3.3 V
- Flash Memory: 4 MB
- SRAM: 64 KB
- PCB antenna

G.S.M. GPRS SIM800C Modem:

- RS232 interface for direct communication with computer or MCU kit.
- Configurable band rate.
- Power controlled using 29302WU IC.
- ESD Compliance.
- Enable with MIC and speaker socket.
- With slid in SIM card tray.
- With stub antenna and SMA connector.
- Input Voltage: 12 V DC.

Sensors:

1. Mq2 gas sensor:

Mq2 gas sensor is a metal oxide semiconductor (MOS) type gas sensor. Its detection is based on change of resistance of the sensing material when gas meets the material.

2. LM35 temperature sensor:

LM35 is an Integrated circuit temperature sensor, whose output voltage change based on temperature around it. It can measure temperature between -55°C to 150°C. If the temperature is 0°C, then the output voltage will also be 0V. There will be rise of 0.01V (10mV) for every degree Celsius rise in temperature.

III. SOFTWARE DESIGN

Flowchart:

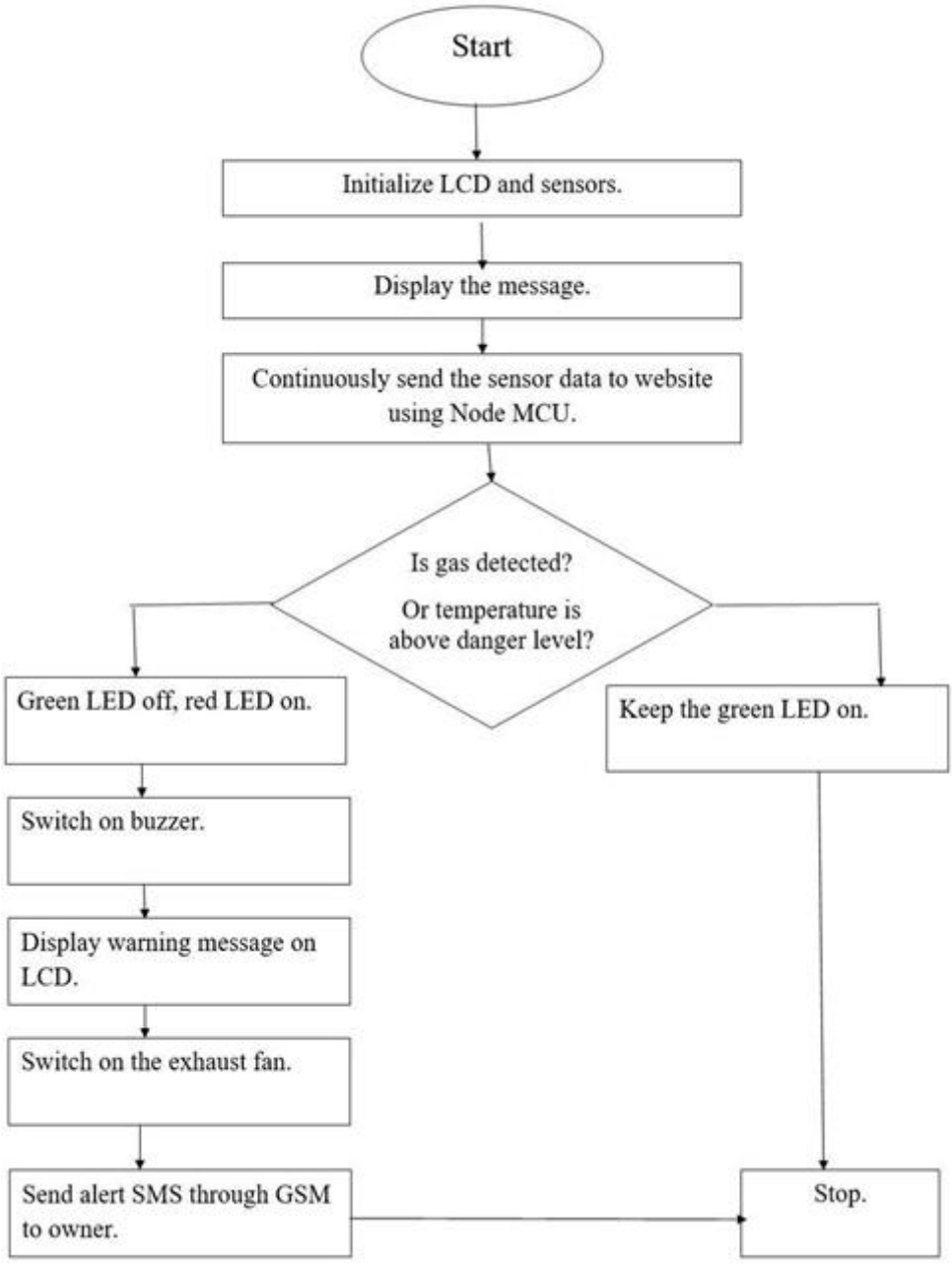

Fig – 2: Flow chart

IV. CONCLUSION

This project is very useful to prevent accident due to gas leakage. Each flame and gas detection applicationhasits own unique safety hazards. If we implement this in broad way, it is very successful. The main advantage of this simple gas leak detector is its simplicity and its ability to warn its stakeholders about the leakage of the L.P.G

gas. Also due to continue monitoring by IOT it possible for the owner to remotely check the status of gas levels and temperature in the kitchen.

V. REFERENCES

[1]. "GSM Based Low-cost Gas Leakage, Explosion and Fire Alert System with Advanced Security" by Pritam Ghosh, Palash Kanti Dhar, International Conference on Electrical, Computer and Communication Engineering (ECCE), 9 February 2019.

[2]. "Automatic Smart and Safety Monitoring System for Kitchen Using Internet of Things" by Harika Pudugosula, Proceedings of the International Conference on Intelligent Computing and Control Systems (ICICCS 2019) IEEE Xplore.

[3]. "IoT based system for detection of gas leakage and house fire in smart kitchen environments" by Marjan Ralevski, Biljana Risteska Stojkoska, 27th Telecommunications forum TELFOR 2019, Serbia, Belgrade, November 26-27, 2019.

[4]. "A Highly reliable Smart Kitchen Security Alarm System Based on Internet of Things" by Yun Wang, Tong Zhou, 2018 3rd International Conference on Materials Science, Machinery and Energy Engineering.

[5]. "SMART KITCHEN SYSTEM USING IOT" by Mrs Varsha R. Palandurkar, Simran J. Mascarenhas, Naaz D. Nadaf, Rupa A. Kunwar, International Journal of Engineering Applied Sciences and Technology, March 2020, Vol. 4, Issue 11.

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Comparative Analysis Between Various Types of Bracings for Steel Building in Different Seismic Zones

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ABSTRACT

We are preparing a relative report on a G+13 tall structure in this research paper. In this structure, we will contrast exposed casing and edges having various types of bracings at the corners. A three-dimensional structure is taken; 13 stories are taken with a story tallness of 3m. The bars and segments are intended to withstand dead and live loads only. Seismic tremor loads are taken by bracings. The bracings are given just on the fringe sections. Here auxiliary displaying and examination are finished utilizing investigation programming Etabs which is a limited component-based programming apparatus. A tall structure will be analyzed for seismic loading corresponding to various seismic zones. The effectiveness of bracings in reducing lateral displacements and their efficiencies during the earthquake is to be investigated. So the objective is to do a comparative analysis between symmetrical G+13 story RCC buildings with bracings and similar buildings without the bracings using commercially available software. In this paper static linear analysis is carried out for high-rise steel frame buildings with different patterns of bracing system. The shear capacity of the structure can be increased by introducing Steel bracings in the structural system. There are 'n' numbers of possibilities to arrange steel bracings such as Diagonal, X, K, Inverted V bracings such as Diagonal, X, K, and Inverted V bracings. A typical 14th-story regular steel frame building is analyzed for various types of concentric bracings like Diagonal, X, inverted V, and K-type, and the Performance of each frame is carried out through static linear analysis ie. The equivalent static force method. Three types of sections i.e. ISMB, ISMC, and ISA sections are used to compare for same patterns of bracing with different positions.

Keywords: Static Analysis, Steel Frames with Different Types of Bracings

I. INTRODUCTION

Today's tall buildings are becoming more and more slender, leading to the possibility of more sway in comparison with earlier high-rise buildings. This has brought more challenges for the engineers to cater to both gravity loads as well as lateral loads, earlier buildings were designed for gravity loads but now because of height and seismic zone, the engineers have taken care of lateral loads due to earthquake and wind forces. Seismic

zone plays an important role in the earthquake-resistant design of building structures because the zone factor changes as the seismic intensity changes from low to very severe. Another important aspect in the design of earthquake-resistant structures is soil type, as the soil type changes the whole behavior and design of the structure changes. So to cater to all the lateral forces, we have to design the structure very unique so that the structure can withstand for the maximum time period so that there is no harm to society. The steel-braced frame is one of the structural systems used to resist lateral loads in multistoried buildings. Steel bracing is economical, easy to erect, occupies less space, and has the flexibility to design for meeting the required strength and stiffness. Braced frames are often used to resist lateral loads but braces can interfere with architectural features. The steel braces are usually placed in vertically aligned spans. This system allows obtaining a great increase of stiffness with minimal added weight, and so it is very effective for existing structures for which poor lateral stiffness is the main problem. Bracings are usually provided to increase stiff the fitness and stability of the structure under lateral long d and also to reduce lateral displacement significantly. Bracing is a highly efficient and economical method of resisting horizontal forces in a frame structure. A braced bent consists of the usual columns and girders, whose primary purpose is to support the gravity loading, and diagonal bracing members that are connected so that the total set of members forms a vertical cantilever truss to resist the horizontal loading. The braces and girders act as the web members of the truss, while the column act as the chords. Bracing is efficient because the diagonals work in axial stress and therefore call for minimum member sizes in providing stiffness and strength against horizontal shear. The bracing methods adopted in the past fall into two main categories, namely external bracing and internal bracing. In the external bracing system, existing buildings are retrofitted by attaching a local or global steel bracing system to the exterior frames. In the internal bracing method, the buildings are braced by incorporating a bracing system inside the individual bays of the RC frames. Bracing is a member of the structure they are either eccentric or concentric.

Bracing is said to be concentric if they are joined at the center of the beam with a column beam junction or direct column beam junction and eccentric if the above condition not gets satisfied. The main aim of the research work has been to identify the type of bracing that causes minimum story displacement that contributes to greater lateral stiffness to the structure. This project explores the structural behavior of steel buildings for both braced and unbraced conditions under static and lateral loading. The methodology of analysis has been presented and discussed in this Report. Finally, a comparative study has been presented to assess the best structural performance of RCC buildings under lateral loading.

AIM

To compare various types of steel bracing (concentric) systems in high-rise buildings under seismic loading for different zones

OBJECTIVE OF THE WORK

1) To study the role of the bracing system in a high-rise structure
2) To analyze different parameters in high-rise structure
3) To investigate efficient bracing systems in high rise structures by following the point of view
   a) Lateral Displacement

b) Base shear
c) Total weight
d) Axial force
e) Bending Moment

II. PROBLEM STATEMENT

To analyze the effect of earthquake forces on high-rise RCC buildings with bracing. To compare the behavior of RCC buildings with different kinds of bracings. The effectiveness of bracings in reducing lateral displacements and their efficiencies during the earthquake is to be investigated. So the objective is to do a comparative analysis between symmetrical G+13 story RCC buildings with bracings and similar buildings without bracings using commercially available software.

TRUCTURAL DETAILS

Sr.no	BUILDING DESCRIPTION	
1	Zone	3,4,5
2	Zone factor(IS 1893-2002)	0.16
3	Responce reduction Factor (IS 1893-2002)	5.0
4	Importance Factors(IS 1893-2002)	1.0
5	Height of Building	46.8
6	Floor to Floor height	3.2
7	Types of building used	Residential
8	Length of bays @ X & Ydirection.	3.0
9	Column details	ISMB 550
10	Beam details	ISMB 450
11	Bracing Type	ISMB 175
12	Thickness of slab	150mm
13	Grade of concrete	M 20
14	Grade of steel	Fe 415
15	Floor finished load(IS 875)	1.0 KN/m2
16	Live load (IS 875-P-II)	3.0 KN/m2
17	Live load on roof	1.5 KN/m2
18	Density of Brick(IS 875 P-I)	20 KN/m2
19	Thickness of inner wall	150mm
20	Thickness of outer wall	230mm
21	Density of concrete	25 KN/m2
22	Types of bracings provided	X,Diagonal, Inverted V,K-types

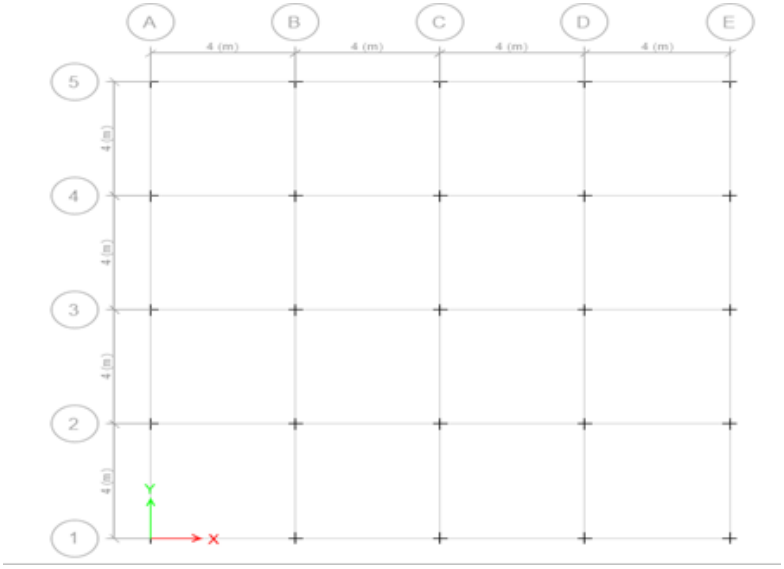


Fig. 4.1. Plan of the Building

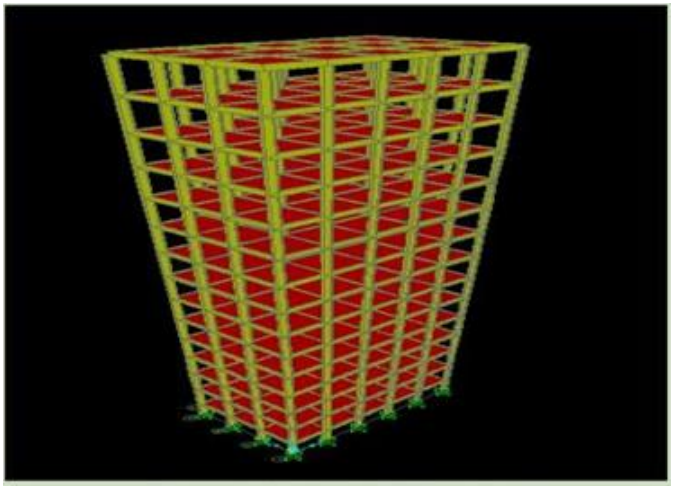


Fig. 2. 3D View Of Bare Frame

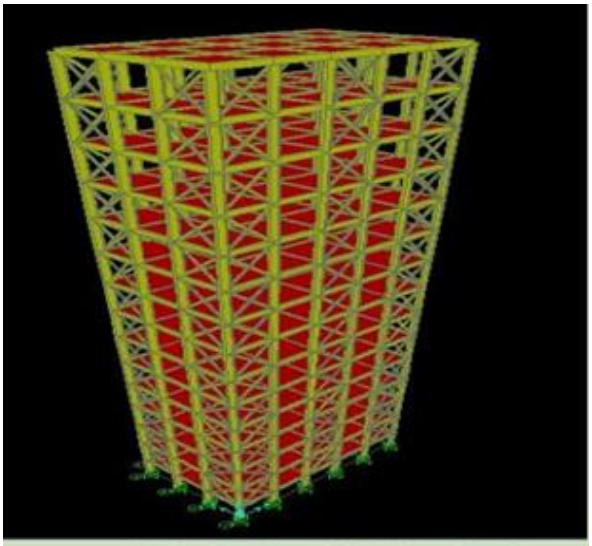


Fig. 3. 3D View Of X-Type Bracing

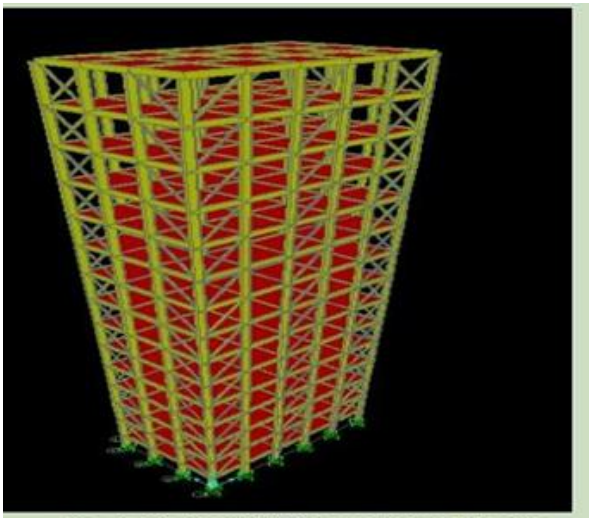
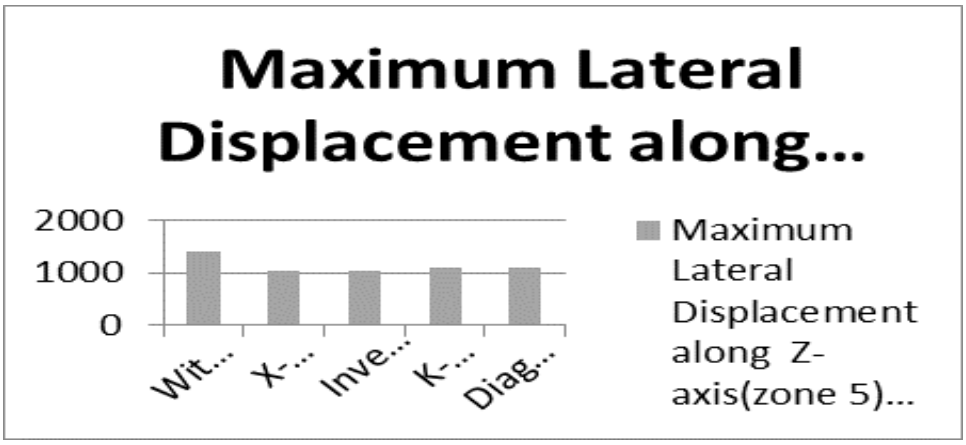
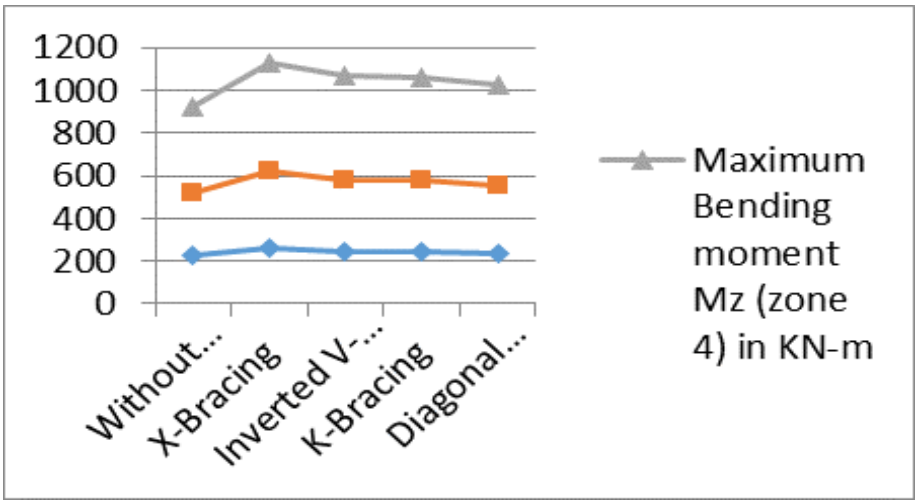


Fig. 4. 3D View Of Diagonal Type Bracing

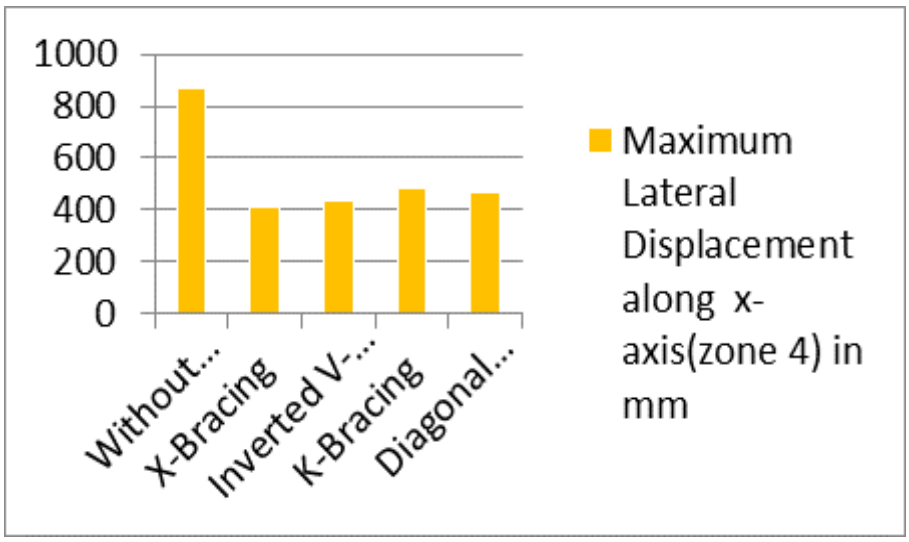
Max. Lateral Displacement along Z-axis (zone 5)



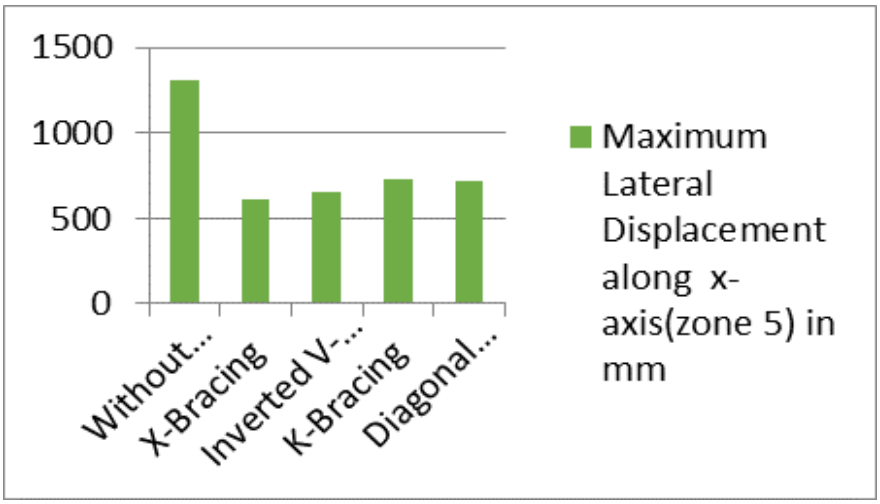
Maximum Bending moment Mz (zone 4) in KN-m



Max. Lateral Displacement along X-axis (Zone 4)in mm

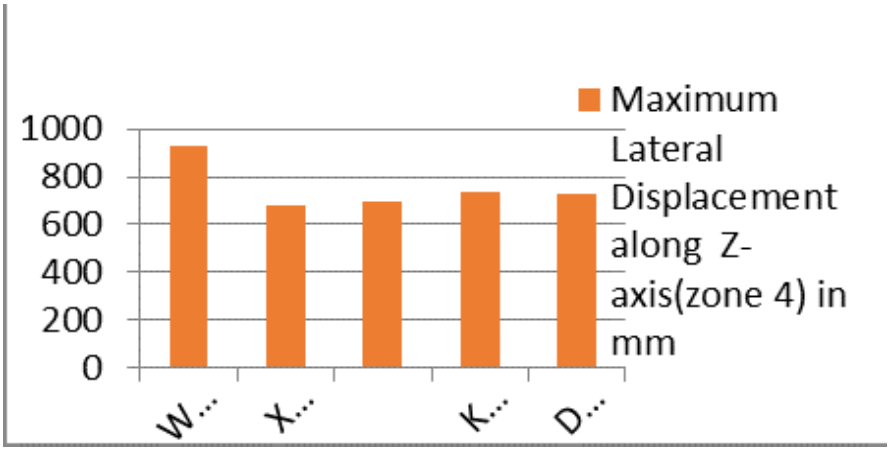


Max. Lateral Displacement along X-axis (Zone 5)



Type of Bracing	Weight of structure in KN	Percentag e increase in weight of structure
Without bracing	76186.914	
X-Bracing	77259.414	1.40 %
Inverted V- Bracing	77152.64	1.26 %
K-Bracing	77074.944	1.16 %
Diagonal Bracing	76723.164	0.70 %

Max. Lateral Displacement along X-axis (Zone 4) mm



Base Shear

Percentage increase in Base shear

Type of Bracing	Base Shear Vibe (zone3) in KN	Base Shear Vibe (zone 4) inKN	Base ShearVibe (zone 5) KN
Withoutbracing	5800.722	8701.083	1051.624
X-Bracing	5811.316	8716.362	13075.46
Inverted V-Bracing	5810.277	8715.416	13073.124
K-Bracing	5809.420	8714.130	13671.19
Diagonal Bracing	5806.018	8709.026	13063.539

III. RESULT & DISCUSSION

Bracing plays an important role in keeping structure stable. An earthquake produces inertial forces in the structure. These inertial forces act in the form of base shear on the structure. Base shear is distributed to different floors along the height of the building. This force produces later displacement in the structure. For high-rise buildings, lateral displacements are common due to towing loading. But if the earthquake is of high intensity, it can be disastrous. Bracings play an important role in distributing this force in columns and beams. In this project, we have analyzed unbraced structures with structures having different bracings.

X-bracing system has shown good results when it comes to reducing lateral displacements. Base shear values are the same in both directions. Since the number of bracings along X-directions was more, bracings showed good performance in lateral displacements along X-axes. Diagonal bracing shows overall good performance considering the maximum bending moment. K-bracing has shown good performance considering Maximum

Support Reactions. The weight of the structure remains almost the same. Not more than a 2 percent change in weights of structure. Since base shear is dependent on weight, base shear also remains similar.

IV. CONCLUSION

Lateral forces are distributed to beams and columns by bracings. In this project a comparative analysis of unbraced structure with structures having different bracings.

With parameters such as Bending Moments, Lateral displacements, and support reactions. X-bracing system has shown good results when it comes to reducing lateral displacements.

As much as a 26% decrease in lateral displacements in Z-Direction and up to 53% reduction in lateral displacements along X-direction is observed.

But the X-bracing arrangement shows the most increase in value of Maximum bending moment (24.86%) and support reactions (30%). Base shear values are the same in both directions.

Since the number of bracings along X-directions was more bracings showed good performance in lateral displacements along X-axes.

Diagonal bracing shows overall good performance considering Lateral displacements (45.58%), Support reactions (26.77%), and maximum bending moment (14.16%).

The weight of the structure remains almost the same. Not more than a 2 percent change in weights of structure. Since base shear is dependent on weight, base shear also remains similar.

V. FUTURE SCOPE OF WORK

This project primarily focused on concentric bracings. There are so many different types of concentric bracings. In this project, only four of them are utilized. There are various types of eccentric bracings too. Eccentric bracings can be useful when lateral loads are of knowing directions. In future works, this analysis can be utilized as a source of data for further analysis. There could be multiple arrangements. Here we have only focused on only one type of arrangement. This work can be further carried out with different arrangements. Bracing types can be compared by using many more parameters. This project can also be tested for dynamic loading, and wind loads. Work is done on the static coefficient method. It can be redone using the Response spectra method, Time history analysis. This is a symmetrical structure. Further projects can be done on irregular structures. Irregularity can induce unexpected forces in the structure.

VI.REFERENCES

[1]. Mohammed Idrees Khan, Mr.Khalid Nayaz Khan, Seismic analysis of steel frame with bracings using pushover analysis," International Journal of Advanced Technology in Engineering and Science Volume No.02, Issue No. 07, July 2014.

[2]. Manish S. Takey, Prof. S.S.Vidhale,"Seismic response of Steel building with linear bracing system (A Software Approach)."International Journal of Science and Engineering ISSN: 2277-9477, Volume 2, Issue 1.

[3]. Electronics, Communication & Soft Computing K.K.Sangle, K.M.Bajoria, V.Malungkar," Seismic analysis of high rise steel frame with & without bracings," 2012.

[4]. Z.A. Siddiqi, Rashid Hameed, Usman Akmal ," Comparison of Different Bracing Systems for Tall Buildings", Pak. J. Engg. & Appl. Sci. Vol. 14, Jan., 2014 (p. 17-26).

[5]. M. N. Chimeh & P. Homami," Efficiency of bracing systems for seismic rehabilitation of steel structures," Kharazmi (Tarbiat Moallem) University, Tehran, Iran.

[6]. S.R. Thorat and P.J. Salunke," Seismic Behaviour of Multistorey Shear Wall Frame Versus Braced Concrete Frames," International Journal of Advanced Mechanical Engineering, ISSN 2250-3234 Volume 4, Number 3 (2014), pp. 323-330 © Research India Publications.

[7]. Kulkarni J. G., Kore P. N., Tanawade S. B.," Seismic Response Of Reinforced Concrete Braced Frames," International Journal of Engineering Research and Applications (IJERA) ISSN: 2248- 9622 Vol. 3, Issue 4, Jul-Aug 2013, pp.1047-1053

[8]. Viswanath K.G, Prakash K.B, Anant Desai," Seismic Analysis of Steel Braced Reinforced Concrete Frames

[9]. P.Sairaj , K.Padmanabham, "Performance base seismic design of braced composite multi storied building" International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 2, February 2014.

[10]. H.R. Tawakoni, A. Rashidi Alashti & G.R. Abdollahzadeh "3-D Nonlinear Static Progressive Collapse Analysis Of Multi- Story Steel Braced Buildings"

[11]. Kapil Khandelwal, Sherif El-Tawil, Fahim Sadek "Progressive Collapse Analysis Of Seismically Designed Steel Braced Frames

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Analysis of Traffic Nodes On Expressway; A Case Study of Pune – Ahemadnagr Corridor

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ABSTRACT

Traffic congestion is one of the most visible, pervasive, and immediate transport problems plaguing not only India's but also most of the cities of the world on a daily basis. It affects all modes of transportation especially roads and all socioeconomic groups. Rapid population growth, increasing urbanization, inadequate/unplanned transport infrastructure, poor public transport systems and the rising number of personnel vehicles are some of the primary causes of congestion. This article reviews the findings of studies based on road traffic congestion
Traffic Congestion or traffic jams is one of the major issues in most metropolitan cities like Pune. As we know Pune city is a well-developed and popularly known for Oxford for east for its education many students come from different cities secondly many young people come for jobs because of booming IT companies. Due to this city has become densely populated. Today the Pune's population is around 35 lakhs. Registered vehicles are 36.2 lakh which is exceeding the human population. During the peak hours i.e. 09:00 to 11:00 in the morning and 6:00 to 8:00 in the evening traffic situation gets worst and chaotic

Key Words: - Traffic Jams, Conjunction, Double Tier Elevated Highway Corridor (DTEHC)

I. INTRODUCTION

For the Increasing Traffic widening of road is not only the solution as there is land to be accured in the cities. Land acquisition is a tedious and time consuming process which is not feasible in the cities as well as in the outskirt, so we have to find the sustainable solution for the increasing traffic i.e Construction of Double Tier Elevated Highway Corridor including provision for metro (section from Pune to Shirur of NH-753F (from Km. 0.000 to Km. 56.000)) in the State of Maharashtra.
The Starting Ch. 0+000 takes off near Kharadi Bypass Junction on Pune-Ahmednagar Road and Project end location to be considered at Shirur bypass end on Pune-Aurangabad Highway i.e. near at Bridge over Ghod River. Hence, the total length of the project corridor shall be 59.60Km

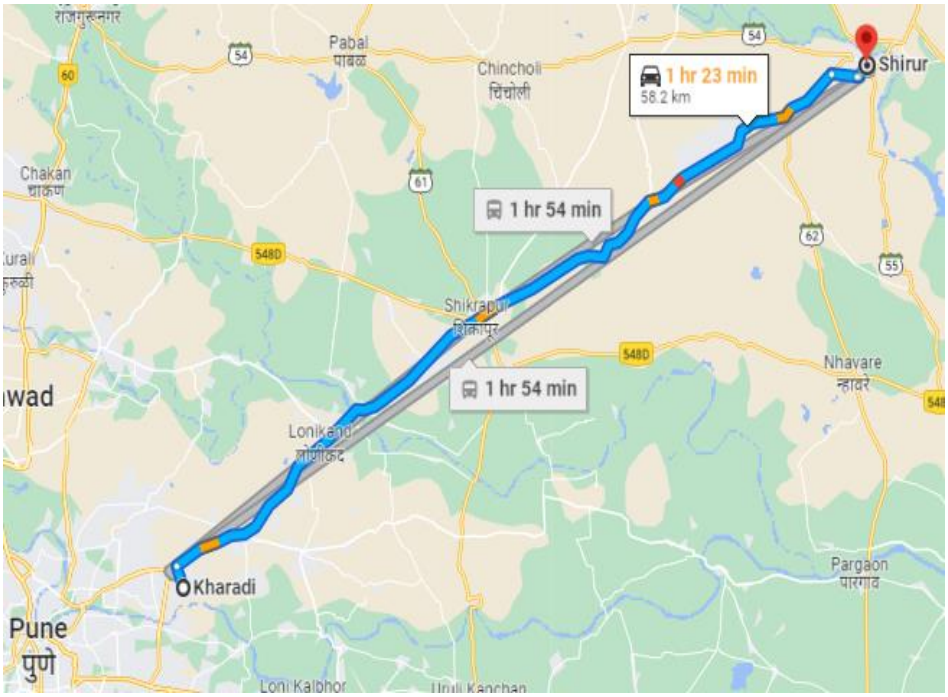

Image: - Map of Project Section

II. SCOPE OF PAPER

The scope of the Paper is to Conduct Traffic Survey (like Transport Data Base, Vehicle Registration Data, Demographic Data etc.) across the Project corridor as we know the importance of the entire corridor is. It connects to the Major cities like; Pune, Shirur, Ahmed Nagar, Mumbai Nashik etc. and also, along this project highway there is the presence of Maharashtra Industrial Development Corporation (MIDC) areas by which the traffic of Mumbai, Chakan, Nashik and Ahmed Nagar are using this corridor for the movement to MIDC areas.

III. METHODOLOGICAL FRAMEWORK

The paper presents a description of our Technical Approach and Methodology for performing the assignment keeping in view the Terms of Reference, available related data of the project parameters from the site visit
The provisions of "Manual of Specifications and Standards for Six laning of Highways" (IRC: SP: 87-2019), "Manual on Road Safety Audit" (IRC: SP: 88) and various relevant standards published by Indian Road Congress, shall be followed wherever required in the project preparation activities

3.1. Vehicle Registration Data

The Transport Commissioner office of the Government of Maharashtra publishes annual report on vehicle registration. This publication, together with the Ministry of Road Transport & Highways (MoRT&H), Government of India publication on Transport Statistics, will provide necessary information on the growth rates of individual vehicles for this area, which will be used for the estimation of the growth rates for traffic flow.

3.2. Demographic Data

Population growth trends in each of the districts / traffic zones in the influence area, and other associated areas, will be obtained from the census hand books to compute population growth rates.

IV. LOCATION OF TRAFFIC SURVEY STATION

As per the TOR the minimum number of traffic survey stations shall be as follows

Sr No	Description	Number of survey stations
1	Classified Traffic Volume Count	3
2	Origin Destination and Commodity Movement Characteristics	2
3	Axle Loading Characteristics	2
4	Intersection Volume Count	All Major Intersection
5	Speed Delay Characteristics	Project Road Section
6	Pedestrian/Animal cross traffic count	All Major Inhabitation along the highway
7	Turning movement surveys	For all Major Intersection

V. LOCATION OF TRAFFIC SURVEYS FOR PUNE -SHIRUR SECTION

S. No.	Type of Survey	Name of Locations	
		Chainage	Place
1	Turning Movement Count (TMC) & Intersection Volume Count Survey	Km. 0+550	Kharadi Bypass
2		Km. 6+000	Wagholi Bazar
3		Km. 6+200	Kesnand Phata, Wagholi
4		Km. 13+500	Lonikhand
5		Km. 22+400	Sanaswadi
6		Km. 26+500	Shikrapur Phata / Chakan Road
7	Classified Traffic Volume Count (CTVC) Survey	Km. 0+000 to 6+200	Between Kharadi to Wagholi
8		Km. 6+200 to 26+500	Between Wagholi to Shikrapur
9		Km. 26+500 to 40+600	Between Wagholi to Ranjangaon
10		Km. 40+600 to 53+000	Between Ranjangaon to Shirur Bypass
11	Origin-Destination (O-D) & Axle load Survey	Km. 6+000 to 27+000	Between Wagholi to Shikrapur
12		Km. 26+000 to 41+000	Between Shikrapur to Ranjangaon
13	Speed-Delay Characteristics	From Km. 0+000 to Km. 59+600	Between Shikrapur to Ranjangaon
14	Pedestrian/ Animal Cross Traffic Count	-	At Major Junction Locations

VI. START & END POINT PHOTOGRAPHS

Image: - At Km. 0+000 (Near Kharadi Bypass Junction)

Image: - At Km. 59+600 (Near Shirur Bypass End)

VII. EXISTING CARRIAGEWAY AND PAVEMENT:-

The entire project corridor is having both 6-lane divided carriageways with a carriageway width of 11 mt either side & 4-lane divided carriageway with a carriageway width of 7.5m wide carriageway either side. The surface of the carriageway is having Bituminous. However, at some location the existing carriageway surface is Cement Concrete (CC).

1) Image: - Existing Carriageway of Pune to Shirur

2) Image: - Existing Carriageway of Pune to Shirur

3) Image: - Existing Carriageway of Pune to Shirur

VIII. AT GRADE INTERSECTIONS

Since the project corridor connects various built-up sections by major district roads and village roads. All along the corridor there are 07 numbers of Major Junctions and 89 nos. of Minor Junctions (among 89 Nos., for this paper we have taken 8 Minor junctions) connecting various towns, villages and MIDC areas and roads leading to cluster of villages and hamlets. List of Major & Minor Junctions tabulated below

Table for List of Major Junctions:-

Sr. No.	Existing Chainage (Km.)	Type of Junction	LHS	RHS	Remarks
1	0+550	T	--		SH- 27
2	5+330	T	WRd	--	
3	6+000	X	Wag	Aw	
4	6+200	T	--	Kes	
5	6+200	T	--	Kes	
6	22+400	X	Krnd	TD	
7	26+500	X	C-T	Nhav	

Abbreviations for above table are as:-	
M-S	Magarpatta- Solapur
Aw	Awhalwadi
Kes	Keshnand
TD	Talegaon Dhamdhere
Nhav	Nhavare (NH-548D)

WRd	Wagholi Rd.
Wag	Wagholi
Krnd	Karandi
C-T	Chakan- Talegaon (NH-548D)

Table for List of Minor Junctions:-

Sl. No.	Existing Chainage (Km.)	Type of Junction	LHS	RHS
1	0+040	T		NR
2	0+110	T	CN	
3	0+710	T	CR	
`4	1+160	T		FR
5	1.170	T		Kr
6	1+310	T	PB	
7	2+080	T		Gr
8	2+640	T	KN	

Abbreviations for above table are as:-	
CN	Chandan Nagar
CR	Colony Road
PB	Patil Basti Rd.
KN	Khandve Nagar Rd.
NR	Niwas Road
FR	Fountain Rd.
Kr	Kharadi
Gr	Grant Rd.

8.1. Photographs of Junctions:-

Image: - Junction towards MIDC area @ Karegaon (LHS Side)

Image: - Junction towards Jagtap Basti

Image: - Junction towards Wagholi village @ Wagholi (LHS Side)

Image: - Junction towards Alandi

Image: - Junction towards MIDC Area @ Sanaswadi

Image: -Junction towards MIDC area @ Karegaon (LHS Side)

Image: - Junction towards Shirur Village (LHS)

It is observed that, the existing highway connected with huge nos. of junctions (Major and minor junctions as well) at these junctions Traffic jam occurs when there are more vehicles than the road can handle. As such the vehicles are not able to move fast. Traffic congestion occurs when a volume of traffic or modal split generates demand for space greater than the available street capacity; this point is commonly termed saturation. There are a number of specific circumstances which cause or aggravate congestion; most of them reduce the capacity of a road at a given point or over a certain length, or increase the number of vehicles required for a given volume of people or goods.

IX. CONCLUSION

In this paper in-depth study of Traffic Survey Station, Location of Traffic Surveys, the study of Existing Carriageway and Pavement and major & minor junctions across the said section of highway (i.e. Pune to Shirur Section) are studied.

It is found that the existing highway connected with huge nos. of junctions (Major and minor junctions as well) with a heavy traffic, which lead to the problems of Traffic congestion issues. On the basis of Traffic Survey of Existing highway, a sustainable Solution for increasing traffic can be introduction of double tier elevated highway corridor with a provision of future expansion.

X. REFERENCES

[1]. Dr. Dhananjay Mandlik (2020). “Pune Traffic Congestion: Reality,Cause And Regulation A Case Study, Vol.11 (3), pp. 228-234.

[2]. Dr.Pallavi Kharat, Shrutika Gurav, Priya Godase, Abhilasha Thakur, Rutuja Kolekar (2019). “Evaluation of Accidents on Curves in Ghat Section”International Journal for Research in Applied Science & Engineering Technology Vol 07 (6) pp. 14-18.

[3]. Sun Ye “Research on Urban Road Traffic Congestion Charging Based on Sustainable Development” International Conference on Applied Physics and Industrial Engineering. proceeding 24, PP. 1567 – 1572

[4]. S R Samal1, P Gireesh Kumar2, J Cyril Santhosh3, and M Santhakumar4 (2020), “Analysis of Traffic Congestion Impacts of Urban Road Network under Indian Condition” IOP Conference Series: Materials Science and Engineering, pp 1-10.

[5]. Chetan Shivatare1, Swapnali Dalvi2, Prashant Patil3, Rupesh Shete4 (2017) “Pune Traffic Problems & Control Measures” Journal Of Information, Knowledge And Research In Civil Engineering, Vo. 4, Issue 2, pp 450-453.

[6]. Gayatri S Choudekar 1, Rohit R Salgude 2, “Study of Road Traffic & Management: A Case Study at Katraj and Nalstop Intersections In Pune City” International Journal of Innovative Research in Science, Engineering and Technology, Vol 6, Issue 5, pp 8801-8805

[7]. Abhishek Rajkumar Patni1, Pranita Pranjale2, “Study of Analysis of Development of Major Road Network at Aurangabad City” International Journal for Research in Applied Science & Engineering Technology. Vol 10, Issue 7. pp 4754-4760

[8]. The Times of India (13th April 2018) “Pune Municipal study finds Pune-Ahmednagar Road most dangerous in city”

[9]. https://indianexpress.com/article/cities/pune/traffic-diversions-pune-ahmednagar-highway

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Nonlinear Finite Element Analysis of Rubber Bearings for Base Isolation and Replacement of Steel Layers with FRP Within the Bearings

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ABSTRACT

Base isolation is a mechanism that provides earthquake resistance to the new structure. The base isolation system decouples the building from the horizontal ground motion induced by earthquake, and offers very stiff vertical components to the base level of the superstructure in connection to substructure (foundation). In this study a parametric study is conducted to study the effect of base isolation by replacing steel by CFRP plates in the High damping rubber bearings.

Keywords: Base isolation, High damping rubber bearing, CFRP plates

I. INTRODUCTION

The use of seismic isolation for structures has been gaining worldwide acceptance as an approach to aseismic design. Many experimental and numerical studies are required on isolation pads to substantiate the adequacy of design and service conditions so that they can be used for isolation of structures.
This study tries to clarify the advantage of the base isolation technique with respect to buildings using laminated rubber bearings since only few researches were done into this area [1]. In this paper the numerical modelling of high damping rubber bearings (HDRB) is implemented using ANSYS 12.0. A three-dimensional finite element model of the isolator is created and a non-linear static analysis is done. Based on the behaviour of the isolator, a parametric study is conducted by varying the material property that is, by replacing the steel plates with CFRP plates and the effect is studied.

II. METHODS AND MATERIAL

The entire model was developed in ANSYS 12.0 finite element software. Half of the isolator is modelled in its real dimension. The dimensions of the model are given in the Table 1.

TABLE 1. DIMENSIONS OF THE MODEL

Diameter	1000 mm
No. of rubber layers	10
Thickness of rubber layer	10mm
Thickness of steel plate	4mm
Total height of isolator	136mm

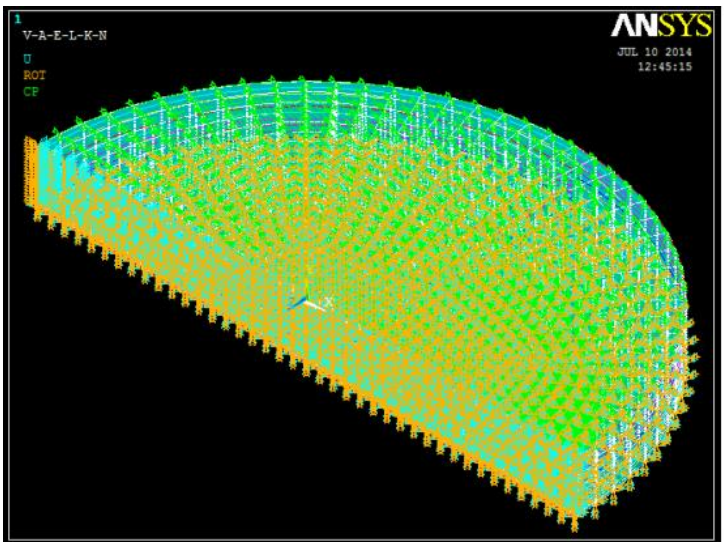

Figure 1. Model of the isolator with boundary conditions

A) Material Property

Rubber is a hyperelastic material and the material property is defined by strain energy functions. The Polynomial 2-P function is used here and the material parameters were obtained as follows [2]: C10 = 0.797

C01 = -0.05910

C20 = 0.01609

C02 = 1.103 x 10^-3

Steel is modelled as a linearly elastic material with E=2x10^5 MPa and v = 0.3.

B) Replacing Steel with FRP

The development of light-weight low-cost isolator is crucial if this method of seismic protection is to be applied for a wide range of buildings. To make the base isolation a viable method in such buildings, it is necessary to reduce the cost of the isolators. Conventionally, steel plates are used as reinforcing material. Bearings using steel as reinforcing material are known as steel-reinforced elastomeric bearings (SREI). Steel is heavy and makes up for most of the weight of the isolator. Further, thick end-plates are needed on both ends of the isolators which adds to the total cost. The process of bonding steel with the rubber involves placing steel plates between rubber layers and heating them under pressure for several hours. The entire process is complicated and expensive. Many fibre materials whose stiffness is comparable to steel are now available. Seismic isolators can be designed using layers of rubber, bonded with thin layers of bidirectional fibre fabric [4]. Replacing steel with

fibre, isolators of much lesser weight can be manufactured. Bearings with fibre reinforcement and elastomeric damping material are called fibre-reinforced elastomeric isolator (FREI) bearings. CFRP fibres have orthotropic material property and are modelled as linearly elastic with the following material constants [5]:
Ex = 44000 MPa; Ey = 44000 MPa; Ez = 10000 MPa vxy = 0.3; vyz = 0.25 ; vzx = 0.25
Gxy = 10000 MPa; Gyz = 5000 MPa; Gzx = 5000 MPa

C) Analysis

Rubber undergoes large deformations and hence the behaviour is nonlinear. Therefore, a non-linear static analysis is conducted to understand its behaviour under compressive load as well as combined compression and shear. Horizontal displacement values are applied incrementally. Initially, displacement corresponding to 100% shear strain is applied along with the design vertical load. Displacement values are increased until maximum shear strain is reached. It has been found that the material remains stable up to 350% shear strain. The different analysis cases are shown in Table 2.

TABLE 2. ANALYSIS CASES

Analysis Case	Applied Horizontal Displacement (mm)	Applied Vertical Load (kN)
1	-	8000
2	100	8000
3	200	8000
4	300	8000
5	390	8000

Ply orientations were changed while modelling with FRP. Two types of ply orientations were studied:

1. Alternate layers oriented at 0/90◦
2. Layers oriented at 0/45/90◦ symmetrically from the middle layer.

III. RESULTS AND DISCUSSION

The isolator was subject to 100% vertical load and a horizontal displacement corresponding to 400% shear strain. But it was found that the material remained stable until 392mm horizontal displacement after which the elements were found to be highly distorted. Hence this is the maximum horizontal displacement that the isolator with the given dimensions can take. The tensile stresses reach a value close to 5 MPa. The permissible tensile stress in rubber is 4.2MPa [3]. Hence the value exceeds the permissible limit, which will lead to cavitation in the rubber layers and the bearing will lose its stability. The shear stress distribution is uniform with the maximum values at the interface of the steel and rubber layers. The variation of stresses along the isolator is shown in Fig.2 and Fig.3. The horizontal shear force Vs displacement plot shows the typical hyperelastic nature of the material (Fig.4).

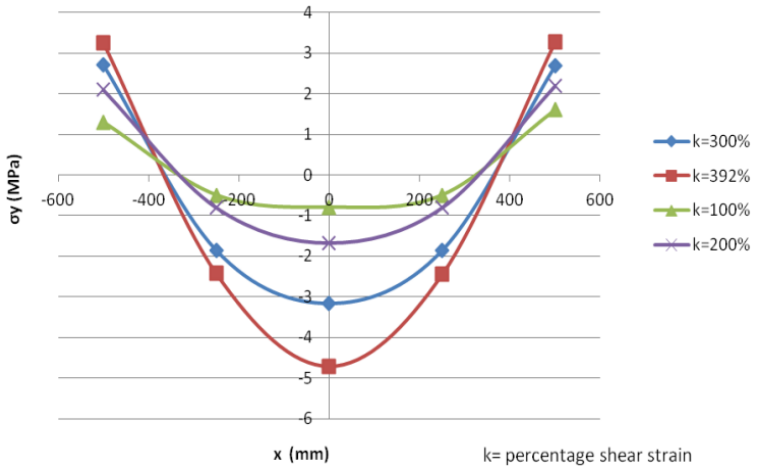

Figure 2: Variation of σy along the isolator

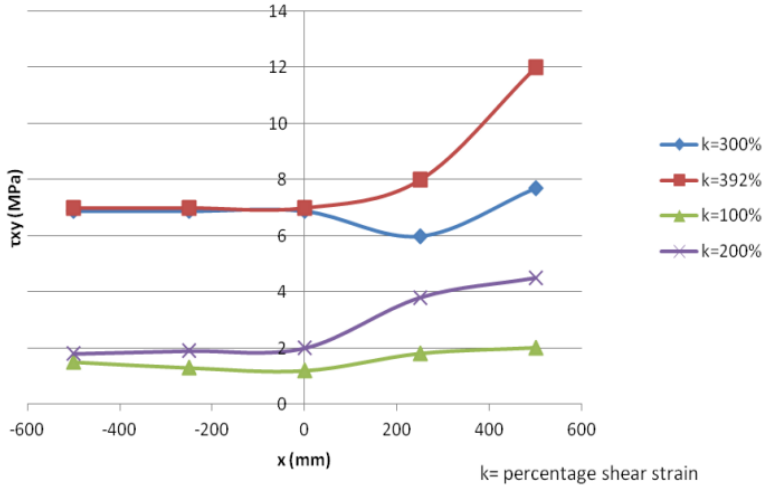

Figure 3: Variation of τxy along the isolator

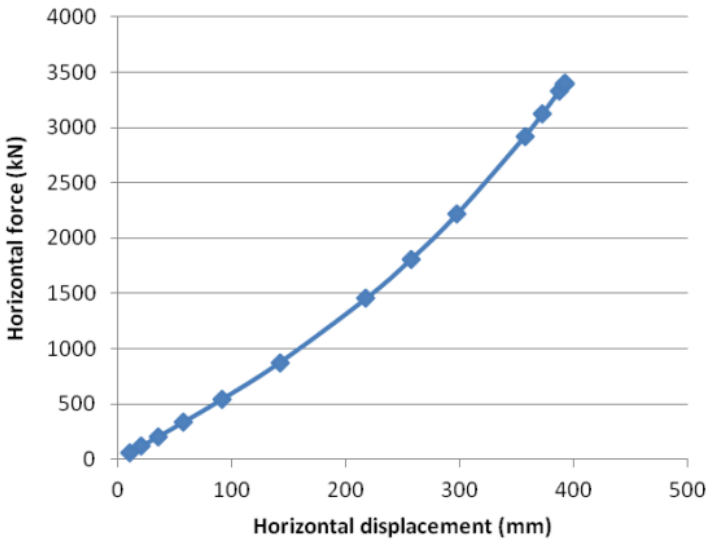

Figure 4: Horizontal force Vs Displacement

Nonlinear static analysis was done for FREI bearings as in SREI bearings and Table 3 shows the comparison of results for both the ply orientations at a horizontal displacement corresponding to 100% shear strain. From these results we can conclude that the 0/90◦ orientation is the most efficient since the stresses are less.

TABLE 3. COMPARISON OF PLY ORIENTATIONS

Orientation	σy (MPa)	τxz (MPa)	τxy (MPa)
0/45/90	1.63	13.4	1.8
0/90	0.544	7.03	0.59

The model with 0/90◦ was further studied and analysis was done with increments in horizontal displacement. The fibre-reinforced isolator was found to perform well and remained stable over 350% shear strain in the same way as the steel-reinforced elastomeric bearings. The Fig.8 shows the comparison of axial stress and shear stress values for both the isolators at 390% shear strain. From the results it can be stated that the performance of FREI is comparable to SREI and in fact more efficient than the other since the vertical and shear stress values are lesser for FREI when compared to SREI. Hence CFRP can be used as an effective replacement to steel in elastomeric bearings.

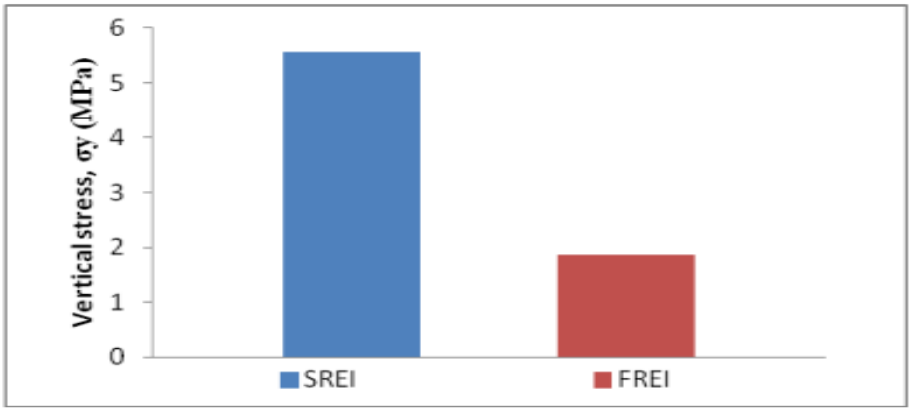

Figure 5: Vertical stress comparison for SREI and FREI

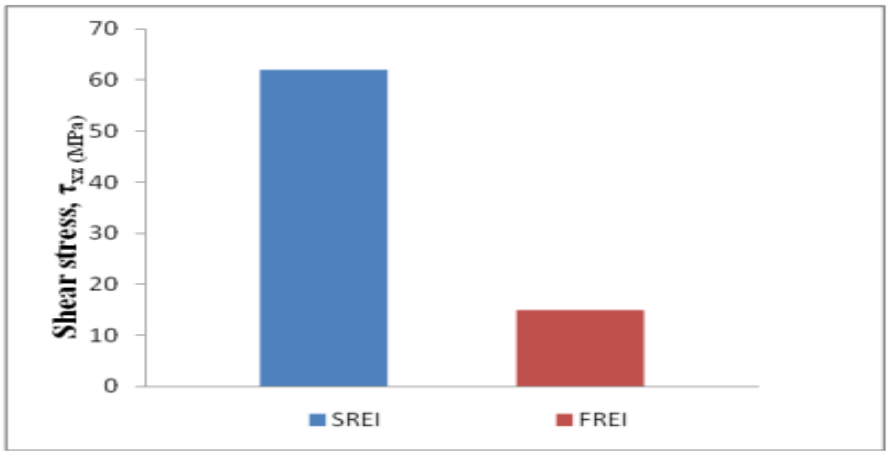

Figure 5: Shear stress (xz) comparison for SREI and FREI

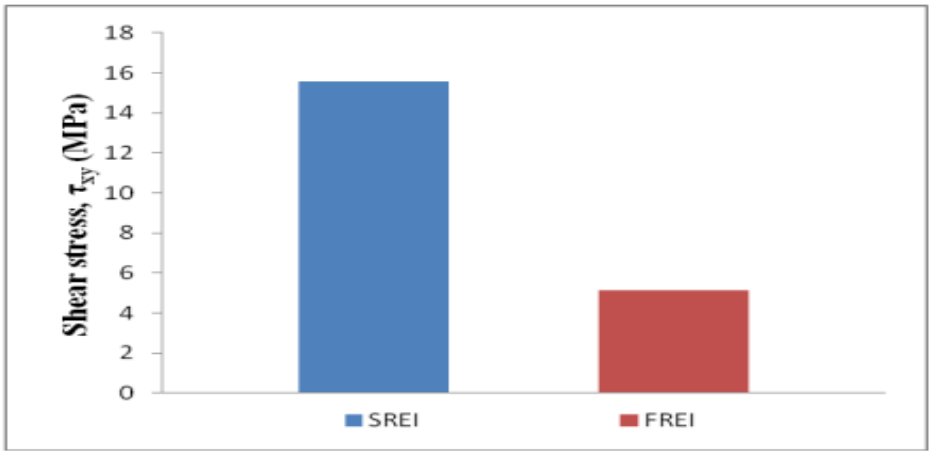

Figure 5: Shear stress(xy) comparison for SREI and FREI

IV. CONCLUSION

The high damping rubber bearing was modelled and nonlinear finite element analysis was done using ANSYS 12.0. The same model was analysed by replacing steel plates with FRP and by changing the ply orientations in FRP. The main conclusions from this study are as follows:

- The maximum displacement that the isolator can undergo without losing its stability corresponds to 350% of shear strain or 350% of the thickness of rubber layer.
- However, the isolator can take up to 400% shear strain but the tensile stress exceeds the permissible limit which can damage the bearing.
- By replacing steel with CFRP in the multi-layer isolator it was found to behave in a similar manner and more efficient than steel plates.
- Fibre-reinforced plates can be used as an alternative to steel there by reducing the weight of the bearing and the use of isolators can be made more widespread.

V. REFERENCES

[1]. S.B. Bhoje, P. Chellapandi, S. Chetal, R. Muralikrishna and T. Salvaraj, "Comparison of computer simulated and observed force deformation characteristics of anti-seismic devices and isolated structure", Indira Gandhi Centre for Atomic Research, India, 1998.

[2]. Federico Perotti, Giorgio Bianchi, Davide C.M, "Limit State Domain Of High Damping Rubber Bearings In Seismic Isolated Nuclear Power Plants", Politecnico Di Milano, 2011.

[3]. C. Constantinou, A. S. Whittaker, Y. Kalpakidis, D. M. Fenz and G. P. Warn, "Performance of Seismic Isolation Hardware under Service and Seismic Loading", Technical Report MCEER-07, State University of New York, Buffalo, 2007.

[4]. Kelly, J.M and Takhirov, S.M, "Analytical and Experimental Study of Fibre-Reinforced Elastomeric Isolator", PEERR Report, 2001.

[5]. Animesh Das, Anjan Dutta and S.K Deb, "Modeling of Fiber-Reinforced Elastomeric Base Isolators", The 15th World Conference on Earthquake Engineering, Lisboa, 2012.

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Driver Drowsiness Detection System for Safe Driving

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ABSTRACT

Drowsy drivers are a major factor in traffic accidents. Here, we proposed a way to know the driver's closed eyes, yawning, and drowsiness ratings. Our evaluation consists of four steps. - Specifically face detection, eye detection, mouth detection, closed eyes, and yawning detection. Extract attention and mouth regions from the face and look for signs of exercise fatigue. We are exploring the possibility of using acoustic sensors embedded in smartphones to warn of drowsy driving. If the driving force proves to be last-eyed, yawning, or fatigued, an alarm may be sent to the vehicle owner and a buzzer may be activated to warn the driving force. First, we consider the characteristics of sleepy driving and identify the distinctive Doppler shift styles resulting from three common sleepy behaviours. i.e., Nodding, yawning, steering. We then validate key findings through empirical analysis of driving data collected in real driving environments.

Index Terms key phrases: OpenCV, Python, Dlib, picture Processing

I. INTRODUCTION

Drowsiness, defined as sleepiness when rest is needed, can lead to symptoms that significantly impair task performance. These include delayed reaction times, intermittent unconsciousness, and microsleep. This is very dangerous while driving. Drivers are much more likely to miss traffic signs or exits, change lanes, or cause an accident with their vehicle. Therefore, it is necessary to monitor driver fatigue and warn the driver if necessary. Most existing solutions address the problem of estimating driver drowsiness from a single cue.

II. PROBLEM STATEMENT

Drivers - If you don't get proper sleep or rest, you are more likely to fall asleep, which can lead to traffic accidents. Therefore, a system that detects driver fatigue is needed. Recently, machine learning techniques have been used in research and development to predict driver states. These states can be used as information to improve traffic safety. Driver status can be estimated based on basic characteristics of age, gender, and driving experience. The driver's driving behavior, facial expressions, and biosignals also help in the assessment. Machine learning has advanced video processing, allowing us to accurately analyze images. In this article, we

proposed a method to detect drowsiness by using a convolutional neural network model for the eye positions and using OpenCV and Dlib to extract detailed mouth features and count yawns.

III. METHODOLOGY

- **SYSTEM ARCHITECTURE**

This is the system architecture which explain about how we can detect the drowsiness of the driver. In our system process start with capturing images through the webcam and after capturing it detect the face through haar cascade algorithm. This algorithm uses haar feature which can detect the face . If the system detect the face it will proceed with next phase that is eye detection. By using the same haar cascade feature eye are detected and it used for blink frequency and by making use of perclos algorithm the state of eye are detected .By using this algorithm the percentage of time the eye lids closed is detected .Once it is find that the eye is in closed state then it conclude that the driver in drowsy state and the alert them by an alarm. there are certain cases in which distraction can be there then distraction can be measured by continues gazing .The drivers face is analyzed continuously to detect the distraction if the distraction is detected then alarm is activated by the system.

The system architecture is divided into 6modules.

1. Face Detection
2. Eye Detection
3. Face Tracking
4. Eye Tracking
5. Drowsiness Detection
6. Distraction Detection

Face detection: This module with take input as image capture from camera and tries to find a face in the video input. The detection of the face can be enable by using the haar classifier mainly we make a use of Frontal face cascade classifier. This haar classifier is trained by using haar training data set.The face is detected in a rectangle format and then it converted the image into grayscale image and this images stored in the memory which can be used to training the model.

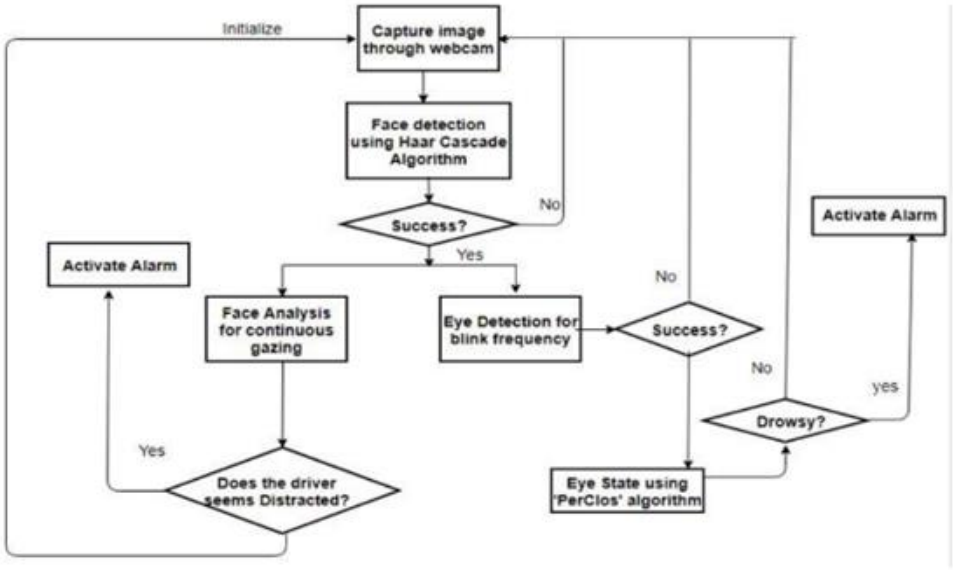
Eye Detection: Since Our project is to detect the drowsiness of person so we have to focus on the eye to detect the drowsiness . The detection of the face can be enable by using the haar classifier mainly we make a use of Frontal face cascade classifier. This haar classifier is trained by using haar training data set. The eye is detected in a rectangle format and then it converted the image into grayscale image and this images stored in the memory which can be used to training the model.

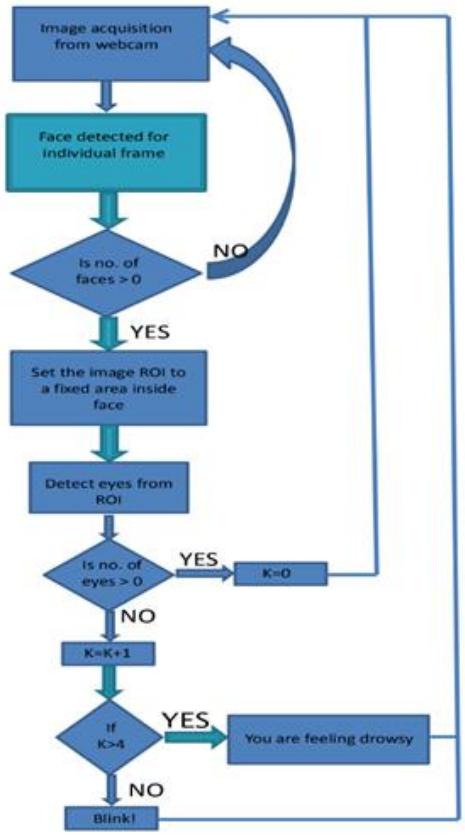
Face Tracking: As it as real time project, we need to track the faces continuously for any form of distraction. Hence the faces are continuously detected during the entire time.

Eye Tracking: The input to this Eye tracking module is taken from the previous module. The eyes state is determined through Perclos algorithm. The State of eye is determining by suing perclos algorithm, then by using this frequency of time of closed eye is calculated.

Drowsiness detection: Frequency of time of closed eye is calculated from previous module and if it remains 0 for a longer time then the driver is alerted for the drowsiness through an alert from the system .

Distraction detection: In the previous module that is faced tracking module the face of the driver is continuously monitored for capturing the frequent movement or the long gaze of the eye without blink which can be measured as lack of concentration of the driver and then driver is alerted by the system for distraction.





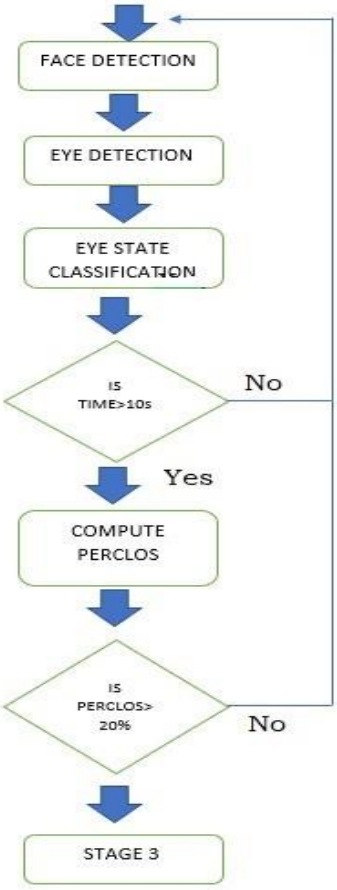
Haar Algorithm

PERCLOS is a drowsiness metric, based on eye closure rates. PERCLOS may be defined as the proportion of time in which the eyelids are at least 80% closed over the pupil. the PERCLOS value is calculated as

$$P = \frac{E_c}{E_o + E_c} \times 100\%$$

Here, Ec and Eo give the counts of closed and open eyes respectively for a predefined interval. A higher value of P indicates a higher drowsiness level and vice versa. The steps involved in the computation of PERCLOS from an image sequence involve face detection followed by eye detection and eye state classification as given below

Image from Camera



A. Preprocessing: -

Real-world driving presents challenges where neither the lighting nor the position of the driver's head is limited. We use geometric and photometric correction preprocessing to tackle this problem.

B. Face and Eye Detection: -

It is clear that accurate estimation of PERCLOS requires fast and accurate eye detection. We use a facial recognition classifier based on features like hair, trained with optimal parameters based on what we learned in previous research. From the detected face region F(x,y), find the eyes in the top half of the face region. The hair

classifier is trained on eye images. They trained his two classifiers. One for his visible images while driving during the day and another for his NIR images while driving at night.

C. Eye State Classification: -

To accurately estimate PERCLOS, the localized eye region E(x,y) must be accurately classified into open or closed states.

Following are the steps for eye state classification -

1. Gradient Image Computation:- We first obtain sub-images Ei,j of size 8 × 8 from the eye image E with a 50% overlap in both the directions.

The gradient images are obtained as

$$G_{x(i,j)} = E_{i,j} * S_x$$
$$G_{y(i,j)} = E_{i,j} * S_y$$

2. Orientation computation:- The edge map is gradient operated to find the oriented gradients. The size M and orientation D of the source image is obtained as follows:

$$M_{i,j} = \sqrt{G^2_{x(i,j)} + G^2_{y(i,j)}}$$
$$D_{i,j} = \arctan \frac{G_{y(i,j)}}{G_{x(i,j)}}$$

In this step, we first create a cell histogram. A weighted score is obtained based on the value found in the gradient computation for each pixel. Since we are using unsigned representation, the histogram channels are evenly distributed over 0 to 180 degrees.

3. Feature Computation:- Finally, form nine bins along both the horizontal and vertical axes. So, with 9 bins in rows and columns, we get a feature vector of length 81. The selected features perform better than other competing features such as edge orientation histograms, scale-invariant feature transformation descriptors. This is because it uses overlapping local contrast normalization to improve accuracy.
4. Classification: Train a linear SVM using 1200 images (700 eyes open and 500 eyes closed) from the database created in normal and NIR illumination.
5. PERCLOS calculation: Once the eyes are classified as open or closed, the algorithm uses (1) to calculate the PERCLOS value in a sliding time window of 10 seconds. Use a threshold of 20% of the PERCLOS value to proceed to the next stage.

IV. GET PEER REVIEWED

Here comes the most crucial step for your research publication. Ensure the drafted journal is critically reviewed by your peers or any subject matter experts. Always try to get maximum review comments even if you are well confident about your paper.

V. FUTURE WORK

Future work may focus on using external factors such as vehicle state, sleep duration, weather conditions, and mechanical data for fatigue measurements. Driver drowsiness is a major road safety issue: round-the-clock driving, high mileage per year, exposure to harsh environmental conditions, and demanding work schedules all contribute to serious safety problems. Monitoring a driver's drowsiness and alertness level and providing feedback on the driver's condition so that he or she can take appropriate action is an important part of the set of precautionary measures needed to address this problem. It's a step. There is currently no on-the-fly adjustment of camera zoom or orientation. In future work, it may be automatically zoomed in once the eyes are found. This avoids the compromise between a wide field of view for locating the eye and a narrow field of view for detecting fatigue. In the event of an accident, the driver's current location is sent to the owner and the local police station

VI. CONCLUSION

A Drowsiness Detection System Can Detect Drowsiness Quickly. A System That Can Distinguish Between Normal Blinking And Drowsiness Can Prevent Drivers From Feeling Drowsy While Driving. The System Works Well Whether The Driver Is Wearing Glasses Or Not, And In Low Light. During Monitoring, The System Can Determine Whether The Eyes Are Closed Or Open. If You Keep Your Eyes Closed For A Long Time, You Will Get A Warning Signal. The Ultimate Goal Of This System Is To Check The Drowsiness Level Of The Driver. It Detects Drowsiness From The Movement Of The Driver's Gaze, Issues An Alarm When The Driver Blinks, Alerts The Driver, Displays The Parking Lights, And Slows Down The Vehicle. This Reduces Many Accidents And Makes Drivers And Vehicles Safer. Systems That Are Driver Safety And Car Safety Are Presented Only In Luxury Expensive Cars. Driver Safety Can Also Be Implemented In Regular Cars Using Eye Recognition.

VII. REFERENCES

[1]. International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Published by, www.ijert.org ICONECT-2015 Conference Proceedings

[2]. Real-Time Drowsiness Detection System for Driver Monitoring To cite this article: M Arunasalam et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 767 012066

[3]. Design and implementation of a driver drowsiness detection system: a practical approach Aleksandar Colic1 , Oge Marques2 and Borko Furht3

[4]. Driver Drowsiness Detection System with OpenCV & Keras - DataFlair (data-flair.training)

[5]. Drowsiness Detection System in Real-Time using OpenCV and Flask in Python. | by Souvik Ghosh | Towards Data Science

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Study of Surface Roughness of AZ91 Magnesium Alloy After ENi-B-TiO2 Electroless Nano Composite Coating

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ABSTRACT

A coating is a covering that is applied to the surface of an object, usually referred to as the substrate or specimen. The purpose of applying the coating may be either decorative, functional, or a combination of both. The magnesium (Mg) and its alloys possess low density, high specific stiffness and electromagnetic shielding property, which are attractive to use this material for the various industrial components. Surface roughness and hardness is a serious drawback of Mg alloys, restricting their practical applications. Electro-less Nano Coating is one of the effective techniques for improvement in these material properties. In this paper, experimental investigation on surface roughness of AZ91 Magnesium Alloy due to Nano composite coating processes of ENi-B-TiO2 are investigated. The detailed investigation along with experimental analysis, of the possibility of improving the deposit efficiency and properties of the composite deposits, by developing a suitable bath composition and operating conditions, would be worthwhile attempt. It has been observed that as concentration of second-phase (titanium) particles increases, the surface roughness of coatings also increases. The optimum value of concentration of second-phase (titanium) particles and bath agitation is also investigated for obtaining better surface roughness after Nano coating.

Keywords: Coatings, Nano Composite, Surface roughness, AZ91 Mg Alloy, Electroless.

I. INTRODUCTION

Electroless coating deposition technique is used for coating alloy or a solid work-piece, such as metal or plastic, also referred to as autocatalytic chemical deposition techniques. Because of the number of advantages, electroless coatings are mostly used in every type of industries [1]. The Figure 1 shows the usage of electroless nickel coatings. While having number of advantages, few important limitations of electroless coatings are smaller life span of chemicals and greater cost of waste treatment due to fast chemical regeneration [2-3]. Electroless nickel coatings have been used either as decorative or protective coatings in industries such as electronics, computer, aerospace, printing, automotive, textile, plastics, optics, paper and food [4-5]. Some of the exceptional characteristics of electroless nickel coatings are wear and superior corrosion resistance,

excellent uniformity, large domain of thickness, good solderability, improved physical and mechanical properties [6].

Most of magnesium alloys contain 8–9% aluminium with small amounts of zinc [7]. The addition of several alloying elements such as aluminium, zinc and rare earths have been reported [8-9] to improve the corrosion resistance, technologically that does not satisfy the requirement for several applications. Hence, the application of a surface engineering technique is the most appropriate method to further enhance the surface properties and corrosion resistance.

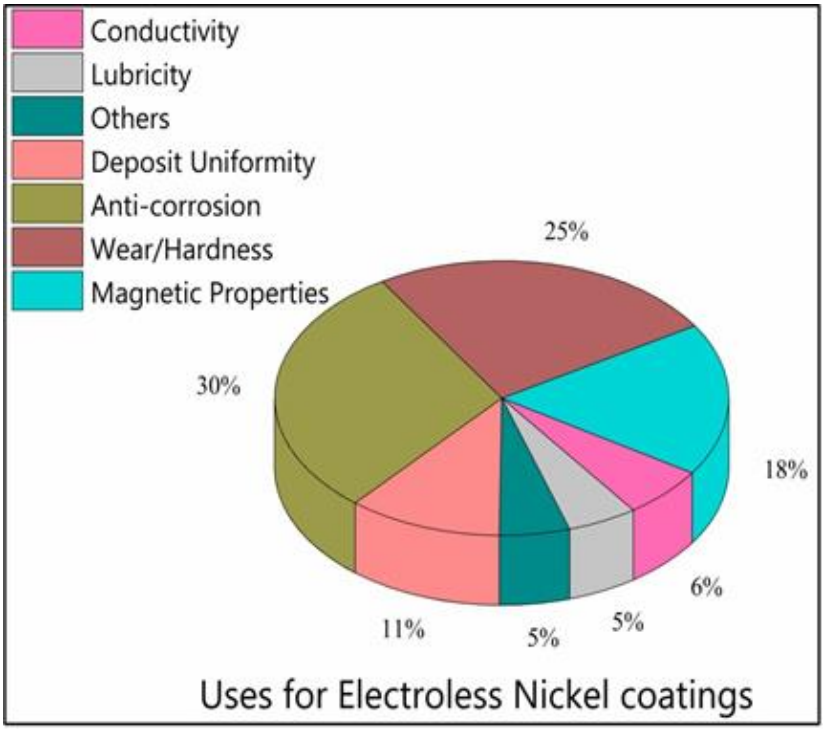

Fig. 1. Use of electroless nickel coatings [2]

Among the various surface engineering techniques that are available for this purpose, coating by electroless nickel is of special interest especially in the electronic industry, due to its conductivity and several other engineering properties Electroless nickel is well known for its corrosion resistance and hardness [10-12].

II. METHODS AND MATERIAL

1. Bath Composition and operating conditions of ENi-B-TiO_2 Composite Coatings

Selection of an appropriate bath along with suitable operating conditions is a key to ensuring desired deposition onto the base substrate. Hence, in order to achieve the most optimum bath composition along with most suitable operating conditions, a number of experiments were undertaken. The Numerous experiments were carried out prior to selection of the most optimum bath constituents along with their quantities for ensuring successful deposition onto the substrate. The final chemical composition and operating conditions for successful deposition of ENi-B-TiO_2 Nano-composite deposition on AZ91 magnesium alloy use is summarized in table I.

Table 1 CHEMICAL COMPOSITION OF ENI-B-TIO2 NANO-COMPOSITE DEPOSITION ON AZ91 MAGNESIUM ALLOY

Bath constituents and operating conditions	Bath Composition
Nickel Sulphate Hexahydrate (g/l)	30
Sodium Borohydride (g/l)	2
Ethylenediamine (98%) (ml/l)	50.0
Ammonium Bifluoride (g/l)	8.0
Hydrofluoric acid, HF (40% V/V) (ml/l)	12
Stabilizer (ppm)	1.0
Nano-Titanium Oxide (g/l)	5 - 15
Bath Stirrer (rpm)	0 - 200
pH (NaOH)	6.4±0.2
Temperature	80 -85ºC
Immersion Time (h)	1.5

2. Experimental Setup

The Experimental setup encompassed a carefully prepared electroless bath (chemical bath) with suitable chemicals in adequate quantities, in addition to a hotplate to provide appropriate amount of energy in the form of heat to the bath constituents, to obtain the desired composite deposit. A square plate of AZ91 magnesium alloy having dimensions 20 mm X 20 mm X 1 mm was taken as the base substrate for composite deposition. The square plate was provided with a pin hole drilled close to one of the corners / edge to enable undisturbed suspension in the chemical bath. The schematic of experimental setup is shown in Figure 2.

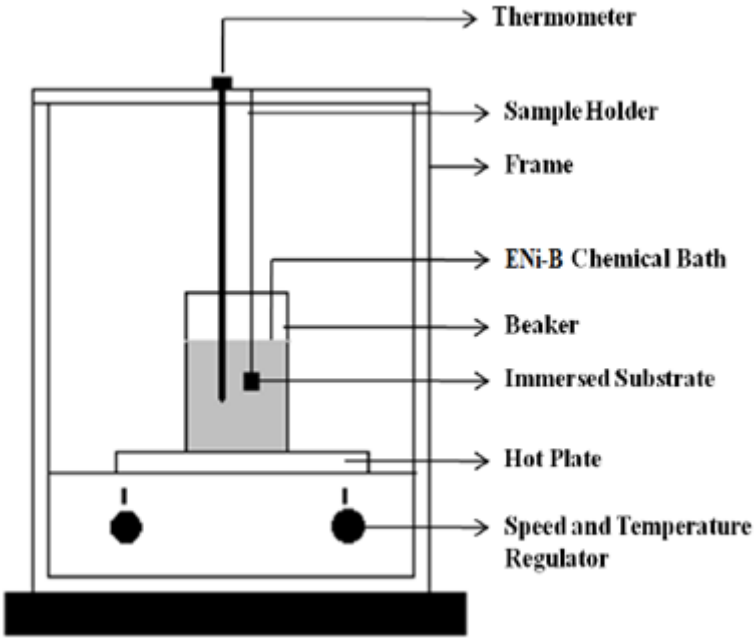

Fig.2.Schematic drawing of experimental setup

The surface morphology of the coated substrate was observed under scanning electron microscopy (SEM) to study morphological changes due to the introduction of second phase particles and at different bath agitation. The effects of bath agitation at different (0, 100 and 200 rpm) are also recognized by the different combinations of the composite shown in Figure.3. The composite samples treated at bath agitation 100 rpm is shown better or uniform deposition as compared to other samples.

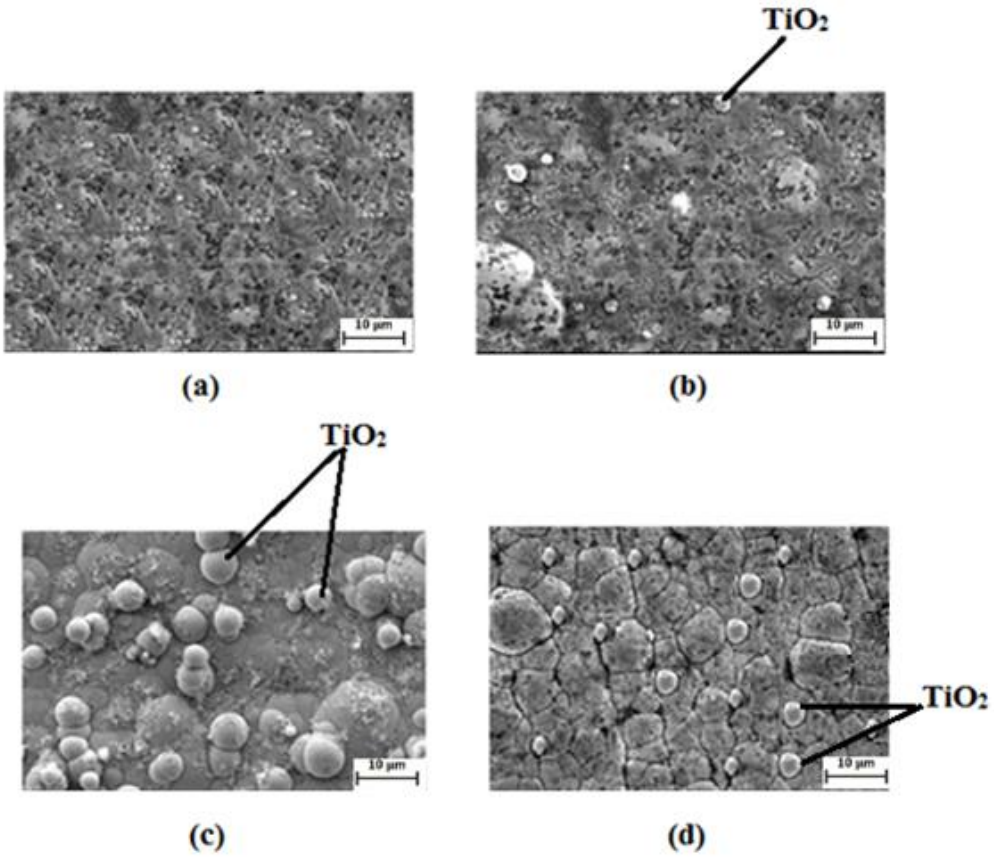

Fig.3. SEM micrographs of ENi-B-TiO_2 composite coatings: (a) Ni-B without TiO_2 (b) ENi-B-TiO_2 with no agitation, (c) ENi-B-TiO_2 with agitation at 100 rpm and (d) ENi-B-TiO_2 with agitation at 200 rpm.

3. Measurement of Surface Roughness of Coatings

One of the purposes of using a electroless coating for a surface of the AZ91 for any application has to do with providing smoothness and extending surface roughness properties. The surface roughness of coatings depends on coating parameters and the amount of second phase particles incorporated in the coated layer. For this purpose, effect of coating parameters on surface roughness ENi-B-TiO_2 composite coatings needs to be investigated. In order to study the surface roughness of substrate after ENi-B-TiO_2 composite coatings, the coated specimens were suitably placed in Profilometer equipment which is used to measure the surface roughness of the composite coating obtained. The table 2 shows results obtained from Profilometer equipment for ENi-B-TiO_2 composite coatings with different concentration of second-phase (titanium) particles. TABLE II: Experimental data of centerline average roughness (Ra) at different concentration of TiO2

Substrate No.	Roughness value Ra (µm)			
	0 g/L	5 g/L	10 g/L	15 g/L
1	0.533	0.609	0.929	1.408
2	0.349	0.433	0.673	0.81
3	0.412	0.406	0.605	0.858
4	0.343	0.493	0.954	1.07
5	0.521	0.541	0.642	0.895
6	0.443	0.508	0.709	0.904
7	0.552	0.642	0.852	1.428
8	0.512	0.481	0.961	1.223
9	0.562	0.693	0.853	1.052
10	0.598	0.661	0.891	1.341
11	0.389	0.453	0.793	0.823
12	0.561	0.515	0.655	0.878
13	0.456	0.495	0.695	1.134
14	0.618	0.773	0.873	1.085
15	0.397	0.496	0.845	1.165

III. RESULTS AND DISCUSSION

Figure 4 shows the graphical representation of the experimental data of the surface roughness of ENi-B-TiO2 and at 0g/L, 5g/L, 10g/L and 15g/L concentration of TiO2. From the Figure 4 it can be observed that, as concentration of second-phase (titanium) particles increases, the surface roughness of coatings also increases.

The average surface roughness obtained for ENi-B-TiO_2 at different concentration of TiO_2 is shown in table III . Figure 5 shows bar chart of average surface roughness of ENi-B-TiO2 composite coatings for various concentrations of TiO2 particles at bath agitation 100rpm. From Figure 5 it can be observed that, as concentration of second-phase (titanium) particles increases, the surface roughness of coatings also increases. The optimum surface roughness of ENi-B-TiO_2 is obtained at 10g/L, the reason behind of this is the uniformly distributed composite coatings on a sample at 10g/L.

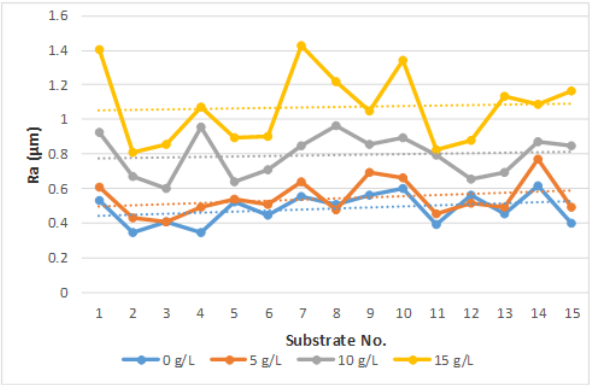

Fig. 4. Variation of center line average (R_a) for different concentration of TiO_2

TABLE I. AVERAGE ROUGHNESS VALUE OF AZ91 WITHOUT AND WITH ENI-B-TiO_2 COMPOSITE COATINGS AT AGITATION 100RPM

Parameter	AZ91Without Coating	AZ91 With ENi-B-TiO_2 Coating at different Concentration of TiO_2 Particles			
		0 g/L	5 g/L	10 g/L	15g/L
Roughness R_a (µm)	0.42	0.48	0.54	0.79	1.07

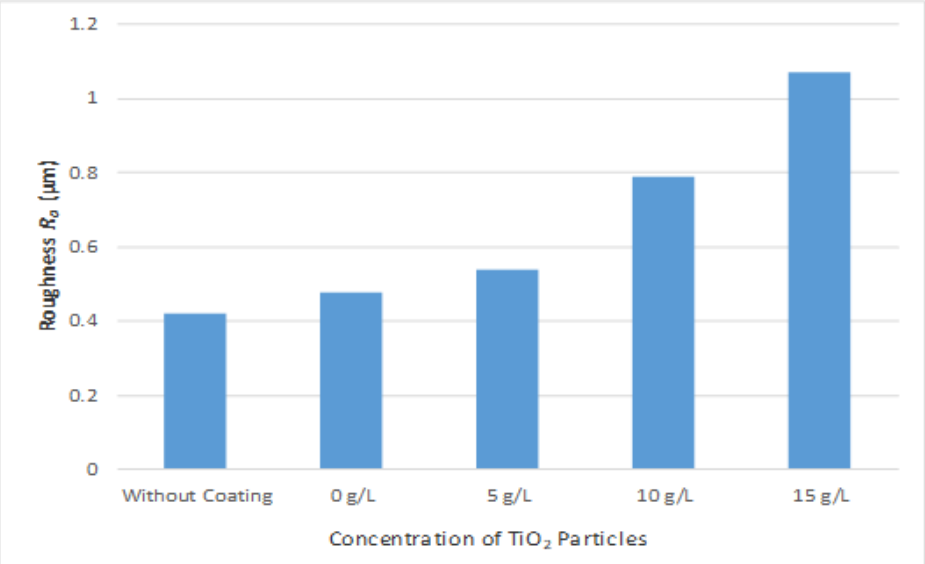

Fig. 5 Roughness Value of ENi-B-TiO_2 composite coatings for different concentration of TiO_2 at bath agitation 100rpm

IV. CONCLUSION

In this paper, the effect of coating process parameters on the surface roughness of ENi-B-TiO_2 composite coatings has been investigated. The investigation shows that the incorporation of TiO_2 particles has greater impact on the surface roughness of the composite coatings. Increase in amount of these particles increases the roughness of the composite coatings. From the analysis of multiple response parameters, optimal combination of coating parameters for minimum roughness is obtained as middle level of nickel source, higher level of reducing agent, and higher level of nickel sulphate and sodium hypophosphite and middle level of titania particle concentration for ENi-B-TiO_2 composite coatings. The ENi-B-TiO_2 composite coatings deposited using optimal combination of parameters have smoother surface as compared to the coatings developed using the initial condition. The optimum surface roughness of ENi-B-TiO_2 is obtained at 10g/L titanium particles.

V. REFERENCES

[1]. Brenner A and Riddell G E; Nickel plating on steel by chemical reduction, Journal of Research of the National Bureau of Standards, 1996, Vol 37, p 31-34.

[2]. Brenner A and Riddell G; Electroless plating by a process of controlled self continuing reduction, Proc. Amer. Electropl. Soc., 2000, Vol 33, p 16-19.

[3]. Cheong W, Luan B L and Shoesmith D W; The effects of stabilizers on the bath stability of electroless Ni deposition and the deposit, Applied Surface Science, 2004, Vol 229, p 282- 300.

[4]. Brenner A and Riddell G E; Deposition of nickel and cobalt by chemical reduction, Journal of Research of the National Bureau of Standards, 1947, Vol 39, p 385-395.

[5]. Wurtz A; Formation of a cuprous hydride, by the action of hypophosphorus acid on a cupric salt solution, Ann. Chim. Phys., 1844, Vol 11, p 250-252.

[6]. Agarwala R C, Agarwala V and Sharma R; Electroless Ni-P based nanocoating technology – A review, Synthesis and Reactivity in Inorganic, Metal-Organic and Nano-Metal Chemistry, 2006, Vol 36, p 493-515.

[7]. Feldstein N, Lancsek T, Lindsay D and Salerno L; Electroless composite plating, Metals Finishing, 1983, Vol 81, p 35-41.

[8]. Balaraju J, Sankara Narayanan T and Seshadri S; Electroless Ni-P composite coatings, Journal of Applied Electrochemistry, 2003, Vol 33, p 807-816.

[9]. Sahoo P and Das S K; Tribology of electroless nickel coatings-A review, Materials & Design, 2011, Vol 32, p 1760-1775.

[10]. Agarwala R and Agarwala V; Electroless alloy/composite coatings: A review, Sadhana,2003, Vol 28, p 475-493.

[11]. Li L, An M and Wu G; A new electroless nickel deposition technique to metallise SiCp/Al composites, Surface and Coatings Technology, 2006, Vol 200, p 5102-5112.

[12]. Mohd Imran Ansari, D. G. Thakur; Influence of Electroless Nickel-Phosphorus Deposition On Hardness of Mild Steel and Az91 Magnesium Alloy, International journal of Pure and Applied Research in Engineering and Technology. 2015, Vol 3(9), 264-271.

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Revamping Industrialization of Tech Industries After Boom in Data Science

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ABSTRACT

According to the sources, more than half of new businesses fail during the first year. 50% startup during the first five and 66% of them in the first 10. The main reason for this failure is that Startups involves huge risk and there is a lack of innovation and lack of use of technology by the Company.
Talking about Amazon, it is an American multinational technology company based in Seattle, Washington. Its focus is on e-commerce, **cloud computing**, digital streaming, **Artificial intelligence, Machine learning** and **Data science**. It is the part of one the Big Four Technology companies along with Google, Apple and Facebook and the main reason for all these companies to rule the world is **INNOVATION & TECHNOLOGY**. Unlike, any other company, it is always two steps ahead and understand the customers.

Keywords: Data Science, Machine Learning(ML), Artificial Intelligence(AI), Big data, Flywheel, Revenue.

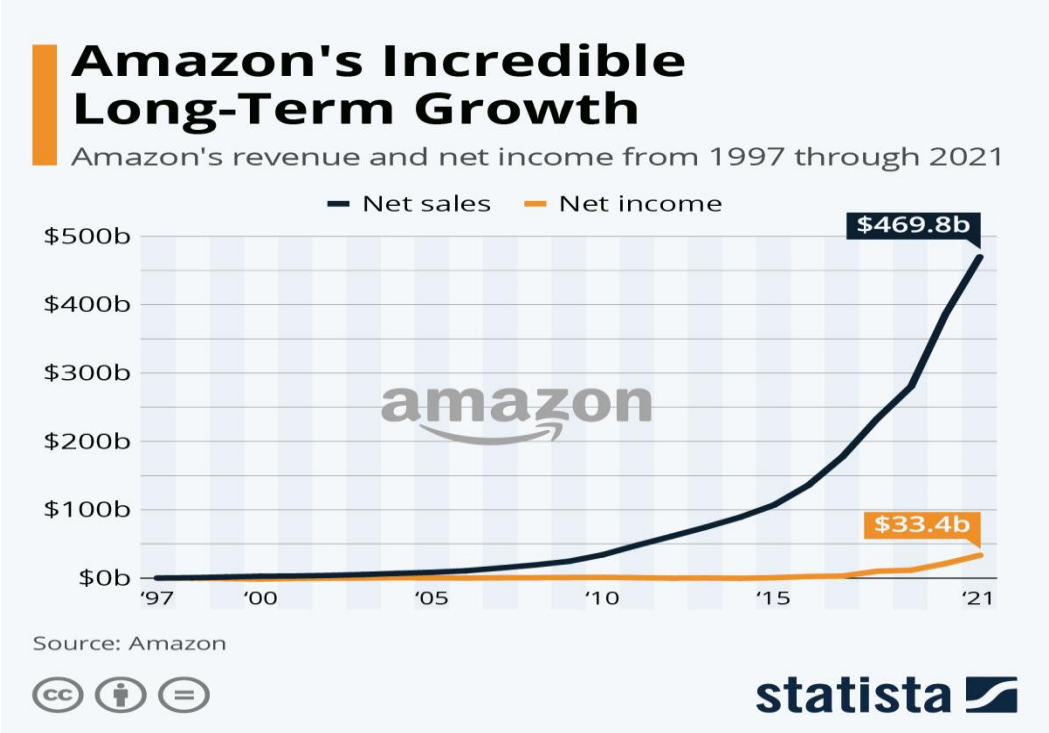
I. INTRODUCTION

Jeff Bezos(Founder and Executive chairman of Amazon) is the man who said we're living in the golden age of AI. For CEO Jeff Bezos, machine learning can improve any institution in the world. It is already solving problems that belonged previously in the sector of science fiction. Today, the near-human or better-than-human abilities of AI can be applied in advertisement, self-driving cars, competitive games such as Go, and artistic industry such as painting and musical composition.
Amazon's approach to AI is called a flywheel. In engineering terms, a flywheel is a deceptively simple tool designed to efficiently store rotational energy. It works by storing energy when a machine isn't working at a constant level. Instead of wasting energy turning on and off, the flywheel keeps the energy constant and spreads it to other areas of the machine.
Amazon faced an uphill battle at the beginning, especially as it was one of the first companies to try its hand at creating a voice-powered virtual assistant that could fit on a countertop. Once the technology started to come together, Company's revenue get increased

The cashier-less Amazon Go store also took advantage of the wealth of data to track customer shopping trends. Data from customers' smartphone cameras tracks shopping activities and not only helps Amazon Go, but can also be shared with the machine learning team for continued development.

II. OVERVIEW ON AMAZON'S GROWTH GRAPH

- Amazon revenue for the quarter ending December 31, 2021 was **$137.412B**, a **9.44% increase** year-over-year.
- Amazon revenue for the twelve months ending December 31, 2021 was **$469.822B**, a **21.7% increase** year-over-year.
- Amazon annual revenue for 2021 was **$469.822B**, a **21.7% increase** from 2020.
- Amazon annual revenue for 2020 was **$386.064B**, a **37.62% increase** from 2019.
- Amazon annual revenue for 2019 was **$280.522B**, a **20.45% increase** from 2018.

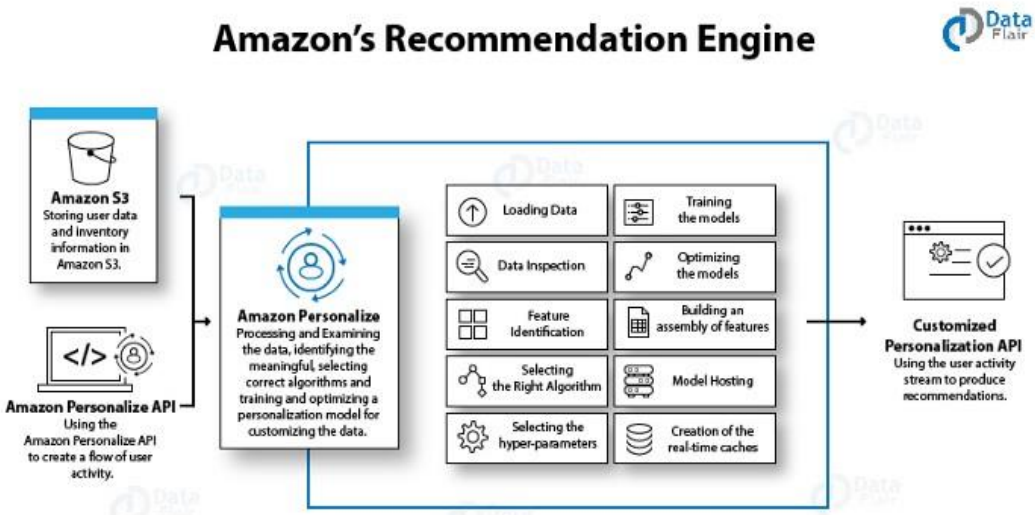


In recent years, as new technologies have been developed, the demand for professionals capable of modelling and simulating these emerging technologies has dramatically increased. Modelling, analysis and computations performed by industrial mathematicians working with other professionals can provide technical advantages and cost saving, importance for company's competitive edge

III. HOW AMAZON USE TECHNOLOGY TO ADVERTISEMENT FOR MARKETING PURPOSE

Amazon has been working hard to make itself a customer-centric platform. Amazon heavily relies on predictive analytics to increase customer satisfaction. It does so through a personalized recommendation system. AI also

plays a huge role in **Amazon's recommendation engine**, which **generates 35%** of the company's revenue. Amazon analyzes the historical purchases of the user to recommend more products.



When you want to watch a movie or shop online, have you noticed that the items suggested to you are often aligned with your interests or recent searches? These smart recommendation systems have learned your behavior and interests over time by following your online activity. The data is collected at the front end (from the user) and stored and analyzed through machine learning and deep learning. It is then able to predict your preferences, usually, and offer recommendations for things you might want to buy or listen to next. This also comes through the suggestions that are drawn from the other users who use similar products or provide similar ratings. Amazon also optimizes the prices on its websites by keeping in mind various parameters like the user activity, order history, prices offered by the competitors, product availability, etc. Using this method, Amazon provides discounts on popular items and earns profits on less popular items. Amazon has an anticipatory shipping model that uses big data for predicting the products that are most likely to be purchased by its users. It analyzes the pattern of your purchases and sends products to your nearest warehouse which you may utilize in the future.

- **Analysis of Revenue from ads:**

Even though ads are not the website's mainstay, the positive cash flow from targeted advertising can bankroll Amazon's core business, improve logistics and quicken the delivery time. The results also drew attention to the company's plans to scale up the investment in its Prime Services and put more money into creating original content for its Prime Video platform.

The revenues from ads also helped offset a minor decrease in online sales during the fourth quarter.

Amazon ads generated more money than the Prime monthly subscription fees (**USD 8.1 billion**). Though Amazon's ad business accounts only for 7% of its fourth-quarter earnings, the trends suggest the segment is primed for growth.

According to Forbes research, **56% of customers** count Amazon as their go-to one-stop-shop. Currently, **75% of sellers** on Amazon use at least one type of pay-per-click advertising, and the website has approximately 2

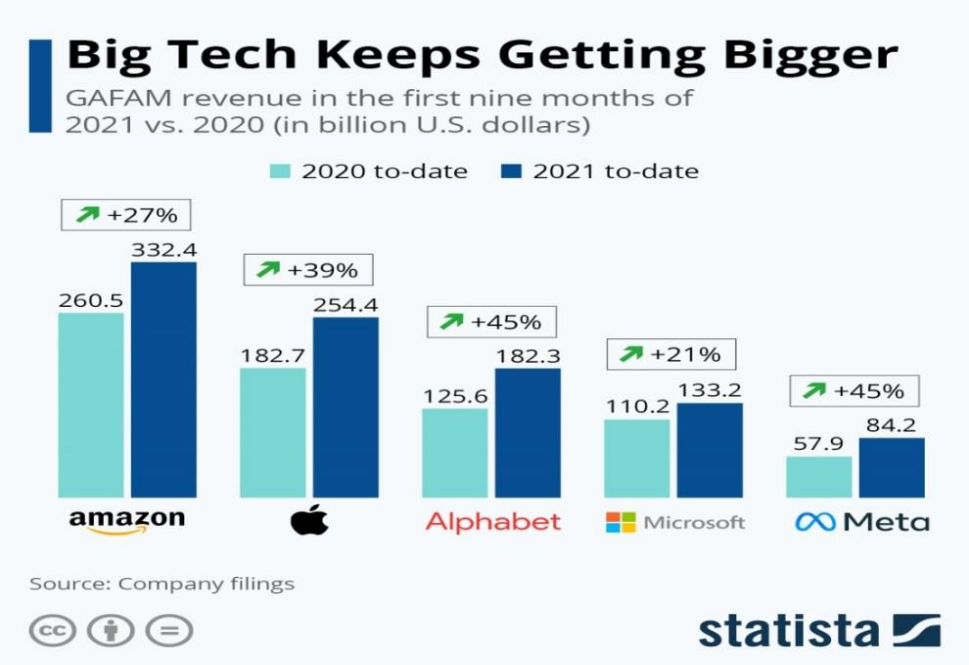
million sellers and brands. Small and medium sellers are usually in the dark about targeted advertising or don't have the tech know-how to build campaigns. Now, the enterprises could optimise sales through targeted ads on Amazon, setting off a positive reinforcement cycle, leading to an influx of sellers, who'd, in turn, spend more on the ads.

According to Tractica (Market intelligence firm that focuses on human interaction with technology), the global artificial intelligence software market is forecast to grow from $10.1 billion in 2018 to $126 billion by 2025. In a data-driven age where companies across all parallels of the industry are adopting Big Data and Artificial intelligence technologies.

Another area where every e-commerce platform is addressing is **Fraud Detection**. Amazon has its own novel ways and algorithms to detect fraud sellers and fraudulent purchases.

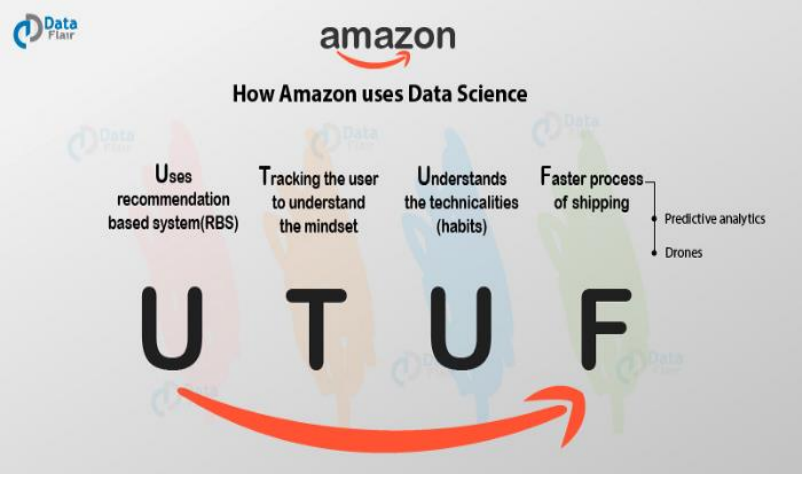
Other than online platforms, Amazon has been optimizing the packaging of products in warehouses and increasing the efficiency of packaging lines through the data collected from the workers.

When comparing the earnings of Tech Giants (Google, Amazon, Facebook, Apple, Microsoft) of the first nine months of 2020 with those of the first nine months of 2021, almost every company managed to increase the percentage of growth year over year. For Apple, this can be attributed to the tech giant releasing its newest iPhone two weeks before the end of its fiscal quarter, which boosted last-minute sales, while in the case of Microsoft, the increasing importance of cloud services was one of the main drivers for its revenue growth.



Amazon is increasingly taking on Facebook and Google for digital advertising dollars. Here's the latest on what we know about the company's moves to turn advertising into a larger revenue stream.

IV. HOW AMAZON USES DATA SCIENCE:



(1) Uses recommendation based system(RBS) -

Through this technology, it gathers data from their customers (Can also be called Big Data). The more data they have the better it is for them because once they understand what the user wants, they then streamline the process and try to encourage the customers to purchase the products. RBS seeks and predicts the **"rating" or "preference"** a user would give to an item.

Data science helps Amazon to understand the needs and instead of the customers searching for similar products, it provides the products in the recommendation. This is done with the help of collaborative filtering. It tries to build a profile of you while you search for the products. It has many such profiles and through the help of collaborative filtering, it serves you with the product that similar profile people have purchased.

(2) Tracking the user to understand the mindset-

It has track of almost everything- starting from your needs, what you have searched , what you will need in future, your personal details (like contact number and address) and through the address it also tries to understand the income level of the user, so that it can understand what products to offer and what not. It also keeps a check on the feedback habits and studies that as well.

(3) Understands the technicalities (habits)-

Amazon tries to understand the habits and the time one devotes to each platform for browsing. The external database is also being used. All this is handled from its central data warehouse of Amazon.

(4) Faster process of shipping-

Amazon has made the process of shipping a lot easier. Through the help of big data analytics insights, it has reached through a position where it can predict who will order what and when. This has increased the experience of online shopping. The reason for this is that Amazon wants to be able to deliver products faster.

V. CONCLUSION

This shows how Data Science technology is taking over and how commercial companies can make predictions which are accurate. The products which one will order will be delivered to him/her in no time. This helps to ensure that the right items are in stock, based on past buying patterns as well as social media analytics and weather predictions. This has definitely made products deliver in no time.

It is not only e-commerce that is gaining advantage from this technology. There are many industries which are also using this technology in the most efficient way.

VI.REFERENCES

[1]. Source: https://www.icbse.com
[2]. Forbes(American business magazine)
[3]. Tractica:(Market intelligence firm that provides in-depth analysis of global market opportunities surrounding human interaction with technology, including qualitative and quantitative assessment of Artificial Intelligence)
[4]. https://www.businessinsider.in/
[5]. https://www.statista.com/
[6]. https://data-flair.training/
[7]. https://medium.com/

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A Review on Soil-Structure Interaction for The Design of Shear Wall

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ABSTRACT

An earthquake is a phenomenon that happens suddenly and causes the ground and everything to shake violently. It happens when accumulated stress from shifting crustal or lithospheric plates is released. India is at significant risk due to its growing population and the numerous haphazard construction projects that are springing up across the country, including multistory luxury flats, enormous factories, enormous malls, and supermarkets, as well as warehouses and brick buildings. Three interconnected systems—the structure, the foundation, and the soil beneath and surrounding the foundation—interact to determine how a building responds to earthquake shaking. The process in which the motion of the structure is influenced by the reaction of the soil and the motion of the structure is influenced by the response of the soil is known as "SoilStructure Interaction" (SSI). prior earthquakes' observations as. Moreover, investigations have demonstrated that the relationship between the soil and the structure does influence how the building reacts and the harm done.

Keywords: Accumulated stress, building respond, earthquake shaking relationship between the soil and the structure, shake violently

I. INTRODUCTION

In essence, soil-structure interaction can be described as a set of events in which structures respond in reaction to the flexibility of the soil beneath the foundation and in which soils respond in response to the presence of structures. A frame in a superstructure, its foundation, and the soil on which it is situated make up a comprehensive soil-foundation-structure system. With the differential settlement (owing to soil characteristics) among various areas of the structure, both the axial forces and the moments in the structural components may alter. The majority of civil structures have a structural component that comes into direct contact with the ground. The ground displacements and structural displacements are no longer kept apart when external forces, like earthquakes, act on these systems. Soil-structure interaction is the process through which structural movements impact soil reaction and soil response affects structural movements (SSI). The degree of load redistribution operating on the structural components is influenced by the rigidity of the structure and the load-settlement properties of the soil. There are thus numerous research in the literature that were done to

calculate the impact of this aspect. These SSI impacts are disregarded by traditional structural design techniques. However, big structures resting on relatively soft soils, such as nuclear power stations, skyscrapers, and motorways, are more susceptible to the impacts of SSI: A technique for assessing the combined reaction of the aforementioned three interconnected systems to an earthquake motion is called soil-structure interaction analysis. The term "soil-structure interaction" refers to the process by which the movement of a particular structure influences the response from the soil and the movement of the soil effects the movement of the structure. In this phenomenon, the ground displacements and the structural displacements occur independently of one another.

II. METHODS AND MATERIAL

2.1. DIRECT METHODS

In a single step, the direct technique analyses the idealised soil-structure system. The direct method is required for nonlinear SSI studies and is applicable to linear and equivalent linear idealisations. In contrast, the substructure method splits the SSI problem into a number of smaller problems, each of which is solved independently, and then the answers are superimposed. Since it relies on superposition, the substructure approach is only applicable to linear and corresponding linear idealisations.

2.2. SUBSTRUCTURE METHODS

a) Developing machine vibration toolkits that considered the dynamic behaviour of the semi-infinite half-space was the logical next step for tackling the SSI analysis of nuclear installation structures (i.e., the force–displacement behaviour defined by impedance functions that are complex-valued and frequency dependent). These impedances, which relate foundation pressures and moments to six rigid body degrees of freedom, are only defined for foundations that are supposed to act rigidly by 6x6 frequency-dependent matrices of complex-valued impedances. In order to produce flexible impedance matrices (frequency-dependent and complex-valued) that relate forces and displacements for foundations with flexible behaviour, a sufficient number of flexible impedance matrices must be developed. The development of substructuring techniques was driven by the desire to divide the soil-structure problem into more manageable chunks.

The flexible volume method

b) The idea of dividing the entire soil-structure system into three substructure systems serves as the foundation for the variable volume sub structuring approach [227]. The free field site makes up Substructure I, the excavated soil volume makes up Substructure II, and the nuclear installation structure makes up Substructure III, where the foundation takes the place of the excavated soil volume. The original SSI system is composed of the substructures I, II, and III. The flexible volume method assumes that, in addition to interaction between the substructures at the border of the foundation of the structure, the free field site and the excavated soil volume also interact within and at the boundary of the latter.

The subtraction method

The flexible volume approach and the substructure subtraction method [228] both rely on the same substructuring principle. As depicted in Figure 27, the subtraction method divides the entire soil-structure system into three substructure systems. The free field site makes up Substructure I, the excavated earth volume makes up Substructure II, and the nuclear 87 installation structure makes up Substructure III. The original SSI system is composed of the substructures I, II, and III. Contrary to the flexible volume technique, the subtraction method acknowledges that SSI only happens at the boundary of the structure's foundation, or at the common boundary of the substructures. In comparison to the flexible volume method, this freque

III. OBJECTIVES

1. A of knowledge of the core SSI concepts underlies issues with the practical implementation of SSI for building structures.
2. The seismic study of the structure is completed using static and dynamic methods, both with and without the building of an SSI.
3. To identify all ground vibrations in the shear wall's X, Y, Z directions.
4. In order to ascertain how near to resonance a structure is, it is crucial to examine the interactions betwee n the vibrational periods or frequencies of the structure and the soil.

IV. ROLE OF SSI IN Etabs

1. 1.Soil-structure the process of interaction is when the movement of one structure influences the response from the soil, and the movement of another structure influences the response from the soil.
2. One of the most user-friendly and clear modelling interfaces is provided by ETABS. ETABS offers a very user-friendly graphical modelling method. Also, there is an editor mode, but it is rarely necessary because the graphical interface provides you with enough tools to easily construct complex structural models.
3. The analysis from ETABS is imported into ANALYS to perform the soil structure interaction, and the uplift pressure of the soil to the structure is then investigated.
4. Considering the relationship between soil and structures makes a structure more flexible, improving the natural.
5. This technique involves applying accelerations to the building that correspond to the projected earthquake at the structure's base as recorded in seismic records. As well as immediately following the application of a load, it provides the structural response. With the help of ETABS, the study is conducted for the planned building

V. CONCLUSION

It is used in Heavy structures, such as hydraulic and nuclear structures, utilise it. The analysis based on the interaction between soil and structure is beneficial for those structures where the P delta effects are substantial. Deep-seated foundations, buildings supported on soft soil, and tall or slender structures with an average shear

velocity of 100 m/sec all benefit greatly from the study of SSI. To assess the effects of seismic ground motion on an installation's structure, system, and components, soil structure intraction (SSI) analysis is used. It is used to make sure that it is built to endure earthquakes without losing its safety features.

VI.REFERENCES

[1]. Chaitanya Patel, Noopur Shah, (2016) "Building with Underground Storey with Variations in Soil Subgrade Modulus", IJEDR | Volume 4, Issue 2 | ISSN: 2321-9939.

[2]. M Roopa, H. G. Naikar, Dr. D. S. Prakash, (2015) "Soil Structure Interaction Analysis on a RC Building with Raft foundation under Clayey Soil Condition", International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 IJERTV4IS120402 www.ijert.org (This work is licensed under a Creative Commons Attribution 4.0 International License.) Vol. 4 Issue 12, December2015.

[3]. Shehata E. Abdel Raheema, Mohamed M. Ahmed, Tarek M. A. Alazrak, (2014) "Soil-raft foundation-structure interaction effects on seismic performance of multi-story MRF buildings" Engineering Structures and Technologies.

[4]. Jul-Liang Lin, Keh-Chyuan Tsai, Eduardo Miranda, (2014) "Seismic History Analysis of Asymmetric Buildings with Soil- Structure Interaction", DOI: 10.1061/(ASCE0733-9445) I (2009135:2)101 Journal of Structural Engineering ASCE.

[5]. Mohd Ahmed, Mahmoud H. Mohamed, Javed Mallick, Mohd Abul Hasan, (2014) "3D-Analysis of Soll Foundation- Structure Interaction in Layered Soil" Open Journal of Civil Engineering 2014,4,373-385.

[6]. Jonathan P. Stewart,1 Gregory L Fenves,2 and Raymond B. Seed, (2013) "Seismic Soil-Structure Interaction In Buildings. I: Analytical Methods" Journal of Geotechnical And Geo- environmental Engineering.

[7]. M.E. Boostani Darmian, M.Azhdary Moghaddam & H.R. Naseri, (2011) "Soil-Structure Interaction In Steel Braced Structures With Foundation Uplift IJRRAS May 201 www.arpapress.com/Volumes/Vol7issue2/1JRRAS 7.2 12

[8]. L M. Anderson, S. Carey, and J. Amin, (2011) "Effect of Structure, Soil, and Ground Motion Parameters on Structure-Soil Structure Interaction of Large Scale Nuclear Structures" Structures Congress 2011@ASCE

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Video based Gesture Vocalizer (VGV) for Dumb Person

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ABSTRACT

Sign language is an effective communication means for dumb people to communicate with the world. But this language is well understood by the people who are familiar to the sign language. For normal human being it is very difficult to interpret and communicate with dumb person using sign language. This paper presents a comfortable mean for both, dumb as well as normal person, to understand each other by using Video based Gesture Vocalizer (VGV) system. VGV system helps normal human being to understand dumb person by converting the gesture of dumb person into audio. The gesture is identified by processing the video of dumb person captured through camera or smart phone. Whereas the normal person's audio is converted into visual signal for dumb person. This VGV system minimizes the barrier of communication between the society and dumb person.

Keywords: Dumb person, Video based Gesture Vocalizer (VGV), Sign language, Communication

I. INTRODUCTION

According to the survey of the World federation of Deaf (WFD), around nine billion people in the world are deaf and dumb. Figure 1 shows the statistics of literacy of these people. For these people it is very difficult to communicate with the world. Even blind people can also communicate with each other using general language. But deaf and dumb people are not able to communicate with the world as they may not be able to either talk or listen. Hence they use speciallanguage called sign language for communication.

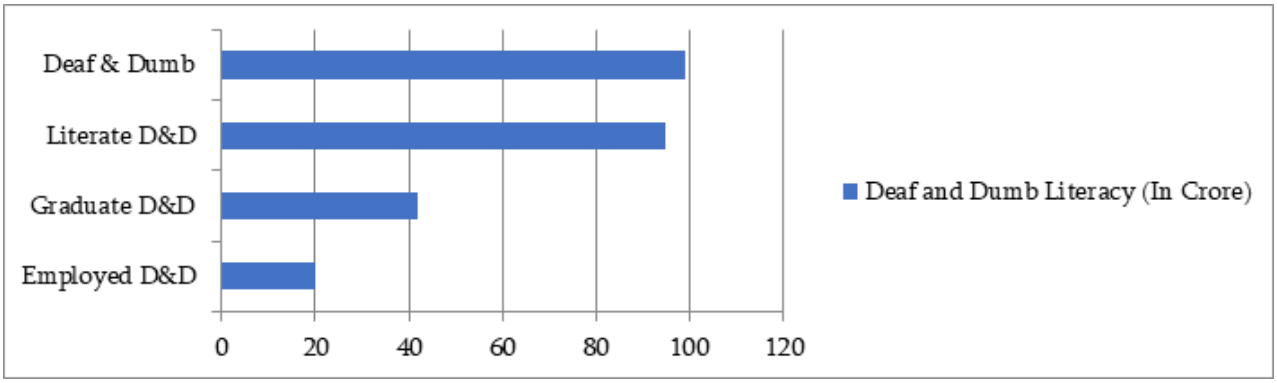

Figure 1. Literacy of Deaf and dumb people

Sign language is composed of visual gestures and signs.A gesture in a sign language is a particular movement of the hands with a specific shape made out of it as shown in figure 2. In order to detect and interpret these gestures some mechanism is required. The detection of gesture from sign language is done either based on sensor (like smart gloves, digital gloves, data gloves, flex sensors, position trackers etc.) or based on image or video.

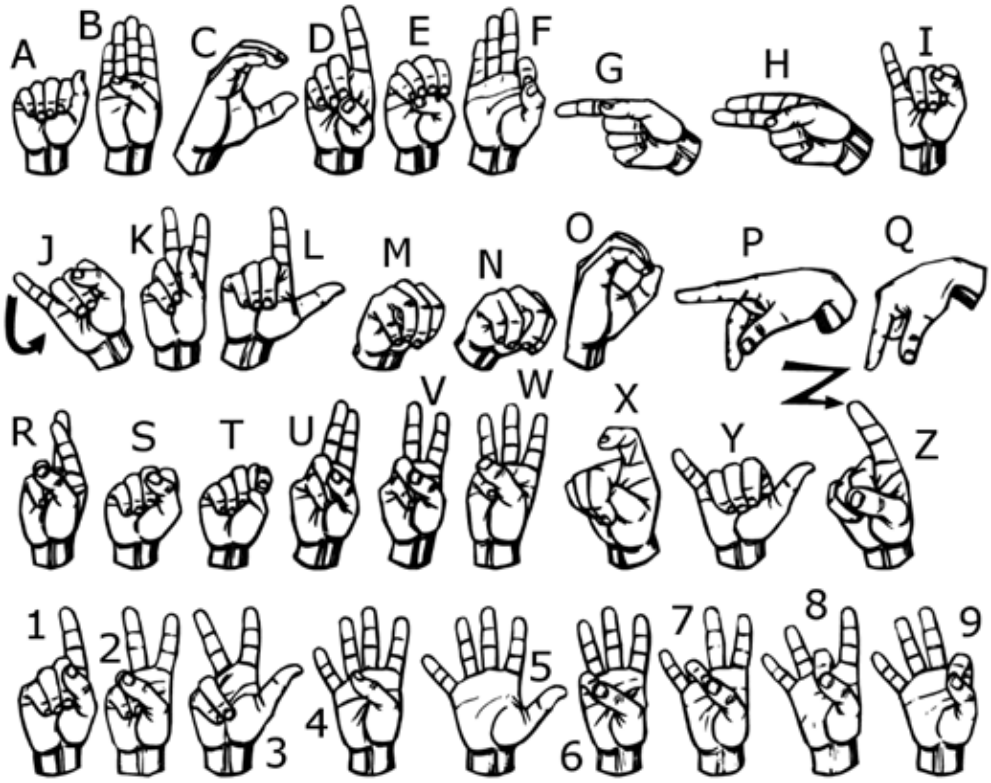

Figure 2. American Sign Language (ASL)

Sensor based detection is costly and limited to specific range whereas video based technique is inexpensive and two-way communication is also possible. But vision based technique includes complex algorithms. There are challenges in image and video processing such as variant lighting conditions, backgrounds, field view constraints and occlusion.

There was a need to use smart technology to facilitate the dumb people. This paper explains a system which makes use of smart technology to minimize the communication gap between dumb people and normal people. This VGV system is developed for recognizing these signs from video and its conversion into audio and vis-a-versa.

II. METHODS AND MATERIAL

The proposed system is very handy and uses smart technology. It is based on detection of gestures on-the-fly for normal person using camera of a smart phone. The display of the same smart phone will help to convert the audio signal into gestures for a dumb person. The block diagram of the proposed system is shown in figure 3.

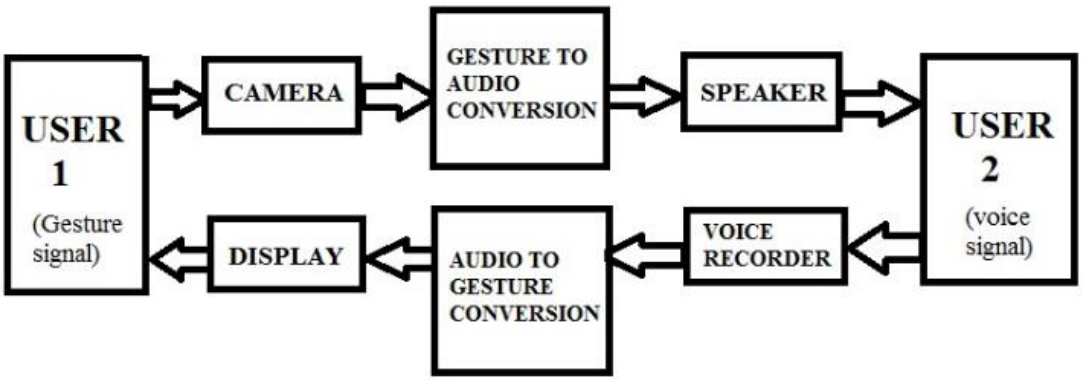

Figure 3. Block Diagram of proposed method

The block diagram consists of different blocks such as hand gestures as input, video camera to record gestures, video to audio conversion using software and a speaker for audio output. If a normal person wants to understand the dumb person, he has to use the camera of smart phone and shoot his gestures. While recording the gestures there has to be sufficient light and plane background. The captured video should be of one of the following: -

AVI (Audio video Interleave)

WMV (Windows Media Video)

MOV (Apple Quick Time Movie)

MP4 (Moving Picture Expert Group 4)

The captured video signal is further processed, as shown in the flowchart in figure 4, to convert these gestures into an audio signal and vice-a-versa.

The prime focus of this work is to convert the video signal into audio signal and vice-a-versa without any errors. A suitable frame is selected from the video and used for further processing.

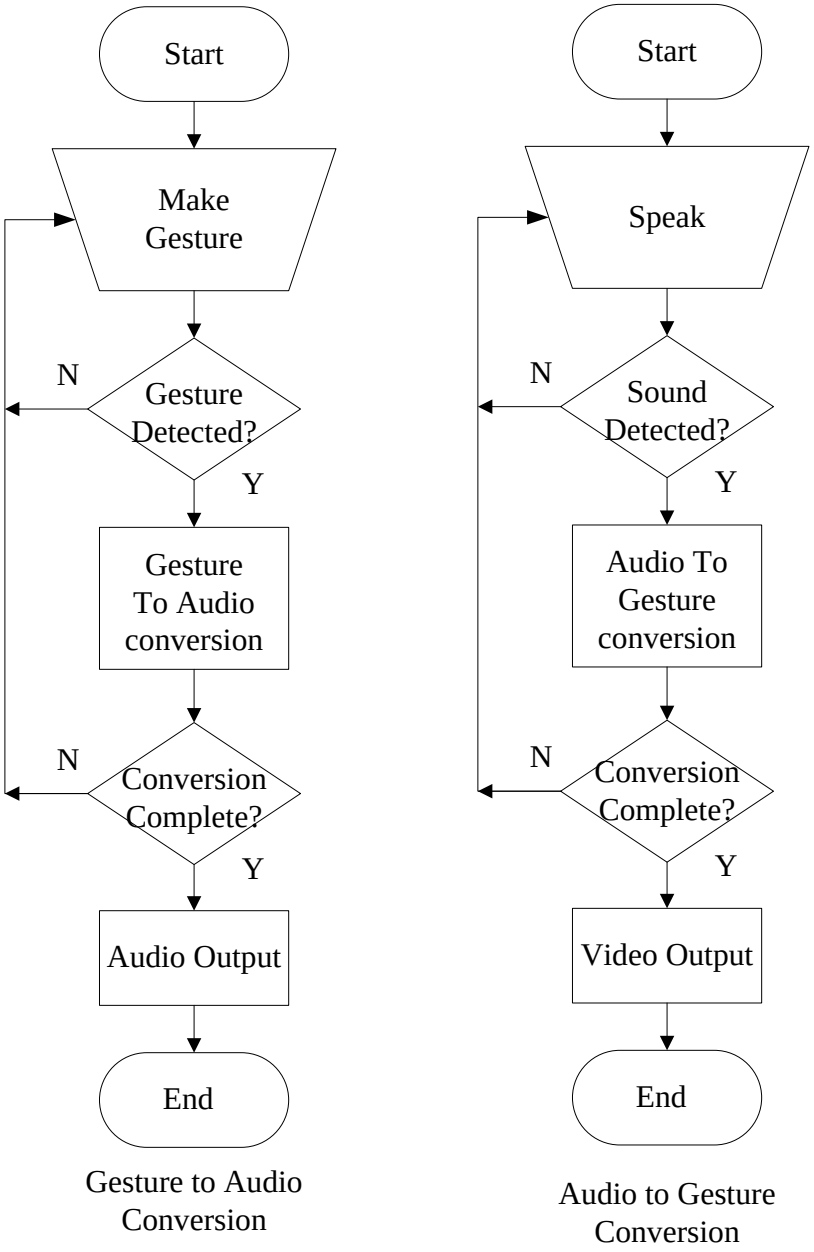

Figure 4. Flowchart of proposed system

The selected frame is converted into binary image. Gesture is recognized using skin detection method as shown in figure 5.

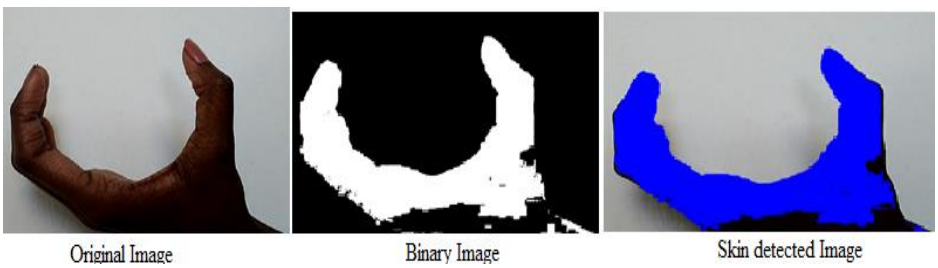

Figure 5. Conversion of image to skin detection image

III. RESULTS AND DISCUSSION

The proposed VGV gives images after skin detection , as shown in figure 6, which are similar to the ASL gestures which are shown in figure 2. The figure shows some samples of detection of gestures corresponding to letters from ‘a’ to ‘e’.

A database of hand gestures in ASL and corresponding pre-recorded sounds is created and stored. According to the recognized hand gesture, the pre-recorded sound track is played as audio output. The reverse process, as shown in figure 4, for sound to gesture conversion is used.

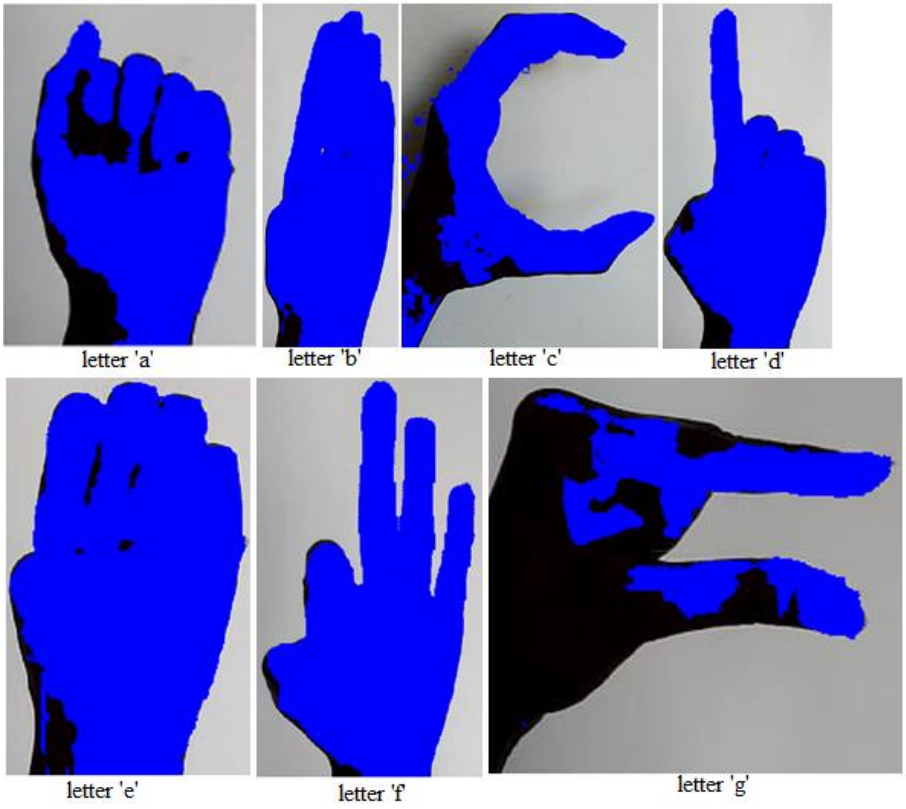

Figure 6. Skin detection images for gestures of ‘a to g’

IV. CONCLUSION

The VGV system thus eliminates the barrier in communication between the dumb community and the normal people. It is also useful for speech impaired and paralysed patient who do not speak properly.

This paper deals with the system which will help the dumb and deaf people who uses hand gesture system to communicate with the normal people.

Hand gesture recognition system is considered as a way for more intuitive and profitable human computer interaction tool.

V. REFERENCES

[1]. Christy Paul, Anju Varghese, Dilna Titus and Vijith C., "A Survey on Sign Language to Verbal Language Converter", International Journal of Engineering Science and Computing, Vol. 6 Issue 9, September 2016, pp. 2300-2302

[2]. Dr. Pramod Sharma, Pooja Raghav and Arpita Gupta, "Sign Language Glove with Voice Synthesizer", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, Issue 3, March 2017, pp. 1369-1374.

[3]. Mr. Prashant Chaudhari, Prof. G. R. Phulay and Mr. Ravindra Patil, "A review on hand gesture recognition systems", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), Vol. 2, Issue 1, January 2013, pp. 86-90.

[4]. Praveen Gurav and Ashwini Hunshyal, "Gesture Vocalizer for Dumb People", International Journal of Current Trends in Engineering & Research (IJCTER), Vol. 2 Issue 5, May 2016 pp. 327-336.

[5]. Manjula G Hegde, Yukti Behal and Sangeetha G. S., "Design and Implementation of Advanced Hand Gesture Controller and Vocalizer", International Journal of Electrical and Electronics Engineers, Vol. 9, Issue 2, Dec. 2017.

[6]. R. L. R. Lokesh Babu, S. Gagana Priyanka, P. Pooja Pravallika and Ch. Prathyusha, "Gesture Vocalizer", International Journal for Modern Trends in and Technology, Vol. 2, Issue 4, April 2016, pp. 22-26.

[7]. Deena Nath, Jitendra Kurmi and Deveki Nandan Shukla, "A Review on Gesture Vocalizer", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Vol.6, Issue IV, April 2018, pp. 2990-2994.

[8]. Abhishek Tandon and Amit Saxena, "A Review Paper on Smart Glove-Converts Indian Sign Language (ISL) into Text and Speech", International Journal for Scientific Research & Development, Vol. 4, Issue 08, 2016, pp. 269-272.

[9]. Kamal Preet Kour and Dr. (Mrs) Lini Mathew, "Literature survey on hand gesture techniques for sign language recognition", International Journal of Technical Research & Science", Vol. 2, Issue VII, August 2017, pp. 431-433.

[10]. Ajit Manware, Rajnish Raj, Amit Kumar and Tejaswini Pawar, "Smart gloves as a communication tool for the speech impaired and hearing impaired", Journal of Emerging Technologies and Innovative Research (JETIR) Vol.4, Issue 06 June 2017, pp. 78-82.

[11]. Asha Shajee, Manonmani Lakshmanan, Lekhita Sharma and Jaya Kumar, "A Survey: Hand Gesture Vocalizer", Journal of Network Communications and Emerging Technologies (JNCET), Vol. 8, Issue 4, April 2018, pp. 93-96.

[12]. M. V. N. R. P. kumar and Ashutosh Kumar, "AVR Based Gesture Vocalizer Using Speech Synthesizer IC", International Journal of Research in Advent Technology, Vol.3, No.5, May 2015, pp. 25-29.

[13]. Supriya Shevate, Nikita Chorage, Siddhee Walunj and Moresh M. Mukhedkar, "Gesture Based Vocalizer for Deaf and Dumb", International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 3, March 2016, pp. 369-371.

[14]. Sruthi Dinesh, "Talking Glove- A Boon for the Deaf, Dumb and Physically Challenged", International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Vol. 4, Issue 5, May 2015, pp. 1366-1369.

[15]. Sunita V. Matiwade and DR. M. R. Dixit, "Electronic Support System to Interpret Sign Language of Communication used by Deaf and Dumb Community", Journal of Emerging Technologies and Innovative Research (JETIR), Vol. 2, Issue 9, September 2015, pp. 52-57.

[16]. Prem Kumar M and Santosh Mishra, "An Intelligence Gesture Vocalize for Deaf and Mute People", International e-Journal For Science And Research-2017, Vol.1, Issue 6, June 2017, pp. 1-7.

[17]. K. V. Fale, Akshay Phalke, Pratik Chaudhari and Pradeep Jadhav, "Smart Glove: Gesture Vocalizer for Deaf and Dumb People", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 4, April 2016, pp. 6800-6806.

[18]. Abhijeet Sondhi, Paresh Kasa and Kuldeep Solanki, "Interacting Device for Deaf & Dumb using Atmega 328 Processor", International Journal Of Engineering And Computer Science, Vol. 4, Issue 9, Sep 2015, pp. 14439-14442.

[19]. Priyanka R. Potdar and Dr. D. M. Yadav, "Innovative Approach for Gesture to Voice Conversion: Review", International Journal of innovative research and development, Vol 3, Issue 6, June, 2014, pp. 459-462.

[20]. Bhavina Patel, Vandana Shah and Ravindra Kshirsagar, "Microcontroller based gesture recognition system for the handicap people", Journal of Engineering Research and Studies, Vol. II, Issue IV, Dec. 2011, pp. 113-115.

[21]. Deepa Haridas and Drishya M, "Gesture Vocalizer using IoT", International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Vol. 5, Issue 4, April 2017, pp. 128-133.

[22]. Praveenkumar S Havalagi and Shruthi Urf Nivedita, "The amazing digital gloves that give voice to the voiceless", International Journal of Advances in Engineering & Technology, Mar. 2013, Vol. 6, Issue 1, pp. 471-480.

[23]. Abhishek Jain, Lakshita Jain, Ishaan Sharma and Abhishek Chauhan, "Image processing based speaking system for mute people using hand gestures", International journal of Engineering science and research technology, April 2018, pp. 368-374.

[24]. Kshirasagar Snehal P. and Shaikh Mohammad Hussain, "Gesture vocalizer for deaf and dumb", International Journal of Engineering sciences and research technology, April 2016, pp. 547-553.

[25]. M. Archana, S. Haripriya, E. Shiny Freeda and Dr. S. Hemalatha, "Aiding Application of Speech-Hearing Impaired for Effective Social Contact", International Journal of Linguistics and Computational Applications (IJLCA), Vol. 4, Issue 1, March 2017, pp. 7-12.

[26]. Pooja Gupta, Dr. Ambuj Kumar Agrawal, and Dr. Shahnaz Fatima, "Sign Language Problem And Solutions For Deaf And Dumb People", 3rd International Conference on System Modeling & Advancement in Research Trends (SMART), 2014, pp. 124-128.

[27]. L. Jayatilake, C. Darshana, G. Indrajith, A. Madhuwantha and N. Ellepola, "Communication between Deaf-Dumb People and Normal People: Chat Assist", International Journal of Scientific and Research Publications, Vol. 7, Issue 12, Dec. 2017, pp. 90-95.

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Prediction and Control Cutting Tool Vibration in CNC Lathe

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ABSTRACT

In machining operation, the quality of surface finish is an important requirement for many turned work-pieces. Thus, the choice of optimized cutting parameters is very important for controlling the required surface quality. The focus of present experimental study is to optimize the cutting parameters using two performance measures, machine tool vibration and work-piece surface roughness. Optimal cutting parameters for each performance measure were obtained employing Taguchi techniques. The Taguchi L 9 run, signal to noise ratio and analysis of variance were employed to study the performance characteristics in turning operation. The experimental results showed that the machine tool vibration can be sensed and used effectively as an indicator to control the cutting performance and improves the optimization process. It is possible to increase machine utilization and decrease production cost in an automated manufacturing environment.

Keywords: Surface roughness, tool vibrations, Taguchi parameter design, turning.

I. INTRODUCTION

Increasing the productivity and the quality of the machined parts are the main challenges of metal- based industry; there has been increased interest in monitoring all aspects of the machining process. Surface finish is an important parameter in manufacturing engineering. It is a characteristic that could influence the performance of mechanical parts and the production costs. The ratio between costs and quality of products in each production stage has to be monitored and immediate corrective actions have to be taken in case of deviation from desired trend.

Surface roughness measurement presentsan important task in many engineering applications. Many life attributes can be also determined by how well the surface finish is maintained. So many researchers were try to optimize the surface roughness. **Palanikumar(2006)** found that surface roughness plays animportant role in many areas and is factor of great importance in evaluation of machining accuracy **Thamizhmani (2006)** studied to analyze the optimum cutting parameters to minimize the roughness in turning SCM 440 alloy steel by Taguchi method. The result of the experiment suggests that the insert radius and feed rate are the main controllable parameters which affect surface roughness more in turning AISI 1030 carbon steel. Instead of

engineering judgment surface roughness can be improved by this approach. **Puertas (2003)** state vibration can be measured in terms of peak acceleration, r.m.s value of velocity, peak to peak displacement.

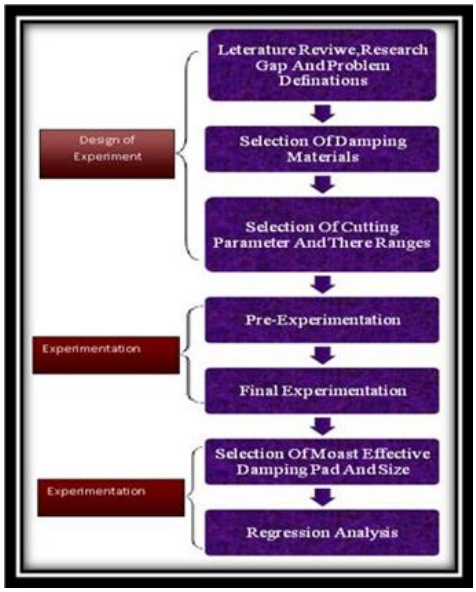
Ghani (2002) presented a study of tool life, surface finish and vibration, while turning nodular cast iron using ceramic tool. They found that surface finish was to be almost constant with the progression of the flank wear under different cutting conditions **Bonifacio (1994)** presented a study on correlating tool wear, tool life, surface roughness and tool vibration in finish turning with coated carbide tools. They concluded that the feed didn't influence the vibrational signal and had a little effect on surface roughness. The surface roughness value decreases slightly after a short cutting time due to chamfering of the edge radius. **Thomas (1996)** studied the effect of tool vibration on surface roughness during lathe dry turning process on mild carbon steel samples at different levels of speed, feed, depth of cut, tool nose radius, tool length and work piece length.

Safeen(2007) studied the effect of cutting tool vibration on surface roughness of work piece in dry turning operation .The surface roughness of the work piece is proportional to cutting tool acceleration. This effect interacts with other independent variable such feed rate, depth of cut, speed. Surface roughness of work piece increases parallel to the tool vibration with increasing tool over hang. **Dogra (2011)** presented a research on effect of tool geometry variation on tool wear, surface roughness and surface integrity of the machined surface. They concluded during finish hard turning increase in the rake angle or the chamfer angle as well as the hone cutting edge radius allowed an increase in the compressive residual stress in the subsurface. Further the increased radius of a cutting tool will produce larger compressive residual stress beneath the machined surface. Increasing the nose radius has a direct effect on cutting forces which leads to a significant increase in the ploughing effect in the cutting zone. Gaitonde et al. used the technique artificial neural network (ANN) method and using this surface roughness model is being developed to investigate the cutting conditions during turning of steel, 9SMnPb28k (DIN). They concluded from their experiment that the surface roughness is highly sensitive to feed and speed while depth of cut has less effect on it. They also concluded that ANN can detect any value of non-linearity that exists between the process response and the input parameters and exhibits good generalization.

All researchers have focused on effect cause parameter on vibration and effect of vibration on various parameters like surface roughness for ductile material like aluminum, MS, copper etc. Also they provide suitable solution for that. But they very little focused on effect of vibrations on surface roughness of hard material like SS304, titanium etc even though they having some good property. In this present work attempt is made to investigate the effect of cutting parameters on tool vibration and surface roughness.

II. METHODOLOGY

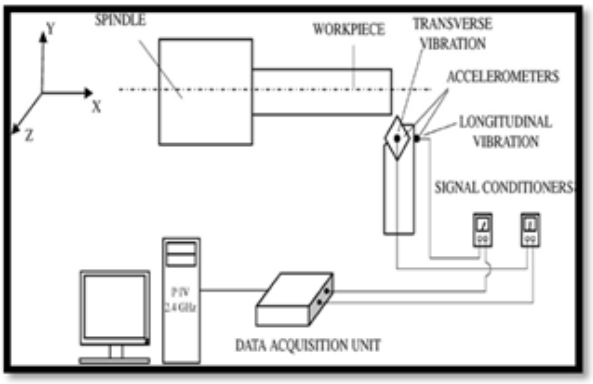
The general methodology for this project work can be explained with the help of flowchart shown in Fig



III. EXPERIMENTATION

Design of Experiment (DOE) approach is selected for investigation effect of varying controllable parameter on acceleration, since Taguchi design of 9 runs is efficient to study the effect of two or more factors these three levels of factor are referred as low intermediate & high level. In this experiment amplitude of vibration, average tool temperature and surface roughness are measured with and without damping pad.Tool without damper and with damper is shown in Fig

Diagram shows tool without and with damper



Layout diagram for experiment

In experimentation tool is supported with and without damper and corresponding reading are taken for same operating conditions. Work piece used for present work is SS304 because of their good properties. Insert selected for turning operation is TNMG 160408-61 with nose radius of 0.6 mm. whole experiment is carried out on CNC machine and machine tool vibration is measured by using FFT analyzer. Also surface roughness is measured by using surface roughness tester.

Pre-experimentation: -

Purpose behind pre-experimentation is to set the levels of the cause parameters which are to be used during experiment. By carry out pre-experiment it is easy to determine the level of 3 cause parameters. The cause parameters used for experimentation are namely Cutting Speed (CS), Depth of Cut (DOC) and Feed Rate (FR). During experimentation it is assume that other parameters like insert nose radius, nose angle and other tool geometry remains constant. During pre- experiment Neoprene rubber is use as damper. Levels of parameters are decided by keeping two parameters constant and varying single parameter. from pre- experimentation following levels are decided.

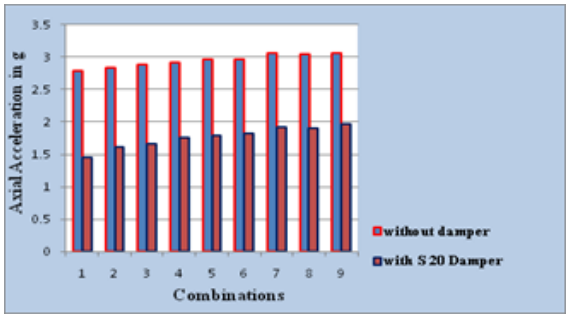
Parameters	Level 1(minimum)	Level 2(mean)	Level 3(maximum)
Cutting speed (CS) C1	420	520	620
Depth of cut (DC) C2	0.4	0.5	0.6
Feed rate(FR) C3	0.15	0.2	0.25

Final Experiment: -

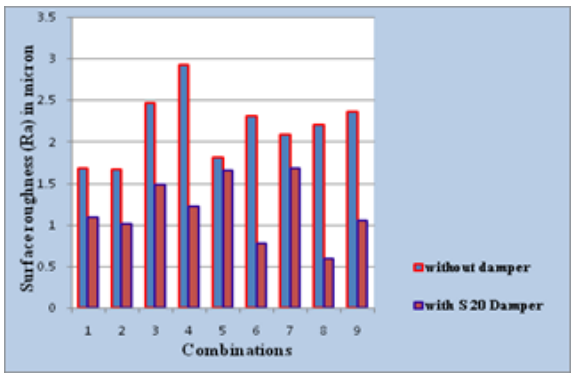
For final experimentation S-20 damper is used

CS rpm	DC mm	FR mm/rev	Amplitude of Acceleration of cutting tool in g				Surface Roughness Ra	
			Axial Direction (RMS)		Tangential Direction (RMS)			
			Without Damper	With Damper	Without Damper	With Damper	Without Damper	With Damper
420	0.4	0.15	2.79	1.459	0.217	0.202	1.684	1.086
420	0.5	0.2	2.834	1.615	0.228	0.204	1.67	1.014
420	0.6	0.25	2.884	1.666	0.273	0.234	2.461	1.475
520	0.4	0.2	2.926	1.753	0.248	0.227	2.926	1.223
520	0.5	0.25	2.96	1.796	0.36	0.29	1.805	1.654
520	0.6	0.15	2.964	1.823	0.277	0.242	2.301	0.776
620	0.4	0.25	3.062	1.912	0.256	0.21	2.08	1.682
620	0.5	0.15	3.046	1.896	0.269	0.23	2.204	0.587
620	0.6	0.2	3.057	1.963	0.259	0.223	2.36	1.044

IV. RESULTS AND DISCUSSION



Axial-acceleration with and without damper



Surface roughness of work –piece without and with S-20 damper

it is observed that by using S 20 damper axial acceleration and surface roughness are reducing by great extent.

Regression Analysis: -

By using this data, we can compare the vibration parameter with damp condition and without damp condition. Also ANOVA and Regression analysis can validate above result.

The regression for axial acceleration

Axial Acceleration (C4) = 0.467 + 0.00172 C1 + 0.547 C2 + 0.653 C3

Where C1 is cutting speed, C2 is Depth of cut And C3 is feed rate.

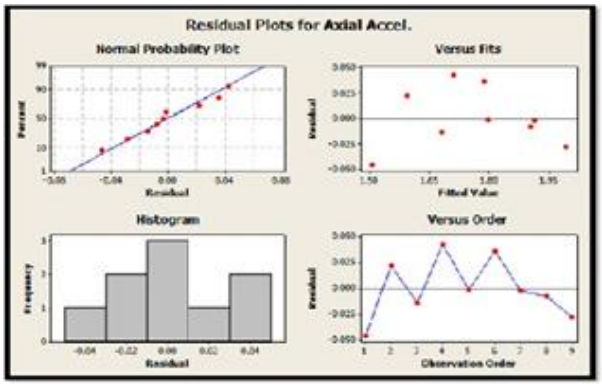
Predictor	Coefficient	SE Coefficient	T	P	VIF
Constant	0.4672	0.1256	3.72	0.014	
C1	0.0017183	0.0001515	11.34	0.000	1.000
C2	0.5467	0.1515	3.61	0.015	1.000
C3	0.6533	0.3030	2.16	0.084	1.000

S = 0.0371108 R-Sq = 96.7% R-Sq (adj) = 94.7%

Analysis of variance for axial acceleration:-

Source	DF	SS	MS	F	P
Regression	3	0.201493	0.67164	48.77	0.000
Residual Error	5	0.006886	0.001377		
Total	8	0.208380			

Source	DF	Seq SS
C1	1	0.177160
C2	1	0.017931
C3	1	0.006403



Residual Plot for Axial Acceleration

Above table shows regression for axial accelerations which indicate 96.7% of variation in the rating observations. The adjusted R is 94.7%, which is a decrease of 2.0% R2value indicate that the degree of closeness of variable with best fit line and parameters are closely co related with each other. From ANOVA table it is clear that feed rate is most significant parameter for axial accelerations. Above graph shows the residual plot for axial accelerations for given regression.

Regression analysis for surface roughness:-

The regression equation is

Surface Roughness = 0.404 - 0.000437 C1 - 1.16 C2 + 7.87 C3

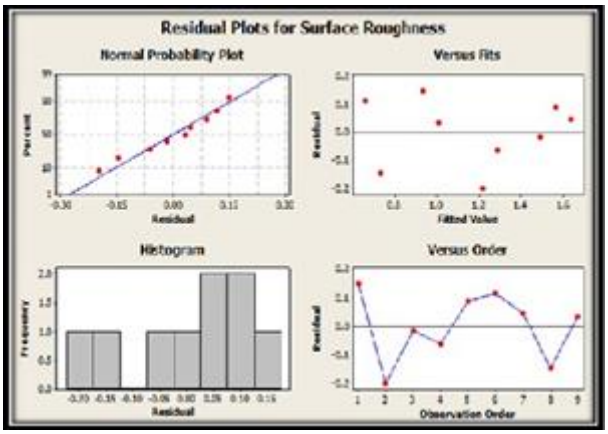
Predictor	Coefficient	SE Coefficient	T	P
Constant	0.4036	0.5078	0.79	0.463
C1	-0.0004367	0.0006126	-0.71	0.508
C2	-1.1600	0.6126	-1.89	0.117
C3	7.873	1.225	6.43	0.001

S = 0.150064 R-Sq = 90.1% R-Sq (adj) = 84.1%

Analysis of Variance for surface roughness:-

Source	DF	SS	MS	F	P
Regression	3	1.02202	0.34067	15.13	0.006
Residual Error	5	0.11260	0.02252		
Total	8	1.13461			

Source	DF	Seq.SS
C1	1	0.01144
C2	1	0.08074
C3	1	0.92984



Residual plot for surface roughness

Above table is showing regression for surface roughness which indicates 90.1% of variation in the rating observations. The adjusted R is 84.1%, which is a decrease of 6.0 %. R2 value indicates that the degree of closeness of variable with best fit line and parameters are closely co related with each other. From ANOVA Table it is clear that feed rate is most significant parameter for surface roughness. Above graphs shows the residual plot of regression for surface roughness

V. CONCLUSSION

The effect of cutting parameters such as cutting speed, depth of cut and feed rate on machining variables is evaluated. The testing result showed that the developed method was successful. Based on the current study, the following conclusions can be drawn:

- ✓ S-20 damper absorbed 37.5% of tangential acceleration
- ✓ As S-20 damper having good damping capacity to which it shows less vibration and good surface finish.
- ✓ Passive damping can provide substantial performance benefits in many kinds of structures and machines, often without significant weight or cost penalties. In all aspects of the studies performed, a significant reduction in tool vibration during machining was achieved for a CNC machining operations.
- ✓ Cutting speed, depth of cut and feed rate are closely correlated to axial acceleration and surface roughness.

VI.REFERENCES

[1]. B. Bhattacharyya, M. Malapati, J. Munda, A. Sarkar ;"Influence of tool vibration on machining performance in electrochemical micro-machining of copper"; International Journal of Machine Tools & Manufacture 47 (2007) 335–342.

[2]. S.Thamizhmanii, Hasan S. " Analyses of roughness, forces and wears in turning gray cast iron";Journal of achievement in Materials and Manufacturing Engineering, 17, 2006 pp 258-265.

[3]. Palanikumar, Karunamoorthy. Krathikeyan R., "Assessment of factors influencing surface roughness on the machining of glass reinforced polymer composites"; Journal of Materials and Design, 27 (2006) 862-871.

[4]. Choudhury S. K.(a), Sharath M.S.(b), "On-line control of machine tool vibration during turning operation"; journal of materials processing technology 47(1995) pp 251-259 .

[5]. Nalbant M., Gokkaya H., Sur G., "Application of Taguchi method in the optimization of cutting parameters for surface roughness in turning"; Materials and design 28(2007) 1379-1385.

[6]. I.Puertas Arbizu, C.J. Luis Pérez, "Surface roughness prediction by factorial design of experiments in turning processes"; Journal of Materials Processing Technology, 143-144 (2003)390-396.

[7]. A.K Ghani , Choudhury I.A, Husni, "Study of tool life, surface roughness and vibration in machining nodular cast iron with ceramic tool"; Journal of Materials Processing Technology, 127 (2002), pp.17–22.

[8]. Bonifacio M.E.R., Diniz A.E. " Correlating tool wear, tool life, surface roughness, and vibration in finish turning with coated carbide tools"; Wear 173 (1994) 137–144.

[9]. Thomas M.,Beauchamp Y. ,Youssef A.Y. , Masounave J. 1996," Effect of tool vibration during lathe dry turning process" , computers Ind. Eng. , vol. 31,No. 3/4,pp. 637-644,1996.

[10]. Safeen Y. Kassab, Younis K. Khoshnaw, "Effect of cutting tool vibration vibration onsurface roughness of work piece in dry turning operation", Eng. & Technology, Vol.25, No.7, 2007.pp 123-128.

[11]. M.Dogra, Sharma V. S., Dureja J.,"Effect of tool geometry variation on finish turning ", Journal of Engineering Science and Technology Review 4(1) (2011) pp 1-13.

[12]. Davim Paulo, Gaitonde V.N. , Karnik S.R. “Investigations into the effect of cutting condition on surface roughness in turning of free machining steel by ANN model”, Journal of materials processing technology 205(208) 16-23 .

[13]. J.P.Den hartog,Mechanical Vibration,McGraw- Book Co.,USA,1956

[14]. Fundamentals of Quality Control and Improvement, second edition, Amitava Mitra, PHI Learning Private Limited, New Delhi-110001, 2008, page (595 to 637).

[15]. TV300 Vibration Tester, User’s Manual (V090304), Beijing TIME High Technology Limited.

[16]. Al-Habaibeh A. and Gindy; “A new approach for systematic design of condition monitoring systems for milling operation”; Journal of Material Processing Technology, 2000, 107, pp.243-251.

[17]. A S Adnan, Sathyan Subbiah; “Experimental investigation of transverse vibration-assisted orthogonal cutting of AL-2024”; International Journal of Machine Tools & Manufacture; 2010, 50, pp. 294–302.

[18]. Y. Altintas and M.R. Khoshdarregi; “Contour error control of CNC machine tools with vibration avoidance”; CIRP Annals - Manufacturing Technology, 2012, 61, pp. 335–338.

[19]. S. S. Abuthakeer, P.V. Mohanram, G. Mohan Kumar; “Prediction and Contour of Cutting to Vibration in C Lathe with Anova and Ann”; International Journal of Lean Thinking, Volume 2, Issue 1, June 2011.pp 2526-2537.

[20]. B Chen, Xuefeng Chen, Bing Li, Zhengjia He, Hongrui Cao, GaigaiCai;“Reliability estimation for cutting tools based on logistic regression model using vibration signals”; Mechanical Systems and Signal Processing; 2011, 25, pp 2526-2537.

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Fast compressive Tracking of robust object with Kalman filter

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ABSTRACT

The primary point of the undertaking is to plan "Quick Compressive Following of the hearty item with Kalman algorithm". It is an exceptionally extreme undertaking to create powerful and effective appearance models for strong article following because of the different variables, for example, light change, posture variety, movement smear, and impediment. Existing following algorithms are typically overhaul models with specimens removed from reconnaissance late edges. Despite the fact that algorithms are effective however there are a few issues stay to be tended to. In any case, while these adaptable appearance models are data needy, there does not exist sufficient measure of data for online computations to learn toward the starting. Second, internet following algorithms regularly encounters the buoy issues. As an issue of readied toward oneself learning, misaligned cases are at risk to be incorporated and corrupt the appearance models. In this paper, we propose an essential yet practical and capable after count with an appearance model concentrated around contrivances expelled from a multi-scale picture idiosyncrasy space with data self-sufficient reason. We pack example pictures of the front line target and the establishment using the same lacking estimation system. The accompanying task is arranged as an issue gathering through a pure Bayes classifier with online upgrade in the pressed territory. A coarse-to-fine interest strategy is grasped to further diminish the computational versatile quality in the distinguished method. Powerful visual after is essential to track different hindered things. Kalman channel and shade information taking after figurings are completed uninhibitedly in most of the rhythmic movement research. The proposed strategy merges enlarged Kalman channel with past and shade information for emulating distinctive inquiries under high hindrance. The proposed method is overwhelming to establishment exhibiting framework. Object distinguishing proof is completed using spatio-common Gaussian mixture model After embodies two steps: to some degree blocked thing after and significantly obstructed article emulating. Taking after partially hindered articles, created Kalman channel is ill-used with past information of thing, however for significantly blocked article emulating, color information and size attributes are used. The structure was attempted in certifiable application and successful results were gotten.

Keywords: Visual Tracking, Random Projection, Compressive Sensing Introduction

I. INTRODUCTION

Object tracking is a huge undertaking in the territory of machine vision. The improvement of super-capable machines, the accessibility of high definition cams at low expenses, and the perpetually expanding interest for

programmed feature investigation in applications like feature surveillance, activity checking, and HMIs has created a lot of enthusiasm toward article following calculations. In its least difficult structure, following can be expressed as the issue of assessing the trajectory of an article in the picture plane as it moves around a scene. In this we are going to study what is Article following? What is Compressive sensing? Furthermore, what is quick compressive tracking?

A. Object Tracking

Article following is the methodology of imitating the position and status of an item. Visual following structures have served well in the field of peculiarity surveillance, militarily heading, robot course, synthetic mental aptitude and restorative applications in the midst of the latest two decades. The vital need for any vision based following system is its quality to the variability in the visual data presentation by dynamic. A following estimation appropriates unsurprising imprints to the took after articles in different edges of a peculiarity. Some piece of techniques have been delivered for following of articles yet protest following remains a testing issue because of the appearance change brought on by stance, light, hindrance, and development. To make a following figuring successful, a convincing appearance model is crucial

B. Compressive Sensing

The compressive sensing (CS) theory exhibit that if the estimation of the contrivance space is sufficiently high, these tricks can be expected to an aimlessly picked low-dimensional space which contains enough information to change the first high-dimensional peculiarities. The dimensionality diminishing framework through subjective projection (RP) is data self-ruling, non-adaptable and information securing. C.Compressive Tracking
We use an incredibly small estimation grid that asymptotically satisfies the constrained isometric property (Tear) in compressive sensing speculation [18], in this way empowering gainful projection from the picture characteristic space to a low-dimensional layered subspace. For following, the positive and negative examples are foreseen (i.e., stuffed) with the same insufficient estimation lattice and isolated by a fundamental unsophisticated Bayes classifier adapted on the web. The proposed compressive following count runs at nonstop and performs emphatically against condition of-the-craftsmanship trackers on troublesome game plans with respect to viability, accuracy and life. The central parts of the proposed compressive following figuring are demonstrated in above figure.
D. Kalman Algorithm &it's use Following instates with concentrating items. Customarily executed establishment showing techniques could simply perform well until there is an uniform development i.e. cam jittering or a non-uniform development, for instance, flag undulating, water undulating and influencing tree augmentations. Accordingly, we oblige a solid methodology which is dynamic and resistant to uniform or non-uniform development outside of anyone's ability to see. The technique should use common and spatio-short lived relations. Such framework spatio-transitory Gaussian mixture model (STGMM) is presented which is used as a piece of our work. After extraction, a nonlinear channel can help to keep the careful track of the articles. Thusly, opened up Kalman channel (EKF) is used to foresee and redesign the state of the article. In this work, a novel methodology for following blocked articles is shown, which tracks different protests viably paying little mind to the way that the establishment exhibiting is exchanged off at some minute. In particular, STGMM is

associated with concentrate closer see. The proposed STGMM rejects the shadow and commotion from the scene. Plus, to predict the state of nonlinear articles EKF is abused. The general execution of the following system can be fortified using EKF if the item is not evacuated in one or more edges. Predominating shade information extraction of every one article is completed in third step and utilized under overwhelmed condition i.e. obstacle of captivated protest by distinctive articles. At last, the qualities of items i.e. its track, shade, time of appearance and leaving the scene and item kind are thought and set away specifically data records for every one article, which can later empower asking a particular item with certain color and article kind from the surveillance feature.

Before submitting your final paper, check that the format conforms to this template. Specifically, check the appearance of the title and author block, the appearance of section headings, document margins, column width, column spacing and other features.

The organization of this document is as follows. In Section 2 (Methods and Material), I'll give detail of any modifications to equipment or equipment constructed specifically for the study and, if pertinent, provide illustrations of the modifications. In Section 3 (Result and Discussion), present your research findings and your analysis of those findings. Discussed in Section 4(Conclusion) a conclusion is the last part of something, its end or result.

II. LITURATURE SURVEY

Generative and discriminative routines are two noteworthy classes utilized as a part of current tracking strategies. The generative models plan the tracking issue as an issue for the areas with the most elevated probability. To address the target appearance changes in an element environment, they proposed to continue redesigning the target appearance display incrementally to adjust it to appearance changes. Discriminative calculations represent the tracking issue as an issue order assignment with nearby inquiry and focus the choice limit for differentiating the target object from the foundation. Reference formats focused around shade histogram, necessary histogram have been utilized for tracking. As of late, meager representation has been utilized as a part of the `1-tracker where an object is displayed by an inadequate direct mix of target and inconsequential formats.Dark et al. [2] take in a logged off subspace model to speak to the object of enthusiasm for tracking. Reference layouts focused around color histogram [11], [12], basic histogram [5] have been utilized for tracking. In [3] Jepson et al. present a Gaussian mixture model with an online desire boost calculation to handle object appearance varieties amid tracking. Kwon et al. [9] join numerous perception and movement models in an adjusted molecule separating system to handle extensive appearance and movement variety. Avidan [4] augments the optical stream approach with a help vector machine classifier for object tracking. In [6] Grabner et al. propose a web boosting calculation to choose characteristics for tracking. Nonetheless, these trackers [4]–[6] utilize one positive example (i.e., the current tracker area) and a couple of negative specimens when redesigning the classifier. As the appearance model is overhauled with loud and conceivably misaligned cases, this frequently prompts the tracking float issue. A semi-regulated learning methodology [12] is produced in which positive and negative specimens are chosen through an online classifier with structural obligations. In [13], Hare et al. utilize an online organized yield help vector machine (SVM) for robust tracking which can

alleviate the impact of wrong naming examples. As of late, Henrique's et al. [8] present a quick tracking calculation which abuses the circulate structure of the part lattice in SVM classifier that can be effectively figured by the quick Fourier change calculation. M.-H. Yang and J. Ho proposed [7] a Visual tracking strategy to gauge the spatial condition of a moving focus through watched arrangements. They tended to the accompanying issues dynamic appearance changes because of light, pivot, and scaling 3d posture varieties and data misfortune because of the projection from 3d to 2d partial and full object impediments complex foundation mess similar objects from the same class which prompted milestone ambiguities. C. Shen, J. Kim, and H. Wang [10] proposed Kernel-based mean movement (MS) trackers have ended up being a making a guarantee to alternative to stochastic molecule sifting trackers. In spite of its prevalence, MS trackers have two crucial downsides:(1) The layout model must be constructed from a solitary picture; (2) It is hard to adaptively redesign the format model. In this work we sum up the plain MS trackers and endeavor to beat these two confinements. It is well realized that displaying and keeping up a representation of a target object is a vital segment of a fruitful visual tracker. Notwithstanding, little work has been carried out on building a robust format model for bit based MS tracking. As opposed to building a format from a solitary casing, they prepare a vigorous object representation model from a lot of information. Tracking is seen as an issue order issue, and a discriminative grouping guideline is figured out how to recognize the object and foundation. They embrace a help vector machine (SVM) for preparing. The tracker is then executed by amplifying the arrangement score. An iterative improvement conspire very much alike to MS is inferred for this reason. Contrasted and the plain MS tracker, it is presently much simpler to join on-line layout adjustment to adapt to characteristic changes amid the course of tracking. To this end, a sophisticated on-line help vector machine is utilized. We demonstrate effective localization and tracking on various datasets. They have proposed a novel approach to portion based visual tracking, which performs better than conventional single-view piece trackers. Instead of minimizing the thickness, distance between the candidate district and the template, the generalized MS tracker meets expectations by maximizing the SVM classification score. Experiments on localization and tracking demonstrate its productivity and heartiness. Thusly, they demonstrate the association between standard MS tracking and SVM based tracking. The proposed method provides a generalized framework to the previous methods.

III. PROBLEM STATEMENT

Tracking of various kinds of object has been addressed in various works. The central challenge is to determine the location of a target object as it moves through a camera's field of view. This is normally done by matching numerous districts or features in successive frames of a video stream. This issue of feature matching is called the temporal correspondence issue. A very sparse measurement matrix that asymptotically has to be satisfied the confined isometry property (Tear) in compressive sensing theory, thereby facilitating effective projection from the image feature space to a low-dimensional packed subspace.

A novel approach for robust object tracking, track more than three blocked objects using dominant shade histogram. Moreover, the chose shades are based on the given distance measure which is also powerful to illumination change. A different object tracking algorithm which helps in both observation modeling and tracking strategy level. For the observation modeling, the progressive observation model is introduced and

dual-mode two-way Bayesian is utilized for tracking strategy. The weighting factors in the proposed algorithm are color, size and movement signal. They not just locate dominant playfield district using dominant color additionally divided the playfield contour. Thus, these prompts help to choose during and after the impediment.

IV. OBJECTIVES

in this exploration, our point is to track the moving objects inside a feature and name them. We will likewise right the officeholder passes in tracking technique utilizing Kalman channel.Our study is motivated by challenges and aims to find answers for a vigorous framework for object tracking.

- Our study is persuaded by difficulties and plans to discover answers for a lively structure for object tracking.
- The future degree of this structure incorporate that the object tracking system should be produced in live feature surveillance.

V. METHODOLOGY

A. Image Representation

To record for huge scale change of object appearance, a multi-scale picture representation is regularly confined by convolving the info picture with a Gaussian channel of different spatial fluctuations.

B. Analysis of compressive features

Relationship to the Haar-like features

As demonstrated in Figure, every part in the low-dimensional peculiarity is a direct blend of spatially appropriated rectangle characteristics at unique scales. Since the coefficients in the estimation lattice can be sure or negative (through (7)), the compressive gimmicks enlist the relative power differentiate in a manner like the summed up Haar-like peculiarities (See Figure 2).

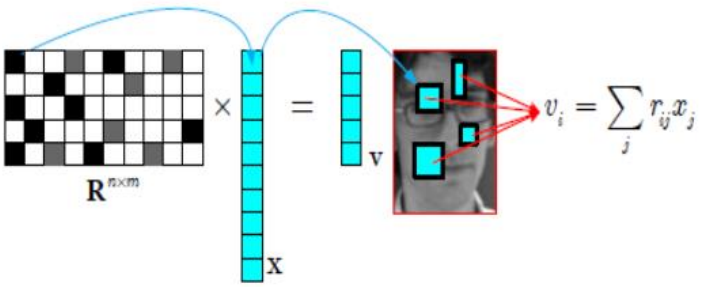

Fig. 2: Graphical representation of compressing a high-dimensional vector x to a low-dimensional vector v.

In the grid R, dull, ash and white rectangles address negative, positive, and zero passageways, separately. The blue shafts represent that one of nonzero passages of one line of R sensing a part in x is equal to a rectangular channel convolving the power at a settled position of a data picture.

C. Scale invariant property

It is not difficult to exhibit that the low-dimensional gimmick v is scale invariant. As demonstrated in Figure 2, each one peculiarity in v is a direct blend of some rectangle channels convolving the data picture at different positions. Thusly, without loss of sweeping statement, we simply need to show that the jth rectangle characteristic x j in the ith characteristic vi in v is scale invariant.

D. Classifier construction and update

We accept all segments in v are autonomously appropriated and model them with an innocent Bayes classifier. Diaconis and Freedman show that irregular projections of high dimensional arbitrary vectors are quite often Gaussian.

E. Fast compressive tracking

The before said classifier is used for nearby hunt. To decrease the computational unpredictability, a coarse-to-fine sliding window seek methodology is embraced (See Figure 3).

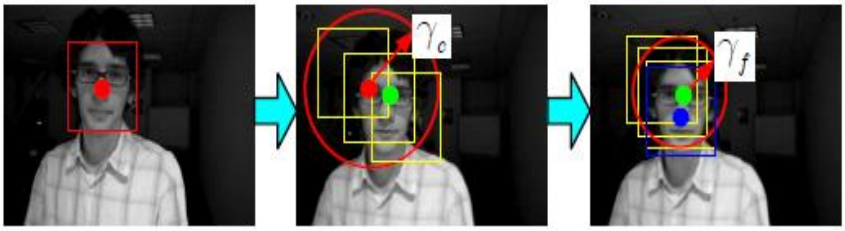

Fig. 3: Coarse-to-fine search for new object location.

F. Kalman filter

In tracking structures two issues must be considered: forecast and modification.

Predict issue: envision the area of an object being followed in the following casing that is perceive a region in which the likelihood of discovering object is high. Cure issue: perceive the object in the following casing inside assigned locale. A remarkable response for expectation is Kalman channel, a recursive estimator of condition of an element system. To expect the pursuit locale more successfully, quick compressive tracking was consolidated with Kalman channel in this examination.

VI. PROPOSED METHOD

The proposed strategy followed diverse objects in a scene utilizing EKF and when they were blocked, shade data was used to settle on objects. As the shade data was coordinated to Kalman sifting, the proposed strategy could gainfully track different objects under high obstacle. Fig. 1 exhibits the flowchart of the proposed technique. The proposed strategy embodies four steps; foundation displaying, developed Kalman separating, overwhelming shade extraction lastly putting away the followed data. Complete delineation of these steps takes after

a. Background Modeling

In this step, we survey the STGMM proposed by Soh et al. [3]. The proposed technique considers fleeting conduct and spatial relations. Point by point clarification of the proposed STGMM can be surveyed in [10].

b. Extended Kalman Filtering with Past Information

For tracking, we embrace EKF over direct Kalman separating on the grounds that the lion's share of the times the state variables and estimations are not straight blend of state variables, inputs to the structure and upheaval. The key variables used as a piece of EKF were state gauge (xˆk) and estimation (zk) whose connection can be outlined in Fig. 2. As, this is the development exploration of our past work so exhaustive clarification of EKF can be seen in [10].

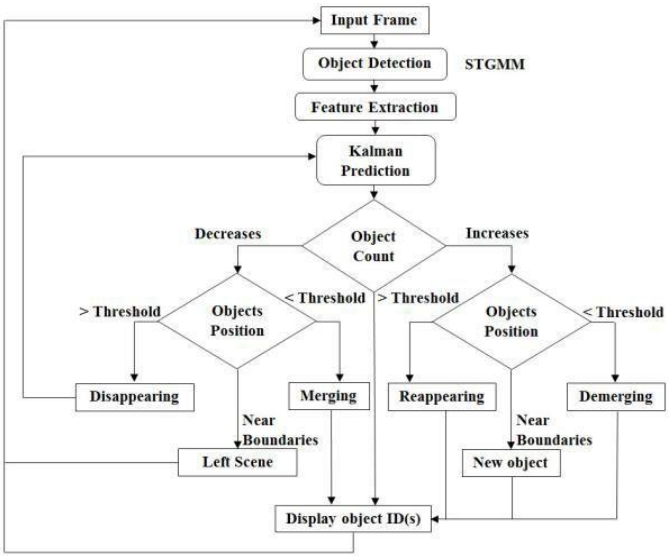

Fig. 5. The flowchart of proposed method.

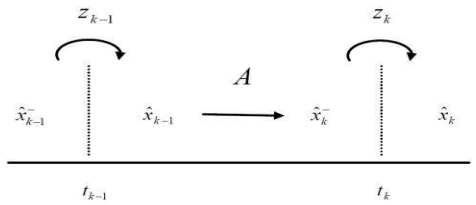

Fig. 5. Estimation and prediction in KF/EKF.

c. The proposed Algorithms in pseudo code.

Algorithm 1

For Each Image

For Each Closer view

Find Most Incessant Color Dominant Shade = Continuous Shade

End of For circle End of For circle For Each Object X

In the event that New Dominant Shade (after demerging) = Previous Dominant Color (before merging)

Same Object X End If

Else
New Object Y End Else
End of For circle

Algorithm 2 Merging & Disappearing
For Each Object X
On the off chance that ((Object Counter in Frame J-1 > Object Counter in Frame J)
&& (No New Object Appears Near Boundaries))
On the off chance that (Object Estimate in Frame J – Object Measure in Frame J-1 > Edge)
Store ID and Dominant Shade in United Array
End If End If Else
Blob Disappears Store Focus point, Dominant Shade in Past Object Array
End Else
End of For circle

Algorithm 3 Demerging & Reappearing
For Each Object X
In the event that ((Object Counter in Frame J-1 < Object Counter in Frame J)
&& (No New Object Appears Near Boundaries))
On the off chance that (Object Estimate in Frame J – Object Measure in Frame J-1 < Limit)
Find Dominant Color of Object
On the off chance that New Dominant Shade (after demerging) = Previous Dominant Color (before merging)
Same Object X End If
End If End If Else Compare the Position to Past Object Array Same Object X
End Else End of For circle

VII. CONCLUSION

We propose a direct yet solid tracking algorithm with an appearance model focused around non-versatile arbitrary projections that protect the structure of unique picture space. An exceptionally inadequate estimation grid is received to beneficially clasp characteristics from the frontal range targets and foundation ones. The tracking assignment is defined as a twofold characterization issue with online upgrade in the pressed area. Different tries different things with condition of the-workmanship algorithms on difficult plans exhibit that the proposed algorithm performs well in regards to exactness, healthiness

VIII. REFERENCES

[1]. K. Zhang, L. Zhang, and M.-H. Yang, “Real-time compressive tracking,” in Proceedings of European Conference on Computer Vision, pp. 864– 877, 2012.

[2]. M. Black and A. Jepson, "Eigentracking: Robust matching and tracking of articulated objects using a view-based representation," International Journal of Computer Vision, vol. 26, no. 1, pp. 63–84, 1998.

[3]. A. Jepson, D. Fleet, and T. El-Maraghi, "Robust online appearance models for visual tracking," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 25, no. 10, pp. 1296–1311, 2003.

[4]. S. Avidan, "Support vector tracking," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 26, no. 8, pp. 1064–1072, 2004.

[5]. R. Collins, Y. Liu, and M. Leordeanu, "Online selection of discriminative tracking features," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 27, no. 10, pp. 1631–1643, 2005.

[6]. H. Grabner, M. Grabner, and H. Bischof, "Real-time tracking via online boosting," in Proceedings of British Machine Vision Conference, pp. 47–56, 2006.

[7]. D. Ross, J. Lim, R. Lin, and M.-H. Yang, "Incremental learning for robust visual tracking," International Journal of Computer Vision, vol. 77, no. 1, pp. 125 141, 2008.

[8]. H. Grabner, C. Leistner, and H. Bischof, "Semi-supervised on-line boosting for robust tracking," in Proceedings of European Conference on Computer Vision, pp. 234–247, 2008.

[9]. J. Kwon and K. Lee, "Visual tracking decomposition.," in Proceedings of IEEE Conference on Computer Vision and Pattern Recognition, pp. 1269–1276, 2010.

[10]. B. Babenko, M.-H. Yang, and S. Belongie, "Robust object tracking with online multiple instance learning," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 33, no. 8, pp. 1619–1632, 2011.

[11]. Malik M. Khan, Tayyab W. Awan, Intaek Kim, and Youngsung Soh," Tracking Occluded Objects Using Kalman Filter and Color Information" International Journal of Computer Theory and Engineering, Vol. 6, No. 5, October 2014.

[12]. X. Mei and H. Ling, "Robust visual tracking and vehicle classification via sparse representation," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 33, no. 11, pp. 2259–2272, 2011.

[13]. S. Hare, A. Saffari, and P. Torr, "Struck: Structured output tracking with kernels," in Proceedings of the IEEE International Conference on Computer Vision, pp. 263–270, 2011.

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Explore Procedure Mining Facet for Queries

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ABSTRACT

Web search queries are often ambiguous or multi-faceted, which makes a simple ranked list of results inadequate. To assist information finding for such faceted queries, we explore a technique that explicitly represents interesting facets of a query using groups of semantically related terms extracted from search results. As an example, for the query baggage allowance", these groups might be different air-lines, different flight types (domestic, international), or different travel classes (rst, business, economy). We name these groups query facets and the terms in these groups facet terms. We develop a supervised approach based on a graphical model to recognize query facets from the noisy candidates found. The graphical model learns how likely a candidate term is to be a facet term as well as how likely two terms are to be grouped together in a query facet, and captures the dependencies between the two factors. We propose two algorithms for approximate inference on the graphical model since exact inference is intractable. Our evaluation combines recall and precision of the facet terms with the grouping quality. Experimental results on a sample of web queries show that the supervised method significantly outperforms existing approaches, which are mostly unsupervised, suggesting that query facet extraction can be e effectively learned.

Keywords: Query facet, faceted search, summarization, user intent.

I. INTRODUCTION

Current information retrieval systems, including Web search engines, have a standard interface consisting of a single input box that accepts keywords. The keywords submitted by the user are matched against the collection index to find the documents that contain those keywords, which are then sorted by various methods. When a user query contains multiple topic-specific keywords that accurately describe his information need, the system is likely to return good matches; however, given that user queries are usually short and that the natural language is inherently ambiguous, this simple retrieval model is in general prone to errors and omissions.

Query facets provide interesting and useful knowledge about a query and thus can be used to improve search experiences in many ways. First, we can display query facets together with the original search results in an appropriate way. Thus, users can understand some important aspects of a query without browsing tens of pages. For example, a user could learn different brands and categories of watches. We can also implement a faceted search based on the mined query facets. User can clarify their specific intent by selecting facet items. Then

search results could be restricted to the documents that are relevant to the items. A user could drill down to women's watches if he is looking for a gift for his wife. These multiple groups of query facets are in particular useful for vague or ambiguous queries, such as "apple". We could show the products of Apple Inc. in one facet and different types of the fruit apple in another. Second, query facets may provide direct information or instant answers that users are seeking. For example, for the query "lost season 5", all episode titles are shown in one facet and main actors are shown in another. In this case, displaying query facets could save browsing time. Third, query facets may also be used to improve the diversity of the ten blue links. We can re-rank search results to avoid showing the pages that are near-duplicated in query facets at the top. Query facets also contain structured knowledge covered by the query, and thus they can be used in other fields besides traditional web search, such as semantic search or entity search.

We observe that important pieces of information about a query are usually presented in list styles and repeated many times among top retrieved documents. Thus we propose aggregating frequent lists within the top search results to mine query dimensions and implement a system called QDMiner. More specifically, QDMiner extracts lists from free text, HTML tags, and repeat regions contained in top search results, and groups them into clusters based on the items they contain. Compared to previous works on building facet hierarchies, our approach is unique in two aspects:

(1) Open domain: we do not restrict queries in a specific domain, like products, people etc. Our proposed approach is generic and does not rely on any specific domain knowledge. Thus it can deal with open-domain queries.

(2) Query dependent: instead of a same pre-defined schema for all queries, we extract dimensions from the top retrieved documents for each query. As a result, different queries may have different dimensions. For example, although "lost" and "lost season 5" are both TV program related queries, their mined dimensions are different. As the problem of finding query dimension is new, we cannot find publicly available evaluation datasets. Therefore, we create two datasets, namely UserQ, containing 89 queries that are submitted by QDMiner users, and RandQ, containing 105 randomly sampled queries from logs of a commercial search engine, to evaluate mined dimensions. We use some existing metrics, such as purity and normalized mutual information (NMI), to evaluate clustering quality, and use NDCG to evaluate ranking effectiveness of dimensions. We further propose two metrics to evaluate the integrated effectiveness of clustering and ranking. Experimental results show that quality of query facets mined by QDMiner is good. We find that quality of query facets is affected by the quality and the quantity of search results. Using more results can generate better facets at the beginning, whereas the improvement of using more results ranked lower than 50 becomes subtle. We find that the Context Similarity Model outperforms the Unique Website Model, which means that we could further improve quality of query facets by considering context similarity of the lists during ranking the facets and items.

II. RELATED WORK

In last some years, there is research and progress happened on this topic Search Recommendation With Mining Query Facets.

ZhichengDou[1] propose a systematic solution, which we refer to as QD Miner, to automatically mine query facets by aggregating frequent lists from free text, HTML tags, and repeat regions within top search results. We create two human annotated data sets and apply existing metrics and two new combined metrics to evaluate the quality of query facets. Experimental results show that useful query facets are mined by the approach. We further analyze the problem of duplicated lists, and find that facets can be improved by modeling fine-grained similarities between lists within a facet by comparing their similarities.

FengZhao[2] propose an effective harvesting framework for deep-web interfaces, namely Smart- Crawler. We have shown that our approach achieves both wide coverage for deep web interfaces and maintains highly efficient crawling. Smart Crawler is a focused crawler consisting of two stages: efficient site locating and balanced in-site exploring. Smart Crawler performs site-based locating by reversely searching the known deep web sites for center pages, which can effectively and many data sources for sparse domains. By ranking collected sites and by focusing the crawling on a topic, Smart Crawler achieves more accurate results. The in-site exploring stage uses adaptive link-ranking to search within a site; and we design a link tree for eliminating bias toward certain directories of a website for wider coverage of web directories.

LidanShou[3] presented a client-side privacy protection framework called UPS for personalized web search. UPS could potentially be adopted by any PWS that captures user profiles in a hierarchical taxonomy. The framework allowed users to specify customized privacy requirements via the hierarchical profiles. In addition, UPS also performed online generalization on user profiles to protect the personal privacy without compromising the search quality. They proposed two greedy algorithms, namely Greedy DP and Greedy IL, for the online generalization. Our experimental results revealed that UPS could achieve quality search results while preserving users customized privacy requirements. The results also confirmed the effectiveness and efficiency of our solution.

Anju G R1[4] as the primary methodology of discovering question features, can be enhanced in numerous angles. For instance, some semi administered bootstrapping list extraction calculations can be utilized to iteratively extricate more records from the top results. Particular site wrappers can likewise be utilized to concentrate top notch records from legitimate sites. Including these rundowns may enhance both precision and review of inquiry features. Grammatical feature data can be utilized to further check the homogeneity of records and enhance the nature of inquiry aspects. We will investigate these points to refine aspects later on. We will likewise research some other related themes to discovering inquiry aspects. Great portrayals of question aspects might be useful for clients to better comprehend the features. Automatically create significant depictions is an intriguing examination subject.

WeizeKong[5] to planned a original assessment metric for this task to association recollection and accuracy of facet relations through group superiority. Investigational out comes presented that the controlled technique meaningfully obtain able accomplishes additional invalid approaches.

Lizhen Liu[6] the outline of the planned technique is separated into three portions, Characteristic Expression, Semantic Illustrations and Grouping Subtopic Mining. In the first part, the connected requests of the issue are extracted from the request record and represent the demand through multi word expression. Previously, unique semantic illustrations and groupings are used to denote there request aspect expressions for characteristic the semantics of arguments as the identical with distinct forms or arguments with dissimilar senses.

Sha Hu [7] Adjust public of the art change procedures, and suggest three equivalent faceted replicas to expand investigation outcome screated on faceted subtopics. Similarly to conduct experimentations to establish that Faceted subtopics can support recover outcome variety. Near accessible that the mutual operator goals of a request can must additional multifaceted construction than a collection of arguments or expressions.

O.Ben-Yitzhak [8] paper defined two extensions to the simple faceted Architecture oration pattern. First extension improves flexible, energetic commercial talent combinations to the faceted request, allowing operators to improvement vision into their records that remains distant richer than objective meaningful the amounts of documents going to every facet.

R.Baeza-Yates[9] Users frequently modify a previous search query in hope of retrieving better results. These modifications are called query reformulations or query refinements. Existing research has studied how web search engines can propose reformulations, but has given less attention to how people perform query reformulations. In this paper, we aim to better understand how web searchers refine queries and form a theoretical foundation for query reformulation. We study users' reformulation strategies in the context of the AOL query logs. We create a taxonomy of query refinement strategies and build a high precision rule-based classifier to detect each type of reformulation. Effectiveness of reformulations is measured using user click behavior. Most reformulation strategies result in some benefit to the user. Certain strategies like add/remove words, word substitution, acronym expansion, and spelling correction are more likely to cause clicks, especially on higher ranked results. In contrast, users often click the same result as their previous query or select no results when forming acronyms and reordering words. Perhaps the most surprising finding is that some reformulations are better suited to helping users when the current results are already fruitful, while other reformulations are more effective when the results are lacking. Our findings inform the design of applications that can assist searchers; examples are described in this paper.

III. SYSTEM OVERVIEW

System architecture is a conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. Following web architecture (figure 1) intended to define and construct structure and methodology of Facet Mining framework. Structural part divide into tree major layer of web application presentation layer, Business layer and Data Access layer. In this client or user interact with system using web browser, post request to web server and web server handle/ process the user query through model and data access logic, write response to browser back. Methodologies are the process of analysing the principles or procedure for behavioral characterizing of discovering query aspect.

1. List and Context Extraction:

From each document in the search result set to extract a set of lists from the HTML content of based on three different type of patterns, namely free text patterns, HTML tag patterns, and repeat region patterns. For each extract list, we extract its container node together with the previous and next sibling of the container node as its context. We define that a container node of a list is the lowest common ancestor of the nodes containing the items in the list. List context will be used for calculating the degree of duplication between lists.

2. List Weighting:

Some of the extracted lists are not informative or even noisy. Some of them are extraction errors. The lists may be navigational links which are designed to help users navigate between web pages. They are not informative to the query. Several types of information are mixed together. Thus, to penalize these lists and rely more on better lists to generate good aspects. We find that a good list is usually supported by many websites and appear in many documents, partially or exactly. A good list contains items that are informative to the query.

3. List Clustering:

To group similar lists together to compose aspects. Two lists can be grouped together if they share enough items. To use the complete linkage distance to compute the distance between two clusters of lists. This means that two groups of lists can only be merged together when every two lists of them are similar enough. Thus, use a modified QT (Quality Threshold) clustering algorithm to group similar lists. QT is a clustering algorithm that groups data into high quality clusters. We use a modified QT (Quality Threshold) clustering algorithm to group similar lists. QT is a clustering algorithm that groups data into high quality clusters. Compared to other clustering algorithms, QT ensures quality byfinding large clusters whose diameters do not exceed a user-defined diameter threshold. This method prevents dissimilar data from being forced under the same cluster and ensures good quality of clusters. In QT, the number of clusters is not required to be specified.

4. Aspect Ranking:

After the candidate query facets are generated, to evaluate the importance of aspects and items, and rank them based on their importance. Based on our motivation that a good facet should frequently appear in the top results, a facet is more important if the lists are extracted from more unique content of search results. Here we emphasize unique content, because sometimes there are duplicated content and lists among the top search results.

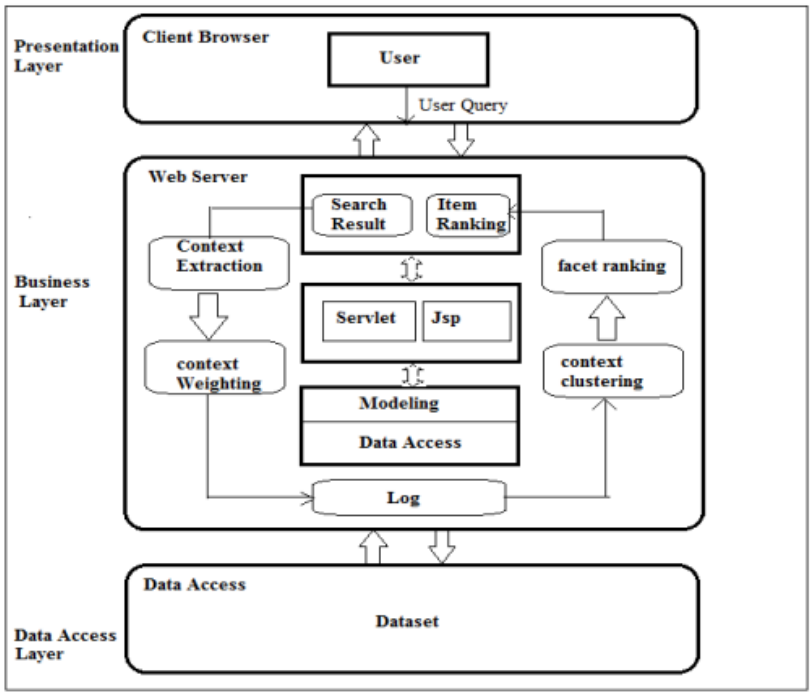

Fig. 1. System Architecture

IV. EXPERIMENTAL RESULTS

1. Precision:

In the field of information retrieval, precision is the fraction of retrieved documents that are relevant to the facets query: Precision takes all retrieved documents into account, but it can also be evaluated at a given cut-off rank, considering only the topmost results returned by the system. Precision is also used with recall, the percent of all relevant documents that is returned by the search. The two measures are sometimes used together in the F1 Score (or f-measure) to provide a single measurement for a system.

2. Recall:

Recall in information retrieval is the fraction of the documents that are relevant to the query that are successfully retrieved. For example for text search on a set of documents recall is the number of correct results divided by the number of results that should have been returned. In binary classification, recall is called sensitivity. So it can be looked at as the probability that a relevant document is retrieved by the query.

Fig. 2. Experiment Results

parameters	values
Avg Precision	1 units
Avg Recall	0.2 units

Table I
Result Table

V. CONCLUSION

We assume that the important aspects of a query are usually presented and repeated in the queries top retrieved documents in the style of lists, and query facets can be mined out by aggregating these significant lists. We propose a systematic solution, which we refer to as QDMiner, to automatically mine query facets by extracting and grouping frequent lists from free text, HTML tags, and repeat regions within top search results.

VI.REFERENCES

[1]. Zhicheng Dou, Member, IEEE, Zhengbao Jiang, Sha Hu, Ji-RongWen, and Ruihua Song Automatically Mining Facets for Queries from Their Search Results.

[2]. O. Ben-Yitzhak, N. Golbandi, N. HarEl, R. Lempel, A. Neumann, S. Ofek-Koifman, D. Sheinwald, E. Shekita, B. Sznajder, and S. Yogev, Beyond basic faceted search, in Proc. Int. Conf. Web Search Data Mining, 2008, pp. 3344.

[3]. W.-K. Chen, Linear Networks and Systems (Book style). Belmont, CA: Wadsworth, 1993, pp. 123135.

[4]. D. Dash, J. Rao, N. Megiddo, A. Ailamaki, and G. Lohman, Dynamic faceted search for discovery-driven analysis, in ACM Int. Conf. Inf. Knowl. Manage., pp. 312, 2008.

[5]. W. Kong and J. Allan, Extending faceted search to the general web, in Proc.ACMInt. Conf. Inf. Knowl. Manage., 2014, pp. 839848.

[6]. T. ChT. Cheng, X. Yan, and K. C.-C. Chang, Supporting entity search: A large-scale prototype search engine, in Proc. ACM SIGMOD Int. Conf. Manage. Data, 2007, pp. 11441146.eng, X. Yan, and K. C.- C. Chang, Supporting entity search: A large-scale prototype search engine, in Proc. ACM SIGMOD Int. Conf. Manage. Data, 2007, pp. 11441146. [7] K. Balog, E. Meij, and M. de Rijke, Entity search: Building bridges between two worlds, in Proc. 3rd Int. Semantic Search Workshop, 2010, pp. 9:19:5.

[7]. M. Bron, K. Balog, and M. de Rijke, Ranking related entities: Components and analyses, in Proc. ACM Int. Conf. Inf. Knowl. Manage., 2010, pp. 10791088.

[8]. C. Li, N. Yan, S. B. Roy, L. Lisham, and G. Das, Facetedpedia: Dynamic generation of query-dependent faceted interfaces for wikipedia, in Proc. 19th Int. Conf. World Wide Web, 2010, pp. 651660.

[9]. W. Dakka and P. G. Ipeirotis, Automatic extraction of useful facet hierarchies from text databases, in Proc. IEEE 24th Int. Conf. Data Eng., 2008, pp. 466475.

[10]. A. Herdagdelen, M. Ciaramita, D. Mahler, M. Holmqvist, K. Hall, S. Riezler, and E. Alfonseca, Generalized syntactic and semantic models of query reformulation, in Proc. 33rd Int. ACM SIGIR Conf. Res. Develop. Inf. retrieval, 2010, pp. 283290.

[11]. Mitra, A. Singhal, and C. Buckley, Improving automatic query expansion, in Proc. 21st Annu. Int. ACM SIGIR Conf. Res. Develop. Inf. Retrieval, 1998, pp. 206214.

[12]. P. Anick, Using terminological feedback for web search refinement: A log-based study, in Proc. 26th Annu. Int. ACM SIGIR Conf. Res. Develop. Inf. Retrieval, 2003, pp. 8895.

[13]. Riezler, Y. Liu, and A. Vasserman, Translating queries into snippets for improved query expansion, in Proc. 22nd Int. Conf. Comput. Ling., 2008, pp. 737744.

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Experimental Study of Thermal Management System for Battery Pack

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ABSTRACT

Increase in air pollution day by day has challenged the automotive, construction equipment and Genset industry which is fueled mainly with fossil fuel. This scenario force the automotive industry to go for alternate source which will be more environment friendly. Automotive industry transforming towards green energy solutions. One of the option among them is Electrical Vehicles (EVs) which is the most predominant which leads the automotive industry towards zero emissions and wheel-drive efficiency. Some limitations in Electrical vehicles are performance, cost, and lifespan & battery safety. To maximize the Electrical vehicle performance, thermal management of batteries become very critical. This paper describes the thermal management of battery with various cooling systems I.e. liquid cooling system, air cooling system, and direct refrigerant cooling system. It describes heat load requirement of battery at various ambient conditions and to optimize it. This paper describes the correlation between the various parameters to its thermal heat load. Battery thermal management system tested and validated for its performance in the laboratory.

Keywords: Electrical Vehicle, Thermal Management, Li-Ion Battery, Model Based Control, Thermal Control System.

I. INTRODUCTION

In order to protect the environment from the emissions coming out from conventional IC engines emissions need to find the alternate source of power and it will be Hybrid vehicles, fuel-cell vehicles or Electrical vehicle. In EV vehicles, Battery is the power source to move the wheels of vehicle with the motor. Main source of heat in battery is electro-chemical reaction and the motion of electron in Battery cell. Thermal management of Battery means to maintain the battery cells temperature within operating range of 20-50 °C with Maximum variation of +/-5. Battery pack temperature effect on Safety, performance and life span of the battery. Temperature uniformity is important within the number of cells with cooling performance. Non uniformity of temperature within cells causes degradation of Battery, thermal runway, uneven utilization of energy of the Battery. Traditional cooling with belt driven water pumps and compressors with fan can over-cooling or under-

cooling of Battery pack. Now a days thermal management of Battery pack done with the Electronic Control units, mechanical systems are upgraded to Actuators, sensors and variable speed fans, thermostats and servo motors. These smart devices will help to control the thermal system means able to control the coolant flow rate and temperature. Objective of study is to maintain the equal temperature within cells of Battery pack, provide stability to system, take out the high heat when battery temperature is high, and maintain the temperature when ambient temperature is low. Air-cooling require 2-3 times more energy than other methods to maintain the temperature by other method. This study important for maintaining the temperature of Battery pack within specified limits. In the study we are using the indirect cooling by different coolants one is regular water and ethylene glycol. Advantages of using Ethylene Glycol over water are Noncorrosive, dirt free and low freezing point of -10 ℃

II. THERMAL PARAMETERS OF BATTERY

1. Heat generation and its effects

Lithium-ion battery consist of positive electrode, negative electrode and electrolyte solution. During battery, charging electron moves from positive electrode to negative electrode means anode to cathode and during discharge of battery electron moves from cathode to anode.

1.1. Heat generated inside the Battery during charging and discharging due to electro chemical reaction. During charging change in entropy and resistive heating due to charging current. Heat generated in Battery during discharging without using cooling. Once heat generation and heat transfer rate we are able to calculate then we can use for the design of cooling system.

1.2. Mathematical Equations used for calculating the thermal parameters like temperature and heat load

$$Q = mCp\ \Delta T$$

$$Q = mCp\ (Tout - Tin)$$ Where

Q = Battery heat load

Cp = Specific heat capacity of coolant

m = Coolant flow rate

Tout = Coolant out let temperature

Tin = Coolant inlet temperature

1.3. Lithium-ion battery cell performance will be optimum in between the temperature range of 20-55 ℃. If it is operating above and below the range then there will be thermal impact on Battery performance and life.

2. Thermal Runway in Lithium-ion Battery

When Battery cell temperature cross, the certain temperature limits then series of undesirable reactions will going to start which will lead to further increase the temperature of the cells. Such chain type reaction will continue, it will going to raise the temperature more and more which lead to incident is called Thermal Runway.

As shown in Figer1, high amount of heat and gas produced during thermal Runway can lead to fire or explosion if chain reaction not managed properly. Due to number of reasons, Thermal Runway can occur overcharging, temperature, short circuit or nail penetration. Thermal Runway initiated at 80 °C when Solid electrolyte interface (SEI) decompose. SEI used as protection layer between the negative electrode and electrolyte solution. If SEI decompose/damaged then both of these will react with each other at 100 °C. This reaction is Exothermic and lead to increase the temperature further. At 130 °C separator between the Anode and Cathode melts down it causes short circuit. At 200 °C chain reaction may start first lithium metal oxide and then electrolyte will react with oxygen and decompose

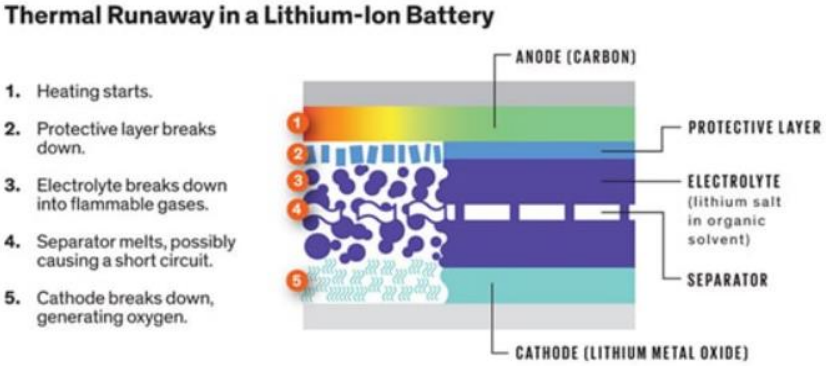

Figure 1: Thermal Runway

3. Battery Thermal Management System (BTMS)

As discussed above temperature having effect on Battery performance, life cycle and safety of the Battery. Therefore, BTMS is required for every battery-operated system/application. Primary requirement of BTMS is to maintain the temperature of battery pack within the defined range and maintain even temperature within the battery pack.

There are several ways to transfer heat from Battery cell as below Figure 2

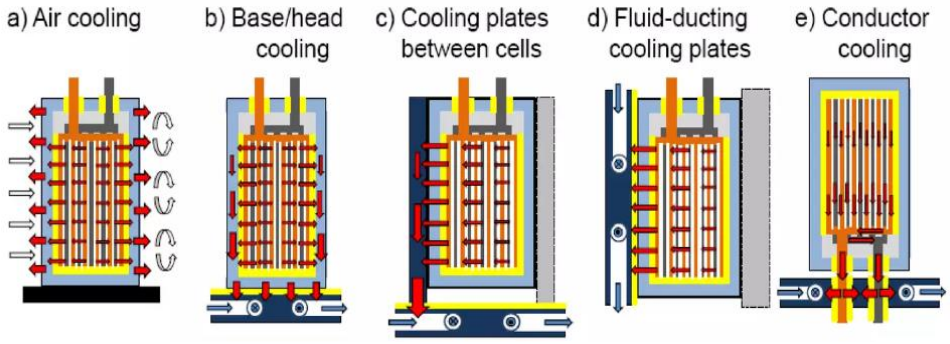

Figure 2 : Transferring heat from Battery

In this paper we are studying the Direct cooling method. Direct cooling covers the entire surface of the battery cells. Coolant used for direct cooling is dielectric, low viscosity having high thermal capacity and conductivity. In this study components used are:

Heat exchanger: In heat exchanger plates are arranged in such a way that the heat to be exchanged between two fluids. Refrigerants are used as cold side fluid and Coolants are used as hot side fluids.

Compressor: It operates according to the system requirements or operating cycle of application

Coolant Pump : Coolant pump is important component of the system ,it is in between the vehicle battery and Battery cooling system .It circulate the coolants through the Battery cooling channels/ jackets and heat exchanger to maintain the constant flow rate throughout the cooling circuit.

Hot water tank: In this experimentation, we are using hot water tank to simulate the Battery heat load

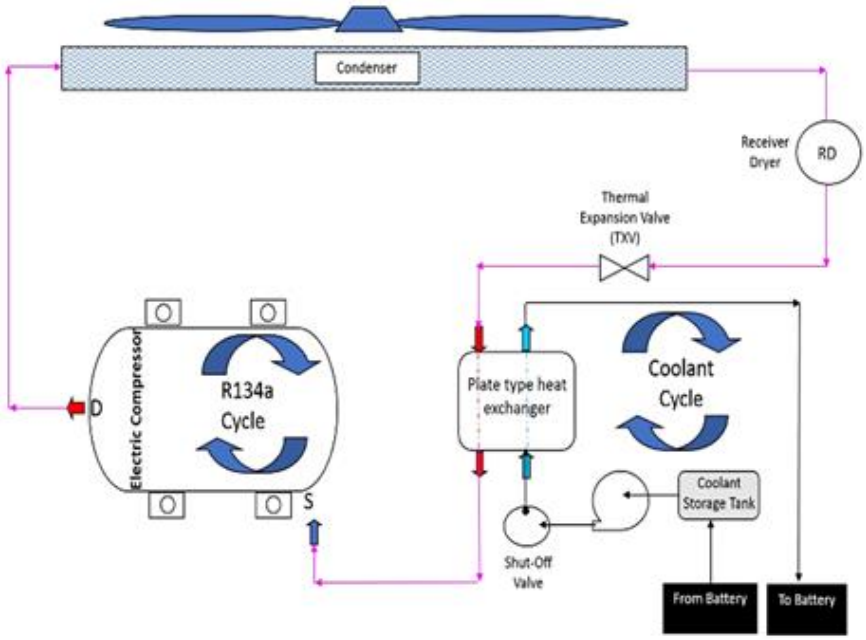

Figure 3: Layout diagram of Battery Thermal management system

In this experiments, heat generated in battery cells from Battery pack first transferred to cold plates which is largely connected with Battery, coolant flowing through the cold plates which carry large part of heat generated by Battery and Coolant pump, circulate the coolant through the cold plates and back to heat exchanger, it is controlled by feed-forward+ PID and feed stream means valve control and mass flow control. Here we had used only one type of heat exchanger, which carry heat only, but when different types of weather conditions are there then heating type (electrical coil) heat exchanger also required. Here we have used the various sensors like manifold temperature, pressure sensor, coolant flow sensors that sense the temperature of the coolant stream, which is going out and input for the pump, with the help of pressure a coolant flow sensors Pump can adjust the speed. Pump controller feed forward and PID able to maintain the temperature of the Battery pack.

Performance Criteria to evaluated with this experiment are

- Intake temperature to Battery pack: 22 +/-1 °C
- Power required for heat transfer: 4kW to 6kW
- Coolant down time: Minimization of cooling time
- Compressor speed: With minimum speed (rpm) of compressor should achieve the desired results

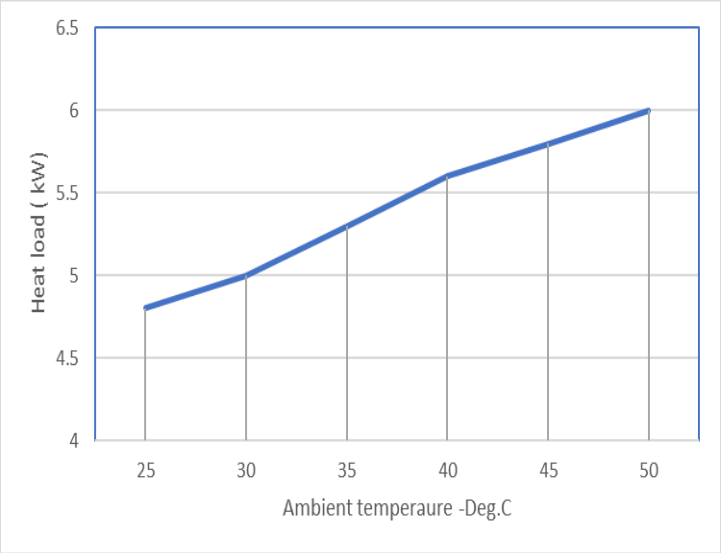

Figure 4: Battery heat load (kW) variation with ambient temperature (°C)

Above figure shows, the actual test results that if ambient temperature increases heat load also increases. More power is required to cool the Battery pack. Optimized Compressor speed to maintain the Battery temperature within the operating range of Battery pack with respect to time taken for cooling

COOLANT FLOW

Flow of the Coolant to be set in such a way that it should carry the maximum heat from the cells of Battery pack and to maintain the minimum temperature difference between the coolants in and out.

Coolant mass flow calculation (V):

$$V = \frac{Q \ * \ Number\ of\ cells}{\rho \ * \ Cp \ * \nabla T}$$

Where

Q = Heat generated per cell

ρ = Density

Cp = Heat capacity of coolant

∇T = Temperature difference between Coolant In & Out

TABLE 1: COOLANT FLOW CALCULATIONS FOR ETHYLENE GLYCOL IN EXPERIMENTS

Coolant flow calculations	
Heat Generated per cell (Q)	12W
Number of cells	4500
Density of Coolant	1030 kg/m^3
Heat Capacity (Cp)	3648 J/kg-K
Temperature difference between Coolant In and Out	5 °C
Result of Coolant Flow	**0.002874 kg/Sec =10.34 LPH**

III. RESULTS AND DISCUSSION

Experiments are performed with the setup mentioned above along with the instruments like temperature sensors, Coolant flow meters, compressor speed measurements. Some of the input parameters are kept constant while experimentation for Battery thermal management system.

CASE1

Test results at ambient temperature 40 °C with below mentioned fix parameters to find out the compressor speed variations

TABLE 2

Parameter	Measurement Value	Units
Ambient Temperature	40	°C
Coolant flow rate	10.34	LPH
Battery outlet temperature	26	°C

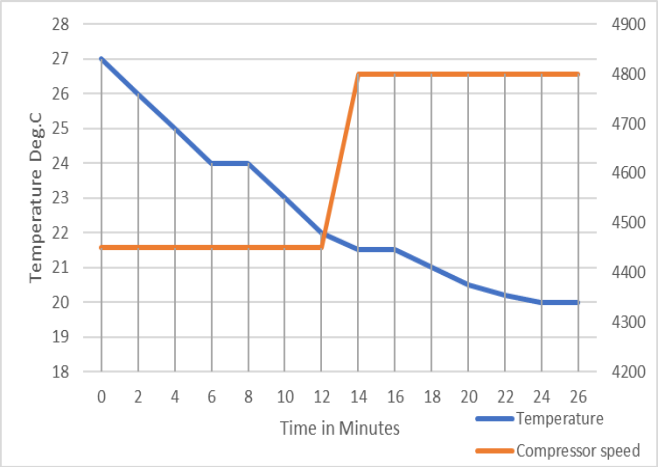

Figure 5: Variation of Battery inlet temperature and compressor speed at ambient temperature 40 °C

Above figure shows the testing results that Battery management system has meet the inlet temperature of 20 °C at the ambient temperature of 40 °C In this experiment Battery temperature comes out to be 27 °C at he compressor speed of 4800 rpm, corresponding cooling time of 24 Minutes

CASE2

Test results at ambient temperature 35 °C with below mentioned fix parameters to find out the compressor speed variations.

TABLE 3

Parameter	Measurement Value	Units
Ambient Temperature	35	°C
Coolant flow rate	10.34	LPH
Battery outlet temperature	26	°C

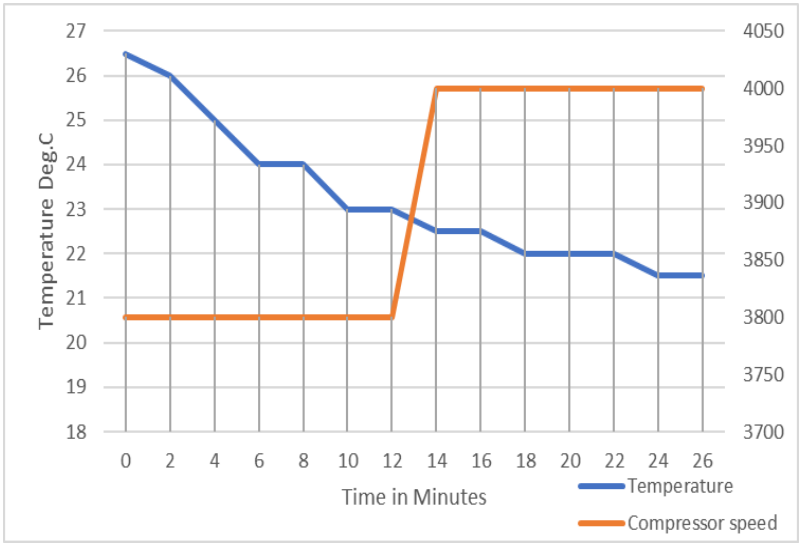

Figure 6 : Variation of Battery inlet temperature and compressor speed at ambient temperature 35 °C

Above figure shows the testing results that Battery management system has meet the inlet temperature of 20.5 °C at the ambient temperature of 35 °C In this experiment Battery temperature comes out to be 26.5 °C at the compressor speed of 4000 rpm, corresponding cooling time of 18 Minutes

CASE3

Test results at ambient temperature 25 Deg,C with below mentioned fix parameters to find out the compressor speed variations.

TABLE 4

Parameter	Measurement Value	Units
Ambient Temperature	25	°C
Coolant flow rate	10.34	LPH
Battery outlet temperature	26	°C

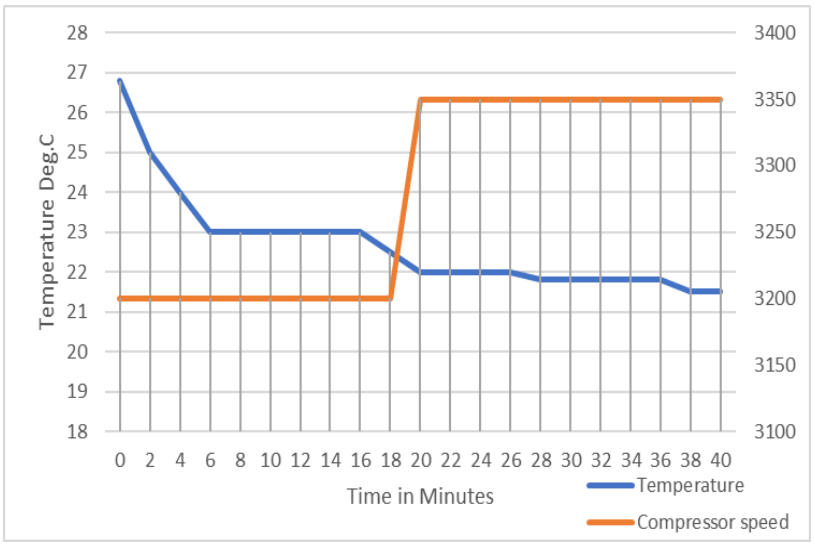

Figure 7: Variation of Battery inlet temperature and compressor speed at ambient temperature 25 °C

Above figure shows the testing results that Battery management system has meet the inlet temperature of 20.5 °C at the ambient temperature of 25 °C In this experiment Battery temperature comes out to be 26.8 °C at the compressor speed of 3350 rpm, corresponding cooling time of 36 minutes

IV. CONCLUSION

Experimental study of Battery thermal Management System was performed at various ambient conditions of Indian weather conditions of various cities. This system designed for Electric vehicle or Electric Bus. This experimental study conducted by considering the Battery heat load of 5 kW. In addition, some of the parameters like Coolant flow rate of 10.34 LPH and Battery outlet temperature of 26-27 °C are fixed. From this experimental study, it is verified that Battery Thermal Management system capable to maintain the Battery temperature to 22 +/- 1 °C at various ambient conditions. It is important to finalize the controller logic also optimized compressor speed. This experimental investigation performed on each case as mentioned above, optimized compressor speed are found. This experimental data completes the BTMS System Performance validation.

V. ACKNOWLDGEMENT

I would like to take this opportunity to thanks Prof. Dr. S.B. Jadhav for the technical know-how support and guidance along with **Prof. Amol N.Patil, Prof. A.nB. Gaikwad, Prof. R.N. Garad and Dr. F. B. Sayyad**, **for** support this project.

VI.REFERENCES

[1]. Deshmukh, V.M. and Durgam, S., "Numerical Study of Thermal Management of Lithium-Ion Battery Pack Using Liquid Cooling," SAE Technical Paper 2021-28-0118, 2021, doi: 10.4271/2021-28-0118.

[2]. Suman, S., Goel, A., and Kushwah, Y.S., "Design Optimization of Battery Thermal Management System for Electric Vehicles," SAE Technical Paper 2021-28-0123, 2021, doi:10.4271/2021-28-0123

[3]. Shukla, A., Arora, R., Goel, A., and Sharma, K., "A Detailed Review on Thermal Management System of Electric Vehicles," SAE Technical Paper 2021-28-0125, 2021, doi:10.4271/2021-28-0125

[4]. Talaei, B., Nahid, M., Shojaei, S., Ali, S. A. et al., "Model-Based Thermal Control Strategy for Electrified Vehicles," SAE Paper 2022-01-0203, 2022, doi:10.4271/2022-01-0203.

[5]. Singh, V.K. and Akshay, S.N., "Multi physics Approach for Thermal Design of Liquid Cooled EV Battery Pack", SAE Technical Paper SAE Technical Paper 2022-01-0209, 2022,

[6]. "A Manufacturer's Guide to EV Thermal Management & Sensor Technology"

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Real Time Health Monitoring System Based On IOT

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ABSTRACT

Internet of Things (IOT) is the emerging technology, which contains huge amount of smart object and smart devices connected to the internet for communicating with each other. In this project to analyze and compute the patient health we are using Arduino, which is the heart of this project. Arduino controls the output devices like buzzer, relay and GSM modem. These smart devices are used to collect temperature, blood pressure, sugar level, heartbeat, lung and respiration information etc. which are used to evaluate the health condition of the patient. The final results are displayed on the LCD display, on web server and also the results are sent to the user through SMS. As health care services are important part of our society, automating these services eases the measuring process. When threshold value is reached, the alarm system that consists of buzzer and LED alerts the doctors and he can act more quickly. The biometric information of the patient which is stored and published online can be given to scientists and researchers of medical fields to analyze the value and find patterns or for other research work.

Index Terms— Arduino, GSM Modem, GSM Module, Internet of Things, LCD Display,

I. INTRODUCTION

Today, the advanced universe of science and innovation, Transportation framework is an essential piece of living. Health is one of the global challenges for humanity. In the last decade the healthcare has drawn considerable amount of attention. The prime goal was to develop a reliable patient monitoring system so that the healthcare professionals can monitor the patients, who are either hospitalized or executing their normal daily life activities. Recently, the patient monitoring systems is one of the major advancements because of its improved technology. Currently, there is need for a modernized approach. In the traditional approach the healthcare professionals play the major role. They need to visit the patient's ward for necessary diagnosis and advising. There are two basic problems associated with this approach. Firstly, the healthcare professionals must be present on site of the patient all the time and secondly, the patient remains admitted in a hospital, bedside biomedical instruments, for a period of time. In order to solve these two problems, the patients are given knowledge and information about disease diagnosis and prevention. Secondly, a reliable and readily available patient monitoring system (PMS) is required. In order to improve the above condition, we can make use of technology in a smarter way. In recent years, health care sensors along with Arduino play a vital role. Wearable

sensors are in contact with the human body and monitor his or her physiological parameters. We can buy variety of sensors in the market today such as ECG sensors, temperature sensors, pulse monitors etc. The cost of the sensors varies according to their size, flexibility and accuracy.

The Arduino which is a cheap, flexible, fully customizable and programmable small microcontroller board brings the advantages of an embedded system to the domain of sensor network. In our system we are measuring patient's parameters (temperature, heart rate, and humidity level) with different available sensors. These sensors collected data i.e. biometric information is given to Arduino and then it is transferred to IOT server.

II. LITERATURE SURVEY

In traditional method, doctors play an important role in health check-up. For this process requires a lot of time for registration, appointment and then check-up. Also reports are generated later. Due to this lengthy process working people tend to ignore the check-ups or postpone it. This modern approach reduces time consumption in the process.

In rural hospitals, the facilities for health caring are limited. The poor quality of health management enables issues in health care system Everyone should get the knowledge of own health as easy and early as possible. Also it should be worth for each. Latest report of The India Spend analysis of data says that the 500,000 doctor's shortage in India. WHO defines the doctor patient ratio will be 1:1000 which has been failed in India.

In developing countries there is lack of resources and management to reach out the problems of individuals. A common man cannot afford the expensive and daily checkup for his health. For this purpose, various systems which give easy and assured caring unit has been developed. Theses system reduces time with safely handled equipment.

III. BLOCK DIAGRAM

In this project, Arduino is used for controlling the whole process with a **GSM module**. The Arduino is responsible for reading data from input devices like sensor.

Components used in this project are:

1) Arduino Uno
2) LCD Display
3) Buzzer
4) Relay
5) GSM Modem

Sensors used in our project:

1) Heartbeat sensor
2) Temperature sensor
3) Humidity sensor

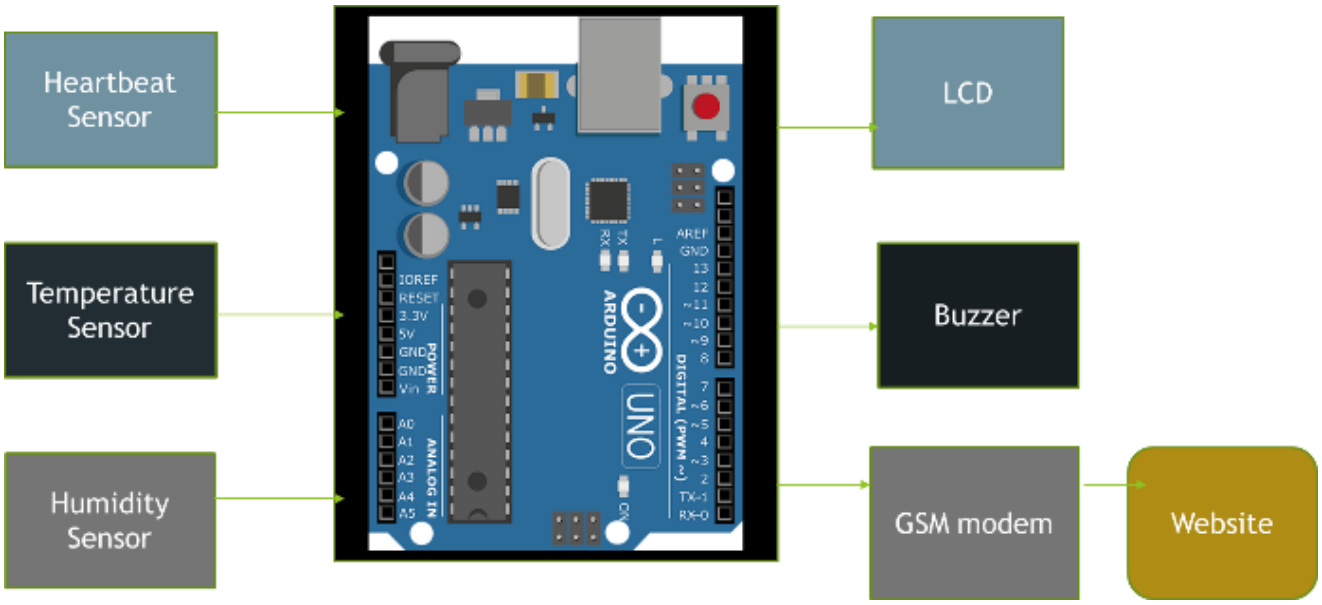
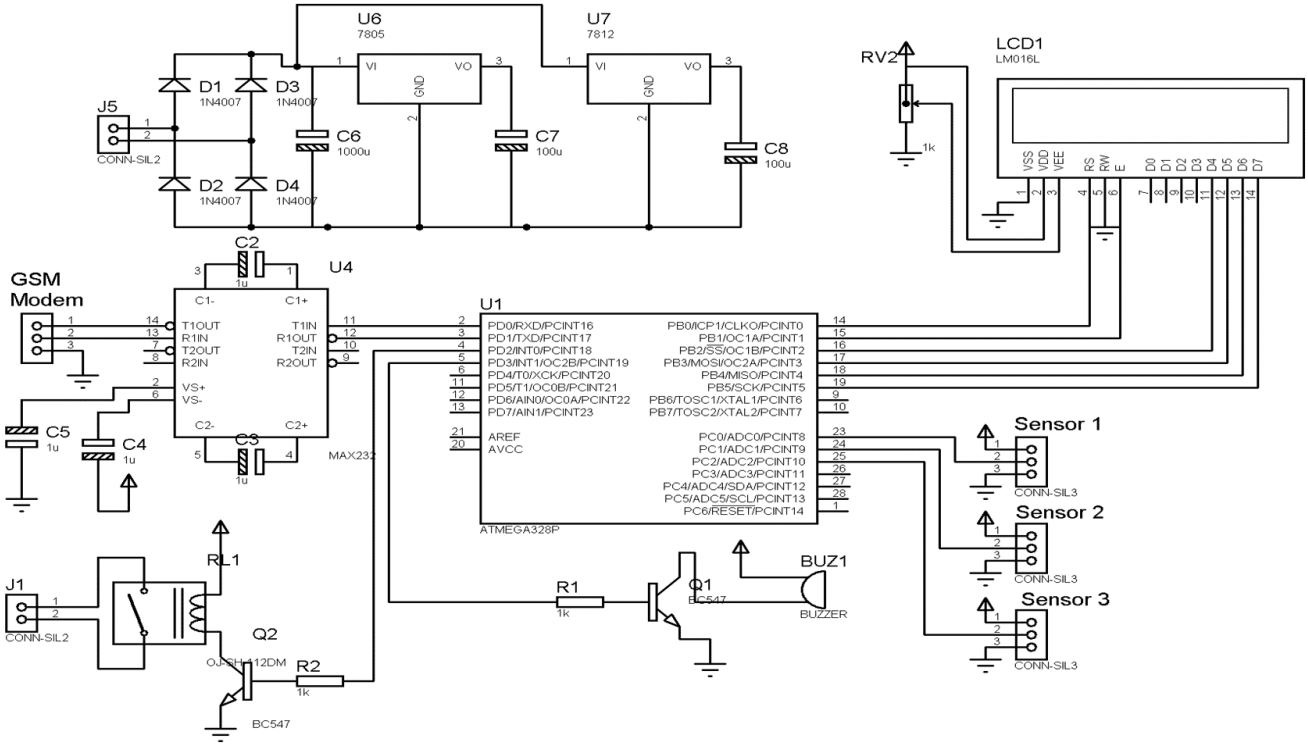


Fig 1 Block Diagram

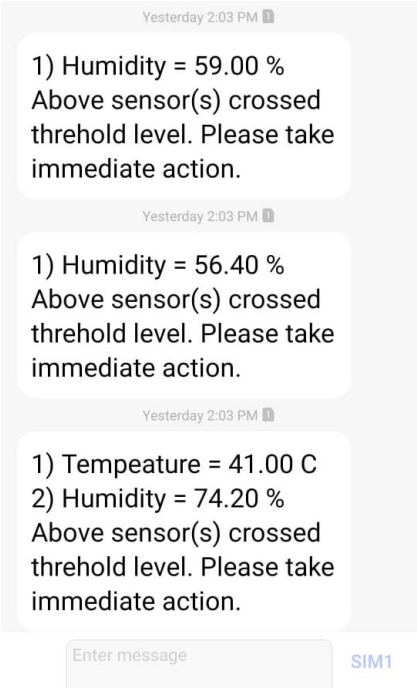
IV. HARDWARE IMPLEMENTATION



Circuit Description

In this project we have used 3 pin analog sensors.
Sensor 1 is temperature sensor,
Sensor 2 is humidity sensor
Sensor 3 is heartbeat sensor
LM 35 is used as Temperature sensor, SYHS220 is used as humidity sensor as pulse sensor is used as heartbeat sensor. All sensors give 0 to 5V analog output. Arduino has 6 analog input pins. Out of these, we have used 3 pins. Output pin of sensor 1 is connected to pin 23 of Arduino. Output pin of sensor 2 is connected to pin 24 of Arduino. Output pin of sensor 3 is connected to pin 25 of Arduino.
Here GSM Modem is used to send SMS and data to Arduino. We have allowed serial communication as transmission protocol. There is voltage level difference between GSM modem and Arduino i.e. 12V and 5V respectively. That is why we have used MAX 232 IC to make communication between GSM modem and Arduino. Pin 1 and 2 of GSM Modem is connected to pin 14 and 13 of MAX 232 IC respectively. Pin 11 and 12 of MAX 232 is directly connected to pin 2 and 3 of Arduino. MAX 232 has 4 capacitors each of 1 micro farade. MAX 232 generates voltage doubler circuit. We have used AT commands to interact with Arduino.
We have used 16x2 alpha numeric display it means that it can display alphabets, numbers as well as special symbols. On this display, we can display 2 lines with maximum of 16 characters in one line. The always write LCD not read. RS 1 pin is used for data and RS 0 pin is used for command. Data (a, b,c,d,#,@,1,2,etc). Commands (clear, cursor on, cursor off). There are 4 data pins used in LCD. We have used ASCII codes to display.
Relay and buzzer is having 12 V voltage level, so that we cannot connect replay and buzzer directly to Arduino. So that to connect buzzer and relay to Arduino, we have used BC547 transistors.

V. RESULT



VI. CONCLUSION

A] Conclusion

This project has built in us confidence that any problem can be solved with sheer determination, hard work and optimism. We feel that our product serves something good to this world and we like to present it before this prosperous world. By doing this project, we were better able to understand the various facets of doing an embedded system project which is emerging as one of the most 'in demand' technologies right now.

With the knowledge of new techniques in 'Electronics' we are able to make our life more comfortable. One such application of electronics is used in "IOT based Patient health monitoring system using Arduino" The approach we followed and which is explained in this project report is novel and has achieved the target of "IOT based Patient health monitoring system using Arduino" satisfying user needs and requirements

B] Future Scope

According to the availability of sensors or development in biomedical trend more parameter can be sensed and monitored which will drastically improve the efficiency of the wireless monitoring system in biomedical field. A graphical LCD can be used to display a graph of rate of change of health parameters over time. The whole health monitoring system which we have framed can be integrated into a small compact unit as small as a cell phone or a wrist watch. This will help the patients to easily carry this device with them wherever they go.

In addition, with medical application we can use our system in industrial and agricultural application by using sensors like humidity sensors, fertility check sensors, etc.

VII. REFERENCES

[1]. Ebrahim Al Alkeem1, Dina Shehada1, Chan Yeob Yeun1,M. Jamal Zemerly ,Jiankun Hu"New secure healthcare system using cloud of things", Springer Science+Business 2017.

[2]. Yena Kim, SeungSeob Lee and SuKyoung Lee "Coexistence of ZigBee-based WBAN and WiFi for Health Telemonitoring Systems"DOI 10.1109/JBHI.2014.2387867, IEEE

[3]. Journal of Biomedical and Health Informatics Mirza Mansoor Baig & Hamid Gholamhosseini "Smart Health Monitoring Systems: An Overview of Design and Modeling", Springer Science+Business Media New York 2013

[4]. S. M. Riazul islam, Daehan kwak, MD. Humaun kabir, Mahmud hossain, and Kyung-sup kwak," The Internet of Things for Health Care:A Comprehensive Survey" , DOI 10.1109/TDSC.2015.2406699, IEEE Transactions

[5]. Adel Serhani, and Alramzana Nujum Navaz "Resource-Aware MobileBased Health Monitoring", 2168-2194 (c) 2015 IEEE Control, Majlesi Journal of Electrical Engineering, Vol.5 No.2 pp. 17-22, June 2018, ISSN: 0000-0388.

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Design of Tube Type Oil Skimmer

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ABSTRACT

The purpose of this review paper is to study modification and improve the tube type oil skimmer which is available in the market. The main objective of this research is to make the skimmer more efficient by modifying the geometry of oleophilic skimmer. Another objective is to study operational variables and oil spill recovery efficiency in a full-scale oil spill recovery test. It is a simple, effective, and dependable means for removing oil from water, they are used for oil spill remediation, removal of oil from machine tool coolant. The improved surface pattern would be efficient on oils with wide range.

Keywords: Oleophilic Skimmer, Tube-type Oil Skimmer

I. INTRODUCTION

An Oil skimmer is a device used for separation of oil and other particles from liquid surface. It is commonly used for eliminating oil from water. Oil adhesion to the rotating surface is the principle on which they are operated. Oil is lifted with the help of rotating surface to an oil removal device which is then transferred into collector.
Various types of oil skimmers such as mop, belt, brush, disc, and drum are developed for increasing efficiency.

II. TYPES OF OIL SKIMMER

A. Belt type

The Belt type oil skimmer is used for high rate of oil removal. It is widely used with big CNCs & VMCs. Following are the features of belt type oil skimmer.

- Compact design fits almost any tank
- Un emulsified oil is removed.
- 5 to 20 lit/hr filtration capacity
- Shut off switch available for maintenance.
- Cost around 50000 Rs

B. Disc Type

Disc is used in this type of skimmer for oil adhesion. The material of the disc is stainless steel which is dipped in coolant and the disc rotates in clockwise direction for collecting oil from the coolant surface. Following are the features of Disc type skimmer.

- Unemulsified oil is removed.
- 5 to 20 lit/hr filtration capacity
- Continuous cleaning operation
- Easy for maintenance and very compact
- Ideal for individual machines

C. Rope Mop Skimmer

Ropes are used in Rope mop skimmers which floats on water surface to retrieve oil. These are large units and crane is used for the operation from launching from vessel or shore. Following are the features of Rope mop skimmer.

- Durable non stretch oleophilic skimmer
- No tools are required
- Toothed belt drive
- Alternative rope mop lengths
- Costs around 110000 Rs

D. Tube Type

Tube is used in this skimmer for oil adhesion. The main advantage of this skimmer is that the tube floats on the water and that helps in more oil sticking which is efficient.

It is placed on a fabricated stand that helps for proper elevation and oil can be collected in the tray placed at the ground level. Tube type oil skimmers are operated by skimming surfaces with the help of 18mm diameter floating continuous loop tube.

Adjustable nylon scrappers are used to wipe out the oil from the tube which is directed towards the sump from which the oil is transferred to the oil collector tray. The length of the tube is calculated and decided according to the oil discharge requirement of the customer.

III. PROBLEM STATEMENT

- Today we have many failures in oil skimmers like
- Slippage of drum due to heavy oil in Drum type skimmer
- Dependency on belt width for desired efficiency in belt type oil skimmer and oil discharge rate
- In general Tube type skimmers, Oil scrappers are placed after driver pulley which affects the life of pulley material which forms the slippage between tube and pulley

To overcome such problems, we have modified tube type oil skimmer which would help to reduce such problems.

IV. OBJECTIVE

Compact design with higher efficiency

- To increase contacting surface area of tube and oil in the tank
- To manufacture compact equipment for separating oil and coolant with the help of tube
- Fully customized design

V. METHODOLOGY

The tube skimmer effectively removes floating surface oils by means of an oleophilic (oil attracting) 3/4-inch diameter continuous looped tube. The tube floats over the surface of the tank or pit and collects the free-floating oils. The Oil Vipers are specially designed in order to remove oil from the periphery of the tube. An additional ceramic wiper on the skimmer is used to remove the collected oil from the tube. The result is an oil free tube which returns to the water for quicker oil removal. Removal rates achieved can be as high as 100 gallons per hour. The unit is powered by a three-phase induction motor or single-phase motor. Motor can be selected on the basis of available voltage source. Wash down duty motors and explosion proof motors can also be used. An automatic shutoff switch turns off the skimmer when the cover is in the open position for safe and easy maintenance. The tube is available in lengths up to one hundred feet. Predrilled mounting holes are provided at the bottom of the unit for easy mounting to any flat surface. The Oil Viper is designed in order to remove all types of oil, making it perfect for use in any industrial or food processing industry where free floating oil is present.

Features

Rugged main frame available in coated cast aluminium (standard) or stainless steel (special order).

Low lubrication is required for bearings, sprockets and gear reducing components. No oil reservoir required and no seals that leak.

Long-life abrasive resistant tube scrapers and pressure blocks are used that are specially designed for tough industrial applications.

Quick connect and release Drive and Pulley Wheels for easy maintenance. Drive and Pulley Wheels have our unique universal replacement rings due to which you may never have to replace the entire wheel.

Safety guards are designed with today's safety concerns. If your existing skimming system functions properly without the safety guards in place, its good but safety of workers should be first priority. Safety is an important factor to be considered while designing the system.

The front guard prevents worker injuries, secures the pieces in place, and allows for easy access to the integral pieces without removing the skimmer from its mount.

Rear safety guard allows easy access to the modern Drive and Pulley Wheel belt drive system. No major disassembly required for maintenance.

Front Safety Guard with integral abrasive resistant tube scrapers and pressure blocks.

Designed for maximum safety - when the Front Safety Guard is removed system will not operate properly without the Front Safety Guard in place.

Drive Wheel and Pulley Wheel with replaceable rings.
Drive Wheel and Pulley Wheel quick release coupling assembly.

VI. CONSTRUCTION

The skimmer main frame is constructed by Light Weight Aluminium sheets or mild steel which are all corrosion resistant epoxy paint coating material.
Skimmer consists of rain hood cover cum safety guards. Skimmer is manufactured internally lubricated for life components that do not require additional lubrication to be added to the unit.
Internal drive and driven shafts shall be driven by a chain sprocket system with tensioning arrangement that is easily accessible.
The drive motor shall be 415 Volt, Single or three phase worm geared motor.
A sealed lubed for life of worm gearbox reducer is coupled to the motor to operate the skimmer collector tubing drive system at the appropriate speed.
The skimmer parts which are in contact with the collector tube, including the tube scrapers, Scraper adjusting blocks, Roller Pins for tube alignment and pressure and Tube Pick Up wheel shall be made up of hard, abrasion resistant and corrosion resistant material that will not crack or chip.
The construction is simple yet robust with a significantly lower recovery rate. However, instead of using belts as the foundation of the design, Tube-type Oil Skimmers use plastic tubes.
This has some advantages compared to belt and other types design as the skimming medium is cheap as well as durable which allows the skimmer to have a high lifting height without affecting the price.
The tube is also partially heat resistant which allows it to be heated to operate in cold weather conditions or during winter season. However, due to the smooth surface of the tube the capacity to recover low viscosity oils is less compared to high viscosity oils.

VII. PROCEDURE

- Oil adheres to the periphery of the floating closed-loop tube as it is drawn across the surface of the contaminated water and into the oil skimmer.
- Unlike other types of oil skimmers, which can get clogged by floating debris, the tube type oil skimmer snakes over and around floating debris, adjusting automatically to changing water levels.
- The tube is then drawn up into the oil skimmer and through scrapers that remove is removed.
- The tube returns to the water surface to collect more oil from the tank.
- Recovered oil flows into a collecting tray.

VIII. WORKING

The Tube floats on the surface of water and is driven in a continuous loop by the oil skimmer which is powered by motor. Free-floating oils, fats and grease sticks to the outside surface of the collector tube and are pulled into

the oil skimmer where they are removed by tube scrapers. The material removed flows into an oil collecting tray. The collector tube is then driven back to the water to remove more floating oil from the tank.

Oil adheres to the periphery of a floating, closed-loop tube as it is drawn across the surface of the water, adjusting automatically to changing water levels.

The movement of the tube across the surface creates a current that draws in the oil. The oil covered tube passes through ceramic scrapers that remove the oil and clean the tube. And the clean tube returns to the surface of tank to collect more oil.

The recovered oil flows into an oil collecting tray and is virtually water-free.

There are many standard mounting systems available for tube type oil skimmers, or custom mounts can be designed to meet each customers' unique specifications.

Tube type skimmers can efficiently remove all petroleum-based oil, fats, grease, oily waste, and animal or vegetable oils that float on the surface of the water.

Unlike other types of skimmers, that can be obstructed by floating debris, tube type skimmers have the ability to snake over, under, and through debris to constantly pick up oil.

IX. CALCULATIONS

Selected data:

Pulley Diameter: 100mm

Length of tube: 2200mm

Diameter of tube: 16mm

Rotation of pulley: 10RPM

Circumference of pulley = π*Diameter of pulley = π*100 Circumference of pulley= 314.159mm

Length per hour = 314.159 * 60 = 18849.54mm

Length for 10 RPM= 18849.54 * 10= 188495.4mm

Surface area = π * Diameter of pipe *Length of Pipe = π * 16 * 188495.4

Surface area of Pipe = 9474812.222 sq mm

Volume = Area * Oil thickness = 9474812.222 * 1 (Considering Oil thickness=1mm)

Volume = 9474812.222 cu. Mm = 9.474812 litre

Discharge of oil= Volume/Time = 9.474812/1

Discharge of oil = 9.474812 litre/hour

X. DESIGN

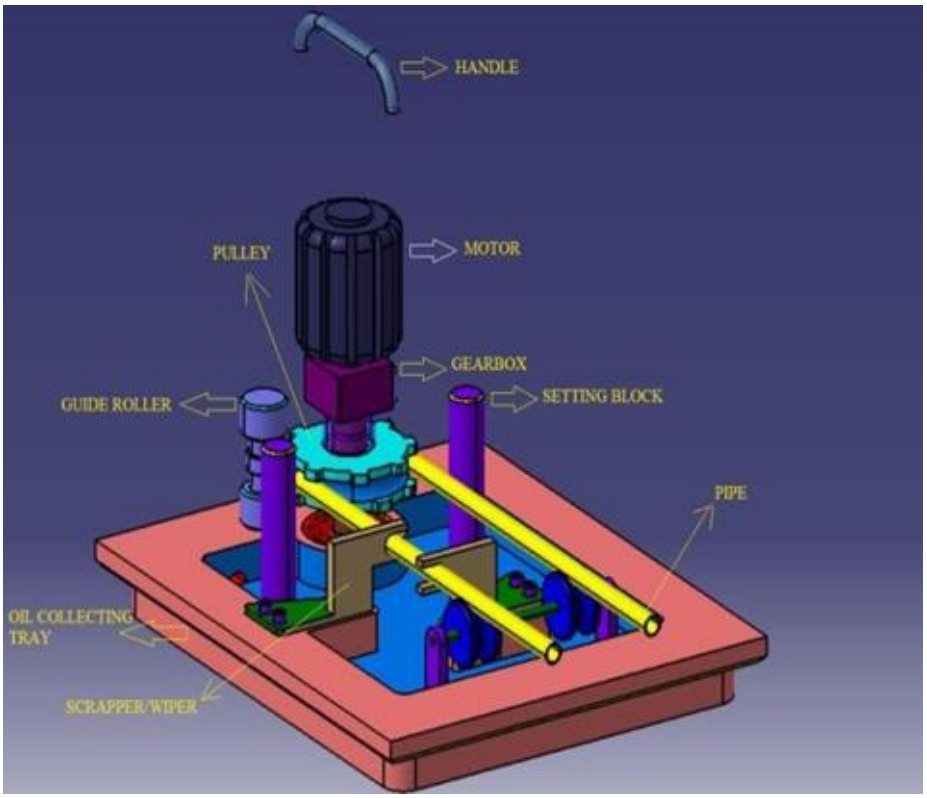

Fig. 1. Modified tube type oil skimmer.

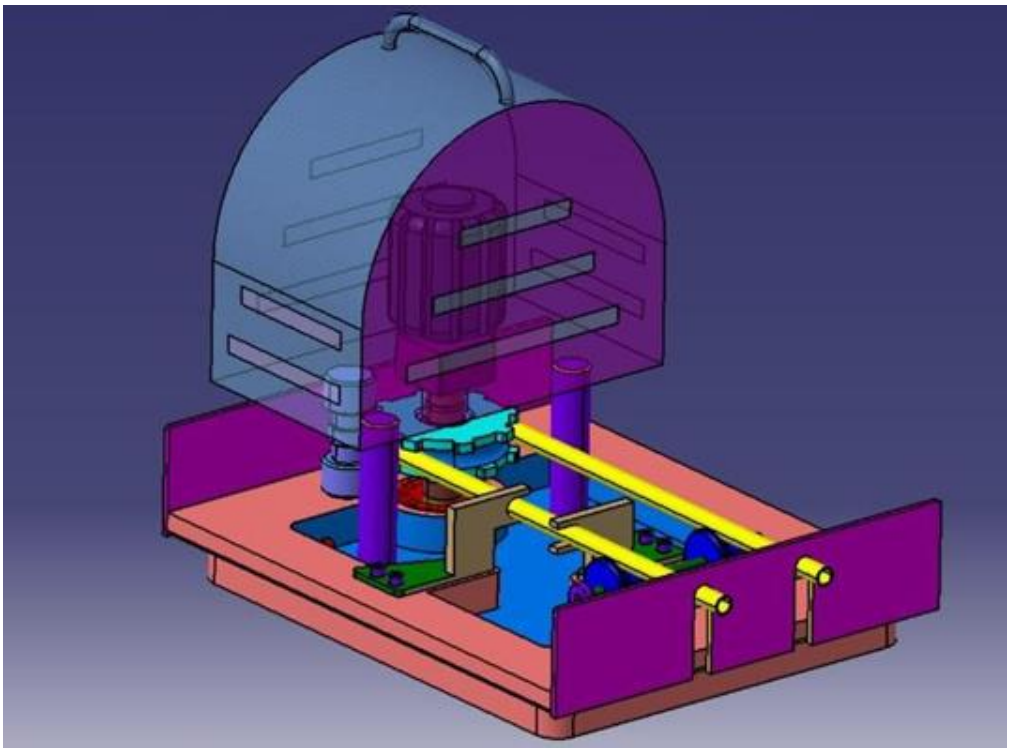

Fig. 2. Oil skimmer with complete casing

XI. CONCLUSION

The scope for this project is that it is simple in construction and design and has low price. It easily floats in the water and removes nearly 90-95% of the oil which is present on the surface of water. The static model has a higher efficiency of nearly 95-97% in removing the oil pumped from the oil spill area. This increases the efficiency of the oil skimmer up to 10%. Further improvement in the skimmer design makes it suitable at any tougher situations or conditions. The efficiency can be found by calculating the time taken for the setup to skim the oil from water. The overall conclusion of this research work is that it is possible to increase the efficiency of the skimmer without sending huge amount of money. This skimmer has a very bright future and is set to have good future use. Following points could be considered for more efficiency:

[1] Speed of the tube cannot vary so it is to be improved by providing multispeed arrangement.

[2] Scrapper plate arrangement may be improved.

XII.REFERENCES

[1]. Broje, V. and Keller, A.A., 2007. Effect of operational parameters on the recovery rate of an oleophilic drum skimmer. Journal of hazardous materials, 148(1-2), pp.136-143.

[2]. Farooq, U., Taban, I.C. and Daling, P.S., 2018. Study of the oil interaction towards oil spill recovery skimmer material: Effect of the oil weathering and emulsification properties. Marine pollution bulletin, 135, pp.119-128.

[3]. Najar, A.M. and Turner, J.T., 2000. Enhanced oil recovery using the rotating-disc skimmer. Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering, 214(4), pp.271-282.

[4]. Hammoud, A.H. and Khalil, M.F., 2003. Performance of a rotating drum skimmer in oil spill recovery. Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering, 217(1), pp.49-57.

[5]. Broje, V. and Keller, A.A., 2006. Improved mechanical oil spill recovery using an optimized geometry for the skimmer surface. Environmental science & technology, 40(24), pp.7914-7918.

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A Unique Interface to Access Heterogeneous Data Stores On Cloud

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ABSTRACT

The term big data is closely related with unstructured data. Big data refers extremely large datasets that are difficult to analyse with traditional tools. Application developer needs to access the various heterogeneous models having structured as well as unstructured data. To interact with heterogeneous data model's different APIs are used. We propose an idea of a common interface which will be useful for application developer to interact with heterogeneous structured and unstructured data stores with the help of NoSQL technology. The OPEN-PaaS-Database API (ODBAPI), streamlined unique REST API will allow application developer to write their application code independent of target data stores. We will also propose an idea of virtual data stores which will act as a mediator and interact with integrated data stores wrapped by ODBAPI

Keywords: Heterogeneous databases, ODBAPI, NoSQL, Structured data, unstructured data

I. INTRODUCTION

Advances in Web technology on the Internet have resulted in immense processing and storage requirements. As the data is emerging from different sources like social media, blogs, twitter etc. which is in unstructured format. To interact with different storage requirements, big data applications usually need to interact with different structured and unstructured data stores having different APIs. The heterogeneity creates several problems while developing, deploying and migrating multiple data store applications. The application developer has many problems like heavy workload, no declarative way for complex query execution, code adaption etc. To overcome such problems, we are proposing a common interface which will be intermediate between a application developer and different heterogeneous databases with the help of technology like NoSQL. In order to satisfy different users requirements, cloud applications usually need to access and interact with different structured and unstructured data stores having heterogeneous APIs. This APIs heterogeneity produces two main problems. First it will connect cloud applications to specific data stores interfering therefore their migration. Second, it requires developers to be known with different APIs. In our work, we propose to use ODBAPI a streamlined and a unified REST API enabling to execute different unary and binary operations on

different structured and unstructured databases. ODBAPI This API is used to provide the seamless interaction with data stores located in a cloud environment. Developers can execute different unary and binary operations. The main purpose of ODBAPI are as one for decoupling cloud applications from data stores in order to the shifting process, and second for easing the application developers task by reducing the burden of managing different APIs. ODBAPI separates cloud applications from data stores showing therefore their migration. Moreover, it reduces developer's task by removing the burden of managing different APIs. NoSQL NoSQL is a technology for storing data which does not have specific structure that it is useful for storing unstructured data. They don't require SQL statements for accessing data stores. The NoSQL databases can usually scale across different servers.

II. LITERATURE REVIEW

In the previous research, different techniques are used for accessing structured databases but now a days in business management accessing unstructured heterogeneous databases is basic need for various reasons like improving the business performance, customer relationship management etc. We are presenting few of them in this section. Many query tasks naturally involve reasoning over data residing across structured or unstructured "SQL" databases. Having data divided over separate stores currently implies increasing manual work for data consumers. In this paper, they propose a general framework that is the gap between SQL and NoSQL. Rami Salami, Sami Bhili, and Bruno Defude[1] proposed that for accessing different heterogeneous databases there is unifying data model used by applications developers to interact with heterogeneous data stores and they proposed a Restful API which is used to interact with multiple data stores.

Donald Kossmann[2] proposed different techniques for special join techniques, techniques to explain intra query parallelism, techniques to reduce communication costs, and techniques to exploit caching and replication of data. Furthermore, he discussed different kinds of distributed systems such as client-server and heterogeneous database systems, and shows how query processing works in these systems.

M. Sellami, S. Yangui [3] proposed that documents are logically incorporated in the structured store, and querying is performed via a novel NoSQL query pattern extension to the SQL language. These patterns allow the user to describe conditions on the document-centric data, while the rest of the SQL query refers to the corresponding NoSQL data via variable bindings. They give an effective solution for translating the user query to an equivalent pure SQL query, and present optimization strategies for query processing. They have implemented a prototype of our framework using PostgreSQL and Mongo DB and have performed an extensive empirical analysis. They study shows the practical feasibility of our framework, proving the possibility of seamless coordinated query processing over relational and document-centric data stores. G. R. Gangadharan, and S. Dustdar [4] they support the view that data concerns should be explicitly modelled and specified in data contracts to support concern-aware data selection and utilization. They perform a detailed analysis of current techniques for data contracts in the cloud. Instead of relying on a specific representation of data contracts, they introduce an abstract model for data contracts that can be used to build different types of data contracts for specific types of data. Based on the abstract model, they propose several techniques for evaluating data contracts that can be integrated into data service selection and composition frameworks. They also illustrate our

approach with some real-world scenarios and show how data contracts can be integrated into data agreement exchange services in the cloud. C. Baun, M. Kunze, J. Nimis[5] presented a programming model that enables homogeneous treatment of non relational schemas. They provided a meta-layer that allows the creation and querying of NoSQL databases defined in MongoDB, HBase and Redis using a common set of simple atomic operation. They also described an example where the interface they provide enables the simultaneous use of several NoSQL databases in a way that it is transparent for the application and for the programmers. It could be observed that such elementary operations might reduce the expressive power of the underlying databases. Actually, in this paper They do not deal with a formal analysis of information capacity of the involved models. However, it is apparent that when lower-level primitives are involved, expressive power is not limited with reference to the whole language, but only to the single statement. This means that a query that can be expressed as one statement in HBase, for example, will require two or more statements in the common query language. T. Kraska, M. Hentschel[6] said that, to the large amount of data generated by user interactions on the Web, some companies are currently innovating in the domain of data management by designing their own systems. Many of them are referred to as NoSQL databases, standing for 'Not only SQL'. With their wide adoption will emerge new needs and data integration will certainly be one of them. In this paper, they adapt a framework encountered for the integration of relational data to a broader context where both NoSQL and relational databases can be integrated. One important extension consists in the efficient answering of queries expressed over these data sources. The highly denormalized aspect of NoSQL databases results in varying performance costs for several possible query translations. Thus, a data integration targeting NoSQL databases needs to generate an optimized translation for a given query. Their contributions are to propose (i) an access path-based mapping solution that takes benefit of the design choices of each data source, (ii) integrate preferences to handle conflicts between sources and (iii) a query language that bridges the gap between the SQL query expressed by the user and the query language of the data sources. They also present a prototype implementation, where the target schema is represented as a set of relations and which enables the integration of two of the most popular NoSQL database models, namely document and column family stores. Many researcher [7][8][9] adopts a relational approach for the target schema which enables endusers to express queries in the declarative SQL language. Several transformation steps are then required to obtain results from the data stored at each of the sources. Hence a bridge query language has been presented as the cornerstone of these transformations. Another important component of our system is the mapping language which (i) handles uncertainty and contradicting information at the sources by defining preferences over mapping assertions and (ii) supports the setting of access path information in order to generate an efficiently process to query plan. On preliminary results, the overhead of these transformation steps does not impact the performance of query answering. Their list of future works is important and among others, it contains the support of NoSQL stores corresponding to a graph model and the (semi) automatic discovery of mapping assertions based on the analysis of value stored in each source. They presented the first generic extensible framework for coordinated querying across SQL and NoSQL stores which eliminates the need for ad-hoc manual intervention. It is well recognized that scalability is a main issue for these systems. The most involved aspect of this integration concerns the fact that these databases are schema less and generally lack a common declarative query language. Addressing this first issue, they emphasized that using existing techniques like FCA together with non-standard DL inferences

like GCS, they could compute an ontology from the structure and instances of each databases source. Using a novel alignment ontology method, they highlighted that these ontologies can be linked to create a global ontology over which SPARQL queries are expressed. Finally, a bridge query language supports a translation approach to generate procedural queries, using specific APIs for each database source, from SPARQL queries. They have already implemented this translation for the Java language for both the MongoDB and Cassandra NOSQL databases and we are currently working on query optimization. Recently, several propositions for a common NOSQL declarative query language are emerging (e.g. CQL for Cassandra, unQL for CouchDB). Studying these specifications is on our list of future works. H. L. Truong, M. Comerio, F. D. Paoli, G. R. Gangadharan, and S. Dustdar [15] presented the first generic extensible framework for coordinated querying across SQL and NoSQL stores which eliminates the need for ad-hoc manual intervention of the user in query (re)formulation and optimization. An extensive empirical study demonstrated practical feasibility of the framework and the proposed implementation strategies. The groundwork laid here opens many interesting avenues for further research. They close by listing a few promising directions. (1) They have just scratched the surface of implementation and optimization strategies. They give two suggestions for future work here. (a) They can study adaptations and extensions of indexing and caching mechanisms developed for RDF, a triple-based data model, and XML to more scalable implementations of F. (b) Individual queries are often part of a longer-running collection. It would be certainly worthwhile to investigate strategies for multi-query optimization with respect to a dynamic query workload. (2) There is recent work in the community towards standardization of document query languages and their semantics. An important interesting topic for further investigation is to coordinate our results with these emerging efforts (e.g., studying appropriate extensions or restrictions to NQP's). Cloud computing has recently emerged as a new computing paradigm. This latter provides provisioning of dynamically scalable and often virtualized resources which are offered as services. R. Sellami and B. Defude, [7] presented and discussed the requirements of such environments and analyse current state of the art. non-relational databases (often termed as NoSQL) have recently emerged and have generated both interest and criticism. Interest because they address requirements that are very important in large-scale applications, criticism because of the comparison with well-known relational achievements. One of the major problems often mentioned is the heterogeneity of the languages and the interfaces they offer to developers and users. Different platforms and languages have been proposed, and applications developed for one system require significant effort to be migrated to another one. Here they propose a common programming interface to NoSQL systems (and also to relational ones) called SOS (Save Our Systems). Its goal is to support application development by hiding the specific details of the various systems. It is based on a meta modeling approach, in the sense that the specific interfaces of the individual systems are mapped to a common one. The tool provides interoperability as well, since a single application can interact with several systems at the same time.Many researchers have accessed different heterogeneous database having structured data. Some of them have proposed the theoretical models for accessing unstructured data. Here we propose a common interface to access structured as well as unstructured heterogeneous databases.

III. PROPOSE WORK

An interface is built through which different structured as well as unstructured data stores in cloud are connected. The restful API helps to connect with databases which are in a cloud. The API connects to the database as per specification of the developer. The proposed system performs CRUD (Create, Read, Update and Delete) operations on the data stores as per developer's requirement. After executing the specified query, the result is sent back to the API. On the server side, it shows all the performed operations and its status. On the API it shows the status of a query, either execution of successful or unsuccessful with its code value.

A. REST API: Ubiquitous access to REST API is one of its best features [8]. It uses standard HTTP method call, available in every language and platform, to perform requests and retrieve information from different data stores. Here the basic methods are mentioned which we performed in this system. 1. post-Creates a new Entity 2. Get-Returns the entity information 3. Put- Update the entity information 4. Delete-Delete the entity information The use of REST is usually preferred over the heavyweight SOAP (Simple Object Access Protocol) because REST does not require as much bandwidth, which makes it a more suitable for use over the Internet. The SOAP approach requires writing or using a server-side program (to serve data) and a client side program (to request data) while REST basically focuses on a specific set of interactions between data elements rather than implementation details. REST works like a website in a browser. A resource is discovered in a program via a URL. The program can access that URL and receive data about the resource. REST allows for a minimum amount of data to be transferred using the same well-established mechanisms that define the web without a lot of the load introduced by large protocols. This allows programmers to more immediately build programs that access and act upon data discovered via APIs, even in environments with unreliable network speeds and limited computing power. B. JSON: JSON (JavaScript Object Notation) it is a self-describing, human readable data format. Originally designed for lightweight data-interchange format between browser and server, it has become widely accepted for many types of applications [9]. JSON documents are mainly useful for data management for various reasons. A JSON document is composed of a set of different fields which are themselves key-value pairs. This means each JSON document contains its own human readable schema design with it. It allows the data stores to easily exchange between database and client applications without losing their meaning. JSON is used in the application layer. It supports a richer and more flexible data structure than tables made up of columns and rows. It supports fields like number, string, Boolean, etc., also it fields can be arrays or nested sub-objects. Using JSON documents in our application means we don't need an object relational mapping between database and the applications it serves.

IV. RESULTS

The proposed system used some structured as well as unstructured databases which are stored in cloud server like MYSQL, MONGO, and COUCH. We accessed these databases through an implemented interface. Following components shows how actual access takes place via the API through the interface.

A. MYSQL database: MYSQL is one of the popular Open Source Relational SQL database management systems. MYSQL is used for developing web-based software applications [10]. MYSQL uses a standard form of the

well-known SQL data language. It works on different operating systems with many languages like C, C++, and JAVA etc. MYSQL database is accessed with the help of SQL expressions. It is a relational database that able to create relationships between individual database elements, to classify data at a greater level than a simple table of records, avoid data redundancy and creates relationships that define how the database functions. The cloud providers have now integrated MYSQL within their cloud offerings such as IBM blue mix which is developed by IBM.

CRUD operations i.e. create, read, update and delete operations are performed on this database. To perform the update operation, PUT method is used. Through API data is passed as Body part. To create connectivity to the database, name and its instance are passed through header part. Then query is executed and further results are sent back to the developer.

B. **Mongo Database:** It is one of the leading NOSQL database which written in C++ [11]. It is a document oriented database. The database contains Collection. It does not contain specific schema. Mongo Database requires a data folder to store its files. The default location for the Mongo Database data directory is c:\data\db.It has different methods. A single MongoDB server typically has multiple databases. In Mongo Database you have to design schema according to user requirement. The databases can access with the help of NOSQL statements. Developer can change the structure of records which we usually call as documents by adding new fields or deleting existing ones.

CRUD operations i.e. create, read, update and delete operations are performed on this database. To perform the update operation, DELETE method is used. In header part we specified the ID of the record which has to be deleted.

C. **Couch database:** Couch database is one of the NOSQL databases [12]. A Couch database does not require a schema, or rigid pre-defined data structures such as tables. Data stored in Couch database is a JSON documents. The structure of the data store, or documents, can change dynamically to accommodate evolving needs. A Couch database document is a JSON object that contains named fields. Field values are like strings, numbers, dates, or even ordered lists and associative maps.

We performed create, read operations on the database. To perform the create operation we used POST method

V. CONCLUSION AND FUTURE WORK

We built a common interface to access the structured as well as unstructured databases. Structured database like MYSQL where as unstructured databases like MONGO and COUCH are used. This system helps to reduce the burden of developer for accessing the structured as well as unstructured databases and perform CRUD operations on databases. System is currently working for basic operations. In future, we will try for more complex operations like join, Cartesian product etc.

VI.REFERENCES

[1]. “Supporting multi data stores applications in cloud environments”,Rami Sellami, Sami Bhiri, and Bruno Defude, DOI10.1109/TSC.2015.2441703, IEEE Transactions on Services Computing

[2]. "A Survey on Supporting Different Data Stores in Cloud Environment", IJSRD -International Journal for Scientific Research & Development| Vol. 4, Issue 02, 2016 | ISSN (online): 2321-0613
[3]. "Using multiple data stores in the cloud: challenges and solutions" Rami Sellami and Bruno Defude,
[4]. "OpenPaaS DataBase API: ODBAPI Specification REST version ", Rami Sellami and Bruno Defude,
[5]. "Data Access for Highly-Scalable Solutions: Using SQL, NoSQL, and Polyglot Persistence" , Douglas McMurtry, Andrew Oakley, John Sharp, Mani Subramanian, Hanz Zhang, ISBN: 978-1-62114-030-6
[6]. "Uniform access to nonrelational data-base systems: The sos platform", P. Atzeni, F. Bugiotti, and L. Rossi, in Advanced Information Systems Engineer-ing - 24th International Conference, CAiSE 2012, Gdansk, Poland, June 25-29, 2012. Proceedings, 2012, pp. 160–174.
[7]. "Nosql database: New era of da-tabases for big data analytics - classification, characteristics and comparison", A. B. M. Moniruzzaman and S. A. Hossain, CoRR, vol. abs/1307.0191, 2013.
[8]. "restful_web_services", Leonard Richardson and Sam Ruby,Froworded by David Hienmeir Hansson ISBN: 978-0-596-52926-0
[9]. http://www.tutorialspoint.com/json/json_tutorial.pdf
[10]. http://www.tutorialspoint.com/mysql/mysql_tutorial.pdf
[11]. http://mdslab.unime.it/sites/default/files/mongodb_tutorial.pdf
[12]. https://media.readthedocs.org/pdf/couchdb/latest/couchdb.pdf

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A Survey on Predicting Match Score and Team Recommendation of Cricket Match Using Machine Learning

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ABSTRACT

Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values. It is a Machine learning based prediction approach Records and previous statuses are trained in all dimensions covering all important factors such as: Toss, Home Ground, Captains, Favorite Players, Opposition Battle, Previous Stats etc., with each factor having different strength. Our system finally present quantitative results displayed by best suited algorithm having highest accuracy. Also, demonstrating the performance of our algorithms in predicting the number of runs scored which is one of the most important parameters of match outcome.

Keywords: Prediction, Machine Learning Algorithm, Classification, Cricket analysis

I. INTRODUCTION

Cricket is very popular game in the world. Individuals of each and every cricket playing nation are exceptionally worried about the public cricket crew before any match or on the other hand any series. Various factors inherit play while selecting a team. In The field of Machine learning, several algorithms like Linear Regression, Random Forest, Support Vector Machine, Naive Bayes are used for prediction and classifications. Feature Selection may be a vital part of a machine learning project. There are several features for a player selection like Experience, Matches played against an opponent, Highest Score, Strike Rate, Total number of 100's, Total number of the '50s, Total number of runs scored by the player, Average runs scored, Number of innings played, Ball faced per matches, habitat or away, Specific format specialist, players ratings, Number of 4's per match, Number of 6's per match, Number of runs scored by the player against the opponent, fielding performance. During this research, we'll attempt to analyze every feature to form a player selection. A large portion of the residents of this nation are obsessed with cricket and they hold their eyes to the player's determination advisory group. So, whether he/she is a broadcaster, player, or die-hard fan, one would want to

know, who is going to play the next games in advance. That's why, people want to do a prediction about cricket. In our country cricket team selection processes are dependent on humans. Moreover, human judgment cannot be relied upon because sometimes they made mistakes. Players selection for a team in cricket is vital to its success. If a team wants to win a game, they must choose their best players for the game. Sometimes, the selection committee has difficulties in the selection process and faces a lot of confusion about player selection before the game.. For example, which player to pick or drop, which batsman or bowler should play in which position and so on. So The Board of Control for cricket in India (BCCI) need an automated system for team combination using machine learning. Furthermore, the India cricket team doesn't need to fully dependent on human judgment any more for the team recommendation. This system will help the BCCI) to know all player's fitness, strength, weakness, measures player performance, and rank the players also enable them to decide for player's selection.

II. LITERATURE SURVEY

Authors of [19] roposed a two-phase framework for player selection and team formation. Md. Muhaimenur Rahman et al. [15] they analysis of Bangladesh One Day International (ODI) Cricket Data using Machine Learning and showed the importance of some features and they have found the predicted outcome. They collected seventeen features and analyze those features with several machine learning algorithms like Naive Bayes, KNN, Random Forest, SVM, decision tree and predict the outcome. They got their best result using the latest version of the decision tree algorithm that is C5.0 and successfully got the accuracy of 63.63% before starting the game, 72.72% for first-innings 81.81% for second innings.

Passi et al. [14] applied some machine learning algorithms. They set some parameters used some equations to generate players rating to evaluate players performance. They analyzed the player's characteristics and stats and predict the batsman's and bowlers' performance separately in ODI matches using supervised machine learning. They got 90.74% accuracy for run and 92.25% for predicting wickets taken by a bowler in Random Forest classifier and it is the most accurate classifier also achieved an accuracy of 51.45% for run predicting and 68.78% for wicket predicting.

To predicate a player's performance, Md.Minhazul Abedin 2 et al. [1] analyzes supervised classification models as Random forest, K-nearest neighbors (KNN), Sup- port Vector Machine (SVM), Decision Tree. Random forest predicts the winning percentage with the highest accuracy of 92.61% when the amount of training data-set is 90% and KNN predicts the least accuracy of 73.73% when the amount of training data-set is 90%. Kalpdrum Passi et al. [13] analyze different characteristics, abilities, statistics using four machine learning algorithms where Random forest got the highest accuracy. To predicate team selection Chetan Kapadiya et al. [12] analyze different machine classifiers like Naive Bayes, Decision Tree, Random Forest, SVM, and Weighted Random Forest. Weighted Random Forest predicts the highest accuracy of the percentage that is 93.73%. Naive Bayes predicts 58.12% of accuracy, Decision Tree predicts 86.50% of accuracy, Random Forest predicts 92.25% of accuracy, and SVM predicts 68.78% of accuracy.

S. R. Iyer et al. [9] used neural networks to prediction of an athlete's performance in cricket team selection and they got max 86% accuracy in batman's selection and max80% accuracy in blower selection with neural networks.

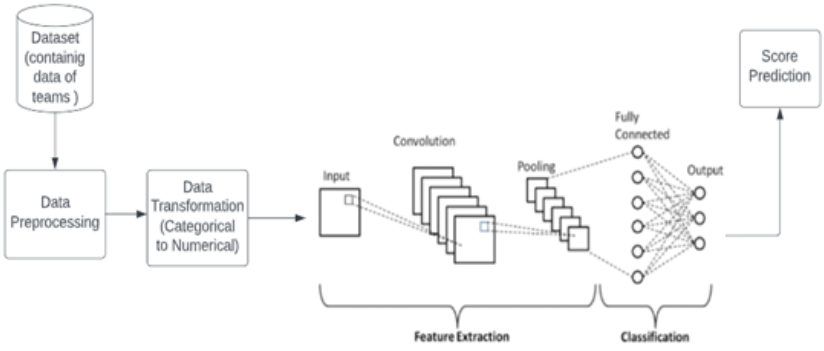
Manuka Maduranga et al. [8] analyzed different types of approaches to predict a match outcome in the Cricket domain. They using historical Cricket data and Collective Knowledge Approach. Here collective knowledge approach predicts the highest accuracy of 87%. Sandesh Bananki et al. [10] analyzed the SVM model with linear, and nonlinear poly and RBF kernels. Here SVM with RFB kernel predict the accuracy of 75%, precision of 83.5%, and recall rate of 62.5%. Linear kernel predicts the accuracy of 70.83% and Poly kernel predicts the accuracy of 68.75%.

Sankalp Rane et al. [18] used Logistic Regression, Support Vector, Random Forest, Decision Tree where Random Forest gave the best result. Madan Gopal et al. [11] analyze different machine classifiers like SVM, RandomForests, Logistic Regression, Decision Trees and KNN. In today's day to day life Machine learning is using everywhere like medical [4], robotics [3], remmote sensing [6], management of disabled people [2], EVM [17], Security [16], Farming [7], Agriculture and IoT [5]. That's why if we can use it in Game it may result good.

III. SYSTEM ARCHITECTURE

The system architecture comprises of the client who can be any user requesting for prediction of score of the match. A dataset containing necessary information about players to the server for processing. The server on the other hand reads the information send by the user and does the task of prediction and analysis and sends the result to the user.

At the sever end the prediction is done by using various machine learning algorithms wherein all the steps of data preprocessing and the actual prediction, using a specific prediction model is done. The data preprocessing involves various steps like importing dataset, cleaning the dataset, normalization of the attributes of dataset and make the dataset ready for next step of processing. Score prediction is done using Deep learning by performing data collecting, cleaning , preprocessing and training our model.



A. Random Forest Regression

Forest regression is a supervised learning algorithm that uses ensemble learning methods for regression. Ensemble learning methods combine predictions from multiple machine learning algorithms to produce more accurate predictions than a single model.

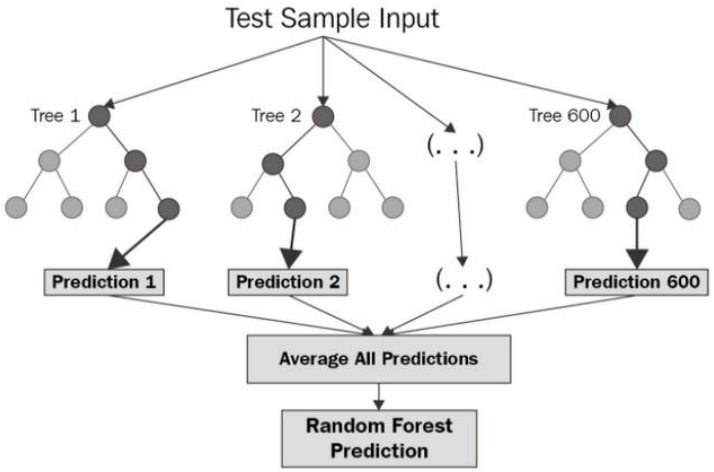


Fig. 8: Decision Tree

Steps Followed:

1. Randomly select k data points from the training set.
2. Construct a decision tree associated with these k data points.
3. Select the number N of trees to create and repeat steps 1 and 2.

For each new data point, it creates its own N-tree tree, predicts the y-value for that data point, and assigns one new data point to the average. Across all predicted y-values.

B. Deep Learning -

Deep learning is part of a broader family of machine learning methods based on artificial neural networks with representation learning.

C. CNN model –

It consists of three layers –

Convolutional layers - A number of filters (kernels) are used in the layer's parameters and can be visualized as neurons in the layer. They have weighted inputs and are based on input size (fixed square), also called receptive field. provide the output.

Pooling layers -the Pooling layer performs the function of reducing the spatial size of the Convolved Feature. This is to decrease the computational power required to process the data by reducing the dimensions.

Full-Connected Layers – The input to the fully connected layer is the output from the final Pooling or Convolutional Layer, which is flattened and then fed into the fully connected layer.

IV. CONCLUSION

We analyzed and predicted scores of cricket matches with the help of Machine Learning and Deep Learning algorithms and compared the outcome of both the methods.

V. REFERENCES

[1]. P. Sri Harsha Vardhan Goud, Y. Mohana Roopa, B. Padmaja," Player Performance Analysis in Sports: with Fusion of Machine Learning and Wearable Technology" Proceedings of the Third International Conference on Computing Methodologies and Communication (ICCMC 2019) IEEE Xplore Part Number: CFP19K25-ART; ISBN: 978-1-5386-7808-4

[2]. Amal Kaluarachchi, Aparna S. Varde," CricAI: A Classification Based Tool to Predict the Outcome in ODI Cricket"978-1-4244-8551-2/10/$26.00 ©2010 IEEE

[3]. Abedin, M.M., Urmi, S.R., Mozumder, M.T.I., Samiur, M., Rahman, A.F.: Forecasting the outcome of the next odi cricket matches to be played

[4]. Akhund, T.M.N.U.: Designing and implementation of a low-cost wireless gesture controlled robot for disable people

[5]. Akhund, T.M.N.U.: Study and implementation of multi-purpose iot nurse-bot

[6]. Akhund, T.M.N.U., Mahi, M.J.N., Tanvir, A.H., Mahmud, M., Kaiser, M.S.: Adeptness: Alzheimer's disease patient management system using pervasive sensors-early prototype and preliminary results. In: International Conference on Brain Informatics. pp. 413–422. Springer (2018)

[7]. Akhund, T.M.N.U., Rahman, M.H.: Bat banisher: An approach to create a high frequency ultrasound system to protect agricultural field from bats

[8]. Akhund, T.M.N.U., Sagar, I.A., Sarker, M.M.: Remote temperature sensing line following robot with bluetooth data sending capability

[9]. Hasan, M.A., Akhund, T.M.N.U.: An approach to create iot based automated smart farming system for paddy cultivation

[10]. Hatharasinghe, M.M., Poravi, G.: Data mining and machine learning in cricket match outcome prediction: Missing links. In: 2019 IEEE 5th International Conference for Convergence in Technology (I2CT). pp. 1–4. IEEE (2019)

[11]. Iyer, S.R., Sharda, R.: Prediction of athletes performance using neural networks: An application in cricket team selection. Expert Systems with Applications 36(3), 5510–5522 (2009)

[12]. Jayanth, S.B., Anthony, A., Abhilasha, G., Shaik, N., Srinivasa, G.: A team recommendation system and outcome prediction for the game of cricket. Journal of Sports Analytics 4(4), 263–273 (2018)

[13]. Jhanwar, M.G., Pudi, V.: Predicting the outcome of odi cricket matches: A team composition based approach. In: MLSA@ PKDD/ECML (2016)

[14]. Kapadiya, C., Shah, A., Adhvaryu, K., Barot, P.: Intelligent cricket team selection by predicting individual players' performance using efficient machine learning technique

[15]. Passi, K., Pandey, N.: Predicting players'performance in one day international cricket matches using machine learning. Computer Science & Information Technology (CS & IT) (2017)

[16]. Passi, K., Pandey, N.: Increased prediction accuracy in the game of cricket using machine learning. arXiv preprint arXiv:1804.04226 (2018)

[17]. P. Sri Harsha Vardhan Goud, Y. Mohana Roopa, B. Padmaja," Player Performance Analysis in Sports: with Fusion of Machine Learning and Wearable Technology" Proceedings of the Third International

Conference on Computing Methodologies and Communication (ICCMC 2019) IEEE Xplore Part Number: CFP19K25-ART; ISBN: 978-1-5386-7808-4

[18]. Amal Kaluarachchi, Aparna S. Varde," CricAI: A Classification Based Tool to Predict the Outcome in ODI Cricket"978-1-4244-8551-2/10/$26.00 ©2010 IEEE

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Approaches for Document Clustering in Forensic Science

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ABSTRACT

Advances in data collection and storage capabilities during the past decades have led to an information overload in most sciences. Computer forensics is a new and fast growing field that involves carefully collecting and examining electronic evidence that not only assesses the damage to a computer as a result of an electronic attack, but also to recover lost information from such a system to prosecute a criminal. Nowadays the digital content involved in a crime is nowhere simple to read & infer. It is increasingly a labyrinth of data/files/folders, which needs to be analyzed, to get ahead into investigation & solving the crime cases worldwide. In light of this, the computer based document clustering, for the forensics analysis of digital content/data, is a very important tool/program. It reduces the much of manual effort & redundancy, & makes the resolution of crimes cases faster. The process of clustering is based on processing of multiple text files simultaneously. These text files may comprise very huge raw/text data, which needs to be converted into structured form in order to do further processing of crime analysis. Huge volumes of data need to be analyzed & this process may be slow if commercial and open source forensic tools are used. In early days, forensics was largely performed by computer proffesionals who worked with law enforcement on an ad-hoc, case-by-case basis. There are many algorithms suggested by various experts for the data analysis. A study of investigation work over the different document clustering methods for forensic analysis is used for this survey. In this paper, we are aiming to explain partitional algorithms namely – kmeans and its variant i.e., Expectation Maximization Algorithm.

Keywords: Computer Forensics Analysis, Expectation-Maximization, kmeans

I. INTRODUCTION

Documents analysis process in computer device is key task of the digital forensic investigation process & this process becomes more complex, if the number of documents available to process very large. The complexity increases further, if the digital device (under investigation) has a large storage. There aresome methods and tools already presented by various researchers for the analysis of multiple documents. These existing methods of DFI propose a multi- level search approach, for giving the accurate results and producing digital evidence that is related to the current investigation task. The inherent drawback of these methods is, no provision for crime

investigator/end user to search the documents relevant to the specific subject in which end user is interested, or to group the document set based on a given subject.

The DFI system first takes the input as raw/text files related to crime data which is in unstructured format. This data is further required to be converted into structured form using the text mining methods. There are many clustering algorithms presented previously those are especially tailored to be used for the analysis of forensic. Such clustering methods are basically used for the data analysis purpose in which there is very less or no prior information about the input data. All computer forensics applications produce end results with same attribute/lacunae. While technically speaking, datasets are made up of unlabeled categories or classes of documents which were initially identified as unknown. In such cases even if we consider the availability of labeled dataset is possible through the past analysis, but there is no certainty that same classes or groups available in input dataset or for next incoming raw dataset which is being collected from different digital devices as well as related to various processes of investigations. The inbound data sample can come from the different types of sources. Therefore to provide an efficient solution, for processing, such heterogeneous input datasets in forensic analysis, the clustering algorithms are used. Such clustering methods are able to find out the latent patterns from the text documents those are available from seized computers. Clustering algorithms improves the process of analysis which is performed by end users. The methodology behind such clustering algorithms is that objects inside the valid cluster are more likely to same with each other as compared to objects belonging to a various other clusters [1]. Hence once the data partition has been induced from the data, the investigator/end user might initially focus on checking similar documents from the obtained set of clusters. After this preliminary analysis, the team may eventually decide to scrutinize other documents from each cluster. Thus with this, we can improvise the difficult task of analyzing the documents individually & at the same time manual scrutiny is available, if it is required in some complicated criminal cases. We have studied, the recent investigation based work done over different clustering algorithms such as k-means clustering, K-medoids, Single Link, Complete Link, Average Link, and CSPA) with different digital forensic datasets in [1]. In [1], author presented the methodology which the document clustering algorithms were used for the forensic analysis of digital data/evidence in the criminal cases being investigated by police. A number of different practical results were reported as well as discussed with different datasets of forensic computing. However as per the author's statements, it still requires more investigations and analysis. In this paper we are analyzing partitional algorithms, for forensic analysis of digital data/evidence. From all the studies we may conclude that, typical clustering methods are: partitioning methods, hierarchical methods, density-based methods, grid-based methods and model-based methods. Our research is focused on model-based clustering.

In next section 2 we have presented the work related to the various methods, which are used in clustering algorithms. In section 3, the approach for clustering is depicted. Finally conclusion and future work is predicted in section 4. Section 5 refers to acknowledgement

II. RELATED WORK

In this section we try to briefly walkthrough the different methods of document clustering in digital forensics

- Computer Forensics field uses very selective clustering algorithms. Most of the studies describe the use of classic algorithms for clustering data—e.g., Expectation-Maximization (EM) for unsupervised learning of Gaussian Mixture Models, K-means, Fuzzy C-means (FCM), and Self-Organizing Maps (SOM). These algorithms have well-known properties and are widely used in practice. • In [1], document clustering algorithms are implemented using various datasets. Two relative validity indices namely silhouette and simplified silhouette are used for estimating the number of clusters from data. Reference partition is used for evaluating data clustering algorithms. Limitations are also explained which throw light on the fact that the success of any clustering algorithm depends upon the input data. In these days, all the data required is available in digital form. A survey and forecast of worldwide information growth is worth consideration. Data storage, networking and security are the important aspects which play a major role in crime investigation [3].
- In [9], Self Oriented Maps based algorithms were used. This helps the examiners to perform clustering more efficiently. The files were clustered by taking into account their creation dates/times and their extensions. This kind of algorithm has also been used in [10] in order to cluster the results from keyword searches. The underlying assumption is that the clustered results can increase the information retrieval efficiency, because it would not be necessary to review all the documents found by the user anymore.
- The partional K-means and K-medioids are discussed in [5] and [6]. Details about convergence of algorithm are also discussed in the same. Cluster ensemble problem and the algorithms to solve that problem is discussed in [7]. In [8] the author stresses that, Clustering is a useful exploratory technique for gene-expression data. According to it, evolutionary algorithms automatically estimate the right number of clusters. Relative cluster validity criterion is discussed in [9]. External cluster validity criteria, such as rand index, adjusted rand index and jaccard coefficient are explained in detail. The already existing studies mention that the number of clusters is known and fixed a priori by the user. This assumption of entering number of clusters by the user is unrealistic in real world applications. Hence, a common way is to find out the number of clusters from the given data. Therefore, different data partitions (with different numbers of clusters) can be considered and then assesses them with a relative validity index in order to estimate the best value for the number of clusters [4], [5], [11].
- M. Laszlo and S. Mukherjee [12] propose the usage of Hyper-Quad trees (HQ) as the initialization algorithm to obtain the initial cluster centers/centroids which serve as input to various clustering algorithms such as K-Means, EM. Related work in this domain can be pursued to achieve increased efficiency in the computation of centroids derived from the initialization algorithm.
- J. Han and M. Kamber [13] provide a detailed description of the widespread concepts of data mining and the tools required to manipulate data. Fault prediction using quad tree and Expectation Maximization clustering algorithm, limits the research in this book to the section of ―Cluster Analysis‖. The cluster analysis section in this book describes different types of clustering methods. In [14], a detail chapter of mixture models and EM introduces the concepts related to Expectation Maximization Algorithm.
- M. Steinbach, G. Karypis, and V. Kumar [15] discuss about comparison of document clustering techniques.

III. APPROACH USED BY CLUSTERING ALGORITHMS

3.1. Types of Clustering

Document clustering is a completely unsupervised task with the goal of discovering groups of similar documents in a collection without a-priori knowledge. There are two typical categories of clustering algorithms, the partitional and the hierarchical. K- means and the single/complete/average link clustering are the representatives of these two categories, respectively. There are many comparisons between K-means and hierarchical clustering. But our consideration is speed, since we are going to apply clustering algorithms on big social network data, which is always of GB or TB size. The hierarchical clustering is extremely computational expansive as the size of data increases, since it needs to compute the D_D similarity matrix, and merges small clusters each time using certain link functions. In contrast, K-means is much faster. It is an iterative algorithm, which updates the cluster centroids (with normalization) each iteration and reallocates each document to its nearest centroid. A comparison of K-means and hierarchical clustering algorithms can be found in [15].

3.2. General Approach

Various algorithms for clustering using k- means, k-medioids, hierarchical clustering can be used. These documents need to be preprocessed to remove the unwanted information which is not useful for investigation. In general, the documents will be stored in files maybe in the same directory or different directories, where we take set of documents as input to system then apply preprocessing methods which include the following steps : 1. Stop word removal 2. Stemming 3. Vector space model Preprocessing includes stop word removal and stemming. The stopwords, which are the most frequently used words, are collected in a separate text file. Preprocessing is performed and using cosine distance formula the required matrix is generated which depends upon the number of input files.To perform cluster analysis, the documents need to be represented in vector form. The vector space model is used for the same. Calculating clusters depends upon the distance between similar words. Cosine based formula or any distance formula is used for this purpose. Also, Levenshtein distance is calculated to find the distance between two documents. Clusters are estimated using various methods such as Kmeans, K- medioids, hierarchical- single, complete and average link, CSPA and Expected Maximization algorithm. Silhouette is used as a relative validity criterion. External validity criterion may be using Random Index Analysis or adjusted random index or Jaccard coefficient.

3.3. Algorithms

3.3.1. K-means Algorithm

In the k-Means algorithm, the labeling function is computed by comparing the distances of a data point xi from the vectors which represent the clusters (the centroids cj). The centroids are the model parameters which are estimate by using iterative steps. According to [13], the k-means algorithm defines the centroid of a cluster as the mean value of the points within the cluster. Algorithm: The k-means algorithm for partitioning, where each cluster's center is represented by the mean value of the objects in the cluster. Input: c: the number of clusters D: a dataset containing n objects Output: A set of k clusters Method: i. Arbitrarily chose k objects from D as the initial cluster centers; ii. Repeat iii. (re)assign each object to the cluster to which the object is most

similar, based on the mean value of theobjects in the cluster; iv. update the cluster means, that is calculate the mean value of the objects for each cluster; v. until no change The time complexity of the k-means algorithm is O(nkt) , where n is the total number of objects, k is the number of clusters, and t is the number of iterations. Therefore, the method is relatively scalable and efficient in processing large datasets.

3.3.2. Expectation Maximization Algorithm

Expectation Maximization is a type of model based clustering method. It attempts to optimize the fit between thegiven data and some mathematical model. Such methods are often based on the assumption that the data are generated by a mixture of underlying probability distributions. The EMalgorithm is an extension of the K-Means algorithm. It is iterative in nature and finds maximum likelihood solutions. With reference to [13], Expectation Maximization consists of two steps: The expectation step assigns objects to clusters according to the current fuzzy clustering or parameters of probabilistic clusters. The maximization step finds the new clustering or parameters that maximize the expected likelihood in probabilistic modelbased clustering. Algorithm Input: c: the number of clusters D: a dataset containing n objects Output: A set of k clusters Method: 1) First find initial centers/centroids which will be the initial input. 2) Compute distance between each data point and each centroid using cosine distance formula or any other distance formula. 3) Assign weights for each combination of data point and cluster based on the probability of membership of a data point to a particular cluster. 4) Repeat i) (Re) assign each data point to the cluster with which it has highest weight i.e., highest probability. ii) If a data point belongs to more than one cluster with the same probability, then (re)assign the data point to the cluster based on minimum distance. iii) Update the cluster means for every iteration until clustering converges. EM has a strong statistical basis, it is linear in database size, it is robust to noisy data, it can accept the desired number of clusters as input, it provides a cluster membership probability per point, it can handle high dimensionality and it converges fast given a good initialization. EM offers many advantages besides having a strong statistical basis and being efficient. One of those advantages is that EM is robust to noisy data and missing information. In fact, EM is intended for incomplete data. The complexity of EM depends upon the number of iterations and time to compute E and M steps. 4.

IV. CONCLUSION AND FUTURE WORK

Due to availability of high speed net connections and newer portable devices, forensic analysis is becoming a complicated process. Existing digital forensic tools for analyzing a set of documents provide multiple levels of search techniques to answer questions and generate digital evidence related to the investigation. However, these techniques stop short of allowing the investigator to search for documents that belong to a certain subject he is interested in, or to group the documents. Most importantly, it is observed that clustering algorithms find out similar words and collect them in a single cluster which helps the forensic examiner for detection. Furthermore, our studies of the proposed approach in real world applications show that it has the capacity to fasten the computer inspection process. In this paper two clustering methods are discussed. The future work may include modifying the existing EM algorithm by combining the Quad Tree approach and the EM algorithm which gives a clustering method that not only fits the data better in the clusters but also tries to make them compact and more meaningful [2].

V. REFERENCES

[1]. Luís Filipe da Cruz Nassif and Eduardo Raul Hruschka, —Document Clustering for Forensic Analysis: An Approach for Improving Computer Inspection‖, IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY, VOL. 8, NO. 1, JANUARY 2013.

[2]. Meenakshi PC, Meenu S, Mithra M, Leela Rani P, —Fault Prediction using Quad Tree and Expectation Maximization Algorithm‖, International Journal of Applied Information Systems (IJAIS) – ISSN : 2249-0868 Foundation of Computer Science FCS, New York, USA Volume 2– No.4, May 2012

[3]. J. F. Gantz, D. Reinsel, C. Chute, W. Schlichting, J. McArthur, S. Minton, I. Xheneti, A. Toncheva, and A. Manfrediz, —The expanding digital universce: A forecast of worldwide information growth through 2010,‖ Inf. Data, vol. 1, pp. 1–21, 2007.

[4]. B. S. Everitt, S. Landau, and M. Leese, "Cluster Analysis". London, U.K.: Arnold, 2001.

[5]. A. K. Jain and R. C. Dubes, "Algorithms for Clustering Data."Englewood Cliffs, NJ: Prentice-Hall, 1988.

[6]. L. Kaufman and P. Rousseeuw, "Finding Groups in Gata: An Introduction to Cluster Analysis". Hoboken, NJ: Wiley-Interscience, 1990.

[7]. A. Strehl and J. Ghosh, —Cluster ensembles: A knowledge reuse framework for combining multiple partitions,‖ J. Mach. Learning Res., vol. 3, pp. 583–617, 2002.

[8]. E. R. Hruschka, R. J. G. B. Campello, and L. N. de Castro, —Evolving clusters in gene-expression data,‖ Inf.Sci., vol. 176, pp. 1898–1927, 2006.

[9]. L. Vendramin, R. J. G. B. Campello, and E. R. Hruschka, —Relative clustering validity criteria: A comparative overview,‖ Statist. Anal. Data Mining, vol. 3, pp. 209– 235, 2010.

[10]. G. Salton and C. Buckley, —Term weighting approaches in automatic text retrieval,‖ Inf. Process. Manage., vol. 24, no. 5, pp. 513–523, 1988.

[11]. B. D. Carrier and E. H. Spafford., — An event-based digital forensic investigation framework‖. In Proceedings of the 4th Digital Forensic Research Workshop, 2004.

[12]. M. Laszlo and S. Mukherjee, —A Genetic Algorithm Using Hyper-Quad trees for Low-Dimensional K-Means Clustering,‖ IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 28, no4, pp. 533-543, 2006.

[13]. Han, Kamber, Pei, ‖Data Mining : Concepts and Techniques‖, MK Third Edition

[14]. C M Bishop, —Pattern Recognition and Machine Learning‖ NewYork Springer-Verlag 2006

[15]. M. Steinbach, G. Karypis, and V. Kumar. —A comparison of document clustering techniques‖. Technical Report 00-034, University of Minnesota, 2000

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Underwater Acoustic Modem Design for Short Range Sensor Network

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ABSTRACT

This paper presents the design consideration, implementation details and initial experimental results of our modem. This paper also discusses the various modulation technique like ASK, FSK. This modem uses commercial ultrasonic transducer of 200kHz bandwidth. Massage from transmitter can be displayed in visual format as well as it can be analyzed using different simulation tools at base station. Under water modem consists of three component i) An underwater transducer ii) An analog transceiver (matching per-amplifier and amplifier), iii) A digital platform for control and signal processing. In this paper comparison of results of communication with ASK, FSK modulation technique, micro controller & FPGA.

Keywords: ASK, FSK, FPGA, simulation tools, acoustic sensor network.

I. INTRODUCTION

The knowledge about the ecosystem is increasing due to physical, chemical and biological time series data from long term sensor. Despite the substantial effort for monitoring ecological aspects of aquatic systems, the infrastructure needed for sensor networks in marine and freshwater systems without question lags far behind that available for terrestrial counterparts.

TABLE: 1 MAIN DIFFERENCES BETWEEN UNDERWATER ACOUSTIC NETWORK AND TERRESTRIAL RADIO NETWORK (PAOLO CASARI MICHEL ZORZI, 34(2011)2013-2025)

Sr.No	Underwater acoustic	Terrestrial radio
1	Low bandwidth (KHz)	High bandwidth (MHz)
2	Long delay	Short delay
3	Distance dependent on bandwidth	Distance independent on bandwidth
4	Few simulation tools available	Several simulation tools available
5	Hard to experiment	Easy to experiment

Courtesy:[1] Paolo Casari Michel Zorzi ((2011) 2013-2025) Protocol design issues in underwater acoustic network ScienceDirect Computer Communication 34,Department of Information Engineering,University of Padova,Italy jornal Homepage : www.elsevier.com/locate/comcom

Now a day's interest in the design and deployment of underwater acoustic communication network. Application of underwater sensor node will be in oceanographic collection of data, monitoring of water pollution, disaster prevention, assisted navigation & tactical surveillance application. (UUV, AUVs) unmanned or autonomous underwater vehicles equipped with sensor will enable to gathering of scientific data. It consist of variable number of sensor & vehicles that are deployed to perform collaborative monitoring task over give area

1.1. Characteristics of underwater acoustic sensor network- (Ian F. Akyildiz , Dario Pompili, Tommaso Melodia, 2005)

Communication media: it uses acoustics waves, electromagnetic waves or optical waves.

Transmission loss: It is related to attenuation and Geometric spreading which is proportional to distance and independent of frequency.

Noise: It of two types man made noise and ambient noise.

Multi path: Multiple propagation cause to degradation of acoustic communication signal due to (ISI) Inter symbolInterference.

Doppler spread: It causes degradation in performance of digital communication. It generates two effects: a simple frequency translation and continues spreading of frequency.

1.2. Major challenges encounter in design of underwater acoustic network are as follows. (Ian F. Akyildiz *, Dario Pompili, Tommaso Melodia, 2005)

1) The available bandwidth is severely limited.
2) The underwater channel is impaired because of multi- pat hand fading.
3) Propagation delay in underwater is five orders of magnitude higher than in Radio Frequency (RF) terrestrial channels.

High bit error rates and temporary losses of connectivity (shadow zones) can be experienced.

4) Underwater sensors are characterized by high cost because of extra protective sheaths needed for sensors and also relatively small number of suppliers (i.e., not much economy of scale) is available.
5) Battery power is limited and usually batteries cannot berecharged as solar energy cannot be exploited.
6) Underwater sensors are failures sometimes because of fouling and corrosion.

II. DESIGN OF ASK MODEM

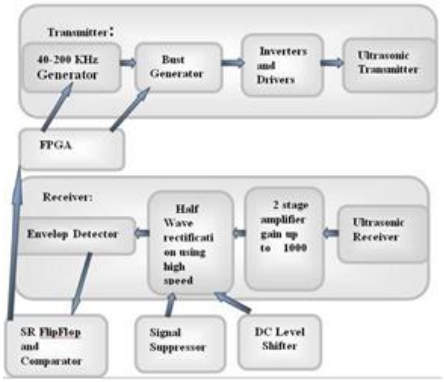

Figure1: Major components of an underwater acousticASK modem

A. Transmitter

1) **Ultrasonic pulse oscillator:** Time of the ultrasonic pulse is controlled by ooscillation circuit.The time of the oscillation pulse can be given by the following formula.

T_L= 0.69 x RB x C T_H=0.69 x 9RA+RB)xC

2) **Ultrasonic oscillator:** This circuit is to make oscillate the ultrasonic frequency of 40KHz. Oscillation's operation is same as above circuit and makes oscillate at the frequency of 40 KHz which makes RB>RA to bring the duty (Ratio of ON/OFF) of the oscillation wave close to 50%.The frequency of the ultrasonic must be adjusted to the resonant frequency of the ultrasonic sensor. Therefore, to be able to adjust the oscillation frequency by making the RB the variable resistor (VR1). The output of ultrasonic pulse oscillator is connected with the reset terminal of ultrasonic oscillator through the inverter. Ultrasonic oscillator works in the oscillation, when the reset terminal is at the H level. The ultrasonic of 40 KHz is sent for the 1 millisecond and pauses for the 62milliseconds.

3) **Ultrasonic sensor drive circuit:** The inverter is used for the drive of the ultrasonic sensor. For more transmission electric power, connect two inverters in parallel .The phase with the voltage to apply to the positive terminal and the negative terminal of the sensor has been 180 degrees difference. Because it gives the direct current with the capacitor, about two times of voltage of the inverter output are applied to the sensor.

B. Receiver

1) **Signal amplification circuit:** The ultrasonic signal which was received with the reception sensor is amplified by 1000 times (60dB) of voltage with the operational amplifier with two stages. It is 100 times at the first stage (40dB) and 10 times (20dB) at the next stage. The circuit works with the single power supply of +9 V. The half of the power supply voltage is applied as the bias voltage, for the positive input of the operational amplifiers,

2) **Detection circuit:** The detection is done to detect the received ultrasonic signal. It is the half-wave rectification circuit. In this the Shottky barrier diodes is used. The DC voltage according to the level of the detection signal is gotten by the capacitor. The Shottky barrier diodes are used because the high frequency characteristic is good.

3) **Signal detector:** This circuit used to detects the ultrasonic which returned from the measurement object. Comparator used to detect output of the detection circuit. The operational amplifier of the single power supply is used instead of the comparator. The operational amplifier used to amplifies difference between the positive input and the negative input. At the circuit this time, it connects the output of the detection circuit with the negative input of the signal detector and it makes the voltage of the positive input constant. There is another device in this circuit. It is the diode (D) which connects with the side of the positive input.

The pulse signal of the transmitter is applied to diode. So, it makes not detect the transmission signal which was crowded when sending out the ultrasonic signal from the transmitter.

4) **Time measurement gate circuit:** This circuit is the gate circuit to measure the time which is reflected with the measurement object and returns after sending out the ultrasonic. It is using the SR (the set and the reset) flip- flop.

The set condition is the time which begins to let out the ultrasonic with the transmitter which uses the transmission timing pulse. Time which detected the signal with the signal detector of the receiver circuit is reset condition is the. That is, the time that the output of SR-FF (D) is in the ON condition becomes the time which returns after letting out the ultrasonic.

5) **Measurement pulse oscillator:** This circuit is the oscillator which makes the pulse to measure the propagation time of the ultrasonic. This oscillation circuit use the CMOS inverter.

III. DESIGN OF FSK MODEM

Underwater acoustic FSK modems consist of three mainblocks:

(1) An underwater transducer,

(2) An analog transceiver (matching pre-amp andamplifier), and

(3) a digital platform for control and signal processing.

Block Diagram

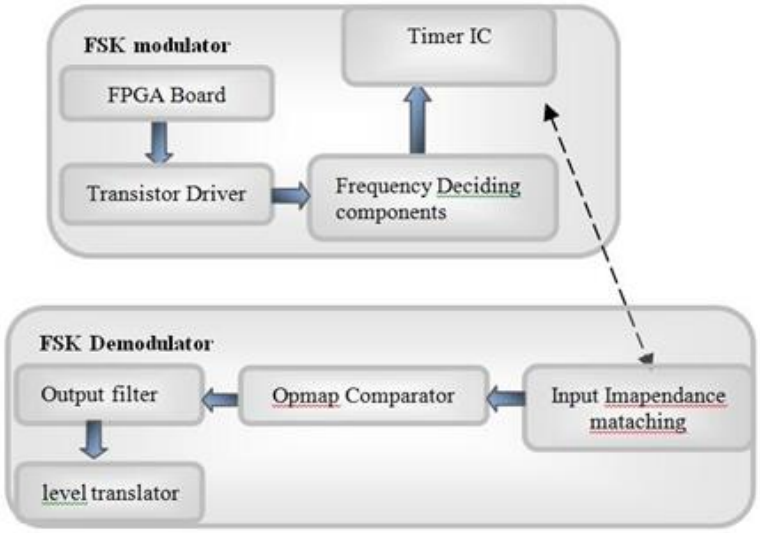

Figure 2: Major components of an underwater acoustic FSK modem.

A. FSK modulator

Frequency Shift Keying plays a great role in wide range of applications in the field of communication and was considered efficient one in data transmission of wireless modems. In this circuit it was wired as a simple Astable multivibrator and in addition a transistor was connected through which input signal was given into the base of the transistor. The resistors R1, R2 and C determine the frequency of the FSK modulated signal in the astable mode of operation. The output frequency of the signal was based on the input digital signal given to the base of the transistor. When the given input was high the PNP transistor was Q is off and IC 555 timer works in the

normal Astable mode of operation & out of it is the series of square wave pulses thus there will be no change in the frequency of the output signal. The output frequency when the input was high which is given by the equation

f= 1.45/(R1 + R2)C

Thus the resultant output FSK will give frequency of 1070Hz when input is high and frequency of 1270 when input is low. Thus in this way the FSK signal was obtainedusing NE555

B. FSK Demodulator

The IC PLL 565 has very wide applications and the most significant among them was employing IC PLL 565 as a FSK demodulator. PLL 565 the frequency shift is usually accomplished by driving a Voltage Controlled Oscillator with the received binary data signal. Thus the output correspond to the input logic 0 or 1 signals. It locks the input signal frequency and tracks it between the two possible frequencies with a DC shift at the output of this IC. The free-running frequency of the internal VCO of the PLL IC is determined by resistor R1 and C1.The output of VCO comparator was fed into the Phase comparator input to perform the locking operation of signal frequencies.

IV. HW/SW Co-Design of Digital Modem

Papilio One XC3s250 Spartan3 will be using. Arduino IDE we will use and Language of programming is somewhat different than VHDL but it finally gets converted into Bit file which can be loaded into FPGA. This IDE better handles floating points and will give u better results that why we have chosen this.

A. Spartan-3E FPGA Family

- Very low cost, high-performance logic solution
- Multi-voltage, multi-standard SelectIO™ interface pins
- LVCMOS, LVTTL, HSTL, and SSTL single-endedsignal standards
- 622+ Mb/s data transfer rate per I/O
- Enhanced Double Data Rate (DDR) support
- DDR SDRAM support up to 333 Mb/s
- Abundant, flexible logic resources
- Efficient wide multiplexers, wide logic
- Fast look-ahead carry logic

B. Arduino

It is a single board microcontroller intended used for interactive objects or environments more accessible. Open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM is main block of board. Current models consists of USB interface, for attach various extension boards it provide 6 analogpins for input, as well as 14 digital I/O pins

1) Hardware: An Arduino board consists of an Atmel 8- bit AVR microcontroller with complementary components to facilitate programming and incorporation into other circuits. Some shields communicate with the Arduino board directly, but many shields are individually addressable, allowing many shields to be stacked and used in parallel. Official Arduinos have used the mega AVR series of chips. A boot loader simplifies uploading of programs to programme an Arduino's microcontroller with the on-chip flash memory.
2) Software: The Arduino integrated development environment (IDE) is a cross-platform application used programming language as Java, and is derived from the IDE for the Processing programming language and the Wiring projects. It is used to introduce programming newcomers unfamiliar with software development. It includes a code editor. The Arduino IDE comes with a software library called Wiring, which makes many common input/output operations much easier
3) Microcontroller: A HW/SW co-design for the digital modem to allow for accurate control and I/O. The co-design consists of the digital modem, a UART (Universal Asynchronous Receiver Transmitter) to connect to serial sensors or to a computer serial port for debugging, an interrupt controller to process interrupts received by the UART or the modem, logic to configure the on board ADC, DAC, and clock generator, and Microcontroller, an embedded microprocessor to control the system. The Microcontroller is an 8-bit architecture optimized for implementation FSK modem. It interfaces to the digital modem through two fast simplex links (FSLs), point-to-point, uni-directional asynchronous FIFOs that can perform fast communication between any two design elements on the FPGA that implement the FSL interface. The Microcontroller interfaces to the interrupt controller and UART core over a peripheral local bus (PLB), based on the IBM standard 64-bit PLB architecture specification.

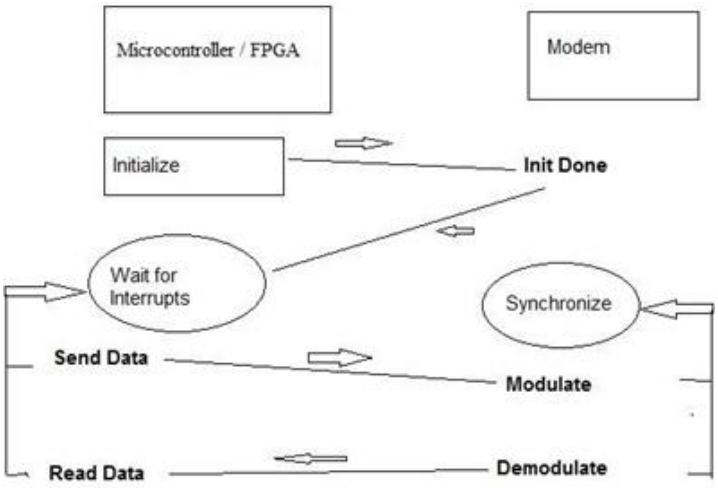

Figure 3: Modem Control flow.(B. Benson, Y. Li, R.Kastner, B.Faunce, K. Domond, D. Kimball, C. Schurgers,2010)

V. INITIAL RESULTS

A. **MATLAB 7.0:** MATLAB 7.0 is high level language and interactive environment for numerical computation, visualization and programming.

Table: 2 Received signal in peak voltage

No.	D Distance between transmitterand receiver in cm	Received signal in peak voltage
1.	2 cm	6.04
2.	5 cm	5.84
3.	15 cm	4.79
4.	20cm	3.97
5.	25cm	3.12

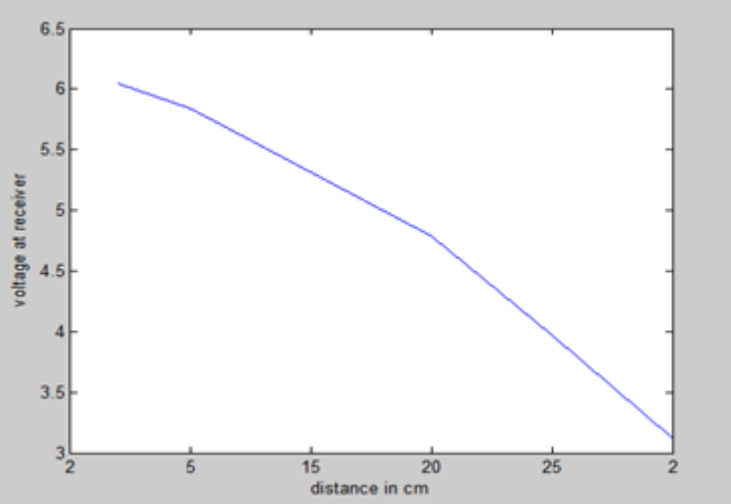

Figure 4: Experimentally determined voltage response at receiver with respect to distance.

Using MATLAB, You can analyze data, develop algorithms and create models and applications. It gives faster solution than with spreadsheets or traditional programming languages. MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment and fourth-generation programming language. MATLAB used to manipulations of matrix, functions plot and data, algorithms implementation, creation of user interfaces, and interfacing with programs used languages such as C, C++, Java, and FORTRAN. MATLAB is also used for MuPAD symbolic engine, which allowing access to symbolic computing capabilities.

B. TERMINAL - terminal emulation program for RS-232: Useful and small terminal emulation program for the Serial port communication. Its uses seven com ports, you can use Transmit Macros. It is com port development tool Terminal is a simple serial port (COM) terminal emulation program. For communicating different devices terminal uses. For serial communication applications, it is very useful debugging tool.

Features:

-without installation, only single and small .exe file
~300KB
-simple file send
-Rx and TX characters counter
-baud rate up to 256kbps & custom baud rate up to 64COM ports

-log to file (hex & string)
-scripting (with graph/visualization support)
-Remote control over TCP/IP – telnet
-run applications from macro commands

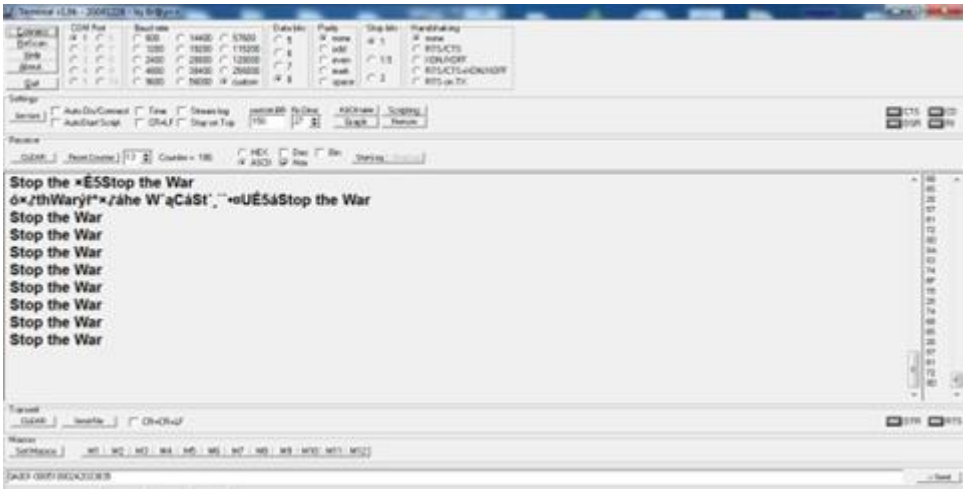

Figure 5: Snapshot of terminal window (result at receiverend).

Table 3.ASK modem parameters

Properties	Assignment
Modulation	ASK
Carrier frequency	40KHz
Mark frequency	NA
Space frequency	NA
Symbol duration	1.04ms
Baseband Frequency	960

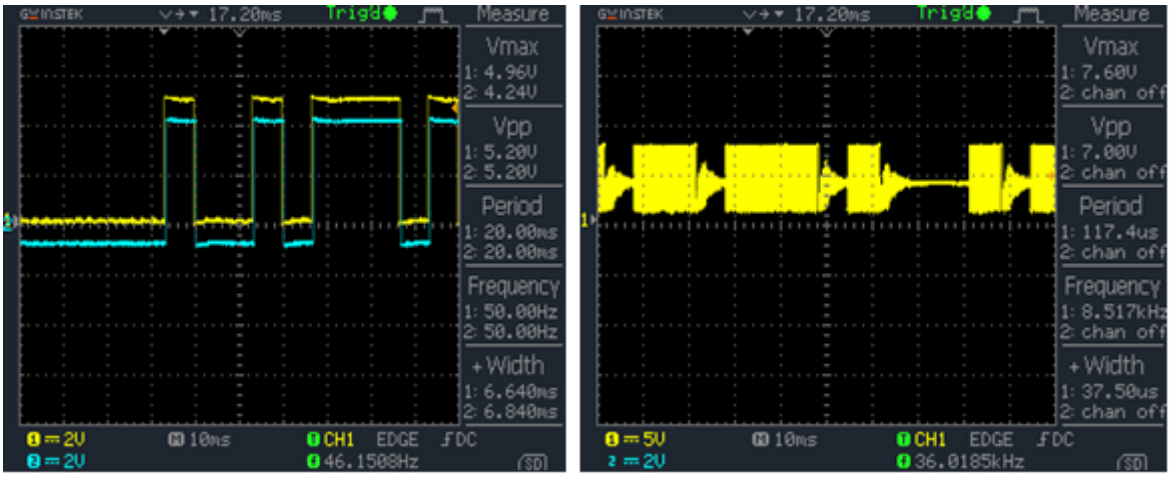

Figure 6: Snapshot of wave forms at ASK receiver end.

Table No,4

Properties	Assignment
Modulation	FSK
Carrier frequency	1KHz
Mark frequency	1.2KHz
Space frequency	1KHz
Symbol duration	6.6ms
Baseband Frequency	150Hz

Figure7: Snapshot of waveforms at FSK receiver end.

7. Modem comparison and conclusion Table 4: Modem Comparison and Conclusion

Modulation Type	FSK	ASK
Carrier Frequency (KHz)	1KHz	40KHz
Mark Frequency (KHz)	1.2KHz	NA
Space frequency (KHz)	1KHz	NA
Symbol duration (ms)	6.6ms	1.04ms
Baseband frequency Hz	150Hz	960

VI. CONCLUSION

Advantage of FSK over ASK is that,

- FSK can withstand variation in amplitude due to do addition of noise. But ASK being amplitude dependant, higher amplitude noise greatly hamper performance of ASK. So ASK can only be used in less noisy environment.
- FSK is not limited by presence of noise, but it is limited by separation of MARK and SPACE frequencies. If MARK and SPACE frequencies are not separated by great value, then it can severely degrade its performance

- FSK works at much less distances as compared to ASK.
- short FSK can be used more efficiently in noisy environment with condition that MARK and SPACE frequencies are sufficiently separated in their value

VII. REFERENCES

[1]. Ian F. Akyildiz , Dario Pompili, Tommaso Melodia (2005)Underwater acoustic sensor networks: research challenges Broadband and Wireless Networking Laboratory, School of Electrical and Computer Engineering,Georgia Institute of Technology, Atlanta, GA 30332, USA

[2]. Benson, Y. Li, R. Kastner, B.Faunce, K. Domond, D. Kimball,

[3]. Schurgers(2010) Design of a Low-Cost, Underwater Acoustic Modem for Short-Range Sensor Networks La Jolla, CA 92093. Paolo Casari Michel Zorzi 34(2011)2013-2025 Protocol design issues in underwater acoustic network ScienceDirect Computer Communication Department of Information Engineering,University of Padova,Italy jornal Homepage : www.elsevier.com/locate/comcom

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Skin Disease Classification Using CNN

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ABSTRACT

The proposed structure contains various disorders, for instance, Atopic Dermatitis, Nail parasite disease, Psoriasisailment acknowledgments and Ringworm affliction stages conjectures. High speed of passings on account of steady disorders,for instance, Dermatitis, Nail development contamination, Psoriasis disease IDs and Ringworm disease need to cultivate genuineinvestigationsystemwhichserves totrained professionals.Someunsatisfactory investigationpromptshumanpassingssoweneedto manage exact assurance of various skin diseases. Many works is presently ruined different sicknesses yet there isn't anyreassuringgameplanfoundthatgives definiteassuranceforinall cases.TheproposedstructureinvolvesvariouscontaminationslikeDermatitis,Naildevelopmentaffliction,Psoriasisail mentareaandRingwormdiseaserecognizablepiecesofproofandstagesassumptions.Weareendeavoringtoencouragest ructurefor multidiseaseIDandstagesassumptionsgivesearlyacknowledgmentand saves lots of life's by reducing death rate by skin disorders. In this paper we used convolutional neural network for diseaseidentification.Wegetthe94.4%accuracy
on100epochs.WearealsorecommendingthehospitalbyusingKNNalgorithm.

Keywords: MultiDiseaseDetection, ConvolutionalNeuralNetwork, NeuralNetwork, DeepLearning,KNN

I. INTRODUCTION

A skin that has insufficient melanin is familiar with the risk of devours from the sun what's more, horrendous splendid exudesfrom the sun. Investigators guarantee that the affliction requires early intercession with a particular outrageous objective to cansee right results that will enhance it for the clinicians and dermatologists to excuse it. This issue has been wound up beinguncommon.Itisportrayedbytheadvancementofwounds intheskinthatchange alive andwell,size,masking,andsurface.DNNperforms better standing apart from other arrangement assessments in talk assertion and peculiarity region etc. The reasonabilityof skin difficulty region has been further developed utilizing later improvement in AI moves close, yet the accuracy has not beenimprovedregardingthesocial affairofskininfirmities.
JaineshRathod,VishalWaghmode etal.[1] stated that, this framework will use computational procedure to dissect, process, and consign the picture information predicated on different highlights of the pictures. Skin pictures are separated to eliminateundesirable commotion and furthermore process it for upgrade of the

picture. Highlight extraction utilizing complex procedureslike Convolutional Neural Network (CNN), characterize the picture dependent on the calculation of softmax classifier and get theconclusion report as a result. Gavrilov, D. A., A. V. Melerzanov, et al. [2] proposed that Melanoma is one of the most perilouskinds ofmalignantgrowth.Theprecisionofvisualanalysisofmelanomastraightforwardlyreliesupontheexperienceandstrength of the doctor. Current improvement of picture handling and AI innovations permits frameworks dependent on counterfeit neuralconvolutionalorganizationstobemade,thesebeingsuperiortopeopleinobjectcharacterizationerrands,including thediagnosticsofthreateningskinneoplasms.

Milton, Md Ashraful Alam [3] proposed that explored different avenues regarding different neural organizations which utilizelateprofoundlearningbasedmodelslikePNASNet-5-Large,InceptionResNetV2,SENet154,InceptionV4.Dermoscopicpicturesareappropriatelyhandledandincreasedpriortotakingcareofthemintotheorganization.Theytriedtheirstrategieson International Skin Imaging Collaboration (ISIC) 2018 test dataset. Nida, Nudrat, Aun Irtaza [4] stated that in this paper, executingthe expanded convolution, we pick the exchange learning with four well known designs: VGG16, VGG19, MobileNet, andInceptionV3. The HAM10000 dataset was used for preparing, approving, and testing, which contains an aggregate of 10015dermoscopic pictures of seven skin sore classes with gigantic class awkward nature. The main 1 exactness accomplished onexpanded renditions of VGG16, VGG19, MobileNet, and InceptionV3 is 87.42%, 85.02%, 88.22%, and 89.81%, separately.Widened InceptionV3 showed themost noteworthy arrangement exactness, review, accuracy, and f-1 score and enlargedMobileNetadditionallyhashighcharacterizationprecisionwhilehavingthelightestcomputationalintricacies.WidenedInceptionV3 accomplished betterbyandlargeandper-class exactness thananyknownstrategies.

II. PROPOSEDDESIGN

In a proposed framework, we are proposed probe skin illnesses like atopic Dermatitis, Psoriasis, Ringworm and Nail organisminfectionswithrestrictedarrangementofregulatedinformationasshowninfig.1.

We are proposed a Convolutional neural organization based multimodal sickness hazard expectation model for restricted skinillnesses with higher exactness. We will address precision issue in determination of Psoriasis with exact stage forecasts. Welikewise work on ringworm location by machine assessments relies upon sizes in mm. Nail parasite and atopic dermatitis locationreliesuponanalyzeddataset.

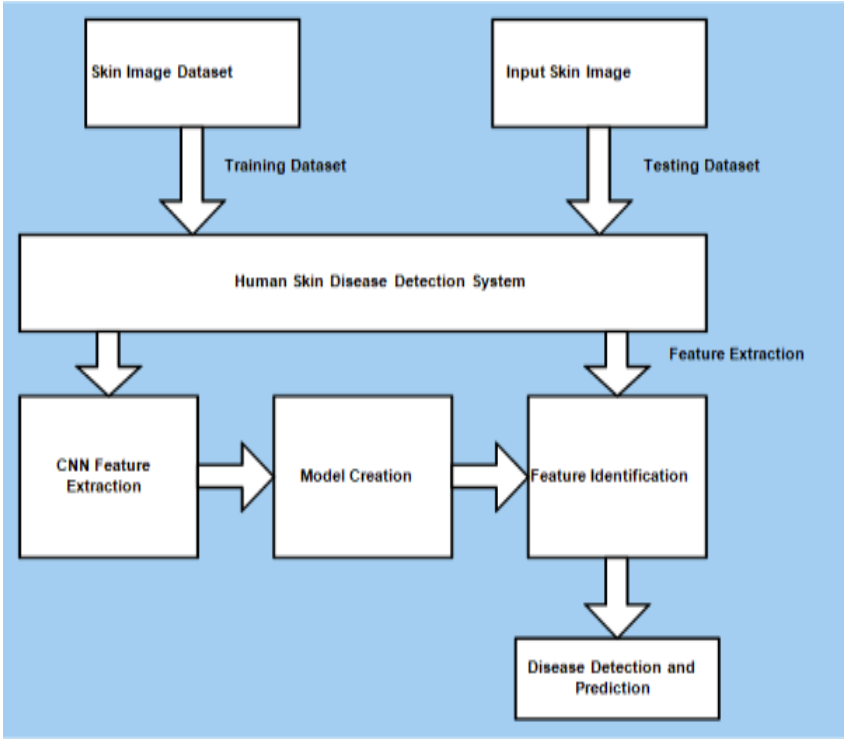

Figure1.ProposedArchitecture

Algorithms

A. Convolutional Neural Networks (CNN)

Convolutional Neural Networks (which are additionally called CNN/ConvNets) are a kind of Artificial Neural Networks that areknowntobetremendouslystronginthefieldofdistinguishingproofjust aspicture order.

Four **mainoperationsintheConvolutionalNeuralNetworksareshownasfollows:**

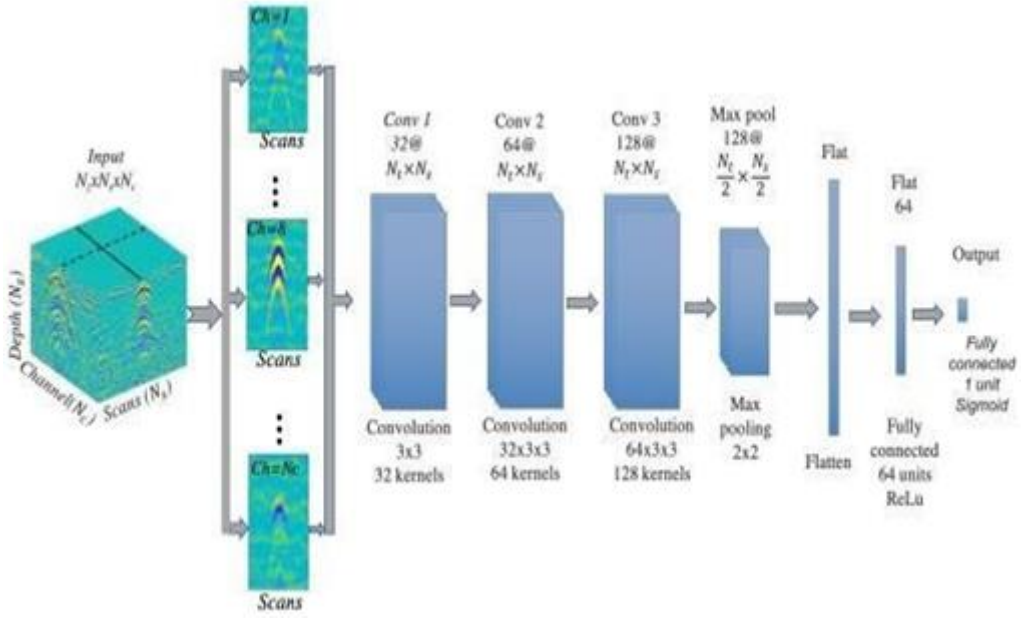

Figure3.ArchitectureofCNN

(i) Convolution

The principle utilization of the Convolution activity if there should be an occurrence of a CNN is to recognize fitting highlightsfrom the picture which goes about as a contribution to the primary layer. Convolution keeps up the spatial interrelation of thepixels This is finished by fulfillment of picture highlights utilizing miniscule squares of the picture. Convolution equation. Everypicture is seen as a network of pixels, each having its own worth. Pixel is the littlest unit in this picture grid. Allow us to take a 5by5(5*5)frameworkwhosequalitiesarejustintwofold(forexample0or 1),for better agreement.ItistobenoticedthatpicturesarebyandlargeRGBwithupsidesofthepixelsgoingfrom 0-255i.e256pixels.

(ii) ReLU

ReLU follows up on a rudimentary level. All in all, it is an activity which is applied per pixel and overrides every one of the non-positiveupsidesofeverypixelinthecomponentmapbynothing.

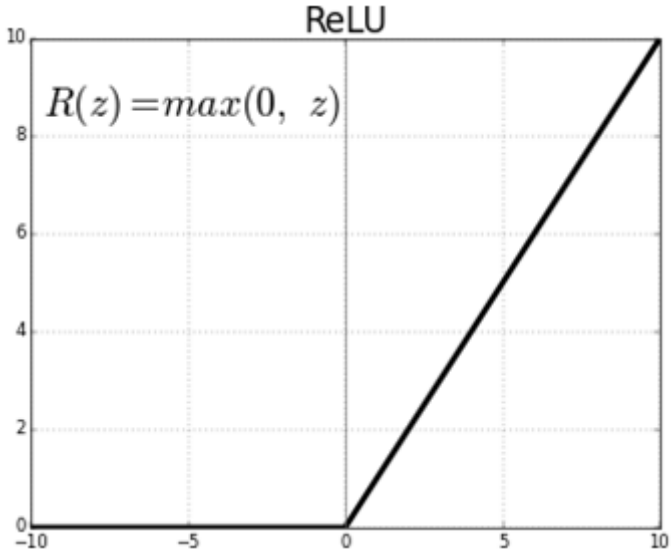

Figure3.KNNArchitecture

(iii) Poolingorsub-sampling

SpatialPoolingwhichislikewise calledsub-samplingordownsamplinghelpsinlesseningtheelementsofeachelementmapyetevenat thesametime, holds themost importantdataoftheguide.Subsequenttopoolingisdone,inthelongrunour3Delementmapischangedovertoonedimensionalcomponentvector.

B. KNN

A refinement of the k-NN characterization calculation is to gauge the commitment of every one of the k neighbors as indicatedby their distance to the inquiry point, giving more prominent load to nearer neighbors. The KNN classifier recommending theemergencyclinicsubtleties forinfectiondependentontheclosest distance.

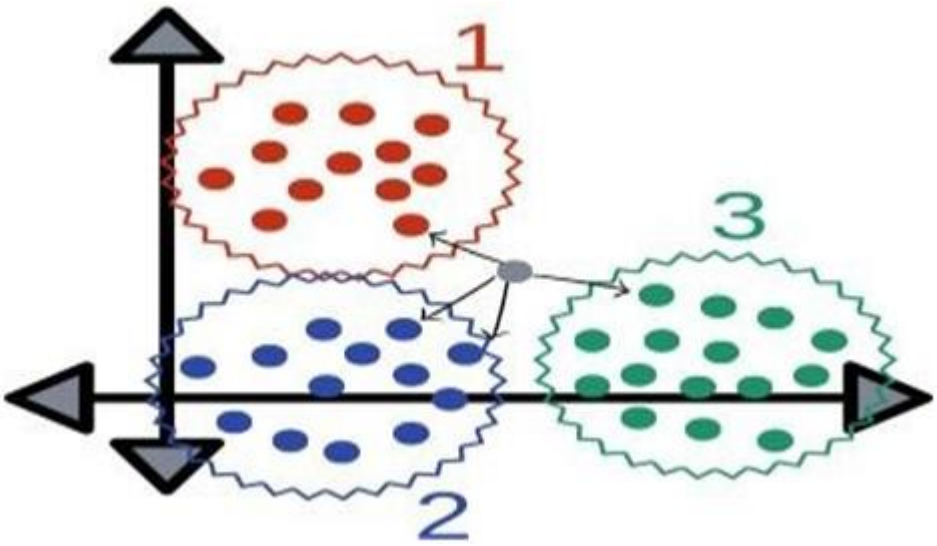

Figure 4.KNNArchitecture

$$d = \sqrt{((x2 - x1)^2 + (y2 - y1)^2)}$$

d=distance
x1, x2, y1, y2=datapoints

III. RESULTS & DISCUSSION

In our experimental setup, as shown in table 2, the total numbers of 287 of trained images for four diseases such as ringworm,nail fungus, psoriasis and dermetatis 56 new images were tested. These images go through CNN framework by following featureextraction using our image processing module. Then our trained model of classification of diseases get classifies the image intospecifiesdisease.Weget theaccuracy94.4%at 100epochs.

Sr.No.	Category	NumberofImages
1	Training	287
2	Testing	56

Table1.ClassificationofData

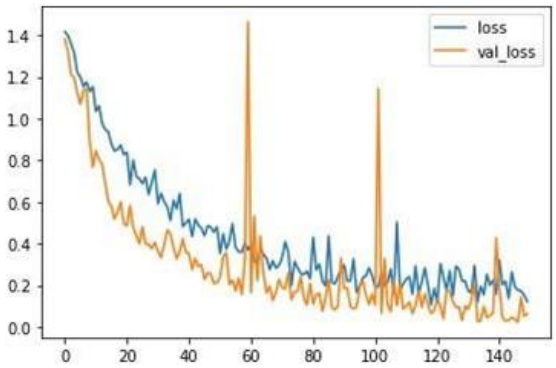

Figure5.Lossof CNN

IV. CONCLUSION

We will concoct multi-illness discovery framework over AI and CNN procedures which takes care of existing exactness issue justas lessen passing rates by skin type infections like Psoriasis identification, Ringworm recognition, Atopic Dermatitis and NailFungus getting 94.4% accuracy on 100 epochs. After recognition of sickness illuminate to clients that how to keep from aninfection. After conclusion we prescribe clinic to client utilizing Knn classifier. For futurework, we can carry out this strategy on some more skin infections with rich dataset. Expanding the quantity of infections and dataset utilized for the interaction can work on theprecision.

V. REFERENCES

[1]. JaineshRathod,VishalWaghmode,AniruddhSodha,Dr.PrasenjitBhavathankar“DiagnosisofskindiseasesusingConvolutionalNeuralNetworks”Proceedingsofthe2ndInternationalconference onElectronics,CommunicationandAerospaceTechnology(ICECA2018).

[2]. Gavrilov, D. A., A. V. Melerzanov, N. N. Shchelkunov, and E. I. Zakirov. "Use of Neural Network-Based Deep LearningTechniquesfortheDiagnosticsofSkinDiseases." BiomedicalEngineering52,no.5(2019):348-352.

[3]. Milton, Md Ashraful Alam. "Automated Skin Lesion Classification Using Ensemble of Deep Neural Networks” in ISIC 2018:SkinLesionAnalysisTowardsMelanomaDetectionChallenge. arXivpreprintarXiv:1901.10802(2019).

[4]. KyameliaRoy,SheliSinhaChaudhuri,SanjanaGhosh“SkinDiseasedetectionbasedondifferentSegmentation Techniques”UniversityofEngineering&ManagementNewtown, Kolkata,WestBengal,India(2019).

[5]. Nida,Nudrat,AunIrtaza,AliJaved,MuhammadHaroonYousaf,and MuhammadTariqMahmood."SkinLesionsClassification Using Deep Learning Based on Dilated Convolution" International journal of medical informatics Telfer SchoolofManagementUniversityofOttawa(2020).

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Crack Detection in Cantilever Beam Using Modal Analysis by FEA

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ABSTRACT

In this work a systematic approach to study and analyze the crack in cantilever beam established. This work addresses the inverse problem of assessing the crack location and crack size in various beam structures. The study is based on measurement of natural frequency, a global parameter that can be easily measured at any point conveniently on the structure. In theoretical analysis the crack is simulated by a spring, connecting the two segments of the beam. The catachrestic equation obtained from the vibration analysis of Eluer-Bernoulli beam is manipulated to give the relationship between the stiffness & location of crack. The model of beam is generated using finite element method. To begin with, natural
frequencies for uncracked beam found out by finite element analysis. Crack has been developed of known dimensions at known location. The induced crack causes reduction in natural frequency. Plots of the spring stiffness verses crack location are obtained for the three lowest transverse mode using the derived relation. There common intersection point will give the crack location & corresponding stiffness. Further the crack size can be estimated from the standard relation between stiffness & crack size. The numbers of cases are evaluated & error in the prediction of crack size & location is less than 4%.

Keywords: Crack, Natural Frequency, crack location, crack size.

I. INTRODUCTION

Most of rotating machines used in process industries or in manufacturing plant need periodic maintenance and repair. However, failure of just one of these machines can disturb an entire process with loss in terms of production, manpower, and equipment repair or replacement. Also failure of a single machine component in the process industries like petrochemicals or power stations can result into loss of millions of rupees per down time hour. These facts together with higher costs for new equipment have placed increasing demand on plant maintenance to keep existing equipment operating efficiently with higher productivity.
As discussed above the failure of machine component is loss of time, money and life. Most of the machine components failures are because of the crack. So there is necessity to predict such failures in advance so that losses because of failure are avoided or minimized. Condition based monitoring is one of the preventive maintenance method used in the plant maintenance. So there is requirement to develop the

methodology which can be used easily to predict the crack in the machine component from the machine condition such as vibration data.

Objective of this study is to establish a method for detecting the location and depth of a crack in beams using experimental vibration data. The scope of present work is kept limited to case cantilever beam with single crack. The method has been considered only for normal edge crack.

Here the beam element is taken to carryout vibration analysis, because the beam represents one of the most important structural members in engineering design and construction. The mounting brackets, cranes are the examples of cantilever beam. This method can be used in conditioning based monitoring, which can reduce the loss of time and money.

II. METHODS AND MATERIAL

In this dissertation efforts are made to develop suitable method that can serve as a basis to detect crack location and crack size from measured vibration data. The method based on vibration measurement for detection of location and size of crack is relatively new. Mostly mode frequencies are used for monitoring the crack because modal frequencies are properties of the whole component. The measurements of natural frequencies of machine component at two or more stages of its life offer the possibility of locating damage in the component. If frequencies measured before the component put into service, subsequent frequency measurements could be used to test whether the structure is still sound or not. As the crack propagates in the beam the stiffness of the beam reduces which intern reduces its natural frequency. The analytical equation can be developed using the natural frequency due to crack at different locations & depth along the free length of the beam. The method adopts weightless torsional spring in the beam element as a model to represent the crack in the structure. The stiffness of the spring is indicating the severity of the crack. As here we have to measure or calculate the natural frequency. Natural frequency being global parameter can be measured at any location without altering the results. This is the most convenient as it can be measured at any location e.g. bridges or large structures, the alternate methods of energy are quiet cumbersome. In theoretical analysis the crack is simulated by a spring, connecting the two segments of the beam. The catachrestic equation obtained from the vibration analysis of Eluer-Bernoulli beam is manipulated to give the relationship between the stiffness & location of crack. The model of beam is generated using finite element method. To begin with, natural frequencies for uncracked beam found out by FEM and the results are compared with the experimental results.

Crack has been developed of known dimensions at known location. The induced crack causes reduction in natural frequency. Plots of the spring stiffness verses crack location are obtained for the three lowest transverse modes using the derived relation. There common intersection point will give the crack location & corresponding stiffness. Further the crack size can be estimated from the standard relation between stiffness & crack size [1][2].

A cantilever beam with following details is taken for the study.

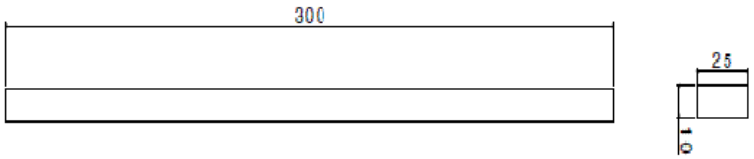

Figure 1: Dimension of Cantilever Beam in mm

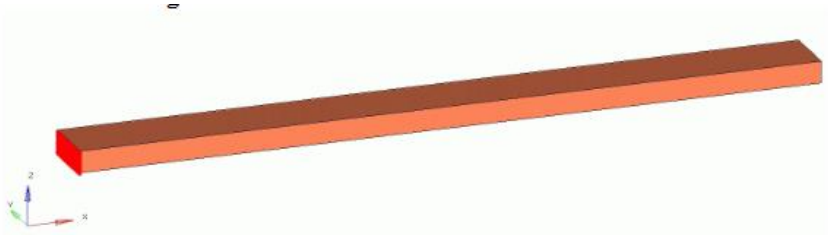

Figure 2 FE Model of Uncracked Cantilever Beam

Table1: Material Details

Material data	Mild steel
Young's modulus (E)	2.1 e11 N/m^2
Density (ρ)	7860 N/m^3
Poisson's Ratio	0.29

Finite elements analysis of uncracked and cracked beam is carried out. Normal mode analysis result of uncracked and cracked beam are tabulated in table2. Mode shapes of uncracked beam are shown in figure 4, 5 and 6. As discussed in above using equation 2 a variation of stiffness with crack location is obtained for lowest three transverse natural frequencies. The position at which the three curves intersect gives crack location & spring stiffness K. The plots for different cases are plotted. Refer figure 7 to 11 for the details. Further using equation 3 crack size is calculated. The variation of stiffness with crack location is obtained using MATLAB program.

III. RESULTS AND DISCUSSION

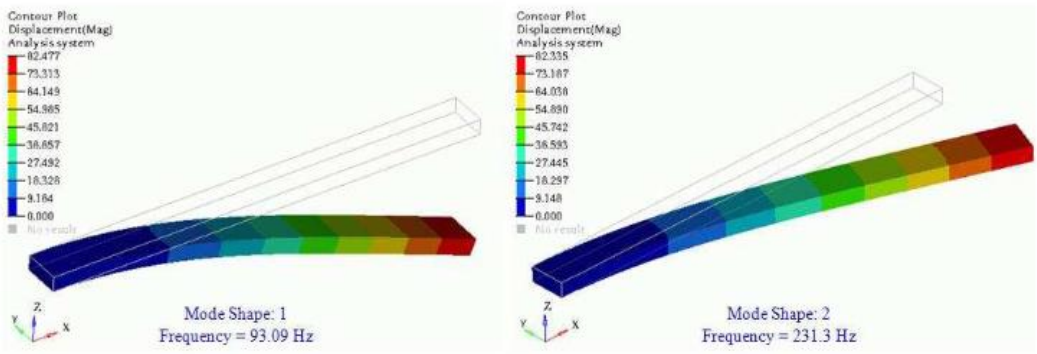

Figure 3 Uncracked Beam - Mode Shape 1 and 2

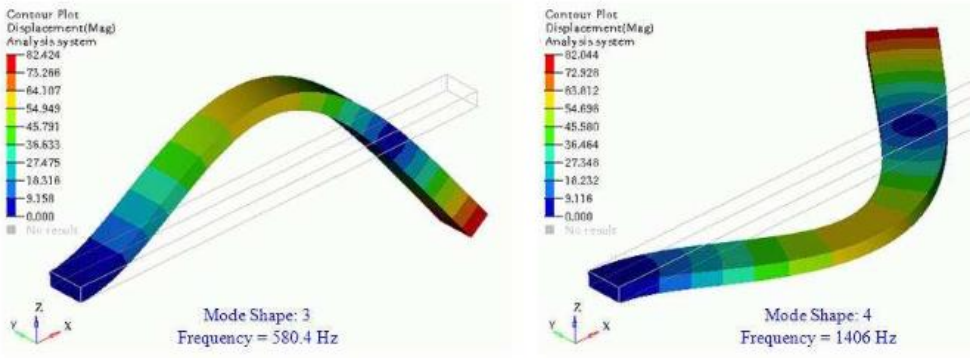

Figure 4 Uncracked Beam - Mode Shape 3 and 4

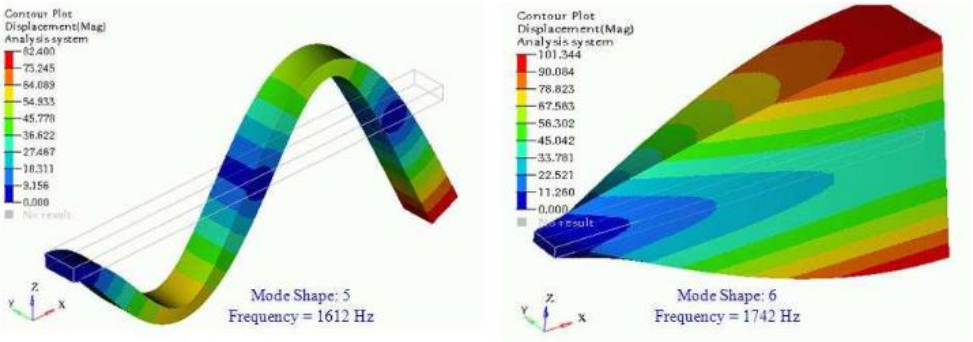

Figure 5 Uncracked Beam - Mode Shape 5 and 6

Table2: Frequency Results

Case No	Natural Frequencies from CAE (rad/s)		
	ω1	ω2	ω3
Uncracked beam	584.92	3646.83	10131.45
1	566.54	3645.79	10040.40
2	583.99	3637.42	10114.53
3	570.94	3513.00	9903.00
4	584.02	3598.23	10052.94
5	581.27	3460.08	9845.85

Table3: Crack Results

Case No	Actual		Predicted result				
	Location β	Size a/h	Location β	Error for location %	Stiffness K	Size a/h	Error for Size %
1	0.2	0.3	0.195	-2.257	32.920	0.292	-2.535
2	0.4	0.1	0.414	3.457	267.940	0.102	2.387
3	0.4	0.4	0.387	-3.189	17.197	0.389	-2.659
4	0.6	0.2	0.614	2.389	68.703	0.205	2.723
5	0.6	0.4	0.582	-2.938	16.824	0.393	-1.755

IV. CONCLUSION

The crack is modelled as a torsional spring and is placed at the root of the crack. With this type of crack location can be predicted accurately. In deriving these theories few important assumptions are made like, the structural member is assumed to behave linearly, the structural properties are assumed to be a time invariant. The error in prediction of crack location size is up to 4%. The proposed method is by comparing it with results of FEM results. Proposed method is found to be simple and accurate.

NOMENCLATURE

a Crack Depth
b Width of the Beam
h Beam Height
a/h Crack Depth Ratio
L Beam Length
A Beam Cross Sectional Area
ρ Material Density
E Material Young's Modulus
υ Material Poisson's Ratio
I Moment of Inertia
ω Natural Frequency
β Crack Location
λ Frequency Parameter
K Non-Dimensional Stiffness of the Rotational Spring

V. REFERENCES

[1]. B. P. Nandwana and S. K. Maiti, "Detection of the location and size of a crack in stepped cantilever beams based on measurements of natural frequencies", Journal of Sound and Vibration (1997) 203(3), 435-446

[2]. B. P. Nandwana and S. K. Maiti, "Modelling of vibration of beam in presence of inclined edge or internal crack for it's possible detection based on frequency measurements", Engineering Fracture Mechanics Vol. 58, No.3, pp. 193-205, 1997

[3]. H. Nahvi, M. Jabbari, "Crack detection in beams sing experimental modal data and finite element model", International Journal of Mechanical Sciences 47 (2005) 1477–1497

[4]. Samer Masoud Al-Said, "Crack identification in a steeped beam carrying a rigid disk", Journal of Sound and Vibration 300 (2007) 863–876

[5]. Q.S.Li, "Vibratory characteristics of multi step beam with an arbitrary number of cracks and concentrated masses", Applied Acoustics 62 (2001) 691-706

[6]. Meirovitch L, Fundamentals of vibrations. New York: McGraw-Hill comp.2001

[7]. Tirupathi R. Chandrupatla, Ashok D. Belegundu, "Introduction to finite element in engineering" 3rd edition, prentice hall. Inc 2002

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Structural Design between Monolithic Concrete vs. Precast Concrete Bridge Structure by Using Cantilever Method

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ABSTRACT

A bridge management system is a method of managing bridges throughout the design, operation, building, and maintenance phases of the bridge's lifecycle. When funding becomes more difficult to come by, road management authorities all over the world have had to deal with challenges related to bridge management as well as an increase in the number of maintenance requests for large infrastructure assets in their jurisdictions. The system of bridge management assists agencies in achieving objectives such as inventory construction, maintenance planning, bridge inspection, and repair and rehabilitation interventions in the most systematic manner, increasing the safety of bridge users, and optimizing the allocation of financial resources. The most important task associated with bridge management is the collection of inventory data; condition evaluation and strength; inspection, repair, prioritization of funds allocation; and replacement of bridge elements. Moreover, business management is regarded as a method of managing information about a bridge for the aim of designing maintenance programs within the constraints of a budgetary constraint. The business management also includes four parts, including degradation and cost, data storage, analysis and optimization models, and updating functions, amongst things.

Keywords: Bridge, Monolithic, Precast, Staad Pro Connect Software, Operations

I. INTRODUCTION

A bridge management system is a way through which bridges are managed in throughout the design, operation, construction, and maintenance of the bridge. When accessibility of funds gets tighter, road management authorities all over the world had to face issues associated with bridge management as well as an increase in maintenance needs of massive infrastructure assets. The system of bridge management support agencies in fulfilling the objectives like constructing inventories, maintenance planning, inspection bridge, interventions of repair and rehabilitation in the most systematic manner, enhancing bridge user's safety and optimization of financial resource allocation.

Conceptofbase isolation

Base isolation is the separation of the base or substructure from the superstructure. It is also called Seismic isolation. Instinctively, the concept of extrication the superstructure from the substructure to avoid earthquake damage is relatively simple to understanding. At the time of earthquake, the ground moves and this ground movement which induces the inertial forces on the structures from both directions which cause most of the harm to structures. An airplane flying over an earthquake is not affected.

So, the fundamental theory is quite simple. Separate the superstructure from the substructure. The sub-structure will move but the structure will not move. Base Isolation falls into the overall class of Passive Energy Dissipation.

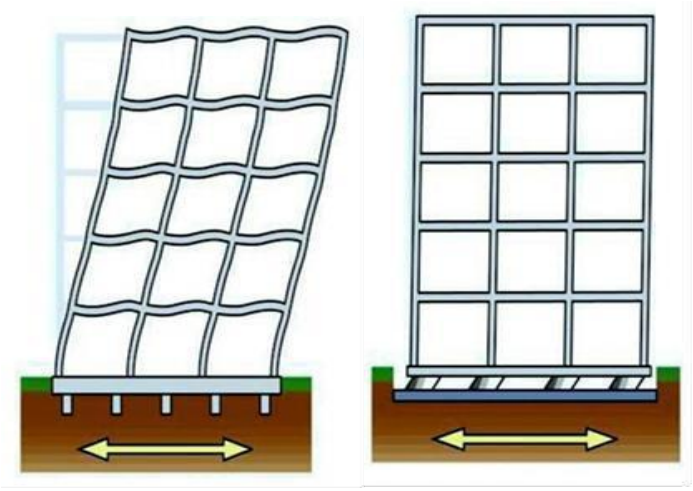


Figure 1:(a) Conventional bridge under ground motion and figure 1 (b) Base isolated bridge under ground motion

The basic principle of base isolation is to transform the response of the bridge so that the ground can move Below the Bridge without transferring these motions into bridge.

The assumption of the ideal system is a complete separation between ground and structure. In actual practice, there is a contact between the structure and the ground surface.

Bridges with a perfectly stiff diaphragm have a nil fundamental natural time period. The ground motion induces acceleration in the structure which will be equivalent to the ground acceleration and there will be nil relative displacements between the structure and the grounds. The structure and substructure move with the same amount. A Bridge with a perfectly stretchy diaphragm will have an immeasurable period. For particular type of structure, when the ground beneath the structure travels there will be zero acceleration induced in the structure and the relative displacement between the structure and ground will be equivalent to the ground displacement. In this case, structure will not change but the substructure will move Incorporation of the isolator into bridge construction:

When it comes to earthquake safety, the first issue that comes to mind for a structural engineer is when to use isolation in the bridge. The simple answer is when it gives a more effective and economical alternative to other methods of employ for earthquake safety. In some cases, base isolation may be practicable if the design for

earthquake loads necessitates the use of strength or detailing that would otherwise be insufficient for other load circumstances.

The easiest technique to determine whether a structure is suited for isolation when evaluating structures that fit this fundamental condition is to go through a checklist of items that make isolation more or less effective depending on the structure ease isolation system is more efficient for the structures which have heavy masses. To effective isolation can be achieved with the help of the long period of the response. As we know the period is an inherent property of the structure which is relative to the square root of the mass M and contrariwise proportional to the square root of the stiffness K. To achieve an effective isolated time period, a heavy mass must be associated with a low stiffness. Devices that are used for isolation do not have an infinite range ofstiffness. For example, elastomeric bearings need to have a minimum diameter to ensure that they remain stable under seismic displacements. This minimum plan size sets a smallest practical stiffness

Sliding systems do not have time period restraint and so low weight bridges may be intelligent to be isolated with sliding systems. However, even these incline not to be cost- effective for light bridges for different reasons. Regardless of the weight of the bridge, the movement is the same for a given effective period and so the size of the slide plates, the most expensive part of sliding bearings, is the same for a heavy or a light structure. In real terms, this usually makes the isolators more expensive as a proportion of the first cost for light bridges. There have been systems proposed to isolate light bridges. However, the fact remains that there are few instances of successful isolation of light structures such as detached residential dwellings.

Location of the isolator in bridges

The paramount requirement for installation of a base isolation system is that the bridge is able to move horizontally relative to the ground, usually at leastX100 mm and in some instances up toX1 meter. A plane of separation must is selected to permit this movement. Final variety of the location of this plane depends on the structure but there are a few things to consider in the process. The most common configuration is to install a diaphragm immediately overhead the isolators. This permits earthquake loads to be spread to the isolator's according to their stiffness. For a bridge without a basement, the isolators are mounted on foundation pads and the structure constructed above them, as shown in Figure2.

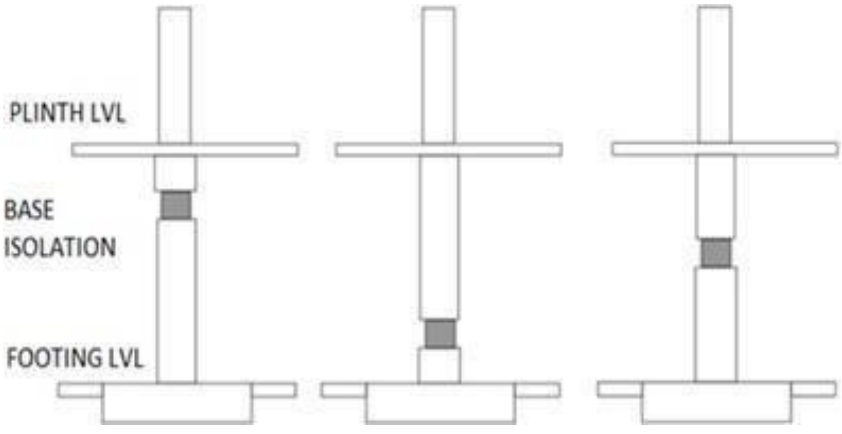


Figure 2:Isolation in bridge with no basement

Uncertainty the bridge has a basement then the options are to install the isolators at the top, bottom or mid-height of the basements columns and walls, as shown in Figure 3.

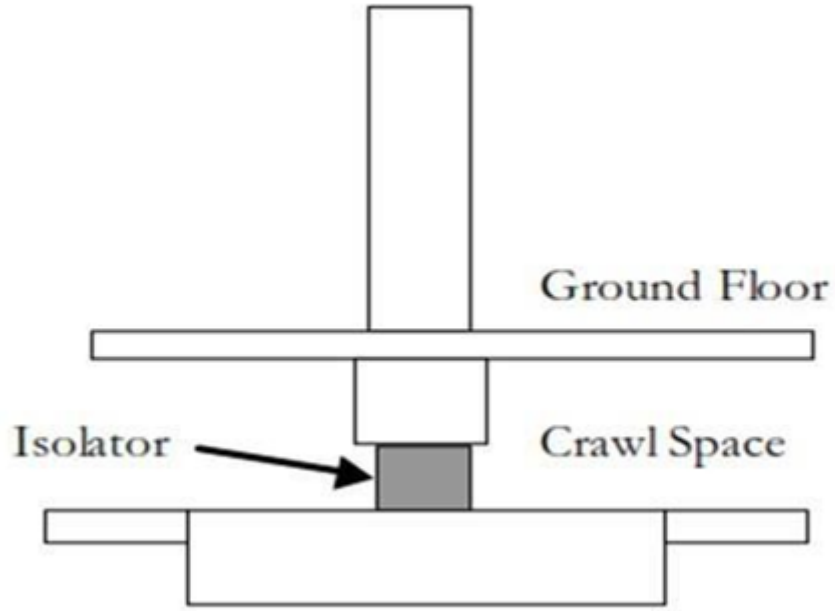


Figure 3: Isolation in the basement

For the options at the top or bottom of the column/wallthen the element will need to be designed for the cantilevermoment developed from the maximum isolator shear force.This wills often require substantial column sizes and mayrequirepilastersinthewallstoresistthefaceloading.

II. METHODOLOGY

- Study of literature review survey
- Problem identification and research gap
- Structural study of existing structure by research papers, books, some field works
- Study of precast and monolithic concrete technology, background and current scenario
- Selection of method and technique
- Design and implementation of precast construction of bridge in India
- Result and discussion
- Conclusion

III. DESIGN AND MODELING

Design a bridge to span a given distance while supporting a maximum load and study various parameters such as deck slab, pier, I section beam, isolated footing etc.

- Bridge span= 12 m

- Roadway= 12 m
- Single Pier
- Pier dia= 2m
- Trapezoidal section of beam
- Upper portion= 10m x 1.5m
- Bottom portion= 1.8m x 1.2m
- Plate Girder of
- Longitudinal Beam (X-Dir 1mx1m)
- Longitudinal Beam (Z-Dir 1mx1m)
- Tapered Section (1.2 mx1.6 m)
- Deck Slab= 400 mm
- Bearing size 0.8m x 0.8mx0.75 m
- Height- 8 m
- Width-8 m
- Loading:
- Dead Load
- Earthquake Load as per 1893:2002

Geometry Creation

Bridge model geometry is analyzed by using differentsketchingandmodelingtoolsavailable.Theslabcrosssection is sketched on one of the planes and dimensioned itasperthebridgemodelslabcrosssectiondimension.

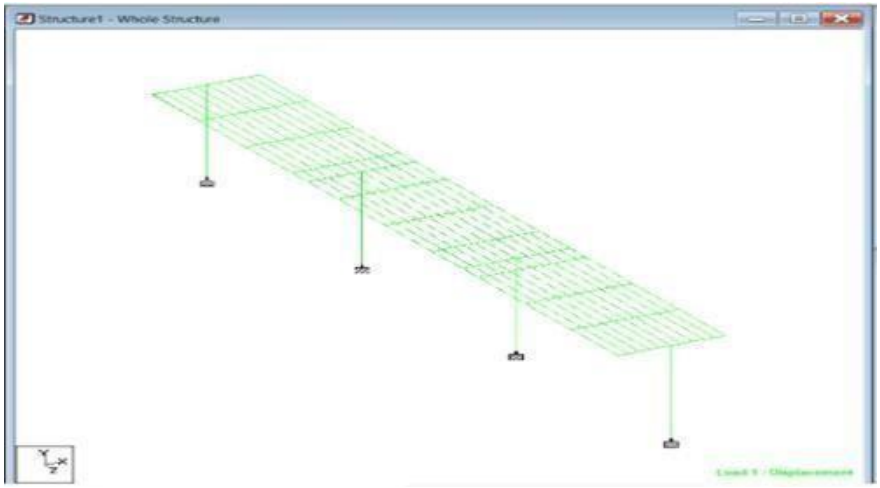


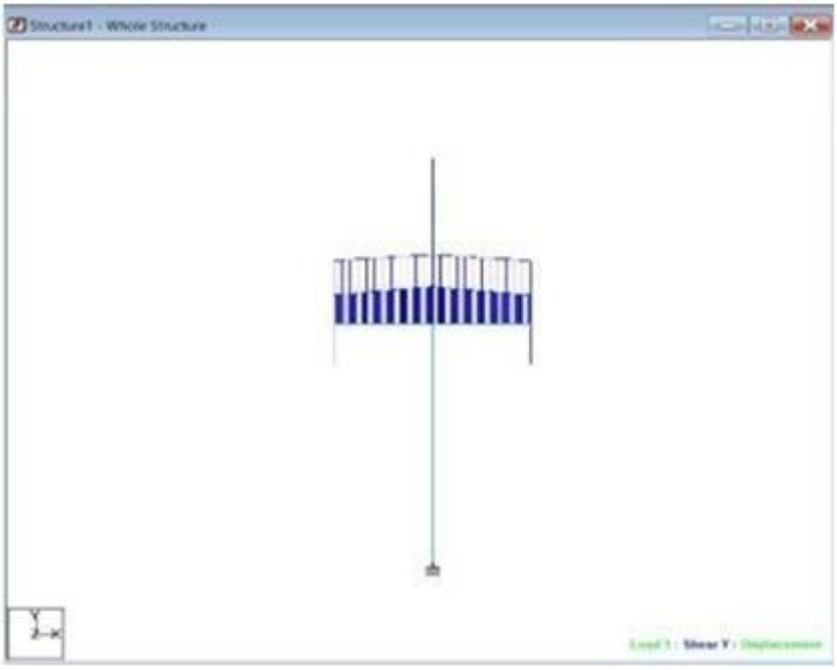
Figure 4: Bridge section

Thenslabcrosssectionisextrudedinthenormaldirection to the sketching plane for the required length. Onthelowersurfaceofthemodeling,acrosssectiononcolumn of bridge is sketched and is extruded normal to theslab surface for the required column length. The Linearpattern is used to make the multiple copies of the columnbyspecifyingthenumberofcopiesandspacingbetween eachcolumn.Onthelowersurfaceofthecolumnfoundation block cross section sketch is created and byusing

extrude command material is added in the normaldirection for the required length. Multiple copies of thefoundation blocks are created by using the linear patterncommand. Defining the Physical properties of Bridge slabsection / Applying the material. Concrete material behavior for the bridge material, thepropertiesofwhichareasbelow,

Thefollowingarethebasicstepsrequiredtoperformtheanalysis,

- Set the analysis preference.
- Create or import model.
- Define element attributes (element types, real constants, and material properties)
- Mesh the model.
- Specify the analysis type, analysis options, and the loads to be applied.
- Solve the analysis problem.
- Post process the result.



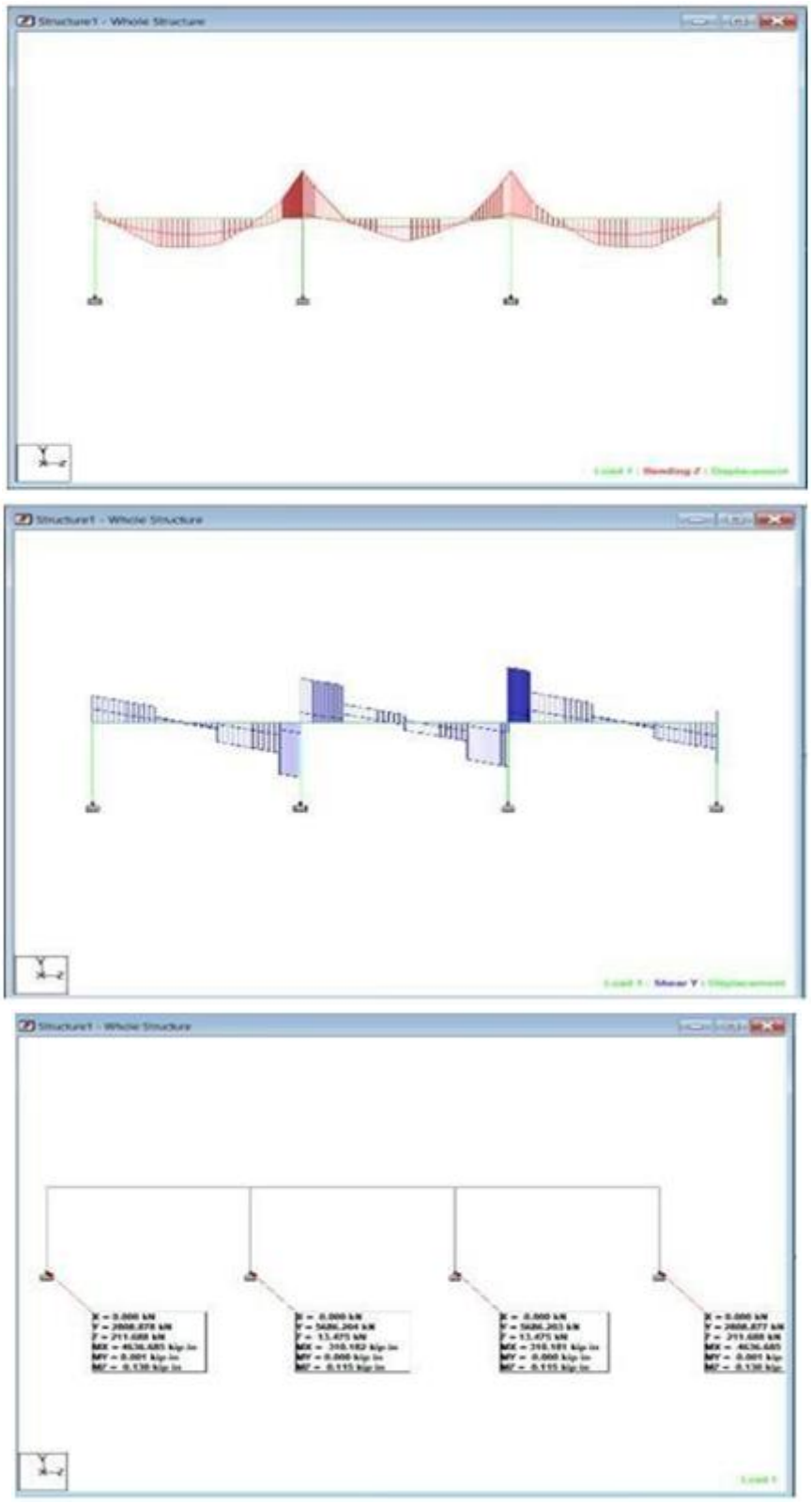
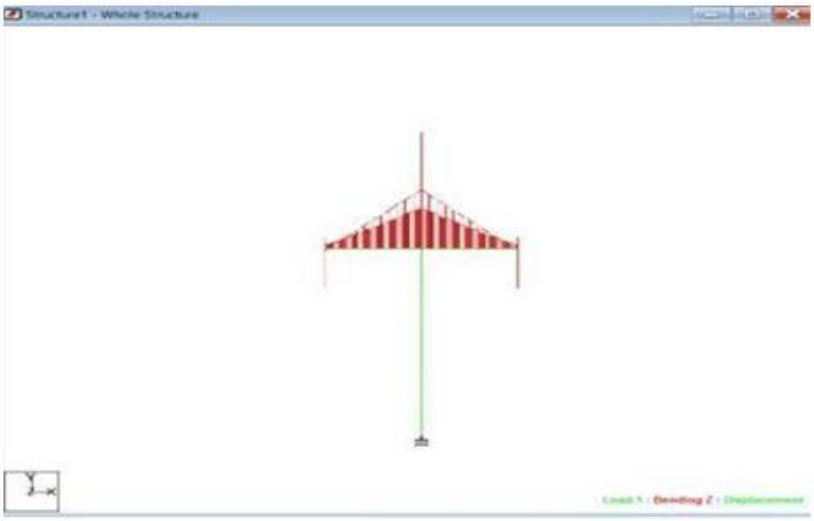
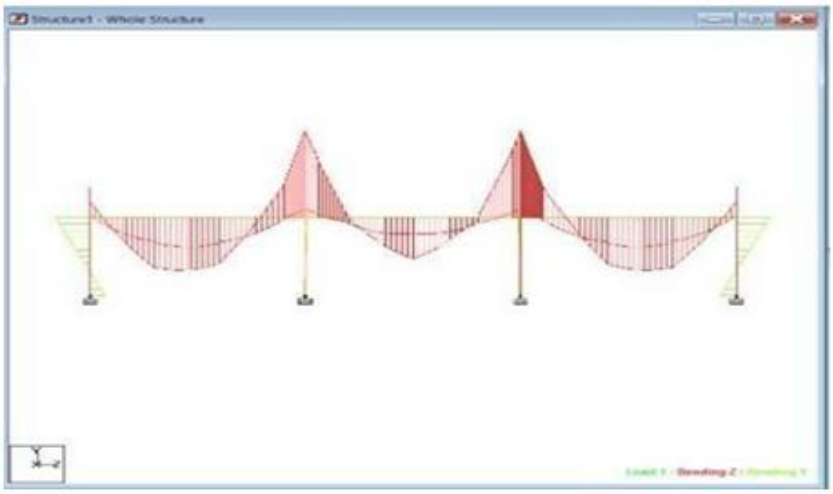
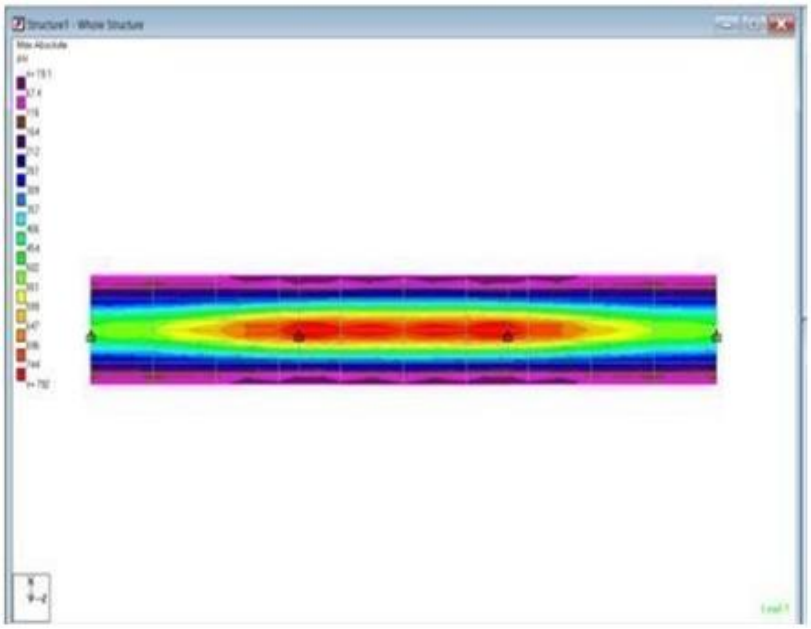


Figure 5: 3DView of Model

IV. RESULTS AND DISCUSSION







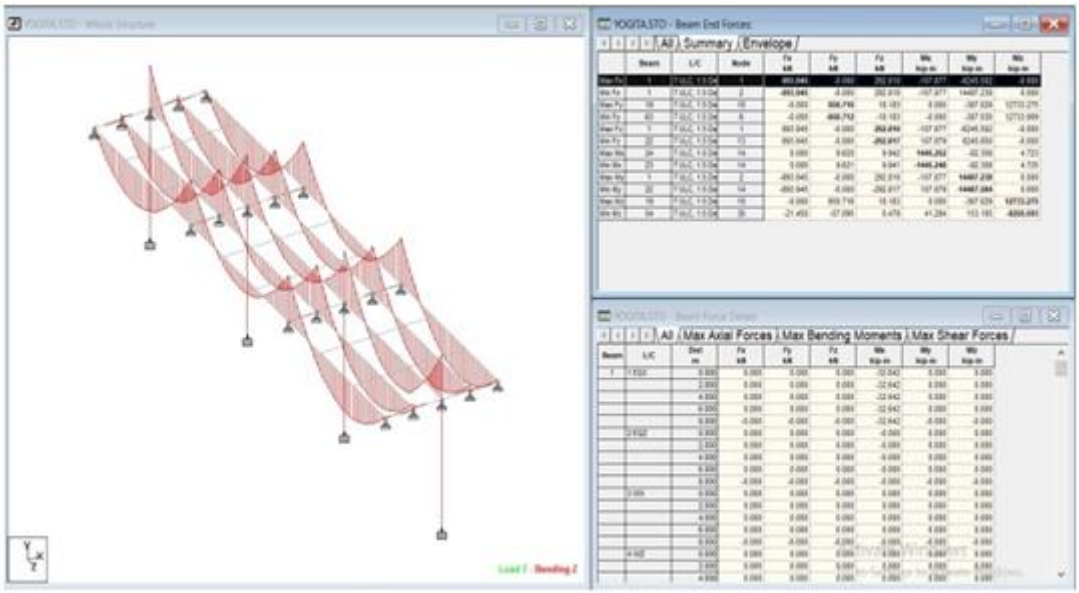


Figure 6: Beam BMD and Column BMD

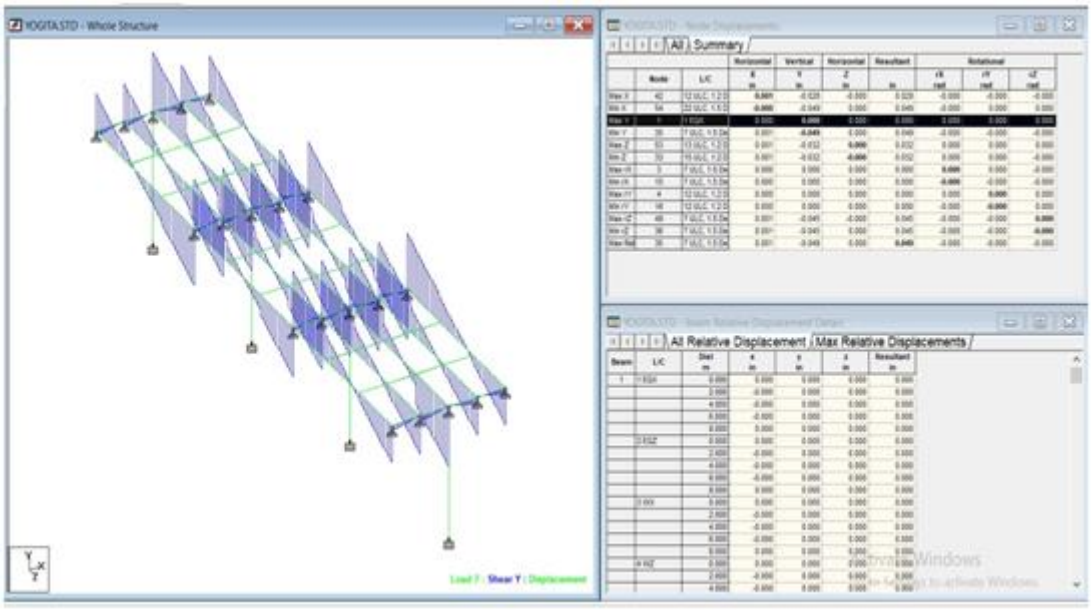
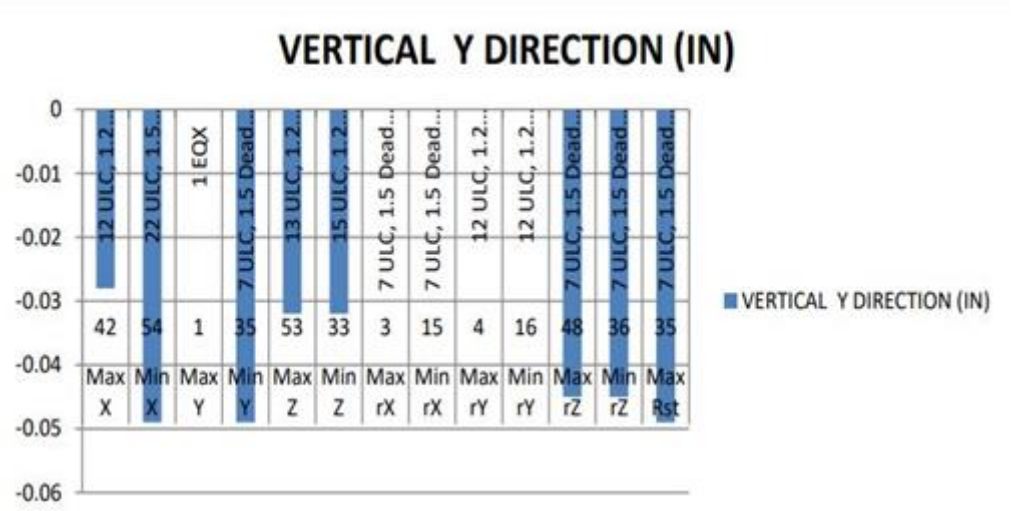


Figure 7: Displacement due Load Combination

TABLE I MAX DISPLACEMENT FOR LOAD COMBINATION

MAX/ MIN	NODE	LOADCOMBINATION	VERTICALY DIRECTION(IN)
MaxX	42	12ULC, 1.2Dead +1.2 Live+ 1.2Seismic (1)	-0.028
MinX	54	22ULC, 1.5Dead +-1.5Seismic (1)	-0.049
MaxY	1	1EQX	0
MinY	35	7ULC, 1.5 Dead + 1.5 Live	-0.049

MaxZ	53	13ULC, 1.2Dead +1.2 Live+ 1.2Seismic(2)	-0.032
MinZ	33	15ULC, 1.2 Dead+ 1.2 Live+-1.2Seismic(2)	-0.032
MaxrX	3	7ULC, 1.5 Dead + 1.5 Live	0
Min rX	15	7 ULC, 1.5 Dead + 1.5 Live	0
Max rY	4	12 ULC, 1.2 Dead + 1.2 Live + 1.2 Seismic (1)	0
Min rY	16	12 ULC, 1.2 Dead + 1.2 Live + 1.2 Seismic (1)	0
Max rZ	48	7 ULC, 1.5 Dead + 1.5 Live	-0.045
Min rZ	36	7 ULC, 1.5 Dead + 1.5 Live	-0.045
Max Rst	35	7 ULC, 1.5 Dead + 1.5 Live	-0.049



Graph 1: Max Displacement for Load Combination in Bridge

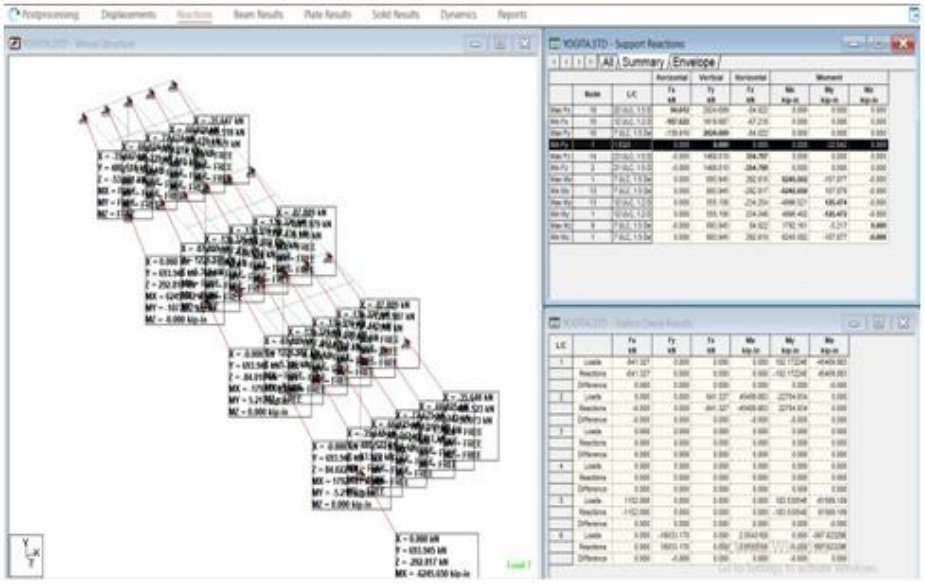


Figure 8: Displacement due Load Combination

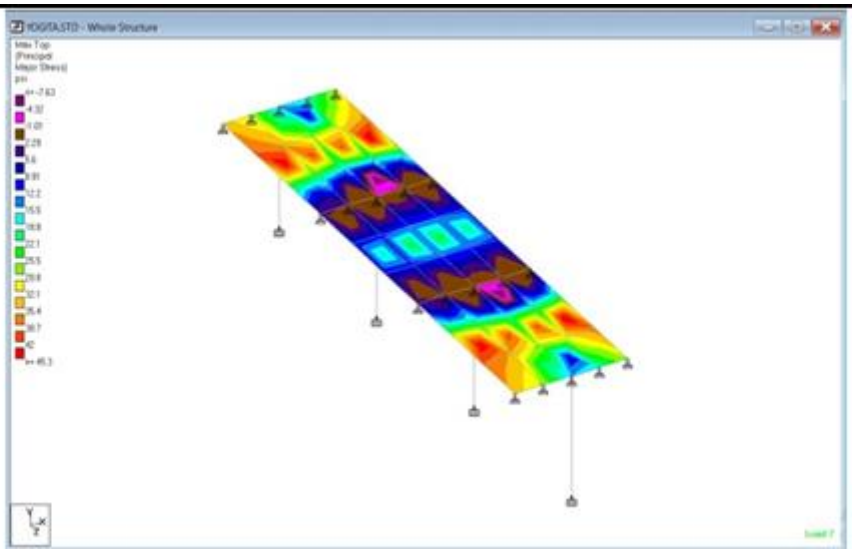


Figure 9: Stresses due to Load Combinations

V. CONCLUSION

- Construction of this structure at that junction Results in the traffic control and enhances safe driving.
- It has been observed that the maximum support reactions 2024.609 KN and Moment 6245.502KNm is which is safe limit
- The maximum displacement is occurred on column -0.049mm in Y direction is safe.
- The maximum plate stress due to moving vehicle 45.306 KN/m2 at top

Designed structure by using software result in obtaining reduction in time of design work and improved the accuracy of the work.

VI.REFERENCES

[1]. M.S.Alam, M.A. Youssef and M. Nehdi, "Analytical prediction of the seismic behaviour of super elastic shape memory alloy reinforced concrete elements", 2019

[2]. ArnkjellLokke, Anil K. Chopra, "Direct-Finite-Element Method For Nonlinear Earthquake Analysis Of Concrete Dams Including Dam–Water–Foundation Rock Interaction", Pacific Earthquake Engineering Research Center, March 2019.

[3]. G. R. Vijay Shankar, S. Deepa, M. Arun, G.Vignesh, "Advanced Sensor Dynamic Measurement and Heuristic Data Analysis Model for Bridge Health Monitoring System", International Journal of Recent Technology and Engineering (IJRTE) July 2019.

[4]. M. Hosseinpour, M.Celikag, "Investigation Of Seismic Performance And Reliability Analysis Of Pre-Stressed Reinforced Concrete Bridges",International Engineering Conference On Developments In Civil & Computer Engineering Applications, 2018.

[5]. Xia Zhanghua, Lin Shangshun, "Seismic Performance Of Precast Bridge Columns Connected With Grouted Corrugated-Metal Duct Through Biaxial Quasi-Static Experiment And Modeling", 16 July 2021.

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Thermal Analysis of a Tungsten Ionizer Hot Plate in a Vacuum and a Multi-Cusp Magnetic Field Of Q-Machine to Increase Productivity

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ABSTRACT

The Q-Machine is an instrument used primarily for studies of waves and instablilities in fully ionized plasmas. The main problem in studying basic plasma and wave modes in fusion research machines and glow discharges was the very unstable nature of these types of plasmas. It was believed that development of a quiet, steady plasma source that would avoid complications introduced by large currents and magnetic fields The Q-machine in the form developed by Rynn and D'Angelo, and now used by the Experimental Plasma Group, is in principle a very simple device. The plasma source is a "hot plate", which is heated to ~2300 Kelvin by electron bombardment, from a filament located behind the plate. The hot plate is usually made of tungsten.

Keywords: Design, Tharmal Analysis, Q- Machine, Plasma, Magnetic cusp

I. INTRODUCTION

The Q-Machine is an instrument used primarily for studies of waves and instablilities in fully ionized plasmas. The main problem in studying basic plasma and wave modes in fusion research machines and glow discharges was the very unstable nature of these types of plasmas. It was believed that development of a quiet, steady plasma source that would avoid complications introduced by large currents and magnetic fields The **Q-machine** in the form developed by Rynn and D'Angelo, and now used by the Experimental Plasma Group, is in principle a very simple device. The plasma source is a "hot plate", which is heated to ~2300 Kelvin by electron bombardment, from a filament located behind the plate. The hot plate is usually made of tungsten.The wholeset up is usted Q-Machine is a device used to Generates a plasma in vacuum chamber, to keep plasma steady at neutral at central axis and study it at steady state and increase productivity of Q-Machine.

II. BASICS AND FUNDAMENTALS

2.1 Definitions

Plasma is a more or less ionized gas. It is the fourth state of matter and constitutes more than 99% of the universe. It consists of electrons, ions and neutrals which are in fundamental and excited states. From a macroscopic point of view, plasma is electrically neutral. However, it contains free charge carriers and is electrically conductive. The word "PLASMA" was first applied to ionized gas by Dr. Irving Langmuir, an American chemist and physicist, in 1929.

Though lightning is its only one well-known manifestation on the earth, plasma is the most common form of matter in the universe including most of stars and even the sun. Plasma can be artificially created by subjecting a gas to such intense electrical forces that the gas is totally ionized and generates temperatures up to 5000°C.[1]

2.2 Q-Machine

The main problem in studying basic plasma is the very unstable nature of plasma. The development of a quiet, steady plasma source avoids complications introduced by large currents and magnetic fields. In 1960, two independent groups, one led by Nathan Rynn and Nick D'Angelo at Princeton University, and the other by Knechti and Wada at the Hughes Research Laboratories, were successful in developing sources of magnetically confined alkali plasmas, or Q-machines. Plasma produced by Q-machine is quiet and steady. The letter Q stands for the word "Quiescent".[1]

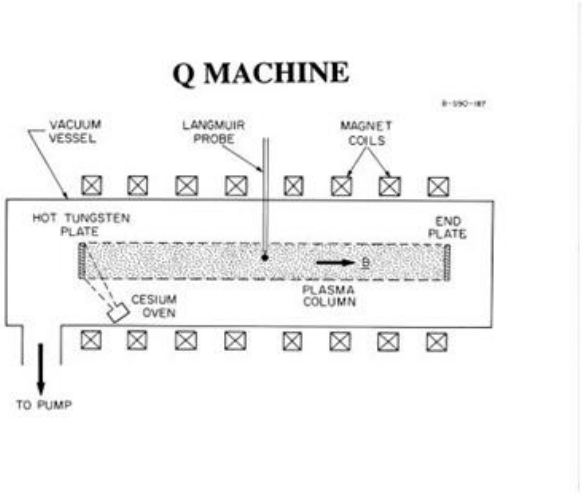


Fig1Q-Machine

III. WORKING AND EXPERIMENTAL SET UP

The set up of the machine is made at this institute for experiments as shown in the figure 2.4 and it makes the magnetically confined cesium plasma. The whole set up contains four sub-assemblies.

i. Magnets
ii. Vacuum system
iii. Hot plate or Ionizer
iv. Cesium vapor oven

Fig2-Whole set-up (Prototype)

3.1 Magnets. and cusp formation.

In the experiment at this institute, a cusp field is proposed to confine the plasma. Here, magnetic coils are placed axially rather than radially as mentioned above This type of arrangement is done by expecting that since in a cusp configuration, the field in the center is nearly zero, the drift wave oscillations observed before will be absent in the center and it will be effective only in the edges.

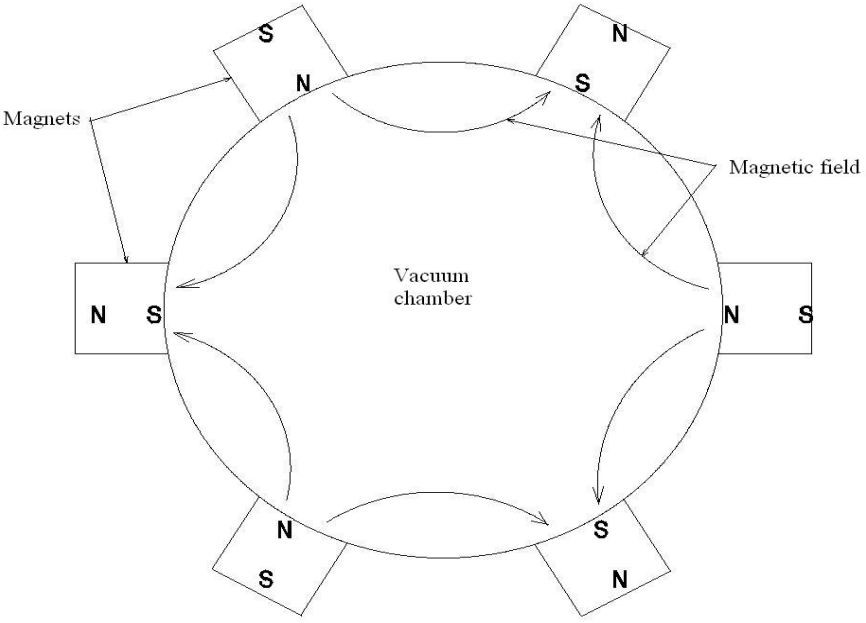


Fig 3- Magnetic Cusp Arrangement

Even the edge dominant drift wave oscillations are expected to die in a few ion larmor radius scale length. So in the central region where the ions are not magnetized will be having a really quiescent plasma. This collision-less plasma is expected to be quiescent because the temperature of both the species (ions and electrons) would be same as the temperature of the plate (~0.2 eV).

In this experiment it is being proposed to have a cusp field to confine the Q-machine like plasma. It is expected that since in a cusp configuration, the field in the center is nearly zero, the drift wave oscillations observed before will be absent in the center and it will be effective only in the edges. Even the edge dominant drift wave oscillations is expected to die in a few ion larmor radius scale length. So in the central region where the ions are not magnetized will be having a really quiescent plasma

3.2 vacuum Chamber

A non-magnetic cylindrical chamber with inner diameter 40 cm, which can withstand $1\times10^{-}7$mbar vacuum. Since the hot cesium ions will hot the inner surface, the chamber has to bear the ion temperature (0.2 eV ~ 2300 K), though the density will be very less ($<10^{11}$ /cc). Apart from this, it is indended NOT to have any cooling for either magnets or the chamber, which might influence the radial gradient of ions inside the chamber. [1]

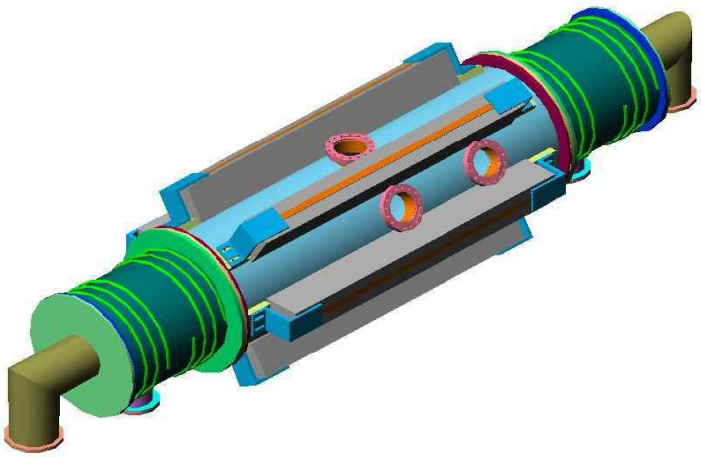


Fig4-Vacuum with magnets

This contains a main chamber inside which the hot plate will be held by the end flanges. These flanges would also have big holes for pumping. The extended chamber will have baffled path with cooling. There will be two gate valves between the main chamber and the extended chamber for enabling cesium recovery in a vacuum later

3.3 Hot plate or Ionizer

The hot plate is an important part of the assembly. It acts as a cathode in the Q-machine to produce magnetically steady plasma. The hot plate is an electron emitting plate and the source of plasma. It is heated up to the temperature 2700 K through an electron bombardment from filaments located just behind the plate. A temperature of 1200 K is enough to produce cesium ions. But since to produce plasma, the plate is heated to a temperature above 2700 K, so that the thermionic electron emission from the plates and the cesium ions combined will give the neutral plasma. As the assembly is operated in vacuum, there are no any ions for collision. So, the losses can be neglected and the temperature of filaments and the plate are approximately same.

Also, it is desirable that the temperature distribution on the surface of the plate facing towards cesium must be uniform to produce magnetically confined plasma at uniform temperature.[3]

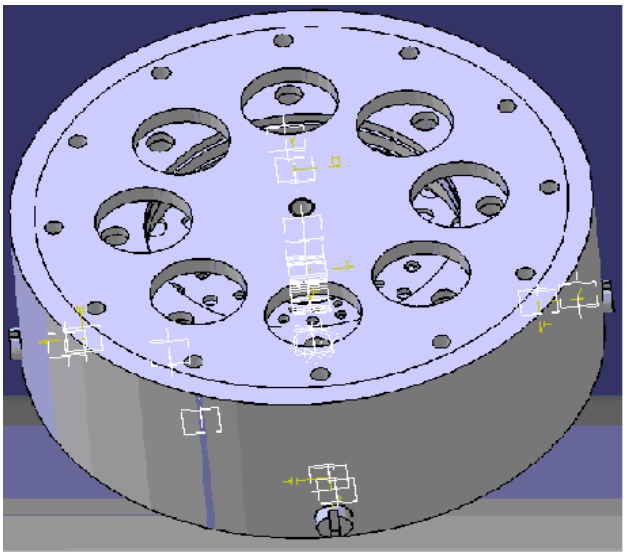


Fig 5- Tungsten Ionizer hot Plate

There are two ionizer plates used, one at the starting and one at the end of the vacuum chamber.

IV. MATERIAL SELECTION

Tungsten ionizer is plasma producing device and operated at high temperature. The material of different parts must be capable to work at high temperature. Material selection is very important procedure as the machine is made to work for longer life at high temperature. Some important factors that should be considered while selecting the material are as follows.

1. Material should withstand against high temperature.
2. All parts are assembled very accurately. A little expansion in any part due to high temperature makes problem. So, materials should have very low thermal coefficient of expansion.
3. All materials should be easily machinable
4. Material of the parts which are used for heating should be good electric conductor at higher temperature.
5. Insulating material has low heat transfer coefficient
6. Materials should resist oxidation and should not react with any gas as plasma is produced through this assembly
7. Materials should be easily available
8. Cost is also an important consideration while selecting materials

4.1 Filament material

Normally tungsten filaments are used. In some big devices tantalum filaments have been used to minimize the effect of heating. However, tungsten has been used in smaller devices and the tungsten filaments have longer life time[3]

V. METHODS OF HEATING OF TUNGSTEN IONIZER

Hot plate, the main part of the assembly, is heated to a high temperature about 2700 K. Some methods for the heating of the hot plate are available.

One method is to heat the tungsten plate directly by passing current through it. But the problem is that large currents distort the magnetic field near the plate and the ripple in the power supply excites oscillations in the plasma.

Another method is to heat the plate by radiation. But it is not easy to achieve high temperature by radiation. For instance, to supply the random electron flux of 1.2 A/cm^2 at a density of 10^{12} cm^{-3}, a temperature of 2660 K

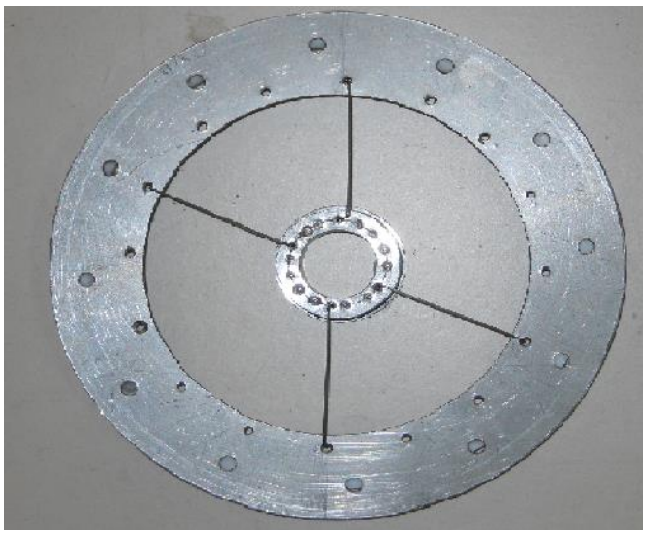


Fig 6- Tungsten Heating Filament

5.1 Heating supply calculation

To choose the electric power supply for heating, first an equivalent thermal power should be calculated.

Let, D = Density of the filament material, kg/m^3

l = Length of one filament, m

d = Diameter of the filament wire, m

s = Specific heat for filament material, J/kg.K

T_R = Room temperature (Assuming 20^o C = 293 K), ^{o}C

T = Temperature up to which filament is heated, ^{o}C

Now, cross-sectional area of the filament,

$$A = \frac{\pi}{4} d^2 \quad m^2$$

Volume of the filament,

$$V = \frac{\pi}{4} d^2 \times l \quad m^3$$

We know that the mass of the filament,

m = Density x Volume

$= D \times V$ kg

Heat required for the heating of 1 filament,

H = Mass x Specific heat x Temperature raise

$= m \times s \times \Delta T$ Joule ……(5.1)

Where, ΔT = Temperature difference

$= T - T_R$

5.1.1 Electric power

Let, ρ = Resistivity of the filament, Ω.m

I = Current required for heating, A

t = Time for passing the current (Assuming 1 sec), sec

Resistance,

$$R = \rho \frac{l}{A} \ \Omega$$

Electric heat required to heat the filament,

$H = I^2 \times R \times t$ Joule ...…….....(5.2)

Now, from the equations (5.1) and (5.2), we have

Thermal heat = Electrical heat

Therefore, $m \times s \times \Delta T = I^2 \times R \times t$ ……..…… (5.3)

From the above relation, we can find the current (I) required to raise the temperature of one filament from T_R to T.

5.1.2 Calculation

We know, different properties like density, specific heat, electrical resistivity, etc. are temperature dependent and they vary with change in temperature. Here, the temperature of filaments is raised up to 2700 K. Filaments are made of tungsten. So, different properties of tungsten at 2700 K are as follows. Calculations done to find the current are for only one filament because all filaments are in parallel connection and so, total current can be found by multiplying the current with the number of filaments.

$D = 18593.19$ kg/m^3

$l = 40 \times 10^{-3}$ m

$d = 0.5 \times 10^{-3}$ m

$s = 187.82$ J/kg K

$\rho = 8.21 \times 10^{-7}$ Ω.m

$t = 1$ sec

$T_R = 293$ K $= 20^o$C

$T = 2700$ K

Now, cross-sectional area of the filament,

$$A = \frac{\pi}{4} d^2$$

$= \frac{\pi}{4}$ x $(0.5 \times 10^{-3})^2$

$= 0.19625 \times 10^{-6}$ m^2

Volume of the filament,

$V = \frac{\pi}{4} d^2 \times l$

$= \frac{\pi}{4}$ x $(0.5 \times 10^{-3})^2 \times (40 \times 10^{-3})$

$= 7.85 \times 10^{-9}$ m^3

Mass of the filament,

m = Density x Volume

$= 18593.19 \times (7.85 \times 10^{-9})$

$= 0.14596 \times 10^{-3}$ kg

Heat required for the heating of one filament,

$H = m \times s \times \Delta T$

$= 0.14596 \times 10^{-3} \times 187.82 \times (2700-293)$

= 65.985 Joule ……(5.4)

Now, Resistance,

$R = \rho \frac{l}{A}$

$= (8.21 \times 10^{-7}) \times \frac{40 \times 10^{-3}}{0.19625 \times 10^{-6}}$

$= 0.1673\ \Omega$

Electric heat required,

$H = I^2 \times R \times t$

$= I^2 \times 0.1673 \times 1$

$= I^2 \times 0.1673$ Joule ……..(5.5)

From equation (4.4) and (4.5), we have

$65.985 = I^2 \times 0.1673$

So, **I = 19.862 A**

Now, total current required is,

$I_{total} = 16 \times I$

$= 16 \times 19.862$

I_{total} = 317.792 A

Here, filaments are connected in parallel. So, current will be multiplied with the number of filaments but the total voltage remains same as for one filament.

Also we know that, $I^2 \times R = V \times I$

Therefore, $V \times 19.862 = 65.985$

V = 3.322 Volts

VI. THERMAL ANALYSIS OF TUNGSTEN PLATE

6.1 Steady State Thermal Analysis

In steady state Thermal analysis we can apply all these boundary conditions are independent of time steps. After applying all boundary conditions the oriented result in ANSYS 12.0 software is as shown in [Fig-5.11]

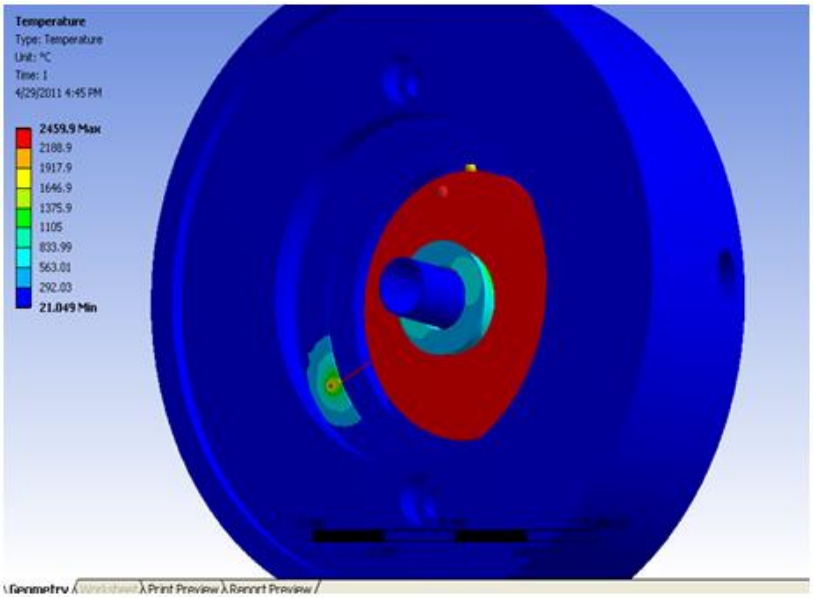


Fig-7 Temperature effect at Filament by using Mo

The above result is at temperature 2700 ◦ k, in which the molybdenum ring is get less affected then the Temperature at 3000 ◦K , as shown in [Fig-7]

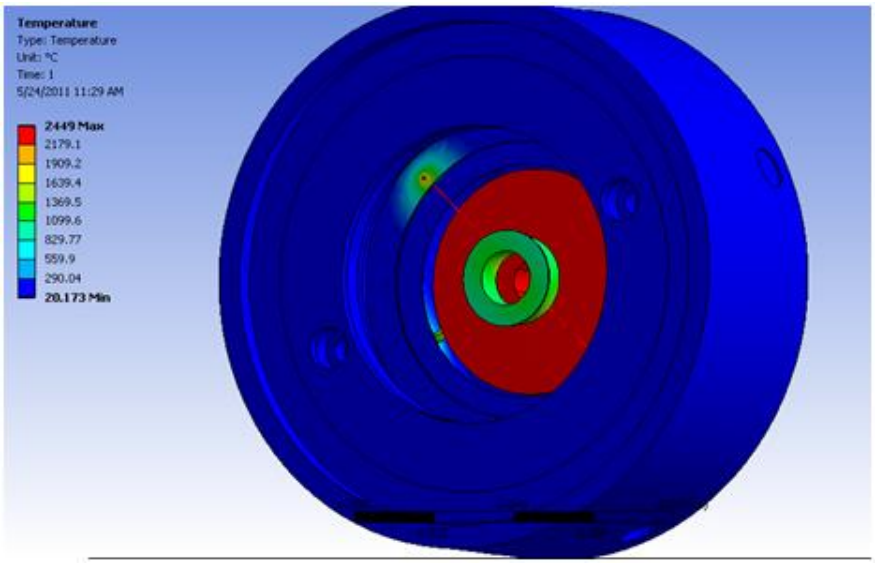


Fig-8 Temperature effect at Filament by using Ti

The above result is at temperature 2700 ◦ k, in which the TItanium ring is get less affected then the Temperature at 3000 ◦K , as shown in [Fig-8]

6.2 Thermal Analysis of vacuum chamber with Ionizer plate

By considering vacuum chamber with ionized plate and Titanium as an insulating material, following result is obtained.

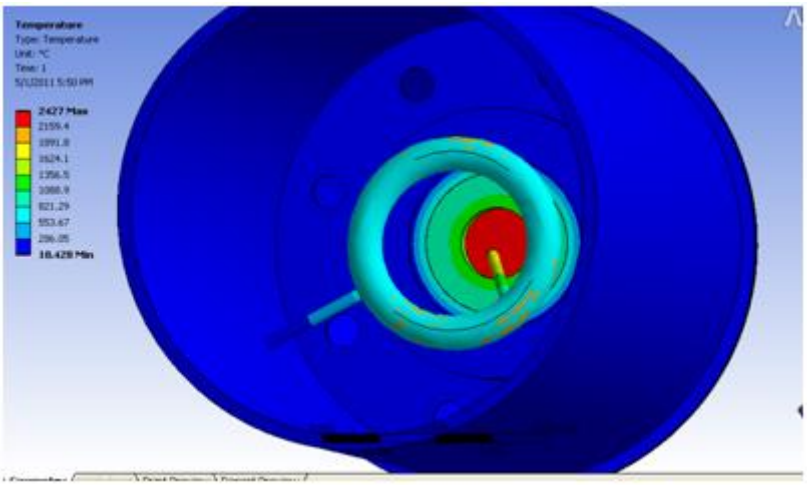


Fig-9 Result of vacuum chamber

VII. RESULT COMPARISON

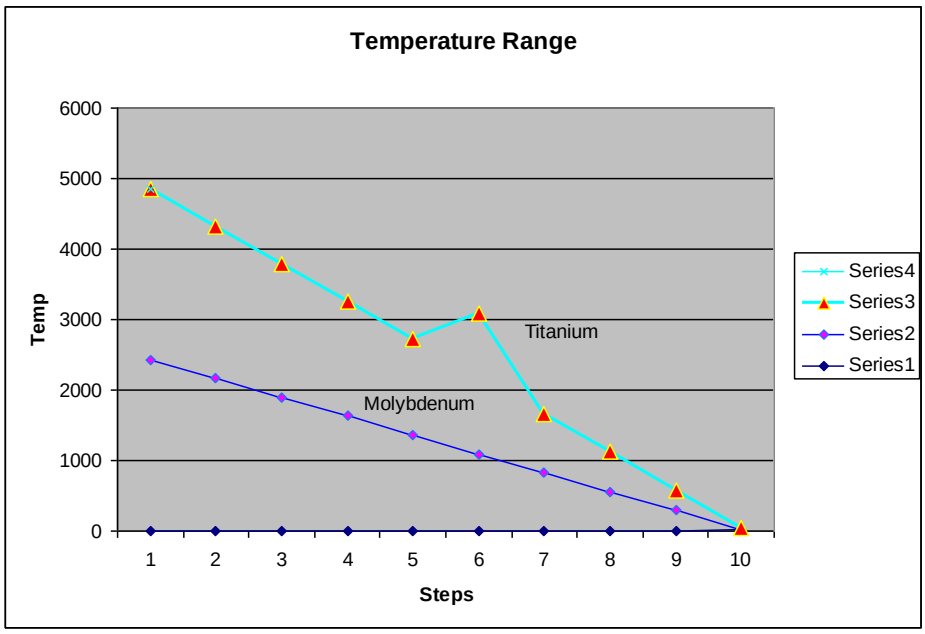
Comparing to the values in the table of all these materials, best material is found to be Molybdenum Variation in Temperature is Radially means from centre to outwards direction.

Table 7.1 Result comparison of all materials

Sr. No.	TEMPERATURES (^{0} C)		
	Ceramic	Molybdenum	Titanium
1	2427	2459.9	2428.9
2	2159.8	2188.9	2161.3
3	1892.6	1917.9	1893.6
4	1625.3	1646.9	1625.9
5	1358.1	1375.9	1358.2
6	1090.9	1105	1090.5
7	823.67	833.99	822.87
8	556.44	563.01	555.19
9	289.22	292.03	287.51
10	22	21.04	19.83

7.1 Graphical view of Result

After converting result of table format into graphical format, the difference between Molybdenum and Titanium Material, following graph is displayed.



Graph-7.1 Comparison of Thermal Expansion

Titanium material at 6th step shows more thermal expansion then Molybdenum.
Molybdenum gives high degree of temperature uniformity then the Ti and Ceramics.
After successful Thermal analysis of Ionizer plate next step is Design and Thermal analysis of Vacuum Chamber with Ionizer hot plate inside it and Cs as an flowing fluid.

VIII. EXPERIMENTAL ANALYSIS AND SETUP

Fig-10 Experimental Analysis and setup

In experimental analysis the obtained result has only with initial setup.

IX. APPLICATION OF Q-MACHINE

- Q-Machine is a device used to Generates a plasma in vacuum chamber from Cesium sample at 2700 K Temperature.[5]
- Also Q-Machine used to keep plasma steady at neutral at central axis by using Magnetic-Cusp phenomenon.

After maintaining Plasma in vacuum chamber in Magnetic-cusp, plasma can be studied at steady state in defense and Aerospace research field.

X. CONCLUSION

- Selected materials are suitable for specified temperature range, because Molybdenum is less costly compare to other as well as it shows less range in variation of Temperature, Thermal expansion and heat flux.
- The high degree of Temperature uniformity is achievable for selected material.
- Temperature tested at different values and among these 2700 K is best suited.

Since Temperature above 3000 K is very dangerous to control and handle.

- After these result the Q-machine will be ready and validate for manufacture, set-up and test experiment as well as run Q-Machine.
- Finally this result of set up increases productivity of Q-Machine.

XI. REFERENCES

[1]. A. Barkan, N. D' Angelo, R.L. Merlino, Potential relaxation instability and ion acoustic waves in a single-ended Q-machine dusty plasma, August 1996, Dept. of Physics and Astronomy, University of Iowa, Elsevier, Vol-222.

[2]. Cs. SzaboH, S. Biri, L. KeneHz, T. Suta, A. Valek, Diagnostic research of highly ionized plasma generated By an ECR ion source, 2001, University of Debrecen, Pergamon, Vol-61.

[3]. D.M. Allen, P. Shore, R.W. Evans, Ion beam, focused ion beam, and plasma discharge machining, 2009, Precision Engineering Centre, Cranfield University, UK, Elsevier, CIRP annals manufacturing technology 58,547-552.

[4]. Georg Herdrich, Monika Auweter-Kurtz, Inductively heated plasma sources for technical applications, Institute for Raumfahrtsysteme (IRS), University Stuttgart,2006, Elsevier, Vol-80,1138-1143.

[5]. Robert W. Motley. Q-Mahine Book, Plasma Physics Laboratory Princeton University, New Jersey.

[6]. Francies F. Chen, Coaxial Cathode Design for Plasma Sources, Plasma Physics Laboratory Princeton University, New Jersey, April 1969, The review of scientific Instruments,Vol-40, No-8.

[7]. N. Ramasubramanian, An experimental proposal for Cs Plasma confined in a Multi-Cusp Magnetic field, Institute For Plasma Research,Gandhinagar, September,2009, Design report

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F-Share for Hand Held Devices Using Wi-Fi Bluetooth Network

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ABSTRACT

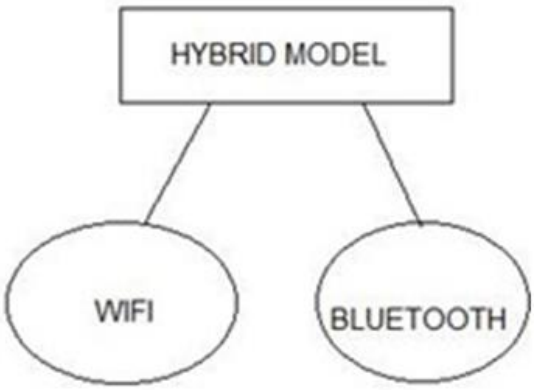
The use of smart phones as increased drastically from last few years due to the facilities provided for user like sharing images, files, videos, and chatting application. Along with its use performance and efficiency has increased, but for using the facilities provided by smart-phones data packet connection is needed which is quite costly. Existing Peer-to-peer system was used for data transmission but there were some limitations related to that system as like whenever data was transmitted through network like Wi-Fi or Bluetooth and if connections were not possible due to some reasons like users displacement of user from one place to another the message was not sent until the user manually resends it again. Smart-phone provides us with the facility of sending SMS, Whatsapp, Hike but they are not freely available as some cost needs to be given. So to overcome all this limitations the proposed application called ”Seamless File Sharing” is introduced which can share data, files, images without using any internet facility. In this application data transmission takes place through two ways first through Wi-Fi network and through takes place through Bluetooth Network. Whenever there is any connection problem then the network automatically switches to Bluetooth network.

Keywords: File Sharing, Ad-hoc Network, Android, Energy efficiency and Sharing at low cost.

I. INTRODUCTION

The use of smart-phones[2][3] has increased drastically form last few years as it has reached up to approximately 50% till 2011.Many features has been added with respect to the upgrade in the version of smartphones. Smartphones has capacity of sharing videos, pictures, file and other features. Now-a-days smart-phones [2][3] have enriched with the facilities like downloading songs sending it to another smart phones and has facility like user can watch movies, video etc. on our home television system. Applications like Whatsapp, Hike, Messenger and other are in trend today, but the main drawback is that for running this application as it require that your phone needs to have data packet connection running on it. Earlier peer-to-peer[4][8] systems were used for sending files from one smart phone to another without using internet facility but its drawback was that this system undergoing frequent disconnection due to user displacement from one place to another. So to overcome this limitation application is proposed known as “Seamless File Sharing”, merits of this application are that it does not undergoes frequent disconnection and if file is unable to send file through one network it will switch to another network.

1) Important Features of Seamless File Sharing:
   1. Adhoc network is created for sharing files through Wi-Fi/Bluetooth network.
   2. Communication is faster.
   3. File is send seamlessly without any interruption.



From the above figure we can say that hybrid model is designed which is the combination of both i.e. file can be send through Wi-Fi or Bluetooth network.

This application can be used in college premises where data and file sharing can be done without any use of 3G connection so file sharing can be an easy job. So an Wireless Adhoc network [1][8] is created for file transfer. For chatting purpose or for sending SMS Global System for Mobile Communication(GSM) or Code Division Multiple Access Network(CDMA) are used but for this application user only needs to install this application in his smart- phone and use the facility of chatting ,file sharing without using any data packet connection and at free of cost. Smart-phones [2][3] having this application has advantages like :

1. Network connection is not billed to the user.
2. Low economic cost.
3. Faster packet data connection.

II. EXISTING SYSTEM

SDNAN (Software-Defined Networking in Adhoc Networks of Smartphones) [2] is this application Software Defined Networking (SDN) is used to meet the changing demand of the operating environment. The theory of SDN is separated into 3 distinct components.

1. Communication layer.
2. Network Operating System (NOS).
3. Control Program.

Communication layer consists of physical network devices like routers and switches; NOS manages network resources and the control program controls the network through NOS. Adding SDN to Adhoc network improves its Performance .It consists of 3 layers:

1. Ad-hoc networking layer based on AODV.
2. Network Operating System layer which maintains the global map of network which manages the sub network for each application.

Development of a cooperative application for sending SMS On Wi-Fi mobile phones [4] this application provides peer Communication on Ad-hoc network but the main constraints is the radio coverage which can be improved by using relay protocols .In this paper WLAN is used as it is cheap as compared to mobile phones or PDAs. MANET (Mobile Ad-hoc Network) mobile devices get connected to any type of infrastructure .The algorithm used for routing are Single-hop, multi-hop. In this type of terminal network used there are 2 reasons taken into consideration i.e.

1. Device battery dependence.
2. Packet priority.

The main objective of this application was to send messages for small group of people over small area.

Mobile Messaging using Wi-Fi Ad-hoc Network [8] earlier uploading and sharing of file contents was done through Peer-to-peer systems as one system was connected to another system .As peer-to-peer system offers advantage over the traditional client-server networking models. Where data can be sent through wireless lines and expensive data packets [8].Wi-Fi Ad-hoc network is created for sharing information between the peers .But the limitations over this system was that if one wants to share any file and if any disconnection occurs in between then retransmission of data was not done automatically.

1) Limitations of Existing Systems:
   1. Existing methods are based on traditional mobile ad-hoc network (MANET) routing protocols which delivers worst performance for content sharing.
   2. Later some method introduced with more efficiency but resulted into more power consumption.

III. PROPOSED WORK

Seamless File Sharing (SFS) [1] consist of two managers:

1. Seamless Service Manager(SSM)
2. File Manager(FM)

SFS is done through both the above mentioned managers whenever file needs to be share it is done through Seamless Service Manager (SSM) [1] and file sent and receive is manage through File Manager(FM)[1].

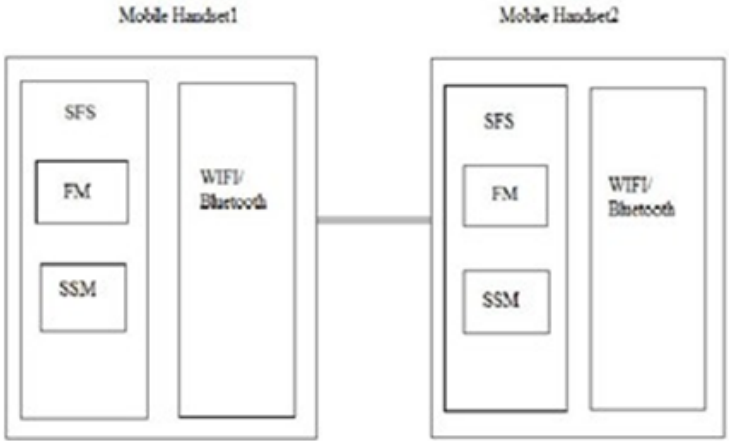


Fig -2: Communication between 2 devices

As shown in above figure communication between 2 devices takes place through SSM and FM. SSM sender communicates with SSM and FM of receiver. Whenever file needs to be share between two devices there are 2 options to send a file first through Wi-Fi network and if it is unable to send through it, it switches to Bluetooth network. When data transfer takes place through Wi-Fi network it is done through User Datagram Packet (UDP)[1] and if data sharing takes place through Bluetooth the it takes place through MAC[1] address.

3.1 Seamless File Manager (SSM)

Seamless File Manager (SSM) [1] maintains and updates name of device after every few seconds. SSM decides through which network data needs to be sent and if it is unable to send through one network it transfer file through other network.

3.2 File Manager (FM)

File Manager (FM) [1] decides which file needs to be sent or received. The file which needs to be sent is first needs to be divided in small blocks and the it is send to the receiver .After receiving file from sender FM stores the offset to check whether the other blocks and the combine other blocks to make entire file.

The Proposed Architecture consist of Network Discovery Manager, Communication Manager, File System Reader Writer, Central Sever and MySql Database .The GUI based Jsp Servlet application which will work as Central Sever and database as Mysql .With the use of that Server it will give the response back to client as android mobile handset. The use of that Server we can track which clients are online in Adhoc Network. Clients shared files are stored in database and owner IP address. If any client give request for any shared file then Server will search in database and send filename, IP address to client for downloading the file.

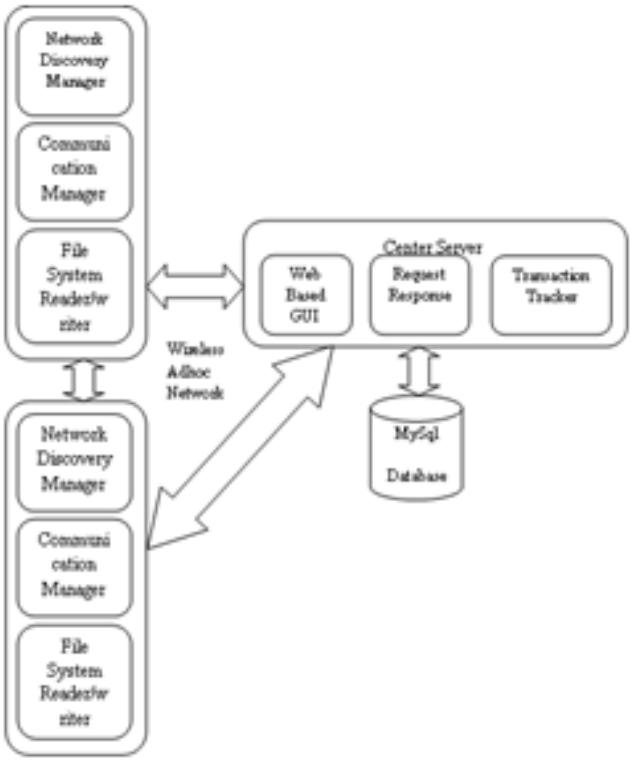


Fig -3:Proposed System Architecture

Android mobile devices when enters in Adhoc Network, Network Discovery Manager will search the online clients. For security reason all clients have provided the facility of login and registration. All the details are stored in database in Server side for verification. With the use of communication manager client can chat with other clients who are online in adhoc network. Clients can share the files and download shared file. When the device is connected through Bluetooth initially there was problem regarding to the coverage area this limitation can be removed by using different techniques like:

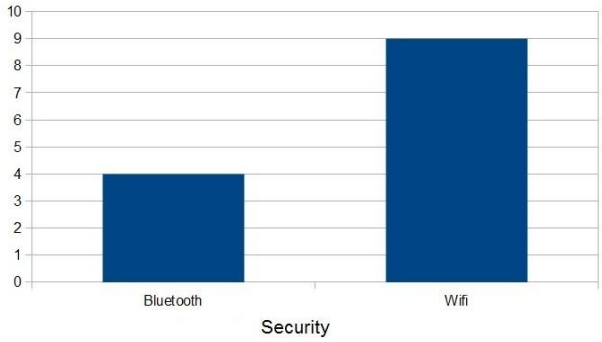
1. Piconets with single slave operation
2. Multi slave operation
3. Scatter net operation

IV. APPLICATIONS

1. The system can be used across a college campus.
2. It can also be used in Military Application.

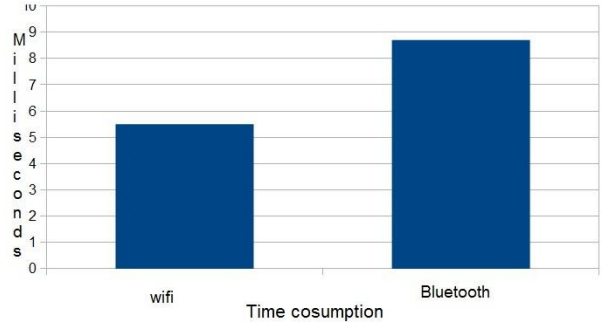
V. RESULTS

The above graph comparison of Bluetooth and Wi-Fi network is done with respect to security where the graph is plotted for message sent with respect to time.It is observed that Wi-Fi network provides more security as compared to Bluetooth.



Graph -1: Graph for security

The graph states the comparison between the two networks through Time Consumption. The messages sent through Wi-Fi network are more faster and within less time limit.



Graph -2: Graph for Time Consumption

VI. CONCLUSIONS

The proposed application for Android device is known as Seamless File Sharing .It provides solution for peer to-peer systems, as peer-to-peer system experience frequent disconnections because of users mobility. In this application data packet charges are cut down as there is no use of internet. Ad-hoc network is created Wi-Fi and Bluetooth as they are also free of charge .It provides capacity of simultaneous sending and receiving of files at same time .Power competence is taken in concerned to extend battery life.

VII. ACKNOWLEDGEMENT

The success of any project is never restricted to any individual .This project is the results of thoughts contributed by many people and would like to acknowledge them here. I express sincere thanks to all those who have provided me with valuable guidance towards the completion of this report .I deeply thank my guide and HOD Prof. Soumitra Das for his useful guidance. The support that he gave truly helped me, without whom this project would have been a far realism. I also thank him for giving me good quality support, suitable remarks and conversation in all phase of the project .I would also like to widen sincere thanks to all teachers and staff for their valuable suggestions and feedback.

VIII. REFERENCES

[1]. MinSeok Jeon, Sun-Kyum Kim, Ji-Hyeu Yoon, Jinhee Jo, Sung-Bong Yang ,Seamless File Sharing for Andriod Devices, Yonsei University Seoul,Korea,2014 IEEE World Forum on Internet of Things(WF-IoT).

[2]. Paul Baskett, Yi Shang and Wenjum Zeng, Brandon Guttersohn, SDNAN: Software-Defined Networking in Adhoc Networks of Smartphones,2013 IEEE.

[3]. Tiancheng Zhuang, Paul Baskett, and Yi Shang, Managing Ad Hoc Net-works of Smartphones International Journal of Information and Education Technology, Vol. 3, No. 5, October 2013.

[4]. Pedro Lopez, Diego Garca, Sergio Almagro, Juan J. Alcaraz, Fernando Cerdan ,Development of a cooperative application for sending SMS on WiFi mobile phones The Second International Conference on Mobile Ubiquitous Computing, Systems, Services and Technologies 2013.

[5]. Matthijs Gielen University of Twente ,The Netherlands, Ad hoc network-ing using Wi-Fi during natural disasters: overview and improvements 17thTwente Student Conference on IT, Enschede, The Netherlands June 25st 2012.

[6]. Li Shu, Dorothy C. PoppeC.S. Draper Laboratory555 Technology Square-Cambridge, MA 02139, USA, Assuring Message Delivery in Mobile AdHoc Networks with Packet Erasure Recovery, Proceedings of the 22 nd International Conference on Distributed Computing Systems Workshops (ICDCSW02) 2002 IEEE.

[7]. Chander Prabha, Dr. Surender Kumar, Dr. Ravinder Khanna, Wireless Multi-hop Ad-hoc Networks: A Review, IOSR Journal of Computer En-gineering (IOSR-JCE) e-ISSN: 2278-0661, p- ISSN: 2278-8727Volume 16, Issue 2, Ver. VI (Mar-Apr. 2014), PP 54-62.

[8]. Mr. Piyush Vilas Shewale, Mr. Amit Subhash Shelke , Mr. Sourabh Madhukar Darange Student, Dept. of Computer Engineering, Sinhgad Academy of Engineering, Maharashtra, Mobile Messaging using Wi-Fi Adhoc Network India, International Journal of Innovative Research in Computer and Communication Engineering Vol. 1, Issue 1, March 2013.

[9]. Elmurod Talipov, Yohan Chon, and Hojung Cha, Member, IEEE,Content Sharing over Smartphone- Based Delay-Tolerant Networks, IEEE Trans-actions on MOBILE COMPUTING, Vol. 12, No. 3, March 2013.

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Algorithm to Increase Energy Efficiency and Coverage for Wireless Sensor Network

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ABSTRACT

Our proposed coverage and energy conscious network grounded on energy well organized routing in the WSN with aim of making the most of networks lifespan. In suggested system, difficulty is formulated linear programming's (LP) with coverage, energy and the connectivity constraints. Cluster heads choice is projected using Learning in networks followed by the coverage, connectivity routing with packet transmissions. The projected system is equated with present systems with parameters like number of live nodes, packet delivery, and node energy. The energy systems for sensor network which is not do efficiently for heterogeneous networks. So Energy effective cluster protocol is design for heterogeneous sensor networks. Here energy efficient cluster protocols for heterogeneous networks and likens protocols on points as location cognizance, cluster methods, heterogeneity and clustering Points.)

Keyword: clustering, Coverage, energy, power consumption.

I. INTRODUCTION

Wireless network are networks which are having group of nodes rooted with simplest process, less memory, minute sensing, and the energy inadequate battery. The correctness of information is determined by coverage in observing region. In other case cause of energy limitation there should be optimum energy consumption while improving coverage efficiency. A lot much attention has drawn towards two basic problems in WSN namely power balancing and coverage efficiency. There are so many coverage based routing algorithms designed to face outdated problems of energy preservation in the WSN. Coverage and energy are also prime factors in WSN with the energy preservation. For acceptable coverage is major question in WSNs. Also cause of energy constrain environment so many tasks to face to improve coverage. Efficient methods for coverage are enhanced coverage with balancing of power intake amongst nodes. Nodes in WSN are considered by partial power and capabilities and predictable to functions for prolonged periods with negligible intervention.

II. MATERIAL AND METHODOLOGY

Literature survey:-

Paper Title	Techniques	Parameters Achieved
An Efficient Cluster-Tree Based Data Collection Scheme for Large Mobile Wireless Sensor Network(2015)	Velocity Energy-Efficient and Link-aware Cluster-tree (VELCT)	1.Reduce Energy Consumption 2. Increase throughput 3. Reduce End-to-End delay
Ring Routing: An Energy- Efficient Routing Protocol for Wireless Sensor Networks with a Mobile Sink(IEEE-2015)	Ring Routing Protocol	1. Reduce control overhead in case of wastage of Energy and Packet Delay.
An Intelligent Hybrid MAC With Traffic- Differentiation-Based QoS for WSN(IEEE-2013)	IH-MAC Protocol(broadcast scheduling-link scheduling)	1.Reduce Energy Consumption 3. Reduce Delay.
An energy Efficient Cross-Layer network operation Model for 802.12.4-Based Mobile WSN(IEEE-2015)	Energy Efficient cross-Layer Network Operation Model	1.Reduced Energy consumption 2.Throughput Improved 3. Low end-to-end delay.
Mobile Sink-Based Adaptive Immune Energy efficient Clustering Protocol for Improving the Lifetime and Stability Period of WSN(IEEE-2015)	MSIEE Protocol	1.Eliminate energy hole problem 2. stability period 3.Improved PDR 4. Packet delay.
EDAL: An Energy-Efficient, Delay-Aware, and lifetime- Balancing Protocol for Heterogeneous WSN.(IEEE-2015)	EDAL Protocol	1. Increased N/W lifetime, 2.Minimize packet delay.
Energy Efficient Clustering Scheme for Prolonging the Lifetime of wireless Sensor Network with Isolated Nodes.(IEEE-2015)	Regional energy Aware Clustering method using isolated nodes (REAC-IN)	1. Improved the lifetime 2. stability of N/W.

III. SYSTEM ARCHITECTURE

The energy and the coverage conserving system is extension of the LEACH. Also it adjusts unique nodes arrangement system tracked by cluster's creation and stable state. It also checks coverage preservations in the round by analysis by convergence.

Cluster head selection

1. Node carries energy levels and degree of neighbor to base stations.

Coverage preserving node scheduling

To improve LEACH with scheduling of nodes scheme, the way is to insertion the self-scheduling. Phase of proposed system before LEACH clusters set up. In beginning of every round all nodes self-determining either to go off or stay On and off duty nodes won't contribute in clustering starting and steady state followed. The improvement of timeline is our node schedule system is surrounded into LEACH without having modifications in original.

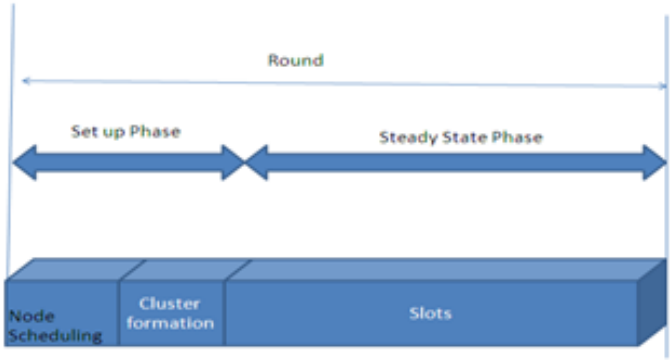

Figure 1

IV. EVALUTION

Experimentations done on unlike clusters completed of node namely N1, N2, N3… to N10 which are having energy of nodes which provides result in handling times compulsory for unlike nodes and clusters creations founded on nodes which are having higher energy will be cluster's head CH. This experimentation results as shown in table.

Node	Energy
N1	10
N2	5
N3	3
N4	2
N5	6
N6	4
N7	4
N8	8
N9	5
N10	5

Fig. Table 1: Node Energy.

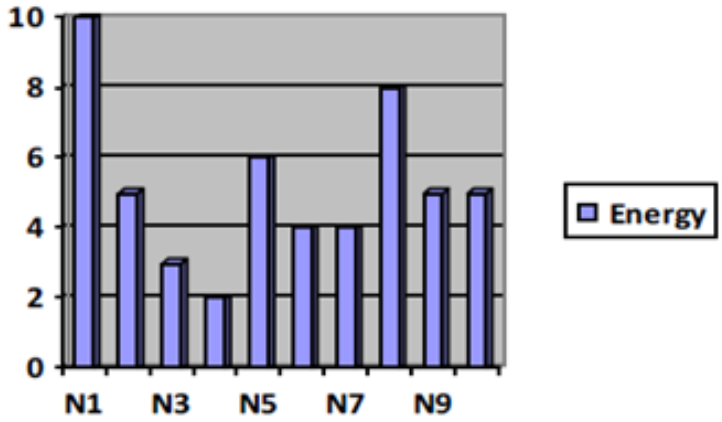

Fig. Node Energy

We can equate proposed system's time with minimum handing time and existing time. Fig3 displays evaluation on nodes as inputs i.e. nodes with time require for minimum process,present scheme time and proposed system with unlike value.

V. RESULTS AND TABLES

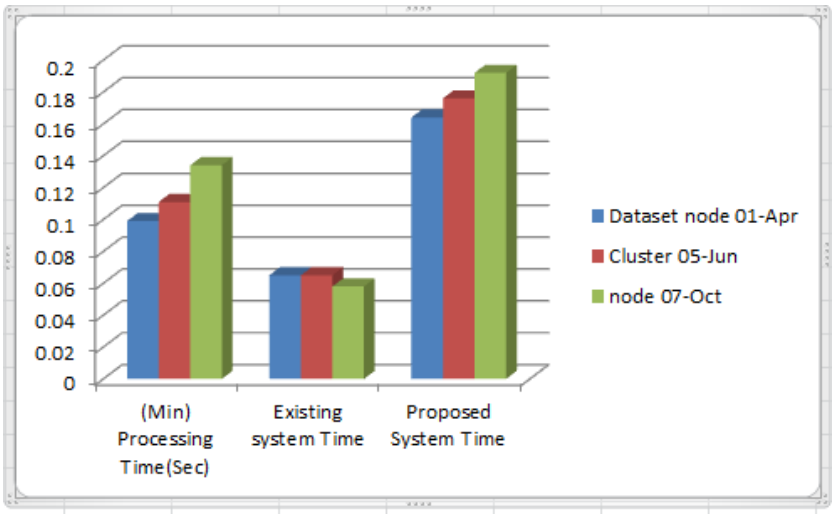

Fig3: Comparison for Time Constraints on Node

VI. CONCLUSION

Numerous investigators introduce routing methods as debated above to enhancement in unlike parameters related to network node for example Delay, Throughput, Energy, Transmission time, Bandwidths. Routing through energy consciousness is modern subject in investigation to upsurge network life and performances. Network can't accept only protocol universally so that it needs to project protocols which satisfy all circumstances and parameter.

For future to advance Routing with bearing in mind power conscious for example delay, cost,transmission link, energy time, and aware parameter to increase node's era, consistency of information, increasing throughput, packets delivery ratio.

VII. REFERENCES

[1]. R. Velmani and B. Kaarthick, An Efficient Cluster-Tree Based Data Collection Scheme for Large Mobile Wireless Sensor Networks,page no. 2377, IEEE Sensors Journal, Vol. 15, no. 4, April 2015.

[2]. C. Tunca, S. Isik, M. Donmez, and C. Ersoy, Ring Routing: An Energy-Efficient Routing Protocol for WSNs with a Mobile Sink,page no.1947, IEEE Transactions on mobile computing, Volume 14, No. 9,Sept 2014.

[3]. M. Arifuzzaman, M. Matsumoto and T. Sato, An IH-MAC With Traffic-Differentiation-Based QoS for WSNs, IEEE Sensors Journal, Vol. 13, No. 6,June 2013.

[4]. K. Kr. Gola, B. Gupta, Z. Iqbal, An Energy Efficient Cross-Layer Network Operation Model for IEEE 802.15.4 Based MWSNs, IEEE 2014.

[5]. M. Abo-Zahhad, S. M. Ahmed, N. Sabor and S. Sasaki, Mobile Sink Based Adaptive Immune Energy Efficient Clustering Protocol for Improving Lifetime and Stability Period of WSNs, IEEE Sensors Journal, Vol. 15, No. 8, August 2015.

[6]. Y. Yao, Q. Cao and A. V. Vasilakos, EDAL: Energy Efficient Delay Aware and Lifetime Balancing Data Collection Protocol for Heterogeneous WSNs. IEEE 810 IEEE/ACM Transactions on Networking, Vol. 23, No. 3, June 2015.

[7]. J. Leu, T. H. Chiang, M. Yu, and K. Su, An Energy Efficient Clustering Scheme for Prolonging the Lifetime of WSN With Isolated Nodes, IEEE Communication Letters, Vol. 19, No. 2, Feb.2015.

[8]. J. Long, M. Dong, K. Ota, A. Liu and S. Hai, Reliability Guaranteed Efficient Data Gathering in Wireless Sensor Network,Digital Object Identifier 10.1109/ACCESS.2015.2426794, 28 April 2015.

[9]. A. Arya, J. Singh, Comparative Study of AODV, DSDV and DSR, Routing Protocols in WSN Using NS-2 Simulator, IJCSIT, Vol. 5 (4) , 2014, 5053-5056.

[10]. K. Kr. Gola, B. Gupta, Z. Iqbal, High Speed Data Collection in Wireless Sensor Network, IJARI, Vol. 2, Issue 3 618-622, ISSN 2347 3258, August 2014.

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Overcoming the Top Challenge of Electrical Vehicles in India – Out of Ways, Thinking

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ABSTRACT

This paper explores the top challenge faced by electrical vehicles in India and proposes innovative solutions to overcome it. The challenge is the lack of charging infrastructure in the country, which hinders the widespread adoption of electric vehicles. The article presents an "out of ways thinking" approach that involves a combination of technological, regulatory, and social innovations to solve the problem. These solutions include the development of mobile charging stations, the integration of renewable energy sources, and the creation of a sharing economy for EV charging infrastructure. The article argues that adopting these innovative solutions will not only address the charging infrastructure problem but also pave the way for a sustainable and inclusive EV ecosystem in India.

Keywords: Electric vehicles, Charging infrastructure, Sustainable mobility, Smart charging, Public perception, Environmental impact

I. INTRODUCTION

Electric vehicles (EVs) are gaining popularity as a more eco-friendly and sustainable alternative to traditional gasoline-powered vehicles. However, the widespread adoption of EVs in India is still facing significant challenges. One of the top challenges is the lack of adequate charging infrastructure, which makes it difficult for EV owners to charge their vehicles conveniently and reliably.

To tackle this issue, there have been various proposals for building more charging stations across the country. However, such solutions require significant investment and time to be implemented on a large scale. In this article, we propose an out-of-the-box approach to resolve the challenge of EVs in India, which is both cost-effective and quick to implement.

We believe that the key to resolving the EV charging challenge lies in leveraging existing infrastructure and resources. By doing so, we can minimize the need for large-scale investments and reduce the time required for implementation. Our approach involves using a combination of innovative technology and creative thinking to create a network of charging stations that are easily accessible to EV owners across the country.

In this article, we will discuss our out-of-the-box approach in detail and explain how it can effectively resolve the top challenge of EVs in India. We will also explore the benefits of this approach and how it can help to accelerate the adoption of EVs in the country.

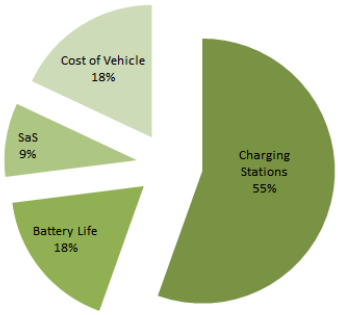
II. CHALLENGES OF ELECTRICAL VEHICLES IN INDIA

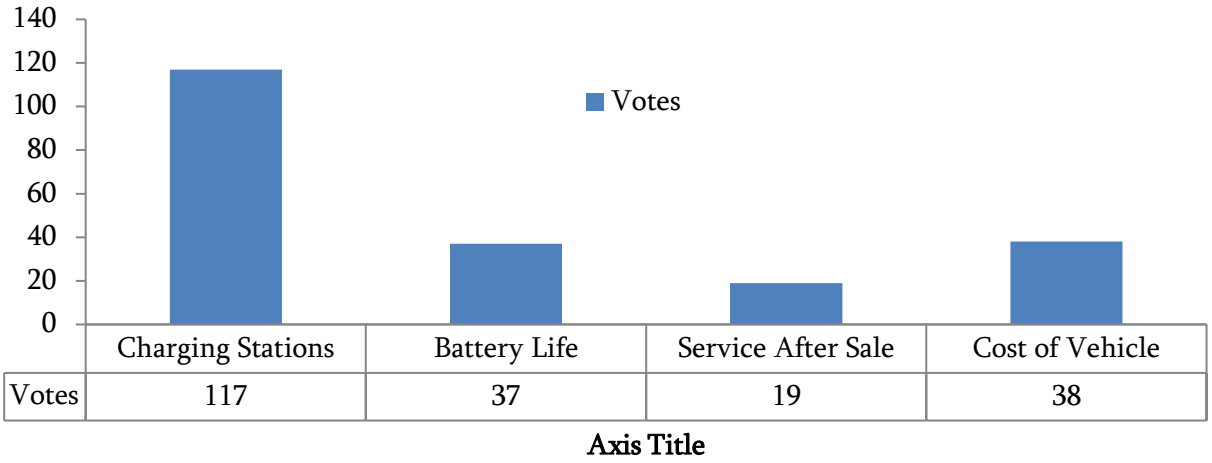
Electric vehicles (EVs) are increasingly seen as a more sustainable and eco-friendly mode of transportation than traditional gasoline-powered vehicles. However, there are several challenges that need to be addressed to encourage their widespread adoption in India. Some of the main challenges of electric vehicles in India are:

1. Lack of charging infrastructure: One of the biggest challenges of EVs in India is the lack of adequate charging infrastructure. According to a report by the Society of Manufacturers of Electric Vehicles (SMEV), there are only about 1,800 public charging stations in the country, compared to the estimated requirement of 2.5 lakh stations by 2030. This shortage of charging infrastructure makes it difficult for EV owners to charge their vehicles conveniently and reliably.
2. High cost of EVs: Another major challenge of EVs in India is their high cost compared to traditional gasoline-powered vehicles. According to a study by the International Council on Clean Transportation, the high cost of EVs is mainly due to the import duties and taxes levied on them, which can be as high as 100% in some cases.
3. Limited range and battery life: EVs have a limited range, which can be a significant challenge for long-distance travel in India. Moreover, the battery life of EVs can also be limited, which means that EV owners may need to replace their batteries frequently, adding to the overall cost of owning an EV.
4. Lack of awareness and incentives: There is a lack of awareness among consumers about the benefits of EVs, and this can be a significant hurdle in their adoption. Moreover, there are limited incentives and subsidies for EVs in India, which makes them less attractive to consumers.
5. Inadequate supply chain: The lack of a robust supply chain for EV components, such as batteries and charging equipment, can also be a challenge for the growth of the EV market in India.

III. THE TOP CHALLENGE

There are number of challenges like lack of charging infrastructure, cost of vehicle, Service after sale, Battery life etc. A survey has been conducted at LinkedIn to understand the top challenge in India. Total 211 people voted and 55% identified “Lack of charging infrastructure” as the top challenge.





Despite the government's efforts to promote EV adoption in the country, the lack of adequate charging infrastructure is a major hurdle in the widespread adoption of EVs. According to a report by the National Institution for Transforming India (NITI) Aayog, India needs to set up at least one charging station every 25 km on highways and every 3 km in cities to meet the demands of electric vehicles. However, the current charging infrastructure in India is not sufficient to meet this requirement. This lack of charging infrastructure is a significant concern for potential EV buyers, as it restricts their ability to travel long distances and increases their range anxiety. Additionally, the high cost of setting up EV charging infrastructure is also a barrier for private players to invest in this sector.

IV. OUT OF WAY THINKING

To overcome the challenge of the lack of charging infrastructure for electric vehicles in India, an "out of ways thinking" approach is needed. Here are some innovative solutions that can be adopted:

1. Mobile charging stations: This solution involves developing mobile charging stations that can move around to meet the demand for EV charging. Mobile charging stations can be powered by renewable energy sources like solar and wind, making them an eco-friendly option. This approach can be particularly useful for densely populated urban areas where there is limited parking and no space for fixed charging stations.
2. Integration of renewable energy sources: India is blessed with abundant sunshine and wind, making it an ideal location for solar and wind energy generation. Integrating renewable energy sources with EV charging infrastructure can create a sustainable and decentralized energy system. This approach can reduce the dependence on the grid and create a more resilient and reliable charging infrastructure.
3. Sharing economy for EV charging infrastructure: This solution involves creating a sharing economy model for EV charging infrastructure. EV owners can rent out their charging stations to others when they are not using them. This approach can make EV charging more affordable and accessible, particularly in areas where there is a shortage of public charging stations.
4. Incentivizing the private sector: The government can incentivize the private sector to invest in EV charging infrastructure. Tax breaks, subsidies, and other financial incentives can encourage private

companies to install charging stations in their parking lots and public spaces. This approach can create a more extensive and reliable charging network in India.

By adopting these innovative solutions, India can overcome the challenge of the lack of charging infrastructure for EVs and create a sustainable and inclusive EV ecosystem.

V. FUTURE AVENUES

The future avenues for overcoming the top challenge of the lack of charging infrastructure for electric vehicles (EVs) in India require sustained efforts towards innovative thinking, partnerships, and policy interventions. Here are some future avenues that can be explored:

Partnerships: Collaboration between the government, the private sector, and other stakeholders can help create a sustainable and inclusive EV ecosystem. The government can incentivize the private sector to invest in EV charging infrastructure, while the private sector can bring in expertise, technology, and innovation to develop cost-effective and efficient charging solutions.

Smart charging infrastructure: The deployment of smart charging infrastructure can help optimize the utilization of electricity and reduce the load on the grid. Smart charging infrastructure can be integrated with renewable energy sources, such as solar and wind, to create a decentralized and sustainable energy system.

Battery swapping: Battery swapping can be an effective solution to address the range anxiety issue for EV owners. Battery swapping allows users to exchange their depleted battery with a fully charged one, enabling them to continue their journey without waiting for the battery to charge.

Electric public transportation: Promoting the use of electric buses, taxis, and other forms of public transportation can help create demand for EVs and support the development of charging infrastructure. The government can incentivize public transportation operators to adopt EVs, while private companies can invest in charging infrastructure for public transportation.

Policy interventions: The government can introduce policy interventions, such as tax breaks, subsidies, and other financial incentives, to promote the adoption of EVs and support the development of charging infrastructure. The government can also streamline the regulatory processes for charging infrastructure installation and create a conducive environment for EV adoption.

By exploring these future avenues, India can create a sustainable and inclusive EV ecosystem, overcome the challenge of the lack of charging infrastructure for EVs, and accelerate the transition towards a cleaner and greener transportation system.

VI. CONCLUSION

In conclusion, the lack of charging infrastructure for electric vehicles (EVs) is a significant challenge in India that hinders the widespread adoption of EVs. However, an "out of ways thinking" approach that involves a combination of technological, regulatory, and social innovations can help overcome this challenge. Mobile charging stations, the integration of renewable energy sources, a sharing economy for EV charging infrastructure, and incentivizing the private sector are some of the innovative solutions that can be adopted.

Moreover, exploring future avenues such as partnerships, smart charging infrastructure, battery swapping, electric public transportation, and policy interventions can create a sustainable and inclusive EV ecosystem. The adoption of these solutions can not only address the charging infrastructure problem but also create opportunities for innovation, job creation, and a cleaner and greener transportation system.

It is essential to acknowledge that overcoming the challenge of the lack of charging infrastructure for EVs requires sustained efforts, collaborative partnerships, and policy support. Nevertheless, with the right approach and continued commitment, India can become a leader in electric mobility and accelerate the transition towards a sustainable and inclusive future.

VII. REFERENCES

[1]. Government of India. (2018). National Electric Mobility Mission Plan 2020. Retrieved from https://dhi.nic.in/writereaddata/UploadFile/NEMMP_2020.pdf

[2]. International Energy Agency. (2020). Global EV Outlook 2020. Retrieved from https://www.iea.org/reports/global-ev-outlook-2020

[3]. NITI Aayog. (2018). India's Energy Storage Mission: A Make-in-India Opportunity for Global Leadership. Retrieved from https://niti.gov.in/writereaddata/files/document_publication/ESSbookletfinal.pdf

[4]. Reuters. (2021). India's electric vehicle revolution faces charging challenge. Retrieved from https://www.reuters.com/business/energy/indias-electric-vehicle-revolution-faces-charging-challenge-2021-02-19/

[5]. Singh, R., & Thakur, M. (2021). Smart EV Charging Station Management System Using IoT. In 2021 5th International Conference on Computing Methodologies and Communication (ICCMC) (pp. 23-27). IEEE.

[6]. The Economic Times. (2021). Why India needs to work on EV battery swapping policy. Retrieved from https://economictimes.indiatimes.com/industry/auto/auto-news/why-india-needs-to-work-on-ev-battery-swapping-policy/articleshow/82373433.cms

[7]. The Hindu. (2021). Tackling the EV charging infrastructure conundrum in India. Retrieved from https://www.thehindu.com/business/Industry/tackling-the-ev-charging-infrastructure-conundrum-in-india/article35465661.ece

[8]. Transport and Environment. (2020). Electromobility in India: Moving towards a sustainable future. Retrieved from https://www.transportenvironment.org/sites/default/files/publications/2020_03_Electromobility_India_REPORT%20%281%29.pdf

[9]. Brounen, D., & Scholtens, B. (2020). The adoption of electric vehicles in the Netherlands: An analysis of national adoption trends, policies and incentives. Renewable and Sustainable Energy Reviews, 131, 109959. https://doi.org/10.1016/j.rser.2020.109959

[10]. Jia, Y., Duan, S., Wang, Y., Zhang, X., & Fu, M. (2019). A review on charging infrastructure planning for electric vehicles with uncertainty. Renewable and Sustainable Energy Reviews, 114, 109337. https://doi.org/10.1016/j.rser.2019.109337

[11]. Kim, K. H., Lee, J., Lee, J., Lee, Y., & Han, S. (2019). Key challenges and policy implications for electric vehicle deployment in South Korea. Applied Energy, 236, 804-814. https://doi.org/10.1016/j.apenergy.2018.11.055

[12]. Martinez-Lao, J., Garcia-Sanchez, A., & Garcia-Cascales, M. S. (2020). Sustainable urban mobility: An assessment of the potential of electric vehicles. Renewable and Sustainable Energy Reviews, 121, 109700. https://doi.org/10.1016/j.rser.2019.109700

[13]. Ouyang, M., Dong, H., & Yang, L. (2020). Review of electric vehicle charging technologies, infrastructures, and policies. Applied Energy, 265, 114825. https://doi.org/10.1016/j.apenergy.2020.114825

[14]. Chen, H., Luo, J., & Wang, J. (2019). Energy management strategies of electric vehicles: A comparative review. Renewable and Sustainable Energy Reviews, 110, 47-62. https://doi.org/10.1016/j.rser.2019.04.037

[15]. Gopalakrishnan, S., & Ramanathan, R. (2020). Challenges and solutions for electric vehicle charging infrastructure: A review. Renewable and Sustainable Energy Reviews, 124, 109779. https://doi.org/10.1016/j.rser.2020.109779

[16]. Hao, Y., Wang, L., & Yang, H. (2021). A review on the impact of charging infrastructure deployment on electric vehicle adoption: Challenges and opportunities. Applied Energy, 281, 116014. https://doi.org/10.1016/j.apenergy.2020.116014

[17]. Jin, H., Chen, Z., Wu, Y., Li, H., & Li, S. (2020). Progress and challenges of energy storage technologies for electric vehicles. Applied Energy, 276, 115462. https://doi.org/10.1016/j.apenergy.2020.115462

[18]. Neaimeh, M., & Naser, J. (2020). Electric vehicle integration with renewable energy sources: Review of current progress, challenges and solutions. Renewable and Sustainable Energy Reviews, 123, 109735. https://doi.org/10.1016/j.rser.2020.109735

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Work Sampling and Value Stream Mapping of Lean Construction

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ABSTRACT

Low productivity is the chronic problem in construction industry. One way to increase the productivity is to reduce non-value adding activities. A number of problems affecting productivity can be noted when the activities in progress on a typical construction site are closely observed. Productivity improvements achieve higher cost savings with minimal investment. Lean construction is relatively a new construction management philosophy which has evolved from Lean Manufacturing principles. Lean construction along with its various tools like Pull Approach, Just in Time (JIT), The Last Planner System (LPS), Total Quality Management (TQM), Work Sampling (WS) and Value Stream Mapping (VSM) etc. has gathered a lot of momentum in the developed nations.

Lean Construction is a philosophy based on the concepts of lean manufacturing. It is about managing and improving the construction process to profitably deliver what the customer needs. Because it is a philosophy, lean construction can be pursued through a number of different approaches. This Research thesis outlines the elements of lean manufacturing and suggests how these might be adapted to deliver lean construction in practice.

Keywords: Lean Technology, Work Sampling, Value stream mapping.

I. INTRODUCTION

India has seen a tremendous growth in construction and infrastructure sector in the last decade. Such a growth opportunity can be leveraged for competitiveness, but can also breed wastage. Delays were rampant in construction earlier and now costs are often too high for quality that is given. With increasing competition from foreign players, market shares of domestic firms in key segments has been shrinking. There is also evidence that the problems have become greater in extent and severity in recent years. Lean construction is a nascent philosophy introduced as recent in 1995 in the western world. The name is penetrating in the Indian Construction industry. It addresses mainly to the wastages prevailing in the construction. The wastages as it is today is as high as 50 to 60% (Source: Dr. Tariq Ahmed, University of Michigan, USA). 50% wastage is huge and colossal. Here definition of wastage is generic overrun of time, costs, poor design, adversarial relationships

etc. Since many years, the construction industry in India has suffered from not delivering the projects in time, within budget and with the quality demanded by the customer. Due to these problems, the loss of big projects to international companies is obvious. This study is concerned with the need to spread and apply The Lean Construction concepts and principles in the real world in order to contribute to the consolidation of a theory. Also, to learn to discover and Reduce/Eliminate wastes in the organization. The Research thesis highlights the real issues confronting construction firms and explores the potential of Lean Construction concepts in construction industry in India. Past research into the causes of waste in construction projects indicate that waste can arise at any stage of the construction process from inception, right through the design, construction and operation of the built facility.

II. OBJECTIVES

1) To identify the amount of time spent by labours in different wasteful activities through implementation of work sampling.
2) To monitor and acquire the productivity of labours using daily progress report.
3) To identify wastes from the current process in construction by preparing the current state map and propose a future state map.

III. METHODOLOGY

Objective 1: Work sampling study will be carried out at the construction site for different RCC activities to achieve objective 1.
Objective 2: The productivity of labours will be monitored through the daily progress reports for different RCC activities and analysed to achieve objective 2.
Objective 3: Waste will be identified from the current state map and more efficient future state map will be proposed for the RCC works of a typical slab to achieve objective 3.

IV. LEAN CONSTRUCTION TOOLS

The following are the key lean construction tools:
1) The Last Planner System (LPS)
2) Value Stream Mapping (VSM)
3) Work Sampling (WS)
4) Location Based Management System (LBMS)
5) 5s Housekeeping (5s)
6) Daily Progress Report (DPR).

V. CONCEPTS OF LEAN CONSTRUCTION

Lean Construction is defined as the continuous process of eliminating waste, meeting or exceeding all customer requirements, focusing on the entire value stream and the pursuit of perfection in the execution of a project. In the opinion of Mossman (2009), lean thinking is lean because it provides a way to do more and more with less and less – less human effort, less equipment, less time and less space – while coming closer and closer to providing customers with exactly what they want.

Lean theory and principles taken together provide the foundation for a new form of project management. Lean Construction has produced significant improvements particularly on complex, uncertain and quick projects. Managing construction under Lean Construction is different from typical contemporary practice because it:

- Has a clear set of objectives for the delivery process;
- Is aimed at maximizing performance for the customer at the project level;
- Designs concurrently product and process;
- Applies production control throughout the life of the project.

VI. THE LEAN WASTES

Womack et al. (1990) define waste as any human activity which absorbs resources but do not create value. Ohno defines waste into seven categories that are apparent in every manufacturing facility in the world:

1) Overproduction
2) Waiting
3) Unnecessary transport
4) Inappropriate processing
5) Unnecessary inventory
6) Unnecessary motion
7) Defects an eighth waste was added by Liker (2004)
8) Unused employee creativity.

VII. LEAN CONSTRUCTION VERSUS TRADITIONAL CONSTRUCTION

Construction is considered to be one of the most change resistant industries in the world. Koskela (1992) claimed that the most general concept seems to be understanding construction as a simple process of transforming an input to an output. This conception is actually shared by both old and newer methods in construction. The traditional system of construction project focuses more on keeping track of time and cost. Time control is about looking at the progress in the production line, while cost control is primarily concerned with the budget. Cost control tracks if the project is under or over budget. Kim (2006) suggests that in traditional construction, control consists of monitoring against schedule and budget estimates; while in Lean construction control is defined as causing events to conform to plan. Kim (2006) continues to say that traditional construction focuses more on individual activities. In traditional construction, control begins with

tracking cost and schedule, and therefore any effort to improve productivity leads to unreliable work flow due to suboptimization. As a result, project performance is considerably reduced.

In Lean philosophy, the focus is on how one activity affects the next activity, as all activities are part of the whole system. It works first to assure the reliable flow of work between the tasks. In that perspective Koskela (2000) depicts construction as a continuous flow of materials and/or information instead of just conversion activities (from input to output).

The Most fundamental difference between traditional and Lean construction can be found in scheduling (Kim, 2006). In scheduling, Lean construction uses the "pull" work schedule while traditional construction uses the "push" work schedule. Pull systems schedule work based on demand as opposed to the push systems which schedule work based on system status.

VIII. WORK SAMPLING – A LEAN CONSTRUCTION TOOL

Work sampling is an activity measurement technique that has received increased emphasis in recent years as managers struggle to control construction costs. The underlying theory of work sampling is that the percentage of observations recording a man or machine as idle, working or in any other condition reflects the percentage of time actually spent in that state or condition. If the observations are randomly distributed over a sufficiently long period of time, this theory is held to be true. Work Sampling has three main uses Activity and Delay Sampling: To measure the activities and delays of workers or machines (e.g., to measure the percentage of the day that a person is working or notworking). Performance Sampling: To measure working time and non-working time of a person on a manual task, and to establish a productivity of the person during his or her working time. Work Measurement: To establish a time standard for an operation.

IX. DATA COLLECTION

Under the above heading data were collected from a construction site in Mumbai for following three lean construction tools. The three lean construction tools are:

1. Work Sampling,
2. Daily Progress Report, and
3. Value Stream Mapping.

X. WORK SAMPLING

There seems to be a misconception in the construction industry that if a worker is moving then they are being productive. The work sampling study helps in identifying the actual tasks being performed and can help identify wasteful activities within a process. Work sampling is a management tool which consists of making a large number of random observations and using the theory of probability to identify the activities where waste exists. Work sampling groups the activities into one of three categories: value-added, non- value-added but necessary, and non-value-added. The value-added (VA) activity is anything that directly contributes to the

construction, the Non-value added but necessary (NVAN) activity is that which is necessary to be done, but does not directly add value to the construction and Non-value added (NVA) activity is any activity which does not add value to the project.

To successfully conduct a work sampling study the following steps must be followed:

1. Establish the study objective
2. Define the population to be studied
3. Define the study period
4. Formulate the activity categories
5. (VA, NVAN and NVA)
6. Establish number of observations
7. Develop random observation times.

The steps were followed with the help of the site engineers to successfully conduct the work sampling study. Table 3.1 shows the pre-defined activity categories formulated for RCC work activities.

REINFORCEMENT		
Value added	**Non value added but necessary**	**Non value added**
Cutting of bars	First shifting of materials	Late start/Early Quit/ Unavailability of Labours
Bending of bars	Shifting of tools	Break
Fixing of bars	Cleaning of bars	Personal/Talking
Cover blocks	Reading Plans	Waiting
SHUTTERING		
Value added	**Non value added but necessary**	**Non value added**
Placing of Materials	First Shifting of materials	Late start/Early Quit/ Unavailability of Labours
Shifting of Materials	Cleaning of Surface	Break
Erecting the Materials	Making/ Cutting of wood (Ply)	Personal/Talking
Supporting/Staging	Oiling	Waiting
	Levelling (Verticality Check)	
CONCRETING (RMC)		
Value added	**Non value added but necessary**	**Non value added**
Concreting	Transportation of Materials	Late start/Early Quit/ Unavailability of Labours
Curing	Slump Test	Break
	Filling Cubes for test	Personal/Talking
	Vibrating	Waiting
	Cleaning of Aluminium Formwork	

Table 3.1 Pre-defined activity categories for RCC work activities

- **VALUE STREAM MAPPING**

Value stream mapping (VSM) is an important tool of the lean approach and is used to identify value-adding activities and those considered wasteful of materials and the flow of information and people. The purpose of studying this tool is to understand how Value stream mapping (VSM) is helpful in lean implementation and to develop the road map to tackle improvement areas to bridge the gap between the existing state and the proposed state of different construction activities. Through this case study, the existing process of a slab cycle is mapped with the help of VSM process symbols and the biggest improvement areas like transportation materials, cutting of steel, fixing of reinforcement etc. are identified. Some modifications in current state map are

suggested and with these modifications future state map is prepared. We have considered RCC activities for service floor slab (Part- 1).

After the thorough brainstorming, the list of different activities was prepared which include all the major tasks for RCC works and categorised them into VA, NVAN and NVA as per its contribution to the final product.

The observation sheet for work sampling study can be found in the appendix 1, are as: -

Observation Sheet

WORK SAMPLING SHEET					
ACTIVITY: RCC Works					
PROJECT NAME: GODREJ Platinum					
DATE:				OBSERVER NAME: Maharshi J.Shelat	
Observation No.	VA	NVAN	NVA	Time	Remarks
TOTAL					

REINFORCEMENT		
VA	NVAN	NVA
Cutting of bars	First shifting of materials	Late start/Early Quit/ Unavailability of Labours
Bending of bars	Shifting of tools	Break
Fixing of bars	Cleaning of bars	Personal/Talking
Cover blocks	Reading Plans	Waiting
SHUTTERING		
VA	NVAN	NVA
Placing of Materials	First Shifting of materials	Late start/Early Quit/ Unavailability of Labours
Shifting of Materials	Cleaning of Surface	Break
Erecting the Materials	Making/ Cutting of wood (Ply)	Personal/Talking
Supporting/Staging	Oiling	Waiting
	Levelling (Verticality Check)	
CONCRETING (RMC)		
VA	NVAN	NVA
Concreting	Transportation of Materials	Late start/Early Quit/ Unavailability of Labours
Curing	Slump Test	Break
	Filling Cubes for test	Personal/Talking
	Vibrating	Waiting
	Cleaning of Aluminium Formwork	

- **CURRENT STATEMAP**

The goal of current state mapping is to create the clear picture of an existing process and to identify waste. For mapping the current state map, the information for different RCC activities for slab preparation was collected from the contractor, site engineer, site supervisors and workers. The data like, types of activities, its quantity for a typical slab, no. of days and resources required for RCC activities are gathered. It is shown in the table3.3

According to current practice, a single slab takes 15 days to complete. This process is put in the graphical form to understand the value stream and identify waste from it. Consider activities in blue colour as preactivities, Green as main activities and red as post activities.

It is assumed that the steel for starters, columns and beam bottom are used from the safety stock (Inventory). Fixing and shuttering of 17 starters take 2 days for 6 labours, fixing and shuttering of 17 columns take 4 days for 9 labours, Fixing and shuttering of beam bottom and fixing of slab shuttering of area 265 SQMT take 4 days for 22 labours, Fixing of Slab reinforcement of 5.5 Ton take 4 days for 23 labours, concreting of as lab is completed

in a single day using ready mix concrete. It takes 32 labours for the slab area of 265 SQMT Concrete is ordered 2 days before the day of concreting by the management.

Activity	Quantity	Resources Required					Days
		Carpenter	Fitter	Helper	Mason + MC	Total	
Starters fixing & Shuttering	17 nos.	3	2	1	-	6	2
Columns fixing & Shuttering	17 nos.	4	3	2	-	9	4
Beam bottom & Slab Shuttering	265 SQMT.	11	-	9	2	22	4
Slab Reinforcement Fixing	5.5 T	-	19	4	-	23	4
Concreting	265 SQMT.	4	1	8	19	32	1

Table 3.3 Resources required for each activity

XI. CONCLUSSION

- This Paper described the work sampling & value srtream mapping for the lean technology, using this methodology, the considerable results were achieved.
- The slab cycle time for a typical slab, Service floor slab (Part-1) was reduced to 13 days from 15.
- The additional cost required for applying innovations should be considered.
- The off-site column fixing saves 2 days in the cycle time but, for erecting the cage of column a tower crane is required.
- The rental of tower crane should be considered, It should not exceed the amount saved for two days.

It should be considered that the readymade steel is 8 to 10% costlier than the normal steel.

XII.REFERENCES

[1]. Koskela, L. and Howell, G., (2002), "The Underlying Theory of Project Management is obsolete"

[2]. Kpamma, Z.E., (2009), "The practice of lean thinking at the pre-contract stage of building construction projects by selected Ghanaian firms", a thesis submitted to the Department of Building Technology at the Kwame Nkrumah University of Science and Technology.

[3]. Liker, J.K. (2004), "The Toyota Way: 14 management principles from the world's greatest manufacturer", New York; London, McGrawHill.

[4]. Mossman, A., (2009), "Why isn't the UK Construction Industry going lean with gusto?" Lean Construction Journal.

[5]. Peter Simonsson1, Anders Björnfot2, Jarkko Erikshammar3 & Thomas Olofsson4, (2012), "'Learning to see the Effects of Improved Workflow in Civil Engineering Projects", Lean Construction Journal.

[6]. Womack, J. P., and Jones, D. T., (1996), "Lean Thinking: Banish Waste and Create Wealth in Your Corporation".

[7]. Womack, J.P., Daniel, P., Jones, T. and Ross, D., (1990), "The machine that changed the world"

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Digital Fuel Level and Battery Life Indicator

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ABSTRACT

The existing fuel indicators installed in vehicles like Honda, Hero, TVS, Yamaha are having the petrol indication in the form of points and analog meters which lead to miscalculations to what distance vehicle can go with present fuel in tank. One of the major problems with the kick less motor vehicles is that once battery gets discharged, the self-start motor will not respond making situation horrible to the user. In recent day's world has become digitized, if we make fuel meter in the vehicle also digital it will help to know exact amount of fuel present in fuel tank. In our Project we have made digital fuel meter. Here is the indication for the amount of fuel present in tank digitally. That value is in numerical digits. In this project a proposal of a digital measurement system which displays the different parameters like fuel quantity and battery health. The fuel indicator which we use gives us 100% accurate result by displaying the quantity of petrol in numerical format i.e. in milliliters. The heart of the project is the microcontroller which takes necessary decision depends on the sensor feeds and displays the results in the digital format. An ultrasonic sensor is interfaced to the Analog to digital controller (ADC) which converts analog voltage output from the sensor to the digital form and feed to microcontroller. Then the microcontroller calculates the level depends on the digital value multiplied with the volume of the tank at that level and displays the digital numeric value on the screen

Keywords: Arduino, Ultrasonic Sensor, Battery, Voltage sensor.

I. INTRODUCTION

We are already aware that motor vehicles display the amount of fuel in the fuel tank by means of some indication like bars running through the E (empty) and F(full) indicators. The manufacturer provides the specification that each bar maps to the corresponding liters of fuel approximately. To the contrary every one of us might have experienced the problem with improper estimations of the current fuel level in the tank with the existing bars representation system. Today in this digitalized world, if the fuel indicator in the automobiles is also made digital it will help to know the exact amount of fuel available in the tank. An advanced digital Fuel meter is the one which shows the level of Fuel in digital format. In this work, we propose a digital measurement system which constantly displays the different parameters like Fuel quantity and battery health.

Now a day's everything is digital in all over field. Digital fuel meter is also implemented in two-wheeler, but they do not show the exact fuel level which is present in the tank i.e., they show the amount of fuel in terms of bars and not in numbers or digits like liter or milliliter. That's why we do not get proper idea about fuel present in our tank. We get only approximate level of fuel. So, this problem is taken into consideration for our project work of developing the Digital (numeric) fuel indicator system for two wheelers which shows exact amount of fuel in terms of liter or milliliter. This value in liters will be in numerical digits (ex: 1.2 lit, 1.3 lit, 1.4 lit). This project mainly concentrates about the indication of fuel level in two- wheeler tanks. In the recent times we are constantly hearing about petrol theft. Most of the petrol bunks today have fraud the pumps such that it displays the amount as entered but the quantity of fuel filled in the customer's tank is much lesser than the displayed value. Yet the pumps are tampered for the benefit of the petrol bunks owner. This results in huge profits for the petrol bunks but at the same time the customers are cheated. All the vehicles in India consist of analog meters hence it is not possible to precisely know the amount of fuel currently in the vehicle and it is not possible to cross check the quantity of fuel filled in the petrol bunk. In this project we focus on creating a digital display of the exact amount of fuel contained in the vehicles tank and help in cross checking the quantity of fuel filled at the petrol theft.

The heart of the project is the microcontroller which takes necessary decision depending on the sensor feeds and displays the results in the digital formatted value on the screen. Our digital indicator will indicate the level of Fuel in milliliters. An ultrasonic sensor which is a noncontact type sensor send signal to the Arduino uno microcontroller. Then the microcontroller calculates the level depending on the digital value multiplied with the volume of the tank at that level and displays the digital numeric value on the screen. Our digital indicator will indicate the level of Fuel in milliliters. This type of Fuel indicator has not been implemented in any of the two wheelers till now. In this project, we are using many components.

II. LITERATURE SURVEY

A.Avinashkumar,U.Singaravelan,T.V.Premkumar and K.Gnanaprakash, "Digital fuel level indicator in two-wheeler along with distance to zero indicator", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE),e-Issn: 2278-1684,P-Issn: 2320-334x, Volume 11,Issue 2 Ver. III (Mar-Apr. 2014), PP 80-84,"Today in this digitized world, if the fuel indicator in the automobiles is also made digital it will help to know the exact amount of fuel available in the fuel tank. The above furnished fact is considered in our project, and we found out a proper solution for indicating the exact availability of fuel in the tank digitally. Here, we are indicating the amount of fuel in the tank in liters. This value in liters will be in numerical digits (ex: 1.2, 1.3, 1.4). This project mainly concentrates about the indication of fuel level in two- wheeler tanks. Various other features like the distance can be travelled to the corresponding fuel, is added with this arrangement which will explain the clear performance of the vehicle to the corresponding fuel."

Mrs. Udayavalli.V., Mrs. M. Omamageswari, "Embedded system based intelligent digital fuel Gauge",Ipasj International Journal Of Electronics & Communication (Iijec),Volume 2, Issue 12, December 2014,"In the recent times we are constantly hearing about petrol bunk frauds. Most of the petrol bunks today have manipulated the pumps such that it displays the amount as entered but the quantity of fuel filled in the

customer's tank is much lesser than the displayed value. I.et the pumps are tampered for the benefit of the petrol bunks owner. This results in huge profits for the petrol bunks but at the same time the customers are cheated. All the vehicles in India consist of analog meters hence it is not possible to precisely know the amount of fuel currently in the vehicle and also it is not possible to cross check the quantity of fuel filled in the petrol bunk. In this project we focuses on creating a digital display of the exact amount of fuel contained in the vehicles tank and also help in cross checking the quantity of fuel filled at the petrol bunk. Finally once the fuel is filled at

a bunk the device also sends an SMS to the vehicle owner indicating the amount, quantity, and date, time etc. And also, we can find the exact location of the vehicle."

Nitin Jade, "Modified type intelligent digital fuel indicator system",IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-Issn:2278-1684, P-Issn:2320- 334x,Pp 20-23,"There are many sensor based techniques available in the market to measure the liquid level and gives you a close idea of quantity of the liquid, however can provide you an exact approximation of quantity as in cars by fuel meters by which we can get an idea of whether tank is full, half full or empty etc. The liquid level detector and optimizer play an important role in tanks to indicate the level of liquid of a particular density. In this paper we have proposed a technique to measure the amount of liquid available in tank also give the knowledge about their chemical composition as well as purity level of fuel & it is the first device which can give the accurate knowledge about of how much the vehicle can run. This device digitally displays the level of liquid inside the tank, fuel composition & running capability of vehicle by using load sensors. The measurements are taken so the accuracy level is of 95% - 98%. Thus it is an efficient device made by keeping in mind the petroleum thefts at the various petrol pumps at the time of filling of tanks."

Raj Patel, Hitesh Pungalia, Saurabh Mahajan, "Flow Meter and Arduino Based Fuel Gauge for Automotive Vehicles", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), e-Issn: 2278-1684,P-Issn: 2320-334x, Volume 13, Issue 5 Ver.VII (Sep. - Oct. 2016), Pp 85- 92,"Design and implementation of digital fuel gauge which measures the accurate level of fuel adding while fuel filling process. Now-a-days all fuel bunks having types of digital displays unit in order to display the value of fuel adding to the vehicle. But we don't know whether they adding accurate value or not. In this paper we have proposed a technique to measure the amount of fuel available in tank during static as well as dynamic condition. This system digitally displays the level of fuel inside the tank by using load sensor, flow meter and vibration sensor and these sensors are interfaced with a development board-arduino. Thus, it is an efficient system to detect the fuel volume in the fuel tank, to get instantaneous reading of fuel volume and to avoid petroleum thefts at the various petrol pumps at the time of filling of tanks."

Stephen A. Dyer, "Survey of Instrumentation and Measurement",Journal Of Information, Knowledge And Research In Mechanical Engineering, Issn 0975 – 668x,Nov 15 To Oct 16,Volume – 04, Issue-01,"In this introductory chapter we will examine the architecture of typical measurement systems and discuss how noise, calibration errors, sensor dynamic response and nonlinearity can affect the accuracy, precision and resolution of measurements. We will also discuss the modern, physical and electrical standards used by the U.S. NIST (National Institute of Standards and Technology, formerly the National Bureau of Standards) and discuss how these standards are used to create secondary standards used for practical calibration of measurement systems.

Measurement systems are traditionally used to measure physical and electrical quantities, such as mass, temperature, pressure, capacitance and voltage. However, they can also be designed to locate things or events, such as the epicenter of an earthquake, employees in a building, partial discharges in a high voltage power cable, or a land mine. Often, a measurement system is called upon to discriminate and count objects, such as red blood cells, or fish of a certain size swimming past a checkpoint. A measurement system is often made a part of the control system. The old saying 'if you can't measure it, you can't control it' is certainly a valid axiom for both the control engineer as well as the instrumentation engineer. The reader should realize that the fields of instrumentation and measurements are rapidly changing and new standards, sensors and measurement systems are continually being devised and described in journal literature. The IEEE Transactions on Instrumentation and Measurement, the Review of Scientific Instruments, the IEEE Transactions on Biomedical Engineering and the Journal of Scientific Instruments are four of the important periodicals dealing with the design of new measurement systems, instruments and standards."

III. DESIGN

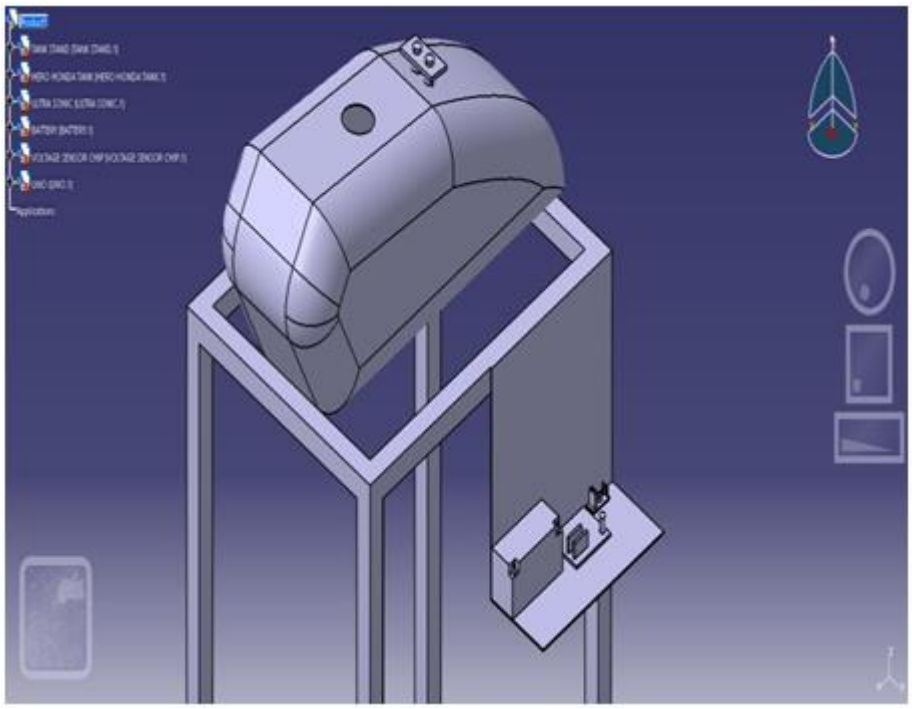

Fig. Isometric view

IV. DESIGN PROCEDURE

This idea was actually formed for the good cause of common people. Petrol rates are hiking every day and it's a burning issue. In the present, all bikes which are available in the market are not having a digital Fuel meter in it. With this the person cannot know how much amount of petrol is there. So if the bike consists of a digital Fuel meter in it, the person will be able to know how much petrol is present in millimeters. So, this concept

will be very helpful for a common man. Generally, in the winter season the battery gets drained. Because of this, the vehicle will not start soon. So, it's a problem faced by many people. If the vehicle is consisting of a battery indicator, it shows how much amount of charging is present in it. So, if these two concepts are present in the bike or a car it will be very useful to everyone. This is actually an innovative project. This concept is not present in any of the automobile companies like Benz, BMW, Audi and Ferrari. So, this is just an innovative project and we are implementing this on a 4 stroke two wheeler vehicle by modifying bottom shape of tank.

Tank Construction:

a. The original petrol tank is used by modifying the bottom shape of the tank by making it flat instead of the bottom curved shape.
b. The capacity of the tank is 12 liters.
c. The tank is of indefinite shape.
d. The ultrasonic sensor is mounted at top surface of fuel tank by making it in two holes.

Fig. Hero Honda Fuel Tank

PERFORMANCE TESTING:

Fuel indicator specifications:

After the prototype is developed many observations are done on the Fuel indicator. Checking had been done by pouring selected amount Fuel and noting down the reading shown in LCD display. So by checking variations in the indication the total observations were performed.

Fig . Fuel level indicator

Battery indicator specifications:

The observations of the battery indicator are performed, by keeping the bike constant. So, if the bike is still for long period the battery gets discharged. When we again start the bike, ignition gets activated and so the battery gets charged when it is in movement.

Fig . Battery level indicator (*Battery Level varying from080% to 70%*)

V. CONCLUSION

The proposed idea consists of ultrasonic technique for fuel measurement that acquires the measured fuel level and sends to the display unit which is present on the dashboard.

The data acquired from the sensor is given to the microcontroller. The processor processes the data by calculating the litre value that send to the display unit. At the same time voltage sensor which is connected in between the battery and Arduino uno microcontroller gives we reading on display unit of the percentage of charge are left in the battery.

VI.REFERENCES

[1]. A. Avinash kumar, U. Singaravelan, T. V. Premkumar and K. Gnanaprakash, "Digital fuel level indicator in two- wheeler along with distance to zero indicator", IOSR Journal of Mechanical and Civil Engineering (IOSR- JMCE),e-Issn: 2278-1684,P-Issn: 2320-334x, Volume 11, Issue 2 Ver. III (Mar-Apr. 2014), PP 80-84.

[2]. Mrs. Udayavalli V., Mrs. M. Omamageswari, "Embedded system based intelligent digital fuel Gauge", Ipasj International Journal Of Electronics & Communication (Iijec),Volume 2, Issue 12, December 2014.

[3]. Nitin Jade, “Modified type intelligent digital fuel indicator system”,IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-Issn:2278-1684, P-Issn:2320- 334x,PP 20-23.

[4]. Raj Patel, Hitesh Pungalia, Saurabh Mahajan, "Flow Meter and Arduino Based Fuel Gauge for Automotive Vehicles", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), e-Issn: 2278-1684,P-Issn: 2320- 334x, Volume 13, Issue 5 Ver.VII (Sep.- Oct. 2016), Pp 85- 92.

[5]. Stephen A. Dyer, “Survey of Instrumentation and Measurement”,Journal Of Information, Knowledge And Research In Mechanical Engineering, Issn 0975 – 668x,Nov 15 To Oct 16,Volume – 04, Issue-01.

[6]. Rahul S. Vaidya, "Digital Fuel Level Indicator", Journal Of Information, Knowledge And Research In Mechanical Engineering, Issn 0975 – 668x,Nov15 To Oct16 Volume– 4, Issue-01.

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Performance Evaluation of Gas turbine using exergy analysis

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ABSTRACT

Exergy is the advanced method to design any thermal system. The exergy analysis is used to find exergy involved in the component of any thermal system, exergy flow, entropy production flow and the appropriate exergy rate terms such as fuel and available work. The detailed exergy analysis has been done on Gas turbine plant. The aim of this paper is to make exergy analysis in each component of gas turbine in which the losses, exergy flow work, entropy flow, exergy loss or destruction, rate of available work have to be calculated. The thermal efficiency and exergy efficiency shows that how much system is efficient actually. Exergy gives the actual data of performance of system. So, this method is very important for the design of any thermal system.

Keywords: Exergy, Availability, entropy, relative humidity, Exergy destruction, lost work

I. INTRODUCTION

Exergy is the maximum theoretical work obtainable as the system comes to equilibrium. The method of exergy analysis is based on the conservation of mass and conservation of energy, second law of thermodynamics and the concept of irreversible production of entropy. It is particularly suited for furthering the goal of more efficient energy resource use, since it enables the locations, types and true magnitudes of waste and loss to be determined. The exergy analysis based on exergy balance equation permits one to predict the thermal efficiency of the system (i.e. energetic efficiency), exergy loss in each component as well as mass flow rate, the composition and the temperature of exhaust gases, rate of available work at each station of thermodynamic system.

This information can be used to design thermal system, guide efforts to reduce sources of inefficiency in existing system and evaluate system economics.

II. METHODOLOGY

(i) According to 1st law of thermodynamics, the energy rate balance equation is given by

$$\frac{dE_{cv}}{dt} = \frac{Q_{cv}}{m} - \frac{W_{cv}}{m} + \left(h1 + \frac{V_1^2}{2} + g.Z_1 \right) + \left(h2 + \frac{V_2^2}{2} + g.Z_2 \right) \quad ...(I)$$

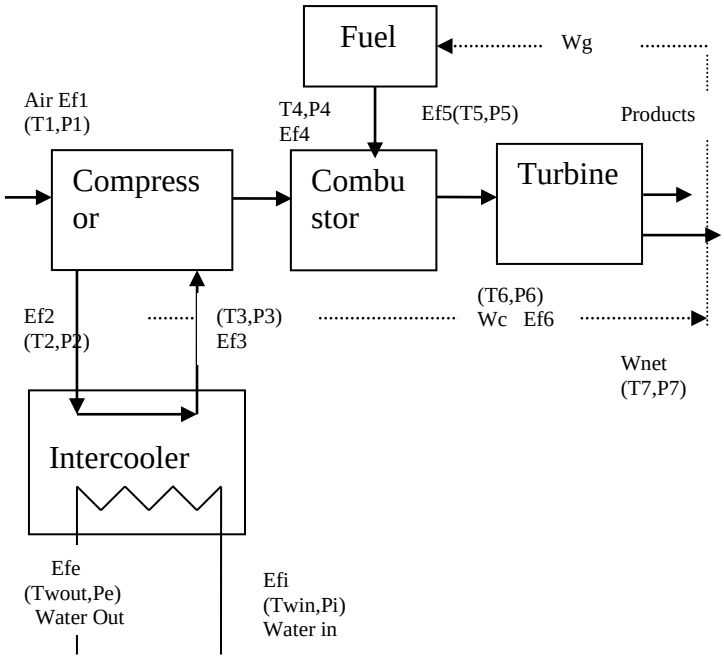
Work needed in the first stage of the compressor, $\frac{W_{cv}}{m_a} = h_1 - h_2$

(ii) According to 2nd law of thermodynamics, the entropy rate balance equation is given by

$$\frac{dS_{cv}}{dt} = \sum_j \frac{Q_j}{T_j} + \sum_i m_i S_i - \sum_e m_e S_e + \sigma_{cv} \quad .....(II)$$

Entropy change in compressor, $S_2 - S_1 = cp_a \ln \frac{T_2}{T_1} - R_a \ln \frac{P_2}{P_1}$

Above two equation (I) and (II) are applied for thermodynamic analysis of Compressor, Intercooler, Combustor, Turbine.



Gas turbine Plant with work and exergy flow

III. EXERGY ANALYSIS OF A GAS TURBINE PLANT

1) Exergy analysis of two stage Compressor-

Exergy rate balance equation is given by

$$\frac{dE_{cv}}{dt} = \sum_j \left(1 - \frac{T_0}{T_1} \right) Q - \left(W_{cv} - P_o * \frac{dE_{cv}}{dt} \right) + \sum_i m_i e_{fi} + \sum_e m_e e_{fe} - Ed \quad .....(A)$$

Exergy flow at compressor inlet and outlet are given by

$$e_{f1} = (h_1 - h_0) - T_0 (S_1 - S_0)$$

$$e_{f2} = (h_2 - h_1) - T_0(S_2 - S_1)$$

Exergy flow change in compressor 2nd stage,

$$e_{f4} - e_{f3} = (h_4 - h_3) - T_0(S_4 - S_3)$$

Exergy destruction or lost work in 1st stage and 2nd stage of compressor,

$$Ed_{c1} = T_0\sigma_{c1} = T_0 * m_a * (S_2 - S_1)$$

$$Ed_{c2} = T_0\sigma_{c2} = T_0 * m_a * (S_4 - S_3)$$

Exergy efficiency in 1st stage & 2nd stage of compressor,

$$\eta_{exec1} = \frac{e_{f2} - e_{f1}}{\left(-W_{cv1}/m_a\right)}, \quad \eta_{exec2} = \frac{e_{f4} - e_{f3}}{\left(-W_{cv2}/m_a\right)}$$

Exergy efficiency of compressor,

$$\eta_{exec} = \frac{(e_{f1} - e_{f2}) + (e_{f3} - e_{f4})}{W_c/m_a} = 1 + \frac{Ed_c}{m_a}$$

The total exergy balance for the compressor is given by,

$$\frac{W_c}{m_a} = \left(\frac{W_{c1}}{m_a} + \frac{W_{c2}}{m_a}\right) = (e_{f1} - e_{f2}) + (e_{f3} - e_{f4}) - \frac{Ed_c}{m_a}$$

Total exergy destruction or lost work in compressor,

$$\frac{Ed_c}{m_a} = T_o * [(S_4 - S_3) + (S_2 - S_1)]$$

2) Exergy analysis of Intercooler-

The outlet temperature of air in intercooler is given by

$$T_3 = \frac{(1-R)T_2 + \{1 - \exp[NTU(R-1)]\} * R * T_{w1}}{1 - R * \exp[NTU(R-1)]}$$

Number of heat transfer units,

$$NTU = \frac{UA}{m_h c_h} \text{ when } m_h * cp_h \geq m_w * cp_w$$

Heat capacity rate,

$$R = \frac{m_w * cp_w}{m_h * cp_h}$$

The outlet of temperature of water,

$$T_{w2} = T_{w1} + \frac{T_2 - T_3}{R}$$

Exergy change of air in intercooler,

$$(e_{f2} - e_{f3}) = (h_2 - h_3) - T_0(S_2 - S_3)$$

Exergy change of water in intercooler,

$$(e_{fw2} - e_{fw1}) = (h_{w2} - h_{w1}) - T_0(S_{w2} - S_{w1})$$

Exergy destruction or lost work in intercooler,

$$Ed_i = m_a\left(e_{f2} - e_{f3}\right) - m_w\left(e_{fw2} - e_{fw1}\right)$$

Exergy efficiency of intercooler,

$$\eta_{execi} = \frac{m_w\left(e_{fw2} - e_{fw1}\right)}{m_a\left(e_{f2} - e_{f3}\right)}$$

3) Exergy analysis of combustor-

On a one kmol of fuel basis, the overall combustion reaction for typical gas turbine operation may be written as on the basis of complete combustion,

$$\left(aC_{\alpha j}H_{\beta j} + bC_{\alpha k}H_{\beta k} + cC_{\alpha l}H_{\beta l} + dC_{\alpha m}H_{\alpha m}\right) + n_{to}O_2 + 3.728n_{to}N_2 + 0.044n_{to}A_r + n_{wv}H_2O \rightarrow n_{\alpha t}CO_2 + \left(0.5n_{\beta t} + n_{wv}\right)H_2O + n_{eo}O_2 + 3.728n_{to}N_2 + 0.044n_{to}A_r$$

The total mole number of carbon atoms in fuel,

$$n_{\alpha t} = a\alpha j + b\alpha k + c\alpha l + d\alpha m$$

The total mole number of hydrogen atoms in fuel,

$$n_{\beta t} = a\beta j + b\beta k + c\beta l + d\beta m$$

The total mole number of correct oxygen in fuel,

$$n_{eo} = n_{\alpha t} + 0.25n_{\beta t}$$

The total mole number of dry air, $n_{da} = 4.772xn_{co}$

To find total number of water vapour,

Relative humidity,

$$\Phi = \frac{Partial.Pressure.of.water.vapour(P_{wv})}{Saturation pressure.at.air.temperature(P_{sat})}$$

$$P_{wv} = \phi P_{sat} \ @T_1$$

Specific humidity or humidity ratio,

$$\omega = \frac{m_{wv}}{m_a} = 0.622 * \frac{P_{wv}}{P_a} = 0.622 * \frac{P_{wv}}{P - P_{wv}}$$

The total no. of total air,

$$n_{ta} = n_{da} + d_{wv}$$

The total no. of water vapour,

$$n_{wv} = n_{ta}\frac{1.608\omega}{1 + 1.608\omega}$$

The total number of excess oxygen in air,

$$n_{eo} = (x-1)n_{co} \qquad n_{to} = xn_{co}$$

Total volume of exhaust gases,

$$V_t = n_{\alpha t} + (0.5n_{\beta t} + n_{wv}) + n_{eo} + 3.728n_{to} + 0.044n_{to}$$

Lower Heating value of fuel, $Q_f = \frac{a(h_f)_{CH_4}}{M_{CH_4}} + \frac{b(h_f)_{C_2H_6}}{M_{C_2H_6}} + \frac{c(h_f)_{C_3H_8}}{M_{C_3H_8}} + \frac{d(h_f)_{C_4H_{10}}}{M_{C_4H_{10}}} - \frac{n_{at}(h_f)_{CO_2}}{M_{CO_2}} - \frac{0.5n_{\beta t}(h_f)_{H_2O}}{M_{H_2O}}$

The absolute entropy of air can be calculated $S_4 = \frac{n_{to}(S_{T4} - S_{T0})_{O_2}}{M_{O_2}} + \frac{3.728n_{to}(S_{T4} - S_{T0})_{N_2}}{M_{N_2}} + \frac{0.044n_{to}(S_{T4} - S_{T0})_{A_r}}{M_{A_r}} + \frac{n_{wv}(S_{T4} - S_{T0})_{H_2O}}{M_{H_2O}}$

The absolute entropy of fuel can be calculated as..

$$S_5 = a * S_j + b * S_k + c * S_l + d * S_m$$

$$S_{j,k,l,m} = cp_{j,k,l,m} * \ln\left(\frac{T_5}{T_0}\right) - R_{j,k,l,m} * \ln\left(\frac{P_5}{P_0}\right)$$

The absolute entropy of products (combustion) can be calculated as ..

$$S_6 = n_{at} * (S_{T4} - S_{T0})_{CO_2} + (0.5 * n_{\beta t} + n_{wv}) * (S_{T4} - S_{T0})_{H_2O} + 3.728 * n_{to} * (S_{T4} - S_{T0})_{N_2}$$
$$+ n_{eo} * (S_{T4} - S_{T0})_{O_2} + 0.044 * n_{to} * (S_{T4} - S_{T0})_{A_r}$$

Entropy generation in combustor

, $\sigma_{cb} = m_f * (S_6 - S_4 - S_5)$

Exergy destruction or lost work in combustor,

$$Ed_{cb} = T_o * \sigma_{cb}$$

Chemical exergy of fuel,

$$E_{che} = m_f * \left[a(E_{che})_j + b(E_{che})_k + c(E_{che})_l + d(E_{che})_m\right]$$

$$h_5 = \frac{a * cp_{CH_4} * (T_5 - T_0)}{M_{CH_4}} + \frac{b * cp_{C_2H_6} * (T_5 - T_0)}{M_{C_2H_6}} + \frac{c * cp_{C_3H_8} * (T_5 - T_0)}{M_{C_3H_8}} + \frac{d * cp_{C_4H1_{10}} * (T_5 - T_0)}{M_{C_4H_{10}}}$$

The exergy flow of fuel.

$$E_{f5} = (h_5 - h_0)_{j,k,l,m} - T_0 * (S_5 - S_0)_{j,k,l,m}$$

The exergy products or combustion,

$$E_{f6} = n_{at} * \left[(h_6 - h_0) - T_0 * (S_6 - S_0)\right]_{CO_2} + (0.5n_{\beta t} + n_{wv}) * \left[(h_6 - h_0) - T_0 * (S_6 - S_0)\right]_{H_2O}$$
$$- n_{eo} * \left[(h_6 - h_0) - T_0 * (S_6 - S_0)\right]_{O_2} + 3.728 * n_{to}\left[(h_6 - h_0) - T_0 * (S_6 - S_0)\right]_{N_2}$$
$$+ 0.044 * n_{to}\left[(h_6 - h_0) - T_0 * (S_6 - S_0)\right]_{A_r}$$

Exergy efficiency of combustor,

$$\eta_{cb} = 1 - \frac{Ed_{cb}}{E_{che}},$$

Work done in gas compressor,

$$W_{ge} = e_{f5} - T_{0*} m_f * S_5$$

4) Exergy analysis of Turbine-

From exergy rate balance equation,

Work done by turbine,

$$\frac{W_t}{m_g} = e_{f6} - e_{f7} - \frac{Ed_t}{m_g}$$

Exergy change in turbine is given by

$$e_{f7} - e_{f6} = (h_6 - h_7) - T_0(S_6 - S_7)$$

Exergy destruction or lost work in turbine,

$$Ed_t = T_0 * \sigma_t$$

Exergy efficiency of turbine,

$$\eta_{exet} = 1 - \frac{Ed_t}{W_t}$$

Thermal efficiency of turbine, $\eta_{th} = \frac{W_t - W_c - W_g}{Q_f}$

Following Assumptions have been made for the analysis of gas turbine plant:-

1) The mass flow rate of air is adjusted depending on the inlet air so that the air temperature does not affect the isentropic efficiency of the compressor very much.
2) Kinetic and potential energy in exergy flow in all components of gas turbine are neglected.
3) The heat transfer to the environment is neglected in case of compressor, combustor and turbine.
4) Compressors, Intercooler, combustor, turbine are working at steady state and control volume.
5) Air and water each pass through at constant pressure and no pressure loss occurred.
6) Inlet air temperature, mass flow rate, compression ratio, isentropic efficiency of compressor is taken as the input to the compressor.

Fuel composition and air fuel ratio is input to combustor.

Exergy Analysis of Gas turbine Plant:-

Suction Air Pressure, (Pa)	kPa	103.32 kPa	Temperature,T2(K) /exergy e_{f2} at LPC outlet (kW)	426.51/605.85
Suction air temperature,T1	K	288	Temperature,T3/exergy e_{f3} at intercooler outlet	320.43/486.65
Pressure ratio, Pr		10	Temperature,T4/exergy e_{f4} at HPC outlet	482.271/1206.63
Relative Humidity, Φ	%RH	60	Temperature,T5/exergy e_{f5} at fuel	632.64/153.03
Air mass flor rate, ma	kg/s	5.0	Temperature,T6/exergy e_{f6} at combustor outlet	1201/4020.17
Fuel flow rate, mf	Kg/s	0.0838	Temperature,T7/exergy e_{f7} at turbine outlet	749.13/1289.58
Isentropic efficiency of compressor, η_isec	%	81.34	Thermal eff, η_{thet} /Exergy eff. of gas turbine η_{exet}	40.96/93.035
Isentropic efficiency of turbine,η_iset	%	85.00	Lost work(Ed_c) of compressor	183.39

Power Output of gas turbine	kW	1206.57	Lost work(Ed_{cb}) of combustor	1103.66
Exhaust gas mass flow rate	Kg/sec	5.0833	Lost work(Ed_{ct}) of Turbine	189.15

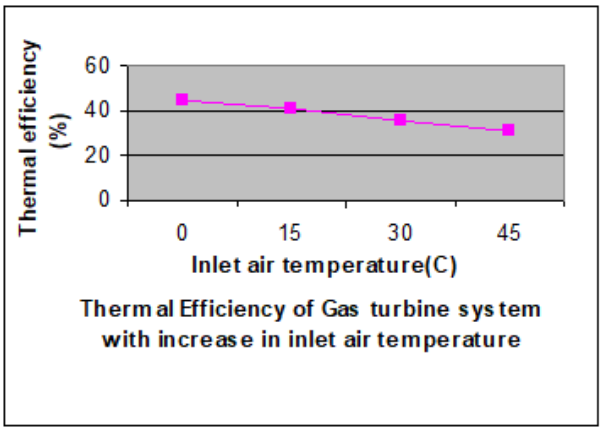


Fig .1

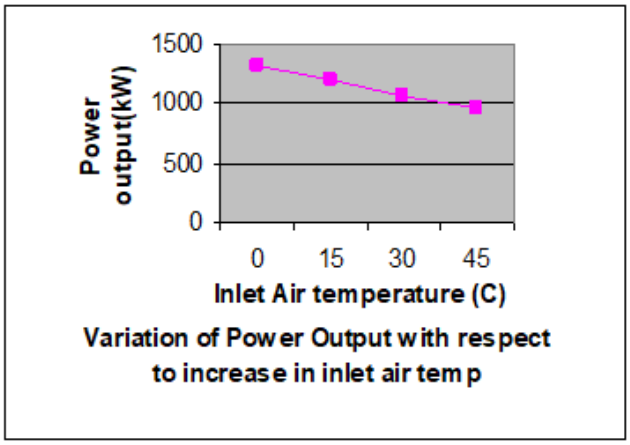


Fig .2

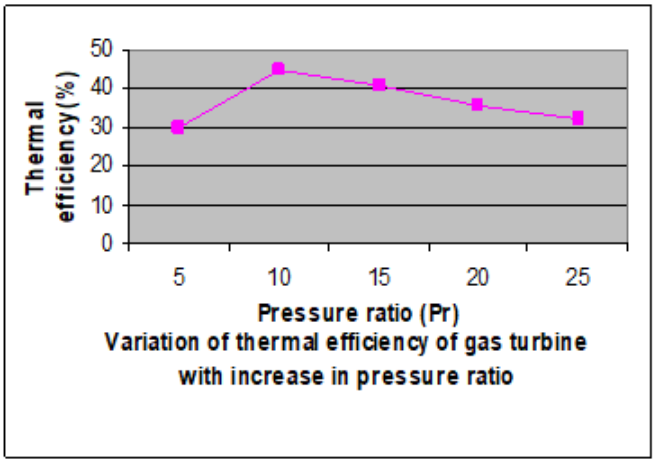
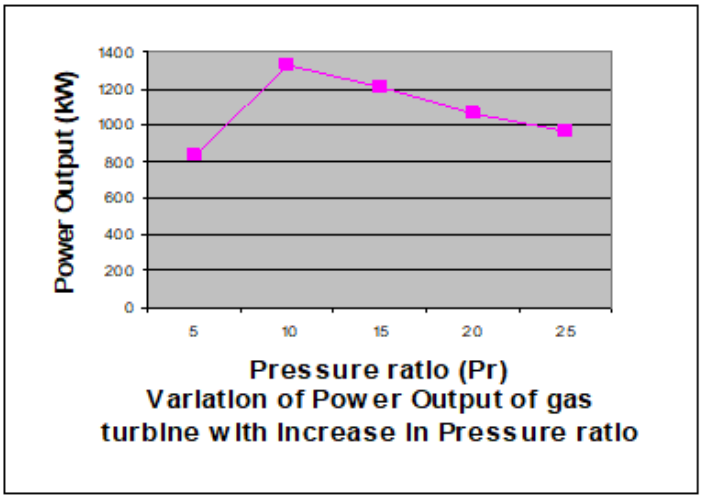


Fig. 3



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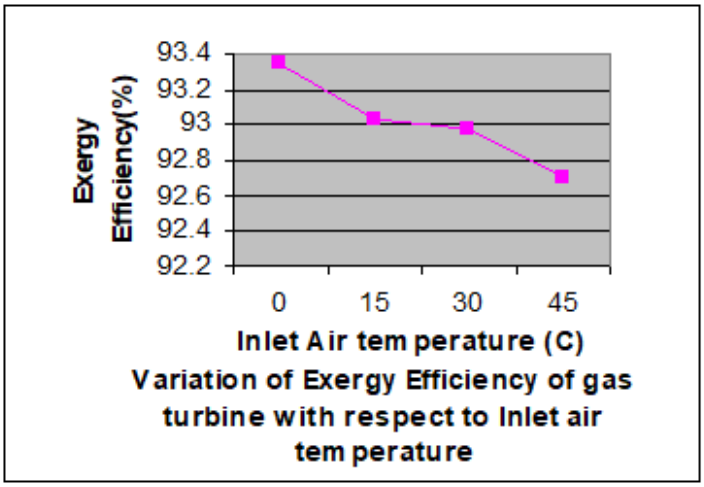

Fig. 5

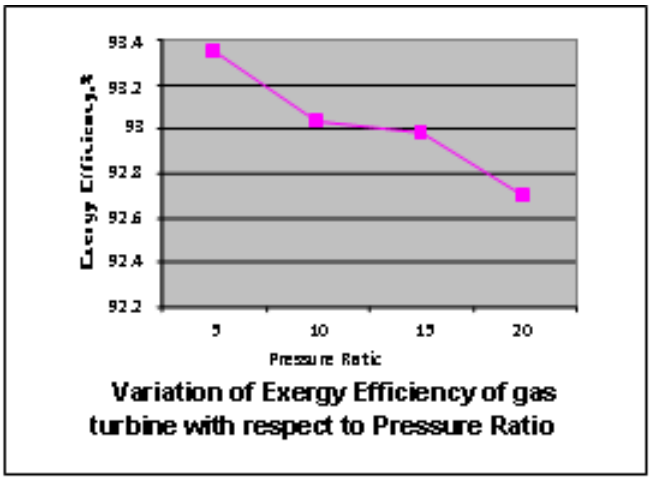

Fig. 6

IV. RESULT ANALYSIS

The isentropic efficiency of either compressor or turbine varies as the mass flow rate, if the pressure and temperature of working gas are changed. The change of thermal efficiency and net power at the shaft end of gas turbine depending on the inlet air temperature (Fig.1).calculation results show that the net power decreases more rapidly than the thermal efficiency as the inlet air temperature increases. The reason is that when inlet air temperature of compressor increases, the compressor outlet temperature is also increases. So compressor work done is increases. When compressor work increases, power output by turbine is decreases .So, the thermal efficiency of gas turbine will goes on decreases with increase in inlet air temperature of compressor (Fig.2). Calculation result shows that initially thermal efficiency and power output increases and later it is decreases slightly with increase in pressure ratio (Fig. 3 and Fig 4).The exergy efficiency is decreases with respect to increase in inlet air temperature and pressure ratio (Fig. 5 and Fig. 6).

V. CONCLUSION

The exergy balance equation, which is applicable to any component of thermal system, has been formulated in this analysis. One of the distinct feature of this formulation is that the exergy involved in any component of any thermal system can be decomposed into exergy flows, entropy production flows and appropriate exergy rate terms such as fuel and available work.

The comparison between thermal and exergy efficiency of turbine gives clear idea of how much turbine is efficient. The exergy balance equation may also be utilized in exergoeconomics analysis to estimate the production cost depending on various input costs of a Gas turbine plant.

VI.REFERENCES

[1]. Ahern, A.J.,1984,"The energy method of exergy system analysis", John Willey and sons.

[2]. Baughn,J.W.,1987"Comparison of predicted and measured thermodynamic performance of a Gas turbine Cogeneration system",ASME,Journal of Gas Turbine and Power,Vol 109-pp32-38.

[3]. Kotas,T.J.,1985," The exergy method of thermal plant analysis",Butterworths,London.

[4]. Si-Doek,oh,Hyo-Sun Pang, Si-Moon Kim,Ho Ypoung Kwak,1996,"Exergy analysis for a Gas turbine cogeneration system",ASME Journal of Engineering for Gas turbine and Power,Vol 118-pp 782-791.

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Stochastic Static and Dynamic Vibration of Piezoelectric Functionally Graded Beam

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ABSTRACT

In this paper, second order statistics of large amplitude free flexural vibration of shear deformable functionally graded materials (FGMs) beams with surface-bonded piezoelectric layers subjected to thermoelectrical loadings with random material properties are studied. The material properties such as Young's modulus, shear modulus, Poisson's ratio and thermal expansion coefficients of FGMs and piezoelectric materials with volume fraction exponent are modeled as independent random variables. The temperature field considered is assumed to be uniform and non-uniform distribution over the plate thickness and electric field is assumed to be the transverse components only. The mechanical properties are assumed to be temperature dependent (TD) and temperature independent (TID). The basic formulation is based on higher order shear deformation theory (HSDT) with von-Karman nonlinear strain kinematics. A C0 nonlinear finite element method (FEM) based on direct iterative approach combined with mean centered first order perturbation technique (FOPT) and second order perturbation technique (SOPT) is developed for the solution of random eigenvalue problem. Comparison studies have been carried out with those results available in the literature and Monte Carlo simulation (MCS).

Keywords: Piezoelectric FGMs beam, stochastic analysis, nonlinear free vibration, random material properties

I. INTRODUCTION

The FGMs are microscopic inhomogeneous anatomy ceramic and metal to continuous changes in their microstructures by the variation in compositions and structures gradually over volume in a preferred direction. Now a days, functionally graded material (FGM) is increasingly used due to the advantage of eliminating the interface problems due to smooth and continuous change of material properties from one surface. Due to above characteristics, it fulfills the specific demand in different engineering applications specially for working high temperature environment applications of heat exchanger tubes, thermal barrier coating for turbine blades, thermoelectric generators, furnace linings, electrically insulated metal ceramic joints, space/aerospace industries, automotive applications, biomedical etc. [1].

In the recent research and development, FGM structures with surface bonded thin piezoelectric layers at top and bottom have promised new design opportunities for future high performance mechanical and structural due to its properties of inherent capability for accurate measurement of the traditional performance.

Large amplitude free flexural vibration (LAFFV) behavior of a beam arises in many engineering applications, particularly in the panels of aircraft using intelligent materials such as piezoelectric or shape memory alloy (SMA). When a structure is deflected substantially, i.e., half of its thickness, a considerable geometrical nonlinearity occurs, mostly due to the development of in-plane membrane. These membrane stresses are tensile in nature that stiffens the panel. This stiffening effect results in the rise of resonance frequencies and change of mode shapes as well. Thus, the linear model is not being capable to determine the behavior of the structures completely.

In this direction, Ke et al. [2] obtained nonlinear free vibration response with of FGM beam with different end supports by using Euler Bernoulli beam theory with von Karman nonlinear strain-displacement. Shoostari and Rafiee [3] presented the nonlinear forced vibration response of a beam made of symmetrically functionally graded materials based on Euler-Bernoulli beam theory and von Karman geometric nonlinearity. Yang and Chen [4] investigated free vibration and buckling analysis of FGM beam with open crack at their edge by using Bernoulli-Euler beam theory and the rotation spring model. Xiang and Yang [5] used Timoshenko beam theory to study the free and forced vibration of laminated functionally graded beam under heat conduction using differential quadrature method (DQM). Kitipornchai et al. [6] derived the eigenvalue equation by using Ritz method via direct iterative method to obtain the nonlinear forced vibration of a cracked FGM beam with different end supports based on Timoshenko beam theory and von Karman geometric nonlinearity. Sina et al. [7] formulated the analytical solution for a free vibration of FGMs beam using first order shear deformation theory (FSDT). Simsek [8] has investigated the fundamental frequency of FGMs beam having various boundary conditions within the framework of classical, first order and different higher order shear deformation theories using Lagrange multiplier method. Thai and Vo [9] developed higher order shear deformation beam theories for bending and free vibration of FGM beam. Huang and Shen [10] investigated the nonlinear vibration and dynamic response of FGM plate with surface bonded piezoelectric layer in thermal environment using semi analytical approach. Kapuria et al. [11] presented a bending response and natural frequency of FGM beam from efficient zigzag and theoretical models showing validation with experiments. Li et al. [12] investigated the response of free vibration of piezoelectric FGM beam under uniform electric field and nonuniform temperature rise using the Galerkin's procedure and elliptical function.

Fu et al. [13] analyzed the nonlinear free vibration and nonlinear dynamic stability of piezoelectric FGM beam using Galerkin’s technique, doffing equation and nonlinear Mathieu equation.

Certain effort have been taken by the researchers to predict the structural response of structures with random system properties. In this direction, Stefanou [14] provided a state-of-the-review of past and recent developments of stochastic FEM in computational stochastic mechanics indicating future directions to be examined by the computational mechanics community. Vanmarcke and Grigoriu [15] evaluated the second order statistics of deflection behavior of beam using random material properties and rigidity via correlation method. Liu et. al. [16] investigated the probabilistic distribution of the dynamic response of truss and beam using finite element method by Monte Carlo simulation, probabilistic finite element method and Hermite-

Gauss quadratures. Kaminski [17] evaluated bending response using second-order perturbation and second order probabilistic moment method via stress-based finite element method (FEM). Fallah and Aghdam [18] presented approximate analytical expressions for geometrically nonlinear vibration analysis of FGMs beam on nonlinear foundation by using He's variational method. Onkar et al. [19] presented the generalized force nonlinear vibration of laminated composite plate with random material properties using classical plate theory (CLT) combined with FOPT. Kitipornchai et al. [20] studied the vibration composed by the third order shear deformation theory with random material effect using FOPT incorporating mixed type and semi-analytical approach to derive the standard eigenvalue problem. Shaker et al. [21] presented the stochastic finite element method (SFEM) to investigate the natural frequency of composite laminated and functionally graded plates HSDT based on first order reliability method and second order reliability method.

A piezoelectric laminated FGM beam of length L, thickness h with its coordinate definition and material direction of typical lamina in (x, z) coordinate system is shown in Figure 1. The FGM beam is attached with surface bonded piezoelectric layers in different conditions of top-bottom, top and bottom layers with thickness of h_p. The thickness of FGM beam and total thickness of structures including piezoelectric layers acting top and bottom are assumed as h and H, respectively. The properties of the FGM beam are assumed to be vary through the thickness of the plate only, such that the top surface $z=h/2$ is ceramic-rich and the bottom surface $z=-h/2$ is metal-rich.

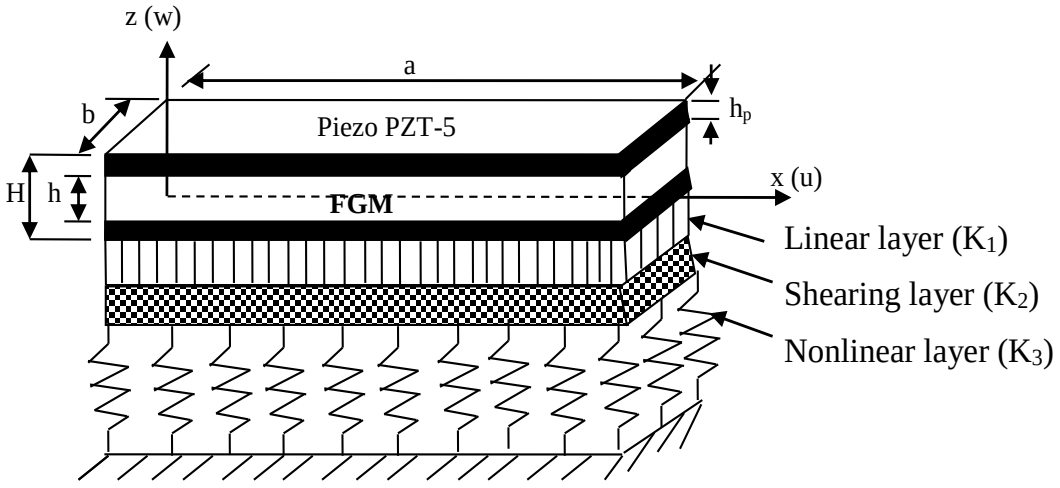


Figure 1: Geometry of FGM beam with surface bonded piezoelectric layers resting on elastic foundation

The elastic material properties vary through the plate thickness according to the volume fractions of the constituents using power law distribution which is expressed as [17]

$$P(z) = (P_c - P_m)V_c + P_m \quad (1)$$

$$V_C(z) = \left(\frac{z}{h} + \frac{1}{2}\right)^n, \quad -h/2 \le z \le h/2,\ 0 \le n \prec \infty \quad (2)$$

where, P denotes the effective material property, P_m and P_c represents the properties of metal and ceramic, respectively. The parameters V_c and n represents the volume fraction of the ceramic and volume fraction exponent, respectively.

II. THEORETICAL FORMULATIONS

In the present study, the assumed displacement field model based on the higher order shear deformation theory (HSDT) is used in the present analysis [12]. The in-plane and transverse displacement field components of an arbitrary points within the beam along x and z directions based on based on above displacement field is expressed as

$$\bar{u}(x,z) = u_0(x) + z\psi_x - \frac{4}{3h^2} z^3(\psi_x + \partial w/\partial x) \quad (3)$$

$$\bar{w}(x,z) = w_0(x)$$

where u_0, w_0, Ψ_x and $\partial w/\partial x$ are the mid-plane axial displacement, transverse displacement, rotation of normal to the mid-plane along y- axis and slope along x- axis, respectively.

The modified displacement field components along x- and z-direction for an arbitrary FGM beam

$$\bar{u}(x,z) = u_0(x) + f_1(z)\psi_x + f_2(z)\phi_x; \quad \bar{w}(x,z) = w_0(x) \quad (4)$$

where $f_1(z)$ and $f_2(z)$, given in Eq.(4) can be written as

$$f_1(z) = C_1 z - C_2 z^3 \text{ and } f_2(z) = -C_4 z^3 \text{ where } C_1=1 \text{ and } C_2=C_4=4/3h \quad (5)$$

The displacement vector for the modified C^0 continuous model is denoted as

$$\{\Lambda\} = \begin{bmatrix} u & w & \phi_x & \psi_x \end{bmatrix}^T \quad (6)$$

For the FGM beam considered here, the relevant strain vector consisting of linear strain (in terms of mid plane deformation, rotation of normal and higher order terms), non-linear strain (von-Karman type), thermal and piezoelectric strains vectors associate with the displacement are expressed as

$$\{\bar{\varepsilon}\} = \{\bar{\varepsilon}^L\} + \{\bar{\varepsilon}^{NL}\} - \{\bar{\varepsilon}^T\} - \{\bar{\varepsilon}^V\} \quad (7)$$

where $\{\bar{\varepsilon}^L\}$, $\{\bar{\varepsilon}^{NL}\}$, $\{\bar{\varepsilon}^T\}$ and $\{\bar{\varepsilon}^V\}$ are the linear, non-linear, thermal and piezoelectric strain vectors, respectively.

From Eq. (7), the linear strain tensor using HSDT can be written as

$$\bar{\varepsilon}^L = [B]\{q\} \quad (8)$$

where B and $\{q\}$ are geometrical matrix and displacement field vector for the two node beam element, respectively [45].

Assuming that the strains are much smaller than the rotations (in the von-Karman sense), one can rewrite nonlinear strain vector $\{\bar{\varepsilon}^{NL}\}$ given in Eq. (7) is represented as [38]

$$\bar{\varepsilon}^{NL} = \frac{1}{2}[A_{nl}]\{\phi_{nl}\} \quad \{A_{nl}\} = \frac{1}{2}\begin{bmatrix} w_{,x} \end{bmatrix} \{\phi_{nl}\} = \{w_{,x}\} \quad (9)$$

The thermal strain vector $\{\bar{\varepsilon}^T\}$ given in Eq. (7) is expressed as

$$\{\bar{\varepsilon}^T\} = \{\alpha\}\Delta T \quad (10)$$

where α is coefficients of thermal expansion along the x direction, and ΔT denotes the uniform or non-uniform change in temperature in the beam attached with surface bonded piezoelectric layer .

The temperature distribution along the thickness can be obtained by solving a steady-state heat transfer equation [5]

$$-\frac{d}{dz}\left[k(z)\frac{dT}{dz}\right]=0 \qquad (11)$$

where, k(z) is thermal conductivity of the piezoelectric FGM beam with surface bonded piezoelectric layers.

The temperature field for uniform or non-uniform temperature change for FGM beam is expressed as [5]

$$\Delta T = T(z)-T_0 \qquad (12)$$

In case of the non-uniform temperature distribution along z direction, T (z) and for uniform temperature change it is expressed as

$$T(z) = T_0 + (T_U - T_L) \qquad (13)$$

where, T_0 is the uniform temperature rise at room temperature and assumed to be 300K.

The electric field vector $\{\bar{\varepsilon}^V\}$ as given in Eq. (7) can be represented as

$$\{\bar{\varepsilon}^V\} = \frac{V_p}{h_p}\{d_{31}\} \qquad (14)$$

where d_{31}, V_p and h_p are the piezoelectric strain constants in the x-direction, applied voltage to the actuators in the thickness direction and thickness of piezoelectric layer in the FGM beam subjected with uniform electric field rise, respectively.

The constitutive law of thermo-piezoelectric-elastic constitutive relationship for material under consideration relates the stresses with strains in a inplane stress state is given as [20]

$$\bar{\sigma} = [Q](\bar{\varepsilon} - \alpha\Delta T) - [e]E_z \qquad (15)$$

where, $[Q]$, $[e]$ and E_z are transform reduced elastic constant matrix of beam material, matrix of piezoelectric stress constant and electric field vectors, respectively [45].

The electric displacement vector of the piezoelectric layer is given by [41]

$$D = [e]\left(\bar{\varepsilon}^L + \bar{\varepsilon}^{NL}\right) + \xi E_z + P\Delta T \qquad (16)$$

where ξ and P are the dielectric coefficient matrix and the pyroelectric constants vector, respectively.

The total strain energy of the system consisting of linear, nonlinear and piezoelectric strain energy of the FGM beam with surface bonded piezoelectric layers can be expressed as

$$\Pi_1 = \Pi_a - \Pi_b \qquad (17)$$

where Π_a and Π_b are the strain energy of FGM beam and surface bonded piezoelectric layer, respectively.

From Eq. (17), the strain energy (Π_f) of the FGM beam can be expressed as

$$\Pi_a = U_L + U_{NL} \qquad (18)$$

From Eq. (18) the linear stain energy (U_L) of the FGM beam is given by

$$U_L = \int_\Omega \frac{1}{2}\{\bar{\varepsilon}^L\}[Q]\{\bar{\varepsilon}^L\}^T d\Omega = \int_\Delta \frac{1}{2}\{\bar{\varepsilon}^L\}[D_{mn}]\{\bar{\varepsilon}^L\}^T d\Delta \qquad (19)$$

where $[D_{mn}]$ is the elastic stiffness matrix .

From Eq. (18) the nonlinear strain energy (U_{NL}) of the FGM beam can be rewritten as

$$U_{NL}=\int_{\Omega}\frac{1}{2}\left\{\bar{\varepsilon}^{L}\right\}[D_3]\left\{\bar{\varepsilon}^{NL}\right\}^{T}d\Omega+\frac{1}{2}\int_{\Omega}\left\{\bar{\varepsilon}^{NL}\right\}[D_4]\left\{\bar{\varepsilon}^{L}\right\}^{T}d\Omega+\frac{1}{2}\int_{\Omega}\left\{\bar{\varepsilon}^{NL}\right\}[D_5]\left\{\bar{\varepsilon}^{L}\right\}^{T}d\Omega \tag{20}$$

where Ω, $\bar{\varepsilon}^{L}$ and $\bar{\varepsilon}^{NL}$ denotes undeformed configuration of FGM beam, linear and nonlinear strain tensors, respectively.

Using Eq. (9), it can be expressed as

$$U_{NL}=\frac{1}{2}\int_{\Omega}[A_{nl}]\{\phi_{nl}\}[D_3]\left\{\bar{\varepsilon}^{L}\right\}d\Omega+\frac{1}{2}\int_{\Omega}\left\{\bar{\varepsilon}^{L}\right\}[D_4][A_{nl}]\{\phi_{nl}\}d\Omega$$
$$+\frac{1}{2}\int_{\Omega}[A_{nl}]\{\phi_{nl}\}[D_5][A_{nl}]^{T}\{\phi_{nl}\}^{T}d\Omega \tag{21}$$

where D_3, D_4 and D_5 are the stiffness matrices of the FGM beam [45].

Following this and using finite element model, Eq. (18) after summed over all the elements can be written as

$$\Pi_a=\sum_{e=1}^{NE}\Pi_a^{(e)}=\sum_{e=1}^{NE}\left(U_L^{(e)}+U_{NL}^{(e)}\right) \tag{22}$$

where, NE is the number of elements and $\Pi_a^{(e)}$ is the elemental potential energy of the beam.

Substituting Eq. (20) and Eq. (21), the Eq. (22) can be further expressed as

$$\Pi_a=\sum_{e=1}^{NE}\left[\{q\}^{T(e)}\left[K_l+K_{nl}(q)\right]^{(e)}\{q\}^{(e)}\right]=\{q\}^{T}\left[K_l+K_{nl}(q)\right]\{q\} \tag{23}$$

where $\left[K_{nl}\right]=\frac{1}{2}\left[K_{nl_1}\right]+\left[K_{nl_2}\right]+\frac{1}{2}\left[K_{nl_3}\right]$

where $\left[K_l\right]$, $\left[K_{nl}\right]$ and $\{q\}$ are defined as global linear, nonlinear stiffness matrices and global displacement vector, respectively.

Similarly from Eq. (22) the strain energy (Π_b) due to surface bonded piezoelectric layers can be rewritten as

$$\Pi_b=U_{\phi L}+U_{\phi NL} \tag{24}$$

where $U_{\varphi L}$ and $U_{\varphi NL}$ are the linear and nonlinear strain energy of surface bonded piezoelectric layers. From Eq. (24), the linear strain energy ($U_{\varphi L}$) due to surface bonded piezoelectric layer can be expressed as,

$$U_{\phi L}=\int_{\Omega}\left\{\varepsilon^{L}\right\}[e]^{T}\left\{E^{\phi}\right\}d\Omega+\int_{\Omega}\frac{1}{2}\left\{E^{\phi}\right\}[\xi]\left\{E^{\phi}\right\}^{T}d\Omega+\int_{\Omega}\left\{E^{\phi}\right\}P\Delta Td\Omega \tag{25}$$

The nonlinear strain energy ($U_{\varphi NL}$) due to surface bonded piezoelectric layer can be expressed as,

$$U_{\phi NL}=\int_{\Omega}\{\phi_p\}^{T}\{A_{nl}\}^{T}[e]E^{\phi}d\Omega \tag{26}$$

Using finite element model, Eq. (24) after summing over the entire element can be written as

$$\Pi_b=\sum_{e=1}^{NE}\Pi_b^{(e)}=\sum_{e=1}^{NE}\left(U_{\phi L}^{(e)}+U_{\phi NL}^{(e)}\right) \tag{27}$$

where $\Pi_b^{(e)}\left(\Pi_{bl}^{(e)}+\Pi_{bnl}^{(e)}\right)$ is the elemental linear and nonlinear potential energy of the surface bonded piezoelectric layers.

The linear potential energy for surface bonded piezoelectric layer can be expressed as

$$\Pi_{bl}=\sum_{e=1}^{NE}\left(\{q\}^{(e)T}\left[K_{1lp}\right]^{(e)}\{q_\phi\}^{(e)}+\{q_\phi\}^{(e)T}\left[K_{2lp}\right]^{(e)}\{q_\phi\}^{(e)}+\{q_\phi\}^{(e)T}\left[K_{3lp}\right]^{(e)}\right)=\{q\}^{T}\left[K_{1lp}\right]\{q_\phi\}+\{q_\phi\}^{T}\left[K_{2lp}\right]\{q_\phi\}+\{q_\phi\}^{T}\left[K_{3lp}\right] \tag{28}$$

Similarly, using and Eq. (24) and Eq. (27) for nonlinear potential energy for surface bonded piezoelectric layer can be expressed as

$$\Pi_{bnl} = \frac{1}{2}\sum_{e=1}^{NE}\left(\{q\}^{(e)T}\left[K_{1nlp}\right]^{(e)}\{q_\phi\}^{(e)}\right) = \{q\}^{T}\left[K_{1nllp}\right]\{q_\phi\} \quad (29)$$

where $\left[K_{1lp}\right]$, $\left[K_{1nllp}\right]$ and $\{q_\phi\}$ are defined as global linear coupling matrix between elastic mechanical and electrical effects, nonlinear coupling matrices between elastic mechanical and electrical effects and global electric field vector, respectively.

The potential energy (Π_2) storage due to thermo-piezoelectric loadings (uniform and non-uniform change in temperature and uniform change in electrical potential) is written as

$$\Pi_2 = \frac{1}{2}\int_A N_{xTE}(w_{,x})^2 dA \quad (30)$$

where N_{xTE} is the prebuckling thermoelectrical stress with $N_{xTE} = \bar{N}_0^T + \bar{N}_0^V$, the $\bar{N}_0^T$ and $\bar{N}_0^V$ are in-plane thermal and electrical loadings, respectively.

Using finite element model, Eq. (30) after summing over the entire element can be written as

$$\Pi_2 = \sum_{e=1}^{NE}\Pi_2^{(e)} = \frac{1}{2}\sum_{e=1}^{NE}\{q\}^{T(e)}\lambda\left[K_{(G)}\right]^{(e)}\{q\}^{(e)}$$

$$= \frac{1}{2}\lambda\{q\}^{T}\left[K_{(G)}\right]\{q\} \quad (31)$$

where, λ and $\left[K_{(G)}\right]$ are defined as the thermo-piezoelectric buckling load parameters and the global geometric stiffness matrix (arises due to thermo-piezoelectric loadings), respectively.

The kinetic energy (Π_3) of the vibrating FGM beam can be expressed as

$$\Pi_3 = \frac{1}{2}\int_v \rho\{\hat{u}\}^T\{\hat{u}\}dv \quad (32)$$

where ρ and $\{\dot{\hat{u}}\} = \left\{\dot{\bar{u}} \quad \dot{\bar{w}}\right\}$ are the density and velocity vector of the FGM beam, respectively.

Using finite element model, Eq. (32) may be written as

$$\Pi_3^{(e)} = \sum_{e=1}^{NE}\left\{\dot{\Lambda}\right\}^{(e)T}[m]\left\{\dot{\Lambda}\right\}^{(e)}dA \quad (33)$$

Using finite element model , Eq. (33) after summing over the entire element can be written as

$$\Pi_3 = \{\dot{q}\}^T[M]\{\dot{q}\} \quad (34)$$

Where, [*M*] is the global consistent mass matrix

III. GOVERNING EQUATION

The governing equation for the nonlinear free vibration analysis can be derived using Hamilton principle, which is generalization of the principle of virtual displacement. The Lagrange equation for the conservative system can be written as

$$\frac{\partial}{\partial t}\left(\frac{\partial T}{\partial \dot{q}}\right)+\frac{\partial\left(\Pi_a+\Pi_{bl}+\Pi_{bnl}\right)}{\partial q}-\frac{\partial\left(\Pi_2+\Pi_3\right)}{\partial q}=0 \qquad (35)$$

By substituting Eqs. (23), (28), (29), (31) and (34) in Eq. (35), ones obtain as in the form of nonlinear generalized eigenvalue problem as

$$[K]\{q\}+[M]\{\ddot{q}\}=0 \qquad (36)$$

where, $[K\ ]=\{[K_L]+[K_{NL}]-\lambda_T[K_{(G)}]\}$ with $[K_L]=\frac{1}{2}[K_{l1}]-\frac{1}{2}[K_{lp_1}]$ and $[K_{NL}]=\frac{1}{2}[K_{nl1}]+[K_{nl2}]+\frac{1}{2}[K_{nl3}]-\frac{1}{2}[K_{1nlp}]$

λ_T is the critical thermopiezoelectric buckling.

The above Eq. (36) is the nonlinear free vibration equation that can be solved literately as a linear eigenvalue problem assuming that the beam is vibrating in its principal mode in each iteration. For each iteration, the Eq. (36) can be expressed as generalized eigenvalue problem as

$$[K]\{q\}=\lambda[M]\{q\} \qquad (37)$$

where, $\lambda=\omega^2$ with ω is the natural frequency of the beam.

IV. PERTURBATION TECHNIQUE

In the present analysis, the elastic constants such as Young's modulus and Poisson's ratio of FGM and surface bonded piezoelectric material along with volume fraction exponent are treated as independent random variables.

In general, without any loss of generality, any arbitrary random variable can be represented as the sum of its mean and a zero mean random variable, expressed by superscripts '*d*' and 'r', respectively

$$K=K^d+K^r,\ \lambda_i=\lambda_i^d+\lambda_i^r,\ q_i=q_i^d+q_i^r \qquad (38)$$

where, $\lambda_{2i}^d=\omega_i^{d^2}$, $\lambda_i^2=2\omega_i^d\omega_i^r+\omega_i^{r^2}$, $i=1, 2,\ldots..,p$.

The parameter p indicates the size of eigen problem.

For sake of simplicity, the mass matrix is taken as constant in the present analysis.

Substituting Eq. (38) in Eq. (37) and collecting same order of the magnitude term obtains as

Zeroth order perturbation Equation: $\left[K^d\right]\left\{q_i^d\right\}=\lambda_i^d\,[M]\left\{q_i^d\right\}$ (39)

First order perturbation equation: $\left[K^d\right]\left\{q_i^r\right\}+\left[K^r\right]\left\{q_i^d\right\}=\lambda_i^d\,[M]\left\{q_i^r\right\}+\lambda_i^r\left[M\right]\left\{q_i^d\right\}$ (40)

The zeroth order perturbation Eq. (39) is the deterministic equation relating to the mean eigenvalues and corresponding mean eigenvectors, which can be determined using conventional eigensolution algorithms. Eq. (40) is the first order random perturbation equation defining the stochastic nature of the free vibration which cannot solve using conventional method [23].

According to the orthogonality properties, the normalized eigenvector meet the following conditions.

$$\left\{q_i^d\right\}^T[M]\left\{q_i^d\right\}=\delta_{ij} \qquad (41)$$

$$\left\{q_i^d\right\}^T\left[K^d\right]\left\{q_i^d\right\}=\delta_{ij}\lambda_i^d,\quad (i,\ j=1, 2,..., p) \qquad (42)$$

where δ_{ij} is the Kronecker delta.

The eigen vectors, after being properly normalized, form a complete orthogonal set and any vector in the space can be expressed as their linear combination of these eigenvectors.

Hence, the ith random part of the eigenvectors can be expressed as $\{q_i^r\} = \sum_{j=1}^{p} C_{ij}^r \{q_i^d\}, \quad (i \neq j, C_{ii}^r = 0, \ i = 1, 2, ...,)$ (43)

where C_{ii}^r are random coefficients to be determined.

$$\left\{q_i^d\right\}^T \left[K^r\right] \left\{q_i^d\right\} = \lambda_i^r \qquad (44)$$

Let $b_1, b_2, ..., b_n$ denote system properties. The random variables (b_i) can also be expressed as

$$b_i = b_i^d + b_i^r, \quad i=1,2,...,n \qquad (45)$$

The FEM in conjunction with the FOPT has been found to be accurate and efficient [29-30, 35-36, 42]. According to this method, the random variables are expressed by Taylor's series. Keeping the first-order terms and neglecting the second- and higher-order terms, Eq. (46) can be expressed as

$$\lambda_i^r = \sum_{j=1}^{q} \lambda_{i,j}^d b_j^r ; \left\{q_i^r\right\} = \sum_{j=1}^{p} q_{i,j}^d b_j^r ; \left[K^r\right] = \sum_{j=1}^{q} \left[K_{,j}^d\right] b_i^r \quad (46)$$

Using the above and decoupled equations, the expressions for $\lambda_{i,j}^d$ is obtained.

Eq. (46), the variances of the eigenvalues can now be expressed as [23] $Var(\lambda_i) = \sum_{j=1}^{p} \sum_{k=1}^{p} \lambda_{i,j}^d \lambda_{i,k}^d Cov\left(b_j^r, b_k^r\right)$ (46) where, $Cov\left(b_j^r, b_k^r\right)$ is the cross variance between b_j^r and b_k^r. The standard deviation (SD) is obtained by the square root of the variance.

V. MONTE CARLO SIMULATION (MCS)

The Monte Carlo simulation (MCS) is the one of the most general approach being used to quantify the structural response uncertainties on the basis of direct use of computer and simulate experiments by a set of random number generations of material properties. In such simulated experiments, a set of random number of random material parameter is generated first to represent the statistical uncertainties in the structural parameters by satisfactory convergence of results. These random numbers are substituted into the response Eq. (40) to obtain again, a set of random number which reflects the uncertainties in structural response. A sufficient set of random number is to be generated for mean and standard deviation of structural response based on the convergence of results.

VI. RESULTS AND DISCUSSION

The second order statistics of nonlinear free vibration and dynamic response of FGM beam with surface bonded piezoelectric layers resting on elastic foundation having random material properties subjected to thermo-piezoelectric loadings is computed using the proposed direct iterative based stochastic finite element method (DISFEM). A C^0 one dimensional Hermitian two node beam element with 8 DOFs per element is developed and implemented for the present problem. Convergence and validation studies have been carried out through numerical examples to demonstrate the accuracy of the present formulation. Based on convergence study

conducted as presented below, a 50 element (as shown in Table 3) has been used for numerical calculation in the present analysis.

The direct iterative based stochastic finite element method (DISFEM) and Monte Carlo sampling via complex method is proposed to solve the dynamic nonlinear random equation of beam.

The basic random variable (b_i) such as E_c ,ν_c, E_m ,ν_m, E_p , n, ρ_c, ρ_m,, α_c,, α_m, , k_1, k_2 and q_o, are sequenced and defined as

$b_1=E_c$, $b_2=\nu_c$, $b_3=E_m$, $b_4=\nu_m$, $b_5=E_p$, $b_6=n$, $b_7=\rho_c$, $b_8=\rho_m$, $b_9=\alpha_c$, , $b_{10}=\alpha_m$, ,$b_{12}=k_1$, $b_{13}=k_2$ and $b_{13}=q_o$,

In the present analysis, various combinations of boundary edge support conditions are as follows:

Both edges are simply supported (SS):

$u=w=0$; at $x=0, a$

Both edges are clamped (CC)

$u=w=\theta_x=\psi_x=0$; at $x=0, a$

One end simply supported and other is clamped (CS)

$u=w=\theta_x=\psi_x=0$; at $x=a$ *and* $u=w=0$; at $x=a$

The dimensionless mean natural frequency is used for validation purpose and defined as (unless otherwise stated)

$$\varpi=\omega(L^2/h)\sqrt{\rho_m(1-\upsilon_m^2)/E_m}$$

where, ω, ρ_m, υ_m and E_m indicate the dimensional mean natural frequency, density Poisson's ratio and Young's modulus of the metal, respectively .

The following TD material properties of FGM beam is given by [23]

$P=P_0(P_{-1}T^{-1}+1+P_1T+P_2T^2+P_3T^3)$

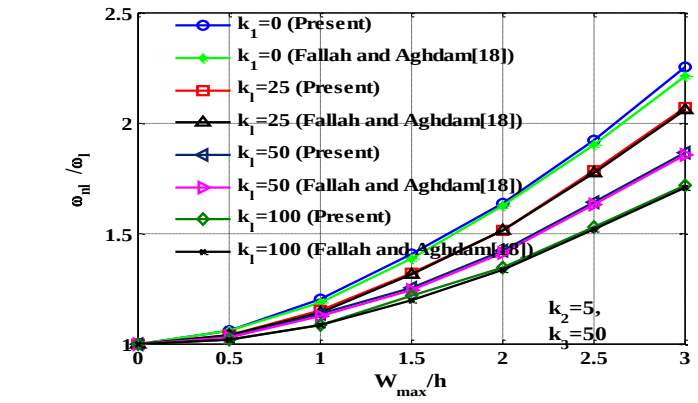
where P_0, P_{-1}, P_1, P_2 and P_3 given in Shegokar[22].

The value of temperature T given in above expression is taken as 300 K for whole of the analysis.

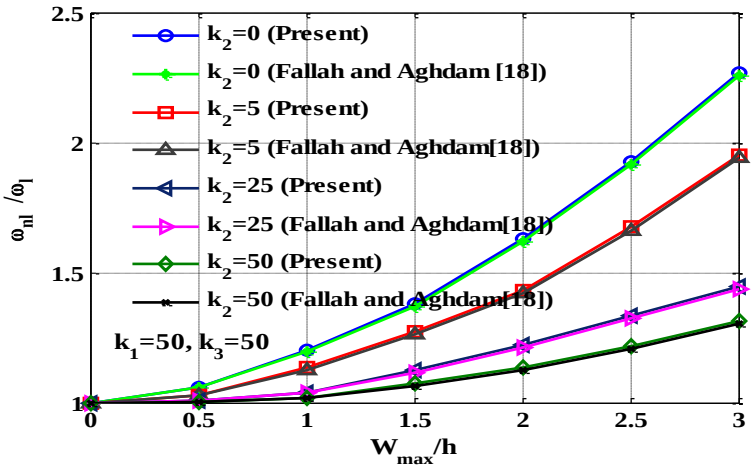
For temperature independent (TID), the values of P_{-1}, P_1, P_2 and P_3 are assumed as zero.

The material properties of surface bonded piezoelectric layer are expressed in Shegokar [22].

The effects of the elastic foundation stiffness on the nonlinear natural frequency of simply supported functionally graded beams are presented in Fig. 2(a)–(c) and compared with Fallah and Aghdam [18]. These figures show the variation of the nonlinear to linear frequency ratio (ω_{nl}/ω_l) versus dimensionless amplitude ratio (W_{max}/h) and can be concluded that as the linear (k_1) and shear (k_2) elastic foundation coefficients increase, the frequency ratio decreases. However, any rise in the value of the nonlinear elastic foundation coefficient (k_3) results in the growth of the frequency ratio. It is observed that the present results of frequency ratio are in good agreement with the published results for the effect of elastic foundation stiffness with respect to amplitude ratio.



(a)



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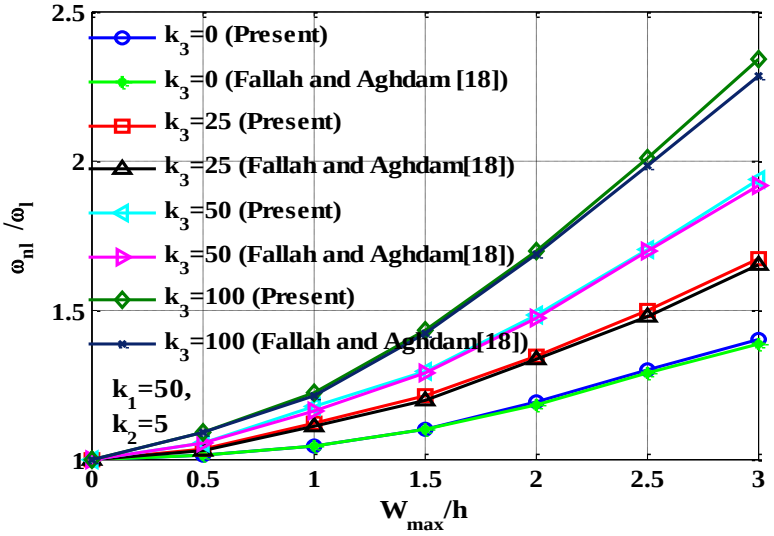
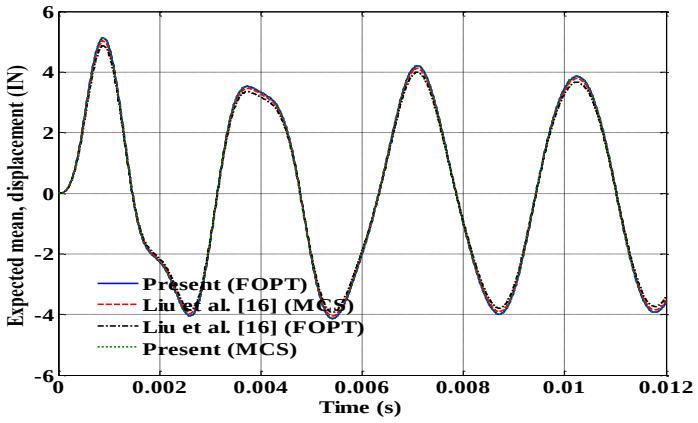


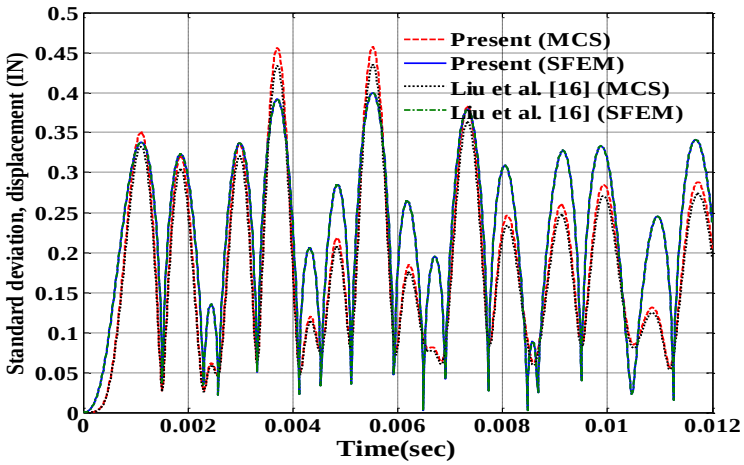
(c)

Figure 2 Validation study for effect of foundation parameter (a) k_1 (b) k_2, and (c) k_3 on frequency ratio of simply supported FGM

The accuracy and efficacy of present probabilistic model is demonstrated by comparing the results with those available in the literature and by MCS through numerical examples. The performance in terms of mean and standard deviation at node 2 using MCS for two degree of freedom of spring mass system are compared in Fig. 3 (a)-(b). The present SFEM and MCS solution results are in very good agreements with the results of Liu et al. [16].



(a)



(b)

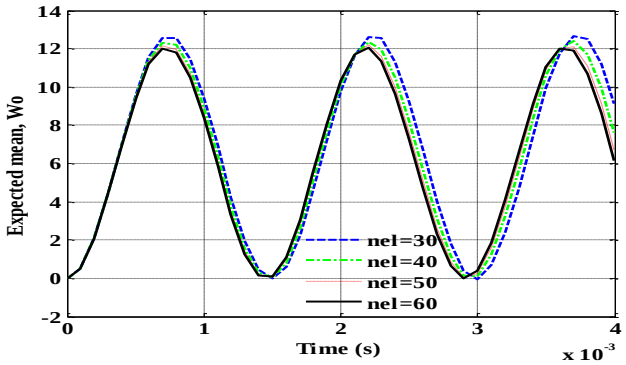
Figure 3 Validation study of (a) mean and (b) standard deviation of displacement at node 2 with respect to time of spring mass system using SFEM and MCS

The convergence study of expected mean transverse central deflection of SS SUS304-Si3N4 FGM beam with surface bonded piezoelectric layers having TD material properties is shown in Fig.4 (a). As number of elements increase, the solution converges consistently and therefore, the total number of elements equal to 60 is taken into consideration for the evaluation of results on the basis of convergence.

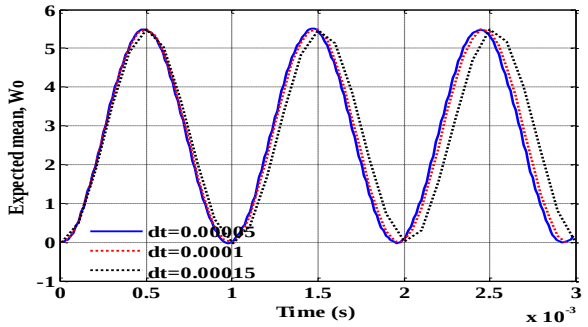
Also, the convergence study of various incremental time step of expected mean transverse central deflection for a clamped supported FGM SUS304-Si3N4 FGM beam with surface bonded piezoelectric layers having TD material properties for L/h=15 and n=0 is shown in Fig. 4 (b). From the figure, it is clear that the nature of

dynamic response at incremental time ΔT=0.00005 sec is most stable. Therefore, ΔT=0.00005 sec is taken into consideration for parametric study of results.

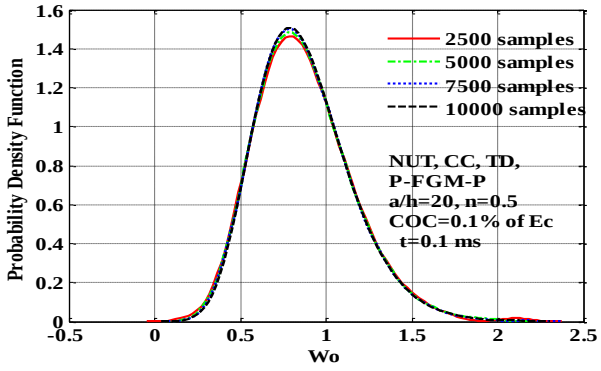
The convergence study for PDF response by changing the random change in E_c material properties at various sample sizes using MCS is shown in Fig. 4(c). As the number of samples increase, the results are converged and stable. Therefore, for the evaluation of present MCS results, the total numbers of samples are considered as 10,000.



(a)



(b)



(c)

Figure 4 Convergence study at (a) various number of elements (b) various time step (c) various samples for PDF.

The first three vibration mode shapes for simply supported piezoelectric FGM beam with a/h=15 and n=1 are plotted and shown in Fig. 5.

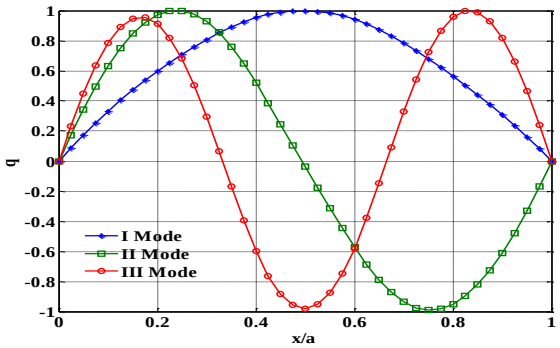


Fig. 5. The first three vibration mode shapes for simply supported piezoelectric FGM beam with a/h=15 and n=1.

Fig. 6 shows the effect of volume fraction exponent for COV with random system properties $\{b_i,\{i=1\text{-}12\}=0.05\text{-}0.2\}$ for random change in E_c, ν_c, E_m, ν_m, E_p, n, ρ_c, ρ_m, α_c, α_m, k_1 and k_2 on the dimensionless nonlinear fundamental frequency of the clamped –clamped SUS304-Si_3N_4 FGM beam with surface bonded piezoelectric layers with TD material properties, NUT, n=0.5, L/h=20, ΔT=200 K and foundation parameters k_1 =100, k_2=10 and k_3=100.

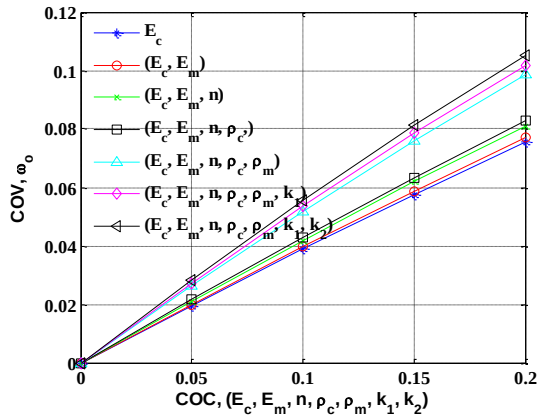
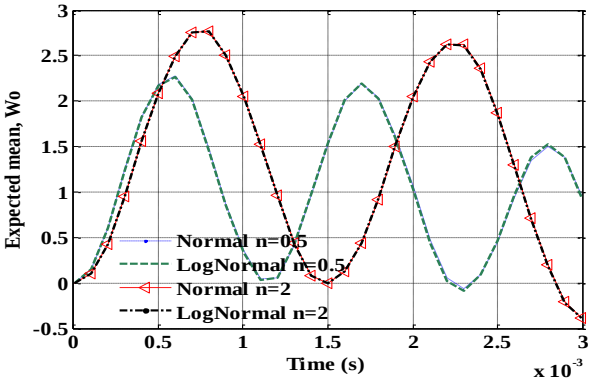
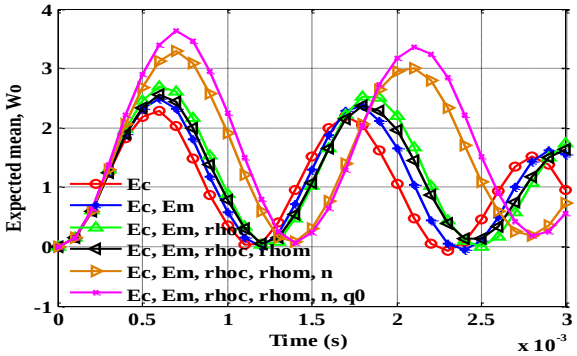


Fig. 6 Effects of different random variables changing simultaneously on the dimensionless nonlinear frequency of the clamped-clamped SUS304-Si3N4 piezoelectric FGM beam resting on elastic foundation.

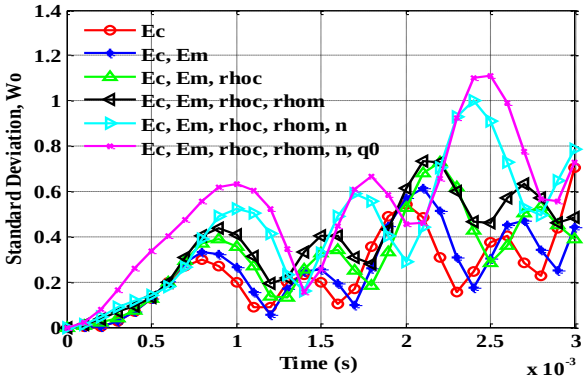
The dimensionless expected mean, SD, PDF and sensitivity of dynamic nonlinear transverse central deflection with respect to random system properties subjected to uniformly distributed step loading for various .values of volume fraction index n, random sample distribution and variation of individual and simultaneously combined random input properties using MCS are shown in Fig. 7 (a-l). As the n increases, the expected mean increases and corresponding SD decreases taking individual or combination of various input random parameter. Also, the sensitivity of expected mean with respect to random change in Ec , Em and n increases. The dispersion in PDF decreases with random change in Ec and n and increases with random change in Em, and q0. It is because of as the n increases, the beam becomes more metal rich and resultantly stiffness decreases.


Expected mean, Wo
Time (s)
x 10^-3
Normal n=0.5
LogNormal n=0.5
Normal n=2
LogNormal n=2

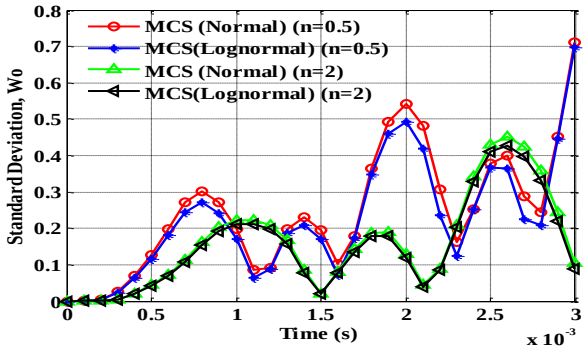
(a)


Expected mean, Wo
Time (s)
x 10^-3
Ec
Ec, Em
Ec, Em, rhoc
Ec, Em, rhoc, rhom
Ec, Em, rhoc, rhom, n
Ec, Em, rhoc, rhom, n, q0

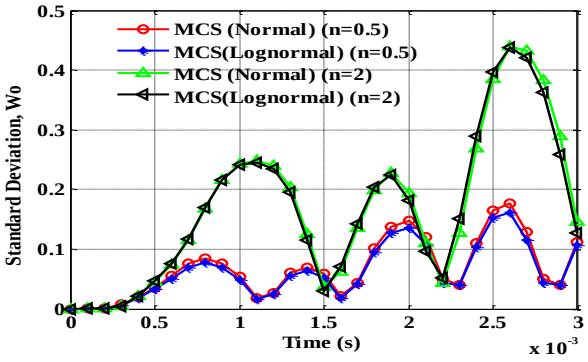
(b)


Standard Deviation, Wo
Time (s)
x 10^-3
Ec
Ec, Em
Ec, Em, rhoc
Ec, Em, rhoc, rhom
Ec, Em, rhoc, rhom, n
Ec, Em, rhoc, rhom, n, q0

(c)


Standard Deviation, Wo
Time (s)
x 10^-3
MCS (Normal) (n=0.5)
MCS(Lognormal) (n=0.5)
MCS (Normal) (n=2)
MCS(Lognormal) (n=2)

(d)



(e)

Figure 7. Effect of volume fraction index for (a) W_0, (b) W_0 with combination of various input random parameter, SD for (c) simultaneously random change in material properties, SD for random change in (d) E_c (e) E_m

VII. CONCLUSION

A C^0 nonlinear FEM using direct iterative procedure in conjunction with FOPT and SOPT has been presented to obtain the dimensionless mean and COV of nonlinear natural frequency of rectangular FGMs beam with surface bonded piezoelectric layers subjected to thermo-piezoelectric loadings with random material properties in the framework of HSDT via von-Karman nonlinearity. From the limited study, the following conclusion can be drawn.

For a given boundary conditions and loadings, the dimensionless mean nonlinear fundamental frequency is lower and corresponding COV is higher for metal rich beam as compared to ceramic rich beam. The dimensionless mean fundamental frequency decreases as the volume fraction exponent increases. However, COV of nonlinear fundamental frequency does not follow the defined path. Among the different random system properties studied, the elastic modulus, volume fraction exponent, density of metal and ceramic have dominant effects on the COV of nonlinear fundamental frequency as compared to other system properties subjected to uniform and nonuniform change in temperature with TID and TD properties. The tight control of these parameters are required if high reliability of the FGM structure is desired. The mean fundamental frequency decreases with increasing the slenderness ratio for both of metal and ceramic rich beam. However, COV decreases with increasing the slenderness ratio for ceramic to metal rich beam. In general, an increase in frequency mode, the dimensionless mean natural frequency of FGM beam with surface bonded piezoelectric layers increases and corresponding COV decreases. The dispersion due thermal exponential coefficients, density of respective FGM beam and surface bonded piezoelectric layers is quite significant. It is not desirable to ignore the randomness in the system properties for a reliable design.

The efficacy of present approach has been verified using PDF assuming Gaussian and the results shown by probabilistic finite element method (perturbation technique) are in perfect agreement with the Monte Carlo sampling.

VIII. REFERENCES

[1]. Birman Victor, Byrd Larry W, " Modeling and analysis of functionally graded materials and structures". Appl. Mech. Rev. 60 (5): 195-216, 2007.

[2]. Ke LL, Yang J, Kitipornchai S , "An analytical study on the nonlinear vibration of functionally graded beams", Meccanica 45 (6): 743–752, 2010.

[3]. Shooshtari A, Rafiee M , " Nonlinear forced vibration analysis of clamped functionally graded beams", Acta Mechanica doi:10.1007/s00707-011-0491-1, 2011

[4]. Yang J, Chen Y, "Free vibration and buckling analysis of functionally graded beams with edge cracks " . Compos Struct 83:48–60, 2008

[5]. Xiang HJ, Yang J , "Free and forced vibration of a laminated FGM Timoshenko beam of variable thickness under heat conduction ." Compos Part B :Eng 39:292–303, 2008.

[6]. Kitipornchai S, Ke LL,Yang J, "Xiang Y Nonlinear vibration of edge cracked functionally graded Timoshenko beams, " J. Sound Vib. 324 (3–5): 962–982, 2009.

[7]. Sina SA, Navazi HM, Haddadpour H , "An analytical method for free vibration analysis of functionally graded beams." Mater Des 30:741–7, 2009.

[8]. Simsek M "Fundamental frequency analysis of functionally graded beams by using different higher-order beam theories". Nucl Eng Des 240:697–705, 2010.

[9]. Thai Huu-Tai, Vo P. "Thuc Bending and vibration of functionally graded beam using various higher-orders shear deformation theories". Int J Mech Sci. 62(1): 57, 2012.

[10]. Huang XL, Shen HS , "Vibration and dynamic response of functionally graded plates with piezoelectric actuators in thermal environments." Journal of Sound Vib 289:25-53, 2006.

[11]. Kapuria S, Bhattacharya M, Kumar, " An Bending and free vibration response of layered functionally graded beam: A theoretical model and its experimental validation." Compos Struct 82:390–402, 2008.

[12]. Li Shi-rong, SU Hou-de, CHENG Chang-jun , "Free vibration of functionally graded material beams with surface-bonded piezoelectric layers in thermal environment." Appl. Math. Mech. -Engl. Ed. 30(8): 969–982, 2009.

[13]. Fu Yiming, Jianzhe Wang, Yiqi Mao , " Nonlinear analysis of bucklng, free vibration and dynamic stability for the piezoelectric functionally graded beams in thermal environment. " Appl Math Model 39(9): 4324, 2011.

[14]. George Stefanou , "The stochastic finite element method: Past, present and future, Engineering, Comput Methods", Appl Mech Engg 15:1031–1051, 2009.

[15]. Vanmarcke E, Grigoriu M , "Stochastic finite element analysis of simple beams," ASCE Journal of Engineering Mechanics 109(5):1203-1214, 1983.

[16]. Liu., W. K., Belytschko, T., and Mani A., , "Probabilistic finite elements for nonlinear structural dynamics," Computer methods in applied mechanics and engineering., 56(1), pp. 61-81, 1986.

[17]. Marcin Kaminski , "Stochastic second-order perturbation approach to the stress-based finite element method", International Journal of Solids and Structures 38:3831–3852, 2001.

[18]. Fallah A, Aghdam MM , "Nonlinear free vibration and post buckling analysis of functionally graded beams on nonlinear elastic foundation" European Journal of Mechanics A/Solids 30:571-583, 2011.

[19]. Onkar AK, Yadav D , "Forced nonlinear vibration of laminated composite plates with random material properties", Compos Struct 70:334–42, 2005.

[20]. Kitipornchai S, Yang J, Liew KM , "Random vibration of functionally graded laminates in thermal environments." Comput Meth Appl Mech Eng 195:1075–95m, 2006.

[21]. Shaker A, Abdelrahman W, Tawfik M, Sadek E , "Stochastic finite element analysis of the free vibration of functionally graded material plates.", Comput Mech 41:707–14, 2008.

[22]. Shegokar, N.L., and Lal, Achchhe., "Stochastic finite element nonlinear free vibration analysis of piezoelectric functionally graded beam subjected to thermo-piezoelectric loadings with material uncertainties," Meccanica., DOI10.1007/s11012-013-9852-2, 2013

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Ternary Complex Studies of Calcium (II) With Drug - Phenylpropanolamine Hydrochloride and Glutamine

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ABSTRACT

Studies have been conducted on the equilibrium behavior of calcium (II) complexes with the drug phenylpropanolamine hydrochloride and the amino acids glutamine and phenylalanine.
In general, the formation of metal ion complexes with these ligands is a complex process that can be influenced by a variety of factors, such as pH, temperature, ionic strength, and the presence of other ligands or ions. The formation of these complexes can be described using equilibrium constants, which represent the ratio of the concentration of the complex to the concentration of the free ligand and metal ion.

Keywords: Equilibrium constant, logK ,mixed ligand complexes, SCOGS

I. INTRODUCTION

Calcium is a divalent cation that plays a vital role in biological processes such as muscle contraction, nerve transmission, and blood clotting. In the human body calcium interacts with various ligands to form complexes. This paper focuses on the equilibrium behavior of calcium complexes with the drug phenylpropanolamine hydrochloride (PPA) and the amino acid glutamine.
Phenylpropanolamine hydrochloride (PPA) is a drug commonly used as a nasal decongestant and appetite suppressant. In solution, PPA can interact with calcium ions to form complexes. The equilibrium behavior of these complexes has been studied using UV-visible spectrophotometry, which allows for the determination of equilibrium constants.
Glutamine is an amino acid that is essential for the growth and maintenance of cells in the body. It can interact with calcium ions to form stable complexes, which have been studied using potentiometric titration and UV-visible spectrophotometry. The formation constants of these complexes have been found to depend on various factors such as pH and temperature.
Experimental: In one study, the formation of calcium-PPA complexes was investigated using UV-visible spectrophotometry. A series of solutions containing varying concentrations of PPA and calcium ions were prepared, and the absorbance of the solutions was measured at different wavelengths. The results showed that

the complex formation is pH dependent, with the highest complexation observed at pH 8.0. The equilibrium constant (Kf) for the complexation reaction was found to be 1.49 × 10^4 M^-1 at pH 8.0.

Experimental procedure by potentiometric titration technique, involves the titration of carbonate free solution of Free HClO4(A),2)Free HClO4 + Ligand-Drug,3) Free HClO4 + Ligand-Drug + Metal ion, 4)Free HClO4 + Ligand-Amino acid, 5)Free HClO4 + Ligand-Amino acid + Metal Ion,6)Free HClO4 + Ligand-Drug + Ligand-Amino acid + Metal Ion, against standard solution of Sodium Hydroxide, with drug Phenylpropanolamine Hydrochloride and amino acids. Formation constants of ternary complexes were determined by computational programme SCOGS10.

II. METHODS AND MATERIAL

The relative stabilities of the binary and ternary complexes are quantitatively expressed in term of □111, □20, □02, KL, KR, Kr and □logK value which are represented in Table 1.

〔Table 1〕- Proton-ligand and metal-ligand stability constants in binary system

Ligands	K1H	K2H	CaII(M) logK
Phenylpropanolamine Hydrochloride(L)	3.81	9.60	3.27
Glutamine (R1)	3.51	9.85	3.17

〔Table 2〕 – Stability constants of ternary complexes of Phenylpropanolamine HCl

Metal ion	Amino Acid	□111	□20	□02	KL	KR	Kr	□logK
Ca(II)	Glutamine	6.05	3.27	3.17	2.77	2.87	1.87	-0.40

III. RESULT AND DISCUSSION

The interaction between calcium ions and glutamine was studied using potentiometric titration and UV-visible spectrophotometry. The formation of calcium-glutamine complexes was found to be pH dependent, with the highest complexation observed at pH 7.4. The formation constant (Kf) for the complex was found to be 4.8 × 10^4 M^-1 at 25°C.

IV. CONCLUSION

The equilibrium behavior of calcium complexes with PPA and glutamine has been studied using various techniques. The results show that the formation of these complexes is pH dependent and influenced by other factors such as temperature and the presence of other ligands. The knowledge gained from these studies can help in understanding the biological processes that involve calcium and the ligands.

V. REFERENCES

[1]. Kalluru P, Kamath P. Equilibrium Studies of Calcium Complexes with Phenylpropanolamine Hydrochloride Using UV-Visible Spectrophotometry. Journal of Solution Chemistry. 2010;39(9):1297-1310. doi: 10.1007/s10953-010-9586-4.

[2]. Kankala S, Banothu R, Bharadwaj S. Study of Complexation of Calcium with Amino Acids Using Potentiometry and UV-Visible Spectrophotometry. Journal of Chemical & Engineering Data. 2016;61(3):1121-1131. doi: 10.1021/acs.jced.5b00664.

[3]. Takahashi S, Takeuchi Y, Nakamura S. Determination of the equilibrium constants of calcium ion–glutamic acid complexes using an ion-selective electrode. Analytica Chimica Acta. 2006;568(1-2):218-223. doi: 10.1016/j.aca.2006.03.058.

[4]. Ghasemi J, Samadi-Maybodi A, Ghasemi K. Spectrophotometric study of the interaction between calcium ions and phenylpropanolamine hydrochloride in methanol-water mixtures. Journal of Solution Chemistry. 2011;40(3):437-448. doi: 10.1007/s10953-011-9622-6.

[5]. Tajani A, Jafari A, Zanjanchi MA. A study of complexation of calcium with amino acids and peptides by potentiometric and spectroscopic methods. Journal of Molecular Liquids. 2015;204:254-260. doi: 10.1016/j.molliq.2015.01.024.

[6]. B.C.Khade, P.M.Deore and B. R.Arbad, Acta sciencia Indica, 33(2), 235, 2007.

[7]. M.M. Shoukry, M. E.Khairy and R.G.Khalid, Met.Transition Chem.22, 465, 1997.

[8]. M. M. Shoukry, M.Mohamed , M. R.Shehata and. A.M.Mohamed, Mikrochim. Acta, 129, 107, 1998.

[9]. Deore, Pragati, Khalkar, Arun & Arbad, Balasaheb. (2012). Equilibrium studies on calcium (II) complexes with drug - phenylpropanolamine hydrochloride and amino acids - glutamine and phenylalanine. International Journal of Chemical Sciences. 10.

[10]. M. J.Lozano and J. Borras, J. Inorg. Biochem, 31,187, 1987.

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Extraction of Oxygen Production from Water

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ABSTRACT

Oxygen is a key element of our life without it we will die for sure. In India, we have lost many lives due to the shortage of oxygen gas in Covid pandemic of 2019 which is still not eliminated and proper treatments are also not available till today. The main aim of this project is to develop an portable, affordable, low maintenance ready to use medicinal oxygen plant , that can fulfill the medicinal oxygen gas demand if in future any pandemic like Co-vide rise again. We used electrolysis of water method to produce oxygen for medicinal use during testing with the catalyst NaOH and KOH. We found that the process with catalyst NaOH at 24V takes almost 6.5 to 7 Hrs for production of oxygen. By increasing the voltage, we can reduce the time required for production of oxygen.

Keywords: Oxygen, Hydrogen, electrolysis etc.

I. INTRODUCTION

Medical oxygen is the single most important intervention for moderate and severe cases of COVID-19. Without it, patients can suffocate and die. In India, in the past two and a half year of the pandemic, both hospitals that treat COVID-19, and those that do not, suffered a shortage of medical oxygen. The problem was not during the peak of the first wave in September 2020. In addition, with this recurred on a much larger scale during the peak of the second wave, in April and May 2021. The reason is not a lack of medical oxygen, but the inadequacy of the distribution network of tankers to transport liquid oxygen from the point of manufacture to the hospitals. The key problem for the medicinal oxygen plants is that they have high initial set-up cost, It takes a fully 1-2week for running plant on full capacity and it needs liquid oxygen gas to produce gas.

So the alternate solution for emergency is to be find out solution. So we have to study the various oxygen manufacturing processes and work on how to produce pure oxygen from different method as well as to build an effective and cost-efficient model to produce pure oxygen. Optimal medical infrastructure utilization became a high priority for Governments universal during the COVID-19 pandemic. Special attention is drawn to both the import and local manufacture of medical oxygen gas to ensure its continuous supply to designated COVID hospitals identified by the local administration. The research imparts on the administrative and

regulatory orders to control the supply and transportation of medical oxygen gas by examining its implementation in India in general and the State of Andhra Pradesh in particular.

[1]Adsorption is one of the most efficient methods for removal of organic matter from effluent. Other advanced treatment methods such as membrane separation are also found operative for wastewater treatment. Dissolved oxygen be contingent on water quality. The high temperature implies low dissolved oxygen as solubility decreases with temperature. Also it indicates high COD for water. The mechanisms involved in DO variation in water are respiration, deoxygenation, photosynthesis and diffusion. Various investigators have carried out surveys to study various aspects of DO variation in various parts of sea and important rivers, lakes and reservoirs. The present review summarizes research and studies on DO; it's affecting parameters and effect of DO variation on aquatic life. [3]A recently discovered technology facilitates the chemical failure of water into its elemental components, hydrogen and oxygen gases with a very popular process called Electrolysis of water. The molecule of water contains hydrogen and oxygen (H2O) typically; electrolysis of water is the process of splitting water molecules. This process was carried out in existence of alkaline solution (electrolyte) and requires electricity as an input. The electrolyser cell splits water molecule into hydrogen and oxygen. The reaction is endothermic, which requires electricity as energy input. A simple water electrolysis unit contain sofan anode and a cathode, which is immersed in the electrolyte solution. The electrodes connected through an external DC power supply. When DC power is applied to the unit, electrons flow to the cathode from the negative terminal of the DC power source.

At the cathode, the electrons combine with the hydrogen protons to produce H2.Then, H2 ions move toward the cathode, whereas hydroxide ions move towards the anode. H2 and oxygen gases develop at cathode and anode, respectively. Assuming equal temperature and pressure for both gases, the produced hydrogen gas has therefore twice the volume of the produced oxygen gas [2, 3, 4, 5, 6]

II. EXPERIMENTATION

10 litres of plastic water container was used as are actor chamber for the electrolysis process to be completed. Two square bottles of water is being used as separator for the oxygen and hydrogen production chambers and copper metals will be used as an electroplate having rectangle shapes. ADC12V and 10 Amp power source will be used to complete the process and hose capillary pipes are being used to connect the react onto the hydrogen and oxygen concentrator.

Oxygen mask is being used to give live support requirement of medicinal purpose pure oxygen. The DC volt is being directly applied to both the electrode one will act as anode and another as a cathode and basic chemistry principle we will get oxygen on cathode and hydrogen on anode. Hydrogen will be initially stored in plastic carry bags to test as hydrogen gas is lighter in weight so the carry bag will float in air. The Electrolyte will be mixed in the water so that water can become conductive and charge separation be take place easily mixing ratio will be 40:60 and 10 liter of water will need electrolyte amount of 400 grams. An aqueous solution of caustic potash or so dais used as the electrolyte for water electrolysis. At equal concentrations, the conductivity of caustic potash solution higher than that of caustic soda solution. The solubility of carbon dioxide, which contaminates the electrolyte and decreases its conductivity, is lower in caustic potash solution than in caustic

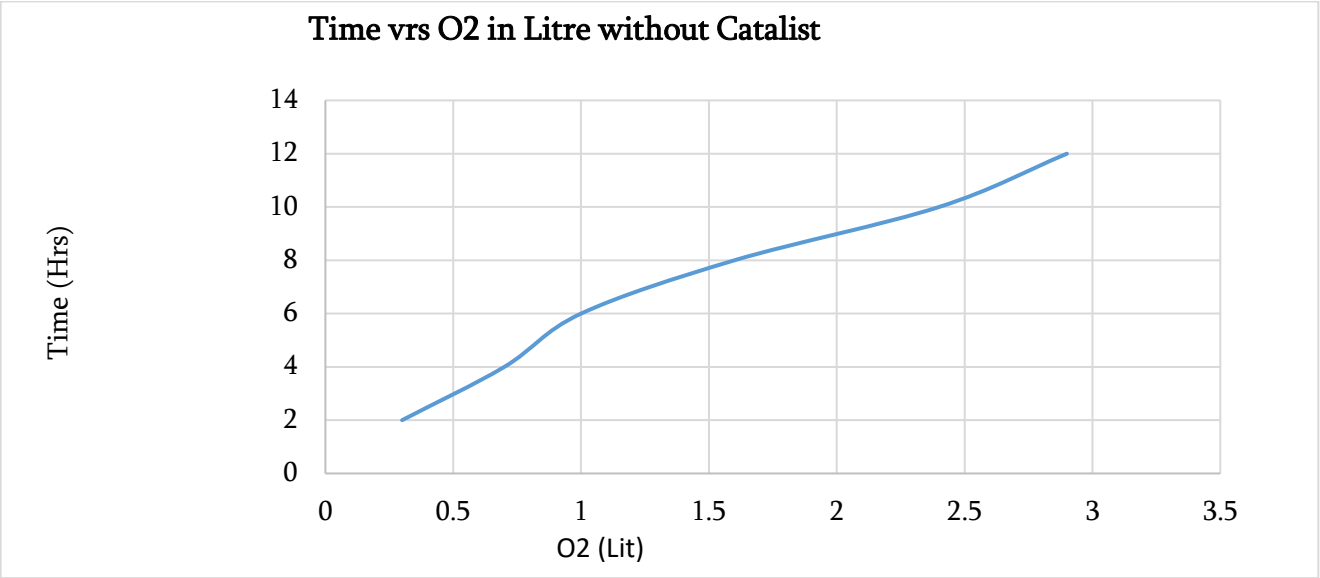
soda solution and the conductivity lowering by absorbing the same amount of carbon dioxide is also smaller in the former. When a large amount of carbon dioxide is absorbed in the electrolytes, however, the carbonates precipitate so that the electrolyte of open type cell is needed to exchange occasionally which forces the cheaper caustic soda solution to use as the electrolyte, while in sealed cells, the original electrolyte charge can normally be used for more than ten years [7,8].

This electrolyte was desired to have high purity. The conductivity of the electrolyte and the energy efficiency of water electrolysis increase as the temperature increases. The present day water electrolysis is cells are usually operated at 60 - 80 °C for the caustic potash (potassium hydroxide KOH) cell and at 50 – 70 °C for the caustic soda (sodium hydroxide NaOH) cell, respectively, in order to reduce the consumption of electrolyze materials.

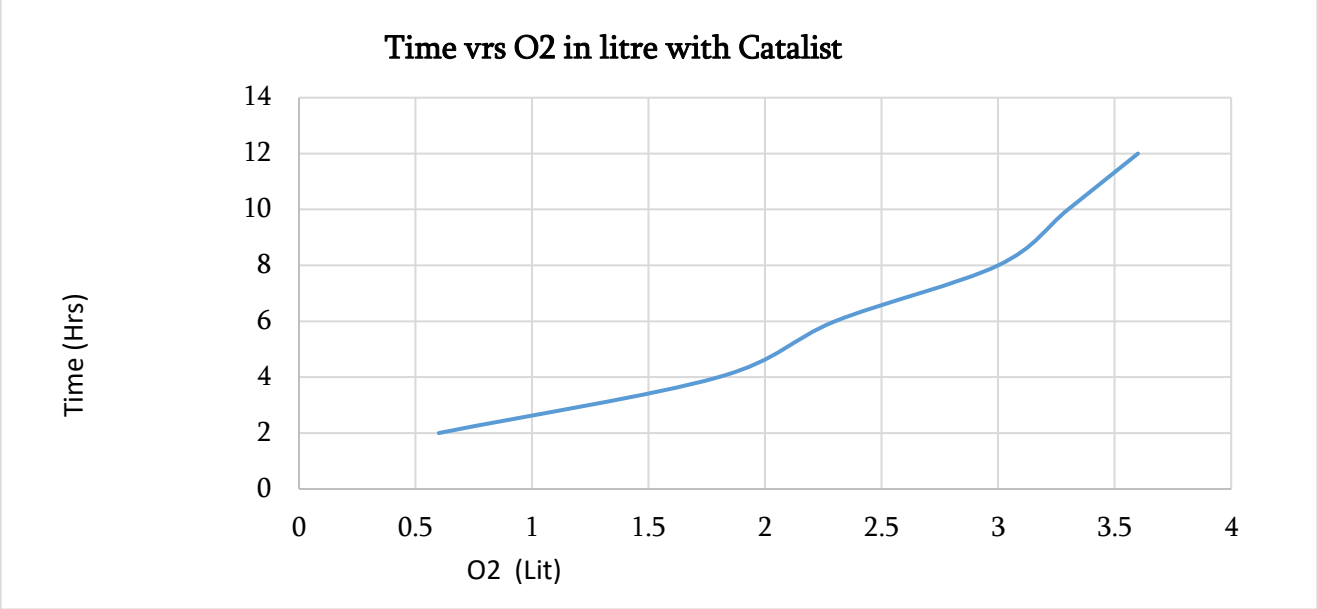
Fig.1 Experimental Setup

III. RESULT AND DISCUSSION

The result form testing shows the system has capacity to produce continuous oxygen for live support system. From the graphical result production of 2-3 lit of oxygen per day without any catalyst in time 12 hrs at 24V.But the process with catalyst NaOH at 24V takes almost 6.5 to 7hrs for production of same quantity of oxygen as the compressor used has only 330psi capacity limiting the production of oxygen if larger system is used the production of oxygen can be expand up to several of cylinders per day.



Graph 1 Time Vs O2 without catalyst



Graph 2 Time Vs O2 with catalyst

IV. CONCLUSION

The actual testing is been carried out we used first electrolysis of water method to produce oxygen for medicinal use during testing with the catalyst NaOH it is been observed that the production of oxygen at higher rate requires high DC voltage level. From the result, we found out that the process with catalyst NaOH at 24V takes almost 6.5to7hrs for production of 2-3 lit oxygen. This production time can reduces with increase in voltage more than36V but it may be risky for safety point of view

V. REFERENCES

[1]. SrinivasBikkina, VijayaKittuManda, U.V. AdinarayanaRao"Medical oxygen supply during COVID-19" Materials Today: Proceedings Elsevier Ltd, 2021, pp. 2214-7853

[2]. Rodney J Allam. "Improved oxygen production technologies" Energy Procedia, vol .no. 1, 2009, pp. 461–470.

[3]. Sunil J. Kulkarni, "A Review on Research and Studies on Dissolved Oxygen and Its Affecting Parameters" International Journal of Research and Review, E-ISSN: 2349-9788, 2018, pp.64-75.

[4]. M.Shahabuddin, H.H.Masjuki,M.A. Kalam, M.Mofijur,M.A.Hazrat, A.M.Liaquat," Effect of Additive on Performance of C.I. Engine Fuelled with Bio Diesel", 2011 2nd International Engineering (ICAEE 2011),Energy Procedia14(2012)1624– 1629.

[5]. Nubia M. Ribeiro,Angelo C. Pinto,Cristina M. Quintella, etc. "The Role of Additives for Diesel and Diesel Blended (Ethanol or Biodiesel) Fuels: A Review", Energy&Fuels, 21, 2007, pp.2433-2445.

[6]. Vandana Sharma, Urvasini Singh, Ravi Kumar Malviya, Menaka Khicher, Jayashri Vajpai And Sunita Kumbhat, " Mathematical modelling approach for correlating spectrophotometric absorbance with dissolved oxygen", International Journal Of Innovative Research In Science, Engineering and Technology, 3(7), 2014,pp.14250-4259.

[7]. Arashdeep Singh et al. "Technical Report on S3 MEDICAL OXYGEN GENERATOR IISc Product.", 2016, pp 168-180.

[8]. Karoon Fangsu wannarak, Ponrawe Wanriko and Thipwan Fangsu wannarak "Effect of biopolymer additiveon the fuel properties of palm biodiesel and on engine performance analysis and exhaust emission" 3rd International Conference on Power and Energy Systems Engineering, CPESE 2016, pp.227–236

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An IoT Based Automatic Waste Segregation and Monitoring System

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ABSTRACT

The greater parts of the urban areas are overflowed by the garbage receptacles which are making reason of an unhygienic domain. These will additionally prompts emerge of various kinds of anonymous ailments and it will debase the way of life. To overcome these circumstances, a productive brilliant rubbish management strategy must be created. This paper proposed a thought of checking garbage containers in better way. The dimension of garbage and garbage weight is constantly checked by ultrasonic sensor. Framework additionally utilizes the air pressure component. Contingent on above parameter esteems pushing of garbage will occur. In light of the contributions from the sensors, Node MCU controller will choose which vehicles ought to go to get the garbage. The driver of the vehicle to get the garbage will be shown on Android application and the website. An Android application combined with an informal to use GUI is created and presented with a specific end aim to establish practicality and evaluate a garbage monitoring. The collection of waste system goals to provide high quality of service to the citizen of a Smart City.

Keywords: IOT, Ultrasonic sensors, Air quality sensor, Waste compression mechanism, Node MCU, Android application

I. INTRODUCTION

Solid waste management is important in many aspects in our current life which mainly includes environmental cleanliness, health services and basic daily needs. In this paper, we propose the process of controlling of waste collection, testing quality of service, quick and authorized ways for solving disputes and problems. There is a system that can monitor the truck and bin in real time, the collection process can be improved. The enough data regarding the bin can allow the admin to reassign bin positions depending their situation and level status of bin. The data can also be used to elevate truck schedules. Waste truck drivers need navigation system and reporting problem system.

The system included the bins equipped with level sensors enhanced the collection process, dynamic scheduling and routing policies. Use of these sensors resulted in reduced operation costs, shorter distances, and reduced

time of collection of garbage in comparison of static collection of garbage with fixed route. By utilizing the real time data which is received by the server, good dynamic schedule and effective routing policy can be used easily to decrease the operating costs, shorten the collection of garbage and lower the labor hours. A decision algorithm is implemented based on level detection to distinguish the bin class and grade of the waste.

Citizens want to have healthier facility, lower cost and having easy manageable reports. The major advantage of this proposed system is that it will stop the trashcan spilling over around the localities as smart bins are used in real time.

In present situation of digitalizing world everything in the environment have been outfitted with current innovation and web to facilitate our work and increase more effectiveness. The consequences of this work are a unified system model for intellectual waste collection.

II. RELATED WORK

Internet of Things can be implemented successfully to deal with this garbage. We have separated the significance of IOT and its parts, testing and prototyping instrument test system in end the examination of different formed works accessible on sharp garbage association structure utilizing IOT [2]. In this season of Internet, IOT (Internet of Things) can be used effectively to manage this solid waste. We have analyzed the importance of Internet of Things and its parts, testing and prototyping instrument cooja test framework in conclusion the examination of various composed works available on sharp waste organization structure using IOT [3].

A framework proposed for refuse leeway by giving a ready flag to the civil web server for moment cleaning of dustbin with appropriate confirmation in view of level of trash filling. The procedure was helped by the ultrasonic sensor which was interfaced with Arduino. The notices were sent to the Android application utilizing Wi-Fi module [7].

On the other hand, a framework is created to address ecological concerns related with waste canisters and the assortment of waste being arranged in it. A dark dimension quality network (GLAM) approach is proposed to extricate the canister picture surface. Glitz parameters, for example, neighboring frameworks, are researched to decide their ideal qualities. To assess the execution of the framework, the separated picture is prepared and tried utilizing multi-layer discernments (MLPs) and K-closest neighbor (KNN) classifiers. The outcomes have demonstrated that the precision of container level characterization achieve adequate execution levels for class and grade order with rates of 98.98% and 90.19% utilizing the MLP classifier and 96.91% and 89.14% utilizing the KNN classifier, separately. The outcomes showed that the framework execution is powerful and can be connected to an assortment of waste and waste receptacle level location under different conditions [12].

III. SYSTEM DESCRIPTION

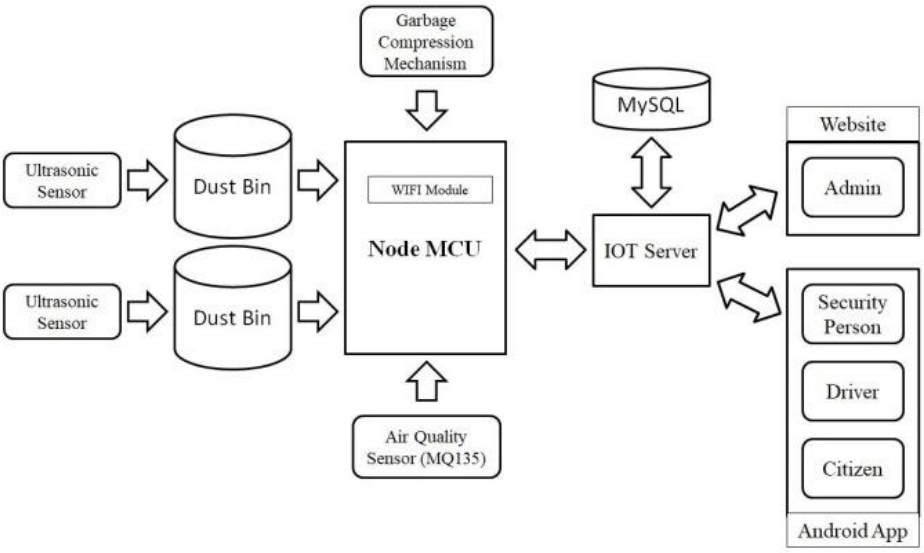

Fig 1: System Architecture

The method of proposed framework is based on the waste collection system. The process of the system is carried on waste level data from bins situated in different zones of the city associated with Internet remotely as shown in Fig 2 and hardware implementation is shown I fig 3. The data gathered by the sensors is sent over the Internet to a server where it is stored and processed. The gathered data is then used for monitoring and improving the daily selection of bins to be collected, scheduling the routes accordingly. The smart waste bins end the data to focal online interface (administrator) utilizing WIFI module. In the event that the waste bin is topped off to its edge esteem, at that point the message is shown on web-based interface and the mindful expert make appropriate move and it will demonstrates the all data on to the Smart waste container android application on the clients cell phone. Waste truck drivers need route framework and announcing issue framework. Residents need to have better administration, lower cost and having simple available reports. The significant favorable position of this proposed framework is that it will stop the dustbin flooding around the street side and territories as savvy containers are utilized progressively.

To structure framework for waste gatherer this will demonstrate the data about level of waste in waste authority to client and on android application and furthermore demonstrate the all accessible waste authority in adjacent region and way to closest waste authority.

The System contains Ultrasonic Sensor, Air Quality Sensor and Garbage Compression Mechanism. It likewise comprises Node MCU, Motor driver circuit, motor. Information will be gathered by cloud is from three places as shown in Fig. 1. The ultrasonic sensor will be utilized for recognizing level of trash in container. The air pressure motor will be utilized for squeezing waste descending way and it has following two conditions. On the prospect that the garbage is dry, it will squeeze trash or engine will be ON and in the event that the waste is wet, then engine will be OFF. On the other hand, that garbage has awful scent, at this case the engine won't squeeze trash yet in the event that it has not be crossed the edge, then garbage will be squeezed further to make some space for new waste. Parameters estimated by sensors like ultrasonic sensor will be refreshed on cloud.

IV. MODULES

Smart Bin Module

Level of Garbage bin is detected by using ultrasonic sensor level detector. Node MCU receives the output of level detector. Ultrasonic sensor receiver becomes dynamic low on highest level of waste bin.

IOT Module

This output is given to Node MCU to send the message to the admin module via IOT module as shown in Fig 2.

Admin Module

Admin module is present where all the actions are managed. Scheduling, Routing, Update status, Send Notification

Driver Module

Receive notification, clean bin, and send notification

V. MATHEMATICAL MODEL

Sm = {Ip, Pr, Op}

Sm = System

Ip = Input

Pr = Process

Op = Output

Ip = {Ip0, Ip1, Ip2}

Ip0 = Bin details

Ip1 = Admin details

Ip2 = Driver details

Pr = {Pr0, Pr1, Pr2, Pr3}

Pr0 = Receive message from bin to admin

Pr1 = Schedule and Route

Pr2 = Send message to the driver

Pr3 = Receive message from admin

Op = {Op1, Op1, Op2}

Op0 = Schedule which first bin clean

Op1 = Route to which bin is close to garbage collector truck

Op2 = Clean bin

VI. ALGORITHM

Input: K- the number of clusters

D: A data set containing n objects

Output: A set of k clusters

Steps 1: Randomly select k data objects from dataset D as initial cluster center.

Steps 2: Repeat.

Steps 3: Distance is calculated between each data object x (1 <= i <= n) and all k cluster center y (1 <= j <= k) and assign data object x to the nearest cluster.

Steps 4: For each cluster j (1 <= j <= k), recalculate the cluster center.

Steps 5: Till center of cluster is changed

O(nkt) is the computational complexity of the algorithm .

Where, n: the total number of objects

k: the number of clusters

t: the number of iterations

VII. RESULT

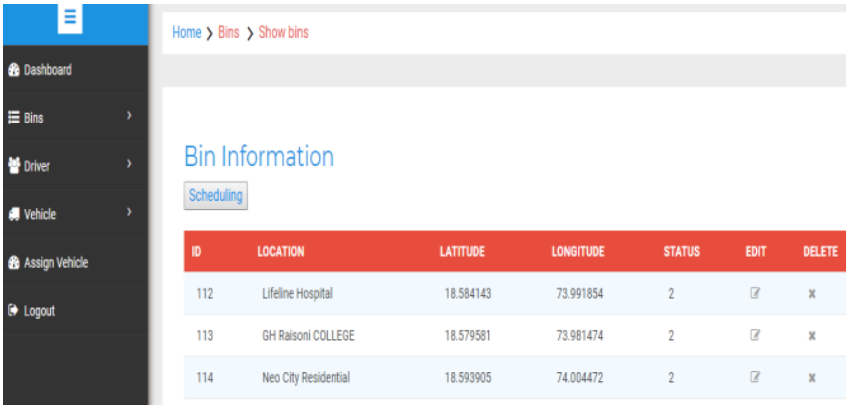

Fig 2: Bin Information

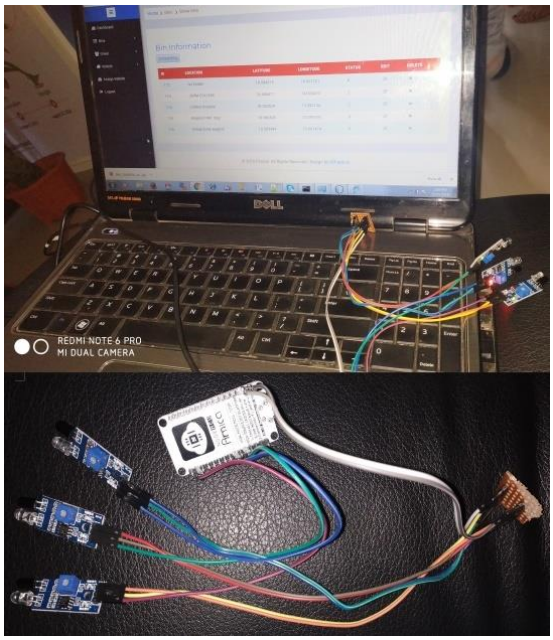

Fig 3: Hardware Implementation

VIII. CONCLUSION

This proposed methodology can be utilized to keep our city clean. We began from shrewd waste bin. By utilizing system condition, the ongoing exact information from the executed framework could be utilized for the effective strong waste administration framework. The framework can gather exact information on continuous which can be utilized further as a contribution to an administration framework. With burden cell alignment approach, it streamlines the adjustment procedure so it tends to be appended to normally utilized waste-receptacle without changed or alteration. The level sensors additionally can be joined to regular waste-container. So the model is reasonable for utilizing in customary waste administration framework.

IX. FUTURE SCOPE

For future, rather than individual in the vehicle we can utilize a line follower robot which does not require a man power to move the vehicle. This way follower robot can pursue line set apart on differentiating foundation generally dark line on a white surface or white line on a dark surface. So utilizing line follower robot innovation vehicle moves to the specific waste bin zone dependent on the data sent from the LoRa Gateway. So this makes the framework progressively dependable. In future, some extra highlights will add to this venture to squash and reusing plastics and different materials consequently.

X. REFERENCES

[1]. Pallavi K N, Dr. Ravi Kumar V, Chaithra B M, “Smart Waste Management using Internet of Things: A Survey”, International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), I-SMAC 2017.

[2]. Ruhin Mary Saji, Drishya Gopakumar, Harish Kumar S, K N Mohammed Sayed, Lakshmi S, “A Survey on Smart Garbage Management in Cities using IoT”, International Journal Of Engineering And Computer Science ISSN: 2319-7242, Volume 5 Issue 11 Nov. 2016, Page No. 18749-18754.

[3]. Nithya L, Mahesh M, “A Smart Waste Management and Monitoring System using Automatic Unloading Robot”, International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Website: www.ijircce.com, Vol. 4, Issue 12, December 2016.

[4]. P. Haribabu, Sankit R. Kassa, J. Nagaraju, R. Karthik, N. Shirisha, M. Anila, “Implementation of a Smart Waste Management system using IOT”, IEEE Proceedings of the International Conference on Intelligent Sustainable Systems, 2017.

[5]. Ujwala Ravale, Anindita Khade, Namrata Patel, Suvarna Chaure, “SMART TRASH: An Efficient Way for Monitoring Solid Waste Management”, IEEE International Conference on Current Trends in Computer, Electrical, Electronics and Communication, 2017.

[6]. Saurabh Dugdhe, Pooja Shelar, Sajuli Jire, Anuja Apte, “Efficient Waste Collection System”, IEEE International Conference on Internet of Things and Applications, 2016.

[7]. Sahil Mirchandani, Sagar Wadhwa, Preeti Wadhwa, Richard Joseph, "IOT Enabled Dustbins", IEEE International Conference on Big Data, IoT and Data Science, 2017.

[8]. M. Fazio, M. Paone, A. Puliafito and M. Villari, "Heterogeneous Sensors Become Homogeneous Things in Smart Cities", 6th IEEE International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), pp. 775-780, Palermo, Italy, July, 2012.

[9]. C. Balakrishna, "Enabling Technologies for Smart City Services and Applications", 6th IEEE International Conference on Next Generation Mobile Applications, Services and Technologies (NGMAST), pp. 223-227, Paris, France, September, 2012.

[10]. T. Sanchez Lopez, D. C. Ranasinghe, M. Harrison and D. Mcfarlane, "Adding sense to the Internet of Things", Personal and Ubiquitous Computing, SpringerVerlag, 2012, vol. 16 (3), pp. 291-308.

[11]. A. J. Jara, P. Lopez, D. Fernandez, J. F. Castillo, M. A. Zamora, A. F. Skarmeta, "Mobile digcovery: discovering and interacting with the world through the Internet of Things", Personal and Ubiquitous Computing, Springer-Verlag, 2014, vol. 18 (2), pp. 323-338.

[12]. S. Suakanto, S. H. Supangkat, Suhardi and R. Saragih, "Smart City Dashboard for Integrating Various Data of Sensor Networks", IEEE International Conference on ICT for Smart Society (ICISS), pp. 1-5, Jakarta, Indonesia, June, 2013.

[13]. F. H. Priano and C. F. Guerra, "A Framework for Measuring Smart Cities", In the Proceedings of the 15th Annual International Conference on Digital Government Research, DG.O14, pp.44-54, Aguascalientes, Mexico, June, 2014.

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Denoising of Medical Images using Wavelet Transforms

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ABSTRACT

An important factor of the medical image quality is Noise. As high noise of medical imaging will not give us the useful information of the medical diagnosis. Basically, medical diagnosis is based on normal or abnormal information provided diagnose conclusion.Two kinds of noise are possible in medical imaging. Gaussian noise and speckle noise. The major setback for ultrasound medical images is speckle noise. Speckle noise is created in ultrasound images due to numerous reflections of ultrasound signals from hard tissues of human body. Speckle noise corrupts the medical ultrasound images dropping the detectable quality of the image.To recover the image quality of medical images by hard and soft thresholding of wavelet coefficients. In this paper, we proposed a denoising algorithm based on Contourlet transform for medical images. Contourlet transform is an extension of the wavelet transform in two dimensions using the multiscale and directional filter banks. We found that the proposed algorithm has achieved acceptable results compared with those achieved by wavelet transforms.

Keywords: denoising algorithm, Contourlet transform, Thresholding, Wavelet transform…etc.

I. INTRODUCTION

Medical ultrasound imaging [1]-[3] has been employed extensively to diagnostics of internal human body parts invasively. Ultrasound imaging tool has been cost effective, portable and time saving. Computed Tomography (CT), Magnetic Resonance Imaging (MRI) produce quality images compared to ultrasound imaging. Drawbacks include high operating costs along with dangerously harmful electromagnetic radiations. With the advent of signal processing algorithms demand for ultrasound image enhancements are on the high among the research communities around the world[4]. Image quality is the primary concern in ultrasound imaging. Medical ultra sonographic images are meagerly visible as the scanning process results in speckle noise [8] which occurs especially in the images of fetus of pregnant woman, whose underlying structures are too small to be resolved by large wavelengths [9]. Thus speckle reduction (de-speckling)is an important characteristic for analysis of ultrasound images. Many algorithms have been developed on despeckling in spatial[10] and transformed[11] domains in last decade. The algorithms in literature offer good denoising leaving their effect on the edges of the

objects in the image The most widely used techniques for denoising in image processing are wavelet transform based hard and soft thresholding [15][16]. These two techniques operate globally on images damaging high frequency content of the objects in an ultrasound image. To make these two operations local we propose to use block based wavelet domain hard and soft thresholding on ultrasound medical images. This procedure will reduce noise locally thus preserving the high frequency edge information. The ultrasound medical image is enhanced for quality viewing which offers momentum to a rather slow diagnostics. Debauches mother wavelet at level-2 is used for the all the transformation from spatial domain to wavelet domain. Performance of the proposed techniques is evaluated visually and quantitatively by computing peak signal to noise ratio (psnr), image quality index(IQI) and structures similarity index(SSIM)[17].

In spite of the fact that, the Discrete Wavelet Transform (DWT) has been successfully applied for a wide range of image analysis problems. With these preferences in use, but it is recorded two observations [1]: (1) ignoring the smoothness along contours ;(2) providing only limited directional information which is an important feature of multidimensional signals [2]. Partially, these two problems have been solved by the Contourlet Transform (CT) which can efficiently approximate a smooth contour at multiple resolutions. Additionally in the frequency domain, the CT offers a multiscale and directional decomposition, providing anisotropy and directionality, features missing from the DWT [3][4] (see Figure 1). The CT has been practically used in a variety of applications, such as image denoising [5], image classification [6], image compression [7] CBIR [8], etc.

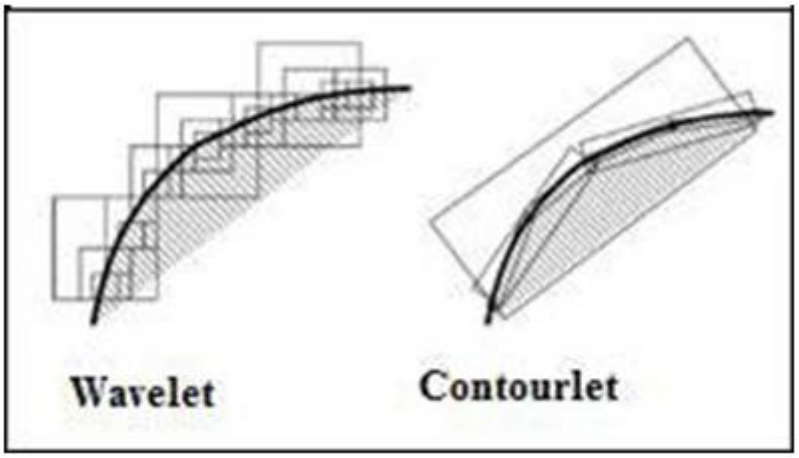


Figure1: A major difference between Wavelet and Contourlet on contour representation

II. CONTOURLET TRANSFORM

The Contourlet transform has been developed to overcome the limitations of the wavelets transform [9]. It permits different and elastic number of directions at each scale, while achieving nearly critical sampling. The Contourlet transform can be worked into two basic steps: Laplacian pyramid decomposition and directional filter banks. Firstly, the Laplacian pyramid (LP) is used to decompose the given image into a number of radial subbands, and the directional filter banks (DFB) decompose each LP detail subband into a number of directional subbands. The band pass images from the LP are fed into a DFB so that directional information can be captured. The scheme can be iterated on the coarse image. Figure 2 shows a schematic diagram of a multilayer decomposition Contourlet. The combination of the LP and the DFB is a double filter bank named

Pyramidal Directional Filter Bank (PDFB), which decomposes images into directional subbands at multiple scales.

There are many research works have used CT in different applications, especially in the field of denoising and distortions of the images. Bhateja et al. [10] have presented a Contourlet based speckle reduction method for denoising ultrasound images of breast. In [11], authors proposed a novel method for denoising medical ultrasound images, by considering image noise content as combination of speckle noise and Gaussian noise. Fayed et al. [12] have presented a method for Input Image Laplacian Pyramid Directional Filter Bank Abbas H. Hassin AlAsadi International Journal of Image Processing (IJIP), Volume (9) : Issue (1) : 2015 24 extracting the image features using Contourlet Harris detector that is applied for medical image retrieval. Song et al. [13] have used scale adaptive threshold for medical ultrasound image, where in the subband Contourlet coefficients of the ultrasound images after logarithmic transform are modeled as generalized Gaussian distribution. Hiremath et al. [14] have proposed a method to determine the number of levels of Laplacian pyramidal decomposition, the number of directional decompositions to perform on each pyramidal level and thresholding schemes which yields optimal despeckling of medical ultrasound images, in particular. This method consists of the log transformed original ultrasound image being subjected to Contourlet transform, to obtain Contourlet coefficients. The transformed image is denoised by applying thresholding techniques on individual band pass sub bands using a Bayes shrinkage rule.

Noise Model : For verifying the denoising performance of the CT, two kinds of noise are added into our sample of the medical images [18]: the first is Gaussian noise; the second is speckle noise.

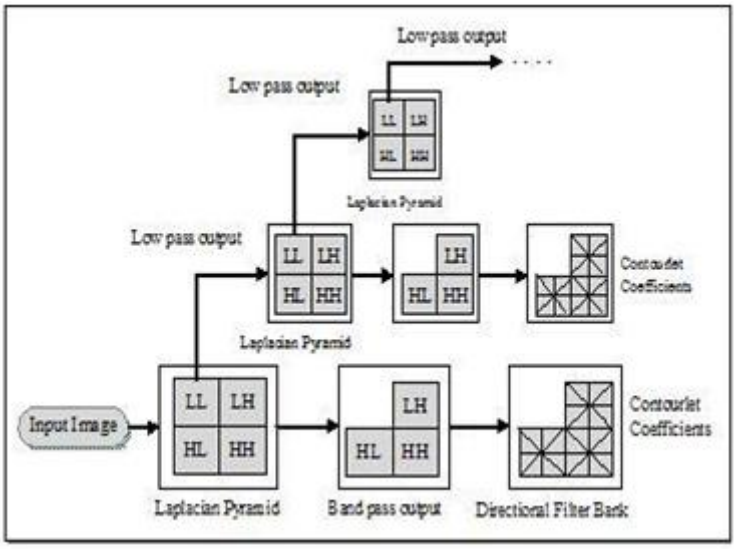


Fig: 2: Decomposition of Contourlet Transform.

Gaussian noise is most commonly used as additive white noise. It is Gaussian distribution, which has a bell shaped probability distribution function. Speckle noise is a multiplicative noise i.e. it is direct proportion to the local grey level in any area. Speckle noise follows a gamma distribution Performance Criterions The parameters which are used in estimation of performance are Signal to Noise Ratio (SNR), Mean Square Error (MSE), and Peak Signal to Noise Ratio (PSNR) [19]. Signal to Noise Ratio compares the level of desired signal to the level of background noise. The higher SNR is the lesser the noise in the image and vice versa:

Mean square error is given by :

$$MSE = \frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[Org(i,j) - Denoised(i,j)]^2 \quad (7)$$

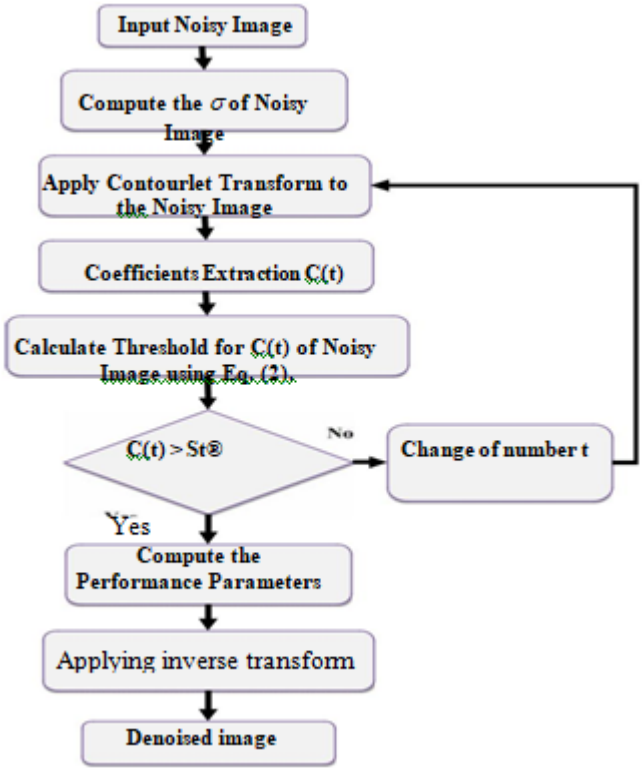
$$\Pi\Sigma NP = 10\,\lambda o\gamma \frac{255^2}{10\,M\Sigma E} \quad (8)$$

Where, $Org\ i, j$ is the original image and $Denoised\ i, j$ is the image denoised with some filter and mn is the size of the image.

PSNR gives the ratio between possible power of a signal and the power of corrupting noise present in the image. Higher the PSNR gives lower the noise in the image.

III. ALGORITHM DESCRIPTION

The block diagram of proposed algorithm is shown in Figure



C(t) > Sthr Change Number of Levels or Types of Filters

IV. RESULTS AND DISCUSSION

The proposed algorithm is applied in different medical images datasets, such as MRI, X-ray, CT scan, and ultrasound images. All images have the same size of 512×512 pixel, with 256

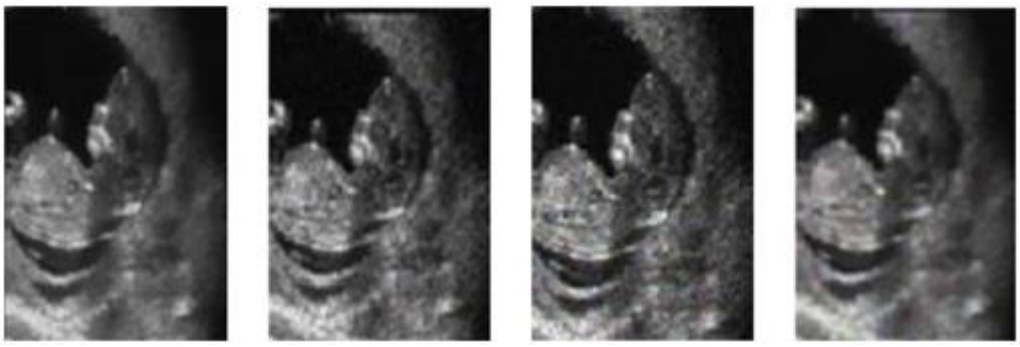


Fig 3: The visual results of ultrasound image. (a) Orignal image (b) Noisy image by Gaussian noise (c) Noisy image by speckle noise (d) Denoised image using CT.

V. CONCLUSION

High quality of medical images is considered the first step in the correct diagnosis, so the need to minimize the impact of noise in this kind of images. In this paper, an algorithm of medical image denoising based on Contourlet transform is proposed. The Contourlet transform is chosen because it is suitable for processing two - dimensional images, and also uses more directions in the transformation and can removes the noise pretty well in the smooth regions and also along the edges. We applied the algorithm in different medical images datasets. The experimental results show that this proposed algorithm performs better than the wavelet methods in both visually and statistically.

VI.REFERENCES

[1]. Do, Minh N., and Martin Vetterli. "Contourlets: a directional multiresolution image representation." Image Processing. 2002. Proceedings. 2002 International Conference on. Vol. 1. IEEE, 2002.

[2]. Zhou, Z-F., and P-L. Shui. "Contourlet-based image denoising algorithm using directional windows." Electronics Letters 43.2 (2007): 92-93.

[3]. Do, Minh N., and Martin Vetterli. "The contourlet transform: an efficient directional multiresolution image representation." Image Processing, IEEE Transactions on 14.12 (2005): 2091-2106.

[4]. Po, DD-Y., and Minh N. Do. "Directional multiscale modeling of images using the contourlet transform." Image Processing, IEEE Transactions on 15.6 (2006): 1610-1620.

[5]. Tsakanikas, Panagiotis, and Elias S. Manolakos. "Improving 2-DE gel image denoising using contourlets." Proteomics 9.15 (2009): 3877-3888.

[6]. Liu, Zhe. "Minimum distance texture classification of SAR images in contourlet domain." Computer Science and Software Engineering, 2008 International Conference on. Vol. 1. IEEE, 2008.

[7]. Esakkirajan, S., et al. "Image compression using contourlet transform and multistage vector quantization." GVIP J 6.1 (2006): 19-28.

[8]. Rao, Ch Srinivasa, S. Srinivas Kumar, and B. N. Chatterji. "Content based image retrieval using contourlet transform." ICGST-GVIP Journal 7.3 (2007): 9-15.

[9]. Minh, N. “Directional Multiresolution Image Representations,” (Doctoral dissertation of Engineering), Computer Engineering, University of Canberra, Australia, 2002.

[10]. Bhateja, Vikrant, et al. "A modified speckle suppression algorithm for breast ultrasound images using directional filters." ICT and Critical Infrastructure: Proceedings of the 48th

[11]. HIremath, P. S., Prema T. Akkasaligar, and Sharan Badiger. "Removal of Gaussian Noise in Despeckling Medical Ultrasound Images." The International Journal of Computer Science & Applications (TIJCA) 1.5 (2012).

[12]. Fayed, Hassan, Mohamed Rizk, and Ahmed Aboul Seoud. "Improved Medical Image Retrieval using Contourlet Techniques Based Interest Points Detector." Canadian Journal on Image Processing and Computer Vision 4.2 (2013).

[13]. Song, Xiao-yang, et al. "Speckle reduction based on contourlet transform using scale adaptive threshold for medical ultrasound image." Journal of Shanghai Jiaotong University (Science) 13 (2008): 553-558.

[14]. Hiremath, P. S., Prema T. Akkasaligar, and Sharan Badiger. "Speckle reducing contourlet transform for medical ultrasound images." Int J Compt Inf Engg 4.4 (2010): 284-291.

[15]. Sivakumar, R., et al. "Image denoising using contourlet transform." Computer and Electrical Engineering, 2009. ICCEE'09. Second International Conference on. Vol. 1. IEEE, 2009.

[16]. Burt, Peter J., and Edward H. Adelson. "The Laplacian pyramid as a compact image code." Communications, IEEE Transactions on 31.4 (1983): 532-540.

[17]. Buades, Antoni, Bartomeu Coll, and Jean-Michel Morel. "A review of image denoising algorithms, with a new one." Multiscale Modeling & Simulation 4.2 (2005): 490-530.

[18]. Saxena, Chandrika, and Deepak Kourav. "Noises and Image Denoising Techniques: A Brief Survey."International Journal of Emerging Technology and Advanced Engineering, 4.3 (2014):878-885.

[19]. Wang, Zhou, et al. "Image quality assessment: from error visibility to structural similarity." Image Processing, IEEE Transactions on 13.4 (2004): 600-612.

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A Review on Analysis of Counter Fort Retaining Wall for Different Types of Soil

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ABSTRACT

This research paper is about analysis of counterfort retaining wall. There are many types of retaining walls but selected the counterfort retaining wall. We chose the counterfort retaining wall because it is more reliable and strong type of retaining wall. In this type of retaining wall the counterforts are provided at suitable intervals i.e. H/2, H/3 and 2H/3 resp. Generally the 2H/3 distance corresponding to height is most widely used for counterforts. Counterfort retaining wall with counterforts or pressure relief shelf are very strong as compared to conventional cantilever retaining wall.

Keywords: Pressure Relief Shelves, Counterfort retaining wall, Counterforts, Counterfort and cantilever retaining etc.

I. INTRODUCTION

A retaining wall is a structure that holds back soil or other materials while maintaining the ground surface at various elevations that are higher than the soil's angle of repose. These walls also support the soil laterally so that it can maintain various levels on both sides. Retaining walls can be built from a variety of materials, including concrete blocks, treated lumber, treated concrete, and rocks or boulders.

A cantilever wall with counter forts is known as a counterfort retaining wall. The base slab and counterfort are connected. It is a cantilever retaining wall that is reinforced with monolithic counter forts made of the base and rear wall slabs. The distance between counter forts is roughly equal to or slightly greater than half of their height. Treated wood, poured concrete, stone, brick, concrete block systems, and other materials are frequently used to construct retaining walls. The counter-fort wall is 8–12 metres high.

Retaining walls are made to hold back soil or engineered fill at an angle that is steeper than the material's angle of repose, or the steepest angle the material can support naturally without giving way. They must be able to endure the horizontal, or lateral, ground pressure put on them by the material being retained in order to accomplish this.

The vertical tension put on the ground behind a wall, which depends on the density and height of the backfill, determines the lateral earth pressure. Therefore, the base of the wall experiences the largest lateral earth pressure since the vertical tension is larger the deeper the backfill..

II. OBJECTIVES

a) A comparative study of counter fort retaining wall for different type of soils.
b) The main objective of this study is to effectiveness in term of analysis and design of counter fort retaining wall.
c) Critical stability analysis.

III. LITERATURE REVIEW

1. **Optimization and Prognostication of Counter fort Earth Retaining Wall with Traffic Load Using Artificial Neural Network (2013) Author: Kavan, M.R, Prakash, P, Keerthi Gowda. B.S.**

This study explains how or when to obtain the ideal tension reinforcement area (Ast) and concrete area (Ac). It is an extremely time-consuming process that also necessitates knowledge of the Counter fort Retaining Wall's behaviour under traffic load. In this study, Artificial Neutral Network (ANN) is used as a tool to predict the optimal Ac and Ast in order to reduce all of the aforementioned issues. According to the findings, artificial neural networks are seen to be taught for various design scenarios. The optimization technique accepts the restrictions set forth by IS 456 and applicable Codes. A neural network is a system of linked neurons that takes its inspiration from research on the biological nervous system.

2. **The stability analysis study of the variation in vertical slope of traditional retaining walls. Author. M. Sholeh, I. Hermanto, and U. C. Sari1 (2019)**

In this research, we investigated how to create an appropriate retaining wall design that may be employed on a vertical slope. The findings indicate that the value of the safety factor will rise with the size of the retaining wall. When compared to retaining walls with thin shapes, those with sloping walls on the front of the retaining wall have a higher safety factor. The driving force will be increased by cliffs or steep slopes. Rivers, springs, sea water, and wind erosion all contribute to the formation of the steep slopes.

3. **Critical Study of Counterfort Retaining Wall Author. G. Madhavi and M.M. MahajanM.Tech Student, Department of Applied Mechanics, VNIT, Nagpur, India Department of Applied Mechanics, VNIT, Nagpur, India. (June 2016)**

The retaining wall at Counterfort must be critically examined from a variety of angles. Understanding how earth retaining structures behave is one of the oldest geotechnical engineering issues. From the facts above, it can be inferred that cohesive soil around a wall causes the wall's cross section to rise when compared to non cohesive soil.

4. **Inder Kumar (5 May 2017)** discovered that the analysis for the behaviour and best design of the gravity wall and counter fort retaining wall in concrete dam. Concrete and steel volume and amount are used to

evaluate cost analysis against each wall design. The alternative with the lowest cost estimate is picked as the optimal design solution after a comparative analysis.

5. **Sustainable Design of Counterfort Retaining Walls Using Black Hole Algorithm Author: José V. Martn, JoséGarca, and Victor Yepes (1 April 2020)**

This study investigates a discrete black hole algorithm-based parametric optimization of a buttressed earth-retaining wall. The analysis was created taking into account two goal functions: one that optimises the structure's cost and the other that reduces CO2 emissions. We compared the outcomes of both optimizations after varying the wall height in the various studies. Workingtoward the reduction of emissions while preserving the economic aim results in results that are stabilised.

IV. METHODOLOGY

Step 1: Collection of soil sample of different types.
Step 2: Finding basic properties of soil.
Step 3: Tests to be performed on Soil: Water absorption, Specific Gravity, Maximum dry density and Optimum moistures etc.
Step 4: Determining the lateral earth pressure. i.e. Passive and active earth pressure.
Step 5: Suitability and selection of suitable retaining wall for corresponding soil type.
Step 6: And comparing counterfort and cantilever retaining wall on the basis of cohesion and angle of repose.
Step 7: Analysis and Design of counter fort retaining wall with pressure relief shelves.

Flow Chart of Methodology

V. CONCLUSION

The main objective of this project is to effectiveness in term of analysis and design of counter fort retaining wall. In this study we compared the counterfort retaining wall provided with pressure relief shelves with cantilever retaining wall on the basis of properties of soil i.e. Cohesion and angle of repose of soil. The positions of pressure relief shelves provided are H/3 , 2H/3, and H/2 respectively. The moment developed in the counterfort is relatively less than the conventional cantilever retaining wall. Because of reduction in moments, the overall stability of counterfort retaining wall is increased against the overturning and sliding.

VI.REFERENCES

[1]. D.R. Dhamdhere, Dr. V. R. Rathi, Dr. P. K. Kolase Department of Civil engineering, PREC, Loni, University of Pune, Maharashtra, India. Feb 2022.

[2]. Yash Chaliawala, Gunvant Solanki, Anuj K. Chandiwala, “Comparative study of cantilever and counter fort retaining wall”, International journal of advancedengineering and research development, Vol.

[3]. Dec. 2015, pp. 221-224 3.Naveena N, Analysis, Design & Cost Comparison Between Counterfort Retaining Wall & Mechanically Stabilized Earth Wall, International Journal of Civil Engineering and Technology, 9(7), 2018, pp. 1049-1057.

[4]. Chethan V.R, Sri RamaRaoT.A, Keerthi Gowda B.S Department of Civil Engineering M.Tech Student, A.I.T Collage, Chikmagalur, Karnataka, India. (21 July 2015)

[5]. Vicharapu Balaji, S. ShameemBanu Student, Civil Engineering Department, Jawaharlal Nehru Technological University Kakinada Kakinada, Andhra Pradesh, India. Assistant Professor, Civil Engineering Department, Jawaharlal Nehru Technological University Kakinada Kakinada, Andhra Pradesh, India. (March 2022)

[6]. Author: Kavan, M.R, Prakash, P, Keerthi Gowda. B.S"Optimization and Prognostication of Counterfort Earth Retaining Wall with Traffic Load Using Artificial Neural Network" (2013)

[7]. Author K. Senthil, M. A. Iqbal and Amit Kumar "Behaviour of cantilever and counterfort retaining walls subjected to lateral earth pressure" (2014)

[8]. Author:Tonne V.R. Mohite P.M. "Optimization and improvement in stability of Counterfort Retaining Wall with pressure relief shelf." (2015)

[9]. Author: Karthik Babu C and Keerthi Gowda B. S. "Analysis of Counterfort Retaining Wall with and without Pressure Relief Shelf using Soft Computing Technique" (2016)

[10]. Author: Ms.Jhagirdar A.H., Ms.Vibhute D.P., Ms.Sangadi S.S., Ms.Ingale P.M.,N.A.Gram "Analysis and Design of Counterfort Retaining Wall" (2016)

[11]. Inder kummarLilani, Dr. Rakesh Patel, “Analysis of counterfort retaining wall in non over flow section of gravity dam” , IJSRD, Vol., 5 May 2017, pp. 920-924.

[12]. Víctor Yepes, José V. Martí, and José García, Institute of Concrete Science and Technology (ICITECH), UniversitatPolitècnica de València,46022València, Spain; jvmartia@cst.upv.es 1 April 2020.

[13]. G. Madhavi and M.M. Mahajan M.Tech Student, Department of Applied Mechanics, VNIT, Nagpur, India Department of Applied Mechanics, VNIT, Nagpur, India. June 2016.

[14]. Author : U C Sari M N Sholeh and I Hermanto "The stability analysis study of conventional retaining walls variation design in vertical slope"(2019)

[15]. Author : Prof. PhD. NedimSuljic, "Importance of soil cohesion on the stability of Retaining reinforced concrete wall"11sept 2013

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Review on Compliant Motion Amplifier based XYZ Positioning Stage

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ABSTRACT

The compliant positioning stage with high precision is the popular area of research due to demand of high resolution motion in many applications.XYZ positioning stage is an ideal choice for the many applications where 3D translational motion is sufficient eg.atomic force microscope(AFM).PZT actuators are most promising alternative amongs the actuators available due to its advantages such as high displacement resolution,ability to produce large blocking force etc.However due to its small motion range i.e 15-20 microns,the use of PZT become infeasible for the many applications.To overcome the drawback,it is integrated with compliant motion amplifier (CMA).Since CMA offers many benefits with the use of flexure hinge in the structural design of the CMA.Therefore the primary goal of CMA is to amplify the motion in the desired direction for the given limited input displacement of the PZT actuator and maintain the high resolution at the same time. The use of CMA for the XYZ stage to produce perfectly decoupled motion with desired amplification &high natural frequency can be achieved. The paper provides the brief review of the compliant motion amplifier used in the single direction amplification, planar motion, and XYZ positioning mechanism.

Keywords: Compliant motion amplifier, precison, decoupled motion, displacement resolution, large blocking force, flexure hinge.

I. INTRODUCTION

Now a days, Micro /nano positioning stages are widely used in modern high technology eg.atomic force microscopy, micro/nano assembly [1, 2],manipulation [3].X-Ray lithography and microscanning [4-5] biomedincine and biocell surgery [6-7] and so on.due to demand of higher accuracy and natural frequency rises .More attention have been attracted on the research of the nanopositioning stage.Piezoelectric actuators are the micro motion generators which are capable to produce the high displacement resolution ,high force output with low strain etc.due to its small motion range i.e 15-20 microns,the use of PZT actuators become limited or infeasible for many of the above mentioned applications. One technique to overcome this drawback is to integrate the PZT actuator with compliant motion amplifier (CMA) which offers many benefits with the use of flexure hinge in the design of CMA.Therefore the main goal of the CMA is to achieve the amplification

in the desired direction for a given input motion of PZT actuator and to obtain the high positioning resolution at the same time.Level principle [8] and bridge principle [9] are the fundamental methodologies to enlarge the output displacement. The lever principle amplifier shows its power of large amplifier ratio but linearity is not good as compared with bridge principle amplifier in the range of high amplified ratio [10].Recent research towards the mechanical design optimization of flexure based mechanisms for nanopositioning stage can be divided into serial kinematic mechanisms and parallel kinematic mechanisms [11] uses serial kinematic mechanisms while reference [12] adopts parallel kinematic mechanisms. The motion along each direction can be independently measured and controlled in serial kinematic mechanisms. On the other hand, the parallel kinematic mechanism has many advantages including structural compactness, high stiffness and high accuracy. But the coupling of the cross axis motion, Complex kinematic equation and small workspace limits the wide application of this mechanism.So it is necessary to design the flexure mechanism to decouple the motion of parallel nanopositioning stage. The objective of this work is to devise a new decoupled XYZ compliant parallel stage with decoupled flexure joint.The flexure joint has many advantages such as no backlash,no wear, smooth and continous displacements and almost linear displacement relationship between the input and output. The flexure joints are classified into single axis flexure hinges, two axis flexure hinges and multiaxis flexure hinges. The analysis of right circular notch flexure hinge which is the single axis flexure hinges is conducted by Paros and Weisboard in reference[14].This right circular flexure hinge has been widely used in science and engineering applications like atomic force microscopy scanner [15].parallel micro manipulator[16].In addition parallel flexure stages with multiple degrees of freedom are widely used in micro/nano positioning .It provide efficient tool in precision engineering applications such as micro scanning [21],X-ray lithography [22],micro/nano assembly[23].A 5 DOF Flexure stage with module of 2xT-R,1-T and the interface of 3XT-R-RT is produced in [20].a compact 3-PPPRR XYZ CPMs without overlapping SCs [24] .

II. LITERATURE REVIEW

Organization: Section A, summarizes the most common topologies of compliant mechanism for displacement amplification purposes.In this section flexure hinge design designs, within the compliant mechanisms are also reviewed. Section B, Summarizes the different applications in single direction, planar, spatial motion mechanisms (XYZ stages).Section C, Synthesis and analysis methods are reviewed.

A. Review of the most common topologies of compliant motion amplifiers (CMA) :

Ouyang et.al 2008, presented and compared the most popular topologies of Compliant motion amplifiers used in integration with PZT actuators for micro motion applications [35].Different topologies such as bucking beam topology, lever arm topology, double lever arm topology, parallel four bar topology, double symmetric four bar topology,symmetric five bar topology are discussed. Buckling beam topology consists of long slender beam that buckles due to axial compressive force when the force exceeds a critical value.Bharti S.et.al 2003, proposed several amplifier designs based on the buckling principle. However two drawbacks are associated with an amplifier based on buckling beam topology are overall large dimensions as compared to others and the driving force should be large enough for buckling to be produced [38]. Rue et.al 1997, proposed the topology of parallel

four bar structure to improve the stiffness and its natural frequency of the mechanical amplifiers and deals with lateral displacement problem of lever arm structure. This problem can be resolved by implementation of double symmetric four bar structures .The double symmetric four bar topology is used to amplify the input displacement generated by the PZT actuators. The drawback of it is relatively low stiffness and low NF which may limit their industrial application.

Ouyang et.al 2008 developed the new symmetric five bar topology in which combination of symmetric four bar topology and a lever arm topology. It can significantly increase the system stiffness hence the structure's natural frequency with large amplification ratio [35].Xu et.al 1996, have presented the application of some fundamental compound bridge amplifier topologies which utilizes the three basic amplifying elements of simple lever, bridge and four bar linkage amplifiers eg.symmetric structure of a bridge displacement amplifier provides with a higher gain and linear output motion for precision oriented applications. Alternatively the four bar linkage flexure hinged amplifier is capable of producing the large output displacements for both precision and high displacement oriented applications. The simple lever flexure hinge based displacement amplifier is able to produce the large output displacement and having highest efficiency due to less hinges than the other two topologies. Also effect of geometric profiles of the flexure hinges on the performance of the flexure hinged displacement amplifiers. Different hinge profiles such as elliptical and corner fillted, circular hinge designs are analysed and compared [37].

B. Design and analysis of Single motion amplifiers, XY amplifiers,3D motion amplifiers :

Xu et.al 2011,investigated the compact size flexure based compound bridge type (CBT) displacement amplifier for piezoelectric drives. The CBT design is having large amplification ratio and large lateral stiffness which makes it suitable for actuator isolation and protection than the ordinary bridge type amplifiers. The CBT amplifier is optimized for a large resonance frequency subject to other performance constraints. Since the developed CBT model is capable of generating the output displacement over 1mm which is suitable for development of micro/nano positioning stages with a cubic millimeter sized workspace. It utilizes the right circular flexure hinge however, for this model it is also suggested that other hinge geometries can be implemented [31].Polit et.al 2011 presented a high bandwidth (i.e. NF) X Y nanopositioning system. The developed system is designed to achieve a high NF with minimizing the parasitic motion. The structure of the device is based on the parallel kinematic mechanism, which features two parallel independent kinematic chains. Each kinematic chain consisted of a prismatic joint connected to PZT actuator and a parallelogram hybrid flexure mechanism connected to the end effector of the device. Kinematic and dynamic analysis of the mechanism shows that the compliant structure of the stage possessed a high NF and decoupled motion in XY directions.The proposed mechanism can be employed the applications in high throughput nanoscale metrology, imaging and manufacturing [32].A.Eskandari &P.R.Ouyang et.al 2013, proposed XY planar motion compliant mechanical amplifier based on the symmetric five bar topology .Detailed FEA of static and dynamic characteristics of the proposed XY CMDA design is provided and the optimization is carried out to increase the amplification ratio with the minimum compromise in the natural frequency are discussed.Xu et.al 2012 designed and developed a new flexure based dual stage system which features a new decoupling design to minimize the interference behavior between the coarse motion generator and the fine motion generator stages

of the device.the output displacement of the mechanism is guided by the compliant mechanism which consists of eight right circular hinges [16].Ouyang et.al 2011 presented a spatial hybrid motion compliant mechanism based on symmetric five bar topolog]y. In this study, a spatial hybrid motion mechanism with the 3 DOF is developed which is capable of combining the macro and micro motions through only one complaint mechanism. The integral compliant structure of the proposed mechanism helped to eliminate the coupling interaction between the macro motion and the micro motion [34]. Li and Xu et.al 2011 designed and developed a totally decoupled Piezo driven XYZ flexure parallel micro positioning stage (TDPS) for micro/nano manipulation. In the research XYZ TDPS with displacement amplifier and simple architecture for the ease of the manufacturing. The proposed design of an XYZ stage with decoupled output motion by eliminating the cross axis coupling errors between the X,Y and Z directional translational and parasitic rotation errors around the axes .the right circular hinges were employed for the design. It is suggested that the other hinge geometries compatible to the mechanism can be implemented [30].Shorya Awtar et.al 2014 proposed novel parallel kinematic flexure mechanism which provides highly decoupled motions along the three translational directions X,Y and Z and have high stiffness along three rotational directions. Geometric decoupling ensures large motion range along each translational direction and enables integration with large stroke ground mounted linear actuators [46]. X.Zhang,Qingsong Xu, 2015,presented the design of new compact parallel flexure stage with three DOFs.Bridge-principle is proposed by a serial connection of two fundamental bridge amplifiers and then analytical study of amplifiers in terms of two stage amplifiers is conducted by performing the Finite element analysis simulations . PPR flexure joint is demonstrated to reduce the cross axes error. Due to large amplification ratio and flexures, two stage amplifiers is then employed to devise an XYZ parallel stage with decoupled motion. Driven by three low voltage piezoelectric stacks, the XYZ stage provides larger decoupled motions by using the two stacked amplifiers which connects the actuators and output platform with PPR joint [47].

C. Synthesis and analysis methods:

Howell et.al 2001, presented rigid body kinematic synthesis approach which is useful when a compliant mechanism is to be used to perform a traditional rigid body mechanism task, such as path or motion generation, without concern for the energy storage in the flexible members Howell & Midha et.al, 2001 presented the pseudo-rigid body model (PRBM) approach to model the deflection of flexible members using rigid body components which has equivalent force-deflection characteristics. Different types of compliant segments require different pseudo-rigid models that predict the deflection path and force-deflection relationship of a flexible segment. Howell et.al.2001 discussed synthesis with compliance approach which accounts for energy storage. With this type of synthesis, the unique characteristics inherent in compliant mechanisms may be used to design mechanisms with specified energy storage characteristics. The synthesis equations include not only the rigid body loop closure equations from the pseudo-rigid body model, but also include equations dealing with the desired energy storage relationships [39].Jensen and Howell et.al.1999, discussed the kinematic geometry of the mechanism is determined, the structural properties of the flexible members may be chosen as per the allowable stresses and input requirements. The synthesis problems in which rigid-body are applied directly to the pseudo-rigid body model will hereafter be referred to as rigid-body replacement synthesis. If

only the kinematics of the mechanism is an issue, it may be called kinematic synthesis. The topological design of compliant mechanism is then solved as a problem of material distribution using the Optimality Criteria method as discussed by Lau &Du 2001, Lin and Shih 2002.Unlike traditional optimization, and topological optimization does not require the explicit definition of optimization parameters [19].There are different emerging approaches to design compliant mechanisms such as pseudo-rigid-body-model (PRBM) approach, innovative design approaches such as the constraint-based design (CBD) approach, the screw theory based (STB) approach, the freedom and constraint topology (FACT) approach and the building-block synthesis (BBS) approach. Compliant mechanisms obtained using different design approaches can be classified into three categories: lumped-compliance mechanisms such as that in Li'work ,distributed-compliance mechanisms such as that in Awtar's work .If lumped compliance is adopted in the PRBM approach, a limited motion range is produced, but if distributed compliance is used, a relatively large motion range can be generated [40].M.jia,R.P.Jia et.al 2015,presented an based on parameterized compliance for type synthesis of flexure mechanism with serial, parallel or hybrid topologies .The parameterized compliance matrices are derived for commonly used flexure elements which are significantly influenced by flexure parameters including material and geometric properties. Different parameters of flexure elements generate different degrees of freedom (DOF) characterstics of types. Enlightened by the compliance analysis of flexure elements, parameterization approach help to analyse and synthesize flexure mechanisms with case study as serial chains, parallel chains and combination of hybrid chains [48]. Alejandro E.Albanesi et.al 2010,presented brief overview and comparisons of methods applied in the design of compliant mechanisms.Several methods have being conceived to analyse and design the mechanisms which gain part of their motion from the deflection of flexible members[49].

III. CONCLUSION

Compliant motion amplifier offers the ideal choice to overcome the drawback of PZT actuators in precise positioning applications.In the present study,use of various topologies for the displacement amplification purpose along with the effect of various hinge profiles on the static and dynamic performances of Compliant motion amplifier (CMA) i.e.amplification ratio,natural frequency etc.are reviewed.The static and dynamic performance of CMA in case of planar & spatial motion mechanisms i.e.XYZ precise positioning stages are studied in detail. The future work aimed to design and develop compliant motion amplifier (CMA) based XYZ positioning stage with desired amplification and achieving perfectly decoupled motion while maintaining the high natural frequency of the mechanism.

IV. REFERENCES

[1]. E.S.Ferguson ,Kinematics of Mechanisms from the Times of Watt .washington,DC(USA):The museum of History and technology,paper No.27,pp.185-230,1962.

[2]. B.A.Gozen and O.B.Ozdoganlar,"Design and evaluations of mechanical nanomanufacturing system for nano milling,"Precis.Eng.,Vol.No 36.1,pp 19-30,2012.

[3]. Y. Tian, B. Shirinzadeh, and D.Zhang, "Design and dynamics of a 3-DOF flexure-based parallel mechanism for micro/nano manipulation," Microelectronic Engineering, vol. 87, pp. 230-241, 2010.

[4]. P. F. Indermuehle, C. Linder, J. Brugger, V.P. Jaecklin, and N.F. de Rooij, "Design and fabrication of an overhanging xy-microactuator with integrated tip for scanning surface profiling," Sensors and Actuators A: Physical, vol. 43, no. 1–3, pp. 346–350, 1994.

[5]. H. T. H. Chen, W. Ng, and R. L. Engelstad, "Finite element analysis of a scanning X-ray microscope micro positioning stage," Review of Scientific Instruments, vol. 63, no. 1, pp. 591–594, 1992.

[6]. F. Beyeler, A. Neild, S. Oberti, D. J. Bell, Y. Sun, J. Dual, and B. J. Nelson, "Monolithically fabricated microgripper with integrated force sensor for manipulating microobjects and biological cells aligned in an ultrasonic field," J. Microelectromech. Syst., vol. 16, pp. 7-15, 2007.

[7]. S. Thalhammer, "Laser micro-tools in cell biology and molecular medicine," Laser Phys., vol. 13, no. 5, pp. 681–91, 2003.

[8]. Y. Qin, Y. Tian, and D. Zhang, "Experimental Investigation of Robust Motion Tracking Control for a 2-DOF Flexure-Based Mechanism," IEEE/ASME Transactions on Mechatronics, vol. 19, no. 6, pp. 1737–1745, 2014.

[9]. K. B. Choi, H. J. Lim, G. H. Kim, and J. J. Lee, "A flexure-based scanner for a fully bidirectional operation driven by a differential piezo force," Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, vol. 228, no. 17, pp. 3186- 3199, 2014.

[10]. Bhagat, B. Shirinzadeh, L. Clark, P. Chea, Y. Qin, Y. Tian, et al.,"Design and analysis of a novel flexure-based 3-DOF mechanism," Mechanism and Machine Theory, vol. 74, pp. 173-187, 2014 .

[11]. B. J. Kenton and K. K. Leang, "Design and control of a three-axis serial-kinematic high-bandwidth nanopositioner," Mechatronics, IEEE/ASME Transactions on, vol. 17, pp. 356-369, 2012.

[12]. Q. Xu and Y. Li, "Design and analysis of a new singularity-free three prismatic revolute-cylindrical translational parallel manipulator," Proceedings of the Institution of Mechanical Engineers. Part C, Journal of Mechanical Engineering Science, vol. 221, no. 5, pp. 565-576, 2007.

[13]. D. Kang and D. Gweon, "Analysis and design of a cartwheel- type flexure hinge," Precision Engineering, vol. 37, pp. 33-43, 2013.

[14]. J.M. Paros, and L. Weisbord, "How to design flexure hinges," Machine Design, vol. 37, pp. 151–156, 1965.

[15]. D. Kim, D. Kang, J. Shim, I. Song, and D. Gweon, "Optimal design of a flexure hinge-based XYZ atomic force microscopy scanner for minimizing Abbe errors," Review of Scientific Instruments, vol. 76, p. 073706, 2005.

[16]. Q. Xu, "New Flexure Parallel-Kinematic Micro positioning System with Large Workspace," IEEE Transactions on Robotics, vol. 28, no.2, pp. 478-491, 2012.

[17]. S.T. Smith, V.G. Badami, J.S. Dale, Y. Xu, "Elliptical flexure hinges," Review of Scientific Instruments vol. 68, pp. 1474–1483, 1997.

[18]. N. Lobontiu, J.S.N. Paine, E. Garcia, and M. Goldfarb, "Cornerfilleted flexure hinges,"ASME Journal of Mechanical Design, vol.123, pp. 346–352, 2001.

[19]. K.B. Choi, H. Lee, and K. Min Young, "Cartwheel flexure-based compliant stage for large displacement driven by a stack-type Piezoelectric element," in Proc. of International Conference on, Control, Automation and Systems (ICCAS'07), 2007, pp. 2754-2758.

[20]. R.Murielle and C. Reymond, "A new concept of modular kinematics to design ultra-high precision flexure-based robots," Proc. 41st Int. Symp. of Robotics and 6th German Conf. on Robotics.

[21]. H. T. H. Chen, W. Ng, and R. L. Engelstad, "Finite element analysis of a scanning X-ray microscope micropositioning stage," Review of Scientific Instruments, vol. 63, no. 1, pp. 591–594, 1992.

[22]. B.A. Gozen, and O.B. Ozdoganlar. "Design and evaluation of a mechanical nanomanufacturing system for nanomilling," Precis. Eng.,vol. 36, no. 1, pp. 19–30, 2012.

[23]. G. Hao and H. Li, "Design of 3-Legged XYZ Compliant Parallel Manipulators with Minimised Parasitic Rotations," Robotica, vol. 33, no. 4, pp. 787 – 806, 2015.

[24]. P. F. Indermuehle, C. Linder, J. Brugger, V.P. Jaecklin, and N.F. de Rooij, "Design and fabrication of an overhanging xy- Microactuator with integrated tip for scanning surface profiling," Sensors and Actuators A: Physical, vol. 43, pp. 346– 350, 1994.

[25]. N. Lobontiu, E. Garcia, "Analytical model of displacement amplification and stiffness optimization for a class of flexure- based compliant mechanisms," Comput. Struct., vol. 81, pp. 2797– 2810, 2003.

[26]. H.W. Ma, S.-M. Yao, Li-Q. Wang, Z. Zhong, "Analysis of the displacement amplification ratio of a bridge-type flexure hinge," Sensors Actuators A, vol. 132, pp. 730–736, 2006.

[27]. G. Ye, W. Li, Y..Wang, X.-F. Yang, L. Yu, "Kinematics analysis of bridge-type micro-displacement mechanism based on flexure hinge," Proceedings of the 2010 IEEE International Conference on Information and Automation, 2010, pp. 66–100.

[28]. K.q. Qi, Y. Xiang, C. Fang, Y. Zhang, and C.-s. Yu, "Analysis of the displacement amplification ratio of bridge-type mechanism",Mechanism and Machine Theory, vol. 87, pp. 45-56, 2015.

[29]. S. Awtar and A. H. Slocum, "Constraint-based design of parallel kinematic XY flexure mechanisms," J. Mech. Des., vol. 129, no. 8, pp. 816–830, 2007.

[30]. Y. Li and Q. Xu, "A Totally Decoupled Piezo-Driven XYZ Flexure Parallel Micropositioning Stage for Micro/Nanomanipulation," IEEE Transactions on Automation Science and Engineering, vol. 8, pp. 265-279, 2011.

[31]. X. Zhang and Qingsong Xu, Design of a New Flexure-Based XYZ Parallel Nanopositioning Stage, Proceedings of 2015 IEEE Conference on robotics and biomimetics,Zuhai china, December 6-9,2015.

[32]. Polit, S., & Dong, J. 2011.Development of a High-Bandwidth XY Nanopositioning Stage for High-Rate Micro-/Nanomanufacturing. IEE/ASME transactions on mechatronics,16 (4), 724-733.

[33]. Li Y.&Xu Q. 2011. A Totally Decoupled Piezo-Driven XYZ Flexure Parallel Micro positioning Stage for Micro/Nano manipulation. IEEE transactions on automation science and engineering, 8 (2), 265-279

[34]. Ouyang P. R. 2011. A Spatial Hybrid Motion Mechanism: Design and Optimization. Mechatronics, 21 (3), 479-489.

[35]. Ouyang P. R., Zhang W. J., & Yang, G. S. 2008. Micro-motion devices technology: The state of arts review. Int J Adv Manuf Technol, 463– 478

[36]. Ouyang P.R., Zhang W.J., Gupta, M. M. 2008. A New Compliant Mechanical Amplifier Based on a Symmetric Five- Bar Topology. Journal of Mechanical Design, 130 (10).

[37]. Xu W& King T. 1996, Piezoactuator displacement amplifiers: flexibility, accuracy, and Stress considerations, Journal of precision Engineering, 19 (2), pp. 4-10.

[38]. Bharti S, Frecker M. 2003. Compliant mechanical amplifier design using multiple optimally placed actuators.2003, ASME International Mechanical Engineering Congress,pp. 1-8. Washington, D.C.

[39]. Howell, L. L. 2001. Compliant Mechanisms. New York: Wiley and Sons.

[40]. Kim, C.J., Moon, Y. M., Kota, S., 2008, "A Building Block Approach to the Conceptual Synthesis of Compliant Mechanisms Utilizing Compliance and Stiffness Ellipsoids", Journal of Mechanical Design, 130(2): 022308

[41]. Kim, C., 2009, "Design Strategies for the Topology Synthesis of Dual Input-Single Output Compliant Mechanisms", Journal of Mechanisms and Robotics, 1(4): 041002.

[42]. Park, S. R., & Yang, S. H. (2005). A mathematical approach for analyzing ultra precision Positioning system with compliant mechanism. Journal of Materials Processing technology, 164-165, 1584 - 1589.

[43]. Yong Y. K., & Lu, T.-F. 2009. Kinetostatic modeling of 3- RRR compliant micro-motion stages with flexure hinges. Mechanism and Machine Theory, 38 (6), 1156–1175.

[44]. Kim, C.J., Moon, Y. M., Kota, S., 2008, "A Building Block Approach to the Conceptual Synthesis of Compliant Mechanisms Utilizing Compliance and Stiffness Ellipsoids", Journal of Mechanical Design, 130(2): 022308.

[45]. Kim, C., 2009, "Design Strategies for the Topology Synthesis of Dual Input-Single Output Compliant Mechanisms", Journal of Mechanisms and Robotics, 1(4): 041002.

[46]. Shorya Awtar 2013, An XYZ Parallel-Kinematic Flexure Mechanism With Geometrically Decoupled Degrees of Freedom, Journal of mechanisms and robotics, Vol.No-5,pp.10-17.

[47]. Xiaohi Zhang, Q.Xu 2015,Design of a new flexure based XYZ parallel nanopositioning stage, proceedings of 2015 IEEE conference on robotics and Biomimentics Zhuhai,china December 6-9,2015.

[48]. M.jia,R.P.Jia et.al,2015,A compliance based parametrization approach for type synthesis of flexure mechanisms 2015,Vol.no 7 .

[49]. Alejandro E.Albanesi et.al 2010,A review on design methods for compliant mechanisms ,Argentia 15-18,Nov.2010 Mecca computational Vol XXIX,pp 59-72.

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Artificial Intelligence : Impact-Industrial and Defence Sector Perspective

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ABSTRACT

Artificial intelligence (AI) has the potential to completely transform a variety of facets of contemporary society, including national security, transportation, and healthcare. However, there are important hazards to strategic stability associated with the development of AI. The quick development of AI technology might trigger a new weapons race, strain ties between nations, and raise the possibility of unintentional or deliberate conflict. This essay discusses the various hazards that AI poses to strategic stability and considers viable countermeasures.

Keywords: Artificial intelligence (AI), healthcare, Science, Industrial and Defence sector.

I. INTRODUCTION

Amid excitement and apprehension, artificial intelligence (AI) is quickly becoming a transformative technology. On the one hand, AI holds the promise of revolutionizing a variety of facets of contemporary society, including national security, transportation, and healthcare. The rapid growth of AI, however, poses serious threats to geopolitical stability. It is impossible to overlook the potential impact of AI on world affairs, the likelihood of conflict, and weapons control agreements. This essay examines the various hazards that AI poses to strategic stability and suggests feasible countermeasures.

Artificial intelligence (AI) has had a significant impact on both the industrial and defence sectors. Here are some perspectives on its impact:

Transportation:

AI is being applied to transportation networks to increase efficiency and safety. Vehicles that can operate autonomously are being created, lowering the possibility of human error. Traffic management systems that use AI to optimise traffic flow can cut down on congestion and trip times.

Manufacturing:

Processes are being optimised and quality control is being improved with AI. Predictive maintenance algorithms, for instance, can spot possible equipment faults before they happen, cutting down on maintenance expenses and downtime. Before a product reaches the user, faults can be found with AI-powered quality control systems.

Although AI has a mainly favourable effect on these sectors, there are worries about potential employment displacement and ethical issues like bias in decision-making algorithms. While investigating the advantages of AI, it is crucial to address these issues.

Predictive analytics can now be performed in real-time, allowing businesses to make choices and take action more quickly than ever before thanks to the development of sophisticated AI algorithms. This is especially helpful in sectors like manufacturing and logistics, where even modest efficiency gains can result in large cost savings.

For example, in logistics industries Predictive analytics driven by AI can be used in the manufacturing sector to spot possible equipment faults before they happen, enabling maintenance teams to take preventative action to avoid downtime and lower maintenance costs. Predictive analytics driven by AI can be utilised in the logistics sector to optimise delivery routes, lowering transportation costs and speeding up deliveries.

The creation of more effective supply chain management systems is another area where AI can assist in addressing organisational difficulties. AI-powered solutions can assist businesses in identifying inefficiencies and making better educated decisions about inventory management, production scheduling, and distribution by analysing data on suppliers, inventory, and customer demand.

Industrial Sector:

1. Increased Efficiency: AI-driven automation has helped streamline the production process, making it faster and more efficient.
2. Lowered Costs: By automating tasks that were previously done by humans, AI has helped companies save on labor costs.
3. Better Quality Control: AI technologies like machine learning and computer vision have improved quality control and reduced the chances of defects in products.
4. Predictive Maintenance: AI-powered systems can predict machine and equipment failures, saving companies time and money on unplanned downtime.
5. Improved Customer Experience: AI can be used to provide personalized recommendations, making customer experiences more enjoyable and increasing customer loyalty.

Defense Sector:

1. Improved Intelligence Gathering: AI technologies like predictive analytics and machine learning can analyze vast amounts of data quickly and accurately, providing better intelligence to soldiers and commanders.
2. Autonomous Systems: AI-driven autonomous systems like unmanned aerial vehicles (UAVs) have reduced the risk to soldiers in combat zones.
3. Cybersecurity: AI technologies can help detect and prevent cyber attacks on military networks and systems.
4. Improved Situational Awareness: Machine vision and predictive analytics can help soldiers better understand and respond to changing battlefield conditions.
5. Better Decision Making: AI can be used to analyse complex data and provide real-time decision support to commanders in the field.

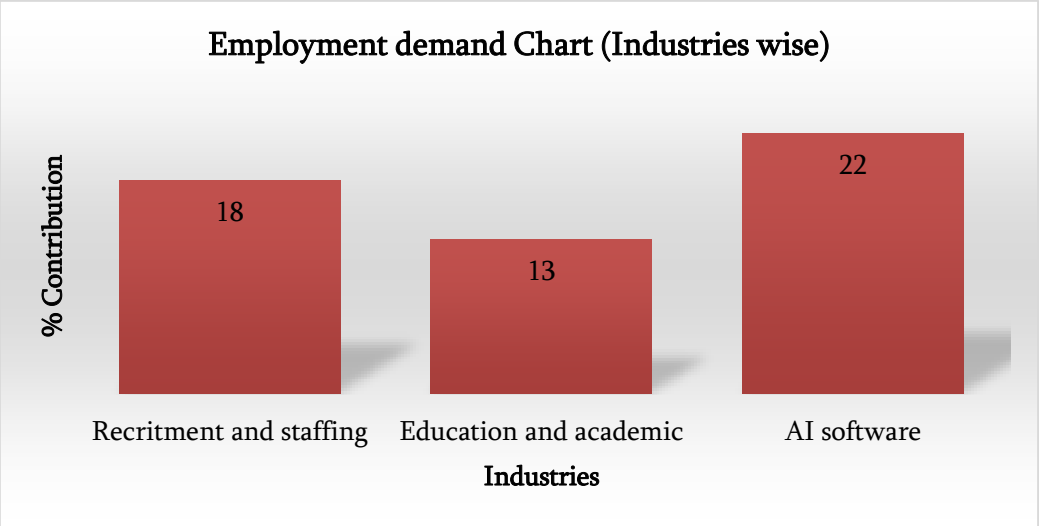

Figure1 : Contribution of Industries in GDP (1)

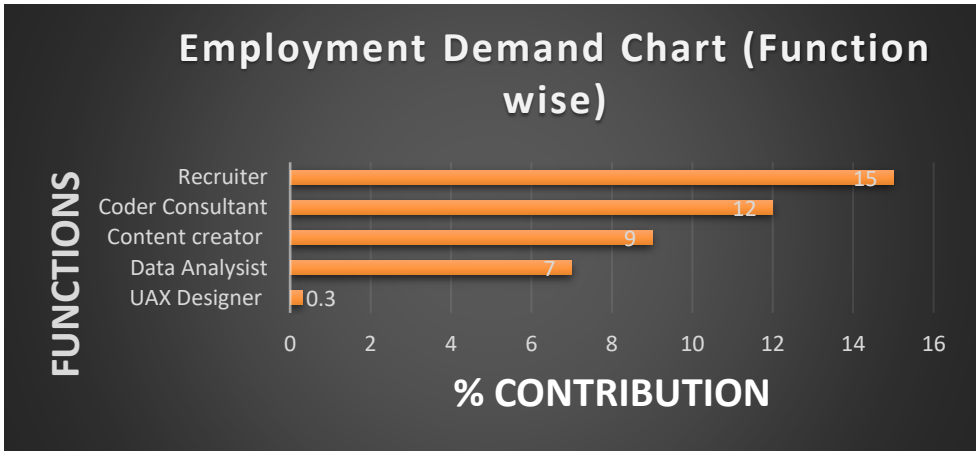

Figure2: Contribution in GDP function wise (2)

Near-nuclear misses throughout history highlight the value of human judgement in reducing the chance of error in calculation and perception (i.e., of another's intentions, redlines, etc.).

the propensity to employ force) between enemies during emergencies.[3] Despite these historical examples, the dangers of unpredictable AI-augmented autonomous systems operating in complex, dynamic, and possibly unknown contexts are still not fully understood by the world's defence communities.[4] China and Russia intend to integrate AI into unmanned aerial and underwater vehicles for swarming missions imbued with AI machine learning technology in order to avoid these hazards.[5] Data-link technologies for "bee swarm" UAVs have apparently been investigated by Chinese strategists, with a focus on network architecture, navigation, and anti-jamming military operations for attacking US aircraft carriers.[6]

Near-nuclear misses throughout history highlight the value of human judgement in reducing the chance of error in calculation and perception (i.e., of another's intentions, redlines, etc.).

the development of the Sea Hunter autonomous surface vehicle (ASV), a double outrigger that the US Navy is now testing to help with antisubmarine warfare missions (also known as submarine reconnaissance). [7] Some analysts have suggested that autonomous systems like Sea Hunter may make the underwater realm transparent, reducing the effectiveness of stealthy SSBNs as second-strike deterrents. But there is a lot of disagreement over whether this theory is technically feasible.[8]

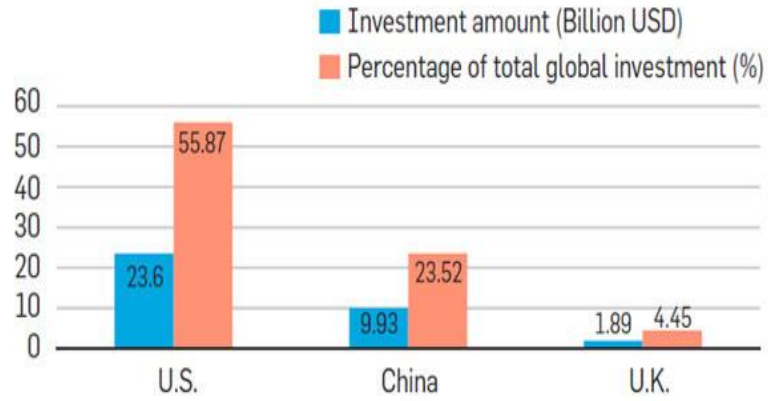

Figure 3. Comparison of the amount of investment in AI start-ups in the US, China, and the U.K. in 2020.[9]

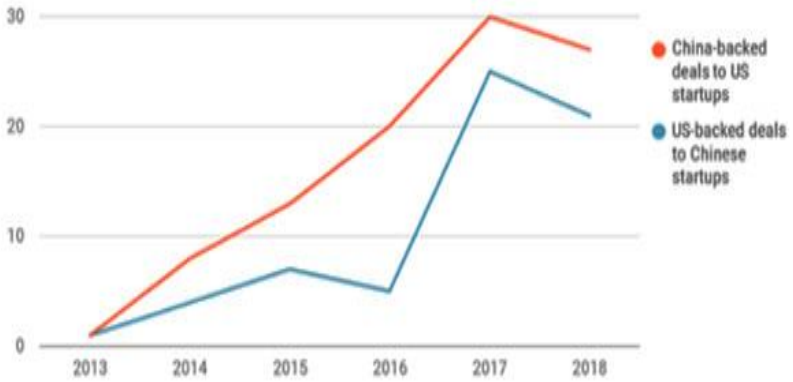

Figure 3. Cross- border AI deals continue despite scrutiny. [10]

The arm race:

The possibility of a new weapons race is one of the biggest concerns that artificial intelligence poses. The development of autonomous weapons and other AI-based military systems might become a new source of strategic instability as nations seek to develop the most cutting-edge AI technologies. As nations compete to develop AI-based military technology, the creation and use of these systems may accelerate as they try to outdo one another strategically. As a result, there may be a greater chance of confrontation and a new, challenging-to-control weapons race.

AI's ability to destabilise international relations is another danger it poses. The likelihood of unintentional or purposeful conflict could rise as AI-based systems become more sophisticated and incorporated into military

operations. For instance, an AI system can incorrectly interpret a perceived danger, causing unnecessary tension to rise. As an alternative, a nation can employ AI-based systems to attack an enemy first based on an incorrect assumption about what they intend. As nations look for opportunities to take advantage of alleged vulnerabilities in their adversaries' AI systems, the use of AI in military operations may also result in the breakdown of conventional deterrent methods.

Undermining arms Control Agreements:

Last but not least, the advancement of AI-based military technologies may jeopardise current arms control accords. It may be difficult to distinguish between offensive and defensive systems as nations develop and deploy autonomous weapons and other AI-based military systems, making it more difficult to verify compliance with arms control accords. Additionally, the concepts of arms control and the stability that these accords offer could be undermined by the employment of AI in military operations by making it simpler for nations to conduct surprise strikes

Conceptualizing military artificial intelligence (AI) involves thinking about how AI can be used to enhance military capabilities, while also considering the ethical and legal implications of its use. Here are some key points to consider:

1. Enhancing Military Capabilities: AI can be used to enhance military capabilities in a number of ways. For example, it can be used to analyze large datasets to identify patterns and insights that would be difficult for humans to detect. It can also be used to develop autonomous systems that can operate without human intervention, such as drones or vehicles. Additionally, AI can be used to improve decision-making in complex situations, such as in battle or during a crisis.
2. Ethical Considerations: The use of AI in military operations raises a number of ethical considerations. For example, there is a risk that AI could be used to make decisions about the use of force without proper human oversight. Additionally, the use of autonomous weapons raises questions about accountability and responsibility for their actions. There is also a risk that AI could be used to perpetuate bias or discrimination in military operations.
3. Legal Considerations: The use of AI in military operations also raises legal considerations. For example, there may be questions about the legality of using autonomous weapons under international law. Additionally, the use of AI in decision-making may raise questions about liability and responsibility for actions taken during military operations.
4. Human-Machine Teaming: To address some of these ethical and legal considerations, there is a growing focus on human-machine teaming, where humans and machines work together to achieve a common goal. This approach recognizes that humans have unique abilities, such as judgment and creativity, that cannot be replicated by machines.

Overall, conceptualizing military AI requires a thoughtful consideration of the potential benefits and risks of its use, as well as an understanding of the ethical and legal implications. By taking a human-centered approach to AI, it is possible to develop military capabilities that enhance the abilities of humans, while also ensuring that the use of AI is responsible and ethical.

II. CONCLUSION

In conclusion, the advancement of AI has the potential to transform many facets of contemporary life, but it also offers serious hazards to the continuity of strategic relations. Significant worries include the possibility of a new arms race, the instability of international relations, and the undermining of arms control accords. There are, however, actions that can be performed to lessen these dangers. more international rules and standards for the use of AI in military operations, more investment in research on AI safety and security, and increased international transparency and conversation are a few of these. By implementing these measures, we can make sure that the advancement of AI technology does not weaken but rather strengthens strategic stability.

III.REFERENCES

[1]. https://economictimes.indiatimes.com/jobs/hr-policies-trends/ai-a-bigger-threat-than-automation-to-millions-of-jobseekers/articleshow/100038528.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

[2]. https://www.forbes.com/sites/forbestechcouncil/2022/01/13/16-industries-and-functions-that-will-benefit-from-ai-in-2022-and-beyond/

[3]. Patricia Lewis et al., Too Close for Comfort: Cases of Near Nuclear Use and Options for Policy (London: Chatham House, Royal Institute of International Affairs, 2014), https://www.chathamhouse.org/.

[4]. Modeling interactions with other agents (especially humans) in either a competitive or a collaborative context is inherently problematic because human behavior is often unpredictable. Andrew Ilachinski, AI, Robots, and Swarms: Issues, Questions, and Recommended Studies (Arlington, VA: Center for Naval Analyses, January 2017), xv, https://www.cna.org/.

[5]. Jonathan Gates, "Is the SSBN Deterrent Vulnerable to Autonomous Drones?," The RUSI Journal 161, no. 6 (2016): 28–35, DOI: 10.1080/03071847.2016.1265834

[6]. Leslie F. Hauck and John P. Geis II, "Air Mines: Countering the Drone Threat to Aircraft," Air and Space Power Journal 31, no. 1 (Spring 2017): 26–40, https://www.airuniversity.af.edu/

[7]. Joseph Trevithick, "Navy's Sea Hunter Drone Ship Has Sailed Autonomously to Hawaii and Back amid Talk of New Roles," The Drive, 4 February 2019, https://www.thedrive.com/.

[8]. Elias Groll, "How AI Could Destabilize Nuclear Deterrence," Foreign Policy, 24 April 2018, https://foreignpolicy.com/

[9]. Jaing Yang, "AI Start-Ups in China", Communications of the ACM, November 2021, Vol. 64, No. 11.

[10]. "China is Starting to Edge Out the US in AI Investment", Research Brief, CBInsights, 12 February 2019.

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Characterization of Bio Fabricated Ti Porous Structure for Artificial Bone Application

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ABSTRACT

Hydroxyapatite (Hap) scaffold with moderate porosity designed for use in tissue engineering for bone structure prepared by Rapid Prototyping and thermal gradient process. Blend of coarse particle and fine particle 1µm-280µm is used. Microscopic pore channel is with 1mm diameter is created using CAD. Porosity of structure is maintained using process variable control to allow only surface diffusion.

Fuse Deposition Machine (FDM) is modified to fabricate Hap biomaterial for artificial prosthetics. In this technique there is no support structure required, in biomaterial fabrication by using three nozzle accompanied step heating arrangement biomaterial is directly deposited on substrate. It may be Alumina or Titanium temperature range changes. Main nozzle is provided with heating arrangement. Two nozzles provided for transient requirement one for Hap raw powder and second for solvent, binder and crosslinking agent.

Three stage heating with two laser source for gradual temperature change so transformation is faster.

Primary result shows mechanical properties and porosity is as per bone structure. The micro structural characterizations such as phase purity and composition of porous BCP granules were performed and verified by X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FT-IR) analysis. The chemical and the microstructure information of the Fabricated Hap were investigated by FT-IR (Fourier Transform Infra-Red), SEM (Scanning Electron Microscopy), X-ray Diffraction (XRD).

Result shows interconnected regular pores and uniformly distribution of Hap. There is covalent boding makes stronger adhesion to prosthetic. Using this technique, it is possible to produce scaffolds with mechanical and structural properties close to those of the natural bone and teeth. The prepared scaffold has an open, regular pattern and uniformly interconnected porous structure. Some extent problem of small Nano particle aggregate together is called Balling and product of different temperature solidify on the layer is called recasting is dominates the process. By optimizing the operating parameter this problem can be minimized.

Keywords: Rapid prototyping (RP), Biomaterial, Hydroxyapatite.

I. INTRODUCTION

Calcium phosphate-based bio ceramics have been used in medicine for 25 years because of their excellent biocompatibility, bioactivity and osteoconductive characteristics [1]. Hydroxyapatite (HA) and related calcium

phosphate ceramic materials have been widely used as implant materials due to their close similarity in composition and high biocompatibility with natural bone. In view of biocompatibility, hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) seems to be a suitable ceramic material for hard tissue replacement implants; It forms a direct bonding with the neighbouring bones [2].

In fact, the dense and porous HA have been vigorously investigated as implant materials for bone and tooth applications. It shows excellent biocompatibility with hard tissues and also with skin and muscle tissues [3].

Titanium (Ti), as one of the strongest and stiffest materials available, have the potential to strengthen and toughen HA, thus expanding the range of clinical uses for the material. However, challenges arise when trying to combine these two materials.

Perhaps, the greatest obstacle to successful production of HAp-Ti composite is the choice of appropriate fabrication conditions. This is particularly the case with rapid Prototyping (RP), when the process variables, mainly (atmosphere) is key, as it must enable the composite to retain the Ti and maintain HAp's stoichiometry and structure at high required for porous structure. Without water present in atmosphere, HAp tends to lose its hydroxyl (OH) group and may decompose to tricalcium phosphate (TCP) and tetra calcium phosphate (TTCP). For use in biological applications, it is important to prevent dehydroxylation and decomposition of HAp, as different calcium phosphate has different biological properties. *In vitro* studies have found that HAp is less soluble than other calcium phosphate phases [4, 5], and α- and β-TCP have been found to resorb faster *in vivo* than HAp [6].

Hydroxyapatite is bioactive, allowing bone cells to grow on its surface. It has been shown that bone growth on HA is greater than the amount of bone growth on an uncoated scaffold [7, 8]. This newly formed bone thus grows around the implant and holds it in place.

1.1 Need of biomaterial for implant.

Due to the poor mechanical properties of bulk HA ceramics, these cannot be used as implant devices. Accordingly, there has been much effort to improve the mechanical properties of the HA. The mechanical properties of HA can be improved significantly by additions of strong reinforcing agents. To be used as a reinforcing agent for the HA, the biocompatibility of second phase should be considered most importantly [9].

II. APPROACH

Theoretical modeling of process laser heating has been carried out to identify heat affected zone (HAZ) which will help in making strategy to switch on and off Laser so that there will be surface diffusion.

The Slurry (slips) were prepared by dispersing the HA powder in solvent (66%powder + 34% solvent by mass), using mechanical stirring. The dispersion behaviour of the HA particles was studied as a function of the pH of the slurry and with the addition of dispersing agent, organic (Ammonium Poly acrylate (NH_4PAA) (0.3% wt.). solution. This mixture is milled for 24 hrs. to get uniform distribution of particle size and viscosity.PH is maintained Approximately 10.

Dynamic light scattering technique is used for particle size and characteristics of the particle. In small size particle surface area is more and lower temperature of melting and bonding. but strongly influenced by inter particulate forces, high shrinkage.

Slurry is of polydispersity index of 0.273 and effective diameter of 918.5 nm.

Slurry prepared will pass through specially designed nozzle to operate at low pressure simultaneously low power Nd: YAG laser will melt target substrate Titanium partially so that inter particle slurry and Ti bonding begins(solid-solid) as soon as this primary laser switched off secondary CO_2 laser switched on which facilitates surface diffusion and consolidation.

While deposition Nd: YAG laser is used and secondary heating CO_2 laser is used which heats the layer upto1350ºC.While rapid heating with Nd: YAG and CO_2 laser enhances gas blowing, pH increment, which is accelerated by cross linking agents decomposition, provides better cross linking. Thus interconnected and well-established macro porous structures were produce easily and rapidly [10].

III. METHOD OF PREPARATION OF HYDROXYAPATITE

Figureno: 1 shows over view of slurry preparation heating arrangement for deposition of Biomaterial on substrate. Hydroxyapatite powder (sigma- Aldrich) of high resolution is used as raw material.

The slips were prepared by dispersing the HA powder in solvent (66%powder+34% solvent by mass), using mechanical stirring. The dispersion behavior of the HA particles was studied as a function of the pH of the slurry and with the addition of dispersing agent, organic (ammonium polyacrylate (NH_4PAA) (0.3% wt). solution. This mixture is milled for 24 hrs. to get uniform distribution of particle size and viscosity.PH is maintained Approximately 10.

Thermal gradient behavior is govern by Particle size distribution (PSD), green density milling time. Critical speed at nozzle and vertex tube is maintained in such a way that centrifugal force is equal to force by gravity,

PH & zeta Potential

The viscosity of the slip is related to the charges on the surface of the particle. When these particles have same sign they repeal each other and disperse the slip, reducing viscosity

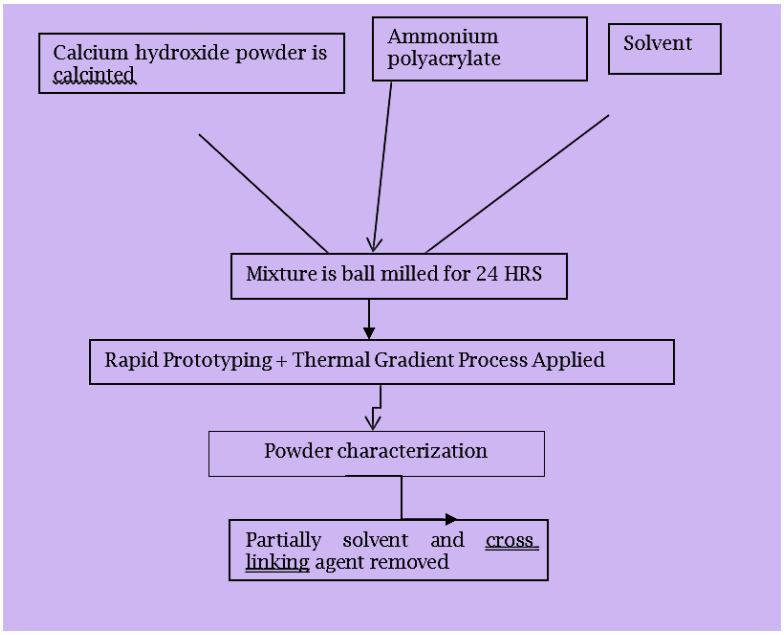


Fig.1 Overview of Rapid prototyping +Thermal gradient process and materials characterization.

IV. ELEMENTAL ANALYSIS

Fig.5 (d).The result of measurement of elemental composition (Ca and P content) and Ca/P molar ratio are summarized in Table 2. The bulk Ca/P molar ratio was determined as 1.71.

The measured Ca/P ratio for this produced Bio coating was higher than stoichiometric ratio (1.667) expected for a pure HAp (stoichiometric formula $Ca_{10}(PO_4)_6(OH)_2$) phase[18]. According to the XRD patterns that showed existence of **small amounts of CaO phase.**

Table no.1. Ca and P content in the fabricated hydroxyapatite bio coating and Ca/P ratio.

Element	Measured content (wt %)	Ca/P ratio
Ca	38.63	1.71
P	17.48	

V. DTA AND TGA ANALYSIS

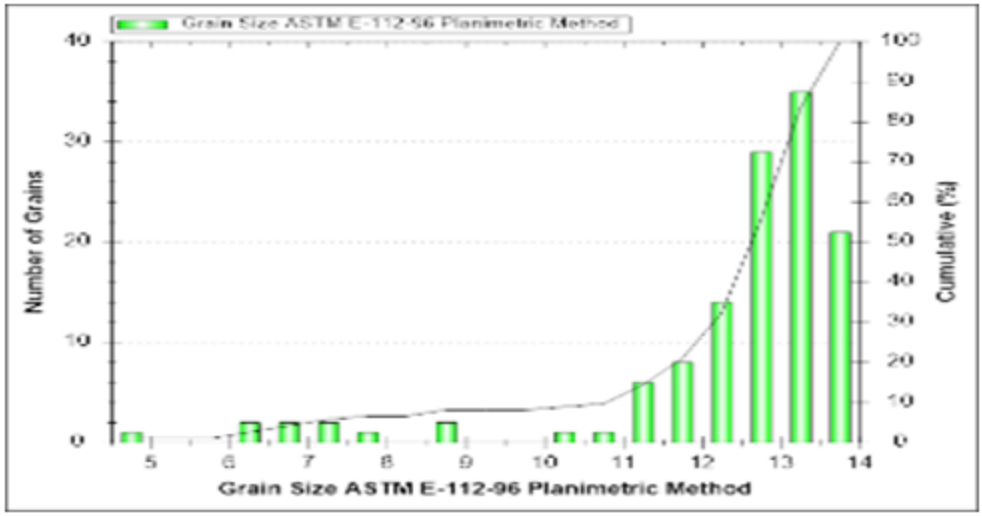
The DTA and TGA curves for the Hydroxyapatite slurry prepared are illustrated in Figure 5(e). The first endothermic region range from 90 to 1055 ºC with a peak at about 100^0cwhich is attributed to dehydration of sample loss of absorbed water. The weight loss in this region is 16%. With increasing temperature from 100 ºC to 800 ºC no peak has been observed, except a small weight loss of observed which is attributed to gradual dehydroxylation of HA Slurry. This can be explained by Equation (1) reaction [11]:

$$Ca_{10}(PO_4)_6(OH)_2 \rightarrow Ca_{10}(PO_4)_6(OH)_{2-2x}O_{x\blacksquare x} + xH_2O \qquad Equation\ (1)$$

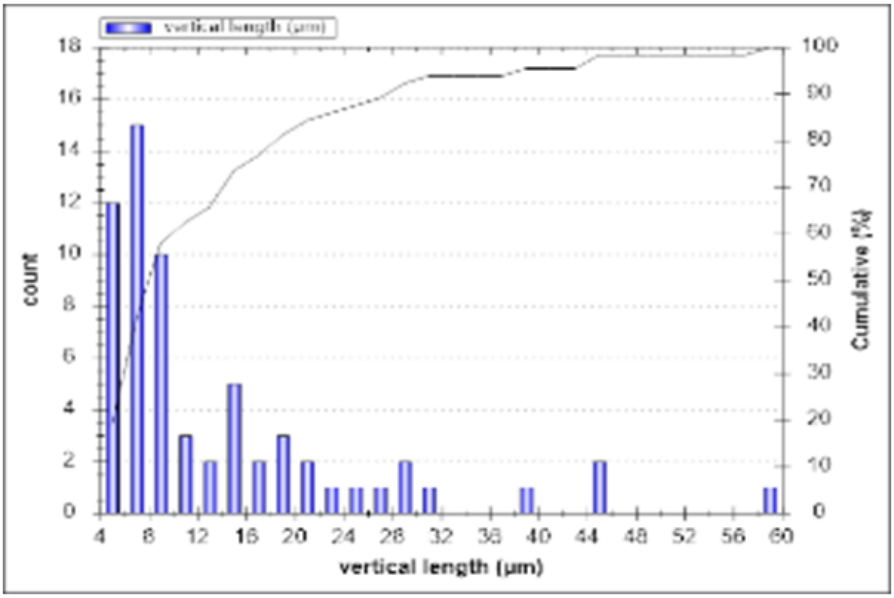
According to the equilibrium phase diagram of CaO/P_2O_5, HAP will decompose into TTCP and a TCP at 1350°C [12].To monitor the process and evaluation of chemical bonds is important in determining the bioactivity. The material with more lattice defect would be expected to be more reactive this fact has been verified experimentally.

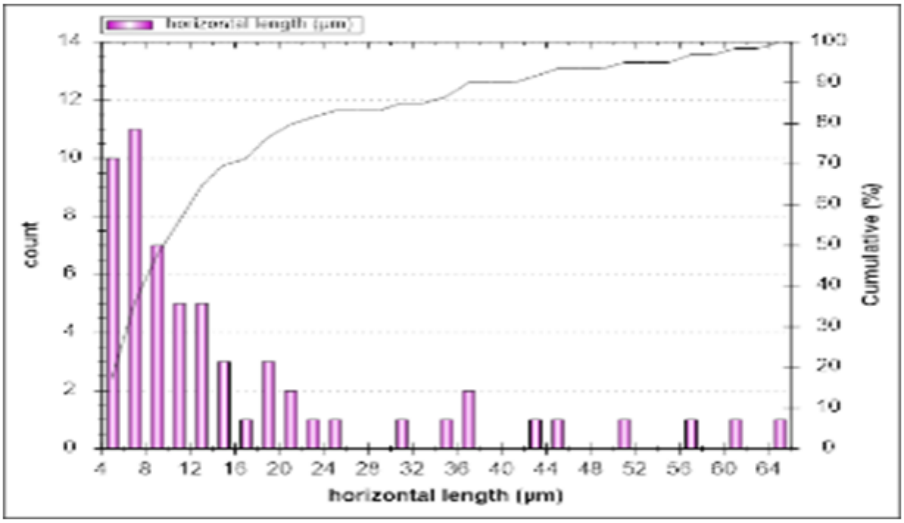
The high temperature and long duration will be resulting in crystalline structure. Therefore, to enhance the bioactivity low temperature and short duration is used for fabrication.

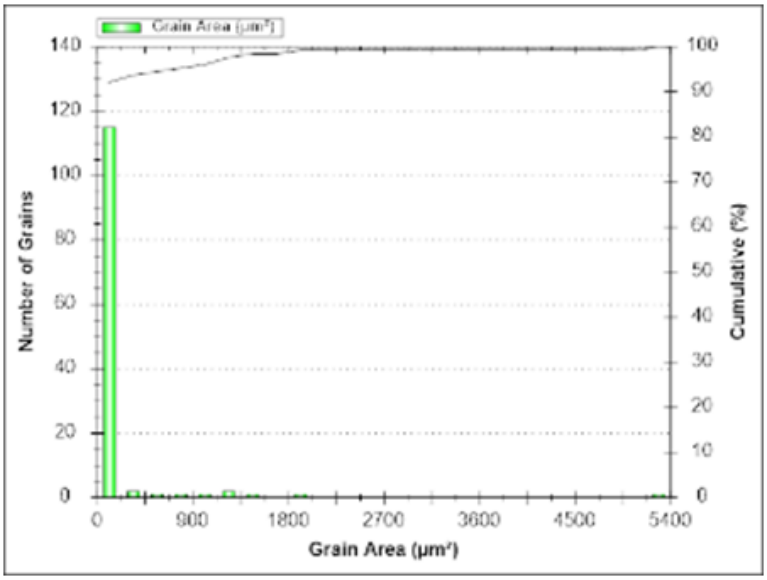
It's critical to find to find optimal operating parameters for fabrication of porous structure.

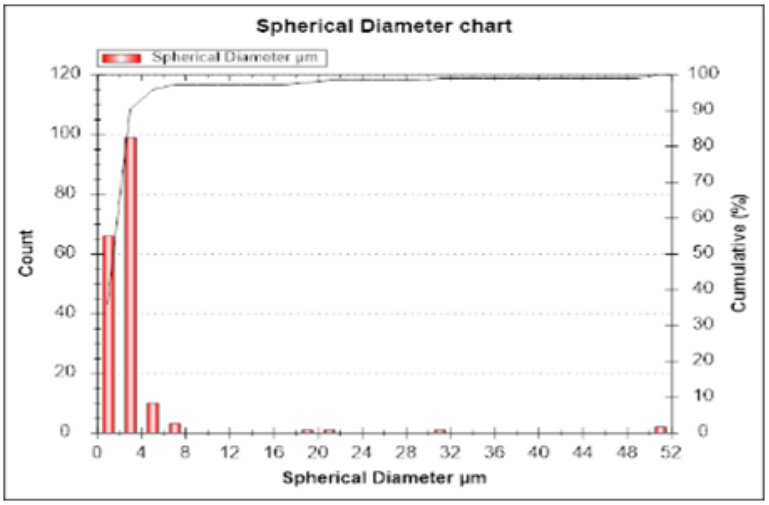


Sr.No.	Description	Variables	Estimated Values	Unit
1	Number of grains per mm²	Na	8.922	1/mm²
2	Average grain area	AM	125569.321	µm²
3	Average diameter of grains	DM	349.432	µm
4	Number of intercepts per mm	NL	3.306	1/mm
5	Mean linear intercept line	LM	311.298	µm
6	ASTM Grain Size Number	G	0.162	G









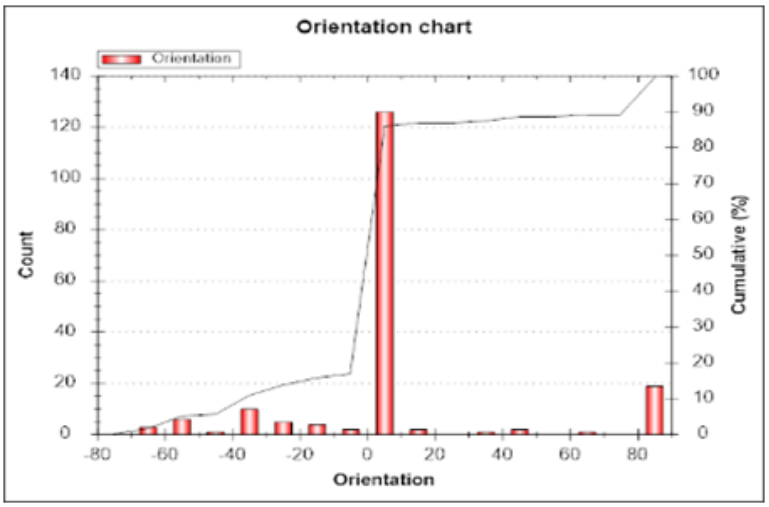


Figure 6. Grain Characterization.

VI. RESULT OF COATING CRYSTALLINITY AND PURITY

As indicated by examination of the XRD patterns, the % crystallinity of the coatings was found to increase with increasing heat treatment temperature, the as-sprayed coating having a crystallinity of 73% ±3% and the samples treated at above 1000°C having a crystallinity of between 90% ± 4 percent. It is clear from that the two stage heating procedure has allowed the amorphous content of the coating to recrystallise. The β-TCP peak is seen to disappear after 800^0c indicating that transformation to HA has occurred. This finding is consistent with the findings of Tsui et al. [13]

Table 2: comparison of active and stable layer

	Stable Base Layer	Active Surface layer
Crystallinity (%)	84.4	74.6
Purity (%)	98.1	96.1
Porosity (%)	8.9	47.3
Thickness (µm)	391.4	232.5

VII. CONCLUSION

This method tried to fabricate Porous Hap using Rapid Prototyping (RP) and thermal Gradient .IR spectra; SEM XRD shows interconnected pores and uniformly distribution of Hap. There is covalent bonding exist between HAP and titanium, zirconium. This covalent bonding makes stronger adhesion to prosthetic.

Rapid Prototyping (RP) and thermal Gradient can be evaluated for the preparation of porous scaffolds which have superior properties for bone tissue engineering.

1. The SEM & EDS indicate uniform and regular distribution of Hap, calcium carbonate, phosphate product. It's showing bonding with zirconium, titanium best interfacial bonding is getting with Alumina.
2. Therefore, the current modification method may provide a better feasible solution to fabricate HAP as one substitute material with high interfacial bonding and performance.

I. REFERENCES

[1]. Three-Dimensional Modeling of Selective Laser Sintering of Two-Component Metal Powder Layers, Tiebing Chen, Yuwen Zhang Journal of Manufacturing Science and Engineering, February 2006, Vol. 128 / 299-306

[2]. Representation of Porous Artifacts for Bio Medical Applications Craig Schroeder, William C. Regli, Ali Shokoufandeh, Wei Sun

[3]. Numerical Modeling of Cartilage as a Deformable Porous Medium, A.J.H. Frijns, J.M. Huyghe and E.F. Kaasschieter

[4]. KleinC. P. A. T., DeblieckhogervorstJ. M. A., WolkeJ. G. C., De GrootK. 1990Studies of the solubility of different calcium-phosphate ceramic particles in vitro. Biomaterials 11, 509–512. (doi:10.1016/0142-9612(90)90067-Z)

[5]. DorozhkinS. V.2009Calcium orthophosphates in nature, biology and medicine. Materials 2, 399–498. (doi:10.3390/ma2020399)

[6]. KellerE. E., TriplettW. W. 1987Iliac bone grafting: review of 160 consecutive cases. J. Oral Max. Surg. 45, 11–24. (doi:10.1016/0278-2391(87)90079-6)

[7]. P. Ducheyne, J. Beight, J. Cuckler, B. Evans and S. Radin, "Effect of calcium phosphate coating characteristics on early post-operative bone tissue ingrowth", Biomaterials, vol. 11, pp. 531-540, 10. 1990

[8]. K. Soballe, "The role of H-A-C in ingrowth prostheses", in Hydroxyapatite Ceramic, a Decade of Experience in Hip Arthroplasty, the Proceedings of a Two Day Symposium: Held at the Royal College of Surgeons of England on Thursday 2nd & Friday 3rd November 1995, R. Furlong, Ed., London: Furlong Research Foundation, 1996, pp. 57-67

[9]. L. L. Hench and O. Andersson, "Bioactive glasses", in An Introduction to Bioceramics L. L. Hench and J. Wilson, Eds., Singapore: World Scientific Publishing Co., 1993, pp. 41-62

[10]. Y. C. Tsui, C. Doyle and T. W. Clyne, "Plasma sprayed hydroxyapatite coatings on titanium substrates Part 2:optimisation of coating properties," Biomaterials, vol. 19, pp. 2031-2043, 11. 1998

[11]. Murray MGS, Wang J, Pontoon CB, Marquis PM. An improvement in processing of hydroxyapatite ceramics. J Mater Sci 1995; 30:3061-74.

[12]. Riboud PV. Composition and stability of appetites in the system CaO-P2O5-iron oxide-

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Crime Hotspot Prediction

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ABSTRACT

Crime is a complex social issue impacting a considerable number of individuals within a society. Preventing and reducing crime is a top priority in many countries. Given limited policing and crime reduction resources, it is often crucial to identify effective strategies to deploy the available resources. Towards this goal, crime hotspot prediction has previously been suggested. Crime hotspot prediction leverages past data in order to identify geographical areas susceptible to hosting crimes in the future. However, most of the existing techniques in crime hotspot prediction solely use historical crime records to identify crime hotspots, while ignoring the predictive power of other data such as urban or social media data. In this paper, we propose Crime, a platform that predicts and visualizes crime hotspots based on a fusion of different data types. Our platform continuously collects crime data as well as urban and social media data on the Web. It then extracts key features from the collected data based on both statistical and linguistic analysis. Finally, it identifies crime hotspots by leveraging the extracted features and offers visualizations of the hotspots on an interactive map. Crime prediction is of great significance to the formulation of policing strategies and the implementation of crime prevention and control. Machine learning is the current main stream prediction method. However, few studies have systematically compared different machine-learning methods for crime prediction. This paper takes the historical data of public property crime from 2015 to 2018 from a section of a large coastal city in the southeast of China as research data to assess the predictive power of several machine learning algorithms. Results based on the historical crime data alone suggest that the GEOFENCING model out performed CNN, random forest, support vector machine, naïve Bayes, and convolutional neural networks. Inaddition, the built environment data of points of interest (POIs) and urban road network density a reinput into tGEO FENCING model as covariates. It is found that the model with built environment covariates has a better prediction effect compared with the original model that is based on historical crime data alone. Therefore, future crime prediction should take advantage of both historical crime data and covariates associated with criminological theories. Not all machine learning algorithms are equally effective in crime prediction. Crime prediction is of great significance to the formulation of policing strategies and the implementation of crime prevention and control. Machine learning is the current main stream prediction method.

Keywords: Face Detection, CNN, Geo-Fencing

I. INTRODUCTION

Our aim, which we believe we have reached, was to develop a system that can be used by police or investigationdepartments to recognize criminalsby their faces. The method of face recognition used is fast, robust, reasonably simple,and accurate with relatively simple and easy-to-understand algorithms and techniques. The face is crucial for humanidentity. It is the feature that best distinguishes a person. Face recognition is an interesting and challenging problemand impacts important applications in many areas such as identification for law enforcement, authentication for bankingandsecuritysystemaccess, andpersonalidentificationamongothers.Face recognitionisaneasytaskfor humansbutit'sentirely different task for a computer. Spatiotemporal data related to public security have been growing at anexponential rate during recent years. However, not all data have been effectively used to tackle real-world problems.In order to facilitate crime prevention, several scholars have developed models to predict crime. Most used historicalcrime data alone to calibrate the predictive models. The research on crime prediction currently focuses on two majoraspects: crime risk area prediction, and crime hotspot prediction. The crime risk area prediction, based on the relevantinfluencing factors of criminal activities, refers to the correlation between criminal activities and the physical environment,whichare bothderivedfromthe"routineactivitytheory".Traditionalcrimeriskestimationmethodsusuallydetectcrime hotspots from the distribution of crime cases and assume that the pattern will persist in the following time periods.

Forexample,consideringtheproximityofcrimeplacesandtheaggregationofcrimeelements,theterrainriskmodeltend stouse crime-related environmental factors and criminal history data and is relatively effective for long-term, stable crimehotspot prediction. Many studies have carried out empirical research on crime prediction in different time periods,combining demographic andeconomic statistical data, land use data, mobile phone data, and criminal history data. Crimehotspot prediction aims to predict the likely location of future crime events and hotspots where the future events wouldconcentrate.Acommonlyusedmethodiskerneldensityestimation.Amodelthatconsiderstemporalorspatialaut ocorrelations of past events performs better than those that fail to account for the auto-correlation. Recently machinelearning algorithms have gained popularity. The most popular methods include K-Nearest Neighbour (CNN), randomforest algorithm, support vector machine (SVM), neural network and Bayesian model, etc. Some compared the linearmethods of crime trend prediction, some compared the Bayesian model and BP neural network and others compared thespatiotemporal kernel density method with the random forest method in different periods of crime prediction. Amongthese algorithms, CNN is an efficient supervised learning method algorithmConvolutional neural networks (CNN) havestrongexpansibilityandcanenhancetheirexpressionabilitywithaverydeeplayertodealwithmorecomplexclassif ication problems. Long Short-Term Memory (GEO FENCING) neural network extracts time-series features fromfeatures and has a significant effect on processing data with strong time series trends. This paper will focus on thecomparison of the above six machine learning algorithms, and recommend the best-performing one to demonstrate thepredictivepower withand withouttheuseofcovariates.

1.1 ProblemStatement:

Crime is one of the biggest and dominating problems in our society and its prevention is important. task. Daily thereare huge numbers of crimes committed frequently. This requires keeping track of all the crimes and maintaining adatabase for the same which may be used for future reference. The current problem faced is maintaining a proper datasetof crime and analyzing this data to help in predicting and solving crimes in the future. Crime data related to publicsecurity have been growing at an exponential rate during recent years. However, not all data have been effectivelyused to tackle real-world problems and for the detection of crime hotspots. Crime hotspot prediction aims to predict thelikelylocationoffuturecrimeeventsandhotspotswherethefutureeventswouldconcentrateNowadayspeopleareusingdifferent algorithms to obtain data on crime hotspots but they do not know which one is the most effective andaccurate.Thesolemotivebehindthetechnologyismakingcriminalidentificationeasierandthisprojectisasteptowardsachieving that goal. We developed a system that is very useful for any investigation department. The images capturedfrom the camera will be stored on the storage device. If some similarities are found in the photos, the website or web portalwillsendinformationandthedepartmentwillgetnotifiedregarding thesame.

1.2 Objective:

Crime prediction is of great significance to the formulation of policing strategies and the implementation of crimeprevention and control. Machine learning is the current mainstream prediction method. However, few studies havesystematically compared different machine-learning methods for crime prediction. This paper takes the historical data ofpublic property crime from 2021 to 2022 from a section of a large coastal city in the southeast of China as research datato assess the predictive power of several machine learning algorithms. Results based on the historical crime dataalone suggest that the GEO FENCING model outperformed CNN, random forest, support vector machine, naïve Bayes,and Convolutional neural networks. In addition, the built environment data of points of interest (POIs) and urban roadnetwork density are input into the GEO FENCING model as covariates.

It is found that the model with built environmentcovariates has a better prediction effect compared with the original model that is based on historical crime data alone.Therefore, future crime prediction should take advantage of both historical crime data and covariates associated withcriminological theories. Not all machine learning algorithms are equally effective in crime prediction. To detect facesfrom Camera footage and remove all unwanted backgrounds using pre-processing To recognizefaces of criminals bycomparinguploadedphotos(fromthe Camera)with the database.

II. METHODS

In [1], Piyush Chhoriya detects and recognized faces of the criminals in a video stream obtained from a camera in realtime. They have used Hear feature-based cascade classifiers in OpenCV approach for face detection. It is a machinelearning based approach where a cascade function is trained from a lot of positive and negative images. It is then used todetect objects in other images. Also, they used Local Binary Patterns Histograms (LBPH) for face recognition. Severaladvantages of this algorithm are: Efficient selection of features, Scale and

location invariant detector, instead of scalingthe image itself, scale the features. LBPH recognizer can recognize faces in different lighting conditions with highaccuracy. Also, LBPH can recognize efficiently even if single training image is used for each person. The real-timeautomated face detection and recognition system proposed would be ideal for crowd surveillance applications. DevendraKumar Tayal et.al [2], in the current paper, they propose an approach for the design and implementation of crimedetectionandcriminalidentificationforIndiancitiesusingdataminingtechniques.Ourapproachisdividedintosix modules,namely—dataextraction(DE),datapreprocessing(DP),clustering,Googlemaprepresentation,andclassification and WEKA implementation. First module, DE extracts the unstructured crime dataset from various crimeWeb sources, during the period of 2000–2012. Second module, DP cleans, integrates and reduces the extracted crimedataintostructured5,038crimeinstances.Theyrepresentthese instancesusing35predefinedcrimeattributes.Safeguardmeasures are taken for the crime database accessibility. Rest four modules are useful for crime detection, criminalidentification and prediction, and crime verification, respectively. Crime detection is analyzed using k-means clustering,whichiterativelygeneratestwocrimeclustersthatarebasedonsimilarcrimeattributes.Googlemapimprovesvisualization to k-means. Criminal identification and prediction is analyzed using CNN classification. Crime verificationof our results is done using WEKA. WEKA verifies an accuracy of 93.62 and 93.99 % in the formation of two crimeclusters using selected crimeattributes. Our approach contributes in the bettermentof the society by helping theinvestigatingagenciesincrimedetectionandcriminalsidentification,and thusreducingthecrimerates.

In [3], an automated facial recognition system for criminal database was proposed using known Principal ComponentAnalysis approach. This system will be able to detect face and recognize face automatically. This will help the lawenforcementstodetectorrecognizesuspectofthecaseifnothumbprintpresentonthescene.Theresultsshowthatabout80%ofinputphotocan be matchedwith thetemplatedata.

Thepurposeof paper [4]istopropose anewnotificationsystemusingfacedetectionandrecognitiontonotifythe houseowner of visitors by using the SMTP to send an email containing the names and phone numbers of those visitors. In thissystem, the camera detects and recognizes the persons in front of the door and then sends their personal information tothe host. The theoretical and practical aspects of this system are provided as follows. Paper “Face Recognition in Real-world SurveillanceVideoswithDeepLearningMethods’

In this [4] Parallel processing is used to reduce the time it takes to process an image by operating on each pixel one byone. This increases the speed of processing significantly and helps to perform video processing in a faster way. NVIDIAGraphicscardsareusedforparallel processingandtheparallelalgorithmisperformedon CUDACplatform.

In this paper [5] Robust face recognition in real-world surveillance videos is a challenging but important issue due to theneeds of practical applications such as security monitoring. While current face recognition systems perform well inrelatively constrained scenes, they tend to suffer from variations in pose, illumination or facial expression in real-worldsurveillance videos. In this paper, they propose a method for face recognition in real-world surveillance videos by deeplearning. First, a novel dataset from target real-world surveillance videos is

constructed automatically and incrementallywith the process of face detection, tracking, labeling and purifying. Then, a convolutional neural network with thelabeled dataset is fine-tuned. On the testing dataset collected from the campus surveillance system, the network afterfine-tuning achieves recognition accuracy of 92.1 %, which obviously outperforms the network without fine-tuning,which returns a recognition accuracy of 83.6% The Automatic Face Recognition system is widely applied in newtechnologies. This system works beyond the ability of human vision. The limited vision of human eye in identifying vastnumberofhumanfacesis overcomebytheautomaticfacerecognitionwithmanymoreadvantages.Thebasicpurposeofface recognition system is to compare the image video which is stored in a database with the image video in real timevariation.Manytechniqueshave beenusedinface recognitionsystem.

The paper [6] presented a survey of several techniques used in face recognition system, an approach to the detection andidentificationofhumanface.

Bernd Heisele Thomas Serre and Tomaso Poggio [7] presented a component-based framework for face detection andidentification. The face detection and identification modules share the same hierarchical architecture. They both consistof two layers of classifiers, a layer with a set of component classifiers and a layer with a single combination classifier.

Thecomponentclassifiersindependentlydetect/identifyfacialpartsintheimage.Theiroutputsarepassedthecombination classifier which performs the final detection/identification of the face. They describe an algorithm whichautomaticallylearnstwoseparatesetsoffacialcomponentsfor the detectionandidentificationtasks. Inexperimentstheycomparethedetectionandidentificationsystemstostandardglobalapproaches.

The experimental results clearly show that our component-based approach is superior to global approaches. Paper“Artificial Intelligence Review” [8] presented a comprehensive survey of various techniques explored for face detectionin digital images. Different challenges and applications of face detection are also presented in this paper.

At the end,different standard databases for face detection are also given with their features. Furthermore, they organize specialdiscussions on the practical aspects towards the development of a robust face detection system and conclude this paperwith several promising directions for future research. Face detection is one of the most relevant applications of imageprocessing and biometric systems. Artificial neural networks (ANN) have been used in the field of image processing andpatternrecognition.

There is lack of literature surveys which give overview about the studies and researches related to the using of ANN infacedetection.Therefore,the research“REVIEWOFFACEDETECTIONSYSTEMSBASEDARTIFICIALNEURALNETWORKS ALGORITHMS” [9] includes a general review of face detection studies and systems which based ondifferent ANN approaches and algorithms. The strengths and limitations of these literature studies and systems wereincluded also. The availability of large annotated datasets and affordable computation power has led to impressiveimprovements in the performance of CNNs on various object detection and recognition benchmarks. These, along with abetterunderstandingofdeeplearningmethods, havealsoledtoimprovedcapabilities ofmachine understandingoffaces.CNNs are able to detect faces, locate facial landmarks, estimate pose, and recognize faces in unconstrained images andvideo

In [10], author described the details of a deep learning pipeline for unconstrained face identification and verificationwhich achieves state-of-the-art performance on several benchmark datasets. Rajeev Ranjan et al propose a novel facedetector,DeepPyramidSingleShotFaceDetector(DPSSD),whichisfastandcapableof detectingfaceswithlargescalevariations(especiallytinyfaces).Theygivedesign detailsofthe variousmodulesinvolvedinautomaticface recognition:face detection, landmark localization and alignment, and face identification/verification. They provide evaluation resultsof the proposed face detector on challenging unconstrained face detection datasets. Then, they present experimentalresultsforIARPAJanusBenchmarksA,BandC(IJB-A,IJB-B,IJB-C),andtheJanusChallengeSet5(CS5).

III. RESULTS AND DISCUSSION

Face detection is the first step in developing a facial recognition system. This is where the system detects the face anddetermines whether it is indeed a human face or otherwise. It also determines whether thesystem can distinguishbetween the subject and the background thus allowing it to detect and recognize faces easily. Face disclosure is a majorstep in the development of face identification systems. Here the structure recognizes a face and chooses whether it is ahuman face or not. It also chooses whether the structure can recognize subjects and institutions along these lines,allowing faces to be recognized and seen with little or no problem. Object Detection using Hear feature-based cascadeclassifiers is an effective method proposed by Paul Viola and Michael Jones in the 2001 paper, "Rapid Object Detectionusing a Boosted Cascade of Simple Features". It is a machine learning based approach in which a cascade function istrainedfromalotof positiveand negativeimages. Itisthenusedtodetectobjectsinotherimages.Featureextractionandmatching dependon these activities. In addition to the main elements of points, another advanced type of parts is alsoprovided.Featureextractionstrategiesare usedtoremovecomponentswhileretainingthe amountofinformationthatcanreasonably be expected from working with large numbers of image data. A data set is provided in preparation forlisteningtothewaterfallalgorithm.Theimage wascreatedusingtheHaarcascade.

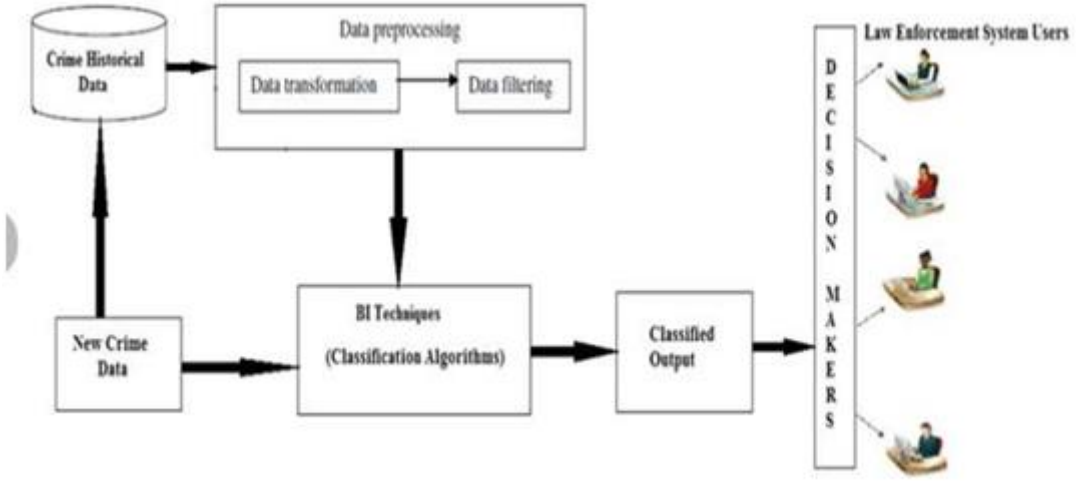

Figure4.1:Architectureoftheproposedsystem

ObjectdetectionusingaHaarfuse-baseheadingclassifierisapowerfulstrategybyPaulViolaandMichaelJonesintheir2001 paper “Fast Object Detection Using Boosted Cascade of Simple Functions”. It is a mindset based on artificialintelligence where a term paper is prepared from a huge pile of positive and negative images. It is then used to recognizeobjectsinother pictures.
Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) andnegative images (images without faces) to train the classifier. Then we need to extract features from it. For this, Hearfeatures shown in below image are used. They are just like our convolutional kernel. Each feature is a single valueobtained by subtracting the sum of pixels under the white rectangle from the sum of pixels under the black rectangle.Finds a large number of parts using the current estimated overall dimensions and area of each part. For each part score, Iwant to keep track of how many pixels are under the white and blurry square shape. To solve this problem, a key picturewasintroduced.Iworkonestimating the number ofpixels,andhow largethenumberof pixels can be for adevelopment that only contains 4 pixels. Nonetheless, of this huge number of people still hanging out there, the vastmajority are insignificant. For example, consider the picture below. The top line shows two unprecedented parts. Theselected part of the rule usually indicates that the eye area is blurrier than the nose and cheek area. The choice of the nextpart depends on the nature of the eyes being more blurry than the part under the nose. However, applying the opponent'sspear to the ball or anything else is pointless. So how do you choose the best parts out of over 160,000? Developed byAdaboost.

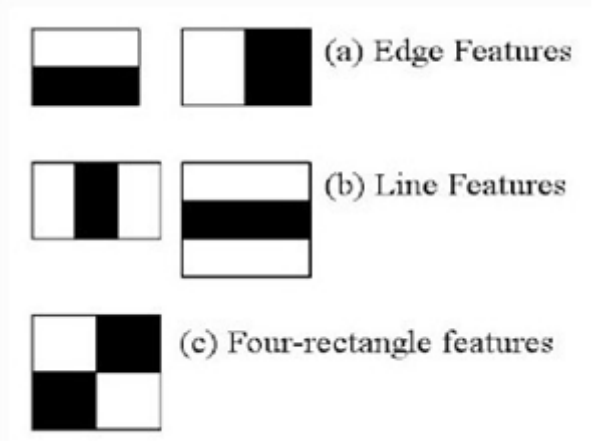

Figure4.2:ProblemAnalyses

Now all possible sizes and locations of each kernel are used to calculate plenty of features. For each feature calculation,we need to find the sum of the pixels under the white and black rectangles. To solve this, they introduced the integralimages. It simplifies calculation of the sum of the pixels, how large may be the number of pixels, to an operationinvolving just four pixels. But among all these features we calculated, most of them are irrelevant. For example, considerthe image below. Top row shows two good features. The first feature selected seems to focus on the property that theregion of the eyes is often darker than the region of the nose and cheeks. The second feature selected relies on theproperty that the eyes are darker than the bridge of the nose. But the same windows applying on cheeks or any otherplaceisirrelevant.Sohowdoweselectthebestfeaturesoutof 160000+features? ItisachievedbyAdboost.

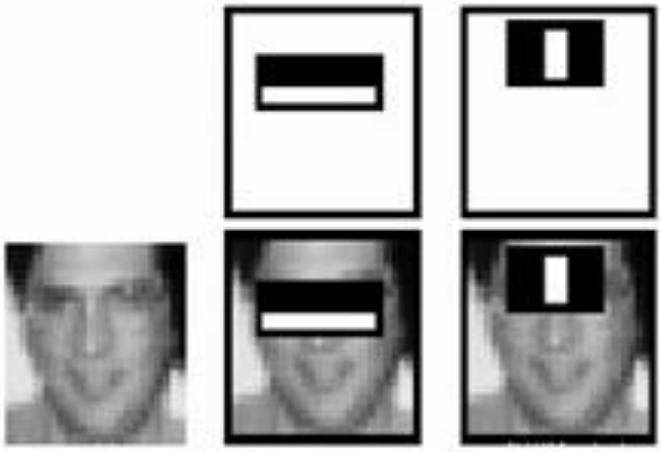

Figure4.3: Image Processing

For this, we apply each and every feature on all the training images. For each feature, it finds the best threshold whichwill classify the faces to positive and negative. But obviously, there will be errors ormisclassifications. We select thefeatures with minimum error rate, which means they are the features that best classifies the face and non-face images.(The process is not as simple as this. Each image is given an equal weight in the beginning. After eachclassification,weightsofmisclassifiedimagesareincreased.Thenagainsameprocessisdone.Newerrorratesarecalculated.Alsonewweights. The process is continued until required accuracy or error rate is achieved or required number of features isfound). Final classifier is a weighted sum of these weak classifiers. It is called weak because it alone can't classify theimage, but together with others forms a strong classifier. The paper says even 200 features provide detection with 95%accuracy. In an image, most of the image region is non-face region. So it is a better idea to have a simple method tocheck if a window is not a face region. If it is not, discard it in a single shot. Don't process it again. Instead focus onregion where there can be a face. This way, we can find more time to check a possible face region. For this theyintroduced the concept of Cascade of Classifiers. Instead of applying all the 6000 features on a window, group thefeaturesintodifferentstagesof classifiersandapplyone-by-one.(Normallyfirstfewstageswillcontainverylessnumberof features). If a window fails the first stage, discard it. We don't consider remaining features on it. If it passes, apply thesecond stage of features and continue the process. The window which passes all stages is a face region. How is theplan!!! Authors' detector had 6000+ features with 38 stages with 1, 10, 25, 25 and 50 features in first five stages. (Twofeatures in the above image is actually obtained as the best two features from Ad boost). According to authors, on anaverage, 10 features out of 6000+ are evaluated per sub-window. So this is a simple intuitive explanation of how Viola-Jonesfacedetectionworks.Readpaper for more details.

IV. CONCLUSION

When the observer is free, he can easily recognize the perpetrator from images and other evidence at the moment of badbehavior. However, if misconduct occurs without witnesses, a Facial identification system can be used to identify thebully. A facial identification system can be used to identify the bully. These models are

very useful for locatingperpetratorsafterbadbehavior.Theframeseesthevillaingraciouslydiscouragingbadbehavior.Thesystemrequiresthatcriminals in most cases do not go against the camera or avoid it. Certain faces may lack anything close to isolating moreobscurefacialfeatures,suchasthemeaningoftheeye.

V. REFERENCES

[1]. Piyush Chhoriya, “Automated Criminal Identification System using Face Detection and Recognition” InternationalResearch Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 10 | Oct 2019www.irjet.net p-ISSN: 2395-0072 © 2019, IRJET | Impact Factor value: 7.34 | ISO 9001:2008 Certified Journal |Page910

[2]. Tayal, D.K., Jain, A., Arora, S., et al. Crime detection and criminal identification in Indiausing dataminingtechniques.AI &Soc 30,117–127(2015). https://doi.org/10.1007/s00146-014-0539-6

[3]. Nurul Azma Abdullaha, Md. Jamri Saidi, Nurul Hidayah Ab Rahman, Chuah Chai Went, and Isredza Rahmi A.Hamid, "Face Recognition for Criminal Identification: An implementation of principal component analysis for facerecognition",The2ndInternationalConferenceonAppliedScienceandTechnology2017(ICAST'17)AIPConf.Proc.1891,020002-1–020002-6;https://doi.org/10.1063/1.5005335

[4]. AhmedAbdulQaderAl-BakeriAbdullahAhmadBasuhail“NotificationSystemBasedonFaceDetectionandRecognition: A Novel Approach” International Journal of Computer Science and Information Security (IJCSIS),Vol. 14, No. 4, April 2016 Ya Wang, Tianlong Bao, Chunhui Ding, and Ming Zhu, "Face recognition in real-worldsurveillancevideoswithdeep learningmethod,"2017 2ndInternationalConference

[5]. M. Shobana, V. R. Balasraswathi, R. Radhika, Ahmed Kareem Oleiwi, Sushovan Chaudhury, Ajay S. Ladkat, MohdNaved, Abdul Wahab Rahmani, "Classification and Detection of Mesothelioma Cancer Using Feature Selection-Enabled Machine Learning Technique", BioMed Research International, vol. 2022, Article ID 9900668, 6 pages,2022.https://doi.org/10.1155/2022/9900668

[6]. Ya Wang, Tianlong Bao, Chunhui Ding, and Ming Zhu, "Face recognition in real-world surveillance videos withdeep learning method," 2017 2nd International Conference on Image, Vision, and Computing (ICIVC), 2017, pp.239-243,DOI:10.1109/ICIVC.2017.7984553.

[7]. Ningthoujam Sunita Devi Prof. K. Hemachandran, “Automatic Face Recognition System using Pattern RecognitionTechniques:ASurvey”,InternationalJournalofComputerApplications(0975–8887)Volume83–No5,December 201310

[8]. BERNDHEISELETHOMASSERREANDTOMASOPOGGIO“AComponent-basedFrameworkforFaceDetectionandIdentification”InternationalJournalofComputerVisionc2006SpringerScience+BusinessMedia, LLC.ManufacturedintheUnitedStates.DOI:10.1007/s11263-006-0006-z

[9]. Ashu Kumar, Amandeep Kaur Munish Kumar “Artificial Intelligence Review” https://doi.org/10.1007/s10462-018-9650-2 Facedetection techniques:areview© SpringerNatureB.V. 2018

[10]. OmaimaN.A.AL-Allaf"REVIEWOFFACEDETECTIONSYSTEMSBASEDARTIFICIALNEURALNETWORKSALGORITHMS",TheInternationalJournalofMultimedia&ItsApplications(IJMA)Vol.6,No.1, February2014DOI:10.5121/ijma.2013.61011

[11]. RajeevRanjan,AnkanBansal,JingxiaoZheng,HongyuXu,JoshuaGleason,BoyuLu,AnirudhNanduri,Jun-ChengChen, Carlos D. Castillo, Rama Chellappa “A Fast and Accurate System for Face Detection, Identification, andVerification”,arXiv:1809.07586v1[cs.C

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Design and Implement Meta Search Engine Using Vector Space Model for Personalized Search

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ABSTRACT

This In this paper, we design & implement meta search Engine using vector space model for personalized search is the search engine that we tell the machine to learn users' interest, so the personalized meta search engine can help users to pick up the important information for them fast by using their interest keeping in the top of the database. Personalized search engine can sort the results according to users' interest, the results that user likes will be on the beginning of the search links. It is a better to use Vector Space Model to help us implement the personalized search engine. We use Vector Space Model to model the user and the results' interest, then we use cosine angel to get the similarity of these interest.

Keywords— User, Search Engine, Meta-search engine, Personalized, User interest

I. INTRODUCTION

The Internet can enable people to get the information more efficiently. On other way, with today's information knowledge in enormous forms, as well as network information into the exponential grows of the trend; the search engines are more essential in our life. Because of the strong benefit of integrating information that makes the results more comprehensive, the meta- search engine is more popular in our day to day life. Because the meta-search engine can get more information from large sources, there is lots of information that users don't think about. This pros turns to cons. It makes user to use more time to deal with the information they are not interested in. Against the background, personalized meta- search engine is one way to solve the problem. The mean of personalization is search engine can help users to sort the important information for them by using user's interest. Search engine will get the users' interest at the beginning of the of results, so it is very convenient for users to access useful information. In this paper we will introduce the design and implementation of meta-search engine. We model the results and users' interest according to the Vector Space Model. They can put the users' interested information at the beginning of results, so the users can get the information rapidly.

The web search engines generally provide search results without consideration of user interests or context. We propose a personalized search approach that can easily extend a conventional search engine on the client side.
The prime reason for the SEs indexes the pages on the basis of keywords. On the other hand, when we are searching the internet we quite often may not know the correct and complete set of key words that might have led us to the desired url.
We need to look into the semantics of the key words. This paper suggests a new approach that is based on some algorithms which considers semantic aspects and uses them to implement a Meta-Search Engine (MSE).

II. LITERATURE SURVEY

A. In meta-search engine

It will examine the advantage and disadvantage of various approaches. There are three main directions for implementing Meta Search Engine:

1. Growth in user-interface
2. To sort the results of query
3. Consider the algorithms for indexing of web-page.

The more concentration on user requirements is recommended in the architecture of Meta-Search Engine. Personalized Meta-Search Engine has been already proposed that provides quick response with re-ranked results after extracting user preference. It uses Naïve Bayesian Classifier for re-ranking.
Some MSEs use proxy log records for accessing user's pattern and store these patterns in the database. A relevance score is measured using some heuristic for each user and the url that she/he visited. A profile is maintained the user which contains currently visited most relevant urls. Relevance of these urls with their respective relative position is updated in profile when users visit those links further.
Current research also suggests the framework of Meta-search engine based on Agent Technology. An enhanced version of open source Helios Meta-search engine takes input keywords along with specified context or language and gives refined results as per user's need.
All the proposed solutions refine search-results up to some extent but they have a serious drawback which is that the user profile is not stationary from this it is observed that we need to consider alternative methods of re-ranking. This is provided by really statistical methods like Latent Semantic Analysis (it is also called as Latent Semantic Indexing) and the newly introduced Probabilistic Latent Semantic Analysis (it is also called Probabilistic Latent Semantic Indexing) which promises to give results that are more correct than those of Latent Semantic Analysis. Thus, the emergence of these algorithms and the need for robust meta- search engines.
Probabilistic Latent Semantic Analysis (PLSA) give robust results for Information Retrieval when the task is to search the most relevant documents from a given corpus, for a given query. As both of these methods depend on the Vector Space Model, the Vector Space Model is explained prior to both.

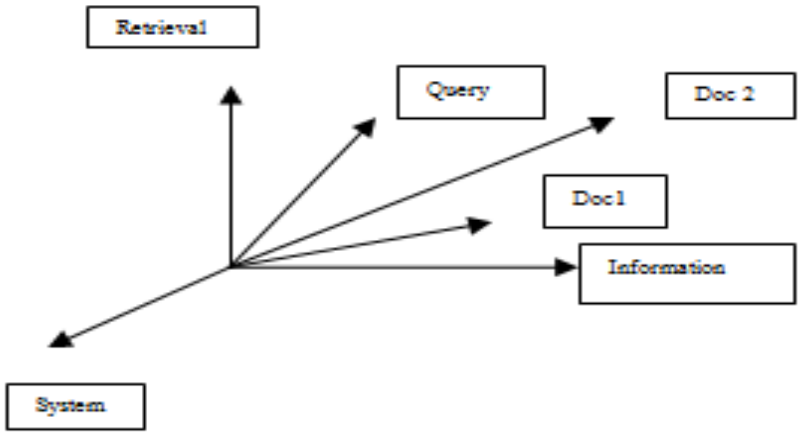
B. Vector space model

The most of the text-retrieval techniques are based on indexing keywords. Since only keywords are unable to capturing the whole documents' content, they results poor retrieval performance. But indexing of keywords is

still the most applicable way to process large corpora of text. After identification of the significant index term a document can be matched to a given query by Boolean Model or Statistical Model. Boolean Model applies a match that relies on the extent. The Fig.1 represent of the documents Doc1 and Doc2 in space of three terms namely "Information", "Retrieval" and "System". Three are perpendicular dimensions for each term represents "Term-Independence". This independence can be of two types namely linguistic and statistical.

When the occurrence of a single term does not depend upon appearance of other term, it is called Statistical independence. In Linguistic independence; interpretation of a term does not rely on other any term an index term satisfies a Boolean expression while statistical properties are used to discover similarity between query and document in Statistical Model.

The statistically based "Vector Space Model" which is based on the theme of placing the documents in the n-dimensional space, where n is number of distinct terms or words (as- t1, t2…tn) which constitutes the whole vocabulary of the corpus or text collection. Each dimension belongs to a particular term. Each document is considered as a vector as- D1, D2…Dr; where r is the total number of documents in corpora. Document Vector can be shown as following: Dr={d1r,d2r,d3r,……..dnr}



Where dir is considered to be the ith component of the vector representing the rth document. There are various similarity

measures that are proposed and one of them, that is very frequently used, is Cosine Similarity.

Cos = Q * D / |Q| * |D|

The above expression represents the cosine of the angle between two vectors in the term space. The relevant document will be that one which is the nearest to given query. In the same way two documents would be considered relevant if they are in neighbor-hood region of each other.

The other measure are

1) Inner Product = Q j * D j
2) Dice Coefficient = 2 Q j * D j / {Q j 2 + D j 2 }
3) Jaccard Coefficient = Qj* Dj /{Q j2 +Dj2-Q j *Dj} Each component of document vector is always associated with some numeric-factor which is called weight of that respective term in document. This weight, wi, can be replaced by term-count or term-frequency (tfi). This assignment leads to another variation of the model that is called "Term Count Model".

III. PROPOSED SYSTEM

The proposed system, we propose a content ontology to accommodate the extracted content and location concepts as well as the relationships among the concepts. We introduce different entropies to indicate the amount of concepts associated with a query and how much a user is interested in these concepts. With the entropies, we are able to estimate the effectiveness of personalization for different users and different queries

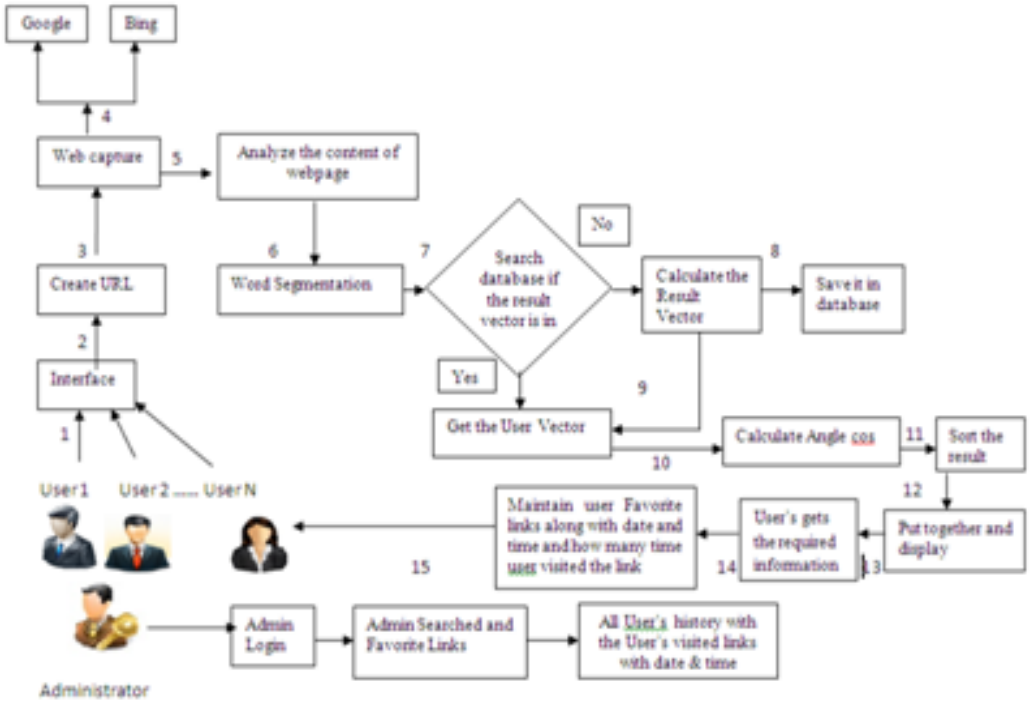


Fig. 2. Proposed System Architecture

A. DESIGN

This system consists of a JSP front with the composition of the background java program. The user interface using JSP production is used with the user interaction (Figure in step 1), the system obtains the keywords entered by the user. It then turns the query to the URL that can get results from Google, Bing (Figure in step 2). Then the page crawling module will search request processing module based on the module generated by the URL of the web pages to crawl (figure in step 4). Due to the page coming from different sources (respectively from Google and Bing), each page is independently analyzed by engine. This is page by page analysis engine module to extract the key content, such as extracting the results of each of the page URL, title, and text descriptions. (Figure in step 6). Then word segmentation results are achieved by the page analysis module (figure in step 7). Result modeling module will use the result of English word segmentation. Result modeling module will search for the database if it contains the result of URL and its vector. If it is not contains the result, the result modeling module will calculate the result's vector (the detail will show in the model module) and put the result into the database (Figure in step 8). Otherwise, the result modeling will use the vector directly (Figure in step 9). Then the system will get the user's interest vector, this vector will use to calculate cosines of angel between result vector and user vector (Figure in step 10). The system will use these

values to sort the results and feedback to users along with the date & time of the favorite link he/she searched. (Figure in step 11, 12, 13,14,15). The architectural design of the personalized Meta search engine is shown in the Fig. 2.

After the sorting the result user will get the required information from the result i.e. url stored by the Search Engine such as Google and Bing . After the searching particular information which required for him/her. After some day/time he/her can access the same information by just login to the Personalized Meta Search engine the user can get the same information by clicking on it's view favorite links. And it also maintain the record of how many time user is visited that links in the Hits column.

In this paper, we put the Administrator to search required information and also maintain the record of the user's history.

B. IMPLEMENTATION

The users will login to the Personalized MSE. It will search the information which is necessary for him/her. When the administrator will log in to the to the Personalized Meta Search Engine then it will store the information of both the users such as date of searching the information and what they have searched along with the user's favorite links of the both the user which they are visited with date and time.

The Personalized Meta Search Engines don't require traversing the network, downloading web documents or building up an index. They mainly consist of member search engine selection, query forwarding, result integration and other algorithms. So, compared to robot based search engines or directory based search engines, the personalized Meta Search Engines have much lower technical doorsill and threshold in development and maintenance.

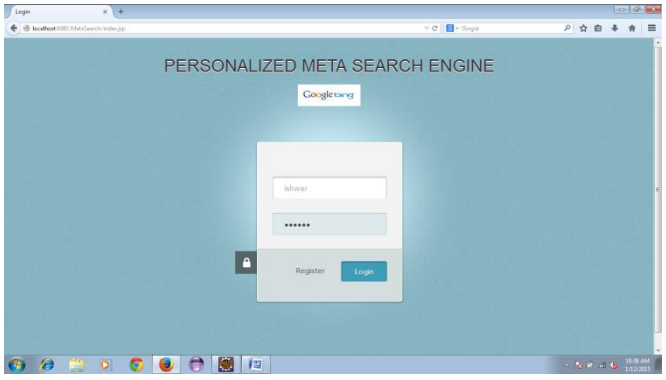


Fig.3. User Login form to Personalized Meta Search Engine

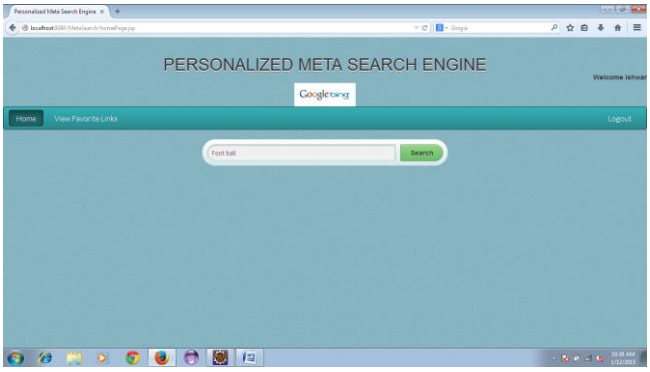


Fig.4. User 1 is searching the information for Foot ball

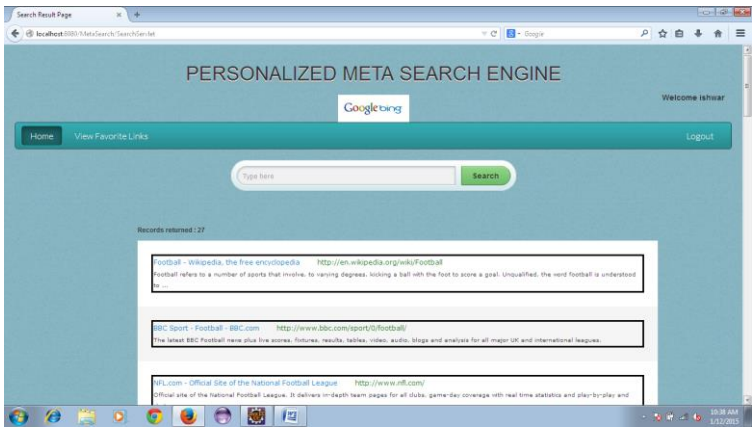


Fig.5. Links for User 1 from Personalized Meta Search Engine

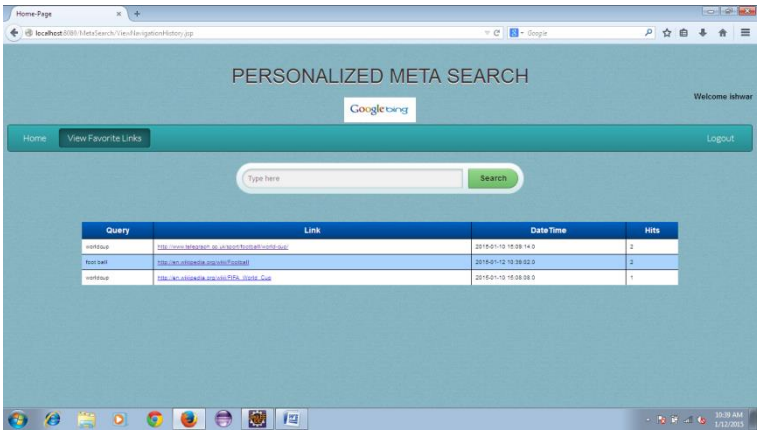


Fig.6. User 1 View Favourite links searched along with date& time

The demonstration of the Personalized Meta Search Engine for the user 1 is as shown in the above diagrams. Similarly the user 2 will login to the Personalized Meta Search Engine and same flow is of User 1 will be use for the user 2.Simarly for the administrator and also it's store the User History and stored how any time the user is visited that links in column of hits.

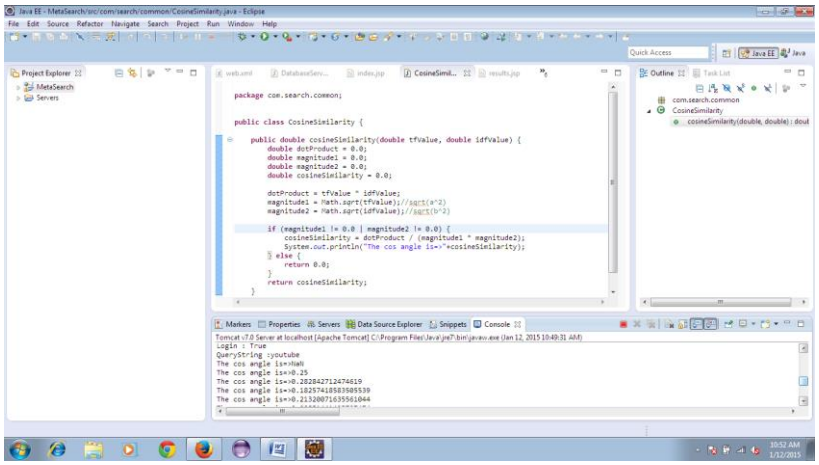


Fig.7.Dipsly cos angle of the result vector

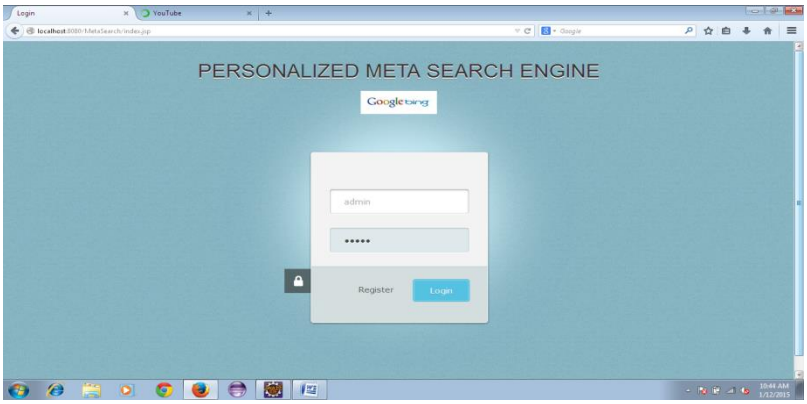


Fig.8. Adminstration login

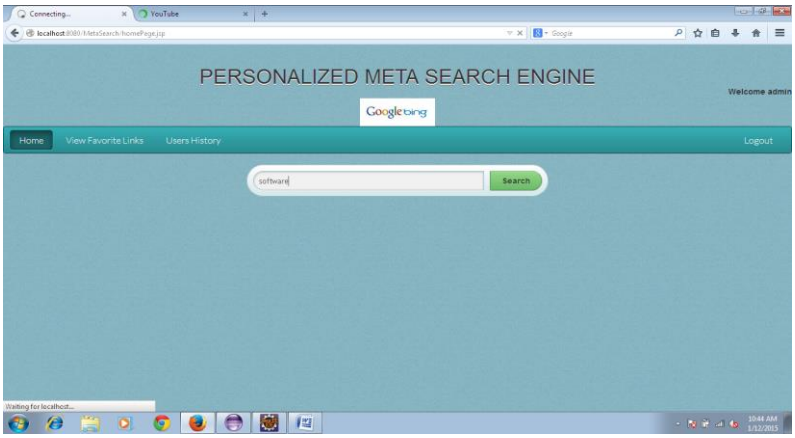


Fig.9. Adminstration is seraching the data for Software

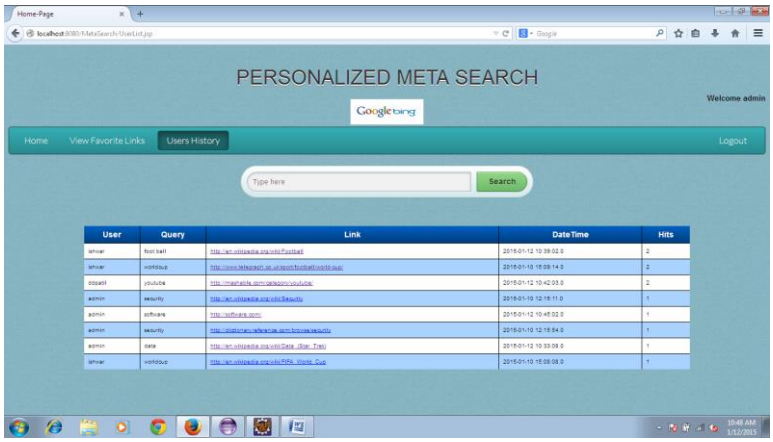


Fig.10. User Histroy in the admin login

IV. CONCLUSIONS

The personalized search provide a common interface and conducts searches in many search engines simultaneously and return results in a uniform format. In present scenario search-engines are really useful

devices to extract needed information from Internet. The personalized Meta-Search engines solve the same purpose with big span of coverage and advanced features like maintaining user's profile, filtering results etc. We Proposed MSE is based on refining the results using query expansion while next keywords are suggested by MSE itself without using any dictionary.

V. REFERENCES

[1]. I.N.Bharambe and R.K.Makhijani,, ," Design and Implementation of Search Engine Using Vector Space Model for Personalized Search ",International Journal of Advanced Research in Computer Science and Software Engineering, ISSN: 2277 128X, Volume 3, Issue 6, June 2013,page 1019-1023.

[2]. I.N.Bharambe and R.K.Makhijani,"Design of Search Engine using Vector Space Model for Personalized Search", International Journal of Computer Science and Mobile Computing(IJCSMC), ISSN 2320-088X, Vol.2,Issue. 3,March 2013,pg.63-66.

[3]. Jiandong Cao, Yang Tang and Binbin Lou," Personalized Meta-search Engine Design and Implementation" Software College Northeast University (NEU) Shenyang, China, 978-1-4244-5540-9/10/$26.00 IEEE 2010.

[4]. Abawajy, J.H.; Hu, M.J., "A new Internet meta-search engine and implementation", The 3rd ACS/IEEE International Conference on Computer Systems and Applications, Page(s):103, 2005

[5]. Shanmukha Rao, B.; Rao, S.V.; Sajith, G.; "A user-profile assisted meta search engine", TENCON 2003 Conference on Convergent Technologies for Asia-Pacific Region Volume 2, Page(s):713 - 717 , 15-17 Oct. 2003.

[6]. Spink, A.; Jansen, B.J.; Blakely, C.; Koshman, S.; "Overlap Among Major Web Search engines", ITNG 2006 Third International Conference on Information Technology: New Generations, 2006. Page(s):370 – 374, 10-12 April 2006.

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Design & Development of Cross Flow Heat Exchanger for Heat Transfer Enhancement

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ABSTRACT

Improve heat transfer capacity of Heat exchanger. Nanofluids in heat exchanger will increase heat transfer of the heat exchanger. The performance comparison will be made between pure water and Nanofluids tested in heat exchanger. Finally, the recommendations are made and conclusions are drawn based on the improved performance of Nanofluids in a heat exchanger.

Keywords: Research Paper, Technical Writing, Science, Engineering and Technology

I. INTRODUCTION

A heat exchanger is a device that is used to transfer thermal energy (enthalpy) between two or more fluids, between a solid surface and a fluid, or between solid particulates and a fluid, at different temperatures and in thermal contact. In a heat exchanger, heat energy is transferred from one body or fluid stream to another. In the design of heat exchange equipment, heat transfer equations are applied to calculate this transfer of energy so as to carry it out efficiently and under controlled conditions. Heat exchangers are found widely scattered throughout the food process industry. Usually, there are no moving parts in a heat exchanger. The heat transfer surface is a surface of the exchanger core that is in direct contact with fluids and through which heat is transferred by conduction. That portion of the surface that is in direct contact with both the hot and cold fluids and transfers heat between them is referred to as the primary or direct surface. To increase the heat transfer area, extended surfaces may be used. These extended surface elements are referred to as fins. Thus, heat is conducted through the fin and convicted (and/or radiated) from the fin (through the surface area) to the surrounding fluid, or vice versa, depending on whether the fin is being cooled or heated. As a result, the addition of fins to the primary surface reduces the thermal resistance on that side and thereby increases the total heat transfer from the surface for the same temperature difference. Fins may form flow passages for the individual fluids but do not separate the two (or more) fluids of the exchanger. These secondary surfaces or fins may also be introduced primarily for structural strength purposes or to provide through mixing of a highly viscous liquid. Not only heat exchangers often used in the process, power, petroleum, transportation, air-

conditioning, refrigeration, cryogenic, heat recovery, alternative fuel, and manufacturing industries, they also serve as key components of many industrial products available in the marketplace. These exchangers can be classified in many different ways. We will classify them according to transfer processes, number of fluids, and heat transfer mechanisms. Conventional heat exchangers are further classified according to construction type and flow arrangements. Cross flow heat exchanger are found in different industrial sectors, such as steam generation in a boiler or air cooling in the coil of an air conditioner, where heat has transferred between different media. For optimal design of heat exchanger and flow pattern, the determination of its operational parameters and performance is required. The normal configuration involves heat transfer between one fluid flowing through a bundle of tubes and another flowing transversely over outside of the tubes. The tubes may have extended surfaces internally and/or externally in order to enhance heat transfer between the two fluids.

II. METHODS AND MATERIAL

Heat exchanger components

Tube

Tube OD of ¾ and 1" are very common to design a compact heat exchanger. The most efficient condition for heat transfer is to have the maximum number of tubes in the shell to increase turbulence. The tube thickness should be enough to withstand the internal pressure along with the adequate corrosion allowance. The tube length of 6, 8, 12, 16, 20 and 24 ft are preferably used. Longer tube reduces shell diameter at the expense of higher shell pressure drop. Finned tubes are also used when fluid with low heat transfer coefficient flows in the shell side. Stainless steel, admiralty brass, copper, bronze and alloys of copper-nickel are the commonly used tube materials.

DIMENSIONS OF TUBE:

Internal Diameter: 6 mm

External Diameter: 6.82 mm

Thickness of tube: 0.41 mm

Length of Tube: 340 mm

Material of the tube: copper

Total No tubes used: 49 (25 in one column & 24 in second and third column)

Inner surface area: 6408.73 mm^2

Outer Surface Area: 7284.73 mm^2

Tube pitch, tube-layout and tube-count

Tube pitch is the shortest centre to centre distance between the adjacent tubes. The tubes are generally placed in square or triangular patterns (pitch). The number of tubes that can be accommodated in a given shell ID is called tube count. The tube count depends on the factors like shell ID, OD of tube, tube pitch, tube layout, number of tube passes, type of heat exchanger and design pressure.

Tube passes

The number of passes is chosen to get the required tube side fluid velocity to obtain greater heat transfer co-efficient and also to reduce scale formation. The tube passes vary from 1 to 16. The tube passes of 1, 2, 3 and 4

are common in application. The partition built into exchanger head known as partition plate (also called pass partition) is used to direct the tube side flow.

Fins

The desirable features of the heat exchanger is to obtain maximum heat transfer performance at the lowest possible operating and capital costs, lower the pressure drop. Thin sheets are used as fin in heat exchanger for they show very effective performance. It can also be very effective, where heat exchangers are predicted to be faced with vibration condition.

Material of fins: Al foil

Thickness: 0.21 mm

Total no of fins used: 227

Length of fin: 350 mm

Width: 28 mm

Pitch: 14 mm

Transverse pitch: 12.82 mm

Staggered offset: 7 mm

Single Fin Area: 6873.51 mm^2

Surface area of single fin: 14380.9 mm^2

Total surface area of 127 fins (A_F): 326464.3 mm^2

A_F=326464.3 mm^2

A_F= Total surface area of 127 fins

A_w=Surface area of the tube between the fins = $N_f \times \Pi \times D_r \times l_{eff}$

N_f= No. of fins=127

l_{eff}= 290-(.21×227)=242.33mm

A_w=1178602.307 mm^2

$A=A_F+A_w$=4443066.607mm^2

A_T=the total external area of the tube without fins

$A_T=N_T \times L \times \Pi \times D_r$=49×300×Π×6.82

=314957.2299mm^2

V_a = 17m/s

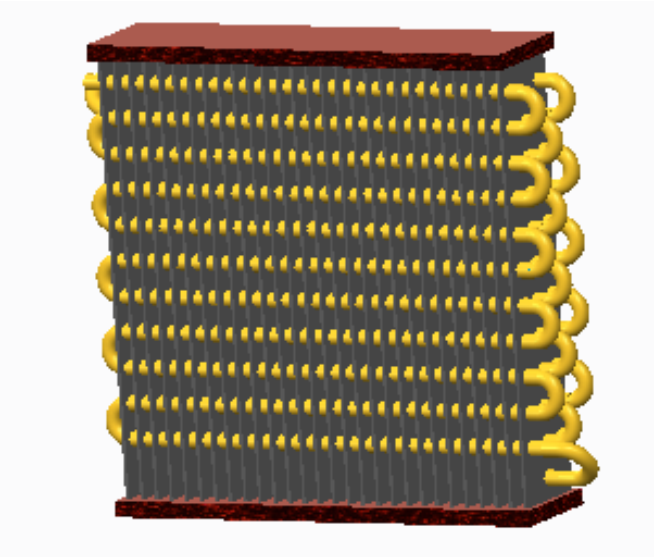

Fig. 1 Cross Flow Heat Exchanger

NanoFluid

Al_2O_3 in heat exchanger is that it has better heat dissipation capacity and its cost is low. There are more nanoparticles having better heat transfer capacity than Al_2O_3, but they are expensive. The Aluminium Oxide nanofluids can be prepared by dispersing directly the nanopowders to the water base fluid and sonicated it at required vibration time and the others affect parameters. Aluminum oxide is prepared in dark room under UV light. Al2O3 nanofluids have novel properties that make them potentially useful in many applications in heat transfer properties are:

- High thermal conductivity
- Low Viscosity
- High Convective heat transfer coefficient
- High surface area per unit volume

CuO is one of the nanoparticles among different nanoparticles. CuO is used as nanofluid in heat exchanger to increase the heat transfer rate. Copper Oxide nano particles were dispersed nano particles are used for increasing the thermal conductivity of fluids. CuO is mixed with water for enhancing the thermal conductivity using various CuO content and concentration. The main reason of use of CuO in heat exchanger is that it has better heat dissipation capacity and its cost is appreciable.

Why Nonofluids

The main goal or idea of using nano fluids is to attain highest possible thermal properties at the smallest possible concentrations (preferably<1% by volume) by uniform dispersion and stable suspension of nano particles (preferably<10 nm) in hot fluids. A nanofluid is a mixture of water and suspended metallic nano particles. Since the thermal conductivity of metallic solids are typically orders of magnitude higher than that of fluids it is expected that a solid/fluid mixture will have higher effective thermal conductivity compared to the base fluid.

Fluids	Avg. Temp Diff. (oC)	QAVG (W)	Effectiveness
WATER	4.4506	5778.0092	0.05612
WATER+2%Al2O3	6.833	6998.0317	0.0717
WATER+2%CuO	9.48	6465.6379	0.11159

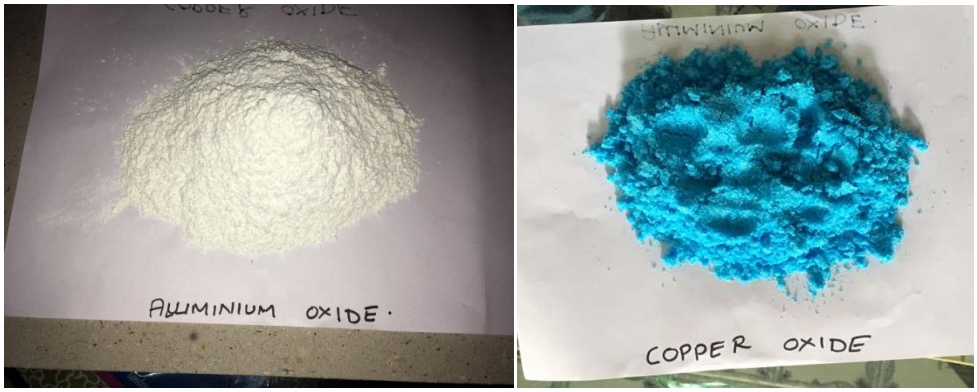

Fig.2. Nano Particles

III. RESULTS AND DISCUSSION

The experimentation carried on water, water + 2% Al2O3 and water + 2% CuO. On the set up the test was carried out for 15 to 20 min for each fluid. The result tab for all three fluid is
Table 1. Result table

IV. CONCLUSION

When the water alone was used as a coolant fluid , the temperature difference of outlet and inlet was less. This shows that the heat transfer rate of water is less and hence effectiveness of heat exchanger with water decreases. It is found that when 2% of aluminium oxide and copper oxide are used as additives in water, the heat transfer rate of the exchanger further increases due to higher thermal conductivity of additives. It is concluded that nanofluids are having better heat transfer rate as compared to water and they can be considered as a potential candidate for numerous applications involving heat transfer and their use will continue to grow. It is also found that the use of nanofluids appears promising, but the development of the field faces several challenges. Nanofluid stability and its production cost are major factors in using nanofluids. The problems of nanoparticle aggregation, settling, and erosion all need to be examined in detail in the applications. We can say that once the science and engineering of nanofluids are fully understood and their full potential researched, they can be reproduced on a large scale and used in many applications.

V. REFERENCES

[1]. IX International Conference on Computational Heat and Mass Transfer, ICCHMT2016 Correlation and numerical study of heat transfer for single row cross-flow heat exchangers with different fin thickness Cracow University of Technology, Institute of Power Engineering, Al. Jana Pawla II 37, 31-864 Cracow, Poland

[2]. Matthew Carl, Dana Guy, Brett Leyendecker, Austin Miller, and Xuejun Fan, The Theoretical and Experimental Investigation of the Heat Transfer Process of an Automobile Heat exchanger , ASEE Gulf Southwest Annual Conference,Texas, 2012

[3]. Pawan S. Amrutkar, Sangram R. Patil, Automotive Heat exchanger Performance – Review, International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249 – 8958, Volume-2, Issue-3, February 2013.

[4]. Q. W. Xiang. A. S. Mujumdar, Heat transfer characteristics of nanofluids: a review, Int. J. Therm. Sci. 46 (2007) 1-19.

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Sales Analysis using Data Mining Techniques

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ABSTRACT

Itisnecessarytoeverybusinesstoknowtheirlevelofmarketcompetition,forexamplewhat is customersdemand,customers'pattern of buying and their sales performance. This projectproposes asales analysis using prediction and associationtechniqueinsalesdata.ChanFurnitureandElectricalAppliances Company have beenselectedas a case study.From the preliminary study, the researcherfound that theCompany is facing fluctuating amount of sales throughout theyear.Thesalesobtainedarelowerthanexpected.Theprediction model is used to predict the product that will besoldforeverymonth.Theassociationmodelisusedtoidentify the associated products purchased by the customer.Purchasing transactions data is taken from the sales invoicesissued by the company. The result obtained from both is usedindevelopingabusiness strategyforChanfurniture.

Keywords: Association, Salesanalysis,CRISP-DM

I. INTRODUCTION

The term Business Intelligence (BI) refers to technologies, applications and practices for the collection, integration, analysis,andpresentationofbusinessinformation.Thepurpose of Business Intelligence is to support better businessdecision making. Essentially, Business Intelligence systemsare data-driven Decision Support Systems (DSS). One of theanalysis in BI is sales analysis. Sales analysis is an activitythat being done by organization and businesses to study andunderstandtheircompanybusinessperformance.

Accordingto[4],salesanalysisreportpresentsthetrendsthatoccur in a company's sales volume over time. In its most basicform,asalesanalysisreportshowswhethersalesareincreasing or declining. While [5] defined sales analysis asexamines sales reports to see what goods and services haveandhavenotsoldwell.Theanalysisisusedtodeterminehowtostockinventory,howtomeasuretheeffectivenessofa salesforce, how to set manufacturing capacity and to see how thecompanyisperformingagainstitsgoals.

Asalesanalysisisimportantbecauseithelpstheseniormanagementofthecompanyinmakingdecisionsforthe companyintermofinventorymanagement,marketingactivities, schemes offers to be rolled and changes inthemanufacturing processes if applicable. Besides that, by doingthe sales analysis it also displays the current market trends tothecompanywhichhelpthecompanyinpreparingtheirfuturebusiness plans.

This paperimplements dataminingtechniques whichareassociation and prediction model to perform sales analysis indailytransactionaldataset.ChanFurnitureandElectricalAppliances Company has been chosen as a case

study. Chanfurnitureandelectricalappliancesoperatesbysellingfurniture and electrical appliances. This organization has 80branchesandtheirmainstore(HQ)islocatedatKaramunsing,Sabah. This project will focus on only one branch which is inJerantut,Pahang.

II. LITERATUREREVIEW

2.1 PredictionandAssociationTechniques

There are fourmaintechniquesthatcanbeusedindatamining which are classification, prediction, association andclustering [3]. In this research, the researcher has focused ontwo techniques which are prediction and association. Table 1shows the definition of prediction and association techniquesproposedby[3].

Table1:Definitionofpredictionandassociationtechniques

Technique	Definition
Prediction	"It is normally referring as the act of tellingaboutthefuturewhichisdifferentfromasimpleguessingactivitybytakingintoaccounttheexperiences,otheropinions,andalso relevantinformation."
Association	"Itispopulartechniquethatbeingusedtodiscover the interesting relationships betweenvariablesofthedatasetsinthelargedatabases.Themostcommonassociationrulemining used idistheMarketBasketanalysis."

2.2 RelatedWorks

Inthissection,thepreviousstudiesonsimilartopicarereviewed.

(a) ResearchofClothingSalesPredictionandAnalysisBasedonID3DecisionTreeAlgorithm

This research paper in written by [6]. This research paper isregardingthesalespredictionbasedoncurrentclothingfashion. In modern society being fashionable is a trend. Therearemultiplefactorsinfluenceapparelandfashionsales,including price, type of cloth, and size, together with thetraditional factors like season and material. Then, in order toimprove the sales and maintain as little inventory as possible,thesellersneedtoidentifyappropriatefactorswhichconsistent with the specific condition of their stores. ThisresearchpaperuseddecisiontreeandID3algorithmtoconductthepredictionanalysisregardingtheclothingsales.It canbeconcludedthatthemainaimofthispreviousworkistocreate an effective model which can help the fashion industrysellers to reduce unnecessary loss from the business. Thisresearch paper explores on how factors of weather, color andsizecaninfluenceapparelsalesandthenmakespredictionsonfuturesales.

(b) Sales Prediction Model Using Classification DecisionTreeApproachforSmallMediumEnterpriseBasedonIndonesianE-CommerceData[7].

In this research, data Mining has been employed in this papertodescribethe patternsofthe marketandtopredictthepotential region of the national market commodities of thee-commercesite.Thealgorithmthatbeingusedinthisresearch paper are decision trees and CHAID. The attributesusedinthisresearchpaperwereprice,typeofshoes,insurance,productviewer,city ofseller, ratingofspeed,serviceandaccuratehasimpactonproductsales.Theresearcher found that West Java, Jakarta and East Java werethe first three largest location of footwear sales while as forthesalespatternontokopedia.comitshowsthatthehigherthepricethehighertheamountofsalegeneratedbythee-commercewebsite.Thedecisiontreegeneratedbytheresearcherhaselevennodeswithseven terminalnodesandthedepthoftheclassificationtreeisthree.

(c) MarketBasketAnalysis ofBeautyProducts by[8]

The main purpose of this research was to see how differentproducts in a beauty shop assortment interrelate and how toexploitthese relations inmarketing activities. Associationrule mining has been conducted by researcher using apriorialgorithm. As a result, the researcher found that some of theshoppers may purchase a single product during a shoppingtripbyrandomlypickwhileothersbuymorethanoneproducton the same time with their own target of use for efficiencyreasons.Thesupportandconfidencevalueusedinthisresearchwere0.1and0.4respectively.Supportandconfidence is a matrix used to evaluate generated associatedruleasdiscussedin[12]

(d) AnalyzeMarketBasketDataUsingFP-Growthand AprioriAlgorithm by[9].

For this case study the researchers had used the data from anelectronic store. From the data they came out with the varietyof association rules and the algorithm that being used in thestudywereFP-GrowthandalsoApriorialgorithm.Itwasalsostated that different algorithm used needs different amount oftimestogeneratealltherules.Inthisstudytheresearchershadusedfewsets ofsupportandconfidencevalues.

(e) AnalyzingCustomerBaskets[10].

Inthisresearch,theresearchermainlyfocusseson theactivityofassociationruleminingforcustomerbasketandindiscoveringthefrequentitemsetswhoseitemshavethehighest correlations. This study only uses one set of supportandconfidencevalueswhichwere0.01foritssupportand0.7fortheconfidence.

(f) SalesAnalysisUsingProductRatinginDataMiningTechniques [11].

In this paper, sales analysis can provide a frequent pattern ofsametypeofproductsaleswhichislikemarketbasketanalysiswithinsametypeofproductsorgoodsandbyrepresenting the data related with the project graphically. So,that they can easily and quickly view type of customer. Thisstep is being done by the researchers to aid them to target thecustomerswhichwillincreasessalesandprofitoforganization.Thisjournalstatedthattheresearchershadusedthe

apriori algorithm to conduct the research project. The aimoftheprojectwastoidentifytheproductsratingbypre-processing the sales data with minimum threshold usingAssociation rule by using the apriori algorithm and then ranktheproduct.

III. METHODOLOGY

BusinessIntelligenceframework(figure1)asproposedby[3]has beenadaptedinthisresearch.

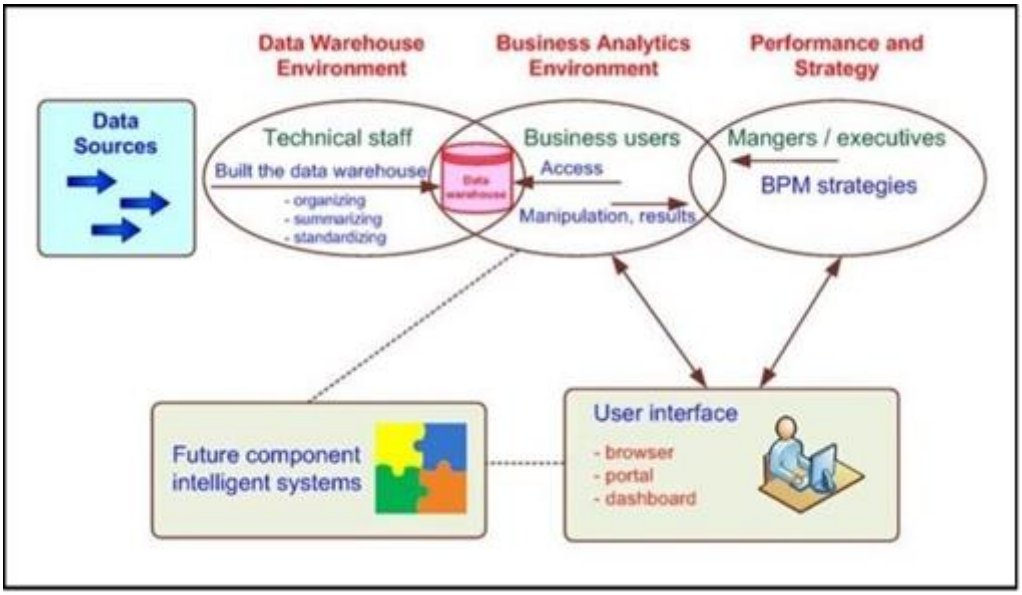

Figure 1:BusinessIntelligenceFramework [3]

There are five main components in the business intelligenceframework,whicharedatasources,datawarehouseenvironment, business analytics environment, performanceand strategy and user interface. For the data sources and datawarehouse,attributesofthedatasetwerecollectedandstored.

Themaincomponentisbusinessanalyticsenvironmentwherethe manipulation of the data happens in this environment.Data mining process was implemented in this environment.CrossIndustryStandardProcessforDataMining(CRISP-DM)has beenusedtocarryoutthedatamining.

Next is performance and strategy component. Result frombusiness analytics environment will be analyzed and usefulinformation will be extracted to propose the business andsalesstrategy.Figure2showstheadaptedBusinessIntelligenceFramework.

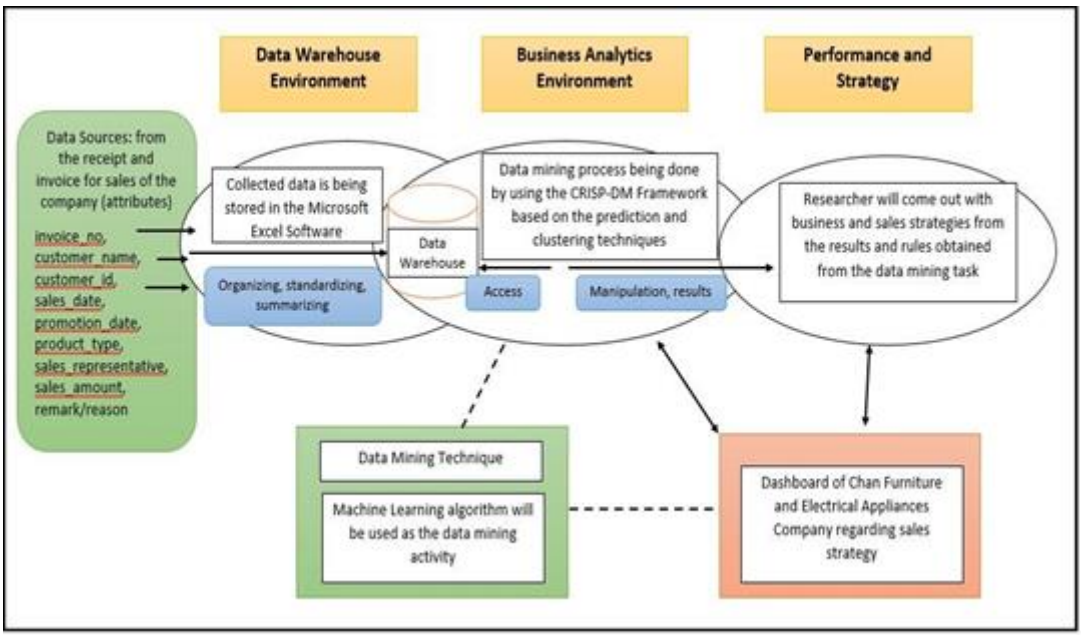

Figure2:AdaptedBusinessIntelligenceFramework

3.1 CRISP–DM

CRISP-DM was used in conducting the data mining process.Thisframeworksplitstheoveralldataminingprojectprocesses into six phases, and it allows the researchers forneeding to go back and forth within the phases between adifferentstage.Figure3showstheCRISP–DMframework.

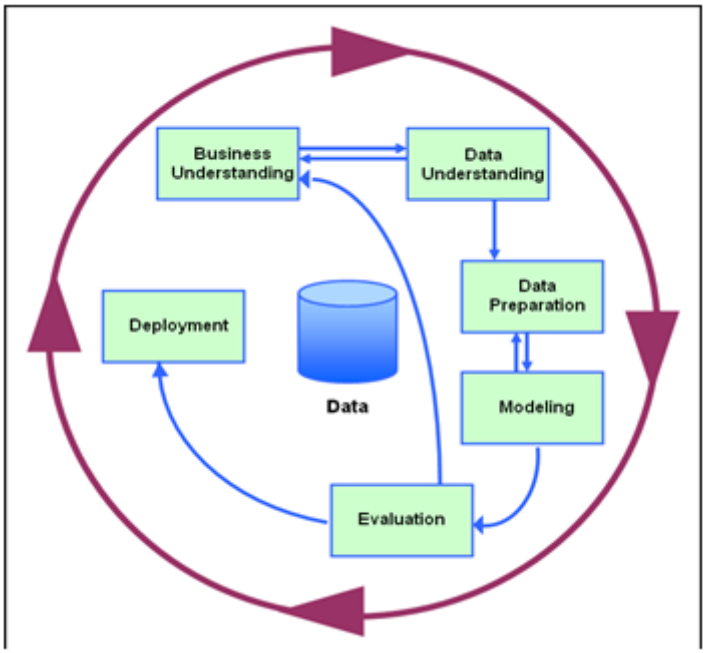

Figure3:CRISP-DM

3.1.1 BusinessUnderstanding

During this phase, the current process, and problem faced bythecompanywillbeidentified.Aninterviewsessionisconductedwiththestaffsofthecompanyespeciallythemanager of the store which is Encik Suhaimi Bin Salleh. TheinterviewsessionwasconductedonAugust2018.Itisimporanttotrulyunderstandtheprocessesthatthecompany undergo in handling their 'sales' business operation in orderto get a clear view about the situation of the company whichlateroncanaffecttheprocessinexecutingthepossiblesolutionthatcanaidin solvingtheproblemofthecompany.

3.1.2 DataUnderstanding

The data was collected via the process of interviewing thestaff of Chan Furniture and Electrical Company and the datacollectedisfromtheyearof2014until2017.Thedatacollectedisintheformofthehardcopyofsalesinvoices.Nineattributes have been extracted from the invoices which areinvoiceno,customername,customerid,salesdate,promotiondate, product type, sales representative, sales amount, andremark/reason.Table2showsthemetadata.

Table2:Metadata

AttributeName	AttributeType	AttributeFormat	Description
Invoiceno	Integer	E.g.:57*173260	Represent theinvoiceseries number
Customer Name	Polynomial	E.g.: - 'FAUZI'	Representthe customername
CustomerID	Integer	E.g.:860923062441	Represent thecustomeridentification cardnumber
Sales_date	Date	DD/MM/YY	Represent thedateofan invoice
Producttype	Polynomial	Eg:- -sofa set -tv	Represent theproducts orgoodstypes
Sales_amount	Integer	Eg:- '2198'	Representtheamountofsales

3.1.3 DataPreparation

In this phase the datasets are being prepared forthe dataminingprocess.Therearefourstepsinthedatapre-processingwhicharedatai)consolidation,ii)datacleaning, iii) data transformation and iv)reduction. For dataconsolidation, the relevant data that used in this project iscollected from the identified sources which means for thisproject, the data is being collected from the Chan FurnitureCompany. During data cleaning there were few subtasks thatbeing done by the researcherwhichare handling missingvalues,identifyingandreducing

noiseinthedatasetandfinding and eliminating erroneous data. Data transformationstep was mainly to transform the data from the original formintonewformthatwasnecessaryforthedataminingpurpose.In this project, the attribute that being transformed was the'items' and 'date'. For 'items' attribute the researcher hadconvertedthetextformofthedataintopolynomialformwhilefor 'date' researcher had separate the date information intothreewhich areday,monthand year.Figure4showsthedata beforebeingtransformedwhileFigure5showsthedatatransformationresults.

DATE	PURCHASE ID	ITEMS	CATEGORY
18/1/2014	1	home theatre	Electrical
18/1/2014	2	sofa set	Furniture
19/1/2014	3	bed set	Furniture
20/1/2014	4	tv	Electrical
21/1/2014	5	mattress	Furniture
11/2/2014	6	bed only	Furniture
10/11/2014	7	wardrobe	Furniture
10/11/2014	7	mattress	Furniture
20/2/2014	8	fridge	Electrical

Figure4:Databeforebeingtransformed

Month	Year	PURCHASE ID	ITEMS	CATEGORY
January	2014	1	home_t	Electrical
January	2014	2	sof_set	Furniture
January	2014	3	bd_set	Furniture
January	2014	4	tv	Electrical
January	2014	5	mattress	Furniture
February	2014	6	bd_only	Furniture
November	2014	7	wardrobe	Furniture
November	2014	7	mattress	Furniture
February	2014	8	fridge	Electrical

Figure5:Datatransformationresults

3.1.4 Modelling

Therearenumberofdataminingtoolsavailableinthemarketasdiscussed[13].Inthisresearch,RapidMinerhasbeenused for the mining process since it provides better visualizationfortheprocess[13].Theprocesscoversfromdatapreparationprocess until generating the rules and result for the predictionandassociationmodel.DecisionTreeandPerformanceoperator used for the highest items sold prediction resultswhile FP-Growth and create association rule operator is usedforfrequentitemsetminingprocess.

Prediction

Predictionisgenerallyreferredtoastheactionoftellingaboutthe future consequences of related activities. There are twocategories that lies in prediction which are classification andregression.Classificationisusedinthisresearchwithdecision tree algorithm with the objective to find the itemsmost likely to be bought by the customers for every monthtogetherwiththequantity.RapidMinersoftwareisbeingusedto develop this prediction model. The dataset used in thismodellingprocesshadbeendividedintotwowhere80%fromthe rows of data were the training data and the rest 20% istestingdata.Decisiontreealgorithmispopularbeingusedfordoing some simple predicting task. A decision tree model is atree which look like a collection of nodes that intended tocreate a determination on the values affiliation to a class or inother words an estimate of numerical target value. Figure 6shows the process flow for the model building of predictiontechniqueusingtheRapidMiner.

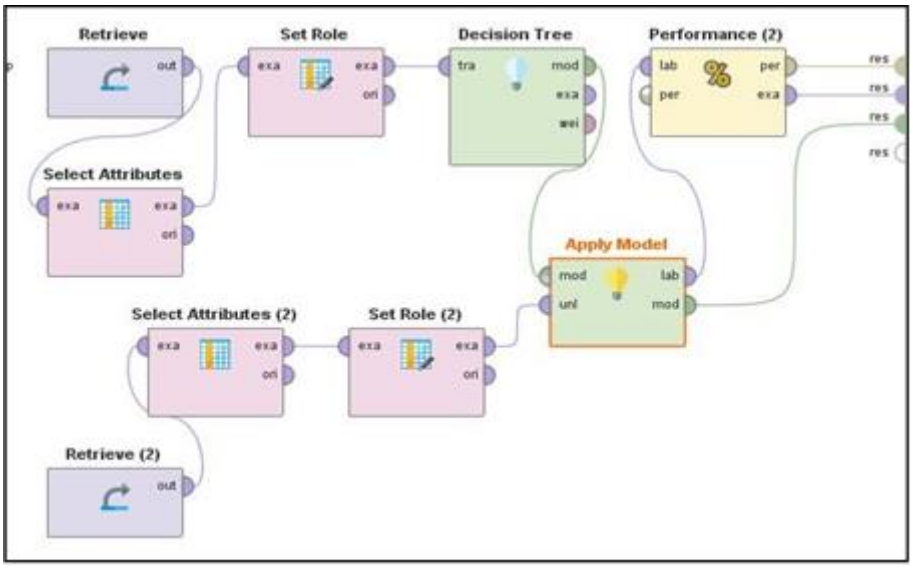

Figure6:Theprocessflowofthedatamodellingprocessforpredictiontechniqueusingthe Rapid Minersoftware

Association

Forassociationtechnique,theFP-Growthalgorithmwasbeing used to trace out the trends of buying patterns of thecustomers of the Chan Furniture and Electrical AppliancesCompany. In order to use the FP-Growth algorithm for thisproject,the'FP-Growth'operatoroftheRapidMinersoftware wasused. Thisoperator had performedthe dataassociations'processusingthealgorithm.Severalsetsofsupport and confidence had been used in this project in ordertogetvarietyofresultsfromtheassociationbetweentheitemsbought by the customers. Figure 7 shows the process flow ofthedatamodellingprocessforassociationtechniqueusingtheRapidMinersoftware.

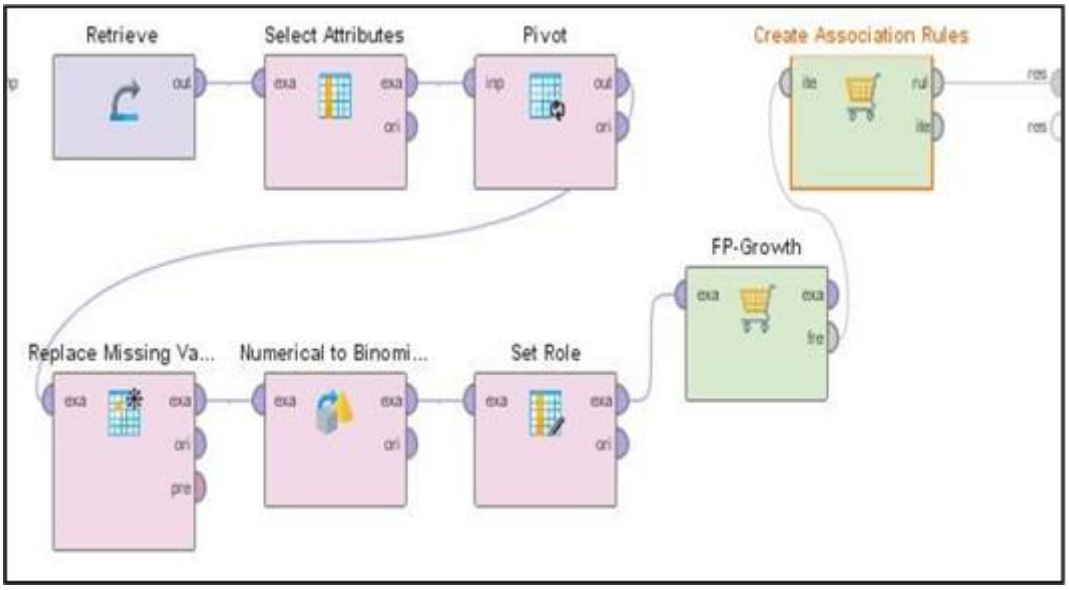

Figure 7: The process flow of the data modelling process forassociation techniqueusingtheRapidMinersoftware

3.1.5 Evaluation

To test the developed prediction model, the accuracy of themodel is generated by using the Rapid Miner software. Theaccuracy level also depends on the condition of the data thatbeing used. To test the developed association model, threeminimum support and minimum confidence value were usedas showninTable 3.

Table3: MinimumSupportandConfidence

Ref	MinimumSupport	MinimumConfidence
[8]	0.1	0.4
[10]	0.01	0.7
-	0.01	0.2

3.1.6 Deployment

In this phase the results and rules from the obtained dataminingtaskisinterpretedintoaproperknowledgeandinformation. The informationthenis usedincreatingthedashboardinterface.Figure8showsthesampleofthedashboardinterface.

Figure8:Dashboardinterface

IV. RESULTANDDISCUSSION

From the prediction and association modelling process rulesandresults,researchercomeoutwithasetofinformationthatisusefulinproposingthenewbusinessstrategytothecompany later. The results from the predicted highest itemssold for every month is tabulated based on each category asshowninTable3,4and5.

As for the association modelling result three experiment havebeen conducted which produce different sets of associationrules. Different sets of support and confident values was usedtothesamedatasetforthis experiment.

Table4:Predictedsalesitems (categoryelectrical)

Month	Electrical	
	Items	Quantity
January	Washer	4
February	Washer	4
March	TV	6
April	Fridge	7
May	TV	5
June	Washer	6
July	TV	5
August	Fridge	6
September	TV	4
October	Washer	4
November	TV	9
December	Washer	4

Table5:Predictedsalesitems(categoryelectronic)

Month	Electronic	
	Items	Quantity
January	Laptop	1
February	Smartphone	1
March	Smartphone	2
April	Smartphone	1
May	Smartphone	1
June	Smartphone	3
July	Laptop	2
August	Laptop	2
September	Smartphone	2
October	Smartphone	2
November	Smartphone	2
December	Smartphone	1

Table6:Predicted salesitems(categoryfurniture)

Month	Furniture	
	Items	Quantity
January	Wardrobe	3
February	Sofa Set	3
March	KitchenCabinet	3
April	Bedroom Set	4
May	Sofa Set	6
June	Mattress	5
July	Sofa Set	5
August	BedSet	3
September	Wardrobe	2
October	Sofa Set	3
November	Sofa Set	3
December	Bedroom Set	3

Experiment1ofAssociationModelling

For experiment 1, the value for support and confidence usedare 0.1 and 0.4 respectively. Only one rules generated fromthis experiment. Table 7 and 8 shows the rule generated inexperiment1.

Table7:Rulegeneratedin experiment1

Premises	Conclusion	Support	Confidence
Mattress	Bedroom Set	0.026	0.474

Table8:Rulegeneratedin experiment2

Premises	Conclusion	Support	Confidence
Speaker	TV	0.003	1
Sofa Set, GasCabinet	DiningSet	0.003	1
DiningSet	Kitchen		
Cabinet	0.003	1	
Display Cabinet, CoffeeTable	Sofa Set	0.003	1
SofaSet,DiningSet, Kitchen Cabinet	GasCabinet	0.003	1

Experiment2ofAssociationModelling

For experiment 2, the value for support and confidence usedare0.01and0.7respectively.Thereareseveralrulesgeneratedfromthisexperiment.Table7shows thetop5rulesgeneratedinexperiment 2.

Experiment3ofAssociationModelling

Forexperiment3,thesetofvaluesforsupportandconfidenceused are 0.01 and 0.2 respectively. There are several rulesgeneratedfromthisexperiment.TheTable9belowshowsthetop5rulesgeneratedinexperiment3.

Table9:Thetop5rules generatedinexperiment3

Premises	Conclusion	Support	Confidence
Mattress	Bedroom Set	0.026	0.474
Home Theatre	TV	0.017	0.667
Coffee Table	Sofa Set	0.011	0.667
Kitchen Cabinet	DiningSet	0.010	0.350
TVStand	TV	0.007	0.333

From the three experiment that being done, the researchergained variety of association rules as the results from themodellingprocess.Forexperiment1onlyoneassociationrulethatwasgeneratedwhileforexperiment2therearesum of12rows of rules that had been generated. As for experiment 3,there were 42 association rules that had been generated. Theresearcher have used the rules gained from all the experimentthat is suitable and favorable, in order to come out with thebusinessandmarketingstrategyfortheChanFurnitureCompany.

V. BUSINESSS TRATEGY

Inthispartthe researcherusesthe informationfromthemodelling process result and rules to visualize the businessstrategythatismeantobeproposedtotheChanFurnitureandElectricalAppliancesCompany.Thebusinessstrategiesincludethepromotions,marketingandalsoinventoryplanning strategy. Figure 9 shows example of marketing andpromotionstrategyvisualization.

Figure9:Marketingand Promotion strategysample

FromtheFigure9showstheimplementationofbothinformation and result from the prediction and associationmodellinginproposingthebusinessstrategy.Asforprediction part, it shows the prediction on highest items to besoldbymonthhelpsinfocusingonwhichitemstobepromoted on every month. As for the association modellingpart,theresearcherusedtheresultsandrulestocomeoutwithoffer or items to be packaged sold with the predicted itemsbased on month. The sides' items to be offered with the mainpredicteditemsisgainedfromtheassociationruleswheretheitemsarecorrelatedwitheachother.

VI. CONCLUSION

Asaconclusionthispaperexplainedregardingalltheactivities and processes that being done by the researcher inorder to achieve all the objectives that have been set at theearly stage of the project. The main objective of this researchto predict the items that will be sold the highest for everymonthandtounderstandthecorrelationsbetweenthepurchaseditemsby thecustomers.Eventherewassomelimitations for this project, it still can successfully be doneaccording to the current needs and requirements. As for theobjectives,alltheobjectiveshavebeenachievedbyimplementingthebusinessintelligencebytheresearcher.

VII. REFERENCES

[1]. Nerkar,A.D.(2016).BusinessAnalytics(BA):CoreofBusinessIntelligence(BI).InternationalJournalofAdvancedEngineering,ManagementandScience,2(12).

[2]. Ishikiriyama, C. S., Miro, D., & Gomes, C. F. S. (2015).Text Mining Business Intelligence: a small sample ofwhat words can say. Procedia Computer Science, 55,261-267. https://doi.org/10.1016/j.procs.2015.07.044

[3]. Sharda R., DelenD., & TurbanE., (2014). BusinessIntelligenceandAnalytics.Pearson,GlobalEdition.

[4]. Akers, H. (2018). What Is a Sales Analysis Report.RetrievedOctober11,2018,from https://smallbusiness.chron.com/sales-analysis-report-58460.html

[5]. Reddy N., (2015). Sales Analysis Techniques. Retrieved December 1,2018,from http://bnreddybi.blogspot.com/2015/10/sales-analysis-techniques.html

[6]. Sun,F.,Liu,Y.,Xurigan,S.,&Zhang,Q.(2015,January). Research of Clothing Sales Prediction andAnalysis Based on ID3 Decision Tree Algorithm. In2015InternationalSymposiumonComputers&Informatics.AtlantisPress. https://doi.org/10.2991/isci-15.2015.42

[7]. Alamsyah, A. (2015). Sales Prediction Model UsingClassificationDecisionTreeApproachforSmallMedium Enterprise Based on Indonesia E-CommerceData.InSeminar&ConferenceonBusiness&TechnologyinICTIndustry.

[8]. Gancheva,V.(2013).Marketbasketanalysisofbeautyproducts.ErasmusUniversityRotterdam.

[9]. Mehay, A., Singh, K., & Sharma, N. (2013). Analyzemarketbasketdatausingfp-growthandapriorialgorithm.InternationalJournalonRecentandInnovation Trends in Computing and Communication,1(9), 693-696.

[10]. Kouzis-loukas, M. (2014). Analysing CustomerBaskets.Erasmus SchoolofEconomics.

[11]. Bhagwat,S.,Jethliya,V.,Pandey,A.,&Islam,L.(2015).Salesanalysisusingproductratingindataminingtechniques.InternationalJournalofResearchinEngineering and Technology, 4(02), 2319-1163.https://doi.org/10.15623/ijret.2015.0402024

[12]. N. Isa, N.A.Kamaruzzaman M.A. Ramlan, N.Mohamed,M.Puteh,MarketBasketAnalysisofCustomerBuyingPatternsatCormCafé,InternationalJournalofEngineeringandTechnology,Vol7,No4.42(2018).

[13]. Priti S. Patel and Dr. S.G. Desai, A Comparative StudyonDataMiningTools,InternationalJournalofAdvanced Trends in Computer Science and Engineering,4(2),March-April2015, 28–30.

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Torsional and Flexural Resistance of Sisal Fiber Concrete RCC Beam

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ABSTRACT

Sisal is the plant fiber used since centuries for different uses such as ropes, mats and other decorative items. The use of these fibers for improving strength of the concrete and other structural elements is studied by many of the researchers Fiber has very unique properties which improve strength by bridging cracks. It also improves the properties of fresh concrete by many ways. The addition of fibers in concrete is helpful in improving its static as well as dynamic properties. In this research the behavior of the beam made by sisal concrete under flexural as well as under pure torsion is studied.

In this study, flexural and torsional resistance of sisal fibers under different aspect ratios and different percentages are mixed with the fresh concrete and then the RCC beams casted using this concrete. Beams are tested for flexure as well as for torsion after curing. Fibers used with aspect ratio 50, 75,100 and the percentage of 0.5%, 1%, 1.5% and 2% were used for the work. Normal M30 mix was used for the study. The experimental work was carried out for different combinations. This study has concluded that an increase in torsional strength by 65.7 % and was observed at 1.5% fiber and 100 A.R. and the maximum flexural strength is at 1 % sisal fiber reinforced concrete beam with aspect ratio 100 which is 40.12 % more than the normal reinforced concrete beam.

Keywords: Reinforced concrete, beam, sisal fiber, torsional strength, flexural Strength.

I. INTRODUCTION

Concrete is a brittle material. It possesses a low tensile strength, ductility and very little resistance to cracking. Internal micro cracks are present in concrete and its poor tensile strength is due to propagation of such micro cracks leading to brittle fraction of concrete. In plain concrete and similar brittle materials, structural cracks develop even before loading due to drying shrinkage and other causes [06]. When load is applied the internal cracks propagate and open up due to stress and additional cracks are formed. The development of these cracks is the cause of inelastic deformation in concrete

The natural fibers have been tried as reinforcement for cement matrices mainly to produce low-cost thin elements for use in housing schemes. Vegetable fibers require only a low degree of industrialization for their processing and in comparison with an equivalent weight of the most common synthetic reinforcing fibers, the energy required for their production is small and hence the cost of fabricating these composites is also low. In addition, the use of vegetable fibers in cement matrices requires only a small number of trained personnel in the construction industry.

1.1 Sisal Plant

The Sisal plant is one of the types of perennial shrub which grows in the tropical and subtropical regions of the world. The average Agave sisalana plant has a height of 1.2 m to 1.6 m and a hard bole diameter of 0.50 m to 0.85 m. Leaves are typically arranged around the meristem or bole with length varies from 0.55 m to 1.6 m and width of 4.5 cm to 12 cm and mass of approximately 0.27 kg to 0.75 kg. Sisal fiber is a leaf fiber extracted from the leaves of plant which is scientifically known as Agave sisalana[02]. It is one of the most extensively cultivated hard fibers in the world. It grows in very hardy type soils where normal plants may not be grown. Though, the ideal condition in which the plant may be cultivated are in the areas where average temperature is between 20 to 28°C and the average annual rainfall is between 600 to 1500 mm. The main advantage of this plant is that, it can be grown where prolong droughts and high temperature are the problems where other plants cannot be grown.

Figure No:1 Sisal Plantation in Kenya

II. THEORETICAL BACKGROUND:

In the previous research by author on beams casted with plain concrete with and without fiber insertion, it was observed that, the flexural strength is increased with the fiber percentage and also with the aspect ratio. It was observed that at 1.5% fiber and aspect ratio 100, the maximum strength was observed. The maximum strength was observed to be 187% more than the strength of the specimen without fiber [02].

Therefore it is clear that the flexural strength depends on length as well as percentage insertion. For the percentage greater than 1.5% however strength starts declining. Also as the fiber percentage increases in the concrete, the concrete becomes harsh and non-workable.

III. SYSTEM IMPLEMENTATION

For the present work, the sisal fiber in two combinations are used, A) The Aspect ratio is varied as 50, 75 and 100 and B) The percentage of the sisal is varied in four combinations such as 0%, 0.5%, 1%, 1.5% and 2%. For each combination the beam samples of size 150mm X 150mm X 700mm with 10mm dia. four bars as longitudinal steel and 6mm diameter stirrups @ 90mm c/c are casted in M30 mix and tested for pure torsion as well as for flexural strength for each combination. Table no.1 gives the quantity required in grams for each combination.

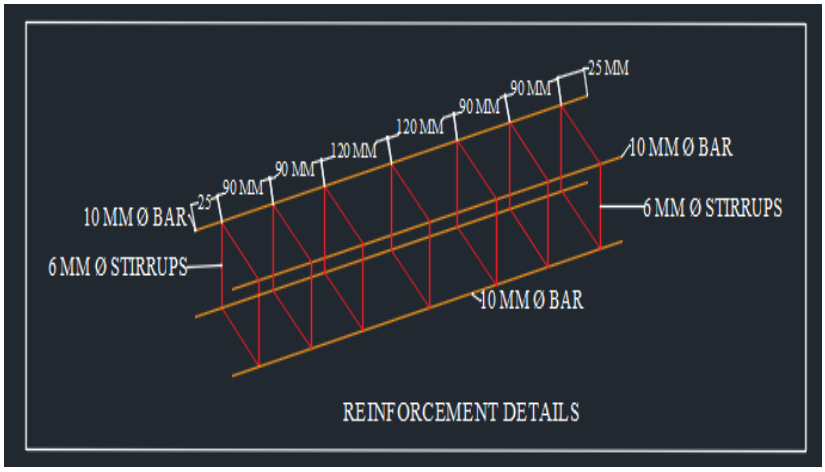

Figure No: 02 Reinforcement Details

IV. RESULT AND DISCUSSION

The beam specimen are casted and cured in water for 28 days, and then are tested for the Torsion as well as for Flexural test separately.

Table No: 01 Sisal insertion in beam moulds

% of sisal fiber	0.5 %			1 %			1.5 %			2%		
Aspect ratio	50	75	100	50	75	100	50	75	100	50	75	100
Sisal (grams)	38	38	38	76	76	76	114	114	114	152	152	152

4.1 Torsion Test on Beams:

For Torsional Test on Beams, the test setup is to be made by using structural steel as shown in below picture. The distance between two ends Rectangular frames made by angle, is kept 650mm. The load eccentricity about the central vertical axis of the beam is kept 137mm.

Due to this eccentricity, the torsional moment is applied on the specimen simultaneously at ends of beam in opposite direction. ISLB 100 is placed on the rings with socket at bottom so that the load can be effectively transferred on the edge of the frame.

When UTM applies load on the I section, The Torsion frames are subjected to loading at one end, thus creating

eccentric loading on the beam specimen which creates Torsional moments on the beam as shown in the below figure. The Torsion test using the test setup is carried out for different combination and the results are compared with the results of the beam with 0% sisal fiber specimen.

Figure No: 03 Torsional Test Setup

Figure No: 04 Torsional Test Setup

In the torsion strength test, the diagonal cracks are developed in the specimen resulting in the failure of the beam in torsion. The torsional resistance is improved significantly in the beam samples with Insertion of fibers. The maximum torsion has been found to be 7.29kNm for the 1.5% fiber content in cement and the aspect ratio was 100. Improvement in strength is observed to be more than 65.7%.

Figure No: 05 Torsional Test failure mode.

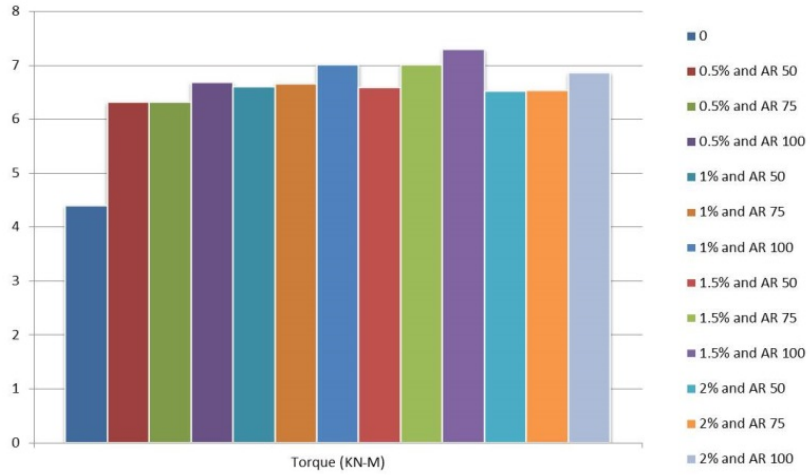

Figure No: 06 Torsional Test Result comparison

Table No: 02 Torsional Test Results

%	Aspect ratio	Load (KN)	Load at each end (KN)	Eccentricity (M)	Torque (KN-M)
Normal M30 Mix with 0 % Fiber		27.80	32.13	0.137	4.40
		35.45			
		33.15			
0.5 %	50	45.25	46.08	6.68	6.31
		46.95			
		46.05			
	75	46.95	46.12	0.137	6.32
		44.25			

		47.15			
	100	48.15	48.73	0.137	6.68
		49.50			
		48.55			
1 %	50	47.65	48.20	0.137	6.60
		49.05			
		47.90			
	75	48.90	48.60	0.137	6.66
		49.15			
		47.75			
	100	50.50	51.20	0.137	7.01
		52.15			
		50.95			
1.5 %	50	52.35	48.08	0.137	6.59
		51.95			
		52.15			
	75	46.95	51.20	0.137	7.01
		44.25			
		47.15			
	100	48.15	**53.18**	**0.137**	**7.29**
		49.50			
		48.55			
2 %	50	47.65	47.62	0.137	6.52
		49.05			
		47.90			
	75	48.90	47.70	0.137	6.53
		49.15			
		47.75			
	100	50.50	50.07	0.137	6.86
		52.15			
		50.95			

4.2 Flexural Test on Beams:

The beam specimen are tested for one point flexural test as seen in the below picture, the supports are at 600mm apart, the central point load is applied by using UTM.

Figure No: 07 Flexural Testing of Specimen

The flexural test results also show that the Flexural strength of RCC beam specimen with 1% sisal and aspect ratio 100 gives the maximum flexural resistance, moreover it can be seen from results that the flexural strength in each category is higher at higher aspect ratio of the fiber.

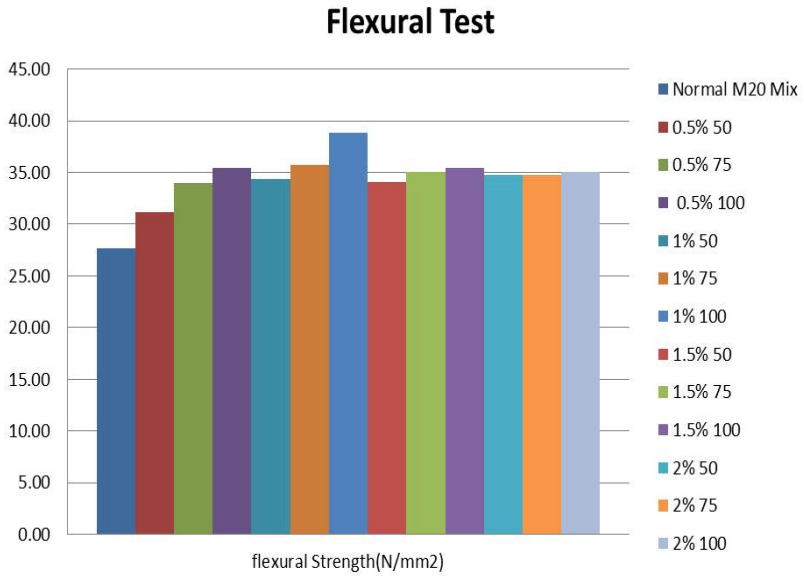

Figure No: 08 Flexural Test Result Comparison

Table No: 03 Flexural Test on Beam Results

%	Aspect ratio	Load (KN)	Avg. Load (KN)	28 days Flexural Strength (N/mm²)
Normal M20 Mix with 0 % Fiber		103.25	103.92	27.71
		104.45		
		104.05		
0.5%	50	116.75	116.75	31.13
		116.75		
		115.25		
	75	126.2	127.57	34.02
		127.25		
		129.25		
	100	131.9	132.73	35.40
		133.05		
		133.25		
1%	50	129.65	128.88	34.37
		128.25		
		128.75		
	75	134.25	134.17	35.78
		134.4		
		133.85		
	100	145.3	**145.75**	**38.87**
		146		
		145.95		
1.5%	50	128.95	127.75	34.07
		127.55		
		126.75		
	75	132.75	131.35	35.03
		130.05		
		131.25		
	100	134.25	132.85	35.43
		132.45		
		131.85		
2%	50	130.45	130.48	34.80
		128.25		
		128.75		
	75	130.25	130.23	34.73
		130.00		

		130.45		
	100	131.75	131.28	35.01
		132.85		
		129.25		

V. CONCLUSION

It is seen from above results that there is considerable increase in both flexural as well as in torsional strength.

1. The plastic concrete has good consistency and the slump was very less as compare to concrete with no sisal.
2. The concrete workability was found to be reduced with more percentage of fiber.
3. While comparing with Normal concrete results with no sisal was added, the results are found to be increased by more than 65 %.
4. In flexural strength test also it is found that, the flexural strength also increases by more than 40%.
5. The longer fibers give better strength that may be due to their more surface interaction to the concrete, where they can have better resistance.
6. The fibers are found to bridge the cracks and the strength continues to increase till they break at the cracks.

VI. FUTURE SCOPE

1. More research is required with different natural fibers.
2. Instead of steel as reinforcement, Natural elements like bamboo may be used for testing the strength with the same or different fibers, this may be more economical.
3. Durability is the major factor to be tested for future as the fiber strength may affect with time.

VII. REFERENCES

[1]. Experimental investigation on the strength sisal fibrereincforced concrete by Dr.Y.K.Sabapathy, J.Rekha, Ramya.Sajeevan(2017) IJSTE, Volume 4, Issue 4, and ISSN 2349-784 X, PP 21-25.

[2]. Mechanical properties of sisal (A. sisalana) relevant to harvesting and fiber extraction by R.K. NAIK, R.C. DASH AND A.K. GOEL, International Journal of Agricultural Engineering | Volume 6 | Issue 2 | October, 2013 | 423–426

[3]. Experimental study assessing the strength and crack resistance characteristics of sisal fibre reinforced concrete by P.Loganathan, Dr.G.S.Thirugnanam (2016) IJASER, Volume 1, Issue 1, ISSN 2455-9288, pp 734-744.

[4]. Sisal fibre reinforced concrete by Kunamineni Vijay, ChinthaUmamaheshwar (2016) IJAERS, Volume 3, Issue 3, ISSN 2349-6495, Pp 14-18.

[5]. Improvement of torsional resistant in ultra-high performancefibre reinforced concrete beam by Karim FR, Abu Bakar BH, Choong KokKeong. (2016) JSSC, Volume 2, Issue 1, ISSN 2472-0437.

[6]. Effect of fibre length and percentage of sisal on strength of concrete by Mr. Jitendra. D.Dalvi, Dr.Uttam.B.Kalwane, Mrs.Pallavi.Pansur (2016) MJERT, Volume 3, Issue 1, ISSN 2348-6953, Pp 923-931

[7]. Behaviour of fibre reinforce concrete beam in pure torsion by c.arvindkumar, madanmohan, d.v.s.prajesh, prathikkulkarni (2015) IJRET, Volume 4, Issue 5,ISSN: 2321-7308 Pp 551-556

[8]. Strengthening of R.C. Beam using Carbon Fibre to Study its Torsional Behavior bySanket.Rathi, Sachin.Kandekar, Dr.R.S.Talikoti. (2015) IJSRD, Volume 3, Issue 7, ISSN 2321-0613, Pp 416-419.

[9]. Study on properties of sisal fiber reinforced concrete with different mix proportions and different % of Fiber addition by Abdul Rahuman, SaikumarYeshika (2015) IJRET, Vol 4, Issue 3, ISSN 2321-7308, and Pp 474-477.

[10]. Experimental study on flexural behaviour of sisal fibre in reinforced concrete beam by Athiappan.K, Vijaychandrakanth. S (2014) IJERT, Vol 3, Issue 5, ISSN 2278-0181, PP 1500-1505.

[11]. Torsional Behavior of Reinforced Concrete Beams Strengthened with FRP Composites by Saravanan. Panchacharam, Abdeldejelil. Belarbi. (2002)

[12]. Kuruvilla Joseph, RomilldoDiasTolêdoFilho, Beena James, SabuThomas&LauraHeckerdeCarvalho ,Areviewonsisalfiberreinforcedpolymercomposites, RevistaBrasileira de EngenhariaAgrícolae Ambiental, v.3, n.3, 1999, Campina Grande, PB, DEAg/UFPB P.P. 367-379.

[13]. Comparative Experimental Study on Torsional Behavior of RC beam using CFRP and GFRP Fabric Wrapping by Shradha.B.Tibhe, Vijaykumar.R.Rathi. (2015) ICETEST, PP 140-147.

[14]. An Experimental study on properties of natural resin concrete with addition of sisal fibre by M.A.Ash,A.Thangadurai,S.Gobhiga. (2017) IJSRT,Volume 3 Issue 10,ISSN-2349-6002.

[15]. An experimental study on properties of self compacting concrete with sisal and coir fibres by E.Gowthaman, M.Seethapathi.(2016) Volume 4,Issue 5 (P) 3221 568X.

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Water Absorption Capacity of Paddy Straw Geo Mesh for Slope Erosion Control

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ABSTRACT

The study encompasses, finding the water absorption capacity ofa handmadePaddy Straw Geomesh (PSG)which is proposed to be used on the outer slope of earthen embankment of Canal, Dam or Road for soil erosion control.The water absorption capacity of the handmade PSG is found out using standard procedure for water absorption test for natural fibre Geotextiles as given by IS 15868 (Part 1 to 6): 2008 and is found to be 230 % maximum at the end of 1800hours since beginning, under ambient atmospheric conditions,and beyond which, it is observed to remain constant till the end of 2400 hours.However it is also observed that the after 2400 hours, the Geomesh specimens starts disintegrating with opening and loosening of joints of strands since the natural fibres with moisture,results intoits swelling and leading further to further leading to weakening of cell wall. Although the maximum230% water absorption capacity of PSG is found to be less than the market available,similar Geotextile products of Jute and Coirwhich vary in the range of 300 to 400%, but is sufficient to create microclimate on the embankment for vegetation establishment and subsequent erosion control.

Keywords: Erosion control, Microclimate, Natural fibres, Paddy Straw Geomesh (PSG), Vegetation, Water absorption,

I. INTRODUCTION

The objective of the study is not only to establish handmade Paddy Straw Geomesh hereinafter called as PSG, as effective erosion control material but also to solve its disposal problem. Paddy straw is an abundantly generated Lignocellulosic waste material that results from rice cultivation in rural India.Most of the farmers who want to take 2nd crop after Paddy, in a hurry and even without thinking of alternative disposal options like incorporation into the paddy field to improve potassium deficit, use as livestock feed, making of compost, pulp, and straw boards etc. prefer to burn straw in open fields to cause severe air pollution in adjoining areas. Additionally the success of the study would create manufacturing demand of PSG and which would generate rural employmentas well. At present Paddy Straw, in the form of Bales, Straw mulching, wattles and blankets

etc.is already in use for erosion control. It is not possible to extract fibres and yarn from the Paddy Straw and hence PSG is made up of Paddy straw strands which in turn are prepared by rolling Paddy straw stems over palm of hand using age old technique of mat making[1].

The performance of PSG alike natural Geotextiles, depends on its several physical and mechanical properties like Mass per unit area, thickness, tensile strength, durability, water absorption and Drapability[2][3] [4] [5]. Except for water absorption, all other above mentioned properties of the 6 mm thick PSG, with different apertures like 12x12, 20x20 and 25x25 mm,now proposed for Erosion control, are experimentally evaluated by Authors [6]using standard procedures as per relevant codes, and are mentioned in Table 1 below.

Table 1: Physical and Mechanical properties of the proposed PSGs

S. N.	Designation	Mass (Gms / sq. m.)	Thickness	Tensile Strength (kN/m)	Aperture size (mm x mm)	Durability	Drape Coefficient (%) in			Stiffness (Flexural) Gms cm		
							Dry	Wet	Sat	Dry	Wet	Sat
1	6PSG-12	1520	06	8.085	12x12	2-3 months	93.32	72.06	64.88	313.69	112.9	71.68
2	6PSG-20	1459	06	6.076	20x20	2-3 months	-	-	-	-	-	-
3	6PSG-25	1103	06	7.399	25x25	2-3 months	-	-	-	-	-	-
Legend: 6 = 6 mm, PSG = Paddy Straw Geomesh, 12 = 12x12 mm Aperture size, Dry= Geomesh in dry state without immersing in water;Wet and Sat = Geomesh immersed in water for 30 and 360 minutes duration(saturation stage) respectively prior to testing;												
Note: Sample size for each test is selected as per the relevant code.												

The water absorption capacity of the natural Geotextiles (PSG in this case) is considered as one of the most important properties to establish control over runoff and to make it highly effective in controlling soil erosion[7]. This is further justified by the fact that once the Geotextiles made up of natural material like jute, coir, straw, hemp etc. absorbs water to capacity, its flexibility increases approximately up to 25% and thereby improve its another important property called Drapability i.e. its ability to maintain intimate contact with soil, reduce the runoff from 42 to 15% while reducing soil erosion[8].The water absorption capacity is also used to evaluate whether a material can conform to the soil surface. If the contact of the erosion product with the soil particles is less than 90%, then the probability of erosion increases[9].The significance of water absorption capacity of the PSGwould be also important from establishment of natural vegetation.Natural Geotextilesis expected to control soil erosion until the vegetation cover in the form of shrubs and plants is established and which in turn would control erosion in the long run [10]

The Erosion Control Technology Council (ECTC),USA, describes different types of Erosion control material when produced in rolls in various forms as Rolled Erosion control product(RECP) and has recommended water

absorption test for OWT type of Geotextiles (PSG in his case) to be performed as per the ASTM D 1117. The procedure for water absorption test for natural fibre Geotextiles as given by IS 15868 (Part 1 to 6): 2008 is almost same as that of ASTM D 1117 and hence it is now used for finding out water absorption property of Paddy Straw Geomesh. The effect of temperature however is not considered in the test however instead of 24 hours, 6 hourly observation of every 3 samples continuously immersed under water for 24 hours, is now proposed. The experimental setup is designed to find the water absorption capacity under two different phases as follows. Although the hand making process of these PSGs is same, they are divided into three type's viz. 6PSG-12, 6PSG-20 and 6PSG-25 so that more no. of samples can be tested to account for the variation in thickness of the strands, size and apertures. The experiment is carried out in two phases.

Phase 1: To find out every 6 hourly water absorption capacity of Paddy straw Geomesh for 24 hours, with continuous immersion in water as per by IS 15868 (Part 1 to 6): 2008.

Phase 2: To find out ½ (half) hourly water absorption capacity of Paddy straw Geomesh for 6 hours immersion in water to get hourly data(Initial trials have indicated that the Geomesh reaches saturation point much before 6 hours of immersion in water).

Phase 1:

Equipments and sample size required: 15(fifteen) Paddy Straw Geomesh specimens(5 specimen each of 6PSG-12,6PSG-20 and 6PSG-25 Type)each of 230 mm dia. Size, Galvanised screen, Plastic clips to fix screen with Geomesh and 3(three) no. of plastic tubs of 360 mm dia. and 300 mm depth for storing water for immersion, 1(one) weighing Balance with accuracy up to 0.01gms, 1(one) Thermometer and 1(one) clock to record the time.

Method: All 15specimen (5 No. of Specimen for each 3 Tubs) of PSGs (PSG 6-12), are prepared and weighed accurately up to 0.01 Gms. First specimen out of 5 (Type 1), is placed on tared 230 mm dia. Galvanised wire Screen. Then another tared screen having similar dimension is placed over the first Geomesh. Similarly remaining four PSG specimens are placed over one another with Galvanised wire Screen inserted in between two PSGs. The entire bundle of PSGs and Wire screen is tied down with binding wire and is then placed in a Plastic tub S-1, that contain water up to 45 cmso that the bundle is fully immersed in water and are allowed to soak water.

At the end of each soaking period of 6 hours, the respective specimen (2nd, 3rd etc.) and the screen are taken out from the tub and is allowed to drain for 10 minutes and then weighed to the nearest 0.01 Gms. The reading of increase in weight of the respective Geomesh due to water is recorded. The amount of water held by the specimen is calculated by subtracting the weight of the dry specimens from the total weight. This procedure is repeated for remaining 10 specimens i.e. 5 specimen of each 6PSG-20 and 6PSG-25 type, using plastic tub no. 2 and 3. The absorption capacity is calculated as the ratio of water held by the specimen from the total weight of the original dry specimen.

Table 2: Shows absorption capacity of the Geomesh calculated experimentally

Day	Weight at time 'T' hours	Time in hours (IST)	Paddy Straw Geomesh Samples of 6G-12			Remark
			S-1	S-2	S-3	
1	Initial Weight at the start	14:00:00	50	47.00	55.00	1) S-1, S-2 and S-3 define the three Plastic tubs used for the absorption test. 2) The readings under S-1, S-2 and S-3 are obtained by actual weighing respective Samples of each type 1,2 and 3, every six hours. 3) The experiment started on 1st day at the end of 14.00.00 hrs and subsequent six hourly readings (Increase in weight) in next 24 hrs on 2nd day are recorded. 4) At the end of experiment the strands of the PSGs are observed to have been disintegrated and loosened up its stiffness.
	Weight at	20:00:00	122	121.00	119.00	
2	Weight at	02:00:00	140	143.00	150.00	
	Weight at	08:00:00	145	150.00	160.00	
	Weight at	14:00:00	145	150.00	160.00	

Phase 2:

Equipments and sample size required: 72 (seventy two) specimen (24 specimen each of 6PSG-12, 6PSG-20 and 6PSG-25 Type) of Paddy Straw Geomesh of diameter 230 mm size, G.I. metal screens, Plastic clips to fix screen with Geomesh, 3 Nos. of plastic tub of 360 mm dia. and 300 mm depth for storing water for immersion, 1(one) weighing Balance with accuracy up to 0.01gms, 1(one) Thermometer and a clock to record the time.

Method: The total 72 specimen of Paddy Straw Geomesh (6PSG-12) are divided into three group of 24 no of samples each of6PSG-12, 6PSG-20 and 6PSG-25 Type. Now 24 (twenty four) no of Specimen of type 6PSG-12 are taken, &numbered from 1 to 24 using water proof tag attached to each PSGs. These are then weighed accurately on weighing balance. The initial weight of each PSG is recorded accurately.

Now these 24 PSGs are subdivided into 3(three) groups in such a way that each group contain 8 (eight) PSGs. The first subgroup of 8 (eight) PSGs are placed on the screen, one over another and finally covering up with screen at the top. This PSG bundle is tied down with metal screens using M.S. binding wires passing through the bundle. Similarly 2nd and 3rd bundle that contain 8 PSGs each of second and third subgroups are prepared. Now these 3(three) bundles are placed in a water tub, taking care that all the PSGs are immersed fully in water. After one hour, 1stPSG is detached from the bundle 1 and is allowed to drain for 10 minutes over the screen and then weighed. Similarly at the end of every next one hour, reading of next Geomesh from bundle 1 and subsequent readings from bundle 2 and 3 are taken, allowed to drain and weighed. This is done for 24 hrs and total 24 readings are noted. The amount of water held by the specimen is calculated by subtracting the weight of the dry specimens from the total weight measured. The experiment is repeated for remaining each 24 no. of

Geomesh sample of type 6PSG-20 and 6PSG-25 and 48 readings(24 for each type) are recorded thus making the record of total 72 observations.

II. RESULT AND DISCUSSION

Phase 1:

The observations of the Table 2 are used to draw curve between of water absorption capacity of three types of PSGs with respect to time and is now shown in Figure 1.

Among the three types of PSGs, 6PSG-20 shows the maximum water absorption capacity of 219.15% at the end of 18 hours, while 6PSG-12 and 6PSG-25, shows maximum water absorption capacity of 190 and 200 %

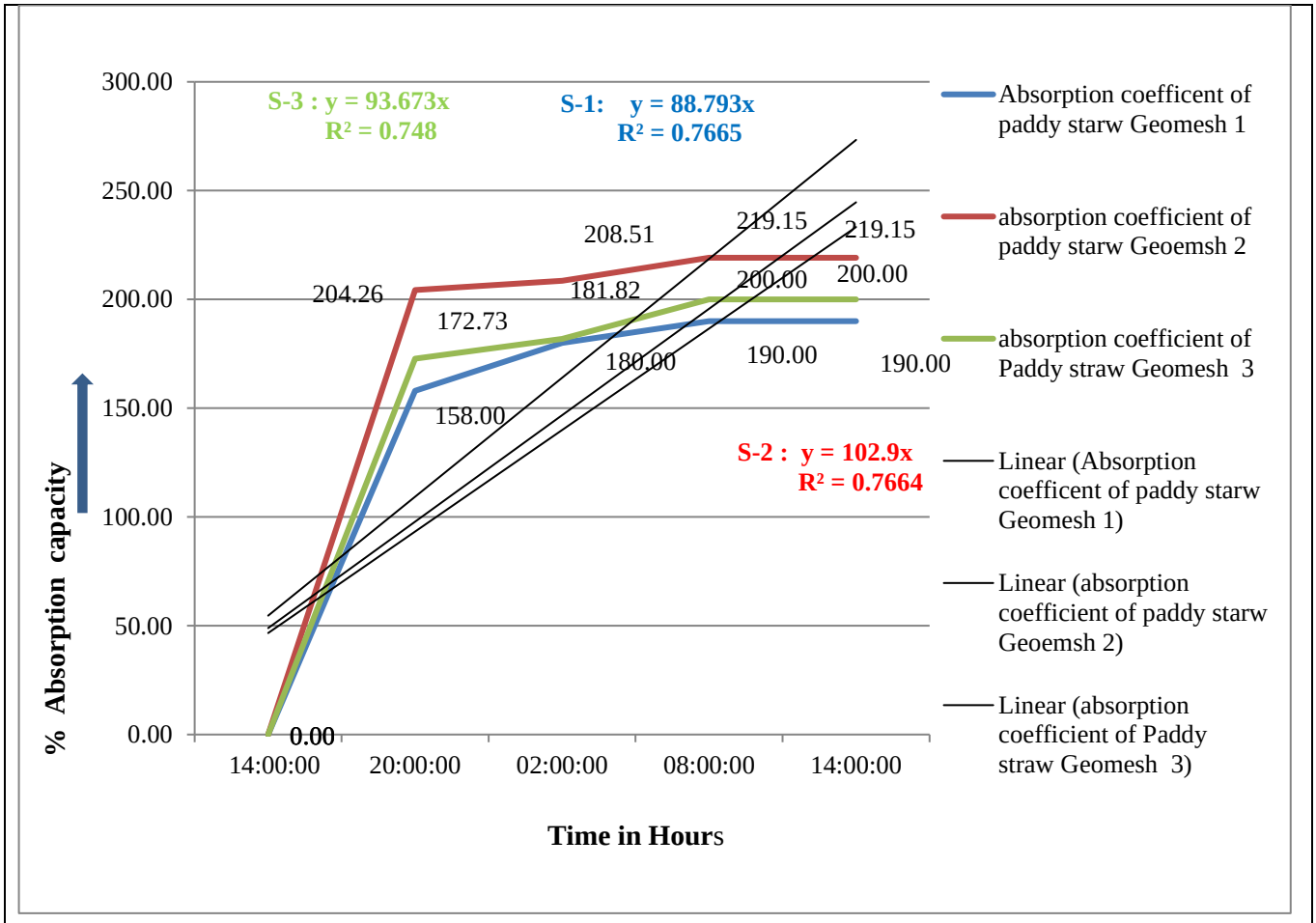

Figure 1: Water absorption capacities of 6PSG-12(Geomesh 1), 6PSG-20(Geomesh 2) and 6PSG-25(Geomesh 3)
Vrs. time interval of six hours for 24 hours

respectively at the same time which is less than the 6PSG-20. Beyond this, the absorption rate is found to have been stabilised and show no considerable increase further even up to the end of 24 hours. In other words it can be stated that the PSGs under S-1,S-2 and S-3 reaches its saturation point at the end of 12.00 hrs itself with

values of absorption capacities as 208.5, 181.82 and 180% respectively and are not very much less than the maximum values. The line of fit drawn for these 3(three) curves of 6PSG-12 6PSG-20 and 6PSG-25 shows respective "r" values equal to 0.876, 0.864, and 0.875. Since these values lie in between 0.5 to 1, it clearly indicates a positive correlation ship that exist between different values of absorption capacities of each Geomesh 1, 2 and 3.

As regards the maximum hourly water absorption rate of these PSGs, it is not visible from the curves in Figure 1 and hence the result of the experiment done in phase 2 are analysed.

Phase 2:

Each 24 out of 72 observations taken respectively for Type 1, 2 and 3 of Paddy Straw Geomesh of 6G-12 are used to draw three curves between of water absorption capacity of each of three types with respect to time interval of one hour for 24 hours and is now depicted in Figure 2 below

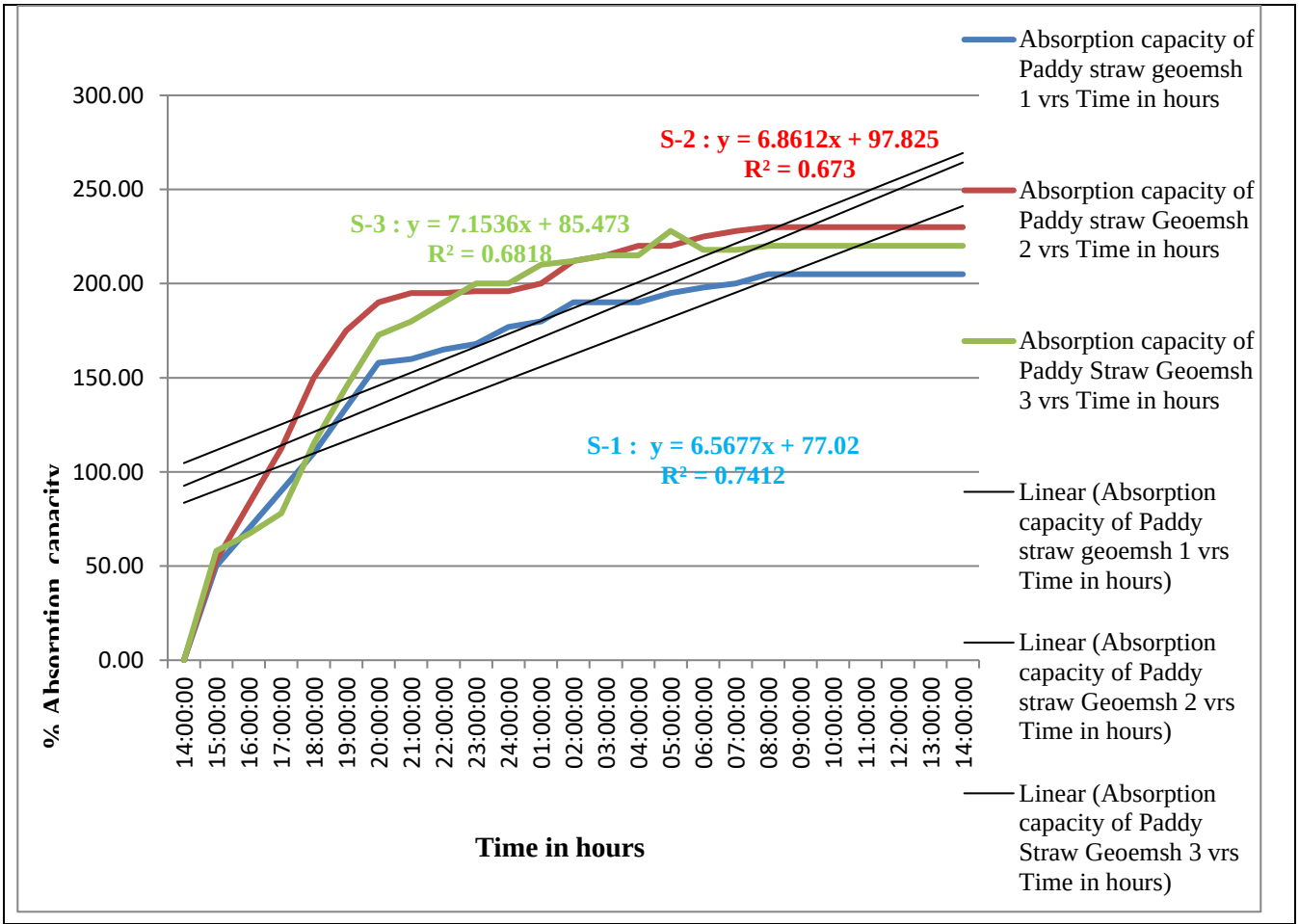

Figure2: Shows curve drawn between water absorption capacities of 6PSG-12(Geomesh 1), 6PSG-20(Geomesh 2) and 6PSG-25(Geomesh 3) vrs. Time interval of one hour for 24 hours as per procedure of phase 2

From Fig.2, it is observed that among the three curves, the one drawn for 6PSG-12, shows the maximum water absorption capacity of 230 % at the end of18 hours, while 6PSG-20 and 6PSG-25, show maximum water

absorption capacity of 205 and 228 % respectively at the end of same time. But these values are obviously less than that of6PSG20. Beyond this, the absorption rate is found to have been stabilised and show no considerable increase further even up to the end of24 hours. Just like the behaviour of curves shown in Fig. 2 above, the curves drawn for the 6PSG-12, 6PSG-20 and 6PSG-25, shows that the saturation point of absorption capacity is reached at the end of 18.00 hrs itself with values of equal to 205,230 and 228% respectively and are not very much less than the maximum values. The line of fit drawn for these 3(three) curves of 6PSG-12, 6PSG-20 and 6PSG-25 shows respective "r" values equal to 0.861, 0.825, and 0.820. Since these values lie in between 0.5 to 1, it clearly indicates a positive correlationship that exist between different values of absorption capacities of each 6PSG-12, 6PSG-20 and 6PSG-25.

Similarly the hourly rate of absorption for all three types of PSGs, is seen as maximum during 1st one hour between 14.00.00 to 15.00.00 hrs and is equal to 50, 53, and 58% respectively. After this the rate of increase is reduced to between 11 to 30% at the end of 16.00.00 hrs. This trend continues up to the end of 20.00.00 hrs and then is seen to have been stabilised with the increase in rate from 5 to 10% for all three types of PSGs. In either experimental phases 1 and 2, the maximum moisture absorption capacity of the Paddy Straw Geomesh is found to be 230 % maximum and which is slightly more than the established absorption capacity of OWT type of coir Geotextiles (163%) but drastically less than OWT type of Jute Geotextiles (JGT) which is said to be 400 to 500% both mentioned in Table 3.

This high water absorption capacity of Paddy Straw Geomesh (230%) is going to serve many important functions related to erosion control. It will be suitable in areas of low rainfall and situations where the establishment of vegetation takes a long time, leaving slopes susceptible to erosion.As the Geomesh absorbs the water, its weight is increased and the contact between the Geotextiles and the soil underneath is enhanced resulting into better flexibility /Drapability of the Geomesh with land surface. This absorbed water of Geomesh further helps in germinating seeds often due to Bird's droppings or manually planted seedlings for vegetation cover.

Another effect of water absorption of Paddy Straw Geomesh is enhancement in its biodegradability which the Authors have already found out experimentally and by field studies to be 2 to 3 months after which the Geomesh is found to have been mingled with soil of the embankment but strengthening the embankment with flourishing vegetation cover. This serves the purpose of placing the Geomesh on the embankment for Erosion control. The following Table no 3 shows the comparison of Absorption coefficient of PSG(6G-12) with similar PSGs of different materials available in the Market.

Table 3: Comparison between absorption capacities of Paddy Straw Geomesh with similar product available in The market

S.N.	Product's name, material used & its form as per ECTC's categorization	Mass Per unit area(Gms /m2)	Thickness (mm)	Water absorption capacity (%)	Source
1	S150BN Erosion Control Blanket (ECB) machine-produced mesh of 100% agricultural straw of 1.27 x 2.54 cm size and sewn together on1.50 inch (3.81 cm)	315	7.87	381	[11]
2	SC150 ECB, double net, machine-produced mat of 70% agricultural straw and 30% coconut fibre of size 1.27 x 1.27 cm	388	9.91	285	[12]
3	Nedia Koir Mat™ 400,700 & 900 is a woven fabric of high strength coir twine made from well-cleaned, fresh water cured coconut fibre.				[13]
	TM-400	400	9	163	
	TM-700	700	9		
	TM-900	900	9	132	
4	Jute Geotextiles(JGT) Open weave machine made				[14]
	Type 1	292	3	400	
	Type2	500	5	500	
	Type 3	730	6	500	
5	East Cost Erosion Blanket				
	ECS-2B Double Net Straw Biodegradable Rolled Erosion Control Product	379.8	8.1	403 %	[15]
6	**Handmade Paddy Straw Geomesh(6G-12)**	**1520**	**06**	**230%**	**Found out**

III. CONCLUSIONS

The water absorption capacity of handmade PSGs viz. 6PSG-12, 6PSG-20 and 6PSG-25 is found out usingIS 15868 (Part 1 to 6): 2008 to ensure its effectiveness as Erosion control material while being laid on the slope of the Embankment of any civil engineering structures like Dam and canals. The following conclusions are drawn. The 6PS-12 has the maximum water absorption capacity of 230% which is found to be sufficient since it is very well comparable with market established similar products of coir. However dissimilarities in the manufacturing processes for these two products prevent the exact comparison between the two.

The maximum hourly absorption capacity of 6PSG-12 is seen at the end of 16 hrs and hereafter the increase is just moderate unless it reaches the maximum values. The ambient atmospheric conditions are not found to

affect absorption capacity of PSGs. The results presented in the current paper suggest that 6PSG-12 has sufficient water absorption capacity to function as surface Erosion control product especially for slopes.

IV.REFERENCES

[1]. Halkude, S. A. and Katdare , R. C. " Design of experimental setup for durability of paddy straw for Erosion control in Pune, India," International Journal of Advanced Research in Education Technology (IJARET) vol. 1, issue 1 (July - Sept. 2014) page 49-56.

[2]. Shivkumarbabu, G.L. (2006)."An introduction to soil Reinforcement and Geosynthetics" Universal Press(India) Pvt. Ltd. 29-43,105-133,181-195

[3]. Ogbobe O, Essien KS, Adebayo A. 1998. A study of biodegradable geotextiles used for erosion control. Geosynthetics International 5:545–553

[4]. Rickson RJ. 2006. Controlling sediment at source: An evaluation of erosion control geotextiles. Earth Surface Processes and Landforms 31: 550–560.

[5]. Vishnudas S, Savenije HHG, van der Zaag P, Anil KR, Balan K. 2006. The protective and attractive covering of a vegetated embankment using coir Geotextiles. Hydrology for Earth System Sciences 10: 565–574

[6]. Halkude, S.A. and Katdare, R.C.(2014),"Investigation of Tensile properties of Paddy Straw Geomesh for Erosion control" Indian Journal of Advance research in Engineering and Technology(IJARET),Chandigarh, India, Page 72-76

[7]. Ghani, S. A., Yahya, M.F. and Dahalan, S.N.(2014),"Proceedings of the International Colloquium in textile engineering" (c) Springer Science and Business media, Singapore, Page 51-54.

[8]. Horricks, A.R. and Anand, S.C.(2000)," Handbook of Technical Textiles" Published by Woodhouse publishing Ltd., Cambridge, England. PP 102-106

[9]. Sutherland RA, Ziegler AD. 2007. Effectiveness of coir-based rolled erosion control systems in reducing sediment transport from hill slopes. Applied Geography 27: 150–164.

[10]. Ingold, T.S., and Mr. J. Thompson, J.C.,(1990).A design approach for performed erosion control systems. Proceedings 4th International conference on Geotextiles, Geomembranes and related products, Den hag: 375-380.

[11]. Upadhyaya, P., Garg, M., Kumar. Nema2, A.K.(2012). The Effect of Water Absorption on Mechanical Properties of Wood Flour/Wheat Husk Polypropylene Hybrid Composites, Published online in 'Material Sciences and Applications' May 2012 (http://www.SciRP.org/journal/msa) 317

[12]. Marwen, B., Naima, B., Dashnor, H., and Muzahim, A.M. (2014)," Physical Characterization of Natural Straw Fibres as Aggregates for Construction Materials Applications" published in Materials 2014,7,3034-3048;doi:10.3390/ma 7043034,ISSN 1996-1944,www.mdpi.com/journal/materials

[13]. Choudhary, K.P.(2013). "Use of jute Geotextiles in road, river and slope stabilization" published in "Proceedings of Indian Geotechnical Conference December 22 -24,2013, Roorkee", page 1 to 7

[14]. Ayuba, K., Olorunnaiye, E.S., Rickson, J.(2014),"Application of Geotextile materials in soil erosion control". Published by JORIND 12 (2) December, 2014. ISSN 1596-8308. www.transcampus.org/journals; www.ajol.info /journals /jorind page264-271

[15]. Brochure East Cost Erosion Blanket, ECS-2B Double Net Straw Biodegradable Rolled Erosion Control Product 443 Bricker Road Bernville, PA 19506 1 . 800 . 582 . 4005 +1 .610 .488.8496 Fax +1.610.488.8494 www.eastcoasterosion.com pp1

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A Review on Gear Rattle Phenomena in Gearbox

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ABSTRACT

Acoustic comfort is an important criterion for sales of automobile manufacturers. For many years, research efforts led to reduction of acoustic levels. Consequently, noise sources that were previously masked emerge. Specifically, gear rattle noise due to impacts between teeth of unloaded gears is particularly audible at low speed regime of the engine. Gear rattling noise is one of the major problems facing the industry, and the car industry in particular, because cars spend so much time idling under no load or very light loads. [11] Many researchers had given their contribution in field of gear rattle its causes and effect. Driveline contains many components; thus it has multiple degrees of freedom. Therefore, review of past literature helps in understanding and resolving complicated problem and will be helpful in future work. This paper is the study of researchers work on gear rattle phenomena, and vehicle noise, causes and effects of gear rattle, Experimental analysis and conclusion by researchers, various techniques to reduce gear rattle, simulation etc.

Keywords: Gear rattle, Vehicle noise, Driveline, Backlash, Techniques to reduce gear rattle

I. INTRODUCTION

The gearbox is a system of gearings that allows the variation of the gear ratio between its input and output, which can be made manually or automatically. The main function of this component is to make the best use of the power provided by the engine. Besides, in order to make a perfect gear mesh (without friction), there must be a clearance between the gear teeth. Impacts between these teeth generate several kinds of noise, usually known as rattle and clunking. [4]

The term gear rattle makes reference to the sound induced by collisions between the unloaded gear mesh pairs in the transmission. It can be noticed on manual transmissionvehicles in neutral condition (idle rattle) related to the engine firing frequency. These collisions result from torque fluctuations transmitted from the engine. The impact force on a driven gear during a collision changes its speed so that a relative motion develops between the mating gears. Rattle is also described in literature referring to a condition where high levels of vibrations are found in the transmission (drive rattle).

Gear rattle is due to the presence of dead spaces and backlashes. Moreover angular backlashes are generally variable with the relative angular rotation and this periodic fluctuation constitutes itself a cause of gear rattle [11].

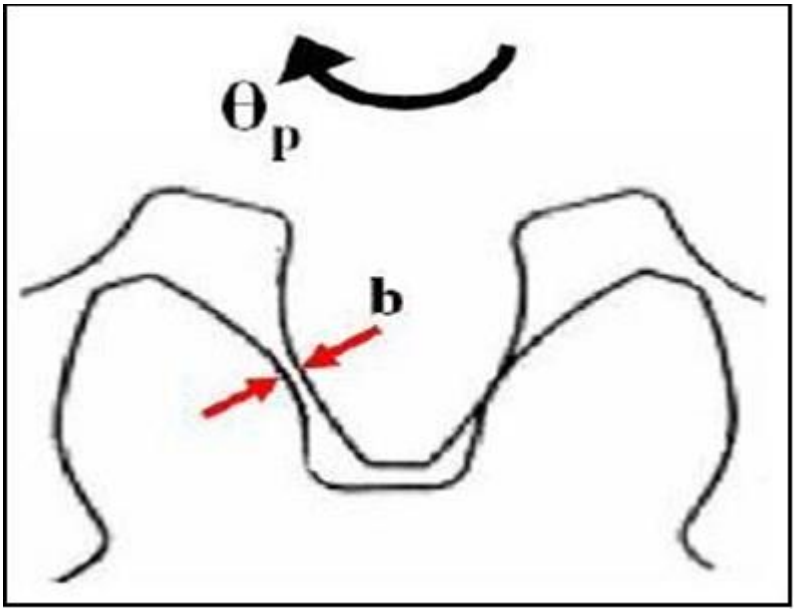

Figure 1. Gears in meshing vibrate due to backlash (b) [6]

Gear rattle risk is becoming more relevant nowadays because of :

- A trend towards downsized engines with reduced cylinder count
- Increased amplitude and reduced frequency of torsional vibration
- Better level of vehicle refinement (i.e. less ”masking noise“)

II. LITERATURE REVIEW

Brancati, et al., (2015), analysed gear rattle induced by multi-harmonic excitation by an experimental point of view. Many analysts consider a sinusoidal law of speed, but a multi harmonic excitation, as a sum of two harmonic components was adopted during the analysis. An interesting behaviour was observed in the gears when variation in the second order harmonic amplitude of the excitation was done. The dynamic behaviour had been evaluated by the use of a test rig for unloaded gear pairs and results of experimental tests, in the time and frequency domain, well agreed with some numerical simulations. The analysis conducted on an unloaded gear pair subjected to a multi-harmonic excitation had evidenced interesting aspects in relation to the gear rattle phenomenon by examining the gear relative angular motion, both in time and frequency domains. The rattle frequency, initially equal to that of the fundamental component of the speed fluctuation, becomes equal to that of the second harmonic component, when the amplitude of the second order excitation component assumes a value equal to about 70-80% of the first component.

From above literature review conducted, gear rattle phenomenon and various techniques for reducing gear rattle are understood. Also, various methods used for modelling of gear rattle problem are studied. These methods will help in developing a model of neutral gear rattle problem. The main work done till now is in

modification of gear geometry, or modifying flywheel i.e., by using a dual mass flywheel. It has also been seen that various clutch parameters do influence gear rattling. Study of induced fluctuation in drive line is done, which is helpful for modeling of real world rattling problem. [1]

Laihang Li et al., (2015), studied the transient vibration phenomenon in a vehicle power-train system during the start-up (or shutdown) process with a focus on the nonlinear characteristics of a multi- staged clutch damper. First, a four-degree-of-freedom torsional model with multiple discontinuous non linearities under flywheel motion input was developed, and the power- train transient event was validated with a vehicle start-up experiment. Second, the role of the nonlinear torsional path on the transient event was investigated in the time and frequency domains; interactions between the clutch damper and the transmission transients were estimated by using two metrics. Third, the harmonic balance method was applied to examine the non linear characteristics of clutch damper during a slowly varying non-stationary process in a simplified and validated single-degree-of- freedom power-train system model. Finally, analytical formulas were successfully developed and verified to approximate the nonlinear amplification level for a rapidly varying process. [2]

Brandon,et al., (2014), Noise produced by components in a diesel affect the quality of the engine noise. One component source related to consumer complaints is gear rattle. Gear rattle is caused by gear tooth impacts resulting from fluctuations indifferential torsional acceleration of the driving gears. Previous work in this area has focused on rating the overall sound quality of diesel engines without specifically focusing on models for predicting the perception of gear rattle. Here, a method to generate sounds having different levels of gear rattle is described. First, diesel engine noise recordings were analyzed to determine the engine speed time histories; they were then used to guide gear impact timing and to generate gear noise components. The gear noise transfer paths were then tuned to improve the quality of the gear noise predictions. The gear noise simulation tool is presently being used to generate sounds for subjective tests designed to quantify the detestability, perception of growth, and annoyance of gear rattle. The noise prediction coupled with the sound quality models based on the analysis of the subjective data will provide a way to predict how people perceive gear rattle so that component noise targets can be set directly related to human perception.

This simulation method has proven successful at creating realistic sounding time histories with varying levels of gear rattle. The independent control of the level of the gear rattle events will be a useful tool in determining thresholds at which gear rattle may be detected and for understanding, the way people perceive growth of gear rattle. Gear rattle simulations created as described here were used in a subjective test designed to quantify detectable levels of gear rattle; the results of that test will be reported later. Decisions that were made during the development of the method that improved the sound of the simulations from a listening perspective but degraded the sound quality metric comparison between the simulated and real signals highlight the importance of listening to the sounds and not relying solely on sound quality metrics during the simulation process. The understanding gained from the development of this simulation process may help to guide the development of a gear rattle metric using noise measurements. In recent work, it has been observed that gear rattle might affect the operation of the engine. It was previously mentioned that the presence of gear rattle tends to amplify the „background" noise (engine noise not related to gear rattle impact events). An improved simulation might implement feedback that more accurately simulates how gear rattle affects the operation of the engine. [3]

Heirichs and Bodden (1999) described gear rattle as an air borne sound, occurring when torsional vibrations of the gearbox are transmitted to its housing through the bearings. It also have a structure borne parcel, originated when the gearbox mounting system interacts with the vehicle frame. In some cases, the shifting system can contribute transmitting vibrations directly to the passenger cavity. In recent years a device called dual mass flywheel (DMF) has been used to reduce these vibrations, due to its inertial, stiffness, and damping effects (Albers, 1994). Instead of using a single flywheel inertia attached to the crankshaft, when a DMF is installed, the transmission input shaft inertia is increased; allowing better vibration insulation in both idle and drive rattle condition.

Simionatto, et al., (2013), performed numerical investigation in order to understand how the parameters of the pre-damper affect dynamics of power train concerning two of the NVH phenomena are the Shuffle and the Clunk. A model with 12 degrees of freedom was built, considering nonlinearities on the clutch disk, on the driving gear pairs of the transmission and also on the differential gear. The clutch disk was modeled as a multi-stage stiffness combined with different levels of dry friction. Then, 18 clutch disks with different pre-damper Specifications were modeled and simulated in the same dynamic model of power train in order to evaluate the sensibility of the Clunk phenomenon to each parameter, and estimated in which driving gear pair the impacts were more severe.

Results showed that the input gear pair of the gearbox was more likely to present high acceleration when subjected to sudden torque reversals. The variation of hysteresis levels on the pre-damper showed the expected results, as the time that the system takes to cease vibration increases with the increase of hysteresis. However, changes in the width of the pre- damper showed that, concerning teeth impacts, too wide or too thick pre-dampers tend to make the system more prone to more intense impacts.[4]

Kadmiri et al., (2012), reported an experimental investigation of a conventional manual automotive gearbox designed by Renault under rattle conditions. First, the gearbox was instrumented and assembled on a test bench which replicates an automobile power train. Driving and loose gears angular displacements were measured with two optical encoders. Stereo- mechanical impacts were characterized by a coefficient of restitution defined from the generalized impact theory. Its value depended on materials, contact geometry, operating conditions and the presence of lubricant. Identification of key parameters was considered in detail. A dimensionless parameter describing rattle excitation level was proposed. It combines excitation frequency and amplitude, inertia and drag torque. The input data were updated from experimental measurements. Nonlinear dynamic response was computed and compared with experiments performed within various ranges of neutral and drive operating conditions. Experiments had also validated models describing the different contributions to drag torque applied to the loose gear. The other parameters governing rattle noise depend on gearbox design (inertia, gear backlash, eccentricity, etc.). Experiments performed confirm that the equivalent excitation level can be described using the dimensionless parameter L. From this work, it can be inferred that a numerical model can be prepared to predict the characteristics of the nonlinear dynamics of gear, whatever the gearbox configuration. Characterization of gear rattle may be considered, for any loose gear, any gearbox and any operating conditions.[5]

Miyasato, (2011), has analyzed idle rattle with a systemic approach. Natural frequencies of a linearized system in idle was calculated and compared to the order content of the engine input torque. Then, a nonlinear model

with piecewise linear stiffness and hysteresis representing the clutch and time-varying stiffness with backlash for the gears, was subjected to alterations in clutch, gears and its inertial parameters in order to compare the gear rattle response in terms of vibration intensity. The hysteresis seems to have an optimum range of values, resulting in vibration level increment when it was over dimensioned. Modifications on the stage transition angle resulted in greater level of vibration when the clutch worked on both idle and drive stages. Varying parameters such as the helix angle and gear width had small influence on the resultant impacts, which were much more related to the gear pair chosen. Increasing the clutch hub inertia resulted in reduction of the rattle index (RI) level, showing the effectiveness of using a dual mass flywheel device on the system.

From this work it can be seen that clutch parameters do influence rattle index. Also, modifications on the clutch stiffness parameter had strong influence on the gear rattle intensity. [6]

Bozcaet al.,(2010), the optimization of gearbox geometric design parameters to reduce rattle noise in an automotive transmission based on a torsional vibration model approach is studied. Rattle noise is calculated and simulated based on the design parameters of a 5-speed gearbox, and all pinion gears and wheel gears are helical. The effect of the design parameters on rattle noise is analysed. The observed rattle noise profiles are obtained depending on the design parameters.

Optimized geometric design parameters lower the rattle noise by 10% compared to the calculated rattle noise values for the sample gearbox. All optimized geometric design parameters also satisfy all constraints. Optimizing the geometric design parameters not only reduces the rattle noise but also increases the desirable bending stress and contact stress level. While geometric parameters, such as the module, number of teeth, helix angle, face width, backlash and axial clearance are optimized, the operational parameters, such as angular acceleration and excitation frequency are not optimized because these operational parameters are given by the automotive manufacturer as input values. [7]

S. Theodossiade et al., (2009), introduced a new approach for understanding the interactions between the transmission gears during engine idle conditions by taking into account the effect of lubrication. Gear impacting surfaces were treated as lubricated conjunctions rather than the usually reported dry impacting solids. Depending on load and speed of entraining motion of the lubricant into the contact domains, the regime of lubrication alters. In this paper, the influence of lubricant in torsional vibration of lightly loaded idling gears was examined which promotes iso-viscous hydrodynamic conditions. It was shown that the lubricant film under these conditions behaves as a time-varying nonlinear spring–damper element. Spectral analysis of the system response is compared to the findings of the linearised system. In the overall response, the engine orders are dominant, while in the microscopic fluctuations the natural frequencies of the system have the strongest presence. The lubricant behaves like a nonlinear spring damper, which significantly affects the response of idle gears during the meshing cycle. The examination of the linearised system revealed that the system response was strongly affected by the lubricant properties. Particularly the viscosity was one of the main factors, which governs the overall system behavior, affecting the drag torque and inertia of the idle gears, promoting rattle. This was an observation, which can contribute to root cause solutions of this NVH concern. [8]

Padmanabhan et al., (2002), presented a state of the art in the modeling of transmission rattle. Specifically they have developed a step-by-step approach to address the rattle problem. Although the overall problem solving procedure was broken up into three key steps, it is essential to remember that each of these was inter-

dependent on the other two steps. Current research and future plans focus on the development of new or improved semi-analytical and computational methods, impact damping mechanisms, sound perception metrics, and optimization of driveline parameters for rattle-free conditions. [9]

Michael Yu Wang et al.,(2002), this paper describes a research work on modeling and numerical analysis of torsional vibration in automotive manual transmissions. The focus of the effort is on a decoupling procedure for the numerical analysis of gear rattle. The power train model is specified into a linear subsystem and a non-linear subsystem that includes the strong nonlinearities of gear backlash and multistage clutch stiffness. The weak coupling of the subsystems is then exploited for efficient numerical analysis. It is shown that the decoupled model yields an acceptable accuracy with a significant gain in computational efficiency when using an algorithm of numerical integration of stiff differential equations or a finite element in time algorithm. Numerical simulation results for a Daimler-Chrysler vehicle power train are given to illustrate the effectiveness of the proposed scheme. [10]

S¨ureyya et al., (1999), the cause of rattling and clattering noise is torsional vibration of transmission components that are not under load, that move backwards and forwards within their functional clearances. This noise is perceived as distinct from other sources of noise, and is intrusive because of its undesirable character. The transmission parameters backlash, axial clearance and main centre distance were varied by experimental analyses in test stand trials, showing the effect on the propensity to rattle and clatter. By optimizing these parameters, it was possible to minimize the rattling and clattering noise. Measures internal to the transmission to reduce loose part vibration in vehicle transmissions were also considered. The effectiveness, in terms of minimizing clattering and rattling proneness, of making the axial thrust collars elastic with and without pre-compression of the elastomer was considered. All internal transmission measures discerned as effective in reducing rattling and clattering noise need to be examined in terms of service life and possible side effects in all the operating states arising in a vehicle transmission. The calculated noise level with the EKMS imulation program correlates with the measured noise level. Parameter studies with the EKMS imulation program, which contains all relevant parameters for the excitation of rattling noise caused by idle gears, shows the significant parameters for the investigated transmissions. [11]

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III. CONCLUSION AND FUTURE SCOPE

From above literature review conducted, gear rattle phenomenon and various techniques for reducing gear rattle are understood. Also, various methods used for modeling of gear rattle problem are studied. These methods will help in developing a model of neutral gear rattle problem. Literature presents study of gear rattle simulation and analysis. Design modifications are made in components like flywheel and gear box. In driveline, flywheel and gear box are major components whose design cannot be modification is critical, costly and difficult. One of the most flexible parts of the power train, in terms of design, is the clutch disk, because it is much less expensive than the engine, the gearbox and the differential gear and a fine tuning of its parameters may reduce the severity of many NVH phenomena [3]. Not much work has been done on clutch design with

regard to this problem. Therefore, there is an opportunity to find out modification in clutch design so that engine vibrations are isolated from gear box.

IV.REFERENCES

[1]. Renato Brancati, Ernesto Rocca, Sergio Savino, Francesco Timpone, Experimental Analysis of the Relative Motion of a Gear Pair under Rattle Conditions Induced by Multi-harmonic Excitation, Proceedings of the World Congress on Engineering 2015 Vol. II WCE 2015, PP 1 - 3.

[2]. Laihang Li & Rajendra Singh, Analysis of start- up transient for a power-train system with a nonlinear clutch damper, Elsevier, Mechanical Systems and Signal Processing 62-63, 2015,PP 4(60–479).

[3]. Brandon Sobecki; Patricia Davies; J. Stuart Bolton, Simulation of gear rattle to aid in the development of sound quality, metrics for diesel engine component specification, Purdue University,USA2014.

[4]. Vinicius Gabriel Segala Simionatto, Hugo Heidy Miyasato, and Milton Dias Junior, On the Influence of the Clutch Disk's Pre-Damper Parameters on Shuffle and Clunk Phenomena in Power trains, DINAME 2013 - Proceedings of the XV International Symposium on Dynamic Problems of Mechanics M.A. Savi (Editor), ABCM, Buzios, RJ, Brazil, February, 2013,PP 17-22.

[5]. Younes Kadmiri, Emmanuel Rigaud, Joel Perret-Liaudet, Laurence Vary, Experimental and numerical analysis of automotive gearbox rattle noise, Elsevier, Journal of Sound & Vibration, 2012 , PP 3144–3157.

[6]. Heidy Miyasato, Study of the gear rattle phenomena in automotive power-train systems, 21st International Congress of Mechanical Engineering, October 24-28, 2011.

[7]. Mehmet Bozca, Torsional vibration model based optimization of gearbox geometric design parameters to reduce rattle noise in an automotive transmission, Yildiz Technical University, Mechanical Engineering Faculty, Machine Design Division,24 July 2010 , Yildiz, Istanbul, Turkey, PP34349

[8]. S. Theodossiades, O. Tangasawi, H. Rahnejat., 2009, Gear teeth impacts in hydrodynamic conjunctions promoting idle gear rattle, Journal of Sound andVibration, 303 (2007) ,PP 632– 658.

[9]. Chandramouli Padmanabhan, Todd E. Rook, and Rajendra Singh, Modeling of Automotive Gear Rattle Phenomenon: State of the Art, SAE International, 2000, PP 951316.

[10]. Michal Yu Wang, Numerical Modelling and Analysis of Automotive Transmission Rattle, Depatment of automation and comuter-aided Engineering, Chinese university of Hong Kong, Shatin, NT Hong Kong,Martch 2002,PP921– 943.

[11]. Sureyya Nejat, Loose part vibration in vehicle transmissions - Gear rattle, 25.02.1999,University of Stuttgart, Institut Maschinenelemente, Paffenwaldring 9, D- 70569, Stuttgart-ALMANYA.

[12]. Laihang Li & Rajendra Singh, Analysis of start- up transient for a power-train system with a nonlinear clutch damper, Elsevier, Mechanical Systems and Signal Processing 62-63, 2015,PP4(60–479)

[13]. Chengwu Duan, Rajendra Singh, Super- harmonics in a torsional system with dry friction path subject to harmonic excitation under a mean torque, Elsevier, Journal of Sound and Vibration 285, 2005 (pp 803–834)

[14]. Literature on Vibration and the Human Body,study which demonstrates of why shiatsu massage systems are better than vibration systems

[15]. R singh, H Xie and R. J. Comparin, Analysis of Automotive Neutral Gear Rattle ,the Ohio State University, Department of Mechanical Engineering, Columbus, USA,1998,PP 43210- 1107,

[16]. Renato Brancati, Ernesto Rocca, Sergio Savino, Francesco Timpone, "Experimental Analysis of the Relative Motion of a Gear Pair under Rattle Conditions Induced by Multi-harmonic Excitation", Proceedings of the World Congress on Engineering 2015 Vol. II WCE 2015, July 1 - 3.

[17]. S.B. Shim, Y.J. Park, K.U. Kim, "Reduction of PTO rattle noise of an agricultural tractor using an anti-backlash gear", Elsevier, Bio system Engineering, 2008 PP 346 – 354.

[18]. Steel Wire For Mechanical Springs, Specification Part 2 Oil Hardened And Tempered Steel Wire,IS4454(part 2):2001

[19]. Tejaswini Kulkarni, Sudhir Takalkar, Digambr Chaudhari, Transmission Noise and Gear Rettle in Automotive Driveline, International Journal of Modern Trends in Engineering and Research, e-ISSN No.:2349-9745, 28-30 April, 2016.

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Facial Emotion Recognition using Machine Learning

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ABSTRACT

Researchers on psychology, technology, linguistics, neurology, and allied fields have become more interested in a human-computer interface system for autonomous recognition of faces or facial expression recognition. An Automated facial expression Identification System was suggested in this study. Three steps make up the suggested methodology: face detection, feature extraction, and facial expression recognition. Skin colour identification utilising the YCbCr colour model, lighting adjustment for face uniformity, and morphological procedures for keeping the necessary face region are all part of the face detection process' first stages. Using the AAM (Active Appearance Modelling) approach, the first phase's output is utilised to extract face features such the mouth, nose, and eyes. Automated facial expression recognition is the third stage, and it is straightforward. Method of Euclidean Distance. This method compares the distance calculated by Euclid among the feature points on the query image and the training images. The output picture expression is chosen based on the minimal Euclidean distance. This approach has a true recognition rate of between 90% and 95%. Utilizing the Artificial Neuro-Fuzzy Inductive reasoning System (ANFIS), this method is further modified. In comparison to previous systems, this non-linear recognition system provides a recognition rate of close to 100%, which is satisfactory.

Keywords— Facial expression recognition (FER), multimodal sensor data, emotional expression recognition, spontaneous expression, real-world conditions.

I. INTRODUCTION

Facial expression recognition FER has advanced significantly in recent years as a result of developments in allied disciplines, particularly machine learning, image processing, and human cognition. As a result, the influence and possible applications of automatic FER, such as human-computer interaction, robot control, and driver status surveillance, have been expanding. Due to the difficulties in precisely identifying the important emotional elements, robust facial expression identification from videos and pictures is still a difficult issue. These characteristics are frequently depicted in a variety of ways, including static as well as dynamic point-based geometric representation and region-based appearance. A facial movement characteristic, such as a change in feature position or shape, is typically brought on by the movement of a face component. And muscles moving as they convey their emotions. When subjects are expressing emotions, the facial elements, especially

important ones, will constantly change positions. As a result, the same feature typically appears in different positions in different photographs. In rare circumstances, the tiny facial muscle movements may potentially distort the form of the feature. For instance, the mouth in the first two pictures has a distinct form from the mouth in the third picture. As a result, in picture databases and in films, the geometrical location and appearance-based shape of any characteristic that denotes a certain emotion typically vary from one image to the next. These types of movement elements are a rich source of expressions' static and dynamic qualities, both of which are crucial. role for FER.

The dynamics of facial expressions have not been included in the great majority of previous studies on FER. Nearly all of the efforts made to capture and use facial movement features have been video-based. These efforts aim to adopt either geometric properties of the tracked facial points (such as shape vectors, parameters for facial animation, distance and angular information, and projections), or appearance differences between holistic facial regions in succeeding frames (such as optical flow and differential-AAM), or texture and movement changes in local facial regions (such as appear deformation, motion parts, spatiotemporal descriptors, animation components, and pixel difference). Despite the positive outcomes, these methods frequently call for precise tracking and location of facial points, which is still a challenge.

II. LITERATURE REVIEW

One of the factors affecting the quality of interpersonal relationships is the ability to effectively read emotional facial expressions. The more one can participate in these encounters, the better one is at reading the emotions of others. Some psychopathological disorders have social interaction issues that have been linked in part to problems with facial expression recognition(2). These deficiencies have been seen in a number of clinical populations. However, the results of the studies to date have been inconsistent with regard to facial expression

In proposed the first important Facial emotion recognition (FER) using machine learning has gained significant attention in recent years due to its potential applications in various fields, such as mental health diagnosis, marketing research, and human-computer interaction. In this literature review, we will explore some of the key research works in this area.

Mollahosseini et al. (2019) conducted a comprehensive review of FER using convolutional neural networks (CNNs) and reported that CNN-based models outperform traditional machine learning models. The authors also highlighted the importance of large-scale datasets in achieving high accuracy in FER.

Liu et al. (2017) proposed a deep CNN-based approach for FER that achieved state-of-the-art performance on the benchmark Emotion Recognition in the Wild (EmotiW) dataset. The authors used a multi-scale CNN architecture that combined global and local features to capture facial expressions from different scales.

Ruiz-Rodarte et al. (2020) proposed a multimodal deep neural network for FER that combined facial features with audio and physiological signals. The authors showed that incorporating multimodal cues can improve the accuracy of FER in real-world scenarios.

Akhtar et al. (2020) conducted a comparative study of different deep learning architectures for FER and reported that deeper and wider architectures perform better than shallower and narrower architectures. The

authors also highlighted the importance of transfer learning in achieving high accuracy with limited training data.

Sariyanidi et al. (2019) conducted a survey on deep learning-based FER and highlighted the challenges associated with FER, such as variations in facial expression, lighting conditions, and occlusions. The authors also discussed the importance of data augmentation and regularization techniques in overcoming these challenges.

Overall, these studies demonstrate the effectiveness of deep learning-based approaches for FER and highlight the importance of large-scale datasets, multimodal cues, and transfer learning in achieving high accuracy. However, FER remains a challenging problem due to variations in facial expression and environmental conditions, and further research is needed to improve the robustness and generalization performance of FER systems.

The study investigated the recognition of standardized facial expressions of emotion (anger, fear, disgust, happiness, sadness, surprise) at a perceptual level

Overall, these studies demonstrate the effectiveness of deep learning-based approaches for FER and highlight the importance of large-scale datasets, multimodal cues, and transfer learning in achieving high accuracy. However, FER remains a challenging problem due to variations in facial expression and environmental conditions, and further research is needed to improve the robustness and generalization performance of FER systems.

We apply a biologically inspired model of visual object recognition to the multiclass object categorization problem.Our model modifies that of Serre, Wolf, and Poggio. As in that work, we first apply Gabor filters at all positions and scales; feature complexity and position/scale invariance are then built up by alternating template matching and max pooling operations. We refine the approach in several biologically plausible ways, using simple versions of sparsification and lateral inhibition. We demonstrate the value of retaining some position and scale information above the intermediate feature level. Using feature selection we arrive at a model that performs better with fewer features. Our final model is tested on the Caltech object categories and the UIUC car localization task, in both cases achieving state-of-the-art performance. The results strengthen the case for using this class of model in computer vision.

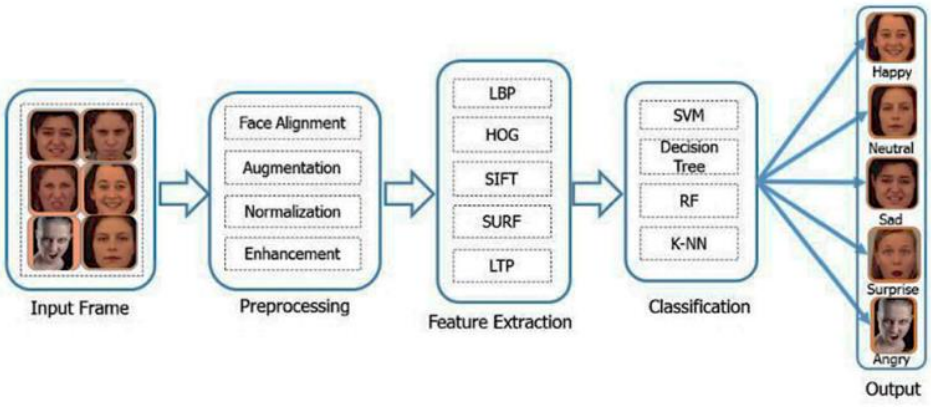
The problem of recognizing multiple object classes in natural images has proven to be a difficult challenge for computer vision. Given the vastly superior performance of human vision on this task, it is reasonable to look to biology for inspiration. In fact, recent work by Serre,Wolf, and Poggio has shown that a computational model based on our knowledge of visual cortex can be competitive with the best existing computer vision systems on some of the standard recognition datasets. Our paper builds on their approach by incorporating some additional biologically-motivated properties, including sparsification of features, lateral inhibition, and feature localization. We show that these modifications further improve recognition performance, strengthening our understanding of the computational constraints facing both biological and computer vision systems

A. BLOCK DIAGRAM

The three key steps of AFERS

1. To recognise a face in an input image or video.

2. To identify facial features such the eyes, nose, and mouth on the recognised face
3. Classify various facial emotions, such as those of happiness, anger, sadness, fear, disgust, and surprise. The detection of faces is a particular type of object detection. To retain the face of the input image, it additionally uses morphological processes and illumination Adjustment methods.



B. Drawbacks:

Because they can reveal a person's affective the state, accumulative activity, personality, intention, and psychological state, the system plays an interaction role in interpersonal relationships. Three modules make up the suggested system. The face recognition module uses an image segmentation algorithm to divide the input image into binary pixels, which is then used for recognising faces.

C. Proposed Work:

The proposed work is to develop a robust facial emotion recognition (FER) system using machine learning techniques. The system will take an input image of a person's face and output the corresponding emotional state..In this proposed work aims to develop a robust FER system that can accurately recognize facial expressions in real-world scenarios. The system has potential applications in fields such as mental health diagnosis, human-computer interaction, and marketing research. The following are the key steps involved in the proposed work

1. Data collection: A large-scale dataset of facial expressions will be collected for training and testing the FER system. The dataset will include images of faces with different expressions and variations in lighting conditions and occlusions.
2. Data preprocessing: The collected dataset will be preprocessed to remove noise, normalize the lighting conditions, and detect and align the faces. This step is critical for improving the quality of the input data and enhancing the performance of the FER system.
3. Feature extraction: The preprocessed images will be fed into a deep neural network to extract relevant features that capture the facial expressions. The features will be learned automatically by the network, and different architectures will be explored to find the most suitable one for the FER task.
4. Training and validation: The extracted features will be used to train a machine learning model for FER, such as a support vector machine (SVM), random forest, or deep neural network. The model will be trained using a subset of the collected dataset and validated on a separate subset to measure its

performance. Testing: The trained FER model will be tested on a new set of images to evaluate its generalization performance. The accuracy of the system will be measured using metrics such as precision, recall, and F1 score.

5. Model optimization: The performance of the FER system will be optimized by fine-tuning the model hyperparameters, exploring different architectures, and incorporating regularization and data augmentation techniques.

   The model can be optimized by fine-tuning the hyperparameters, exploring different architectures, and incorporating regularization and data augmentation techniques.
6. Deployment: Once the model is optimized, it can be deployed in a real-world scenario. The input image can be passed through the model to predict the corresponding emotion. The FER system can be integrated into applications such as mental health diagnosis, human-computer interaction, and marketing research.

D. Advantages:

Facial Emotion Recognition (FER) using machine learning has several advantages has listed below:

1. Accurate: FER using machine learning algorithms can achieve high accuracy in emotion recognition. With the advances in deep learning techniques, FER systems can now achieve state-of-the-art performance in recognizing emotions from facial expressions.
2. Real-time: FER can be implemented in real-time applications such as video conferencing, virtual reality, and gaming. Real-time emotion recognition can provide immediate feedback, which can be useful in scenarios such as mental health diagnosis, where timely intervention is critical.
3. Cost-effective: FER systems are relatively inexpensive to develop and deploy. The cost of data collection, preprocessing, and training can be significantly reduced by using open-source datasets and pre-trained models.
4. Wide range of applications: FER systems have a wide range of applications in various domains such as mental health, human-computer interaction, marketing research, and entertainment. FER can help in developing personalized applications that can respond to an individual's emotions in real-time.
5. Scalability: FER systems can be scaled to handle a large number of individuals simultaneously. This makes it possible to analyze emotions in large groups, such as in public places, events, or meetings.The first phase of face detection involves skin color detection using YCbCr color model, lighting compensation for getting uniformity on face and morphological operations for retaining the required face portion

III. CONCLUSION & FUTURE ENHANCEMENT

This paper had discussed the implementation of the Facial Emotion Recognition system using machine learning involves data collection, preprocessing, feature extraction, model training, testing, model optimization, and deployment. The key to developing a robust FER system is to use a large dataset, apply preprocessing techniques, extract relevant features, train the machine learning model, and optimize the model for accuracy and performance. The paper is very useful to both old and upcoming researchers in the field of FER, it presents

detail information about existing techniques in all stages of that field to reinforcement their understanding of current trends and assist their future research prospects and directions. This paper discussed Currently, FER only focuses on facial expressions, but in the future, it can be combined with other modalities such as speech, body posture, and physiological signals to improve the accuracy of emotion recognition.

IV.REFERENCES

[1]. K. M. Iftekharuddin, H. A. Shah, and M. M. Islam, "Facial Emotion Recognition: A Survey and Analysis of Approaches," IEEE Transactions on Affective Computing, vol. 10, no. 4, pp. 578-591, Oct.-Dec. 2019.

[2]. S. Shafique and S. G. Khan, "Facial Emotion Recognition Using Convolutional Neural Networks: A Comprehensive Review," Cognitive Computation, vol. 12, no. 5, pp. 1099-1117, Oct. 2020.

[3]. P. Ekman and W. Friesen, "Measuring Facial Movement," Environmental Psychology and Nonverbal Behavior, vol. 1, no. 1, pp. 56-75, Mar. 1976.

[4]. T. Kanade, J. F. Cohn, and Y. Tian, "Comprehensive database for facial expression analysis," Proceedings of the 4th IEEE International Conference on Automatic Face and Gesture Recognition, Grenoble, France, 2000, pp. 46-53.

[5]. D. D. Sharma and D. M. Bhalerao, "Facial Emotion Recognition Using Machine Learning Techniques: A Review," International Journal of Computer Applications, vol. 181, no. 1, pp. 28-35, Apr. 2018.

[6]. C. Sagonas, G. Tzimiropoulos, S. Zafeiriou, and M. Pantic, "300 faces in-the-wild challenge: The first facial landmark localization challenge," Proceedings of the IEEE International Conference on Computer Vision Workshops, Sydney, Australia, 2013, pp. 397-403.

[7]. X. Liu, X. Zhang, and S. Li, "Facial Expression Recognition Based on Deep Learning: A Review," Journal of Visual Communication and Image Representation, vol. 52, pp. 283-298, Jun. 2018.

[8]. Y. Li, Z. Liu, and L. Zhao, "Facial Expression Recognition Based on Convolutional Neural Networks," Proceedings of the International Conference on Computer Science and Software Engineering, Xi'an, China, 2015, pp. 549-551.

[9]. A. Mollahosseini, B. Hasani, and M. H. Mahoor, "AffectNet: A Database for Facial Expression, Valence, and Arousal Computing in the Wild," IEEE Transactions on Affective Computing, vol. 10, no. 1, pp. 18-31, Jan.-Mar. 2019.

[10]. S. Kim, J. Cho, Y. Kim, and C. Kim, "Deep Convolutional Neural Network-Based Facial Expression Recognition with Robust Facial Landmark Detection," Sensors, vol. 20, no. 20, pp. 1-16, Oct. 2020.

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An Uncompressed AVI Encryption Based On Haar Wavelet Decomposition of Frames and Audio

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ABSTRACT

The privacy and security becomes the major issues since the multimedia is transmitted openly over the network. Along with the privacy and security, storage space is also an important point that can't be missed. So it is necessary to provide the privacy and security to the multimedia with help of encryption. Encryption is the process of making data unreadable by other humans or computers for the purpose of preventing others from gaining access to its contents. Decryption is the process of taking encoded or encrypted text or other data and converting it back into text that you or the computer are able to read and understand. This term could be used to describe a method of un-encrypting the data manually or with un-encrypting the data using the proper codes or keys. Encryption & Decryption are both methods use to ensure the secure passing of messages, images and video and other sensitive documents & information. This work presents design and implement of an efficient video encryption of uncompressed AVI system, where lossy compression is considered. The AVI (Audio Video Interleaved) file which is uncompressed divided into frames and audio which will be encrypted. Here a new modified International Haar Wavelet is used to encrypt the frames in an efficient secure manner, after encryption of the frame and audio will be decomposes and deliver final decrypted uncompressed video. The implemented image encryption scheme operated in the prediction error domain is shown to be able to provide a reasonably high level of security and efficiency.

Keywords: Encryption, Uncompressed AVI Video, Haar Wavelet Decomposition

I. INTRODUCTION

The high growth in the networking technology leads a common culture for interchanging of the digital video very drastically. Hence it is more vulnerable of duplicating of digital video and re-distributed by hackers. Therefore the videos has to be protected while transmitting it, Sensitive information like credit cards, banking transactions and social security numbers need to be protected. For this many encryption techniques are existing which are used to avoid the information theft. In recent days of Internet, the encryption of data plays a major role in securing the data in online transmission focuses mainly on its security across the internet. Different

encryption techniques are used to protect the confidential data from unauthorized use [1] [2]. With the rapid development of multimedia and network technologies, the security of multimedia becomes more and more important, since multimedia data are transmitted over open networks more and more frequently. Typically, reliable security is necessary to content protection of digital images and videos. Encryption schemes for multimedia data need to be specifically designed to protect multimedia content and fulfill the security requirements for a particular multimedia application. For example, real-time encryption of an entire video stream using classical ciphers requires heavy computation due to the large amounts of data involved, but many multimedia applications require security on a much lower level, this can be achieved using selective encryption that leaves some perceptual information after encryption. Government, military and private business amass great deal of confidential videos about their patient (in Hospitals), geographical areas (in research), enemy positions (in defence) product, financial-status [3] [4].

Haar functions have been used from 1910 when they were introduced by the Hungarian mathematician Alfred Haar. Haar wavelet is discontinuous, and resembles a step function. It represents the same wavelet as Daubechies db1. Haar used these functions to give an example of an orthonormal system for the space of square-integrable function on the unit interval [0, 1]. For an input represented by a list of numbers, the Haar wavelet transform may be considered to simply pair up input values, storing the difference and passing the sum. This process is repeated recursively, pairing up the sums to provide the next scale, finally resulting in differences and one final sum. The Haar Wavelet Transformation is a simple form of compression which involves averaging and differencing terms, storing detail coefficients, eliminating data, and reconstructing the matrix such that the resulting matrix is similar to the initial matrix.

II. LITERATURE SURVEY

I

n 2009, Chunhua Li, Chun Yuan, Yuzhuo Zhong [11] has proposed a layered selective encryption scheme for Scalable Video Coding (SVC). The main feature of this scheme is making use of the characteristics of SVC. This method fully meets the encryption requirements of SVC and the encryption procedures are carried out at the Network Abstractor Layer (NAL) level. Based on the different structure and importance of base tier and enhancement tiers, different domains are encrypted. For base tier, Intra-Prediction mode (IPM) and residual sign are selected. For enhancement tiers, temporal scalability and spatial/SNR scalability are distinguished. Furthermore, key generation and distribution schemes are presented. Stream cipher Leak EXtraction (LEX) algorithm is adopted to reduce computational cost. Experiments were performed to verify the proposed method using the joint scalable video model (JSVM).

Sarvesh Kumar Gupta, Khushbu Bisen [18] presents the use of digital cameras, requirements for storage, manipulation, and transfer of digital images has grown explosively in 2013. These images can be very large in size and can occupy a lot of memory, so compression of images is required for efficient transmission and storage of images. Image data comprise of a significant portion of the multimedia data and they occupy the major portion of the channel bandwidth for multimedia communication. Therefore development of efficient techniques for image compression has become quite necessary. The design of data compression schemes involves trade-offs among various factors, including the degree of compression, the amount of distortion

introduced (if using a lossy compression scheme) and the computational resources required for compressing and decompressing of images. Wavelet based compression methods, when combined with SPIHT (Set Partitioning in Hierarchical Trees) algorithm gives high compression ratio along with appreciable image quality (like lossless). SPIHT belongs to the next generation of wavelet encoders, employing more sophisticated coding. In fact, SPIHT exploits the properties of the wavelet-transformed images to increase its efficiency. Progressive image compression methods are more efficient than conventional wavelet based compression methods it gives the facility to user choose the best compressed image which does not have recognizable quality loss.

Nur Azman Abu, Prajanto Wahyu Adi and Othman Mohd [27] presents the development of digital information has lead to increasing demands on information security technology in order to protect the confidentiality of information. Digital steganography is one of technologies that is capable of protecting the information from unauthorized interception. It is due to its capability to hide the embedded of the information without attracting the eavesdropper's attention. Among digital media, digital image is the most widely used medium for steganography. Discrete Cosine Transform (DCT) is a well known technique in digital image steganography. The use of DCT on small blocks may pose blocking effects and unintended artifacts on the overall image. These disadvantages of DCT can be eliminated by using Discrete Wavelet Transform (DWT) which is more compatible with the Human Visual System (HVS). However the floating point of DWT can cause some loss of information. On the other hand, Integer Wavelet Transform (IWT) represented in finite precision can avoid the problem of floating point precision in DWT. In this paper, the messages are embedded on the 1-level Integer Haar Wavelet Transform (IHWT) using coefficient difference scheme that is adopted from Pixel Value Differencing (PVD). The messages are embedded on the difference values of two adjacent wavelet coefficients. The result shows that the proposed method can easily outperform the existing method that employ IHWT and Pixel Mapping Method (PMM) in term of imperceptibility as well as the maximum capacity.

Er.Rupinder Kaur, Dr.Jagroop Singh [28] introducing the concept of Compressing an image is significantly different than compressing raw binary data. General purpose compression programs can be used to compress images, but the result is less than optimal. This is because images have certain statistical properties which can be exploited by encoders specifically designed for them. Also, some of the finer details in the image can be sacrificed for the sake of saving a little more bandwidth or storage space. This also means that lossy compression techniques can be used in this area. The discrete wavelet is essentially sub band coding system and sub band coders have been quite successful in speech and image compression. In this paper the implemented Haar, Daub & Coif Wavelet Transform. The results in terms of PSNR (Peak Signal Noise Ratio), MSE (Mean Square Error), RMSE (Root Mean Square Error) & Compression Ratio shows that the Haar transformation can be used for image compression. It is clear that DWT has potential application in the compression problem and use of Haar transform is ideally suited. Images requires substantial storage and transmission resources, thus q 3498 image compression is advantageous to reduce these requirement. The objective of this paper is to evaluate a set of wavelets for image compression. Image compression using wavelet transforms results in an improved compression ratio. Wavelet transformation is the technique that provides both spatial and frequency domain information. This paper presents the comparative analysis of Haar, Daub & Coif wavelets in terms of PSNR, Compression Ratio MSE & RMSE using discrete wavelet transform. Discrete wavelet transform has various

advantages over Fourier transform based techniques. DWT removes the problem of blocking artifact that occurs in DCT. DWT provides better image quality than DCT at higher compression ratio.

III. PROPOSED METHODOLOGY

Proposed Methodology has been divided in 2 Phases:-

1) Video Encryption
   - Frame Encryption using Haar Wavelet Decomposition.
   - Audio Encryption.
2) Video Decryption
   - Frame Decryption using Haar Wavelet Decomposition.
   - Audio Decryption.

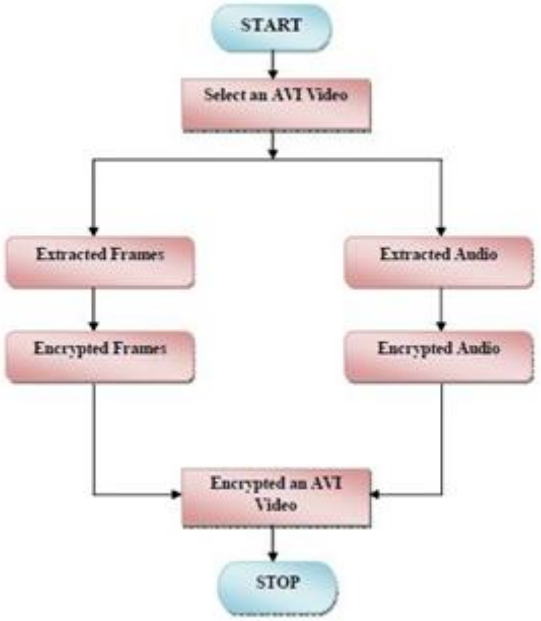

Figure 1 Architecture of Video Encryption

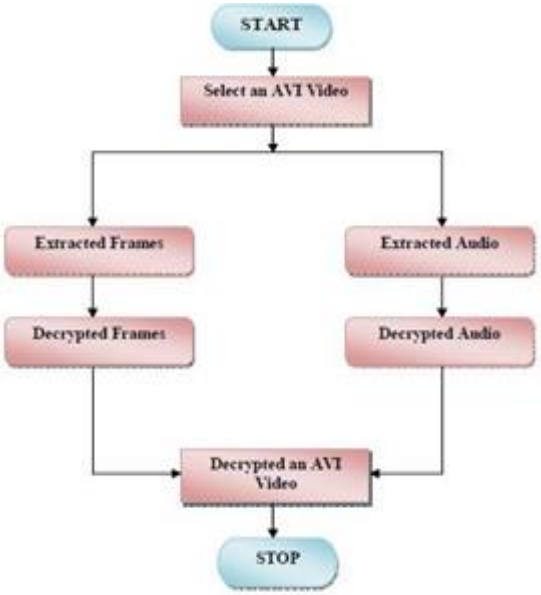

Figure 2 Architecture of Video Decryption

3.1. Algorithm for Frame Encryption

Algorithm for Encryption using Haar Wavelet Decomposition of Frame:-

Step-1. Start.
Step-2. Select an AVI video.
Step-3. Get video information.
Step-4. Extract frames from video.
Step-5. Haar wavelet decomposition of frames at level 0, level 1, and level 2.
Step-6. Generate key.
Step-7. Encrypt the frames of level 2.
Step-8. Join the encrypted frames of level 2.
Step-9. Join the encrypted frames of level 1.

Step-10. Join the encrypted frames of level 0.
Step-11. Get all encrypted frames.
Step-12. Stop

3.2. Algorithm for Audio Encryption

Step-1. Start.
Step-2. Select an audio file.
Step-3. Convert Sound to PCM wave format.
Step-4. Read file data.
Step-5. Convert to binary format.
Step-6. Binary sampling.
Step-7. Generate key.
Step-8. Encrypt data.
Step-9. Stop

3.3. Algorithm for Frame Decryption

Step-1. Algorithm for Decryption using Haar Wavelet Decomposition of Frame:-
Step-2. Start.
Step-3. Select an encrypted video.
Step-4. Extract frames from video.
Step-5. Haar wavelet decomposition of frames at level 0, level 1, and level 2.
Step-6. Generate key.
Step-7. Decrypt the frames of level 2.
Step-8. Join the decrypted frames of level 2.
Step-9. Join the decrypted frames of level 1.
Step-10. Join the decrypted frames of level 0.
Step-11. Get all decrypted frames.
Step-12. Stop

3.4. Algorithm for Audio Decryption

Step-1. Start.
Step-2. Select an encrypted audio file.
Step-3. Convert Sound to PCM wave format.
Step-4. Read file data.
Step-5. Convert to binary format.
Step-6. Binary sampling.
Step-7. Generate key.
Step-8. Decrypt data.
Step-9. Stop.

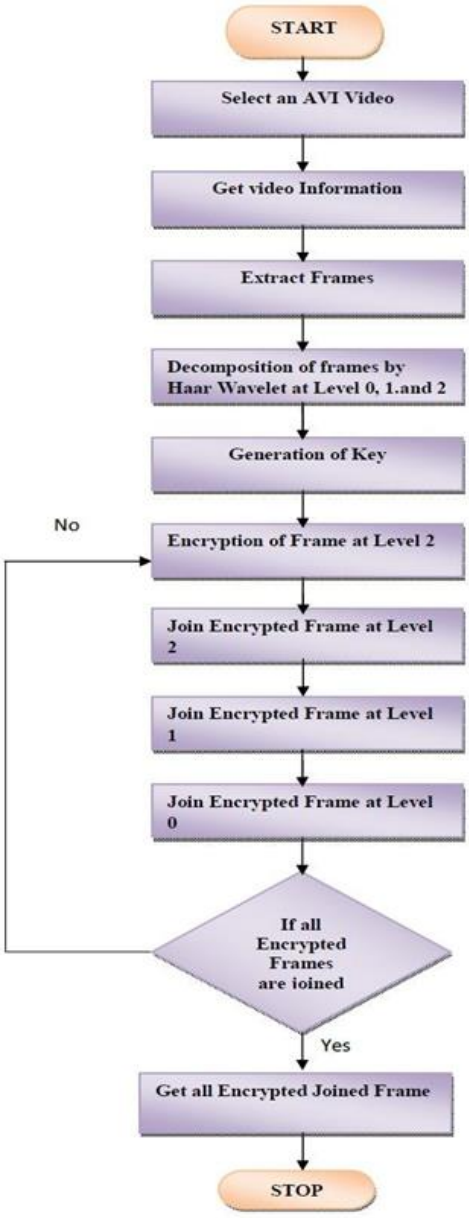

Figure 3 flow diagrams for encryption of frame

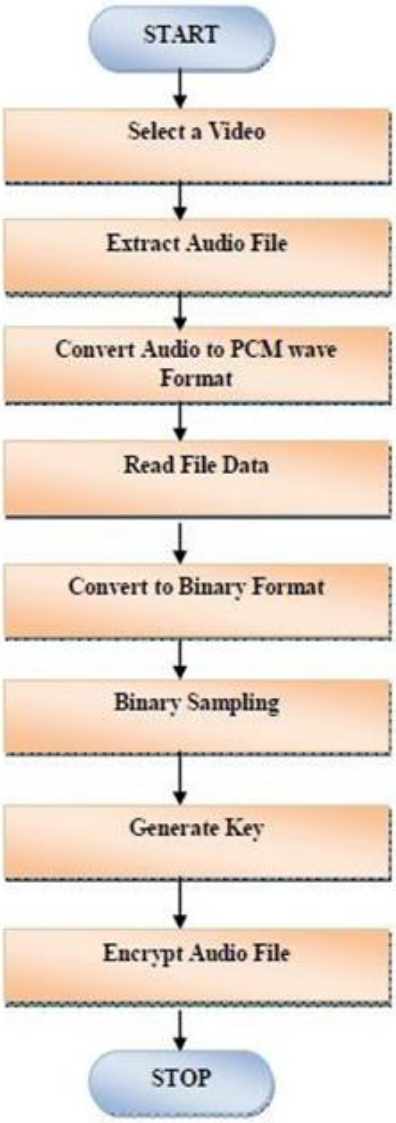

Figure 4 Flow diagram for Audio Encryption Using Haar Wavelet Decomposition

Decomposition of Frames

Image loaded by user is split into four parts horizontally and vertically. After decomposing that image is the image of level 0.Again decomposed that level 1 into horizontally and vertically. After decomposing level 0 into four parts that level is 1.Again decomposed level 1 into four parts by horizontally and vertically it is the 2 level of decomposition.

In the proposed method, an image is decomposed by Haar Wavelet at level 0, level1 and level 2 respectively. Suppose here, I=Image

z =size of an Image Decomposition of Frame=dI/ (dz/2)

Therefore,

Decomposition at level 0=2.dI/dz

Decomposition at level 1= (2dI/dz) / (dz/2)/2

= (4dI/dz) / (dz/2)

At level 1= 8dI / (dz) 2

Decomposition at level 2= (8 dI/ (dz) 2)/ (dz/2/2)/2

= (16.dI/ (dz) 2)/ (2 dz/2)/2

= (32 dI/ (dz) 2)/dz

At level 2= 32 dI/ (dz) 3

Joining of Frames

After decomposition of frame by Haar Wavelet, now join the image first at level 2, level 1 and level 0 respectively. Suppose, in composition or in joining of the frames there must be joining of the four decomposed frames are obtained by original single frame, by dividing it horizontally and vertically.

Suppose there are four frames i.e.C1, C2, C3 and C4 from which the single frame should be created. Now, join the frames C1 and C2 horizontally at level 2-

$$Level\ 2=(\int_1^2 dI_1 / (dz)^3 + (32\ dI_2/ (dz)^3)$$

$$IC1=32 / (dz)^3 \int_1^2 (dI_1) \,||\, (dI_2)$$

+ =Horizontal Concatenation

$$IC2=32/ (dz)^3 \int_1^2 dI_3+dI_4$$

So, final level 2 will be-

$$IC_f=32/ (dz)^3 \int_1^2 (IC1)\,||\,(IC2)$$

||=Vertical Concatenation

For level 1-

$$ICL_{11}=\int_1^2 (32/(dz)^3 \int_1^2 (IC_{f1} + IC_{f2})$$

$$ICL_{12}=\int_1^2 (32/(dz)^3 \int_1^2 (IC_{f3} + IC_{f4})$$

$$ICL_{1f}=\int_1^2 (ICL_{11}) \,||\, (ICL_{12})$$

For level 0-

$$ICL_{01}=\int_1^2 (\int_1^2 (IC_{f1}) + (IC_{f2})$$

$$ICL_{02}=\int_1^2 (\int_1^2 (IC_{f3}) + (IC_{f4})$$

$$ICL_{0f}=\int_1^2 (ICL_{01}) \,||\, (ICL_{02})$$

IV. RESULT ANALYSIS

Table 1: Comparison of entropy of the original split image & entropy of encrypted image

Name of Input Video	Name of Input Image	Entropy of original split image	Entropy of encrypted image
Video 1	Img1.bmp	7.07	7.56
Video 2	Img2.bmp	7.60	7.95
Video 3	Img3.bmp	6.55	7.53
Video 4	Img4.bmp	8.00	9.84

Table 2: Comparison of PSNR of original image and PSNR of encrypted image

Name of Input Video	Name of Input Image	PSNR of original image	PSNR of encrypted image
Video 1	Img1.bmp	9.18	9.54
Video 2	Img2.bmp	6.71	9.24
Video 3	Img3.bmp	9.8	9.10
Video 4	Img4.bmp	8.54	9.05

V. CONCLUSION

Although only some of the main cryptographic techniques were discussed here, one can see that there exists a large selection of approaches to encrypt and decrypt information, images, video in digital media. All the major video file formats have different methods of encrypting and decrypting, with different strong and weak points respectively. The aim of the system is to encryption and decryption of the video. The Haar Wavelet decomposition of frame algorithm is used which helps to decompose the image up to second level so that the encryption is performed on the smallest portion of the image without any pixel loss of that image. At the same time there is perfection in decryption as well because whenever the original image get encrypted it will decrypt as it is like original image. The system is also performing the encryption and decryption on audio. In this system typically, reliable security is necessary to content protection of digital images and videos. Encryption schemes for multimedia data need to be specifically designed to protect multimedia content and fulfil the security requirements for a particular multimedia application.

VI. FUTURE SCOPE

In this dissertation work, the system is worked on only the uncompressed AVI video format but it may possible to modify it by working on compressed and work with any other type format of video. Here the using Haar wavelet the frames can be decomposed up to the second level but in future it can be perform on beyond the second level so that the encryption will applied on frames will very deep with having very high security. The security capacity can be improved.

VII. REFERENCES

[1]. Chunhua Li, Chun Yuan, Yuzhuo Zhon "Layered Encryption for Scalable Video Coding" IEEE Region 10 Conference, pp. 1-4, 2009.

[2]. Sarvesh Kumar Gupta, Khushbu Bisen "Progressive Image Compression Analysis Using Wavelet Transform" International Journal of Engineering Research and Applications Vol. 3, Issue 1, January - February 2013.

[3]. Er.Rupinder Kaur, Dr.Jagroop Singh "COMPARATIVE STUDY OF DWT BASED IMAGE COMPRESSION USING HAAR, DAUB & COIF WAVELETS" International Journal of Advance Research In Science And Engineering Vol. No.3, Issue No.10, October 2014

[4]. Miss. Pallavi Charde " A Review On Image Denoising Using Wavelet Transform And Median Filter Over AWGN Channel" INTERNATIONAL JOURNAL OF TECHNOLOGY ENHANCEMENTS AND EMERGING ENGINEERING RESEARCH, VOL 1, ISSUE 4

[5]. Anupama N, Dr.P Janardhanan "Adaptive Color Constancy Using Wavelet Decomposition" International Journal of Engineering Science Invention Volume 3 Issue 5□ May 2014

[6]. S. Sridhar, P. Rajesh Kumar, K.V.Ramanaiah,"Wavelet Transform Techniques for Image Compression – An Evaluation " I.J. Image, Graphics and Signal Processing, 2014.

[7]. Ch. Samson V. U. K. Sastry "An RGB Image Encryption Supported by Wavelet-based Lossless Compression" (IJACSA) International Journal of Advanced Computer Science and Applications, Vol.3, No. 9, 2012.

[8]. Mrs.M.Praveena, Mr.V.Sivakumar "Secure Data Transfer based on Wavelet Transform from Cryptographic and Steganographic Techniques" INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY March, 2014

[9]. M. Abomhara, Omar Zakaria, Othman O. Khalifa "An Overview of Video Encryption Techniques" International Journal of Computer Theory and Engineering, Vol. 2, No. 1 February, 2010

[10]. Shujun Li, Guanrong Chen, Fellow, IEEE, Albert Cheung, Member, IEEE, Bharat Bhargava, Fellow, IEEE and Kwok-Tung Lo, Member, IEEE "On the Design of Perceptual MPEG-Video Encryption Algorithms" IEEE Transactions On Circuits And Systems For Video Technology, Vol. 17, No. 2, Pages 214-223, February 2007

[11]. Saurabh Sharma, Pushpendra Kumar Pateriya, Lakshmi "A Study Based on the Video Encryption Technique" International Journal of P2P Network Trends and Technology- Volume3Issue1- 2013

[12]. Ajay Kulkarni, Saurabh Kulkarni, Ketki Haridas, Aniket More "Proposed Video Encryption Algorithm V/S Other Existing Algorithms: A Comparative Study" International Journal of Computer Applications (0975 – 8887) Volume 65– No.1, March 2013

[13]. Niraj Kumar, Prof. Sanjay Agrawal "Issues and Challenges in Symmetric Key based Cryptographic Algorithm for Videos and Images" International Journal of Advanced Research in Computer Science and Software Engineering Volume 3, Issue 5, May 2013

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Battery Operated Oscillating Sprayer Mechanism with Urea Spreader

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ABSTRACT

India is a largest populated country, which contains 65% population depending on agriculture. Generally Indian farmer use to traditional way that is spray carry on backpack and weeding is done by bulls. Which become times consuming and costly this both problems over come by using multi nozzle pesticides sprayer and weeder machine. For better yield of crop multi nozzle spraying and simultaneous weeding is must this papers attends to design such a flexible sprayer and weeder. This work gives continuously flow of liquid at required pressure, height and gives freedom of easy engaging and disengaging weeder. This paper suggest a model of manually operated multi nozzle spryer with weeder according to crop which will gives optimum results in less time. Pushing mechanism required less effort and three wheel mechanisms gives proper balancing of machine.

Key words- flexible weeder, multi nozzle sprayer, time, cost.

I. INTRODUCTION

India is an agriculturally based country most of the population is depending on farming. India has a problem of high population and low level of land productivity, low level of farm mechanization, insufficient power availability as compared to the developed nations. Even average land holders in Japan uses proper mechanization for agricultural which led to great achievement for increasing crop productivity. But in India for small farmer's mechanization is difficult even though steps were taken to increase availability of power operated machines, combine harvesters, power tillers, irrigation pumps, solar pumps, dripping system etc. In Agricultural sector use of cheap and beneficial equipment for effective weeding and spraying for increase productivity which is very important for better contribution for India's **GDP.** Generally used low-cost Knapsack sprayer having major drawbacks as back pain and exertion of the user due to its heavy Weight and manual pumping. Manually operated pumping are not constant they generate uneven pressure inside the spray cylinder. When Pressure in the tank fluctuates, it causes flow to become turbulent which is highly undesirable. When the pressure inside the cylinder increases, the width of spray increases, therefore causing the wastage of pesticides. In I C engine sprayer (Power Sprayers) uses an engine instead of manual operation. The drawbacks

include-The I C engine cause high vibrations, noise this could result in number of health problems. Due to heavy weight back pain causes. The tractor mounted sprayers are very expensive, not useful for small space and all type of crop. It suitable for heighted crop in large amount

II. METHODS AND MATERIAL

1. Introduction: It gives the outline of the project. It contains information of various agriculture sprayer & urea spreader
2. Literature Review: It contains the research work carried out by the various authors study on the different spraying methods& fabrication.
3. Components and Design calculation: It contains the design of different components and theoretical calculation
4. Fabrication work: It contains the assemble of different components and manufactured.
5. Numerical Analysis: It contains model is created in CATIA design software analysed by Anysys software.
6. Working: Different mechanisms like sprayer, oscillator and fertilizer sprayer
7. Results and Discussion: It contains the Data collection for the sprayer calculation 8. Conclusion and
8. Future Scope: It contains the conclusion and the future scope of the dissertation.
9. References: Required for the entire work are included at the end of the report compressive load

III. RESULTS AND DISCUSSION

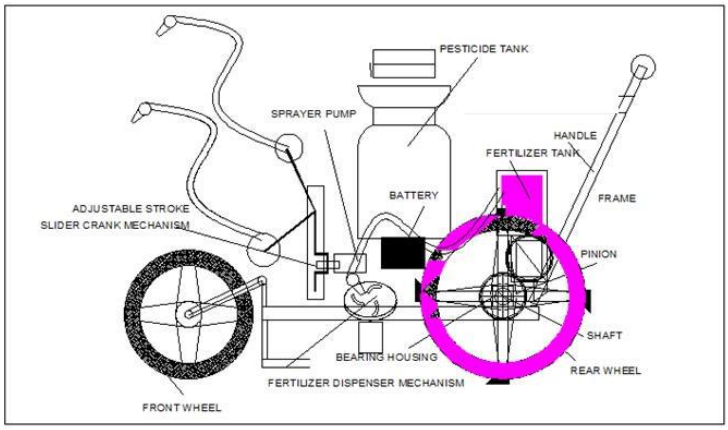
Based on the experimentation, The 12V, 8Ah battery can be charged fully in 7 hours during this time at 1.3A. Hence this module can be operated to spray continuously 7 to 8 hour which is not possible with electrical pesticide sprayer. The model cost will not exceed Rs.14000 Hence the proposed model is cost effective and compatible with other models available commercially

Time consumed **Replicate**	60 seconds Volume of water collected (ltr)
1	1.428
2	1.5
3	1.32
4	1.40

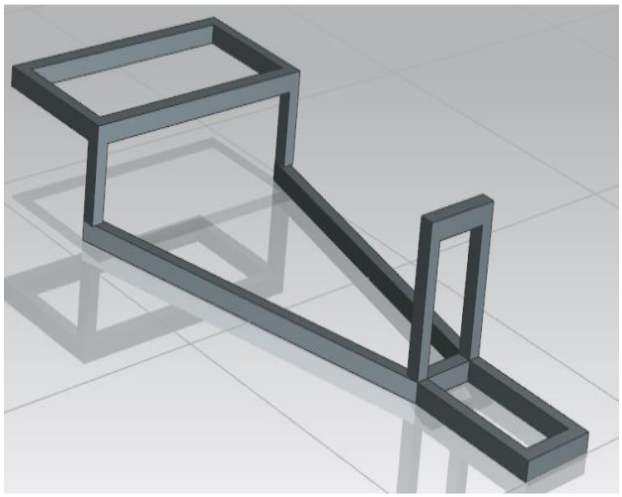
Table 1:-Data collection for the sprayer calculation

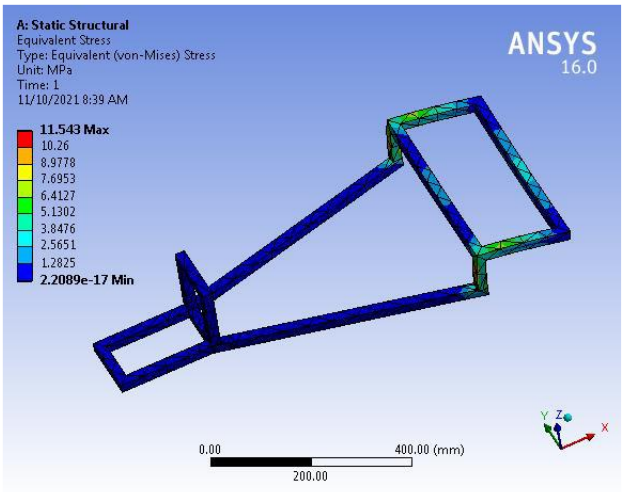
Average volume flow out from the implement
= (1.428+1.5+1.32+1.40) / 4 =1.412 ltrs
Amount of water flow out from the implement per second = 1.412/60 = 0.02 lts/s

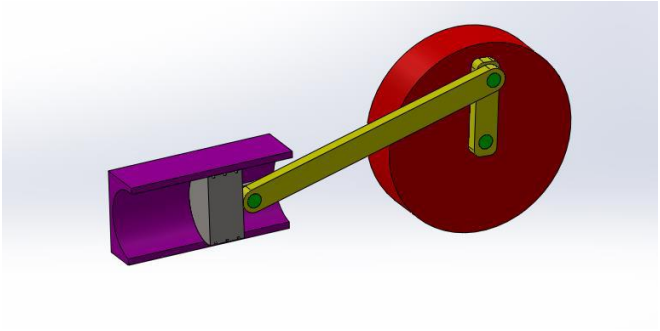
Design

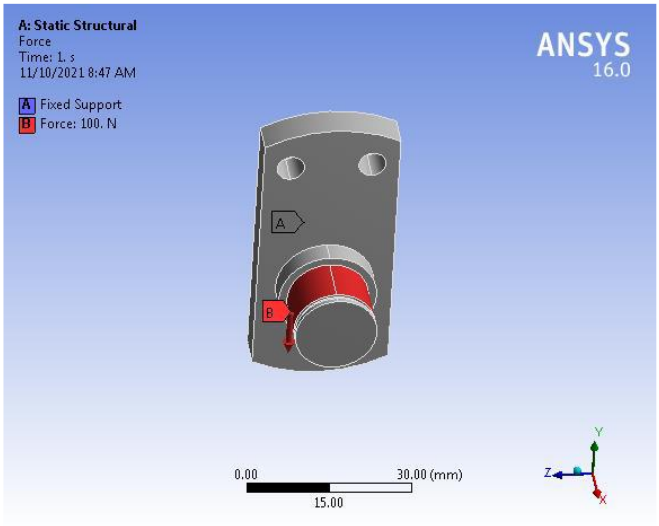


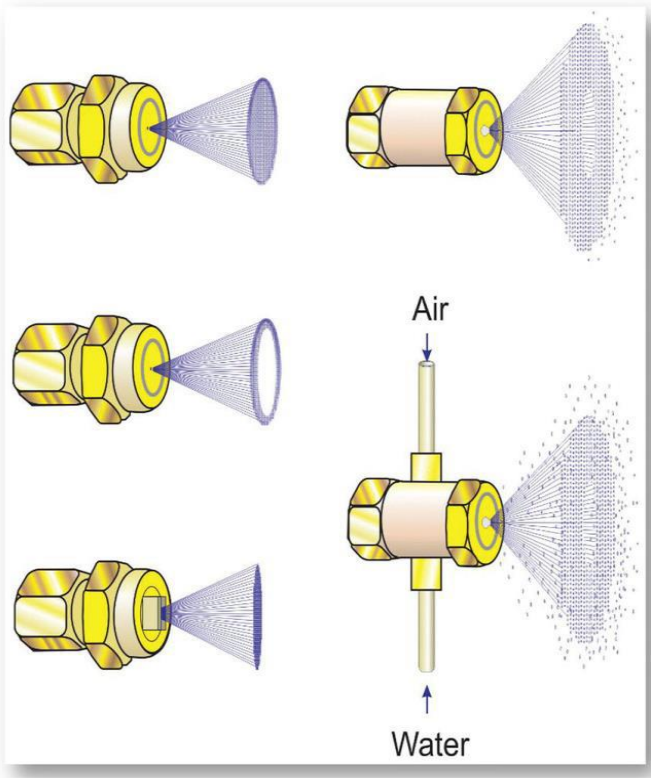
CAD model of set-up of project with actual dimensions of mechanical elements used in set-up. In this segment Design of different components using CATIA software and analysed using Ansys software such as frame, slider mechanism, sprayer fertilizer tank, urea tank..








A: Static Structural
Force
Time: 1. s
11/10/2021 8:47 AM
A Fixed Support
B Force: 100. N
ANSYS
16.0
A
B
0.00
30.00 (mm)
15.00
Y
Z
X


Air
Water

Volt : 12 volt DC
Amp : 3.0 Amp
Flow 4.5 LPM
Pressure 110 PSI

Cutting operation :

Welding operation

Lathe Operation

Actual Working Operation

IV. CONCLUSION

This wheel driven sprayer is manly low cost and easy to move in the fields and also improves the quality of spraying pesticides. After experimentation of this wheel driven sprayer device, it was observed that the operator can cover two parallel rows simultaneously without any additional energy being used as well as it reduces the fatigue of the operator. The proposed system was tested with AC charging as well as solar charging. From the results it was found that the current and time required for charging the full battery capacity of 12V, 7Ah by analytically and practically is 16.67hours and 17.2 hours respectively. The fully charged battery can be

used to spray 580 liters of fertilizer, which approximately spray 5-6 acres of land. It was also found that, if we charge the battery in a day, it can be used to spray 200 liters of fertilizer. The initial cost of the proposed system is little more as compared to conventional sprayer but the running cost of the system is very less. The developed system used for spraying the fertilizer, pesticides, fungicides and painting.

V. REFERENCES

[1]. Application technology: Problems and opportunities with Knapsack sprayer, Including the cf valves or Constant Flow Valves. - David McAuliffe and Vanessa P. Gray

[2]. Journal of arboriculture weed control in landscape plantings1 by J.F. ahrens april 1981 vol. 7, no. 4.

[3]. Backpack Sprayer-Modified for small farm Crop Protection-Rutgers Snyder Research & Extension Farm Staff–Edited by John Grande and Jack Rabin

[4]. To Spray or Not to Spray: Pesticides, Banana Exports, and Food Safety John S. Wilsona Tsunehiro Otsuki*,b a b Development Research Group (DECRG), World Bank, 1818 H Street NW, Washington, D.C. 20433, USA March 2002.

[5]. Farmers understanding of pesticides safety labels and field spraying practices. By Oluyede Clifford Ajayi and Festus K. Akinnifesi_Scentific Research and Essay Vol (2), pp.204-210, June 2007 ISSN 19922248@2007 Academic Journals.

[6]. Wilcoz. M. 1969. A sprayer for application of small amounts of herbicides to flats. Weed Sci. 17:263-264

[7]. Performance evaluation of bullock drawn sprayers for cotton crop-m. Veerangouda, k. V. Prakash, jag jiwan ram and g. Neelakantayya

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Manufacturing of Plastic Product by Shredding of Waste Plastic and Hot Moulding

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ABSTRACT

The use of plastic is increased now days in many industries like automobile, packaging, medical, etc. The reason behind this is that the plastic made things are quite easier to manufacture, handle and reliable to use. This project is about developing cost effective shredding and moulding of plastics machine. This project ensures that all shredded plastics waste is recycled. The project is compact and very easy to handle. The focus is maintained on reducing pollution due to plastics. So, in this paper we are presenting different type of recycling the plastic by pneumatic method.

Keywords: Injection moulding, plastic moulding, Shredding machine, pneumatic injection cylinder

I. INTRODUCTION

Today most used material is considered as plastic. Plastics are in five categories i.e. Polyethylene terephthalate (PET), High density polyethylene (HDPE), Polyvinylchloride (PVC), Polypropylene (PP) and Low density polyethylene (LDPE).Today the wastes are generally of about plastic materials. These plastics wastes create lot of problems as they are non degradable. So this machine is developed to treat the plastic wastes. The plastic waste needs to be produced into a desired shape which is why we need a mechanical crusher. This crusher will crush the plastic into smaller pieces or in the form of pellets. The plastic waste is being crushed for easy disposal.

Recycling is most important parameter in this project. This parameter turns whole plastics waste into set of new products for future use. Today use of plastics is been banned in India due to high amount of plastic waste pollution. The plastics waste if burnt releases the toxic gases like phosgene, carbon monoxide, chlorine, sulphur dioxide, nitrogen oxide, etc. burying and over stressed of waste in the environment can be reduced by investing in polythene bag recycling plants. So this project will reduce environmental pollution. Plastic Injection Moulding is an assembling system for making parts from thermoplastic and thermo set materials. Rather than the expulsion (which makes nonstop parts of steady cross area), infusion shaping makes discrete parts (with perplexing and variable cross areas). Liquid plastic is infused at high pressure into a shape, which is the reverse of the coveted shape. The mold is produced using metal, typically either steel or aluminum. The government of

India have already initiated their actions against the plastic pollution occurring day by day as shown in below figure. Even the plastic less than 50 microns is been banned today in India.

II. PROBLEM STATEMENT

Nowadays the plastic bottles, plastic pipes, injections, etc. are normally used a lot. After use of these plastics, they are disposed of, and they take a lot of space and as it increases pollution. Hence this have to be recycled taking in consideration and environmental concerns. Plastics crushed can be melted and can be used to produce different kind of product, but it is an extremely laborious work.

Hence, we need a simple machine which will reduce the human efforts. So, it is required to design and develop plastic shredder and molding machine.

A. Objectives

1) To cut the plastic waste and recycle them.
2) To reduce plastic pollution by recycling them.
3) To reduce the toxic gases which are produced by burning plastics.

III. RESEARCH METHOLOGY

The data was collected from both primary and secondary sources. The primary source of data is respondents concerned and collected by using a predefined questionnaire. The secondary sources include books, articles, periodicals, newspapers, various reports, websites etc.

Data Sources

A. The study is based on both primary and secondary data. Secondary Data: Secondary data is collected from the company records publications of Journals,

B. Newspapers and Websites.

For this project, many alternative concepts have been generated. The various generated concepts were then individually evaluated to find the most appropriate concept for the product. The concepts that gave the most advantages were considered as the best concept

and a waits further evaluation. The product sketch for the chosen concept was further drafted. Design concept generation is usually expressed in the form of sketches or rough 3-D model sand often accompanied by a brief textual description for the overall design concepts.

1) Literature review
2) Identification of the problem
3) Finding solution of the problem
4) Data collection
5) Design of product
6) Market survey for required components
7) Purchase of required components system
8) Manufacturing and assembly

9) Testing and experimentation
10) Evolution of result of the project

IV. WORKING

Plastic components to be recycled are initially fed to the hopper which is the passage to the shredder. After shredding the plastic in granular or pelletized form is fed from hopper and fall into barrel through its throat. Then it is melted through heating by heaters which surrounds the barrel. The material in heating chamber is forced around a spreader to make its better contact with heated wall and as a result it forms a viscous liquid. This viscous liquid is collected in a pool in a barrel known as injection chamber. Molten plastic is then forced to move forward by the action of plunger (ram). Inside the barrel, there is a piston which carries the molten plastic along the barrel to the mould. The reciprocating piston moves back as molten plastic moves forward. Again by the action of double acting piston cylinder arrangement, this molten plastic is injected through a nozzle into mould cavity. Mould is kept warm before plastic injection. To avoid shrinkage or hollows, pressure inside the mould is kept usually maintained 15,000 psi until solidification occurs. Finally solid material is injected by opening the mould and then entire cycle is repeated.

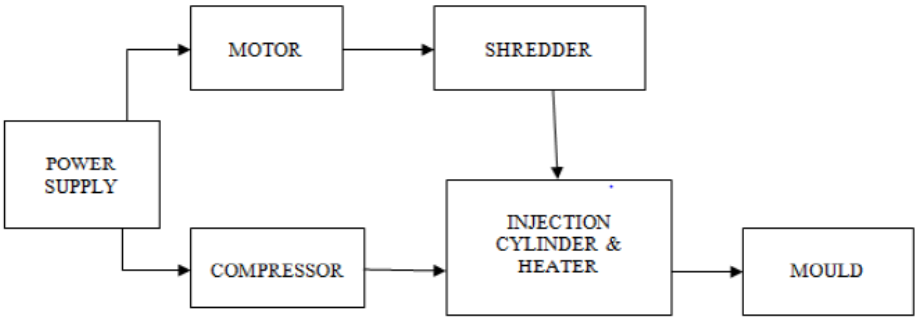

Fig. : Block diagram of plastic shredding and moulding

V. ADVANTAGES

A. High production rate
B. Can process a wide range of materials.
C. Relatively low labour
D. Less or no finishing of parts required.
E. Scrap material can be recycled and reused.
F. Low operation cost
G. Smooth surfaces Full automation is possible with injection moulding.
H. More uniform melting
I. No degradation problem of plastics.

VI. APPLICATION

A. Aerospace components
B. Automotive components
C. Computer and electronics
D. Engineering prototypes
E. Household equipment's
F. Instrumentation
G. Marketing samples
H. Medical and dental products
I. Toys, Model shops etc.

VII. FUTURE SCOPE

A. This project can be modified using automation methods.
B. This project can be modified for new production purpose.
C. Profitable for new plastic product production input given is plastic waste.

VIII. CONCLUSIONS

The motive of project of reducing plastics waste and converting it into new usable products was fulfilled. Huge amount of plastics were recycled using this machine. There were no toxic gases due to no burning of plastic.

IX. REFERENCES

[1]. Poonam G Shukla & Gaurav P Shukla, “Design and fabrication of pneumatically operated plastic injection moulding machine.” IJEIT-January 2013
[2]. Mulla Irfan Faiyyaj, Mete Rushabh Pradip, Bhosale Jaydeep Dhanaji, Dange Prasad Chandrashekhar, Jadhav Suraj Shivaji, “Design and Development of
[3]. Plastic Shredding Machine” International Journal of Engineering Technology Science and Research (2017), ISSN 2394 – 3386 Volume 4, Issue 10
[4]. Olalekan Hammed, Sulaimon Abdulkareem, Ogunniyi Oluwadare, Adio Teslim “Development of a Polythene Chipping Machine for Recycling Purposes”,
[5]. International Journal of Scientific & Engineering Research, , 2015 , ISSN 2229-5518 Volume 6, Issue 7
[6]. Akinfiresoye Waleola Ayo, OJ Olukunle and DJ Adelabu “Development of a Waste Plastic Shredding Machine” International Journal of Waste Resources (2017), DOI: 10.4172/2252-5211.1000281
[7]. Rajkumar Joshi and Sirajuddin Ahmed, “Status and challenges of municipal solid waste management in India: A review” Joshi & Ahmed, CogentEnvironmental Science (2016), 2: 1139434

[8]. Dr. Pawan Sikka, "Plastic waste management in India", Department of Science & Technology, Government of India

[9]. An article on 'Introduction to Recycling Plastic', by Plastic Waste Management Institute.

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Visualization Techniques in Data Analysis

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ABSTRACT

Data is being generated very rapidly due to increase in information in everyday life. Huge amount of data get accumulated from various organizations that is difficult to analyze and exploit. Data created by an expanding number of sensors in the environment such as traffic cameras and satellites, internet activities on social networking sites, healthcare database, government database, sales data etc., are example of huge data. Processing, analyzing and communicating this data are a challenge. Online shopping websites get flooded with voluminous amount of sales data every day. Analyzing and visualizing this data for information retrieval is a difficult task. Therefore, asystem is required which will effectively analyze and visualize data. This paper focuses on a system which will visualize sales data which will help users in applying intelligence in business, revenue generation, and decision making, managing business operation and tracking progress of tasks.

Index Terms— Sales data, Analysis, Visualization, Report generation.

I. INTRODUCTION

Data visualization is a process which aims to communicate data effectively and clearly to the user through graphical representation. Effective and efficient data visualization is the key part of the discovery process. It is the intermediate between the human intuition and quantitative context of the data, thus an essential component of the scientific path from data into knowledge and understanding. It is a powerful new technology having a great potential to help researchers as well as companies for building revenue decision [1].

Extracting relevant information and useful knowledge from large mixed-mode data spaces is complex by various challenging mark such as the limitations of data storage formats, a deficit of expert prior knowledge for real-world databases, the difficulty of visualizing the data using inefficient data mining tools, etc. Data mining is a series of steps in the knowledge discovery process, consisting of the use of particular algorithms for generating pattern, as required by the real world.

Huge amount of data becomes important not for its quantity but for the quality of information extracted from it. For a relatively complex real problem with a large data space, all knowledge generating and data mining tools would become obviously inefficient, even unassisted sometimes. For a larger complex database with more unanticipated variations than normal ones, even the domain master would find it difficult to reach useful results. In order to express better visualization of results, analysis of data is needed.

One of the key steps in Business Intelligence process where data is extracted and correlated from various data sources. In today's globalized market most organizations have multiple information repositories. Human Resources, Sales, Customer Management and Marketing all have information systems for their needs. Often each of these departments has multiple databases and applications and with the adoption of SAAS recently, more and more data is kept in different cloud offerings along with some databases in premise.
Furthermore, in the real world, three other important topics must be faced by the decision makers, which are as follows:

1) Flexibility and versatility of the visualization procedure;
2) Transparency to get at supporting evidence; and
3) The processing cost and computation speed.

This paper is organized into different sections as follows:- Section 2 briefly describes visualization toolkits along with the techniques/methods used, section 3 discuss about the related work done by the different authors, section 4 contains the brief description of the proposed methodology, finally we draw some conclusion in section 5.

II. VISUALIZATION TOOLKITS

In the following section we will discuss the visualization toolkits used, techniques and methods present and drawbacks of it.

A. Visualization Techniques

- Pixel-Oriented Visualization Techniques: Using pixel is an easy way to visualize the value of the data which depends on the dimensions in which the value of dimension represents the color of the pixel. Given a data set of n dimensions, pixel-oriented techniques create n windows on the screen, one for each dimension. The n dimension values of a record are mapped to n pixels at the corresponding positions in the windows. The corresponding values are reflected by the colors of the pixels. The data values are arranged inside a window, in a global order which is shared by all windows [1]
- Geometric Projection Visualization Techniques: The pixel-oriented visualization techniques fail to help us in understanding the distribution of data in a multidimensional collocation. For example, compact domain in multidimensional collocation cannot be shown by pixel oriented visualization techniques. Geometric projection techniques help users in discovering zestful hurling of multidimensional data sets. Visualizing high dimensional space on a 2-D display is the main challenge that the geometric projection techniques try to address. Using Cartesian coordinates scatter plot displays 2-D source points. Using different colors or shapes a third dimension can be added to represent different data points [1].
- Icon-Based Visualization Techniques: In Icon-based visualization techniques multidimensional data values are represented by using small icons. Two popular icon-based techniques are Stick Figures and Chernoff faces. Chernoff faces were introduced by statistician Herman Chernoff in 1973. As a cartoon human face they display multidimensional data of up to 18 variables (or dimensions). Chernoff faces help

reveal trends in the data. Values of the dimensions are represented by the shapes, size, placement, and orientation of the eyes, ears, mouth, and nose, which are the components of the face. For example, dimensions can be mapped to the following facial characteristics: head eccentricity, nose length, eye eccentricity, eye size, mouth curvature, eye spacing, nose width, mouth width, mouth openness, pupil size and eyebrow slant.

- Hierarchical Visualization Techniques: The techniques for visualization discussed so far focus on visualizing various dimensions cumulatively. In spite of it would be stiff to visualize all dimensions at the analogical time for a large data set of high dimensionality. In Hierarchical visualization techniques all dimensions are partitioned into subsets (i.e., subspaces). In hierarchical manner the subspaces are visualized.
- Visualizing Complex Data and Relations: In early days, mainly for numeric data visualization techniques were used. Recently, huge amount of non- numeric data, such as social networks came into existence. Analyzing and visualizing such non- numeric data attracts a lot of interest. There are many modern visualization techniques devoted to these type of data. For example, multiple people on the social network tag various item such as product review, blog entries and pictures. Statistics of user generated tags is visualized by a tag cloud. Often, ina tag cloud, tags are arranged in a user preferredorder or listed alphabetically. The importance of a tagis indicated by color or font size[1].

B. Visualization Methods

The Data presentation can be beautiful, elegant and descriptive. For visualizing data there are variety of conventional ways such as bar graphs, joint graphs, histogram, tables and pie charts are being used every day, in every project and on every possible occasion.

- TreeMap: Space-filling visualization of hierarchical data is carried out using this method. There is a strict requirement that data objects have to be hierarchically linked. Treemap is characterized as a root rectangle splinted into regions, also depicted by the small rectangles, which correspond to dataobjects from a set [2]. Example of this method is free space on hard drive visualization. This Method canbe applied to large volume data, repeatedly representing data layers for each level of hierarchy.
- Circle Packing: Direct alternative to Treemap is Circle packing, as it uses circles as its primitive shape, where circles from a higher hierarchy level arealso included in it. As the circle packing method has the same properties as Treemap has therefore it is based on Treemap method. So, we can say that only large volume data condition can be met by this method.
- Sunburst: Another alternative to Treemap is Sunburst, which uses Treemap visualization, modified to polar coordinate system. The variableparameters are radius and arc length instead of width and height which is the main difference between these methods. Because of this difference there is no need to repaint the whole diagram when datachanges, but only some portion containing new data by modifying its radius. And due to this property, thismethod can be adapted to show data dynamics, using animation.

Circular Network Diagram: Based on the rate of their creativeness data object are placed around a circle and linked by curves. Different line width or color saturation is used as a measurement of object creativeness. This method also provides interactions making hiding useless links and highlighting selected one. So, this method underlays straight connection between multiple items and shows how relative itis [3].

C. Visualization Tools

- Data visualization tools allow you to organize and present information intuitively. Prefuse and flare were the first frameworks for visualization that were used extensively. For simple visualization of data online tool Google chart tools were used, many formats like bubble chart, line plots treemap can be drawn. For plotting and graphing Matplotlib was used which has many packegs for statistics, clustering and plotting. For creating graphics, processing was used widely. Many eyes is a visualization tool created by IBM. It allows uploading a data set and exploring it with pre buid techniques. Spotfire is the best web client and analytical functionality tool. Qliktech may be the best visualization product having interactive drill-down capabilities. Tableau has the excellent skill to interact with OLAP cubes. [18].

III. LITERATURE REVIEW

The term visualization is an evolving study area, where many researchers have contributed from the last few decades. Various authors have proposed different techniques and technologies to support data visualization. This section elaborates about how the flow of research has been carried outby the authors and researchers from reputed journals and conferences.

In [4] the author has proposed a Sensor:Network based approach for storing, sharing, visualizing and analyzing data from multiple devices and to interact with each other and with the end user through an open REST- based API. The author has visualized the geographical location of the data stream which when clicked pops up a tabbed window containing different associated information.

In [5] the author has proposed a virtual reality platform for scientific data visualization, a tool for multi-dimensional data visualization using which scientist can interact with the data and their colleagues in the same space. The author has mappeddata parameters in different data points, shapes, size, colors, XYZ axis and many more. The author has used iViz a visualization tool which can be run as a standalone applicationor in a web browser.

The author has discussed about a framework of financial time series delivery and visualization which can be used in viewing the historical price movement of a stock [6].Specialized binary tree (SB- tree) is used for representing the financial time series. Time series data server, SB-tree server and web service contains is the three major components whichare distributed on different machines. The system can reduce data volume and can capture the critical points.

In [7] the author has proposed a dashboard for displaying data used for communicating and finding trends in laboratory operation. System is based on .NET scripts, SQL repository. The author depicts that data is collected from the multiple sources like admin, internet and user portal and are stored in database using XML layer, Adobe flash, Action Script, etc. Data is being visualized which is used for laboratory and staff management.

In [8] the author has used a concept of visual web mining for analyzing the web data. A tool named WET is been used for visualization which provides a set of visual metaphor that represents the structure of the websites. The websites exploration tool is used for exploring the websites and for giving the feedback to the website owner for the betterment of the website.

In [9] the author has used a concept for analyzing data for examining the trend and evaluating the eco-environment impact of three gorges project. VC.NET and ArcIMs is the development platform for information system. ArcSDE and oracle 10g are used for management and use of spatial data. The author introduces method and processing and storing the data generated from cross-region, cross-department. Visualization helps in enhancing the data analysis and data mining.

In [10] the author has discussed the problem in compliance management which becomes an obstacle for decision making for effective and efficient monitoring. The person should be provided with compliance software which will help in getting high level information about overall compliance status and low level problem regarding possible problems. The author has designed a dashboard for watching the compliance which avoids the obstacle and decision can be made effectively.

In [11] the author has introduced a tool named SECONDA which is used for analyzing both individual and grouped evolution of projects and develops belonging to a software ecosystem, Visualization is implemented in java using JFREECHART libraries. The author has used GNOME ecosystem for studying, under SECONDA. It offers a dashboard for fast visual analysis of local and global matrixes that can be extracted from information stored in the repositories.

In [12] the author has proposed a system for monitoring the user exercising progress and presenting exercise parameters in relation to prescribed targets. This system can be used for monitoring the intensity of the levels recommended by the patients care provider. It uses a miniature wireless 3-axis acceleration tied on the wrist of the patient that transmits acceleration data. The dashboard allows graphical visualization of exercise progress in real time.

The author introduces a system where the huge amount of data generated from the collaborative software development tool during the lifecycle of a project can be used to analyze the performance of the individual member, or a team or manager.

They can analyze from different perspectives across different dimensions and visualized in different ways.

In [14] the author has proposed a dashboard which is an integration, validation and visualizing tool for natural language processing. The system helps the system integration team to integrate and validate the system; developers to profile each module and researchers to evaluate and compare the module with the earlier versions. It also supports execution of modules on heterogeneous platform with an easy to use graphical interface developed using eclipse RCP.

IV. PROPOSED METHODOLOGY

The data visualization mainly focuses on analyzing the data and presenting it to the end user. The main goal of visualization is to relate information clearly and effectively through graphical means.

We are proposing a system which will analyze and visualize sales data. The data will be graphed on different parameters for different perspectives. Data mining process will be applied to discover patterns for future predictions. Dataset of one of the store from USA is taken for analysis and visualization. Data set contains various attributes such as orderID, Order Date, Order priority, Sales, Customer Name, region, Product Name, Product Category and so on. The transition diagram for the system is depicted in the above figure 1, where the

transitions carried among end users, system and database are introduced. The process from the user logged in, visualization till user logged out is briefly depicted.

Before importing the data into the database, dataset is beingprocessed through certain parameters by following functionsas depicted in figure 2.

A. Data Parser

Data set has multiple entries which may be relevant to the user or may not be relevant. So, parsing will be done in java using java.util.Iterator class to check the attributes present in the data set.

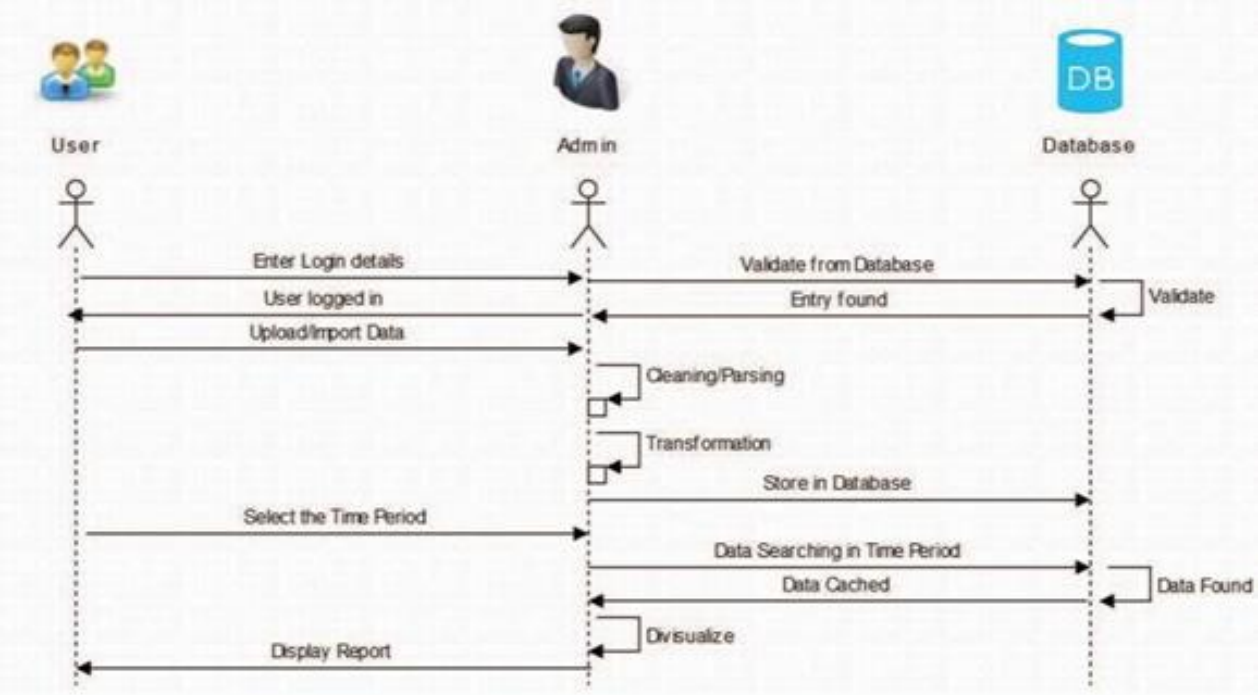

Fig 1. Transition diagram for the system

B. Data Cleaner

The data set may contain information which may not be useful to the user. Such data will be deleted and cleaned from the dataset so that only the relevant data will be processed further which will decrease the space and time complexity.

C. Data Transfer

HSSFWorkbook are used for storing he FileInputStream provided by the user for transforming the attribute name present in the data set. The names of the attributes may not be in proper format. For example, Order Id will be written asOrId which may create confusion.

D. Database

After the above processing, data will be imported in the database. The database will contain appropriate data relevant to the user in the proper format.

E. Cache

Frequent accessed data is extracted from the database and stored in the cache. When the request for accessing the same data is placed then the data is extracted from the cache instead of database which will decrease the time required.

F. Visualization

The data is visualized depending upon the time duration provided by the end user. Top customers, sales per region, top products, no. of customers visited can be visualized. Using this visualization, end user can make decisions such as launching of new products; decisions for revenue generation will be made.

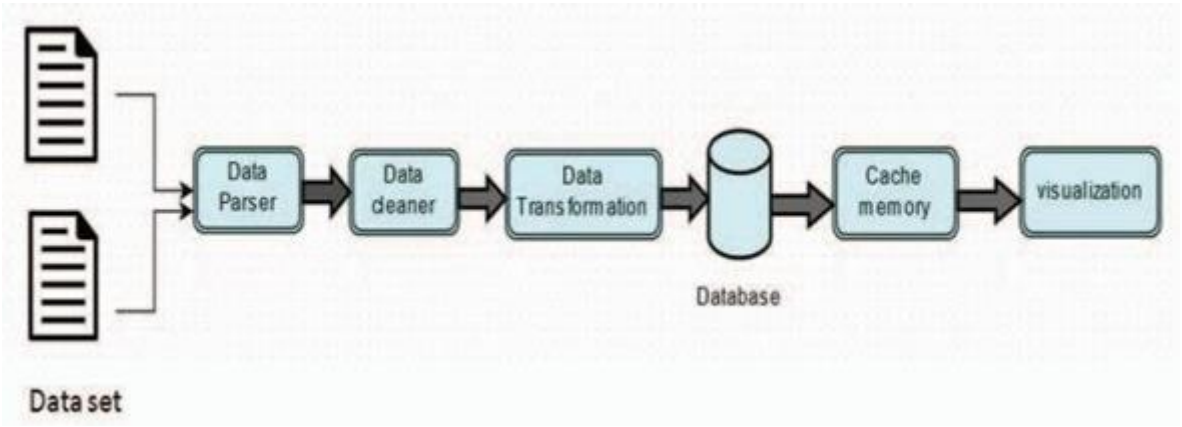

Figure 2: Flow diagram for data processing carried out by the system

V. CONCLUSION

In this paper we have reviewed different techniques methods and tools which have some shortcomings of their own. We have discussed many paper from which we got a broad idea about a system which is required in today's world for analysis and visualizing the sales data using which the investors and owners of the organization can make proper decision and generate revenue.

We have proposed a system when data is imported and stored in database after processing it. This data is visualized with different parameters and dimensions. Using which the enduser can make decision, predict the future sales, calculate regional sales and increase the production dependencies on thedemand.

In future work we will use many different advanced techniques for visualization and place all the graphs and chartson a single dashboard which would help user in making decision and generating revenue at a glance.

VI.REFERENCES

[1]. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining Concepts and Techniques",Third edition, MK Publications, 2009.

[2]. M. Tennekes and E. de Jonge, "Top-down Data Analysis with Treemaps," in Proceedings of the International Conference on Information Visualization Theory and Applications (IVAPP'11), pp. 236–241, March 2011.

[3]. P. Hoek, “Parallel Arc Diagrams: Visualizing Temporal Interactions,” Journal of Social Structure, vol. 12, 2011.

[4]. Vipul Gupta, Arshan Porsohi and Poornaprajna Udupi, “Sensor Network: An Open Data Exchange for the Web of Things,” in Proceedings of 8th IEEE Conference on Pervasive Computing and Communication Workshop (PERCOM), 2010.

[5]. Ciro Donalek, S.G. Djorgovski, Alex cioc, Anwell Wang, Jerry Zhang, Elizabeth Lawler, Stacy Yeh, Ashish Mahbal, Matthew Graham, Andrew, Drake Scott Davidoff and Jeffrey S. Norris, “Immersive and Collaboration Data visualization using Virtual Reality Platforms,” in Proceedings of IEEE International Conference on Big Data, 2014.

[6]. Tak-chung Fu, Fu-lai Chung and Chun-fai Lam, “Adaptive Data Delivery Framework for Financial Time Series Visualization,”in Proceedings of IEEE International Conference on MobileBusiness (ICMB), pp. 267-273, 2005.

[7]. Eric Martin and Vincenzo Di Bernardo, “Enterprise Dashboard Tools for Management of Share-use University Laboratory,” in Proceedings of University Conveinment Industry Micro (UCIM), 2008.

[8]. Victor Pascual-cid, “An Information Visualization System for the Understanding of Web Data,” in Proceedings of IEEE Symposium on Information Visualization (INFOVIS), 2008.

[9]. Liang Zhu, Bing-Fang, Yue-min Zhou, Xin-hui ma and Lei- dong yang, “Researches on Eco-environment Data Visualization for Three Gorgeous Project,” in Proceedings of IEEE International Symposium on Information Engineering Electronic Commerce (IEEC), 2009.

[10]. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining Concepts and Techniques”,Third edition, MK Publications, 2009.

[11]. M. Tennekes and E. de Jonge, “Top-down Data Analysis with Treemaps,” in Proceedings of the International Conference on Information Visualization Theory and Applications (IVAPP'11), pp. 236–241, March 2011.

[12]. P. Hoek, “Parallel Arc Diagrams: Visualizing Temporal Interactions,” Journal of Social Structure, vol. 12, 2011.

[13]. Vipul Gupta, Arshan Porsohi and Poornaprajna Udupi, “Sensor Network: An Open Data Exchange for the Web of Things,” in Proceedings of 8th IEEE Conference on Pervasive Computing and Communication Workshop (PERCOM), 2010.

[14]. Ciro Donalek, S.G. Djorgovski, Alex cioc, Anwell Wang, Jerry Zhang, Elizabeth Lawler, Stacy Yeh, Ashish Mahbal, Matthew Graham, Andrew, Drake Scott Davidoff and Jeffrey S. Norris, “Immersive and Collaboration Data visualization using Virtual Reality Platforms,” in Proceedings of IEEE International Conference on Big Data, 2014.

[15]. Tak-chung Fu, Fu-lai Chung and Chun-fai Lam, “Adaptive Data Delivery Framework for Financial Time Series Visualization,”in Proceedings of IEEE International Conference on MobileBusiness (ICMB), pp. 267-273, 2005.

[16]. Eric Martin and Vincenzo Di Bernardo, “Enterprise Dashboard Tools for Management of Share-use University Laboratory,” in Proceedings of University Conveinment Industry Micro (UCIM), 2008.

[17]. Victor Pascual-cid, "An Information Visualization System for the Understanding of Web Data," in Proceedings of IEEE Symposium on Information Visualization (INFOVIS), 2008.

[18]. Liang Zhu, Bing-Fang, Yue-min Zhou, Xin-hui ma and Lei- dong yang, "Researches on Eco-environment Data Visualization for Three Gorgeous Project," in Proceedings of IEEE International Symposium on Information Engineering Electronic Commerce (IEEC), 2009.

[19]. Thorben sander, Malthias kehlenbeeck and Michael H. Breithner, "Visualization of Automated Compliance Monitoring and Repairing," in Proceedings of IEEE Database and Expert System Applications (DEXA), 2012.

[20]. Javier Perez, Romuald Deshayes, Methieu Goeminne and Tom Mens, "SECONDA: Software Ecosystem Analysis Dashboard," in International Conference on Software Maintenance and Reengineering (CSMR), 2010.

[21]. Cheol Jeong and Joseph Finkelstein, "Computer-Assisted Upper Extremity Training Using Interactive Biking Exercise (iBikE) Platform," in Proceedings of IEEE Conference on Engineeringin Medicine and Biological Society (EMBC), 2012.

[22]. Fleni Stroulia, Isaac Matichuk, Fabio Rocha, Ken Baver, "Interactive Exploration of collaboration software development data," in IEEE International Conference on Software Maintenance (ICSM), 2013.

[23]. Pavan Kumar, Rashid Ahmad, B.D. Chaudary and Mukul K. Sinha, "Enriched dashboard:-An Integration and Visualization Tool for Distributed NLP System on Heterogeneous Platform," in International Conference on Computer Science and its Applications (ICCSA), 2013.

[24]. Ma Xin-hui, Wu Bing-fang, Zhu Liang, etc. "Study on Methods of Hydro-environment Data Visualization for Three Gorges Project" [J], Remote sensing informatics, 2007, pp. 28-31.

[25]. M. Lungu, M. Lanza, T. Gˆırba, and R. Robbes, "The small project observatory: Visualizing software ecosystems," Science of Computer Programming, vol. 75, no. 4, pp. 264 – 275, 2010.

[26]. R. Chang, M. Ghoniem, R. Kosara, W. Ribarsky, J. Yang, E. Suma, C. Ziemkiewicz, D. Kern, and A. Sudjianto, Wire-vis: Visualization of categorical, time-varying data from financial transactions. In IEEE Symposium on Visual Analytics Science and Technology, pages 155–162, 2007.

[27]. "The 37 Best Tools for Visualization," http://www.creativebloq.com/design-tools/data-visualization-712402.Harjeet Kaur, Varsha Sahni, and Dr. Manju Bala, "Asurvey of reactive, proactive, and hybrid routing protocols inMANET: a review", International Journal of Computer Scienceand Information Technologies, vol. 4, no. 3

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Feasibility Analysis and Risk Mitigation of an Infrastructure Project – A Case Study On Irrigation Project

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ABSTRACT

Investment in any construction project is able to give higher benefits besides the high risks and uncertainty. The uncertainty depends on many factors. The influence of the identified factors has to be evaluated and analysed towards the feasibility of the project. Before investment, the feasibility of the project has to be done that gives figures of cash flow during the project duration. This can be one of the considerations for making a decision whether the particular project is feasible or not. For a construction project, it is very important to take into consideration the various risks involved in the project at various stages while assessing the technical and financial feasibility of the project.
Risk is inherent in every business decision. Risks have a major influence on the success or failure of a project. They must be managed by applying a conscientious effort to their reduction or elimination. Not all risks need to be eliminated entirely; often it is sufficient to reduce the project's exposure to a level that is acceptable to the project. This paper investigates the feasibility and risk management of irrigation project.

Index Terms— B/C ratio, Feasibility Study, Internal Rate of Return, Irrigation projects, Payback Period, Risk Management.

I. INTRODUCTION

A comprehensive Feasibility study is the basis for the decision making Authority to decide whether to support or reject the project proposal at an initial stage. The result of any feasibility study shows the preferred solution which is technically and institutionally feasible, financially viable, socio- culturally acceptable and economically justified. A Feasibility report is a part of Initial Project Report (IPR) or Detailed Project Report (DPR) prepared to present an in- depth techno-economic analysis carried out on the projects and contains results of technical as well as economic evaluation of the projects so that the owner can take investment decisions and the projects can be properly planned and implemented. So a detailed technical and financial analysis is necessary for the Feasibility study of a project. For any Irrigation Construction project, it is very important to take into consideration the various risks involved in the project at various stages while assessing

the technical and financial Feasibility of the project. Thus it is very important that detailed work should be done to identify means of risk management while detailing out the technical, economical and financial analysis and hence formed the base for the project work.

II. BASIC ASPECTS AND DATA COLLECTED FOR ANALYSIS

Sample 1: Arala Irrigation Project

Project Details:

The project is located on Bhima river near village Wada in khed Taluka of Maharashtra, there is a good site for construction of a masonry dam near village Kalmodi about 22 kms upstream of Chaskaman project.

Project Cost:

The cost of the project is estimated to be Rs. 21272.74 lakhs. The project is to be financed by Government Corporation and therefore it is presumed that this much amount of fund is made available from the financial planning of the state government corporation.

Means of Finance:

The project comes under the State Government authority and as a separate department and corporation have been setup for the similar type of projects, therefore the funding of the project is entirely done by the water resources department of the state government.

Project Data:

Net project cost = Rs. 21272.74 lakhs Catchment Area (CCA) = 4061 Ha Irrigated Command Area (ICA) = 5065 Ha

Sample 2: Tarali Irrigation Project

Project Details:

Tarali Irrigation Project is situated in Satara district of Maharashtra State. Dam across river Tarali, a tributary of river Krishna, is located near village Dangistewadi in Patan Taluka.

Project Cost:

The cost of the project is estimated to be Rs. 105762.81 lakhs. The project is to be financed by Government Corporation and therefore it is presumed that this much amount of fund is made available from the financial planning of the state government corporation.

Means of Finance:

The project comes under the state government authority and as for the same a separate department and corporation have been setup for the similar type of projects; therefore the funding of the project is entirely done by the WRD of the State Government through MKKVM.

Project Data:

Net project cost = Rs. 105762.81 lakhs Cultivable Command Area (CCA) = 8145 Ha Irrigable Command Area (ICA) = 22025 Ha

III. ANALYSIS AND EVALUATION

The analysis is done by following four methods:

Sample 1 Analysis:

1) Payback Period (PBP)

Payback period = Cost of the project / Cash inflows in one year

= 21272.74 / 4530.64

= 4.69 years

Remark: - PBP in case of this project is Positive & between 4 to 5 year.

2) Benefit/Cost Ratio

B-C Ratio = Total Annual Benefit / Total Annual *C*ost

= 4530.64/2985.34

= 1.52

Remark: - B/C Ratio for this project is 1.52, Hence Positive

3) Internal Rate of Return (IRR)

IRR = Starting Rate + [Surplus at Startig Rate / Surplus at Starting Rate–Surplus at Ending Rate] x [Ending rate – Starting Rate]

IRR = 14 + [8013.16 / 8013.16–6016.94] x [15-14]

= 18.01%

Remark: - IRR in case of this project is 18.01 % i.e. "annualized effective compounded return rate" or "rate of return" that makes the net present value of all cash flows (both positive and negative) from a particular investment equal to zero.

4) Net Present Value (NPV)

NPV = Present value of cash inflows – Initial investment

NPV = 121054.60 – 21272.70

= 99781.9

Remark: The NPV obtained is a Positive value and therefore, the project is acceptable from this analytical method.

Sample 2 Analysis :

1) Payback Period (PBP):

Payback period = Cost of the project / Cash inflows in one year

= 105762.28 / 14073.58

= 7.51 years

Remark: - PBP in case of this project is Positive & in between 7 to 8 year.

2) Benefit/Cost Ratio:

B-C Ratio =Total Annual Benefit/Total Annual *C*ost

= 14073.58/12478.15

= 1.13

Remark: - B/C Ratio for this project is 1.13, Hence Positive

3) Internal Rate of Return (IRR):

IRR = Starting Rate + [Surplus at Startig Rate / Surplus at Starting Rate–Surplus at Ending Rate] x [Ending rate – Starting Rate]

IRR = 14 + [–10534.95 / –10534.95–(–14462.62)] x [15-13]

= 11.31 %

Remark: - IRR in case of this project is 11.31 % i.e. "annualized effective compounded return rate" or "rate of return" that makes the net present value of all cash flows (both positive and negative) from a particular investment equal to zero.

4) Net Present Value (NPV):

NPV = Present value of cash inflows – Initial investment NPV = 93823.79 – 105762.80

= –11939.01

Remark: - The NPV obtained is a Negative value and therefore, the project is not acceptable from this analytical method.

As payback period of Sample 1 is less than Sample 2, the Net Present Value of Sample 1 is Positive & also Benefit/Cost ratio & IRR is higher in sample 1 as compared to that of sample 2. So after considering the above analysis of collected data and its detailed evaluation of the different factors such as IRR, NPV, Benefit/Cost ratio and payback period, it is concluded that Sample 1 i.e. Kalmodi Irrigation Project is more feasible than Sample 2 Tarali Irrigation Project.

Hence after considering above terms and comparative conclusion, Sample 1 (Kalmodi Irrigation Project) is more financially feasible. So here under some more detail data analysis about the same Sample is done for giving more focus on the feasibility of the project.

IV. TECHNICAL ANALYSIS

A] Hydrology: The entire area of the project is subjected to tropical climate, the temperature varies from minimum 8ºC in winter to the maximum of 41ºC in the month of April and May and the rainfall in the catchment area varies from 3340 mm to 1330 mm.

B] Reservoir Planning: To overcome the probable short- falls in achieving the planned reliability of Chaskaman project some carry over storage is necessary in upstream reach of Chaskaman project. Having the benefits of hydrological constraints as discussed in above section the construction of masonry dam on River Arala, a right bank tributary of River Bhima is Proposed.

C] Reservoir yield and Reservoir Storage capacity: The yield at the site is, 50% dependable yield – 1.939 TMC, 75% dependable yield – 1.400 TMC and the reservoir capacity is 42.87 Mcum at FRL.

D] Location and Site: The storage site of the project is located near Gram Kalmodi Taluka Khed District Pune.

E] Materials:

- Rubble: Some quarry spots are been located nearby and some bores are taken at these site to ascertain the depth of rock, depth of overburden and the quality of rock
- Sand: Sand from river Mula near Gram Sakur taluka Sangamner is the nearest source for this project.
- Cement: Made available from Bagalkot in Karnataka. Cement is to be transported by railway from cement manufacturing factory to Pune railway station and then by road up to project site.
- Steel: Steel is to be made available from Pune market.
- Brick & Timber: This is to be obtained from local manufacturers at khed taluka and vicinity.

F] Utilities: The major source for water for construction purpose shall be made available from the river, and where not possible an alternate arrangement for bore is made, the electricity arrangements are to be made from state electricity board and where not feasible, fuel generators are to be arranged.

G] Labour Skills: Many of the skills are possessed by the government authority itself, beside these any specialised techniques, methods and procedures shall be dealt by contractor firm and supervised and examined by the government authority.

H] Schedule of Project Implementation: The project was scheduled to be completed in 5 years and in one stage only. Initially it was scheduled to complete the construction of project in a period of 4 year and to develop irrigation potential in the same period. However due to paucity of funds, the work was delayed and finally the masonry of dam have been completed and storage up to F.S.L. is made by July 2010. The remaining work is to be completed fully by 2018 including the lift irrigation scheme.

I] Machinery and Equipments: The machinery required for this Irrigation project scheme will be required to be possessed by the contractor, also the material testing laboratory is to be established by the contractor.

J] Labour Situation: During construction, employment potential will be created to the skilled and unskilled categories.., After construction, there is scope for employment potential on fields, agro based industries, in markets in the command area as well as in nearby towns.

V. RISK ANALYSIS

A) Risk Identification:

In this process of risk identification, more focus have been centralised on the sources of risks, rather than the risk itself. The technique used for identification of risks is by interviewing Authorised Government officer and technical person. The table below shows the Risks identified;

Table 1: Identification of Risks

Categories and Types of Risks

Categories and Types of Risks			
Category	**Risk Categories**	**Type**	**Risks**
A	Financial Risks	A1	Fund Delays
		A2	Price Escalations
		A3	Funds Sanctioning
B	Political Risks	B1	Changes in Laws
		B2	Payment Failure by government
		B3	Change in government
C	Legal Risks	C1	Land Acquisition
		C2	Breach of Contract Documents
		C3	Clearance from Other Government Departments
D	Environmental Risks	D1	Work Environment/ Condition
		D2	Loss of Flora and Fauna
		D3	Loss of Fertile land
		D4	Rehabilitation & Resettlement Problems
E	Force Majeure Risks	E1	Natural Force Majeure event
		E2	Direct/Indirect Political Force Majeure event
F	Operating Risks	F1	Performance risk
		F2	Operation Cost Overrun
		F3	Operation Contractor Default
G	Technical Risks	G1	Design & Drawing Delays
		G2	Equipment Failure
		G3	Accidents & Safety
		G4	Delays in Previous Activities
H	Miscellaneous Risks	H1	Administrative Inactiveness
		H2	Corruption

B) Risk Assessment:

Risk Assessment is a critical part of any Risk Management, the Risks are been Assessed and Analysed with the help of Risk Assessment Matrix, the risks are been Categorised on the basis of their likelihood and the Consequences followed by actual analysis, The matrix of likelihood and consequences is formed from obtained results. And the Risk type is placed in their respective fields. Depending upon the matrices the risks are been assessed as low Risk, Moderate Risk, High Risk and Extreme High Risk. The results obtained from Risk Assessment are as under;

Table 2: Risk Assessment Sheet

Categories and Types of Risks					
Category	**Risk Categories**	**Type**	**Risks**	**Likelihood**	**Consequences**
A	Financial Risks	A1	Fund Delays	1	2
		A2	Price Escalations	1	3
		A3	Funds Sanctioning	5	4
B	Political Risks	B1	Changes in Laws	3	2
		B2	Payment Failure by government	5	5
		B3	Change in government	3	2
C	Legal Risks	C1	Land Acquisition	5	2
		C2	Breach of Contract Documents	3	3
		C3	Clearance from Other Government Departments	3	4
D	Environmental Risks	D1	Work Environment/ Condition	2	3
		D2	Loss of Flora and Fauna	2	1
		D3	Loss of Fertile land	2	2
		D4	Rehabilitation & Resettlement Problems	2	1
E	Force Majeure Risks	E1	Natural Force Majeure event	5	2
		E2	Direct/Indirect Political Force Majeure event	5	3
F	Operating Risks	F1	Performance risk	2	2
		F2	Operation Cost Overrun	2	3
		F3	Operation Contractor Default	4	4
G	Technical Risks	G1	Design & Drawing Delays	2	2
		G2	Equipment Failure	3	3
		G3	Accidents & Safety	3	3
		G4	Delays in Previous Activities	3	2
H	Miscellaneous Risks	H1	Administrative Inactiveness	4	2
		H2	Corruption	5	1

Fig 1 : Risk Assessment Matrix

LIKELIHOOD	CONSEQUENCES				
	Negligible	Minor	Medium	Major	Severe
Almost certain	H	H	E	A1 A2 E	E
Likely	M	H	D1 F2 H	D3 F1 E G1	D2 D4 E
Possible	M	B1 C3 M	C2 G2 H G3	G4 B3 H	E
Unlikely	L	F3 M	M	H1 H	H
Rare	B2 L	A3 L	E2 M	C1 E1 M	H2 H

C) Risk Mitigation

The selection of the most appropriate option for treating risks involves balancing the cost of implementing of each option against the benefits derived from it. Where large reductions in risk may be obtained with relatively low expenditure, such options should be preferred. Other options for improvement in particular category may be uneconomic and judgement needs to be exercised as to whether they are justifiable or not. The strategy adopted for mitigation of risks outlines four possible ways such as Risk Avoidance (or Terminate), Risk Reduction (or Treat), Risk Transfer, Risk Retention (or Tolerate)

Table 3: Risk Mitigation

Sr. No.	Type	Risks	Level of Risk	Strategy	Risk Mitigation
1	A1	Fund Delays	Extreme High	Risk Reduction	The sanctioned Funds should be preferably at the hands of the director of the project
2	A2	Price Escalations	Extreme High	Risk Retention	This risk can be tolerated as long as the project is not delayed beyond schedule
3	A3	Funds Sanctioning	Low	Risk Retention	As the Risk is Low level, it can be tolerated for some duration, provided initializing early movements for fundsanctioning
4	B1	Changes in Laws	Medium	Risk Transfer	The Project shall have a insurance cover policy, in a huge project case loan proposals shall be accepted
5	B2	Payment Failure bygovernment	Low	Risk Reduction	Although the risk is low level, the transactions and work measurement should be carried smoothly by allotted departments and persons
6	B3	Change in government	High	Risk Transfer	The total estimate needs to be worked out thoroughly and the amount shall besanctioned and allotted well in advance
7	C1	Land Acquisition	Medium	Risk Retention	Alternative Provision for jobs in govt., lands and houses can make the affected people to support for land acquiring
8	C2	Breach of Contract Documents	High	Risk Avoidance	Strictly following of Contract Documents shall be necessary from all parties concerned with it
9	C3	Clearance from Other Government Departments	Medium	Risk Reduction	Intervening of Higher government Authorities and coordinating can reduce this risk
10	D1	Work Environment/ Condition	High	Risk Transfer	The employs on the project should be covered with insurance policy, and necessary precautions and rules shall be strictly made and followed
11	D2	Loss of flora and fauna	Extreme High	Risk Avoidance/ Risk	The project site selection process should study the Bio-diversity and endangered species / The endangered Fauna shall be transported to nearest possible sanctuary,

				Transfer	reserve etc
12	D3	Loss of fertile land	Extreme High	Risk Retention	This risk can be tolerated as the loss of some fertile land shall result in gaining lot of fertile land due from the benefits of project
13	D4	Rehabilitation andResettlement problem	Extreme High	Risk Reduction	The land required for rehabilitation n resettlement shall be made available during land acquisition itself
14	E1	Natural Force Majeure event	Medium	Risk Transfer	Drafting of Emergency plans and insurance shall be provided prior for such activities
15	E2	Direct/Indirect Political Force Majeure event	Medium	Risk Reduction	The authorities shall be made bounded to only respective political heads and officers
16	F1	Performance risk	Extreme High	Risk Reduction	The design of the project should be technically sound and the execution should be strictly as per specifications
17	F2	Operation Cost Overrun	High	Risk Avoidance	The Quality of work shall be monitored from initial phase, so as to get maximum output and economic designs
18	F3	Operation Contractor Default	Medium	Risk Reduction	Provision for such Risks shall be strictly be made in contracts to reduce its effect
19	G1	Design & Drawing Delays	Extreme High	Risk Avoidance	The government shall be clear of its objectives from inception and same shall be made clear with designers, the designers should be well experienced and technically strong, revisions of designs and drawing should me minimum
20	G2	Equipment Failure	High	Risk Transfer	Provisioning of Insurance cover, Equipment backup or alternatives should be studied well in advance
21	G3	Accidents &	High	Risk Transfer	Strictly following safety norms, gadgets, rules, guidelines and establishing safety

		Safety			policy and safety programmes
22	G4	Delays in Previous Activities	High	Risk Avoidance	Maintaining schedules and monitoring each activity, giving due importance to each work and planning, executing, monitoring and scheduling shall be made
23	H1	Administrative Inactiveness	High	Risk Avoidance	Appraisals, perks, regular training, monitoring of Administration works etc shall be continuously assessed
24	H2	Corruption	High	Risk Avoidance	Introduction of software's such as ERP, SAP, etc and by making all the work and transactions online (e-governance) can help a lot to avoid corruption

Although as far as possible risks have been identified and analyzed followed by their mitigation strategies, still there will be many other risks as risk itself are the uncertain factors that affect project. Beyond the Risk Management there has to be well Risk-Related communications at all levels so to deal with Risk situations which may serve the purpose to respond collectively and handle the situation responsibly, rather than communicating about the threats and vulnerabilities that may hamper the moral of staff.

VI. SUMMARY

The Financial analysis covers total project cost, means of finance, Net project Cost, and Cash flow statements. The Data collected gives the basic data necessary to analyze the feasibility of project Financially, Economically and technically. The analysis has been done and the following have been determined; B/C ratio, PBP, IRR, NPV. From above, the B/C ratio and PBP forms the Non-Discounting methods for analysis and IRR and NPV forms the Discounting methods for analysis, Further the Risk Management is carried out including the Risk identification process and their Mitigation with the help of Risk Assessment Matrix Method.

VII. INFERENCE

The following results have been inferred from the study and analysis

- The B/C ratio is positive
- The payback period is between 4 to 5 years, hence Positive
- The IRR for the project is positive and therefore acceptable.
- The NPV value is positive and therefore acceptable.

VIII. CONCLUSION

Thus now the project falls under financially feasible, technically sound project with the management of risks involved in it. With this knowledge the irrigation departments of various states and countries can reach the feasibility of any such Irrigation project as well as the economic and justified use of all the available resources can be made. The effect of various planned strategies, Expenditure stages, and the risks involved in respective stages of project needs to be focused to look after as the aftereffects of these risks can lead the project to many disadvantages. By careful consideration of the results of the feasibility study, the Public party and the project Stakeholders can arrive at a reasonable agreement on the sharing of risks and the terms of the contract.

IX. REFERENCES

[1]. A Guide to the Project Management Body of Knowledge, Third Edition, (PMBOK® Guide), an American National Standard ANSI/PMI 99-001-2004

[2]. C. Paramasivan and T. Subramanian, “Financial Management”, New Age International Publishers

[3]. Dr. P. N. Modi, Seventh edition, Irrigation “Water Resources and Water Power Engineering”, ISBN 818940129-7

[4]. John M. Nicholas, Herman Steyn, “Project Management for Business, Engineering”, and Technology, Principles and Practice, 3rd edition

[5]. L. Fung, AC3059, “Financial Management”, (2015 edition), Undergraduate study in Economics, Management, Finance and the Social Sciences, University of London International Programmes

[6]. Nerija Banaitiene and Audrius Banaitis, Department of Construction Economics and Property Management, Faculty of Civil Engineering, Vilnius Gediminas Technical University, Vilnius, “Risk Management in Construction Projects”, Lithuania

[7]. Prasanna Chandra, Fourth Edition, “Projects- Planning, Analysis, Selection, Implementation and Review”

[8]. Prassana Chandra, (2001) "Financial Management", Tata McGraw-Hill Publishing Company Ltd., New Delhi

[9]. Risk Management – Concepts and Methods, CLUSIF, Paris

[10]. Risk Management Handbook, U.S. Department of Transportation, Federal Aviation Administration, 2009

[11]. T. R. Banga and S. C. Sharma, Twenty Forth edition, “Industrial Organization and Engineering Economics”, Khanna Publications ISBN No. 81-7409-078-9

[12]. A.P.Waghmare , Dr. S.S.Pimplikar, June 2012, “Financial Analysis of Infrastructure Project - A Case Study on Built-Operate-Transfer Project in India”, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-1, Issue-5

[13]. A.P.Waghmare , Dr. S.S.Pimplikar, May-Jun 2012, “Risk Analysis In Feasibility Study Of Road Construction Project: Case Study Construction Of The Four Laning Of Amravati –Talegaon Section Nh-6”, International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622, Vol. 2, Issue 3, pp.3166-3169

[14]. Carl B. Harbitz, Gunilla Kaiser, Sylfest Glimsdal and Christian Jaedicke, "Coastal inundation multi-hazard analysis for a construction site in Malaysia", IJRAM Vol. 19, Nos. 1/2, 2016

[15]. Dr Patrick. X.W. Zou, Dr Guomin Zhang and Professor Jia-Yuan Wang, "Identifying Key Risks in Construction Projects: Life Cycle and Stakeholder Perspectives" International Journal of Construction Management, 02/2014; 9(1)

[16]. Ewelina Gajewska and Mikaela Ropel, "Risk Management Practices in a Construction Project – a case study", Chalmers University Of Technology, Göteborg, Sweden 2011

[17]. Matthew Hallowell and John Gambates, "A Formal Model for Construction Safety Risk Management", The construction and building research conference of the Royal Institution of Chartered Surveyors Georgia Tech, Atlanta USA, ISBN 978-1-84219-357-0, 6-7 September 2007

[18]. Mr. Satish K. Kamane, Mr. Sandip A. Mahadik, "Risk Management in Construction Industry", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684, PP: 59-65, (SICETE) Dr. J.J. Magdum College of Engineering, Jaysingpur

[19]. Patel Ankit Mahendra, Jayeshkumar R. Pitroda, J. J. Bhavsar, October 2013, "A Study of Risk Management Techniques for Construction Projects in Developing Countries", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-5

[20]. Report of the Comptroller and Auditor General of India on "Management of Irrigation Projects", State legislature Assembly 14-06-2014, Government of Maharashtra

[21]. Rogério Cabral de Azevedo, Leonardo Ensslin, Antônio Edésio Jungles, "A Review of Risk Management in Construction: Opportunities for Improvement", Modern Economy, 2014, 5, 367-383

[22]. Third Mid-Term Evaluation (MTE) Report On "Maharashtra Water Sector Improvement Project" (MWSIP), Volume – 1 main report, Water Resources Department, Government of Maharashtra, Sheladia Associates, inc, USA, Agricultural Finance Corporation ltd, Mumbai, April, 2013

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Internet of Things (IoT) : A Survey

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ABSTRACT

Internet of things is considered as the next evolution of the Internet. IoT is considered as a global network of things, having a distinct identity, and these are interconnected via a wide range of the network to exchange data and present it into vital information. Internet of things is an emerging technology that shaping the development of the ICT sector at large. The Internet of Things can also be considered as a uniquely recognizable smart object and their virtual representation in an Internet-like structure. To interchange data, IoT resources using the internet makes use of multiple interconnected technologies like Wireless Sensor Network (WSN) and Radio Frequency Identification (RFID). Also, integration of IoT with cloud provides improved services to end-user. For beneficence to the growing body of research on IoT, authors have presented the four-layered architecture of IoT, services offered by Internet of things, current Internet of things applications as well as issues and challenges of IoT technology in detail in this paper.

Keywords: IoT, Smart things, RFID, WSN

I. INTRODUCTION

to Gradually use of smart devices is gaining popularity around the globe. People use the internet as a global platform to allow smart objects and machines to send and receive data and to maintain coordination among them [31]. Smart things like smart homes, smart grid, smart wearable, and smart healthcare are the emerging application of IoT which are connected to smart grids. These smart devices are responsible for the creation of large smart systems [2]. In 1999, the term Internet of Things was introduced. According to the survey results of the European Commission, 50 to 100 billion devices will link to the internet by 2020. In the year 2008, it was a rough estimate that the number of things connected to the Internet was more than the total population on earth [11]. IoT consists of self-adjustable intelligent nodes that are interconnected with each other in a global and dynamic infrastructure of the network. Development of internet protocols, communication technologies and embedded devices improves communication, processing and sensing capabilities of smart objects [13]. Thus, it allows smart objects to sense environmental activities, transfer data over the internet and to make actuation according to the shared data. A smart device is nothing but an independent thing that has a sensor for sensing external parameters, an actuator for performing required corrected action autonomously, a transceiver for data

transmission and a microcomputer for processing. Both academia and industry are affiliated towards IoT [3]. Over the last five years, there is a rise in sensor implementation, because of advances in cloud and sensor technology, storage and processing capacity and reduced sensor manufacturing cost. As per the definition of IoT, it allows things and people to get connected with anything, at any time and any location by making use of any service and any network/path. IoT is driven by advances in technology and not by user needs or applications. To interact with smart objects without any physical connection, low power wireless connection is useful [11]. While maintaining their identity, smart mobile things can travel around physical space. To make smart things, location and time-aware global positioning system (GPS) is used. IoT allows connected and pervasive smart things to interact autonomously while delivering smart services to the users [26].

The impetus of this paper is to present current IoT services, applications as well as issues and challenges of IoT technology. The composition of this paper is as follows: In section 1, we have introduced IoT technology. Enabling technologies of IoT i.e., Radio frequency identification (RFID), wireless sensor technology (WSN), and cloud computing is briefly described in section 2. In section 3, we have discussed the four-layered architecture of an IoT. Emerging IoT services are discussed in section 4. Current application of IoT like smart waste management, smart agriculture, healthcare, weather forecasting, monitoring environmental parameters, smart homes, smart grid are discussed in section 5, and in section 6 we have discussed issues and challenges of IoT, such as scalability, interoperability, security & big data.

II. ENABLING TECHNOLOGIES OF IOT

Collecting information from the surrounding environment to analyze, control, and making correct action is the main idea for IoT. To interchange data, IoT resources using internet makes use of multiple interconnected technologies like wireless sensor network (WSN) and radio frequency identification (RFID). IoT consists of smart objects, which can be read, locate, address, and control through the internet using RFID, wireless LAN, or some other means. An amalgam of IoT with cloud also helps them to overcome their technological limitations [2] Thus further, we have described RFID, WSN, and cloud computing technologies briefly:

A. Radio frequency identification

To eliminate human assistance and to automate the identification of objects, the electronic tag, also called an RFID tag, which can be read by RFID-reader from a small distance had been developed. RFID-reader does not require a direct line of sight to read the RFID tag. A distinct Electronic Product Code is stored in every RFID tag of the attached object [25]. By acting as a gateway to the internet, RFID- reader sends an object's real-time and location-enabled identity to a remote computer system to manage an extensive database. Due to this advantage, the RFID system has been widely applied in logistics, such as package tracking, supply chain management, healthcare applications, etc. The passive RFID tag and Active RFID tag are the two types of RFID tags. Active RFID tags are provided with their power supply in the form of battery. While passive RFID tags are not provided with any power supply, they get power from energy harvested out of the electronic field which is directed on a tag by RFID-reader [7]

B. Wireless sensor network

Wireless sensor technology is the 21st century's one of the most needed technology. A sensor network consists of spatially distributed connected sensor nodes, which makes a network for data receiving and transmission within them [13]. A recent development in the micro electro-mechanical system, low power communication, and low power microelectronics is capable of making integrated small-sized smart things also considered as sensor nodes [26]. This sensor node consists of a sensor, wireless communication controller, and small microcontroller. To measure environmental parameters, sensor nodes can acquire multiple biological, chemical, and physical signals. Until the least number of nodes are working, and by maintaining the connection of working nodes with one of the base stations, the sensor network can keep operational. Sensor nodes consist of network management components and operating system components [10]. To accommodate network dynamics and to manage the topology of the network, the routing protocol plays an important role. WSN can be used in many operations like transport monitoring, military applications and weather forecasting [2].

C. Cloud computing

Cloud computing technology is provided with virtually unlimited processing and storage capability as well as cloud provides on-demand services which are ubiquitously available than ever before. Thus this technology allows IoT to overcome its technological limitation of limited storage and processing capability [30]. Cloud makes use of the internet for delivery of services i.e., provides infrastructure, platform, and applications through the internet. Now it becomes a new trend, which provides access to shared computing resources [4]. Nowadays, computing resources become cheaper, robust, and ubiquitously available than before, because of increased development of processing technology, storage, and the internet [19]. Over the last few years, cloud technology had put a huge impact on the information technology industry, large enterprises like Amazon, Google, IBM, and Microsoft trying to improve their business strategy and to get benefits from this new technology by providing more reliable, robust and cost-efficient cloud platforms. Cloud can be considered as a new operating model to drive business differently by bringing existing technologies together [17].

III. IOT ARCHITECTURE

In this section, the authors have discussed the four-layered architecture of IoT, as shown in Fig. 1, which consists of a perception layer, which we can also call as a physical object layer whose primary purpose is data collection. The second layer is the network layer, whose function is to perform transmission of data over the network [31]. For data processing, there is a middleware layer. This data user can access at the application layer and using this data, and one can build business strategies in the Business layer [20]. Further, in this section, this four-layered architecture is explained in detail:

A. Perception Layer

This layer is also called a device layer or sensor layer. This layer consists of sensor-enabled physical objects in an IoT based system. These connected devices are the real endpoints for IoT. It is the actual hardware of an IoT system. This layer provides functionalities such as sensing, actuating, communicating, monitoring, and

controlling [20]. Sensors can be barcodes, RFID tags, and infrared sensors. As per application requirements, these sensors are used to get information regarding location, time & environmental changes (temperature, humidity, pressure) [1]. To securely transfer this collected data to the data processing unit, this information is transferred to the network layer [31].

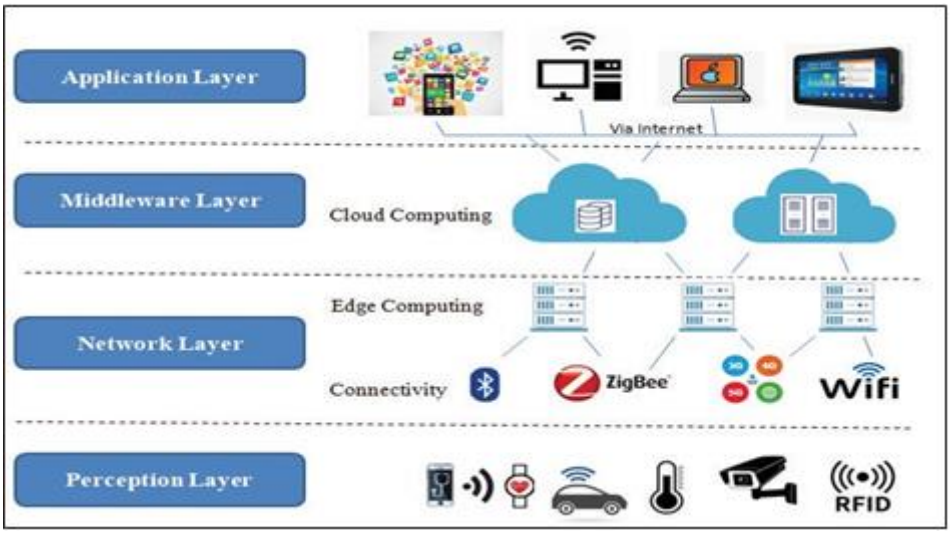

Fig. 1. Four layered IoT architecture

B. Network Layer

This layer is also called as a connectivity layer or edge computing layer, which defines various communication protocols, connectivity of networks, and edge computing [9]. This layer is used to transfer the information securely from sensor devices to the data processing unit. Wired or wireless transmission modes can be used to transfer data over the internet [20]. Also, technologies like ZigBee, Wifi, Bluetooth, infrared, 3G, 4G & 5G can be used depending upon the sensor devices. In this layer, IoT data is distributed and is processed at the edge of the network. Thus, this network layer sends the data from the Device/sensor layer to the middleware layer [31].

C. Middleware Layer

This layer is responsible for receiving the data from the network layer and storing it in the database. This received information can be analyzed by advanced data analytics. The middleware layer is used mainly for service management since these IoT devices are implemented to serve different IoT services. Each smart object connects and communicates with only those other smart objects which are involved in the same type of service. This layer performs data processing, ubiquitous computation, and automatic decision making based on the results [20]. This layer is compatible with cloud infrastructures, as IoT is integrated with cloud services. This received information can be analyzed with advanced data analytics. Thus this layer is mainly responsible for processing and storage using cloud computing. In other words, big data storage and high computing applications can be placed at this layer [29].

D. Application Layer

An IoT system manages various things and notifies the user about any conditions or generates results based on sensed data. Applications are needed to represent such data relevant to the user. Applications are also used to control and monitor such IoT systems [31]. This is the front end part of an IoT application that is accessible to the user. This layer allows the management of the applications depending on the data processed in the middleware layer. The applications implemented by IoT can be a smart home, smart city [32], smart healthcare, smart farming, smart retail & intelligent supply chain [6].

IV. IOT SERVICES

A. Sensing as a service

From this service, we can get ubiquitous access to sensor data [4]. SaaS model consists of four layers sensor & sensor- owner, sensor publisher, extended service provider, and sensor data user, as shown in Fig. 2. Various sensors record the data as per their specifications, and then sensor publishers after taking permission from the sensor owner publish that data in the cloud. When sensor data user needs data from different sensors, extended service providers contact with various sensor publisher for getting sensor data and provide that data to data consumer [5].

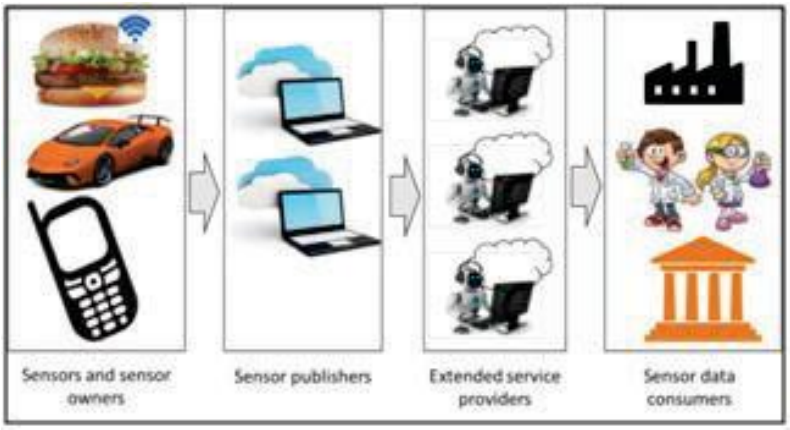

Fig. 2. Sensing as a service model [5]

B. Sensing and Actuation as a Service (SAaaS)

This service provides automatic control logic implemented in the cloud [2]. Sensing cloud provides virtual actuators and sensors, which are used to manipulate actual resources. Using SAaaS, user gets complete control over allotted virtual actuators and sensors through their service API [23].

C. Video Surveillance as a Service (VSaaS)

It provides access to recorded videos in the cloud. VSaaS is considered as a smart monitoring activity for security and related applications as shown in Fig. 3. Because of the cloud's storage and processing capability, the analysis of complicated videos becomes easy. In this service from video capture, storage, and management of video information from the camera until delivery through the internet is done by using load balancing and fault tolerance [3].

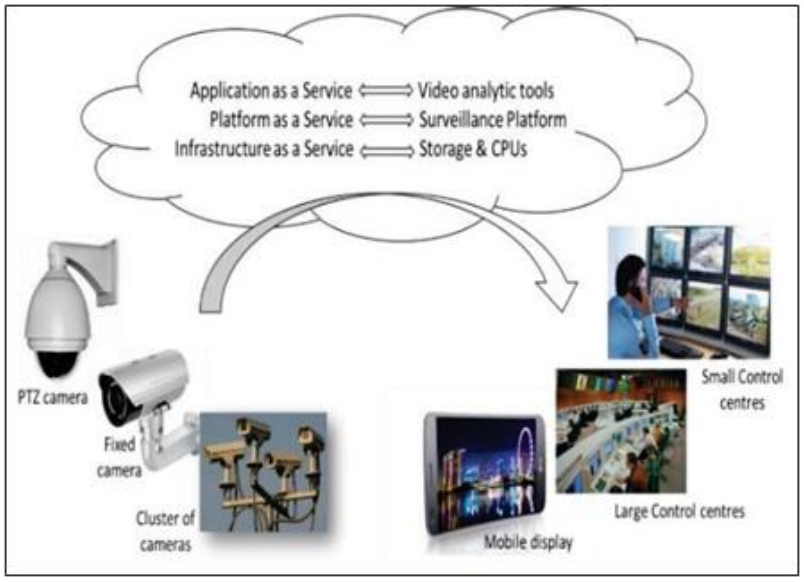

Fig. 3. Cloud-based architecture for VSaaS [3]

D. Sensor Event as a Service (SEaaS)

It provides messaging service actuated by sensor events [2]. The term SEaaSwere introduced to provide a process of making sensor events of interest available to applications and/or clients through cloud infrastructure [4].

E. Sensor as a Service (SenaaS)

Sensor primarily translates parameters like humidity, temperature, etc. into electrically measurable signals [26]. Through this service, we can control and monitor remote sensors ubiquitously using a web browser through user interface [4].

V. APPLICATION

A. Smart Waste Management

One of the major issues that modern cities are facing is waste management. It consists of multiple processes like managing and monitoring waste, transport, collection, disposal, etc. These processes are costly and time-consuming. One can optimize these processes to reduce cost, which can be used for solving other issues that smart cities can be deal with. In cities, there are many parties interested in the management of waste like recycling firms, the council of cities, safety & health-related authorities, etc. Instead of implementing sensors individually, and getting information, sensing as a service allow them to share information and bare infrastructure cost collectively. The city council uses this information to optimize garbage collection strategies to reduce the fuel cost of a garbage truck. While safety and health authorities can supervise and monitors the processes of waste management without going for manual inspection. For these activities, various sensors needed to be installed in places like trucks or cans of garbage, which can detect type and amount of garbage [5].

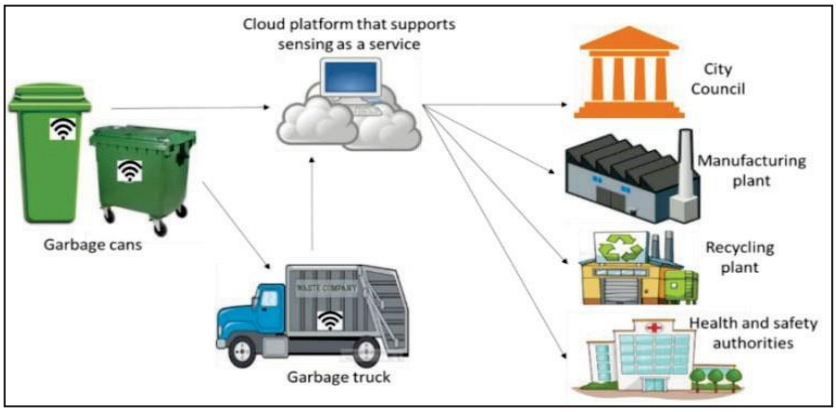

Fig. 4. Waste management using IoT

[1]. Smart agriculture

To satisfy the need for food of the ever-growing population, we should be getting the best yield out of the framing, and this can be achieved with the help of IoT. Data analytics of smart agriculture i.e., land condition, weather situation, and type of soil, collected from the IoT network can provide practical information if used in combination with data captured by sensors, which measures the level of water resources, heat, moisture, chemicals, water stress, pump status, etc. This enables farmers to utilize fertilizer, water, and pesticides in most accurate quantities, at precise positions and with effective time scheduling to improve agricultural outputs. Smarter use of water like monitoring and supervising water capacity, location, timing, and period of flow based on data analytics, helps to increase irrigation efficiency, thus resulting in lower costs. Other benefits of IoT include efficient uses of pumps, boosters, lighting, etc. It can also remotely control the working conditions, the status, and equipment performance [16].

[2]. Smart Home

To reduce user's interference in controlling and monitoring home settings as well as home appliances, smart home is an emerging application [14]. A smart home provides many features for the user like measuring home conditions (i.e., light intensity, temperature, heating, etc.), operate home's Heating, Ventilating, and Air Conditioning (HVAC) appliances and control them with reduced human interaction [22]. Paper [18] presented procedure to develop a smart home by combining IoT with cloud computing and web services, use Arduino platform for implanting intelligence in actuators as well as in sensors and facilitates interaction within smart things using cloud services.

[3]. Monitoring environmental parameters

As the environmental parameters like temperature, humidity, and moisture differ time to time and place to place. Therefore, it is become important to monitor quality level of perishable goods like dairy products, fresh-cut produce, fruits and meat, etc. during its transportation from production to consumption site. This vital task can be easily performed with sensors and pervasive computing technologies. It also improves the efficiency of the food supply chain [12].

Horizontal scalability can be referred as the potential to increase the device to work as a single logical unit by connecting multiple hardware or software entities." It can be accomplished by adding more nodes to a system, such as adding a new computer to distributed software applications [28]. For example, Cassandra runs of hundreds of commodity nodes, which help to scale out horizontally as it is spread across different data centers. Because of the commodity hardware, Cassandra does not have a single point of failure. Vertical scalability is referred as the potential to increase the capacity of the software or the existing hardware when we add more resources to it. For instance, to make it faster we can add processing power to it. It was adopted when the database could not handle large amounts of data. For example, MySQL- amazon RDS it allows vertically scaling to shift from small to bigger machine [31].

[4]. Interoperability

As the data sharing among smart devices is increasing day by day, it is necessary to manage these data transfer properly among the system [10]. Interoperability can be considered as the potentiality of two systems to communicate, exchange information, or program, or transfer the data among each other and to implement the given data [15]. It is the exchange of information among different computers through wide area networks or local area networks. It is critical for IoT as most of the communication takes place as a machine to machine [14] Interoperability is classified into multiple levels containing:

- Technical Interoperability: It potential to perform a task with the satisfactory and appropriate manner with any need of an extra operate when two or more information and communication technology application is used.
- Syntactic Interoperability: Syntactic Interoperability generally associated when we are processed to exchanged information or data and to communicate between the heterogeneous IoT systems. e.g., RDF, XML and JSON.
- Semantic Interoperability: It refers to the capability of exchanging the information, data, and knowledge that has precise meaning and encoding of this data by another system.
- Organizational Interoperability: It is associated with the capability of organizations for effective communication and transfer of information across the many other information systems, geographic

B. Weather Forecasting

To predict the state of the atmosphere for a future time and for a given location, weather forecasting is very important. Weather forecasting and monitoring consist of a collection of data, assimilation of data, and forecast presentation. Sensors at weather station used to sense humidity, temperature wind speed, the moisture of soil, the intensity of light, radiation, etc. Data coming from these sensors is huge in size and difficulty in monitoring. The integration of this sensor infrastructure with cloud increases its storage and computational capabilities. It also provides effective solutions for monitoring and presentation of data [6].

C. Health Care

Sensors of pervasive healthcare applications make use of cloud computing and IoT to allows a machine to machine communication to be done location independently [8]. Nowadays, in modern hospitals, various body

sensors are used to measure and monitor physiological data of the patients. This sensitive collected data is maintained for future diagnosis of patient. In some hospitals, this data is maintained at the local database. Due to this, doctors who are called to handle critical cases unable to analyze disease. After visiting to the patient only they can give proper treatment. However, using cloud, this issue can be solved i.e., data of patients can be maintained and shared with doctors who are abroad, so that they can treat the patient, independent of location. [26]

D. Smart grid

Today most of the power supply system is manually operated, and due to some human error, there is loss of power. These small losses result in massive outrage of power supply. This loss can be brought under control, and a 100% efficient power transfer system can be designed using IoT, and it is known as the Smart grid. It is a fully automated system based on blockchain technology, which is entirely robust & encrypted. This power is divided into channels for each individual, and this channel is wholly encrypted with its stash key, which is to be decrypted. This results in an equalized power supply throughout the grid without any power loss [24].

VI. ISSUES AND CHALLENGES

A. Scalability

The growing idea of IoT which generates a tremendous amount of data for processing and storage guide to enormous leap in the forthcoming year, and hence it becomes insistent on making the scalable system. The vast application of IoT has increased the number of devices being connected to the internet; which meets the concern to consider various complications that are arising in connectivity [30]. As new technology progresses to an altogether different level, it becomes inevitable to make the device more scalable both horizontally and vertically [21].

B. Security

C. regions, and cultures [14].

As time goes to the trend of the IoT inflates the multiple interconnections and the heterogeneity of device, it possibly generates the cyber attackers. Thus the safety of the data it one of the most crucial issue, As there is an increment in the number of connected devices, there are chances of cyber- physical security vulnerabilities safety that can be exploited by various attackers [22]. An essential pillar of the internet is security, which is the major challenge of IoT. Due to incomplete data streams, the possibility of sophisticated kind of theft has been evolved lately, having the capability to create consequences disaster among people's health and safety can be risky. Furthermore, the hacking toolkits have been chiefly automated so that even a novice can execute the destructive attacks [28].

VII. BIG DATA

Different sources like the internet, social media, machine, and many other devices generate data. Thus special attention must be given for transportation, access, storage, and processing of these large sets of structured and unstructured digital data [30]. According to IBM, the volume of data on the web and internet is growing around 2.5 quintillion bytes of data, which creates 90% of the world's data created in the past two years. Handling this data with convenience is a crucial challenge, as the overall performance of the application is highly dependent on the characteristics of the data management service [8]. For processing these vast data exceptionally is a crucial challenge, as overall performance highly depends upon the data management services. Big data deals with unstructured and unconventional databases, and this treatment is not enough when the reaches petabytes or zettabytes. Recently many big organizations like Google, Facebook, Yahoo, and other startups companies today use the cloud. This cloud helps to store big data for a long time, which may be under organizations logical control, but physically reside in infrastructure owned and managed by another entity [2].

VIII. CONCLUSION

An IoT, which is among one of the popular technologies of the 21st century, which is responsible for the creation of large smart systems such as smart city, smart healthcare & smart agriculture. To allow intelligent decisions making, free communication and sharing of information, the use of IoT embed sensors, and actuators are essential. To contribute to the growing body of research on IoT, authors had surveyed and collaboratively presented current services provided by IoT, trending applications of IoT, current issues, and challenges faced by IoT technology. Authors also presented the four-layered architecture of an IoT technology.

IX. REFERENCES

[1]. A. Botta, W. De Donato, V. Persico, & A. Pescapé, “Integration of cloud computing and internet of things: a survey” Future Generation Computer Systems, 56, 684-700, 2016.

[2]. A. Prati, R. Vezzani, M. Fornaciari, & R. Cucchiara, “Intelligent video surveillance as a service”, In Intelligent Multimedia Surveillance (pp. 1-16). Springer Berlin Heidelberg, 2013.

[3]. B. P. Rao, P. Saluia, N. Sharma, A. Mittal & S. V. Sharma, “Cloud computing for Internet of Things & sensing based applications”, In Sensing Technology (ICST), 2012 Sixth International Conference on (pp. 374-380). IEEE.

[4]. C. Perera, A. Zaslavsky, P. Christen, & D. Georgakopoulos, “Sensing as a service model for smart cities supported by internet of things”, Transactions on Emerging Telecommunications Technologies, 25(1), 81-93, 2014.

[5]. D. Miorandi, S. Sicari, F. De Pellegrini, & I. Chlamtac, “Internet of things: Vision, applications and research challenges”, Ad Hoc Networks, 10(7), 1497-1516, 2012.

[6]. E. Prater, G. V. Frazier, & P. M. Reyes, “Future impacts of RFID on e-supply chains in grocery retailing”, Supply Chain Management: An International Journal, 10(2), 134-142, 2005.

[7]. F. Firouzi, A. M. Rahmani, K. Mankodiya, M. Badaroglu, G. V. Merrett, P. Wong, & B. Farahani, "Internet-of-Things and big data for smarter healthcare: from device to architecture, applications and analytics", 2018.

[8]. H. Li, K. Ota & M. Dong, "Learning IoT in edge: Deep learning for the Internet of Things with edge computing", IEEE, Network, 32(1), 96-101, 2018.

[9]. I. Yaqoob, E. Ahmed, I. A. T. Hashem, A. I. A. Ahmed, A. Gani, M. Imran & M. Guizani, "Internet of things architecture: Recent advances, taxonomy, requirements, and open challenges", IEEE wireless communications, 24(3), 10-16, 2017.

[10]. J. Gubbi, R. Buyya, S. Marusic, & M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions", Future generation computer systems, 29(7), 1645-1660, 2013.

[11]. J. Lin, W. Yu, N. Zhang, X. Yang, H. Zhang & W. Zhao, "A survey on internet of things: Architecture, enabling technologies, security and privacy, and applications", IEEE Internet of Things Journal, 4(5), 1125-1142, 2017.

[12]. K. Patel & S. M. Patel, "Internet of things-IOT: definition, characteristics, architecture, enabling technologies, application & future challenges", International journal of engineering science and computing, 6(5)

[13]. L. R. Stojkoska, &K. V. Trivodaliev, "A review of Internet of Things for smart home: Challenges and solutions", Journal of Cleaner Production, 140, 1454-1464, 2017.

[14]. M. Diaz, C. Martín, & B. Rubio, "State-of-the-art, challenges, and open issues in the integration of Internet of things and cloud computing", Journal of Network and Computer Applications,

[15]. M. Roopaei, P. Rad & K. K. R. Choo, "Cloud of Things in Smart Agriculture: Intelligent Irrigation Monitoring by Thermal Imaging", IEEE Cloud Computing, 4(1), 10-15, 2017.

[16]. M. S. Kavre, V. S. Narwane and R. D. Raut "Cloud Adoption in Various Domains and Factors Influencing Its Adoption", International Conference On Emanations in Modern Technology and Engineering, 2017.

[17]. M. Soliman, T. Abiodun, T. Hamouda, J. Zhou, & C. H. Lung, "Smart home: Integrating internet of things with web services and cloud computing", In Cloud Computing Technology and Science (CloudCom), 2013 IEEE 5th International Conference on (Vol. 2, pp. 317-320). 2013.

[18]. R. Buyya, C. S. Yeo, S. Venugopal, J. Broberg, & I. Brandic, "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility", Future Generation computer systems, 25(6), 599-616, 2009.

[19]. R. Khan,S. U. Khan,R. Zaheer, &S. Khan, "Future internet: the internet of things architecture, possible applications and key challenges", In 2012 10th international conference on frontiers of information technology (pp. 257-260). IEEE.

[20]. R. Riesen, K. Ferreira, D. Da Silva, P. Lemarinier, D. Arnold,& P. G. Bridges, "All eviating scalability issues of checkpointing protocols", IEEE Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis, November, 2012.

[21]. R. Sfar, E. Natalizio, Y. Challal, &Z. Chtourou, "A roadmap for security challenges in the Internet of Things", Digital Communications and Networks, 118-137, 2018.

[22]. S. Distefano, G. Merlino, & A. Puliafito, "Sensing and actuation as a service: A new development for clouds", In Network Computing and Applications (NCA), 2012 11th IEEE International Symposium on (pp. 272-275), (2012, August).

[23]. S. E.Collier, "The emerging enernet: Convergence of the smart grid

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Devising Methods to Avoid Formation of Defects in A Ball Bearing Through FFT Analyzer

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ABSTRACT

Most of the essential's part are rolling element bearings in rotating machinery. Between the two parts of linear and relative motion are permitted for the function of bearings. During the operation, the bearings are often subjected to high speed and severe conditions. Under these severe operating conditions, defects are often developed in the bearing components. If no corrective measures are taken, the machine could halt or be seriously damaged. Different effects of bearing failure yield its own distinctive damage like primary damage and secondary damage are peeling and flaws. Excessive internal clearance, vibration, noise, are primary damage has been considered for the necessities. A failed bearing frequently displays a combination of primary and secondary damage.

Keywords: - spall defect, bearing, FFT analyser, vibration spectrum, BPFO, Rolling element etc.

I. INTRODUCTION

Rolling element bearings is obvious that more attention must be paid to the condition of a rolling element bearing if the human life is in question. Rolling element bearings are manufactured by assembling different components: The outer ring, the inner ring and the rolling elements which are in contact under heavy dynamic loads and relatively high speeds. When ball bearings are operated, they generate vibration. Even a geometrically perfect bearing may generate vibration due to varying compliance or time varying contact forces which exist between the various components of the bearing. The nature of vibration response changes with the presence of defect in bearing components. The function of bearings is to permit constrained relative rotation or linear motion between two parts. During the operation, the bearings are often subjected to high loading and severe conditions. Under this severe operating condition, defects are often developed on the bearing components. If no action is taken, the machine could be seriously damaged. Therefore, it is of prime importance to detect accurately the presence of faults, especially at their early stages, in bearings to prevent the subsequent damage and reduce the costly downtime. The vibration analysis is the most commonly used technique for monitoring of the bearings. This technique can provide early information about progressing malfunctions and forms base line for future monitoring purpose.

The radial clearance in rolling bearing systems, required to compensate for dimensional changes associated with thermal expansion of the various parts during operation, cause dimensional attrition and comprise bearing life, if unloaded operation occurs and balls skid. Also, it can cause jumps in the response to unbalance excitation. These undesirable effects may be eliminated by introducing two or more loops into one of the bearing races so that at least two points of the ring circumference provide a positive zero clearance. The deviation of the outer ring with two loops, known as ovality, is one of bearing distributed defects. Although this class of imperfections has received much work, none of the available studies has simulated the effect of outer ring ovality on the dynamic behaviour of rotating machinery under rotating unbalance. The speed of rotation, shaft elasticity and ball bearing nonlinearities has been considered in rotating machine. It is established that with best bearings (no ovality), the vibration spectrum is quantitatively and qualitatively the similar in both the vertical and horizontal directions.

II. METHODS AND MATERIAL

1. Introduction: It gives the outline of the project. It contains information of various defect of bearing, failure theories of bearing.
2. Literature Review: It contains the research work carried out by the various authors
1. recently on the detection of defect (spall) by using vibration analysis.
2. Bearing Types, Bearing Failures and Their Causes: It contains the types of bearing, bearing component and types of failure, their causes.
3. Design Consideration and Theoretical Calculations: It contains the experimental work carried out on experimental set-up, and the reading of the experiments and steps for the experiment.
4. Experimental work: It contains the experimental work carried out on setup and steps for the experimental procedure.
5. Numerical Analysis: It contains how the model is created in ProE design software then its ANSYS analysis. The FEM Analysis of bearing for Structural Aspects give defective frequencies and amplitude.
6. Results and Discussion: It contains the experimental results and graphs related to the readings.
7. Conclusion and Future Scope: It contains the conclusion and the future scope of the dissertation.
8. References: Required for the entire work are included at the end of the report compressive load

III. RESULTS AND DISCUSSION

Vibration characteristics are most vital role in the revision of analytical for the system. In the experimental setup two bearings are well-thought-out one bearing was no any defect and additional bearing was with defect, both the bearings were attached to the system one after another for convey the result. The bearing dimensions are specified in the Table after taking the consequence it was observed that the amplitude values were added for the bearing with defect associate to bearing which has without defect. First arrangement is outing for few minutes to slow down all the inconsequential vibration. After this Accelerometer accompanied by the vibration analyzer is utilized to obtain the signals of vibration. Vibration signals are dignified at dissimilar speeds of the

system for both non-defective and defective bearing. Subsequent are the rare results which are occupied through the help of FFT analyser. Throughout performing the experiment speed of shaft are differ from 1490 rpm to 800 rpm, throughout these shaft speed amplitude values in positions of frequency (Hz) and amplitude (mm/s2) were considered for better understanding. For with defect and without defect bearing results were reserved in time domain, consistently frequency domain results were also occupied for imperfect bearing for excellent accepting of vibration amplitude values.

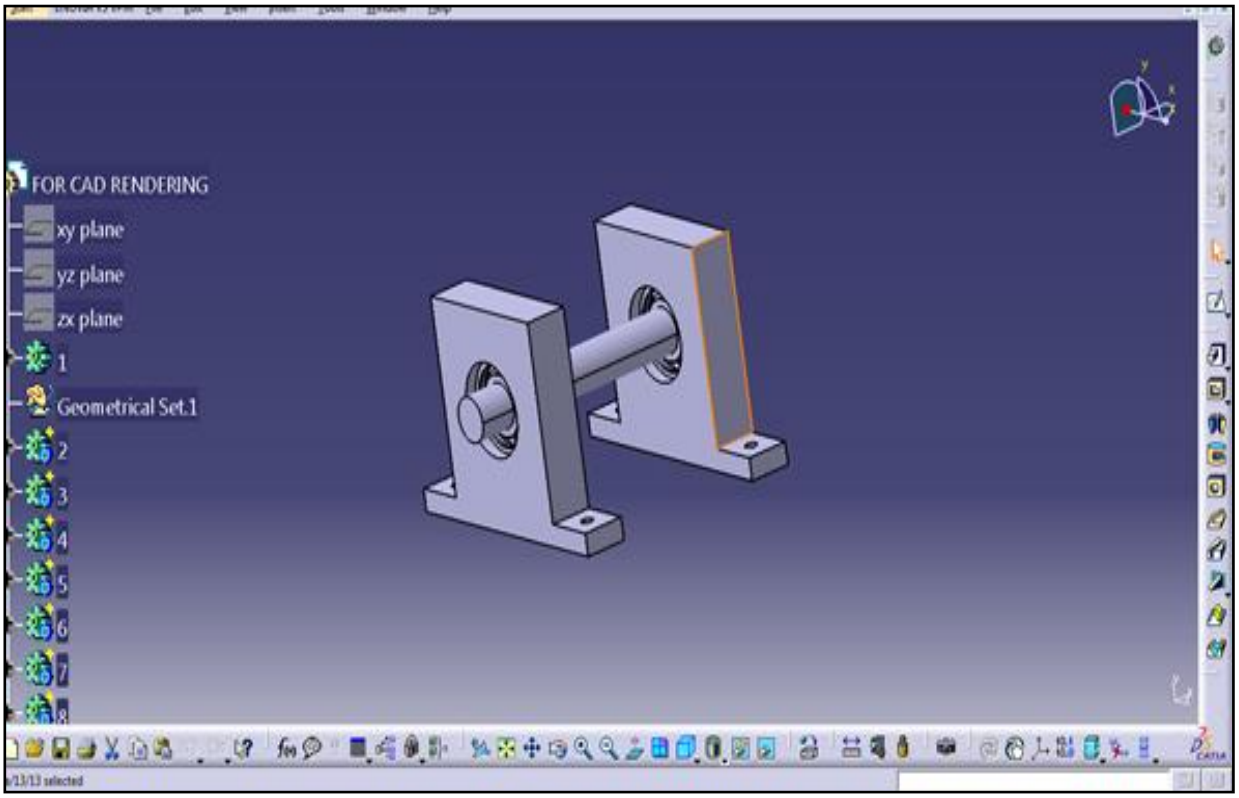
Outer race defect							
Sr.no	Speed in RPM	Defect Frequency	FFT Amplitude (Healthy) Bearing	FFT Amplitude (Defective) Bearing	ANSYS Defective Frequency	ANSYS Healthy Bearing Amplitude	ANSYS Defective Amplitude
1	1490	89.12	0.000212	0.0211	84	0.00019	0.0209
2	1200	71.56	0.002	0.0161	76	0.0018	0.0163
3	1000	59.6	0.0000698	0.0251	55	0.000067	0.0248
4	800	47.7	0.0028	0.031	44	0.003	0.034

Experimental due to inner race defect

Inner race defect							
Sr. no	Speed in RPM	Defect Frequency	FFT Amplitude (Healthy) Bearing	FFT Amplitude (Defective) Bearing	AN SYS Defective Frequency	ANSYS Healthy Bearing Amplitude	ANSYS Defective Amplitude
1	1490	135.05	0.000212	0.0233	130	0.00019	0.0236
2	1200	108.3	0.002	0.0129	105	0.0018	0.013
3	1000	90.32	0.0000698	0.0295	86	0.000067	0.0276
4	800	72.26	0.0028	0.0125	67	0.003	0.0127

Design

CAD model of set-up of project with actual dimensions of mechanical elements used in set-up. In this segment modelling of bearing is done with the help of CATIA software, modelling is a complex task for designing a bearing because in the modelling of bearing various types of joints should be applied at the design stage which is very complex.



IV. CONCLUSION

In most of the studies, the fault diagnosis of rolling element bearings has been focused mainly on vibration measurement methods and utilization of these methods for detecting faults on individual components. However, very few studies have been carried out and reported in literature, which address the effect of severity of localized defects of bearing components on the nature of the vibration response. In the present study, localized defect has been considered on the ball bearing. The dynamic behaviour of healthy/faulty ball bearing elements is investigated. The vibration response due to localized defects on the inner race, outer race and balls have been demonstrated, also combination of these defects and rotational speed.

V. REFERENCES

[1]. L. D. Meyer, F. F. Ahlgren, B. Weichbrodt, “An Analytic Model for Ball Bearing Vibrations to Predict Vibration Response to Distributed Defects.” Trans of ASME J. Mechanical Design 102, 205-210 (1980).

[2]. Bin Zhang, Georgios Georgoulas, Marcos Orchard, Abhinav Saxena, Douglas Brown, George Vachtsevanos, Steven Liang, “Rolling Element Bearing Feature Extraction and Anomaly Detection Based on Vibration Monitoring.” 16th Mediterranean Conference on Control and Automation Congress Centre, Ajaccio, France. June 25-27, 2008

[3]. A. Chaudhary, N. Tondon, “A Theoretical Model to Predict Vibration Response of Rolling Bearings to Distributed Defects under Radial Load.” Transactions of ASME, 214/vol. 120, pp-214-220, January 1998.

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Simulation of Passive Suspension System for Enhancing Ride Comfort of Vehicle

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ABSTRACT

The objective of the current effort is to create and use a systematic methodology to get the best settings for a vehicle's suspension parameters during road stimulation. For experimentation purposes, a quarter-car test rig is created and integrated with the NI-LabVIEW data acquisition system. The arrangements are made to vary the important parameters, such as the sprung mass (Ms), damping coefficient (Cs), spring stiffness (Ks), and speed (N), within a predetermined range. Taguchi approach used to determine each parameter's ideal setting. To assess riding comfort, a quarter automobile simulation model is created in MATLAB. A correlation index of 0.725 was discovered when the experimental model was validated with the simulation model.

Keywords— Optimization, Quarter car test rig, Simulation, Taguchi method.

I. INTRODUCTION

The vibration of the car and the seats makes the driver fatigued and affects driving safety. Designer has always shown great interest in designing better suspension system which improves ride comfort. The three main factors that play a significant role in maximising ride comfort are the suspension spring stiffness (Ks), damping coefficient (Cs), and sprung mass (Ms) [1]. When moving at a high speed across different road profiles, a vehicle's body vibrates. According to SAE J670 nomenclature, ride refers to the low frequency vibrations (up to 5Hz) felt by the sprung mass of the vehicle. According to the ISO-1:1997 standard [2], humans are most sensitive to vertical vibrations in the frequency range of 4 to 8 Hz. This paper makes use of a quarter-car test rig coupled with an NI-LabVIEW data gathering system. A cam has been used to actuate a half sine wave bump profile in order to examine and evaluate suspension behavior. The ability to change the sprung mass (Ms), damping coefficient (Cs), and spring stiffness (Ks) has been built into the test rig. To achieve the best suspension system configuration, Taguchi approach was used.

Nomenclature
Ms: Sprung mass of vehicle.
Mu: Un-sprung mass of vehicle.
Cs: Damping coefficient of damper.
Ks: Spring stiffness of suspension.
Kt: Tire stiffness.
Rc: Ride comfort.

II. LITERATURE REVIEW

A.C. Mitra et al [1] has been successfully implemented the response surface methodology (RSM) which is one of the methods of design of experiment for finding the optimum setting of damper and spring. As per Box-Behenken design of RSM, the ride comfort with accurate independent variables was analyzed by using simulation model. They developed RC using regression analysis which gives a good agreement with simulated model.

A.C. Mitra et al. [2] utilising a quarter car test rig, the complete factorial DOE methodology was used to optimise various suspension parameters in order to maximise ride comfort. They developed a quarter car test rig equipped with NI-LabVIEW data acquisition system. And provide a arrangement to vary the factors within predetermine range. They implemented the DOE methodology to formulate a single objective model of RC using Minitab. Additionally, a quarter-car model was created in Simulink and used to validate the experimental model.

For the study of vehicle dynamics, Manoj K. Mahala et al. [3] used a variety of mathematical models also referred to as lumped parameter models. They studied the responses of different models and compared for different road conditions. They considered mathematical models such as a quarter car, half car and full car model. And analyzed using Simulink for pitch and roll. Their aim is to evaluate the capabilities of different modeling and their deficiencies.

E. Duni et al [4]. explains a numerical approach based on the finite element method used for transient dynamic modelling of the whole car rolling over various sorts of road barriers. They have discussed issues related to the tire finite element model development and its validation. The methodology based on the Fiat Punto car dynamic simulation going over comfort and pothole obstacles has also been effectively utilised.

A approach for improving ride comfort and stability has been put out by Jauo P.C. et al. [5] and is based on the usage of a flexible multi body model. By measuring acceleration at several key spots on the car, they are able to determine the ride index that is best.

A Taguchi technique is presented by P. Senthil Kumar et al. [6] to develop a passenger-friendly car suspension. A quarter car test rig is used as an example of a vehicle model for the optimisation process. They conducted a experimental runs by varying suspension parameters such as stiffness and damping coefficient of seat and shock absorber which is taken as input. They have predicted a optimum parameters using a Taguchi analysis and by confirmation analysis carried out by MSC-ADAMS is verified.

Massimiliano GOBBI et al [7] have reported a critical review of the optimization methods used for solving road vehicle system design problems and given some examples of design optimization, in the field of vehicle system are dynamics, internal combustion engine, active and passive safety, power train design, vehicle system design, advanced automotive electronics and light weight structure.

An experimental investigation of a 2 DOF quarter car's passive suspension system and hydraulic active suspension system for ride comfort is provided by Suresh A. Patil et al. in [8]. A quarter car model consists of sprung mass, un-sprung mass, spring, damper and tire spring. A hydraulic actuator, due to its high power to weight ratio and low cost, has been considered as most feasible choices for an active suspension system. They placed a hydraulic actuator to modify the model to a 2 DOF QCH ASS with its control instrumentation in between sprung and un-sprung masses. The result shows a considerable improvement in ride comfort over conventional passive suspension.

III. EXPERIMENTAL SET UP

A test setup for quarter cars, as shown in fig. 1 was developed to evaluate the influences of various factors on the ride comfort. And have provisions to vary the sprung mass (Ms), damping coefficient (Cs), spring stiffness (Ks) and speed (N) discretely and also incorporated with NI-LabVIEW for data assimilation.

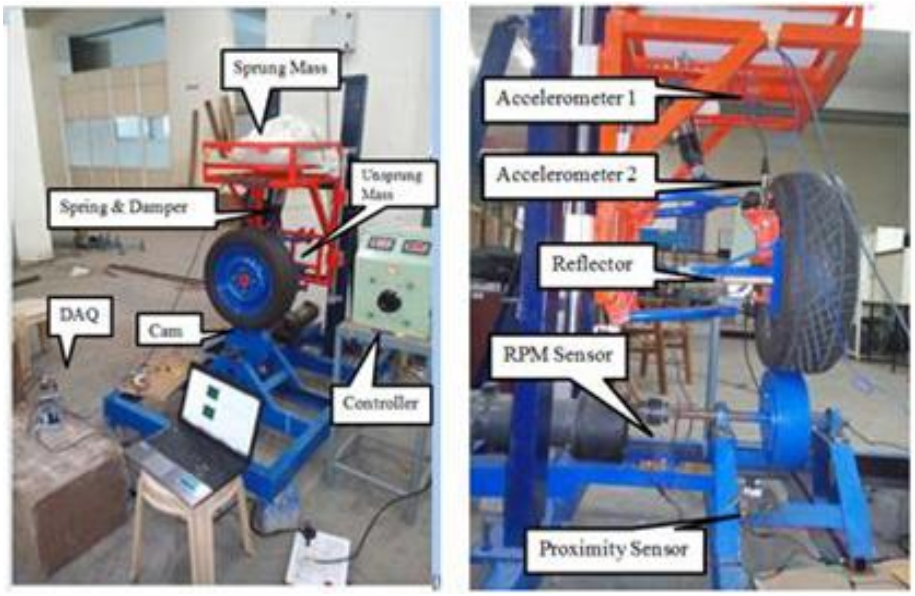

Fig.1. Experimental set up of quarter car test rig

IV. TAGUCHI METHODOLOGY

The experimental procedure is required to evaluate the effects of input parameters on objective parameters and performance of system [9, 10]. Traditional methods are simple in nature and cannot be used due to large number of experiments have to be done when the number of input parameters increases [11, 12, 16]. The Taguchi method is utilized in the quarter car model to determine the ideal suspensions characteristics for ride

comfort.. In Taguchi method, control factors and noise factors are the two main groups of process parameters [13, 16]. The best input parameters are selected by using control factors and all factors that causes variations denoted by noise factors. Orthogonal array was proposed by Taguchi to acquire attribute data and analyzed the performance measure of the data for deciding the optimal process parameters [10, 13, 14, 15 & 16]. Using Taguchi method orthogonal array forms the basis for experimental analysis. In this paper, four factors (parameters) were used as control factors and have 2 levels shown in table1,

Table 1. Taguchi Quarter Car Level

Parameters	Units	Level	Level 1	Level 2
Sprung mass (Ms)	Kg	2	41	81
Damping coefficient (Cs)	Ns/m	2	418	673
Spring stiffness (Ks)	N/m	2	18000	26000
Speed (N)	Rpm	2	150	200

Table2. Estimated Model Coefficients for SN ratios

Term	Coef.	SEcoef.	T	P
Constant	2.81955	0.2304	12.236	0.000
K 18000	0.11330	0.2304	0.492	0.644
C 418	-0.62639	0.2304	-2.718	0.042
N 150	0.78706	0.2304	3.416	0.019
M41	1.28809	0.2304	5.590	0.003
K*C 1800 418	-062911	0.2304	-2.730	0.041
K*N 1800150	-059988	0.2304	-2.603	0.048
K*M 1800 41	0.03024	0.2304	0.131	0.901
C*N 418 150	-0.37830	0.2304	-1.642	0.162
C*M 418 41	0.39033	0.2304	1.694	0.151
N*M 150 41	0.29481	0.2304	1.279	0.257

Table 3 R-sq statistics

S	Standard deviation	0.9217
R-sq	Coeff. of Multiple Determination	93.5%
R-sq (Adj.)	Adjusted Coeff. of Determination	80.5%

Table 4 Analysis of variance for SN ratios

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Ks	1	0.2054	0.2054	0.2054	0.24	0.644
Cs	1	6.2778	6.2778	6.2778	7.39	0.042
N	1	9.9114	9.9114	9.9114	11.67	0.019
Ms	1	26.5470	26.5470	26.5470	31.25	0.003
Ks*Cs	1	6.3325	6.3325	6.3325	7.45	0.041
Ks*Cs	1	5.7577	5.7577	5.7577	6.78	0.048
Ks*Cs	1	0.0146	0.0146	0.0146	0.02	0.901
Cs*N	1	2.2897	2.2897	2.2897	2.70	0.162
Cs*N	1	2.4377	2.4377	2.4377	2.87	0.151
N*Ms	1	1.3906	1.3906	1.3906	1.64	0.257
Residual Error	5	4.2479	4.2479	0.8496	-	-
Total	15	65.4123	-	-	-	-

The individual effects and the coefficients show the ANOVA and for the purpose of a sensitivity analysis of the factors this is a good illustration. Rankings of the major factors Ms, Cs, N, and Ks with regard to the response variable Rc can be made using the ANOVA data.

Fig. 6 shows the main effects plot of RC with factors Ks, Cs, N and Ms. And also stated the rank list of factors.

a) Ms: The slope is more. So it is definitely an important factor.
b) N: It is having lesser slope. So it is have less importance.
c) Cs; It is between N and Ks.
d) Ks: It is least important factor.

Table 5 Response table for Signal to Noise Ratio Smaller is better

Level	K	C	N	M
1	2.933	2.193	3.607	4.108
2	2.706	3.446	2.032	1.531
Delta	0.227	1.253	1.574	2.576
Rank	4	3	2	1

V. SIMULATION MODELS

5.1. Physical Model of Quarter Car

A quarter car model is as shown in Fig. 2, the upper mass (Ms) is the sprung mass representing the body of vehicle and the lower mass (Mu) is the un-sprung mass of the wheel and other suspension parts. The springs and dashpots employed in this model are considered to be weightless and to have linear time-independent

properties throughout the investigation. A road bump with half sinusoidal profile has been considered to simulate road excitation whose characteristic has been depicted in Fig. 3.

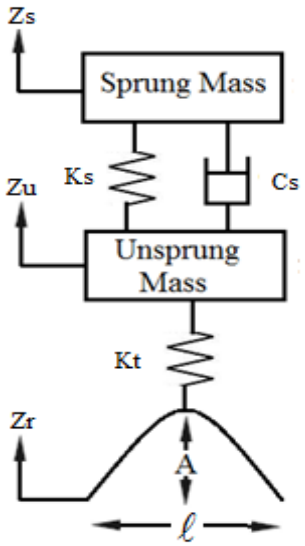

Fig. 2 Quarter car model

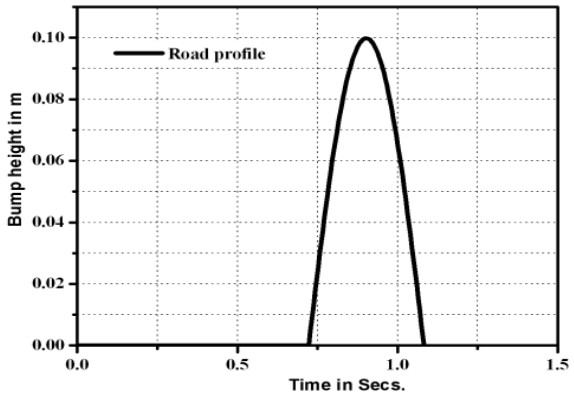

Fig. 3 Road bump profile of height 0.1m

The effect of the bump has been modeled as zr following the conditions given below.

$$zr = 0 \quad \text{when } t < \frac{d}{v}$$

$$= h \times \sin\left[\frac{\Pi \times v}{\ell} \times \left(t - \frac{d}{v}\right)\right]$$

$$= 0 \quad \text{when } t > \frac{d+\ell}{v}$$

$$for \frac{d}{v} \le t \le \frac{d+\ell}{v} \quad \ldots(1)$$

Where 'v' is the velocity in m/s, 't' is the time lag in sec between the crossing of front and rear wheels across the bump and 'd' is the distance between front and rear axle in m. The SIMULINK model receives this profile as input after it has been constructed in MATLAB using MATLAB coding.. Table 2 shows the different parameter values used in modeling.

Table 6. Parameter values of Quarter Car Model

Parameters	Labels	Units	Values
Mass of sprung mass	Ms	Kg	214.65
Mass of un-sprung mass	Mu	Kg	21.46
Suspension spring stiffness	Ks	N/m	12394
Suspension damping coefficient	Cs	Ns/m	1385.4
Tire stiffness	Kt	N/m	123940
Bump height	A	M	0.1
Bump width	ℓ	M	1

As can be seen in Fig. 2, the quarter vehicle is thus simply modelled as a two Degree of Freedom (DOF) damped spring mass system for analysis. The tire has been replaced by equivalent spring stiffness neglecting the damping.

Furthermore, suspension motion is considered in the vertical direction only due to road bump given as input excitation. The sprung and un-sprung mass zs and zu are measured, due to the sinusoidal excitation 'zr' from the road bump, at a particular point of time displacement.

5.2. FBD of Quarter Car Model

From the quarter car model shown in Fig. 1, a free body diagram is developed as shown in Fig. 3.

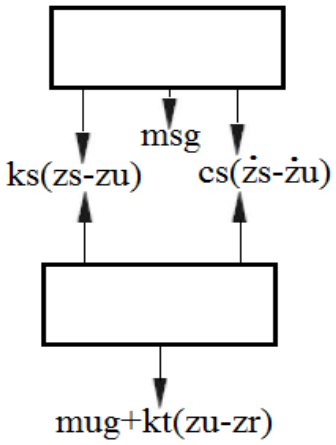

Fig. 4 Free body diagram of Quarter car

Using Newton's Second Law of Motion, following equations (2) and (3) are derived as below:

$$ms\times\ddot{z}s+cs\times(\dot{z}s-\dot{z}u)+ks\times(zs-zu)+ms\times g=0 \quad \ldots\ldots\ldots(2)$$

$$mu\times\ddot{z}u-cs\times(\dot{z}s-\dot{z}u)+ks\times(zs-zu)+kt\times(zu-zr)+mu\times g=0 \quad \ldots\ldots\ldots(3)$$

5.3. SIMULINK Model of Quarter Car

Fig. 5 shows the SIMULINK Model of Quarter Car designed in MATLAB-SIMULINK workspace. This model is designed based on the equations (2) and (3) and using the readily available blocks in SIMULINK library. The parameters namely Ms, Mu, Kt, Ks, Cs, and Zr are provided as input to this model from MATLAB workspace so that sprung mass acceleration, sprung mass displacement, etc. are obtained as output.

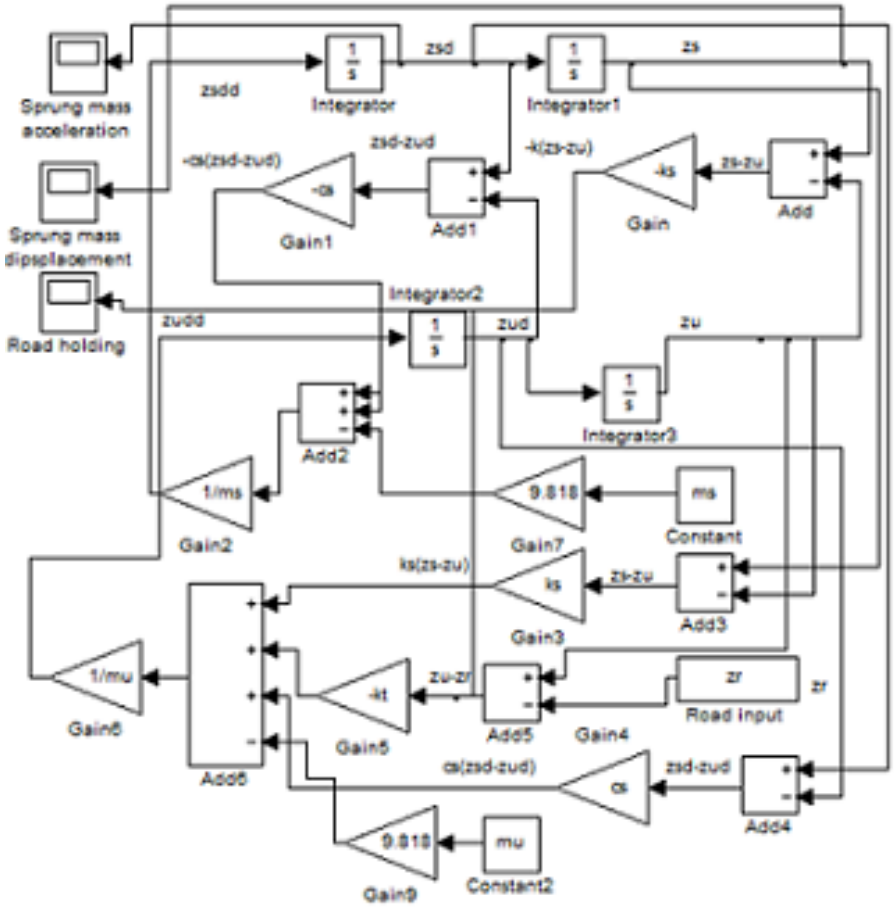

Fig. 5 Simulink model of quarter car

VI. RESULTS AND DISCUSSION

Fig. 6 shows the main effects plot of RC with factors Ks, Cs, N and Ms. and also stated the rank list of factors. From the main effects plot, it is observed that Ms, N and Ms is more sensitive factors than the Ks.

The experimental results shown in table 8 shows that minimum Rc value is obtained at Cs = 418 Ns/mm2, Ms = 81 Kg, Ks = 26000 N/mm and N= 200 rpm.

Ms×Żs

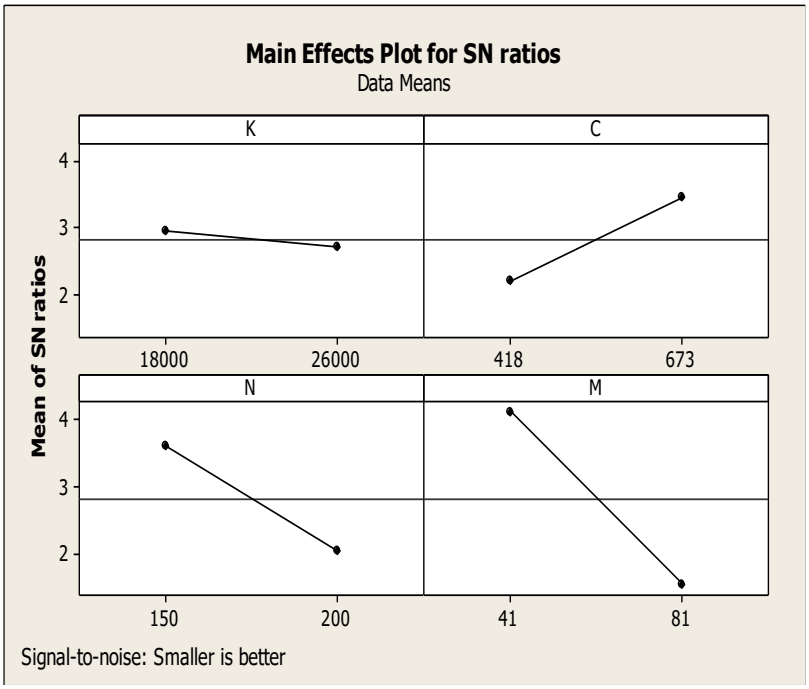

Fig. 6 Main effects plot for SN ratios

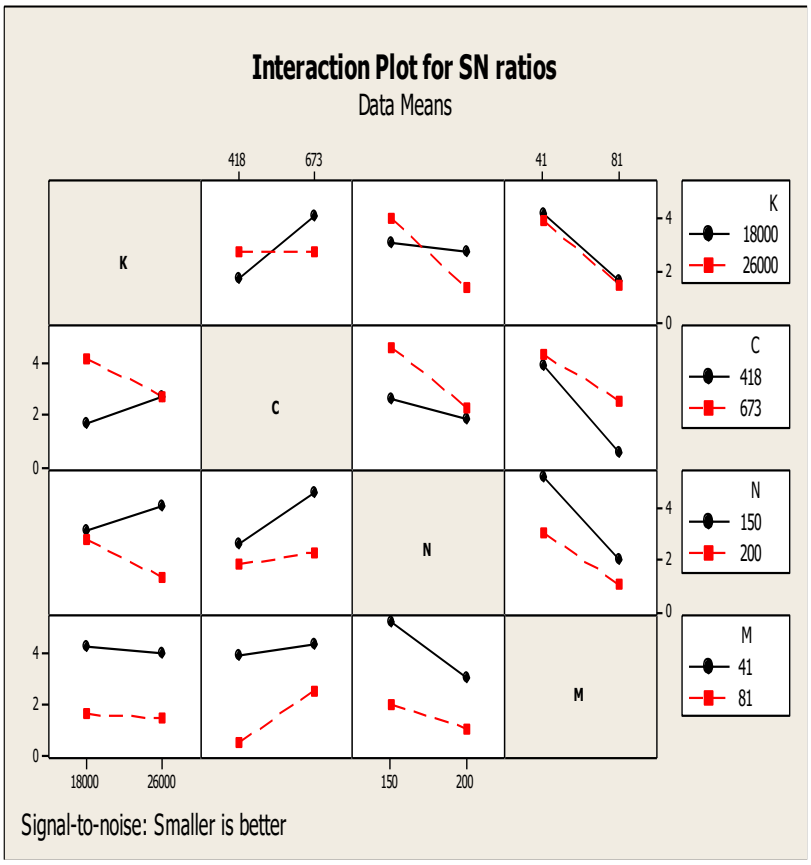

Fig 7 Interaction plot for SN ratio

Table 7 Observation table for Experimenatl and Simulation

K	C	N	M	RC_expt	RC_Simulation
18000	418	150	41	0.52124	0.4202
18000	418	150	81	0.95031	0.5164
18000	418	200	41	0.57976	0.5242
18000	418	200	81	0.77563	0.5408
18000	673	150	41	0.42057	0.3663
18000	673	150	81	0.55021	0.4504
18000	673	200	41	0.53569	0.4282
18000	673	200	81	0.56536	0.4681
26000	418	150	41	0.43269	0.3659
26000	418	150	81	0.67891	0.5841
26000	418	200	41	0.62015	0.5417
26000	418	200	81	0.4032	0.5202
26000	673	150	41	0.46593	0.365
26000	673	150	81	0.53497	0.5063
26000	673	200	41	0.62153	0.5063
26000	673	200	81	0.89631	0.5826

VII. CONCLUSION

To determine the ideal suspension parameter setting, a Taguchi approach is created. Additionally, this approach helps to calculate the effects of major factor changes.

The parameter of suspension, represented graphically by Ks, Cs, N, and Ms in fig. 6, is studied. According to these figures, the sprung mass (Ms) and speed (N) are more susceptible to vehicle vibration than the damping coefficient (Cs), while the spring stiffness (Ks) is the least responsive.

The experimental model and the SIMULINK-created quarter-car model were compared, and the quarter-car model was determined to have a CI value of 0.725.

The factors setting are stiffness, Ks = 26,000 N/m, damping, Cs = 418 N-s/m , speed, N= 200 and mass, ms = 81 kg for the value of RC equal to 0.42057.

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VIII. REFERENCES

[1]. A.C. Mitra, M.V.Patil and N. Banerjee, “Optimization of Vehicle Suspension Parameters for Ride Comfort Based on RSM,” Springer- J. Inst. Eng. India Ser. C DOI 10.1007/s40032-014-0156-7, 2014.

[2]. A. C. Mitra, G. R. Kiranchand, S. B. Dhakare, M. S. Jawarkar, "Optimization of Passive Suspension System for Enhancement of Ride Comfort," IOSRJMCE e-ISSN: 2278-1684,p-ISSN: 2320-334X PP 01-08

[3]. Manoj K. Mahala, Prasanna Gadkari and Anindya Deb, "Mathematical Models for Designing Vehicles for Ride Comfort," Research into Design Supporting Multiple Facets of Product Development.

[4]. E. Duni, G. Monfrino, R Saponaro, M. Caudano and F. Urbinati, " Numerical Simulation of Full Vehicle Dynamic Behaviour Based on the Interaction between Abaqus/ Standard and explicit Codes,"Abaqus Users Conference 2003.

[5]. P.Senthil Kumar, R.Kalidas, K.Sivakumar and E.Hariharan, B.Gautam, R.Ethiraj, "Application of Taguchi method for optimizing passenger-friendly vehicle suspension system," Vol. 2 Issue 1 January 2013 ISSN: 2278-621X.

[6]. J. P. C. Goncalves and J. A. C. AmbroSio,"Road Vehicle Modeling Requirements for Optimization of Ride and Handling" ,Multibody System Dynamics (2005) 13: 3–23 C _ Springer 2005.

[7]. Massimiliano Gobbi, Imtiaz Haqua, Panos P.Y. PAPALAMBROS, Giampiero MASTINU, "A Critical Review of Optimization Methods for Road Vehicles Design," 11th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference 6 - 8 September 2006, Portsmouth, Virginia.

[8]. Suresh A. Patil & Shridhar G. Joshib, "Experimental analysis of 2 DOF quarter-car passive and hydraulic active suspension systems for ride comfort," Systems Science & Control Engineering, 2014 Vol. 2, 621–631.

[9]. M.S. Chua, M. Rahman, Y.S. Wong, H.T. Loh, "Determination of optimal cutting conditions using design of experiments and optimization techniques," Int. J. Mach. Tools Manuf. 33 (2) (1993) 297–305.

[10]. S.H. Lee, S.H. Lee, "Optimization of cutting parameters for burr minimization in face-milling operations," Int. J. Prod. Res. 41 (3) (2003) 497–511.

[11]. W.H. Yang, Y.S. Tarng, "Design optimization of cutting parameters for turning operations based on the Taguchi method," J. Mater. Process. Technol. 84 (1998) 122–129.

[12]. T.R. Lin, Optimization technique for face milling stainless steel with multiple performance characteristics, Int. J. Adv. Manuf. Technol.19 (2002) 330–335.

[13]. P.J. Ross, Taguchi Techniques for Quality Engineering, 2nd ed., McGraw-Hill, New York, USA, 1996.

[14]. Boopathi, S. and Sivakumar, K. "Experimental investigation and parameter optimization of near-dry wire-cut electrical discharge machining using Multi-objective Evolutionary Algorithm", International Journal of Advanced Manufacturing Technology- Springer- Verlag London, DOI: 10.1007/s00170-012-4680-4.

[15]. Boopathi, S. and Sivakumar, K. "Experimental Comparative study of near-dry Wire cut electrical discharge machining (WEDM)", European Journal of Scientific Research (ISSN: 1450-216X), Vol. 75, No. 4, pp. 472-481, 2012.

[16]. Boopathi, S., Sivakumar, K. and Kalidas, R. "Parametric Study of Dry WEDM Using Taguchi Method", International Journal of Engineering Research and Development (ISSN: 2278-800X), Vol. 2, No.4, pp. 1-6, 2012. International Journal of Latest Trends in Engineering and Technology (IJLTET) Vol.

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Solving The Classical Problems in Field of Extremal Graph Theory : A Review

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ABSTRACT

In various field the field of mathematics plays vital role. For the structural modeling the graph theory is the best structure. This structural theory leads towards development and varies according to real world. The graph theory began in year1735 in presence of the problem of Koinsberg bridge. One most favorable graph theory is Extremal graph theory which is the branch of combinatorics (itself is area of mathematics generally it is an intersection of the extremal combinatorics and the graph theory. Extremal graph theory represents the global properties of the graph impacts local substructures. Extremal graph theory is dealing with quantitative connections in between global and local graph properties. This paper focused the basic concepts related to extremal graph theory along with Theorems. In short, this paper gave review of concept related to the extremal graph theory as a part of research in various field along with different application area. Simple classical problem is considered for the discussion.

Keywords: Classical graph theory, extremal, vertex, self-link. Turán's, Mantel.

I. INTRODUCTION

The study of graph in mathematics domain is termed as graph theory, is nothing but the mathematical structures allow the model which represents the relation between objects in pair. The important part of this structure is node called as vertices joined by the links i.e. edges. Graphs are an important principal and plays great role in discrete mathematics [1].

Mathematically, graphs are defined in terms of ordered pair. It is represented as $G(v, e)$ .Here ' v ' represents the node means vertices while ' e ' represents a set of links (edges) .Those are the unordered pairs. Mathematically this set is given as,

$$e \subseteq \{\{x, y\} | x, y \in v \ and \ x \neq y\} \ldots\ldots\ldots\ldots\ldots (1)$$

Such types of graphs are called as undirected simple graph. In $x \ and \ y$ is called as endpoints. Simple graph structure is shown in fig 1.

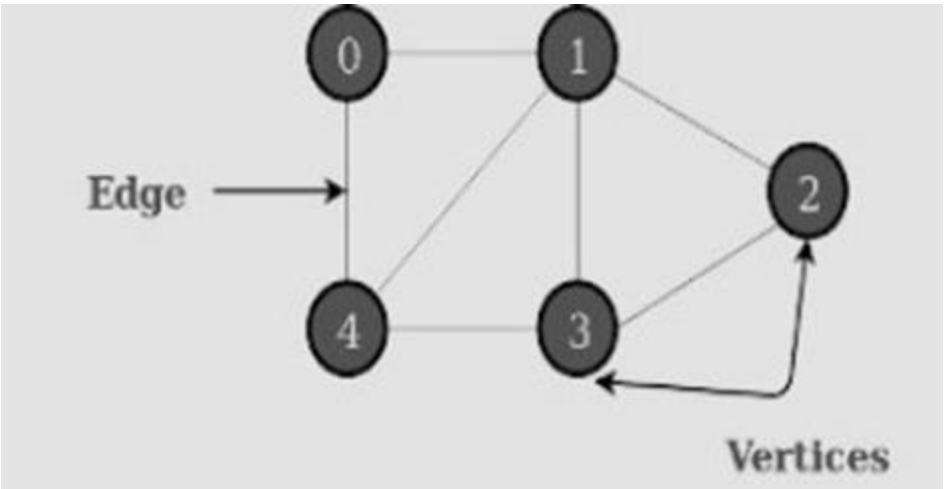

Fig.1 Graph structure

Graph theory is best classical toolbox for the engineers, Mathematicians and the scientist, even for any scientist having the different research area. Hence it becomes a powerful tool with complexity. As a graph theory supports to simplification, which allows for revisiting. Classical graph has edges and vertices . Edges or links generally represented by the straight line [2].Fields of graph theory:As, it is well-known to everyone that graph theory is an important field/area about the graphs. It is tool used to model the relationship. Basic structure of the graph is shown in fig.2 along with edge ,vertex (node) ,loop, self-arc, self link ,multiple arc etc. [3].

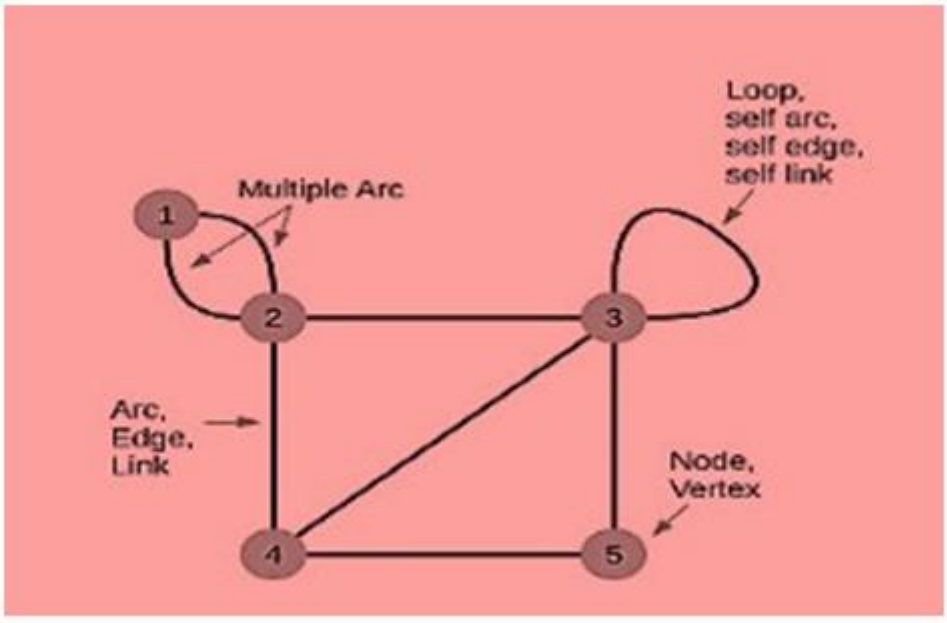

Fig.2 Different fields of graph

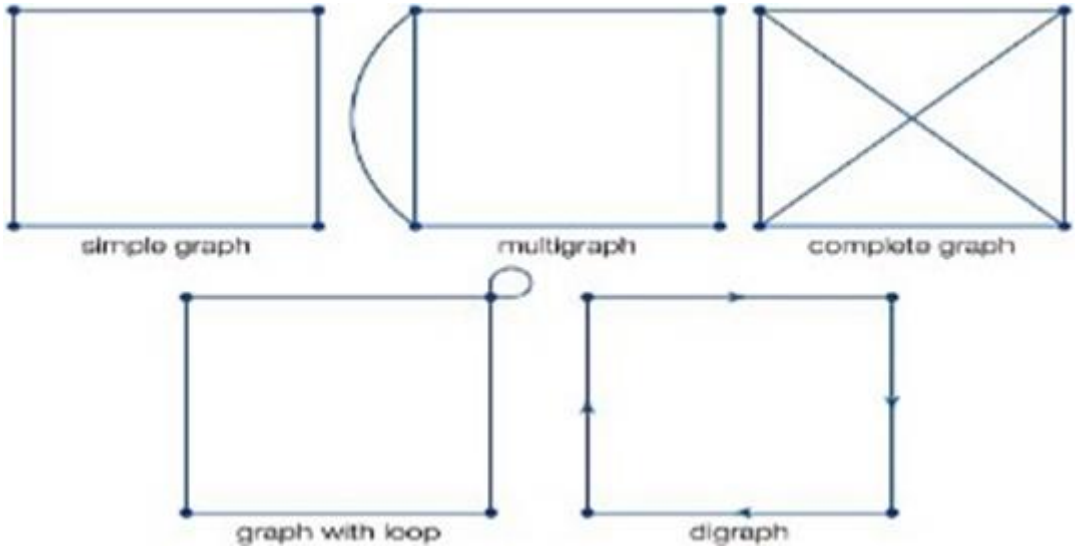

Fig.3 types of graph

An appropriate representation of graph is generally in the form of the matrices related to it. Very popular and relevant depiction of graph is adjacent matrix. Adjacent matrices is the metrics who has ijth element is 1 where the existence of edge is in between ith and jth vertices of graph shown in fig.4 here the degree of vertex is defined in terms of adjacent matric. It i powerful ay

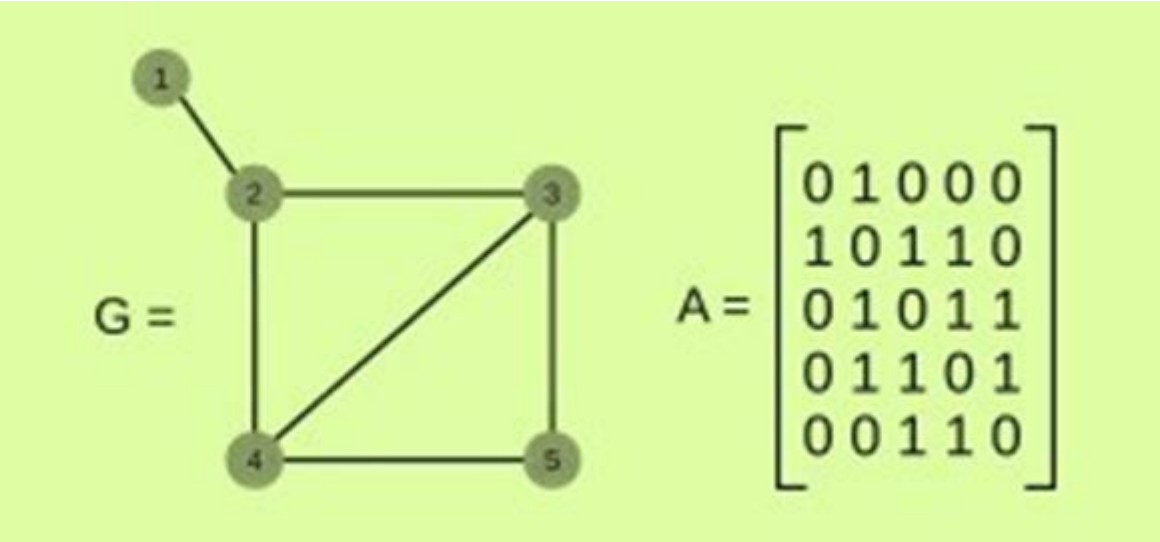

Fig. 4 Matric representation of the graph.

Graph theory is the relation and connection between nodes/vertices with line. This theory plays an important role in field of computer science. It is helpful for demonstration of concept of scientific discipline. This theory used for modeling and analysis of the network. It is generally topological, approbation qualitative as well as quantitative. Applications of graph theory are to find shortest path in network ,to analyze geographical approaches. In mathematics domain , network analysis is applied in various graph concepts for modeling of the functional connectivity [4].The overall substructure within a network summarizes at specific node. Also this theory is used to judge the eigenvalue a specific node. Many researchers were focused on the nodel properties.

Rest paper is organized as: Section II literature survey, section III includes mathematical concepts and theorems related to extremal graph theory. Section IV and section V summarizes the conclusion and references.

II. LITERATURE SURVEY

Abello, J. et al. (1998). In this study, they described new method for designing extremal graph algorithms. It is used to create simple extremal algorithms for minimum spanning trees, computing connected components, maximal matching in undirected graphs and multi-graphs and bottleneck minimum spanning trees. Their I/O bounds take part with those of older methods. Their algorithms are helpful to standard check pointing and programming language optimization tools. The data-structural approach in this study will develop better graph algorithms that utilize parallel disks also remains open [5].

Balaji N et al. (2021). The main objective of this study is to describe the importance of graph theory ideas in different areas of computer science and its applications for developer which they can use graph theory methods for study. In this study, they described a survey for project ideas of graph theory [6].

Gowda, D.V et al. (2021), In this paper, they stated that for designers and programmers, graph theory is an extraordinarily rich field. Basically, graph is used to solve some very complicated issues like visualization, lower costs, program analysis, etc. To calculate network devices , an optimum traffic routing like switches and routers use graphics. This study highlights the main advanced developments in the area of graph theory and different applications in area of engineering [7].

Aydın B. (2015)In this study, they have presented a review of the works carted out in the sector of social networks (SN) and computer science (CS) that employs the concepts of graph theory (GT). They analyzed graph properties and good combination of graphs are chooses for their problems. They also provides practical examples and existing use in most of diverse applications of CN and CS domains. Moreover, they provided practical examples and explanations of use of graph theory to maintain the importance of graphs in modern research. In the future, they will work on new graphical tools and applications for the vehicular network management because of the emergence of smart cities [8].

III. DISCUSSIONS

Definition 3.1: The simple graph ‘ g ’ consists with nonempty set ‘ v ’ , called as node or vertices of ‘ g ’ , and a set ‘ e’ is set having two element which is subset of ‘ v ’ .Then members of ‘ e’ is known as edges of ‘ g ’ , and it can be written as g d.v; e/.

Definition 3.2:The two nodes in simple graph are adjacent if nodes joined with link (edge).The total number of link or edges incident to node(vertex) is known as degree of
node (vertex).It is represented by deg.v/.It means degree of node is equal to total number of adjacent vertices.

Definition 3.3:In n node graph g=(v,e) where v is {v1,v2,… ,vn} then adjacent metrics for g is nxn size matrix

$$A = g \{a_{ij}\} \dots \dots \dots \dots \dots \dots (2)$$

Where ,

$$a_{ij} = \begin{cases} 1 & if\ set\ of\ v \in e \\ 0 & otherwise \end{cases} \quad \ldots\ldots\ldots (3)$$

If the graph is weighted graph then instead of 1,weights of respective are present in the matrix. Adjacency matrix is an important part of th graph theory,having weights shown in blows fig.5.

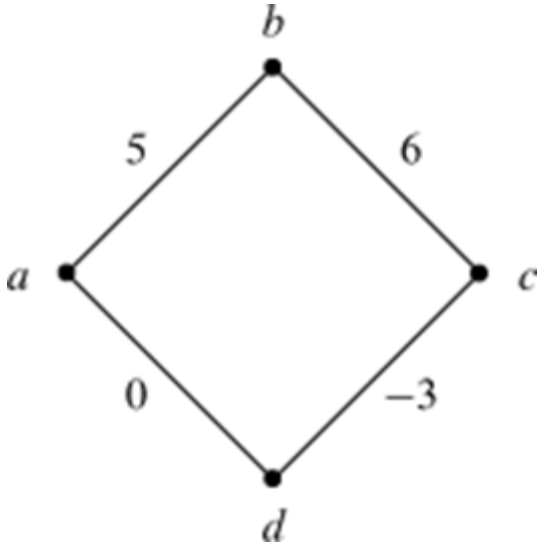

Fig:5 Graph with weights

Fig.5 is indicate four node structure with weights, as per eq.,the general matrix is

$$\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

, and for above fig the weighted matrix is

$$\begin{bmatrix} 0 & 5 & 0 & 1 \\ 5 & 0 & 6 & 0 \\ 0 & 6 & 0 & -3 \\ 0 & 0 & -3 & 0 \end{bmatrix}$$

a. Extremal graph theory: Extremal graph is largest graph having order n .It doesn't have sub graph. Definition and mathematical concepts for extremal graph theory varies according to researchers.in 1959 Goodman defines the extremal theory as

$$N(n) = \begin{cases} \frac{m}{3}(m-1)(m-2) & for \quad n = 2m \\ \frac{1}{3}2m(m-1)(4m+1) & for \quad n = 4m+1 \\ \frac{1}{3}2m(m+1)(4m-1) & for \quad n = 4m+3 \end{cases} \quad \ldots\ldots(4)$$

It is also known as Goodman's formula whereas Schwenk defined theextremal graph theory as follows

$$N(n) \quad \frac{n}{2}\left\lfloor n-1 \frac{(n-1)^2}{4} \right\rfloor \quad \ldots\ldots\ldots\ldots\ldots (5)$$

Where, floor function is represented by $\lfloor x \rfloor$.

b. Theorems of extremal graph theory:

Generally, extremal result in the graph theory is all about to minimize or to maximize quantity between all the graphs belongs to few class. Graph H and the n belongs to Z+ (positive integer) ,defines an extremal number $ex(n, H)$ is the maximum of n edges on a graph with n vertices with absence of sub-graph. The extremal number in an extremal graph theory can be rounded by function which is depends on the value of n [9].

Theorem 3.1: Mantel Theorem: Assume $n \geq 2$ and G is n vertex triangle-free graph. Then

$$ex(n, K_3) = \left\lfloor \frac{n^2}{4} \right\rfloor \quad \ldots\ldots\ldots\ldots\ldots (6)$$

Assumethecompletebipartite $K_{\lfloor n/2 \rfloor, \lceil n/2 \rceil}$ where $l = 1,2,\ldots \lfloor n/2 \rfloor$ triangle free. It has $\lfloor n/2 \rfloor$ edge .it is $l(n-l)$ maximum at $l = \lfloor n/2 \rfloor$ or $\lceil n/2 \rceil$.Both the graph is $s \cdot l(n-l) \quad s \quad s$

things are equivalent. for example $K_{3,4}$ and $K_{4,3}$ known as isomorphic.

Maximum valueis

$$k(n-k) = \begin{cases} \lfloor n^2/4 \rfloor & where \quad k = \lfloor n/2 \rfloor \\ \lfloor n^2/4 \rfloor & where \quad k = \lceil n/2 \rceil \end{cases}$$

When n is even, then $k(n-k) = \frac{n}{2}\cdot\frac{n}{2} = \frac{n^2}{4}$ is the integer.

When n is odd, $k(n-k) = \frac{n-1}{2}\cdot\frac{n+1}{2} = \frac{n^2-1}{4} = \frac{n^2}{4}$

Finally resultedinto

$$ex(n, K_3) \geq \lfloor \frac{n^2}{4} \rfloor \quad \ldots\ldots\ldots\ldots (7)$$

Consider H be the sub graph of G having n verticesand $\lfloor \frac{n^2}{4} \rfloor$ edges. v be the vertex in H with minimum degree : $d_H(v)$ .The $H' = H - \{v\}$ .it is a H' s sub-graph on n-1vertices. It has an edges : $|E(H')| = |E(H)| - (n-1)$

For odd and even value of n we can verify the mathematical expressions/statement given in belows table.

Table1: expression for n(even/odd)

Quantity	*n* even	*n* odd
$k = \lfloor n/2 \rfloor$	$\frac{n}{2}$	$\frac{n-1}{2}$
$\left\lfloor \frac{2\lfloor n^2/4 \rfloor}{n} \right\rfloor$	$\frac{n}{2} = k$	$\frac{n-1}{2} = k$
$\ell = \lfloor \frac{n-1}{2} \rfloor$	$\frac{n}{2} - 1 = k - 1$	$\frac{n-1}{2} = k$
$n - 1 - \ell$	$\frac{n}{2} = k$	$\frac{n-1}{2} = k$
$d_H(v) = \lfloor \frac{n^2}{4} \rfloor - \lfloor \frac{(n-1)^2}{4} \rfloor$	$\frac{n}{2} = k$	$\frac{n-1}{2} = k$

Centralized types of the scenarios (problems) in extremal theory , which has the maximum edges in graph with finite number of nodes (vertices) which doesn't have sub- graphs. Mantel's theorem is one of the most popular theorems in extremal graph theory [10].

Theorem 3.2: Turán' s Theorem: Consider Let $n \geq 1$ and G is the n-vertex graph having K_{m+1} Then $|E(G)| \leq t_m(n)$, having an equality if and only if $G = T_m(n)$ This theorem is used to Avoid certain size cliques .Mantel theorem is the case of Turán' s Theorem with m=2.Turán' s Theorem is the base of the start of extremal graph theory field [11].

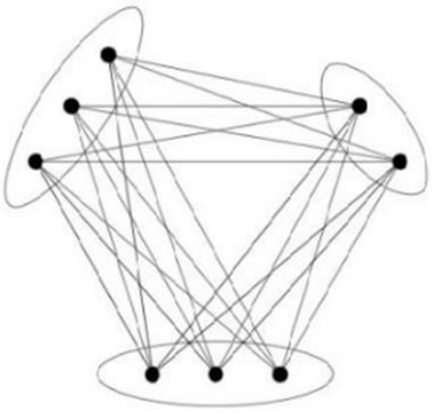

Fig.6 Turán' s graph T3

Theorem 3.3: (van der Waerden, 1927). Consider r, k ∈ Z+. it is existing least N = W(r, k) ∈ Z+ such that, if an elements of [N] are r-coloured, then it represents the monochromatic arithmetic progression of length k [12].
Theorem 3.4 (Szemer´edi, 1969 , finite version). Let k ∈ Z+, δ ∈ (0, 1].It exists the least N = N (k, δ) ∈ Z+ like each subset of [N] has at least δN element having an arithmetic progression of length k [13].
Theorem 3.5 : (Simonovits, 1968). Consider graph H with chromatic number r having colour-critical edge. Then n0 exists for n ≥ n0, ex(n; H) = t(n, r – 1). Furthermore, EX (n, H) = {T(n, r – 1)}[14] and [15].
Theorem 3.6 : Ramsey' s Theorem Assume number R such that R = R(m1 , . . . , mc ; r) for n > R, then for such all colorings, I is the colour and an mi -element set S ⊆ { 1, . . . , n } ,where all the r- elements are subsets of set S having color I [16].
Theorem 3.7 : Ramsey' s Theorem (1930) — Version for graphs Let consider R such that R = R(m1 , . . . , mc) (the Ramsey Number) for n > R ,then all the edge colorings are of Kn with c colors ,must have a monochromatic clique Kmi Of few color i[17].

c. Example: To find number of edges (How to solve simple classical problem) For n vertices with m parts, the total edges are maximized, all the parts are much more closure .Hence all parts are [n/m] or [n/m].When the graph consist of those parameters termed as Turán graph. This graph is denoted by T m (n) whereas number of edges are represented as t m (n). Mathematically it is represented as 1

(1– 1)n 2.

Let see eg. For calculating number of edges. Numbers of vertices are 7and number of parts are 3. then Turán graph is represented as T3(7)=K2,2,3.

Then total number of edges= t3 (7) = 2 · 2 + 2 · 3 + 2 · 3 =4+6+6
= 16 edges

d. Applications:
The dominant application areas for the graph theory are electrical engineering, information science, linguistics, computer network science, physics, biotechnology, chemistry including theoretical applications. Many researchers were dealing with graph theory to solve the problems related to weak vertices, valance, edge detection issues [9] and [18].

IV. CONCLUSION

Here, we have done the complete review study of extremal graph theory. We studied the basic terms related to graph theory in detail. As a part of discussion, we overviewed the theorems which explain the mathematical study of the extremal graph theory. Some application of extremal graph theory is added listed.

V. REFERENCES

[1]. Renaud Di Francesco, Phd. Beyond Graph Theory: Graphoids Part 1: Adjacency Set Valued Maps.

[2]. Stéphane Bessy. Some Problems In Graph Theory And Graphs Algorithmic Theory.HAL Open Science.

[3]. S. Dickinson, R. Zabih: Introduction To The Special Section On Graph Algorithms In Computer Vision , IEEE On Pattern Analysis, 23(10) (2016), 114- 122.

[4]. G. MARCIALIS, F. ROLI: Graph Based And Structural Methods For Fingerprint Classification, Springer Verlag, Berlin Heidelberg, 9(7) (20078), 1- 202.

[5]. Abello, J., Buchsbaum, A.L. And Westbrook. J.R. (1998) A Functional Approach To External Graph Algorithms. Research Article. 00/ 10.1007/3-540-68530- 8_28 - Source: Citeseer

[6]. Balaji N, Megha N And Chinmayee K S. (2027) A Survey: Graph Theory In Computer Science And Applications. International Journal Of Trend In Research And Development, Volume 4(5)ISSN: 2394-9333. DOI: 10.17485/1jst/2020/V13i09/149298

[7]. IMonika Polak, Urszula Roma'Nczuk, Vasyl Ustimenko , Aneta Wr'Oblewska, On The Applications Of Extremal Graph Theory To Coding Theory And Cryptography,Science Direct,Pp.329-342

[8]. Aydin B., Henning M., llya S., Peter S., And Christian S. (2075) Recent Advances In Graph Partitioning. Research Article.

[9]. Dankan V. Gowda 1, K.S. Shashidhara, M. Ramesha, S.B. Sridhara, And S.B. Manoj Kumar. Recent advances in graph theory and its applications. Advances In Mathematics: Scientific Journal 10 (2027) No.3, /%07- 1412.

[10]. S. SKIENA, S. PEMMARAJU: Implementing Discrete MathematicsCombinatorics And Graph Theory With Mathematics, Addison-Wesley Publishing Company, 3(9) (2019), /- 448.

[11]. V. Nikiforov, Tur'An' s Theorem Inverted, Discrete Math. 310 (2070), 125- 1317.

[12]. X. Zhou, T. Nishizeki: Edge-Coloring Algorithms, Technical Report, Graduate School Of Information Sciences, Tohoku University, Sendai, 1(3) (2020), 120˜ 142.

[13]. A. Vince, C. Haaley: Star Chromatic Number, Journal Of Graph Theory, 12(4) (2020) 557- 559.

[14]. A. D. N. J. De Grey, The Chromatic Number Of The Plane Is At Least 5, Preprint Available At Https.//Arxiv.0Org/Abs/1804.02385, Accessed 20 May 2018.

[15]. Z. Tuza, Problems On Cycles And Colorings, Discrete Math. 313 (2013), 2007- 2013.

[16]. A. Arman And S. Tsaturian, A Result In Asymmetric Euclidean Ramsey Theory, Discrete Math.341 (2018), 1502- 1508.

[17]. R. L. Graham, Euclidean Ramsey Theory, In Handbook Of Discrete And Computational Geometry (J. E. Goodman And J. O' Rourke, Eds.), 2nd Ed., Chapman & Hall/CRC, Boca Raton, FL, 2004.

[18]. P.L.K. Priyadarsini, " A Survey On Some Applications Of Graph Theory In Cryptography" , Journal Of Discrete = Mathematical Sciences And Cryptography Volume 18, 2015 - Issue 3,Pp.209-217.

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A Comprehensive Study of Distal Humerus Bone Fracture by using Rapid Prototyping

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ABSTRACT

The Locking Compression Plate gives a number of advantages in fracture fixation, combining angular stability through the use of locking screws with traditional fixation techniques. In the epimetaphyseal area, compression plate implant particularly suitable for use in poor bone stock and complex joint fractures. However, patient specific implant designing is complex and requiring careful attention to biomechanical principles as well as a number of potential pitfalls needs to be considered. The purpose of this study was to review the customized preparation of compression plate as per the requirement of patient.

Keywords: Locking compression plate (LCP), CT scan, X-ray, 3D modeling, Prototype.

I. INTRODUCTION

The actual elbow consists of portions of all three bones of the arm:

1. The distal humerus is the center of the elbow hinge.
2. The radial head moves around the distal humerus also rotate when the wrist is turned up and down.
3. The olecranon is the part of the ulna that cups the end of the humerus and rotates around the end of the humerus like a hinge.

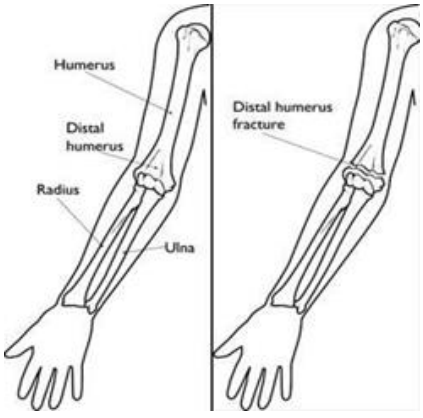

Figure 1: A distal humerus fracture: type of elbow fracture

Figure 2: The elbow is made up of parts of all three bones in the arm

a) Distal humerus

The distal humerus is the part of the humerus that sits within the cup of the ulna, allowing the ulna to move around it. This is elbow motion.

The distal humerus is able to be felt beneath the skin as a prominent bone, both on the inside of the elbow above the funny bone (the ulnar nerve) and on the outside of the elbow.

Upper part of the actual elbow joint makes up by the distal humerus. When it is broken, it can make elbow motion difficult or impossible.

Figure 3: Distal humerus to break into several pieces

It is common for distal humerus to break into several pieces. This type of fracture is called comminuted.

Distal humerus fracture is occurs in distal region when there is a break anywhere within the distal region or at the lower end of the humerus. Distal humerus fractures are fairly uncommon. It may occur in an isolated manner it means that there is no other injuries), but can also be a part of a more complex elbow injury.

b) Doctor physical examination

Discussion about patient any medical history about fracture as well as any kind of symptoms, doctor will perform a careful examination about arm to determine the extent of the injury. Examinations of patient consist of:

1. Tenderness
2. Swelling
3. Bruising
4. Limited movement

During examination or observation if hand color changes it indication that circulation has been affected. Also examination for checking of whether any damage to the nerves or blood vessels.

II. TESTS

The most common and widely available diagnostic imaging technique is X ray. X-rays create images of dense structures, like bone. They can easily show whether a bone is intact or broken anywhere. To determine if a fracture has occurred, an x-ray of the elbow will be taken.

Figure 4: (Left) An x-ray of a healthy elbow & (Right) In this x- ray, the distal humerus fracture is severely displaced (out of place)

Depending on the patient's injuries, it may take x-rays of the upper arm, forearm, shoulder, wrist, to identify more injuries, like other fractures or dislocations.

III. PROCEDURE FOR ELBOW JOINT FRACTURE

Process to be carried out to get compression plate of specific patient:

1. Fracture CT scan: making of CT scan of fracture hand and opposite hand.
2. Opposite hand distal humorous 3D model: preparation of 3D model of opposite hand of fracture from CT scan images. Mimiccs software will directly convert all CT scan image to 3D modeling.
3. Modeling of anatomical plate: by analyzing fracture prepare anatomical plate fix to suite in bones. Also this will helpful for finding the places where to make holes for screwing.
4. Rapid prototyping of plate: at the last prepare plate.
5. Surgery: finally for the implementation.

a) Compression plate

Following are the dimensions which are preferably used in the compression plate:

1. Thickness: 3.5mm to 4.5mm
2. Width: 1.5inches
3. Length: 10cm

Figure 5: (Left) Preoperative x-ray shows a displaced distal humerus fracture (arrow) & (Right) The fracture has been put back into alignment and held in place with metal screws and plates

IV. CONCLUSIONS

Complex distal humeral fractures should be assessed primarily for the reliability with which they can be reconstructed with osteosynthesis. When osteosynthesis is not considered to be feasible then total elbow arthroplasty can be considered. This happens in specific patients who are physiologically older. This is recommendation for total elbow arthroplasty for the treatment of an acute distal humeral fracture.

As per the practitioner most patients can return to their normal activities within about 6 months. Although x-rays shows that the fracture healed completely but in many patients report says that they still have limitations in elbow movement. So, recovering strength in arm might takes longer than might be expected that sometimes up to 6 months or more.

V. ACKNOWLEDGEMENT

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VI.REFERENCES

[1]. Mathias Tricot, Khanh Tran Duy, Pierre-Louis Docquier —3D-corrective osteotomy using surgical guidesfor posttraumatic distal humeral deformity,‖ Acta Orthop. Belgica,Vol. 78 - 4 pp. 538-542, 2012.

[2]. Beals R.K.—The normal carrying angle of the elbow- A radiographic study of 422 patients,‖ Clin Orthop Relat Res 119, pp.194-196, 1976.

[3]. Brown GA, Firoozbakhsh K, DeCoster TA et al —Rapid prototyping: the future of trauma surgery'‖ J Bone Joint Surg 85-A Suppl 4, pp.49-55, 2003.

[4]. Kumar B, Pai S, Ray B, Mishra S, Pandey AK.—Radiographic study of carrying angle and morphometry of skeletal elements of human elbow,‖ Rom J Morphol Embryol 51, pp. 521-526, 2010.

[5]. Murase T, Oka K, Moritomo H et al. —Three- dimensional corrective osteotomy of malunited fractures of the upper extremity with use of a computer simulation system,‖ J Bone Joint Surg 90- A, pp. 2375-2389, 2008.

[6]. Petzold R, Zeilhofer HF, Kalender WA. —Rapid prototyping technology in medicine—basics and applications,‖ Computerized Medical Imaging and Graphics 23(5), pp.277–284, 1999.

[7]. Ciocca L, De Crescenzio F, Fantini M, Scotti R.—CAD/CAM and rapid prototyped scaffold construction for bone regenerative medicine and surgical transfer of virtual planning: a pilot study,‖ Computerized Medical Imaging and Graphics 33(1), pp.58–62, 2009.

[8]. Alberti C. —Three-dimensional CT and structure models,‖ British Journal of Radiology 53, pp. 261– 262, 1979.

[9]. Murase T, Oka K, Moritomo H, Goto A, Yoshikawa H, Sugamoto K. —Three-dimensional corrective osteotomy of malunited fractures of the upper extremity with use of a computer simulation system,‖ Journal of Bone and Joint Surgery—Series A 90(11), pp. 2375–2389, 2008.

[10]. Mahaisavariya B, Sitthiseripratip K, Oris P, Tongdee T. —Rapid prototyping model for surgical planning of corrective osteotomy for cubitus varus: report of two cases,‖ Injury Extra. 37(5):, pp. 176–180, 2006.

AUTHOR'S BIOGRAPHY

I Pramod Wadate working as Assistant Professor at Ajeenkya D.Y.Patil School of Engineering, Pune. My working area interest is in the field of rapid prototyping, biomechanical engineering. From 2009, I worked in Rapid Prototyping afterword with the guidance of senior professors and researcher I started to do study in biomechanical engineering. For this I visited to various manufacturing industry of bone implant and understand process to be carryout.

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A Survey On "Lip Movement Detection"

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ABSTRACT

In the era of speech recognition systems, some drawbacks can be observed by the users while using this application in crowded places like restaurants. The AI lacks understanding of the speaker's spoken phrase, due to the disturbing surrounding noises in crowded places like restaurants or public transportations. Given the increasing computing power of general-purpose workstations it is now possible to track human faces and parts of faces in real-time visually and without any special hardware. With the help of Visual speech recognition, the AI can track the user's lip movement and predict the sentence spoken, using artificial lip-reading technique. The on-device client captures a video of a person 'speaking' which is then uploaded to cloudbased Visual Speech Recognition (VSR) engine for processing. After the backend processing, the correct phrase is returned and displayed/played on the smartphone. In the machine-learning community, deep learning approaches have recently attracted increasing attention because deep neural networks can effectively extract robust latent features that enable various recognition algorithms to demonstrate revolutionary generalization capabilities under diverse application conditions.

Keywords- Deep learning, Machine learning, Tensor Flow lite, Visual Speech Recognition, CNN, LSTM

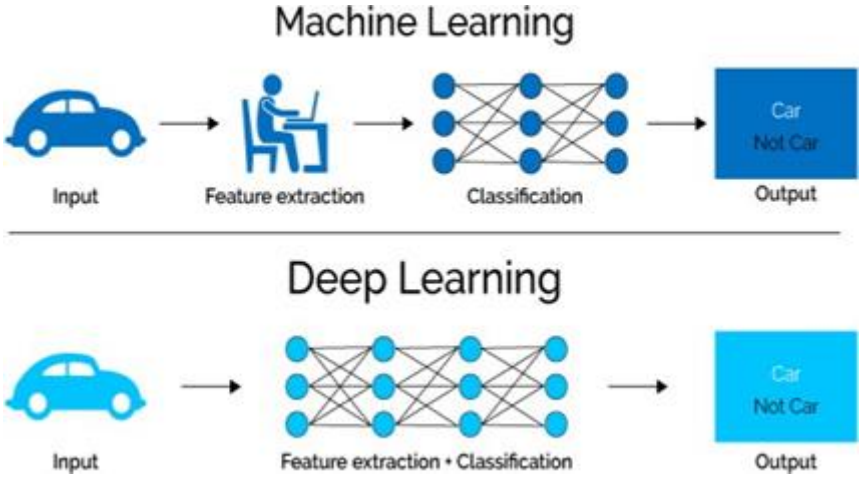
I. INTRODUCTION

Verbal communication has been the traditional and natural way of conveying information; people communicate with each other through verbal communication. Since the rise of the technology era, the possibility of humans communicating with computers is obviously a matter of thought. Giving commands to a computer device with voice has relieved many users from using keyboards while their hands are occupied with some work. There has been much research done on automatic speech recognition (ASR) in recent years. Many big tech companies have implemented voice assistance in their softwares, to reduce the efforts made by the user to do some work in their device. Although all of this research on ASR, there has always been a drawback of ASR like lack of understanding the whole phrase spoken by the user due to environmental noise or office environments, disruptive conversations. There have been significant modifications done, like suppressing the surrounding noises using complex algorithms, these researches and drawbacks spotted light on a new system called Visual Speech Recognition (VSR). VSR has proved to have overcome this problem by understanding the

lip movements of the user and predicting the sentence with the help of pre- processed huge datasets of the lip information data. Visual speech recognition alludes to the detailed feature-based analysis on the lips and its surrounding environment. It includes various aspects of feature extraction due to the need for consideration of the exterior environment and the details that play an important role in prediction.

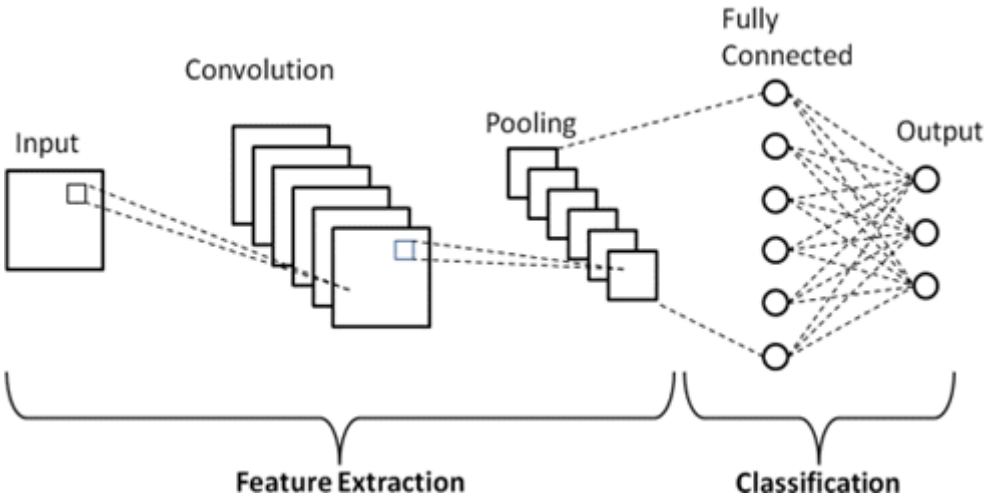
Deep learning-

Deep Learning is a subclass of Machine Learning that learns to represent the world as a layered hierarchy of concepts. Each process is defined as more straightforward ideas and more abstract representations calculated in less abstract ones. It is a field that is based on learning and improving on its own by examining computer algorithms. A deep learning methodology learns categories sequentially through its hidden layer architecture, first establishing low-level categories like letters, then slightly higher level categories like words, and higher-level categories like sentences. Deep learning networks learn by discovering intricate structures in the data they experience. By building computational models that are composed of multiple processing layers, the networks can create multiple levels of abstraction to represent the data.



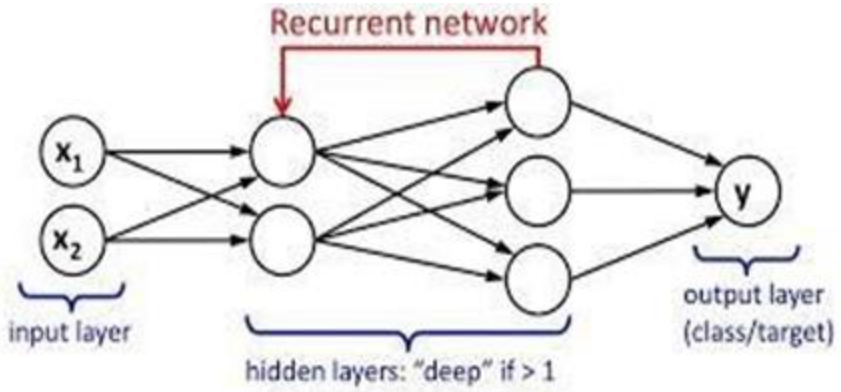
CNN-

A convolutional neural network (CNN or ConvNet), is a type of artificial neural network which works on complex algorithms used for image detection or object detection. It is a network architecture for deep learning which learns directly from data, eliminating the need for manual feature extraction. A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm that can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image, and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics. The architecture of a ConvNet is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. A collection of such fields overlap to cover the entire visual area. The use of Convolutional neural networks in the field of Object detection is due to the complex structure of hidden layers and the features like pooling, reducing, dense etc. makes the prediction better than the previous machine learning approaches.



LSTM-

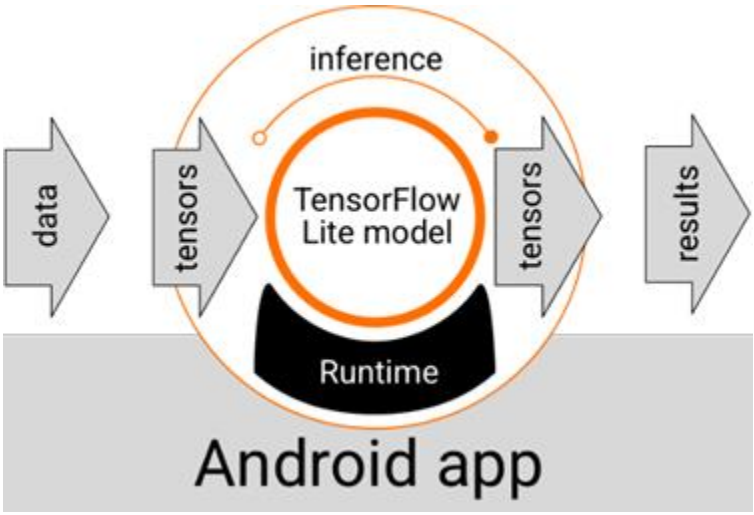
LSTM networks are an extension of recurrent neural networks used for Natural language processing (NLP). LSTM provides a large range of parameters such as learning rates, and input and output biases. Hence, no need for adjustments. Long short-term memory (LSTM) is an artificial neural network used in the fields of artificial intelligence and deep learning. Unlike standard feedforward neural networks, LSTM has feedback connections. Such a recurrent neural network (RNN) can process not only single data points (such as images), but also entire sequences of data (such as speech or video). Long short-term memory (LSTM) units or blocks are part of a recurrent neural network structure. Recurrent neural networks are made to utilize certain types of artificial memory processes that can help these artificial intelligence programs to more effectively imitate human thought.



LSTM is one of the type of Recurrent Neural Network, Recurrent Neural Network(RNN) is a type of Neural Network where the output from the previous step is fed as input to the current step. In traditional neural networks, all the inputs and outputs are independent of each other, but in cases like when it is required to predict the next word of a sentence, the previous words are required and hence there is a need to remember the previous words. Thus RNN came into existence, which solved this issue with the help of a Hidden Layer. The main and most important feature of RNN is the Hidden state, which remembers some information about a sequence.

TensorFlow Lite-

TensorFlow is an open source machine learning library which was created by the Google Brain Team developers as part of Google's Artificial Intelligence research organization for the purpose of performing machine learning and deep neural network research, but the technology is general enough to be used in a multitude of other domains! When one uses TensorFlow to implement and train a machine learning algorithm, one typically ends up with a model file that takes up a lot of storage space and needs a GPU to run inference. On most mobile devices, luxuries such as huge disk space and GPUs are not usable. TensorFlow Lite is a solution for running machine learning models on mobile devices. The TensorFlow Lite is a special feature and mainly designed for embedded devices like mobile. This uses a custom memory allocator for execution latency and minimum load. It is also explaining the new file format supported Flat Buffers. TensorFlow Lite takes existing models and converts them into an optimized version within the sort of. tflite file.

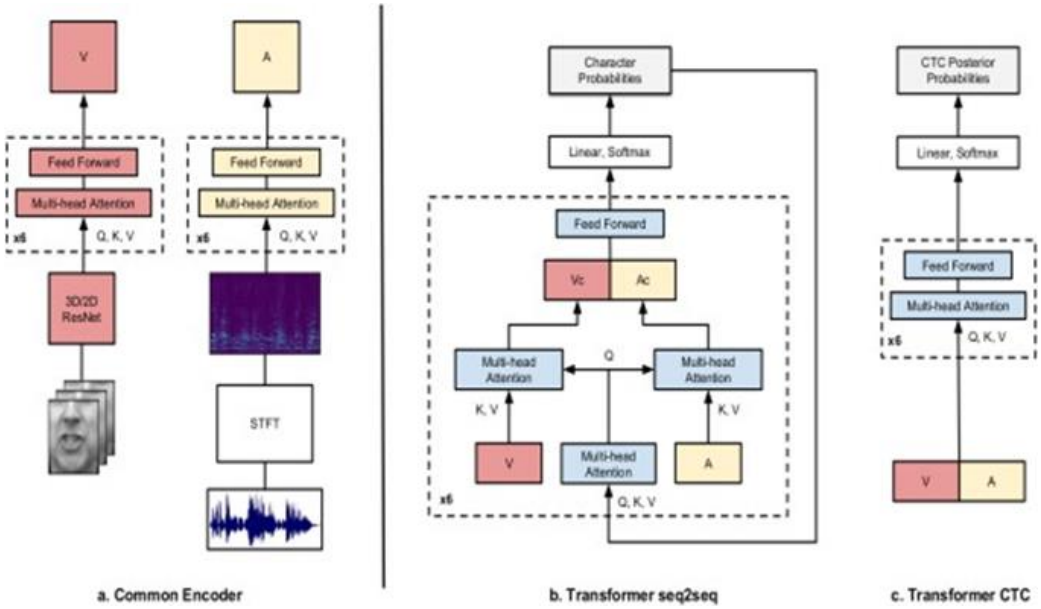


II. LITERATURE SURVEY

In 2018, Pingchuan Ma in his paper "Audio- Visual speech recognition with a hybrid CTC/attention" proposed hybrid CTC attention architecture for audio-visual recognition of speech in-the-wild. To the best of knowledge, this is the first time that such a hybrid architecture is used for audio-visual recognition of speech. In this work we present a joint CTC/attention hybrid architecture audio-visual speech recognition. In 2019, Venkata Chebiyyam in his paper "Speech Audio Super Resolution for speech recognition" proposed an automatic bandwidth extension (restoring high frequency rated information from low sample rate audio) has a number of applications in speech processing. We introduce an end-to-end deep learning based system for speech bandwidth extension for use in a downstream automatic speech recognition (ASR)system. Shabina Bhaskar, in 2019, proposed "Scope for deep learning: A Study in Audio-Visual Speech Recognition", presenting that Audio-Visual signal processing has emerged as an important research area in multi-modal signal processing. Among this, speech recognition from AudioVisual signal has gained more attention because of an unavailability of efficient acoustic noise removal methods. Navin Kumar Mudaliar, in 2020 in his paper "Visual Speech Recognition; A Deep learning approach" presents that lip reading is a method to understand speech by observing and interpreting the motion of the lips, face, and other social cues. Speech recognition is extremely

difficult in noisy environments and visual speech recognition can pave the way in creating assisting technologies. Pingchuan Ma, Stavros Petridis, Maja Pantic, 2021, in paper "End-to-End Audio-Visual Speech recognition with Conformers", present a hybrid CTC/Attention model based on a ResNet-18 and Convolution-augmented transformer (Conformer), that can be trained in an end-to-end manner. We present results on datasets: Lip Reading Sentences 2 (LRS2) and Lip Reading Sentences 3 (LRS3). The model recognises the input even in noisy environments.

III. SYSTEM ARCHITECTURE



Common encoder: The visual image sequence is processed by a spatio-temporal ResNet, while the audio features are the spectrograms obtained by applying Short Time Fourier Transform (STFT) to the audio signal. Each modality is then encoded by a separate Transformer encoder. (b) TM-seq2seq: a Transformer model. On every decoder layer, the video (V) and audio (A) encodings are attended to separately by independent multi-head attention modules. The context vectors produced for the two modalities, Vc and Ac respectively, are concatenated channel-wise and fed to the feed forward layers. K, V and Q denote the Key, Value and Query tensors for the multi-head attention blocks. For the self- attention layers it is always Q = K = V , while for the encoder-decoder attentions, K = V are the encodings (V or A), while Q is the previous layer's output (or, for the first layer, the prediction of the network at the previous decoding step). (c) TM-CTC: Transformer CTC, a model composed of stacks of self-attention and feed forward layers, producing CTC posterior probabilities for every input frame.

IV. CONCLUSION

The field of Lip Reading or Visual Speech Recognition is a major leap for the Artificial Intelligence domain, but still has a long way to go. There has been much research and many models have been developed to get better accuracy, but the accuracy needed for a perfect prediction of sentences is yet to be developed. VSR can prove to

be the best virtual assistant in future. Without the use of hand and voice commands, the user can just send their video input for the assistant to understand even in a crowded or noisy environment. New features need to be added in the models with hyper tuning for a better accuracy for variety of input and variety of lip movements. Different language model options are needed for the system to be flexibly available to all types of users who speak different languages.

V. ACKNOWLEDGEMENT

It gives us a great pleasure and immense satisfaction to present this special topic Project report on "Visual Speech Recognition using deep learning" which is the result of unwavering support, expert guidance and focused direction of my guide Prof. Preeti Rathod to whom I express my deep sense of gratitude and humble thanks, for his valuable guidance throughout the presentation work. The success of this Project has depended upon an exact blend of hard work and unending co-operation and guidance, extended to me by the superiors at our college. Furthermore, I am indebted to Dr. Pankaj Agarkar, HOD Computer and Dr. F.B.Sayyad, Principal whose constant encouragement and motivation inspired me to do my best. Last but not the least I sincerely thank my colleagues, the staff and all others who directly or indirectly helped us and made numerous suggestions which have surely improved the quality of my work.

VI.REFERENCES

[1]. K. Noda, Y. Yamaguchi, K. Nakadai, H. G. Okuno, andT. Ogata. Audio-visual speech recognition using deep learning. Applied Intelligence, 42(4):722–737, 2015.

[2]. J. S. Chung and A. Zisserman. Lip reading in the wild. In Proceedings of the Asian Conference on Computer Vision, 2016.

[3]. Y. M. Assael, B. Shillingford, S. Whiteson, and N. de Freitas. Lipnet: Sentence-level lipreading. arXiv:1611.01599, 2016.

[4]. W. Chan, N. Jaitly, Q. V. Le, and O. Vinyals. Listen, attend and spell. arXiv preprint arXiv:1508.01211, 2015.

[5]. A. Graves and N. Jaitly. Towards end-to- end speech recognition with recurrent neural networks. In Proceedings of the International Conference on Machine Learning, pages 1764– 1772, 2014.

[6]. O. Koller, H. Ney, and R. Bowden. Deep learning of mouth shapes for sign language. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, pages 85–91, 2015

[7]. V. Liptchinsky, G. Synnaeve, and R. Collobert. Letterbased speech recognition with gated convnets. CoRR, abs/1712.09444, 2017.

[8]. B. D. Lucas and T. Kanade. An iterative image registration technique with an application to stereo vision. In Proc. of the 7th International Joint Conference on Artificial Intelligence, pages 674–679, 1981

[9]. R. Collobert, C. Puhrsch, and G. Synnaeve. Wav2letter: An end-to-end convnet-based speech recognition system. CoRR, abs/1609.03193, 2016.

[10]. B. Shillingford, Y. Assael, M. W. Hoffman, T. Paine, C. Hughes, U. Prabhu, H. Liao, H. Sak, K. Rao, L. Bennett, M. Mulville,

[11]. B. Coppin, B. Laurie, A. Senior, and N. de Freitas. Large-Scale Visual Speech Recognition. arXiv preprint arXiv:1807.05162, 2018.

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Analysis of the Stresses in Void and Conventional Slabs Comparatively

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ABSTRACT

Plastic use is increasing daily; some actions were taken to reduce its consumption. This creates more garbage everyday which is not good for the environment. Therefore Re-use of plastic may provide to some advantages to the environment. For example, considering the Disposal of the huge quantity of the plastic may lead to land, water & air pollution etc. Plastic waste and its low recycling rate leads to positive contribution towards environment. So the step taken is to use the recycle plastic in concrete.This paper investigates the reuse of waste plastic in the construction sector so as to make the structure more lighter and to reduce dead load of the structure. In this study hollow shell is made by recycled plastic and is placed in the slab and it is compared with the conventional slab by following points i.e. stresses at the centre and end of slab, strains in slab & deformation of slab etc. This all analysis is done on Ansys Workbench software. At the last comparison of void slab is done with conventional slab.

Keywords: Reuse of plastic, Use of plastic in construction sector, Environmental friendly, Void slab.

I. INTRODUCTION

India being a developing country, as there is increase in infrastructure day by day there is need for invent something new technology in the construction field. The main problem in this field is shortage of material and manpower. All main factor is money it matters a lot in the construction along with equipments, machinery etc. Therefore to satisfy with such results voided slab is the most effective technology in construction sector. Void slab Technology is based on generating specific hollows inside a reinforced concrete slab. This method which replaces the concrete by recycled balls with less amount of concrete is known as void slab Technology.India is a developing nation, and as infrastructure needs grow daily, new technologies in the construction industry are required. Lack of resources, particularly in terms of labour and materials, is the key issue. Money is the most important factor in construction, along with tools, machines, etc. Therefore, the most efficient construction technology to achieve such results is the voided slab. The foundation of void slab technology is the creation of

particular hollows within a reinforced concrete slab. The void slab Technology replaces the concrete with recycled balls and uses less concrete overall.

II. DATA COLLECTION AND ANALYSIS

This innovative bubble shape, which is composed of recycled pp, will be utilised to design voided slabs in accordance with Indian slab specifications. As this module shape has been selected for slab depths up to 150 mm in thickness. The other bubbles and the newly designed bubble differ in that the former can be up to 12" to 14" deep, whilst the latter can only be up to 5" to 7" deep in India, which is how we achieved this shape.First, we tested this steel-caged bubble that is positioned in the slab at a distance of 170 mm from the edge. After that, different end conditions for the slab, including all fixed ends, both opposite ends fixed, and one fixed end, are applied, and analysis is done in the Ansys Workbench programme.

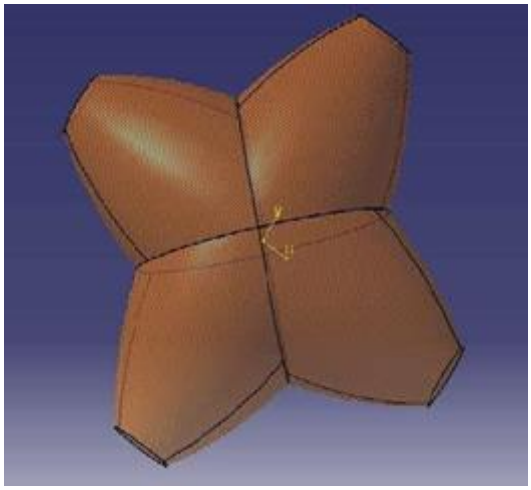


Fig. 1 New shape Bubble

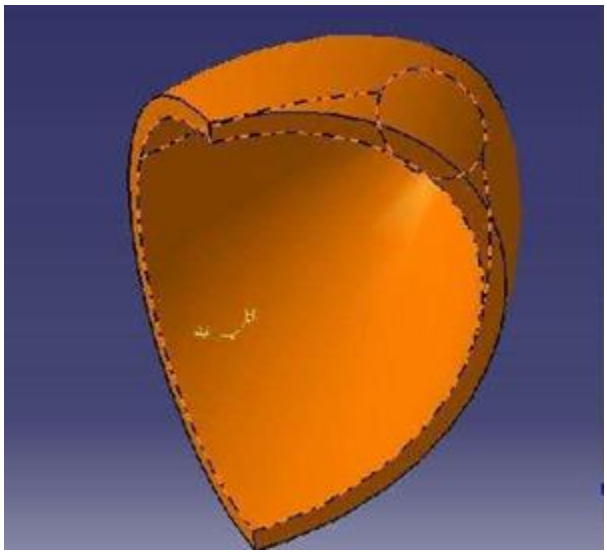


Fig. 2 Inside view of Bubble

2.1. Material Properties

Name ofMaterial	Material Properties	Value
Steel	Modulus Of Elasticity (E)	500000 Mpa
	Density	7850 Kg/m^3
	Specific Gravity	7.7
	Poisson's Ratio	0.3
Concrete	Modulus Of Elasticity (E)	25000 Mpa
	Density	2460 Kg/m^3
	Specific Gravity	9.81
	Poisson's Ratio	0.18
RecycledPP & HDPE	Modulus Of Elasticity (E)	1035 Mpa
	Density	970 Kg/m^3
	Specific Gravity	0.91
	Poisson's Ratio	0.4

2.2. Analysis and Results

2.2.1. Slab no. 1 : All ends are Fixed

- Size of Slab : 1.5m x 1.5m
- Spacing of bars in 'x' direction : 170mm c/c
- Spacing of bars in 'Y' direction : 170mm c/c
- Volume of concrete in Slab : (1.5x1.5x0.15) = 0.3375m^3
- Volume of 1 Bubble module : 0.00341m^3
- Number of Bubbles used in the slab : 64
- Total volume of bubbles in slab : 0.21 m^3
- Grade of Concrete : M25 (1:1.75:3.5), Fe 500

2.3. Results of Conventional slab on Software:

a) Total Deformation –

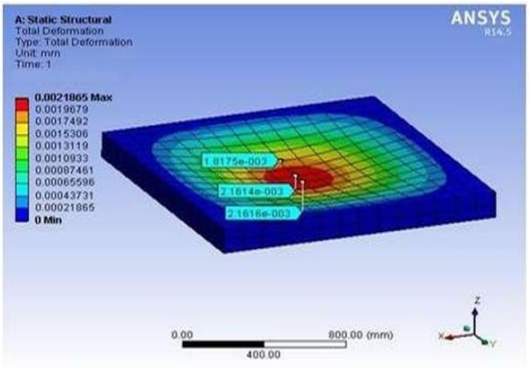


Fig. 3 Deformation of conventional slab 1

b) Total Strain –

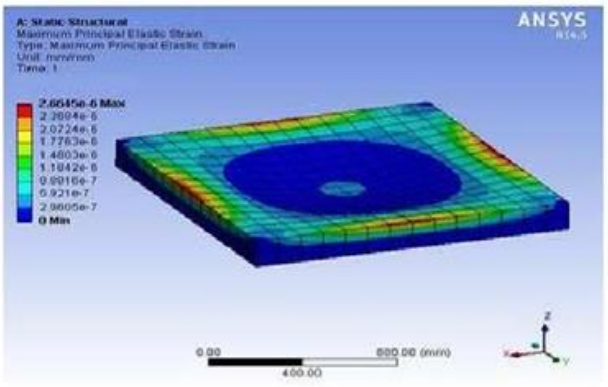


Fig. 4 Strain of conventional slab 1

c) Total Stresses –

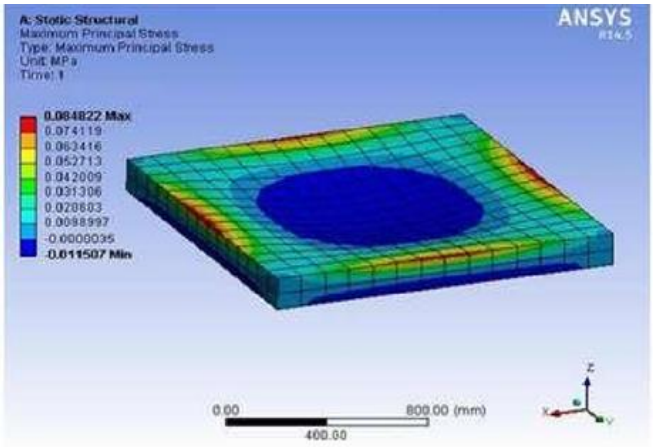


Fig. 5 Stresses of conventional slab 1

2.4. Results of Voided slab on Software:

a) Total Deformation –

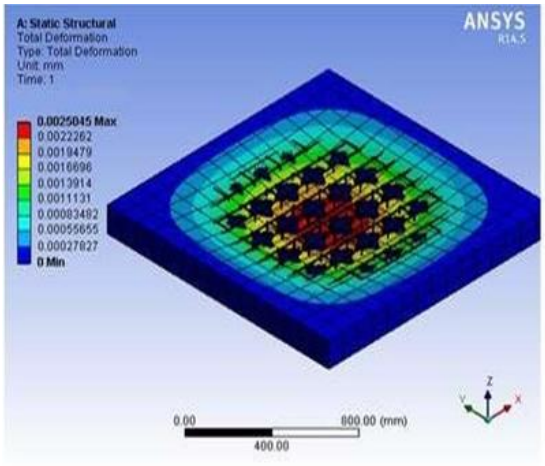


Fig. 6 Deformation of void slab 1

b) Total Strain –

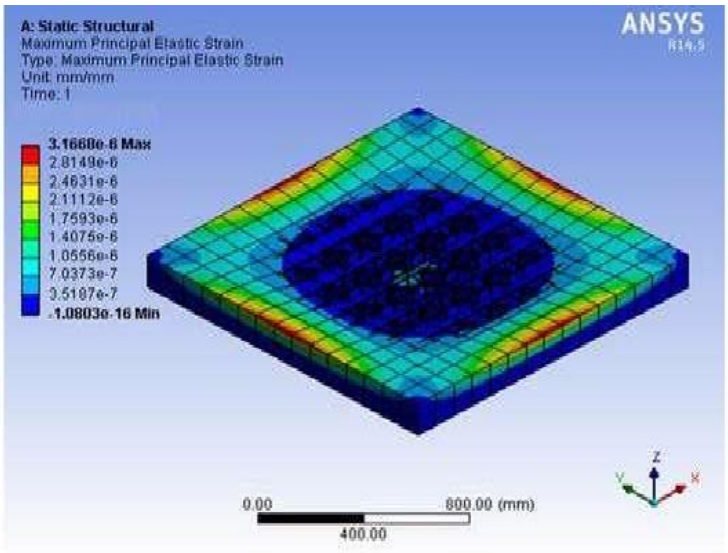


Fig. 7 Strain of void slab 1

c) Total stresses –

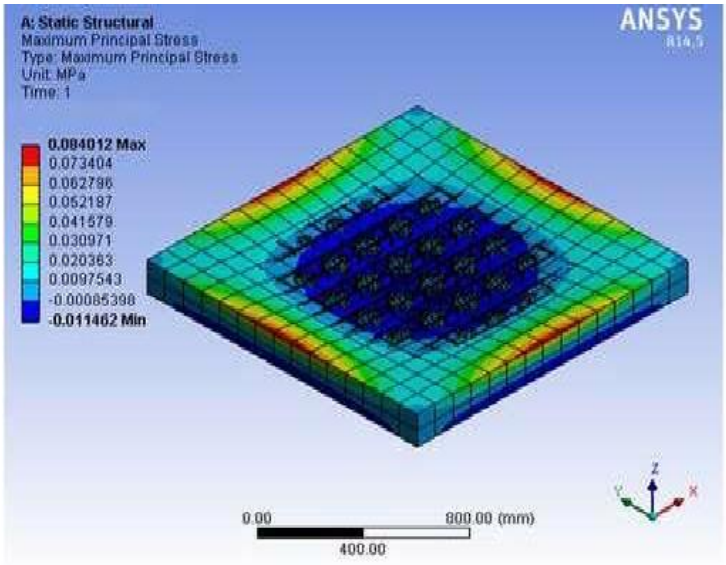


Fig. 8 Stress of void slab 1

A. Comparison of Conventional Slab with Voided Slab:

Sr.no	Description	ConventionalSlab	Voided Slab
1	Deformation	0.002186 mm	0.0025 mm
2	Stresses	0.08482 N/mm^2	0.0840 N/mm^2
3	Strain	2.664	3.1668

B. Comparison of Conventional Slab with Voided Slab in the form of Graph:

a) Deformation –

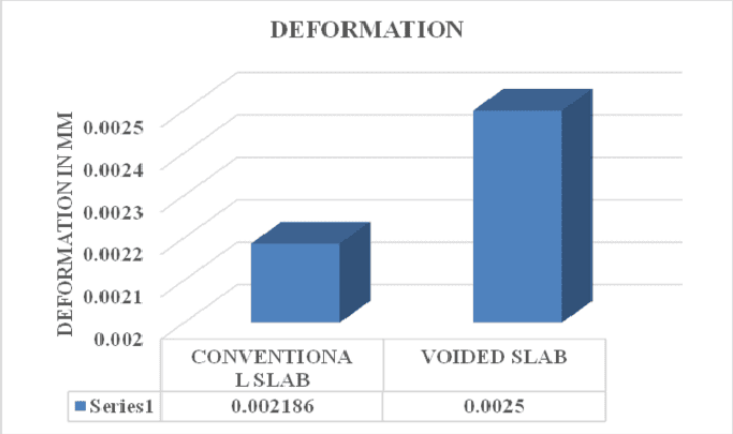
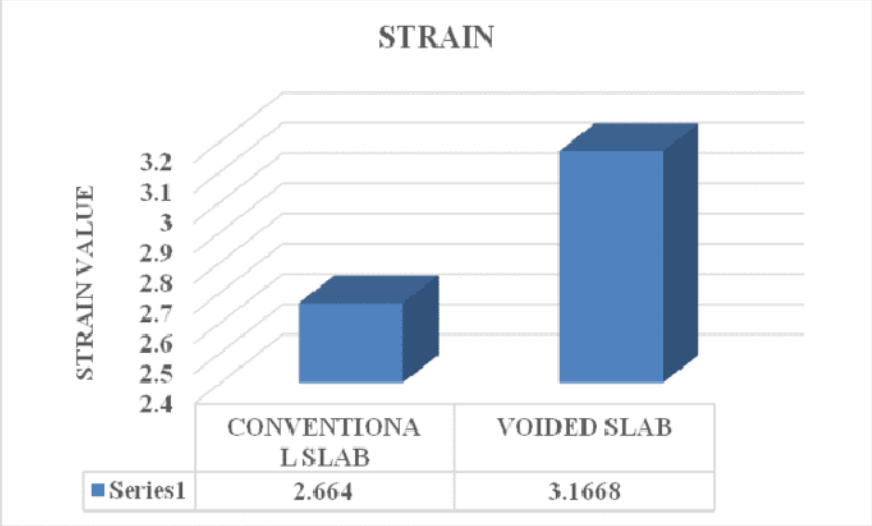


Fig. 9 Comparision of Deformation of slab 1

b) Strain –



c) Stresses -

2.5. Slab no. 2 : Both opposite ends are Fixed

- Size of Slab : 1.5m x 1.5m
- Spacing of bars in 'x' direction : 200mm c/c
- Spacing of bars in 'Y' direction : 200mm c/c
- Volume of concrete in Slab : (1.5x1.5x0.15) = 0.3375m^3
- Volume of 1 Bubble module : 0.000341m^3
- Number of Bubbles used in the slab : 64
- Total volume of bubbles in slab : 0.21 m^3
- Grade of Concrete : M25 (1:1.75:3.5), Fe 500

2.6. Results of Conventional slab on Software:

a) Total Deformation –

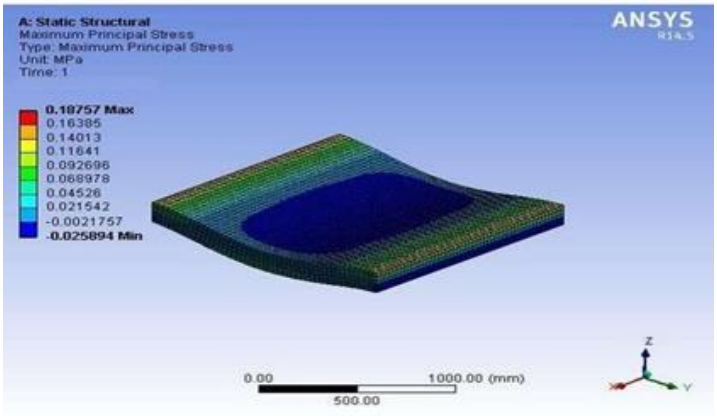


Fig. 12 Deformation of conventional slab 2

b) Total Strain –

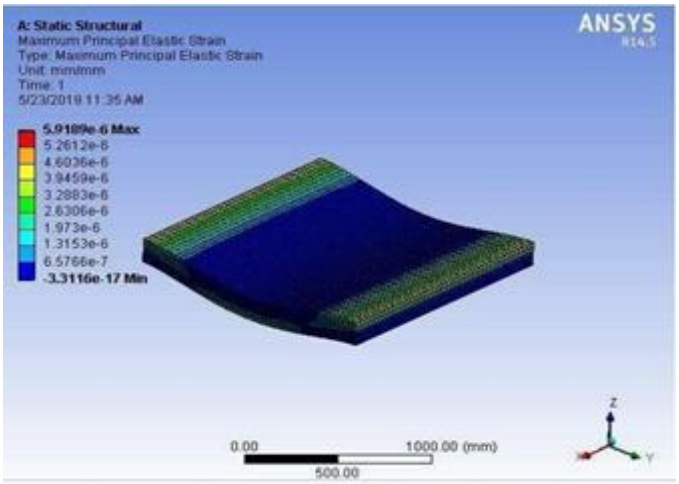


Fig. 13 Strain of conventional slab 2

c) Total Stresses –

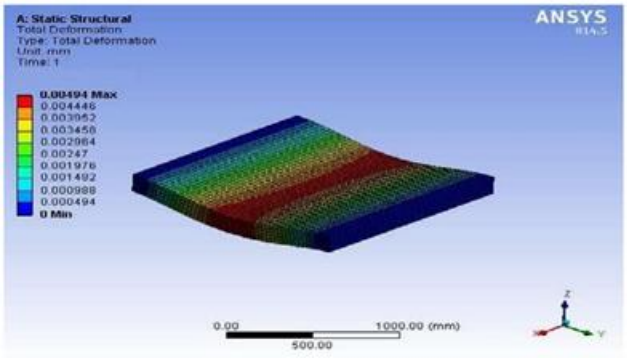


Fig. 14 Stresses of conventional slab 2

2.7. Results of Voided slab on Software:

a) Total Deformation –

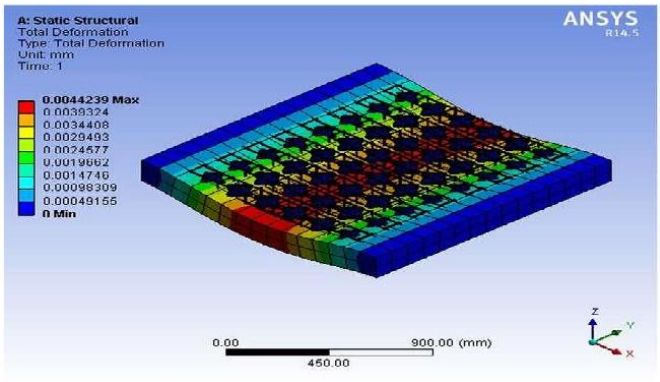


Fig. 15 Deformation of void slab 2

b) Total Strain –

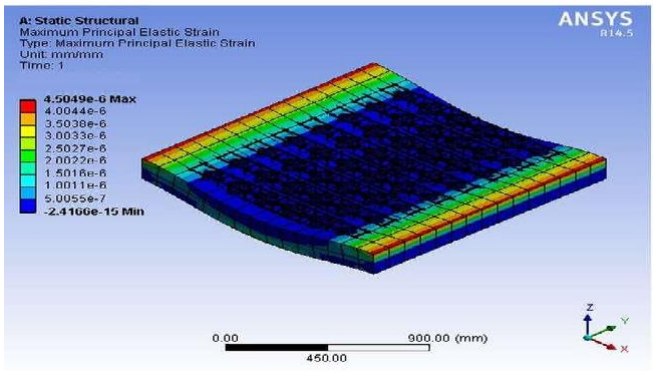


Fig. 16 Strain of void slab 2

c) Total Stresses –

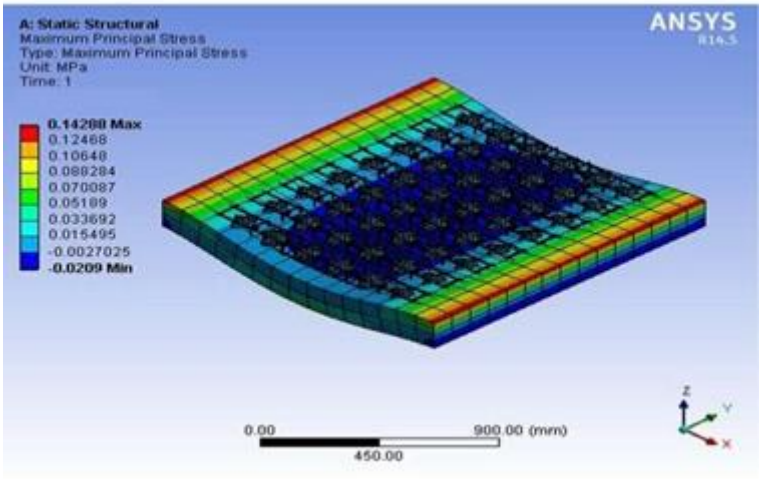


Fig. 17 Stresses of void slab 2

A. Comparison of Conventional Slab withVoided Slab:

Sr.no	Description	Conventional Slab	Voided Slab
1	Deformation	0.0049 mm	0.0044 mm
2	Stresses	0.1875 N/mm2	0.142 N/mm2
3	Strain	5.91	4.5

B. Comparison of Conventional Slab withVoided Slab in the form of Graph:

a. Deformation:

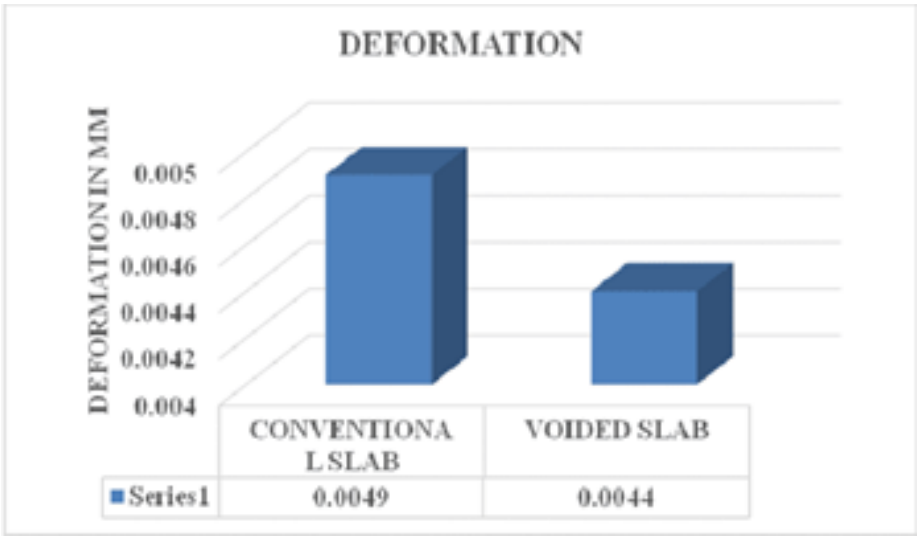


Fig. 18 Comparision of Deformation of slab 2

b. Strain:

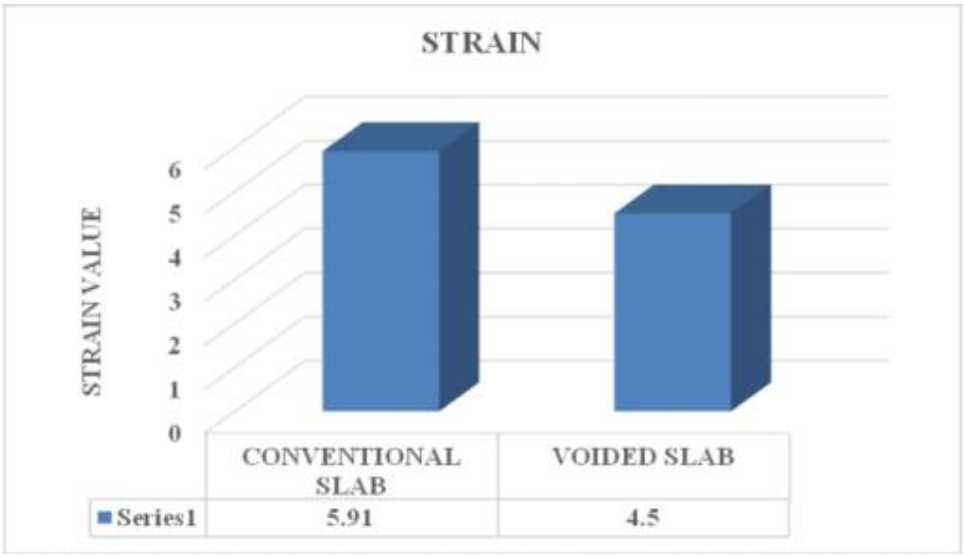


Fig. 19 Comparision of Strain of slab 2

c. Stresses:

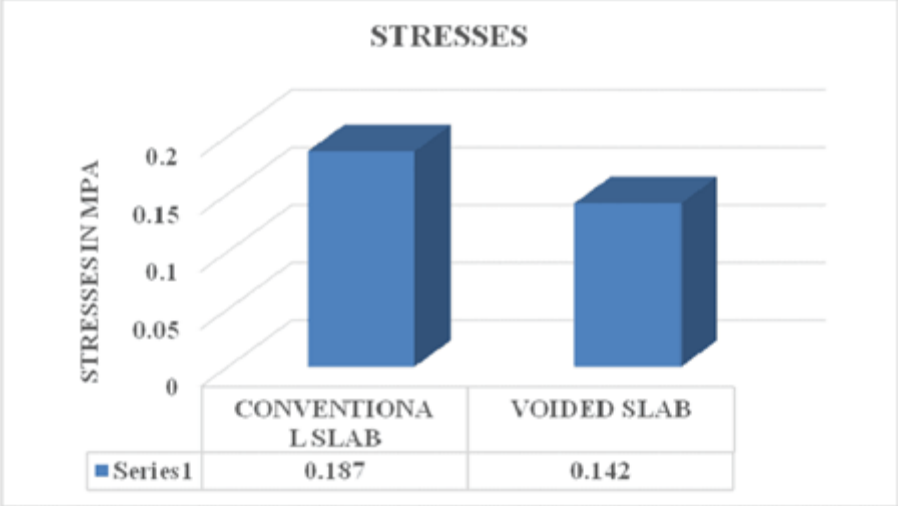


Fig. 20 Comparision of Stresses of slab 2

2.8. One end is Fixed

- Size of Slab : 1.5m x 1.5m
- Spacing of bars in 'x' direction : 225mm c/c
- Spacing of bars in 'Y' direction : 225mm c/c
- Volume of concrete in Slab : (1.5x1.5x0.15) = 0.3375m^3
- Volume of 1 Bubble module : 0.000341m^3
- Number of Bubbles used in the slab : 64
- Total volume of bubbles in slab : 0.21 m^3
- Grade of Concrete : M25 (1:1.75:3.5), Fe 500

2.9. Results of Conventional slab on Software:

a. Total Deformation:

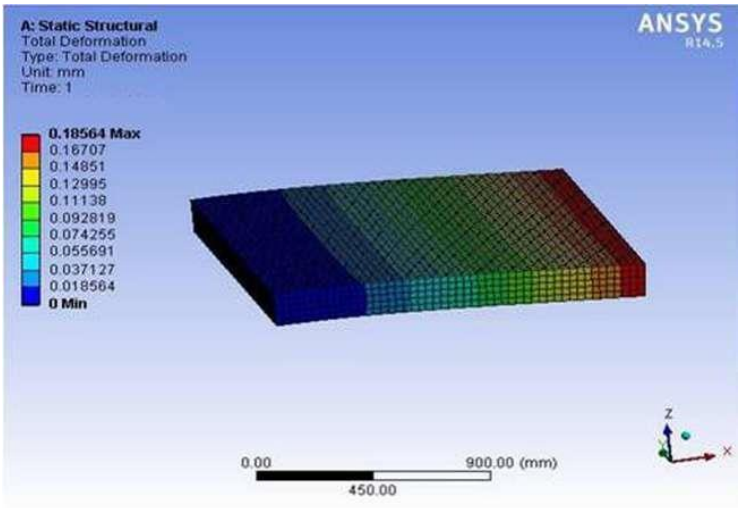


Fig. 13 Deformation of conventional slab 3

b. Total Strain:

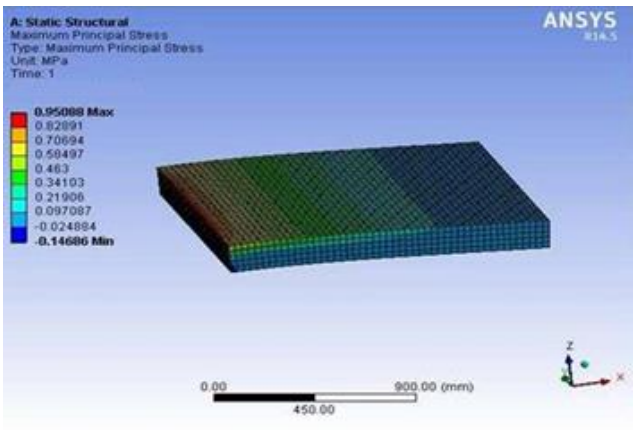


Fig. 14 Strain of conventional slab 3

c. Total Stresses:

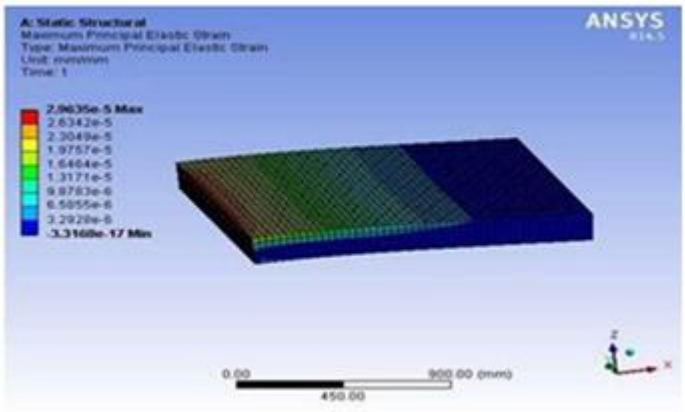


Fig. 15 Stresses of conventional slab 3

2.10. Results of Voided slab on Software:

a) Total Deformation –

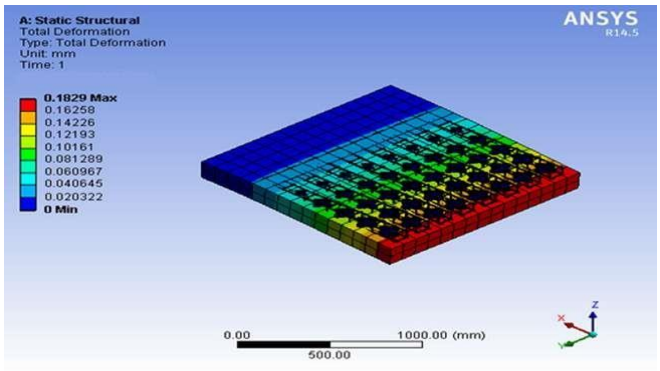


Fig. 16 Deformation of void slab 3

b) Total Strain –

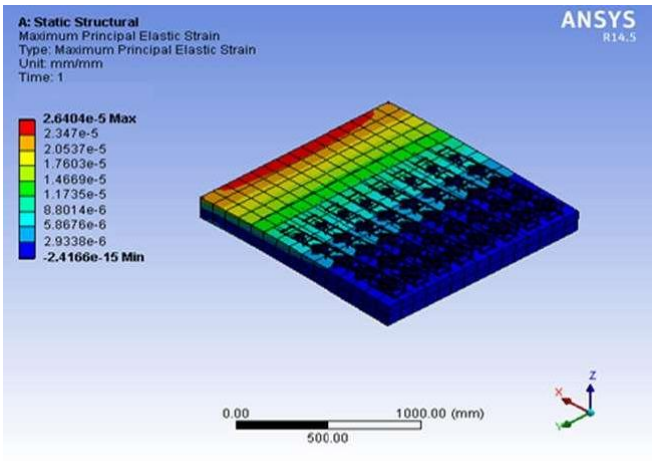


Fig. 17 Strain of void slab 3

c) Total Stresses –

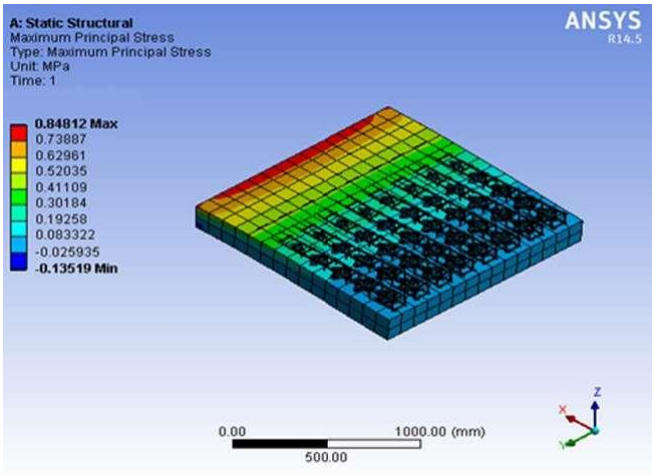


Fig. 18 Stresses of void slab 3

A. Comparison of Conventional Slab with VoidedSlab:

Sr.no	Description	ConventionalSlab	Voided Slab
1	Deformation	0.185 mm	0.182 mm
2	Stresses	0.95 N/mm2	0.84 N/mm2
3	Strain	2.96	2.6

B. Comparison of Conventional Slab with Voided Slab in the form of Graph:Deformation:

Sr.no	Description	ConventionalSlab	Voided Slab
1	Deformation	0.185 mm	0.182 mm
2	Stresses	0.95 N/mm2	0.84 N/mm2
3	Strain	2.96	2.6

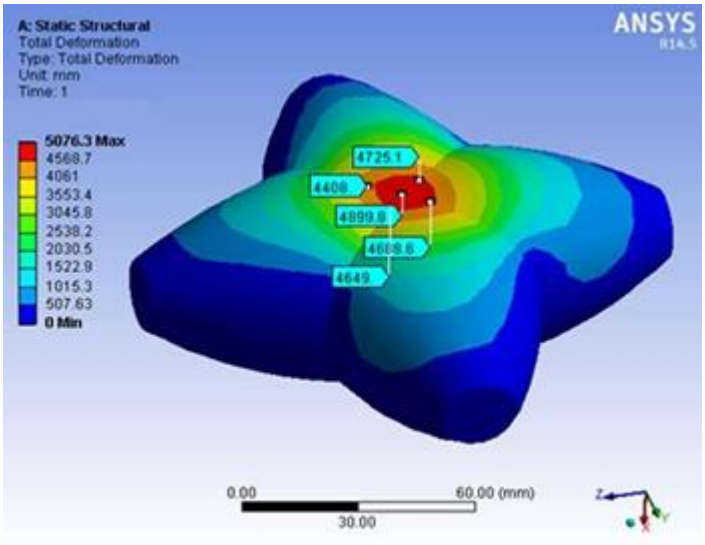
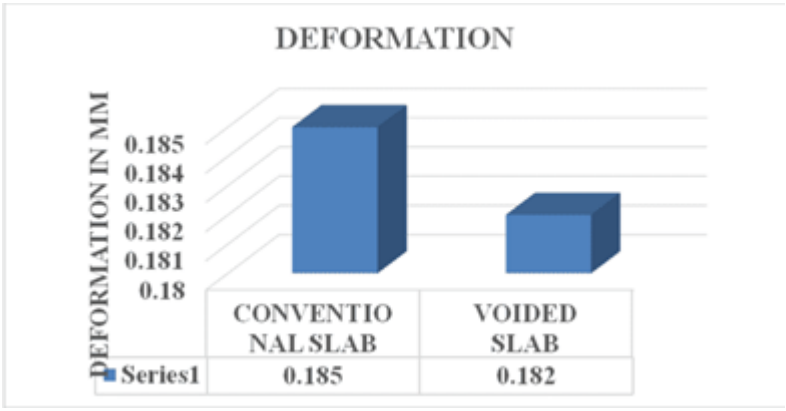
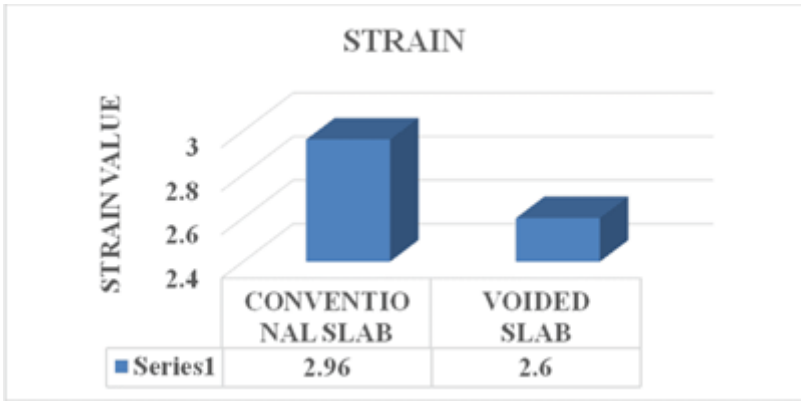


Fig. 19 Comparision of Deformation of slab 3

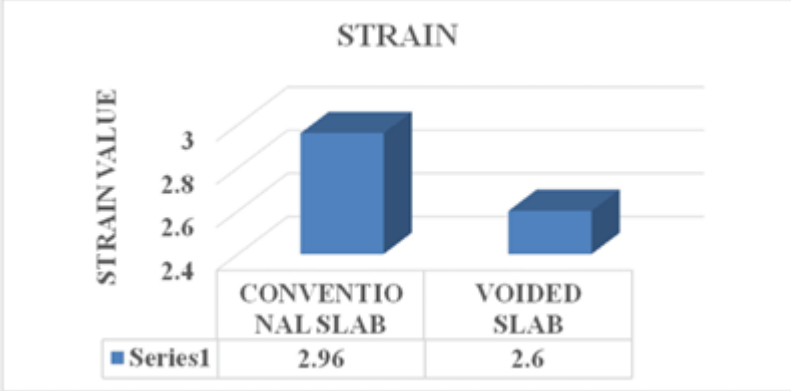
a. Deformation:



b. Strain



c. Stresses



4 Bubble Analysis :

Here the analysis of single bubble at a load of 6kn andfound out deformation, stresses and strain.

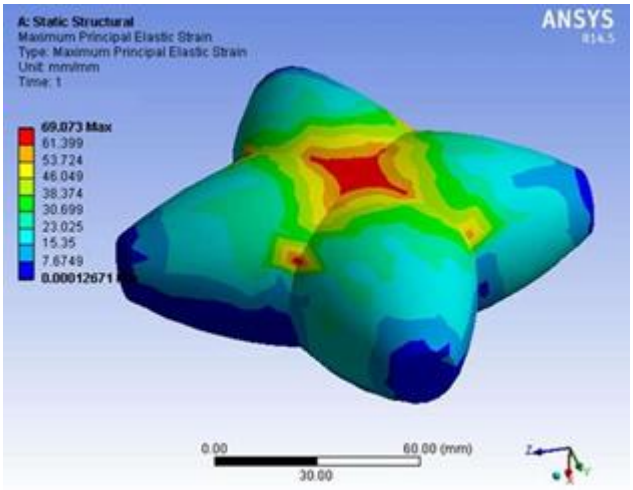


Fig. 22 Deformation of Bubble

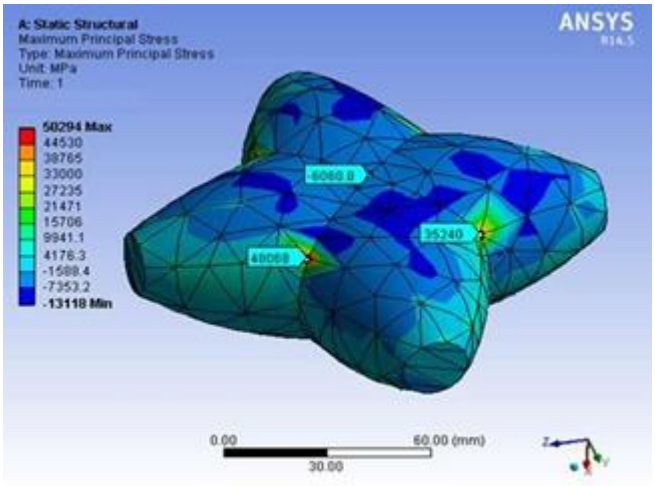


Fig.23 Strain of Bubble

III. CONCLUSIONS & FUTURE SCOPE

Utilising waste plastic in the construction industry is a significant step. The dead load of the slab is reduced by adopting this technology. stiffness is increasing. recycling plastic waste in the building industry. ecologically sound materials.

Future scope

used to build all different kinds of buildings.
The best option for large-span venues like theatres and auditoriums, etc.
Use in parking areas to reduce the need for columns.

IV.REFERENCES

[1]. Bunker, J., Parajuli, and Ashis. (2006). "Examining lateral positions of cars and heavy vehicles on a two lane, two way motorway." Transport Engineering in Australia, 10(2), 129–139. Highway {C}apacity {M}anual. (2012). .

[2]. Kaur, S. (2015). "Use of Vissim in Heterogeneous Traffic Modelling-A Review Lecturer in Civil Engineering , Government Polytechnic , Ah- medabad." (May), 453–454.

[3]. Lennie, S., and Bunker, J. (2004). "Using lateral position information as a measure of driver behaviour around MCVs." 1–19.

[4]. Mahapatra, G., and Maurya, A. K. (2013a). "Study of Vehicles Lateral Movement in Non-lane Discipline Traffic Stream on a Straight Road." Procedia - Social and Behavioral Sciences, Elsevier B.V., 104, 352–359.

[5]. Mahapatra, G., and Maurya, A. K. (2013b). "Study of Vehicles Lateral Movement in Non-lane Discipline Traffic Stream on a Straight Road." Procedia - Social and Behavioral Sciences, Elsevier B.V., 104(December), 352–359.

[6]. Manjunatha, P., Vortisch, P., and Mathew, T. (2013). "Methodology for the Calibration of VISSIM in Mixed Traffic." Transportation Research Board 92nd Annual Meeting, 11.

[7]. Pal, D., and Mallikarjuna, C. (2016). "Analysis of the effect of variable lateral gap maintaining behavior of vehicles on traffic flow modeling." Procedia Engineering, Elsevier B.V., 142, 197–203.

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Design and Implement an Automated Based Unauthorized Parking Detection

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ABSTRACT

By Using automatic techniques, the system aims to mitigate the problem of unauthorized parking to reduce human efforts and improve the efficiency of the system using modern technology. All these issues have been addressed by our proposed system that works intending to improve the traffic conditions on the road to avoid unnecessary traffic jams due to cars being parked in the unauthorized parking area. With the help of the system, regular monitoring can be performed with a minimum of human involvement, and more beneficial outcomes can be obtained. Future iterations of the system might include tools for notifying the nearby traffic police station of the location of a car that was parked improperly as well as include suspension of driving license for repeated offenses. In the future, appropriate parking management software that incorporates the suggested framework might be created for the benefit of the general public.

Keywords: Car detection, RFID Tag (Radio Frequency Identification), Sensors

I. INTRODUCTION

Thus systems use an automated based parking management system by using Arduino, RFID module, and GSM module. With the help of RFID and GSM modules, parking slots can be monitored from anywhere in society. The Parking Area has any number of slots based on our requirements. Every slot has one RFID. Each Sensor is used to detect the presence of a car in the slot. This RFID relates to Arduino. So, when a car is parked in the no parking area, the Arduino sends a command to the GSM module, and the GSM then sends the SMS to the owner and the guard room. Thus, the system solves the Parking issue and get users an efficient parking management system.

To prevent unauthorized vehicle parking and Traffic the Features are the Detection of permitted and non-permitted vehicles in the no-parking zone. Detection of unauthorized vehicle parking in the restricted zone thus sending SMS to authority to act taking fine from the vehicle user. Once a vehicle is parked in a no-parking area and the RFID transmitter comes into the scope of the receiver circuit. The RFID reader scans and reads the transmitter's unique id and can alert the concerned regulating authority with the code of the area so that

authorities. An SMS is also sent to the car owner by the system about the fine being imposed on the vehicle. Arduino Uno, GSM Module.

SIM used in It gives an SMS and imposes a fine to a pre-indicated user mobile number when any sort of vehicle is found in its span.

II. LITERATURE SURVEY

[1] Detection of Unauthorized Parking using RFID. In this paper, We have studied In this paper, We have studied a system that grants and provides an automated detection and alert system for illegally parked vehicles. This system comprises installing an RFID transmitter in every car, jeep, bus, cab, etc. The RFID receiver circuits are established in most places wherein parking is illegitimate. Once a vehicle is parked in a no-parking area and the RFID transmitter comes into the scope of the receiver circuit, the RFID reader scans and reads the transmitter's unique id and can alert the concerned regulating authority with the code of the area so that The technology also sends an SMS to the car owner informing them of the fine being imposed on the vehicle, and authorities may arrive at the scene without delay

[2]Automatic Unauthorized Parking Detector with SMS Notification. This paper deals Thus it is supposed for reducing the range of unlawful parking. It also helps to identify the vehicles parked in non-parking areas and send information regarding those vehicles to the control office. Thus it is supposed for reducing the range of unlawful parking. A Raspberry Pi processor is the main device that manages the whole task Advanced techniques of image processing, using the Support Vector Machine (SVM) algorithm and Optical Character Recognition (OCR), have seen used in the model

[3] Automated vehicle parking system and unauthorized parking detector. This paper aims to ensure proper management of vehicles in public places such as educational institutes, and offices. To prevent unauthorized vehicle parking and traffic. The features include the detection of permitted and non-permitted vehicles on the Before they leave, parking fees are also deducted from the vehicles parked inside the parking lot. Additionally, there are parking lights that turn on when a car into a particular parking space.

[4] IoT-Based Sensor Enabled Smart Car Parking for Advanced Driver Assistance System. The work proposed in this system addresses the issue of parking in smart cities. The system is implemented using low-cost IR sensors, Raspberry Pi model 3b for real-time data processing, an E-parking mobile application, and Geared DC motor. Users can reserve parking spaces from remote places using the mobile application, and the developed system also offers user identification. It provides real-time information on the availability of parking slots in parking sites. The advanced gadget is examined for different cases such as single-user booking, multiple users booking, the user trying to book a reserved slot, and user authentication. The three parking spaces which make up the system being proposed each have a single infrared sensor with an adjustable detection range of up to 30 cm. The proposed work not only reduces traffic congestion, but also provides authentication of the user, is cost-effective, and real-time, and helps in reducing carbon footprint.

[5] This paper proposes Due to high population growth, car demand has increased at an alarming rate. This leads to an increase in demand for more parking slots, which poses an acute problem, especially, when we are concerned with metro and fairly large cities. A solution to this problem on a priority basis is necessary. People

should have to cater to the illegal parking aspect as well. This paper deals with the detection of illegal parking and it also helps to identify the vehicles, which are parked in non-parking areas and sends information regarding those vehicles to the control offices.

III. PROPOSED METHODOLOGY

Define the requirements of the system, including the type of RFID tags needed, the range of the RFID reader, and the location of the RFID reader. You should also consider the type of data that needs to be collected and analyzed, as well as any other features or functionalities that are required.

Step 2: Develop the Central System

Develop the central system that will analyze and process data from the RFID reader. This system will receive data from the RFID reader and determine if a vehicle is parked in a no-parking zone.

Step 3: Develop the User Interface

Develop a user interface for the system that allows users to view the parking status live and receive alerts when unauthorized parking is detected. This can be a mobile app ora web-based interface.

Step 4: Implement the Alert System

Implement an alert system that sends a message through the RFID registered ID number using the GSM module if the vehicle is parked in the same location for more than 5 minutes. If the user is not moving the vehicle from the no parking zone, then the message is sent to the nearby traffic police station, and the vehicle will get towed by the officer.

Step 5: Implement the Fine Payment System

Implement a fine payment system that debits the fine from the user's bank account or online wallet automatically. This will ensure that the fine is paid promptly, and the user will be less likely to park illegally in the future.

Step 6: Analyze the Data

Analyze the data collected from the RFID reader and the fine payments, and other metrics. This data can be used to optimize parking management and improve the overall system performance.

Step 7: Test the System

Test the system thoroughly to ensure that it works as intended. This includes testing the RFID system, the central system, and the user interface.

Step 8: Deploy the System

Finally, deploy the system in the parking lot where it will be used. This may involve installing the RFID reader, configuring the central system, and connecting its platform. The system should be maintained and updated regularly to ensure it continues to function properly.

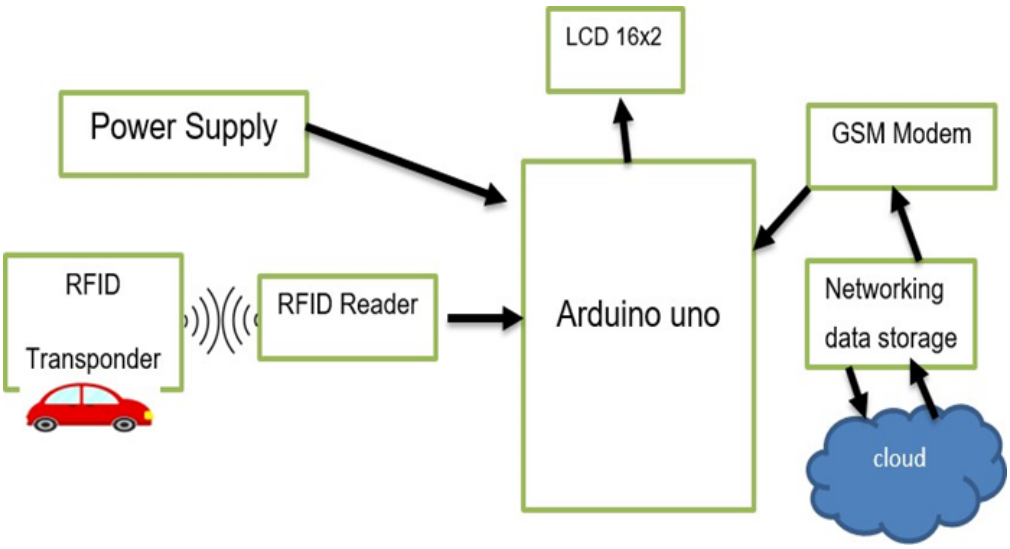

Fig01.Block Diagram

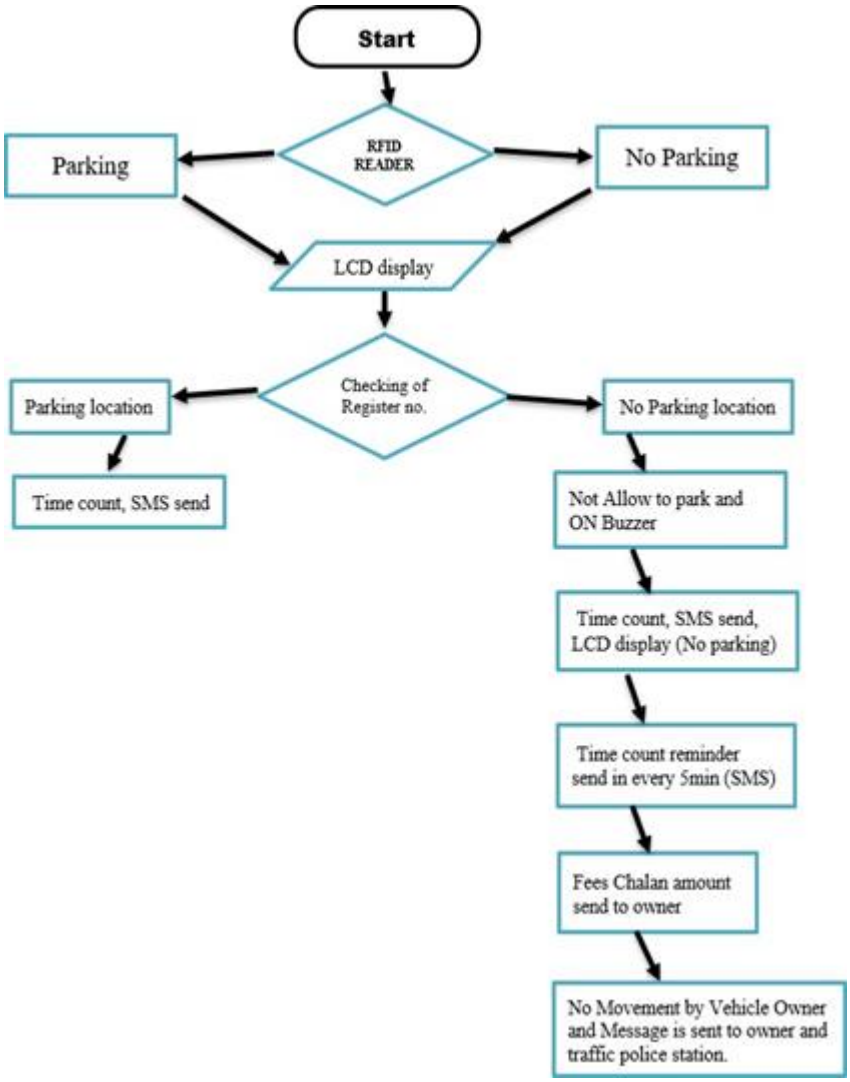

Fig 02. Flowchart

IV. WORKING

Here we have used the 12V/2A adapter. The 12V is supplied to the Arduino Uno at VCC.RFID and GSM modules are both interfaced with the Arduino. The communication protocol is a UART communication system.

The GSM 800L module is used to share the data it is communicating with the Arduino.

A DC-DC buck converter is used. As the IR sensor worked on 5 volts as per a standard specification.

The LCD is directly interfaced with the Arduino, asthe power supply and data transfer from the Arduino.

The digital pins of the Arduino are connected to the LCD.IR sensor that the VCC gets from the Arduino.

The analog pins of the Arduino are interfaced with the IR sensor. As the IR sensor is in digital form.

We have connected the sensor pin to the analog pins of the Arduino pin.

As we have the remaining analog pins of the Arduino. RFID EM-18 modules are used. An RFID reader module is used to read the tag card.

The GSM 800L module needs 4 volts from the power source. As the supply voltage is higher than the required voltage, a DC-DC buck converter is used to bring it to the requiredvoltage.

Four IR sensors are used for the four different locations in a particular area. To detect the vehicle. In the demo section, we have three registration tag cards.

A card consists of a coil. As the tag comes near the reader, it reads the information on the tag card. As the tag is for the vehicle only.

And if the owner comes into the unauthorized area, the message will display on the LCD screen. You're in a no-parking area.

REGISTRATION WEBSITE

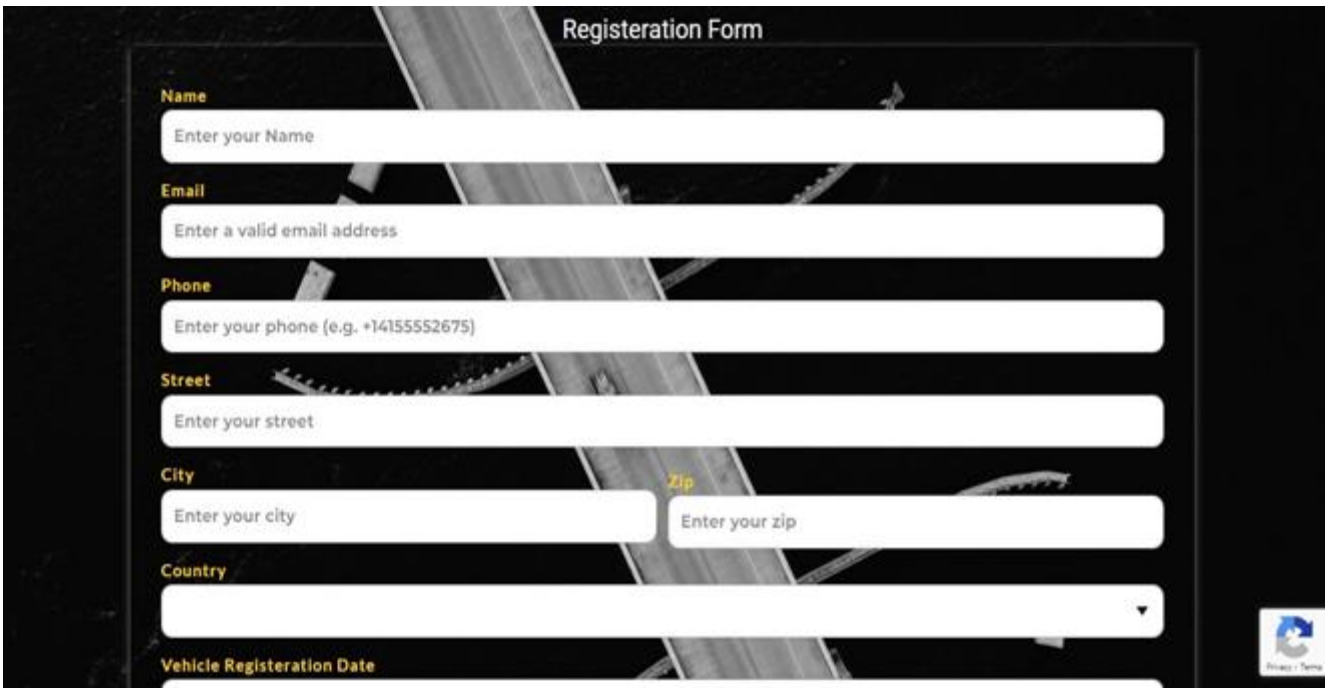

Fig 03. Website Registration Page

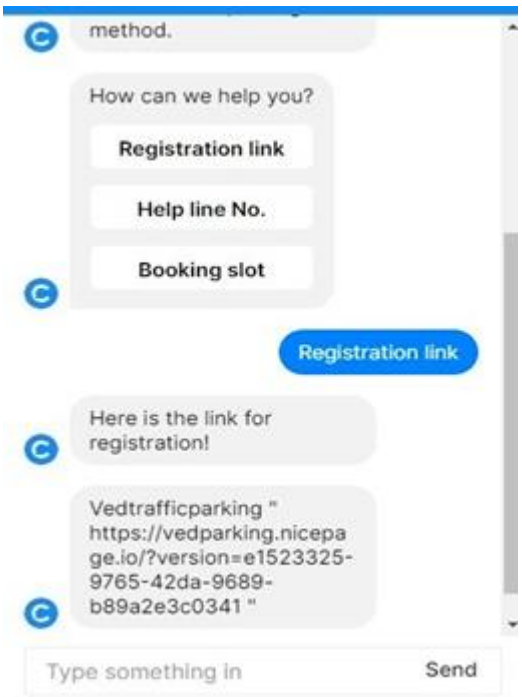

Fig 04 Chatbot

V. RESULT

Fig 05. Welcome Message

Fig 06. Alert Message & Car Detected.

Fig 07. Sending Debited Message to Owner

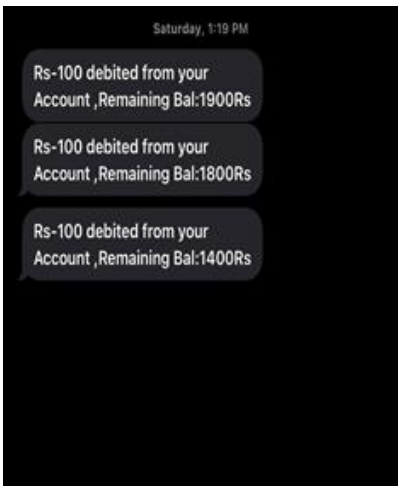

Fig 08. Amount Debited MSG

Once the sensors detect the presence of a vehicle, the system can communicate this information to a central server or database using communication protocols such as Wi-Fi or GSM. The system can also use to analyze the sensor data and determine if the parked vehicle is authorized or unauthorized. If an unauthorized vehicle is detected, the system can send alerts to the authorities or parking management personnel using SMS or email notifications. The system can also use a combination of visual and audio alerts, such as flashing lights or sirens, to notify the driver that they have parked in arestricted area.

VI. CONCLUSION:

As this project is based on an Arduino UNO, EM 18 RFID Module, and GSM 800L. This project involves detecting the unauthorized vehicle and all procedures of the imposing fine will be done automatically. Automated-based unauthorized parking detector is an innovative and revolutionary technology that helps in detecting and preventing unauthorized parking. It helps reduce the number of traffic violations and improve the area's safety. It is also cost-effective and easy to install and maintain, making it an ideal solution for any parking slot.

Automated-based unauthorized parking detector is an effective solution for businesses and organizations or public places to improve the security of their parking slots. It is also compatible with existing parking systems, making it an ideal solution for any parking slot.

VII. REFERENCES

[1]. Detection of Unauthorized Parking using RFID" by Sunny Rana1, Shahid Imran1, Shubham Mathur1, Gunjan Aggarwal2 1Student, 2Asscociate Professor (Guide), Department of Computer Science & Engineering, SET, Sharda University, Greater Noida, India Volume 7, Issue 3, March – 2022

[2]. “Visual Background Extractor for Illegally Parked Vehicle Detection” by Putra Yudha Pranata1 Wahyono2 1Master Program in Computer Science, Universitas Gadjah Mada, Indonesia 2Department of Computer Science and Electronics, Universitas Gadjah Mada, Indonesia, January 24, 2022.

[3]. “Avoidance of Unauthorized Vehicle Parking using IoT” by M. Indumathy, A. Arun Reddy, K. Jitendra Reddy, G. Pavan Kumar Volume 10 Issue No.5, May 2020 (IJESC)

[4]. “Automatic Unauthorized Parking Detector” by M Manoj Prabhu, R Jayaraj, R Karthikeyan, H Sangeetha Srinivasan, Volume-8 Issue-5, June 2019, (IJEAT)

[5]. "DESIGN AND IMPLEMENTATION OF AUTOMATIC UNAUTHORISED PARKING DETECTOR USING GSM" by Srikanth, M. Hariharasudhan, Rajaram, Dr. P Aruna Jeyanthy, 14 April 2019

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AI and Healthcare : Opportunities and Challenges

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ABSTRACT

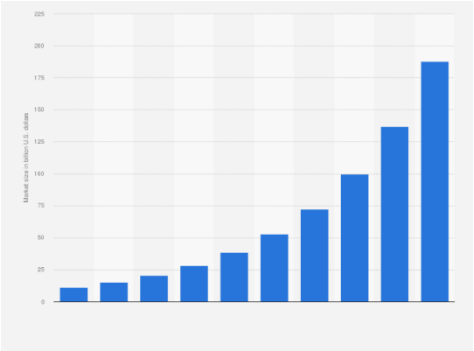
Artificial intelligence is revolutionizing-and strengthening-modern healthcare through technologies that can predict, grasp, learn, and act, whether it's employed to identify new relationships between genetic codes or to control surgery-assisting robots.

I. INTRODUCTION

Artificial intelligence (AI) has the potential to revolutionize healthcare by improving diagnosis, treatment, and patient care. AI technologies such as machine learning, natural language processing, and computer vision are already being used to analyze medical data, develop treatment plans, and even perform surgical procedures. However, the adoption of AI in healthcare also presents significant challenges related to data privacy, ethical considerations, and regulatory compliance. This paper will explore the opportunities and challenges of AI in healthcare.

II. OPPORTUNITIES OF AI IN HEALTHCARE

AI can improve diagnosis and treatment by analyzing large amounts of medical data to identify patterns and predict outcomes. For example, AI algorithms can analyze medical images to detect early signs of diseases such as cancer and Alzheimer's. AI can also help develop personalized treatment plans based on individual patient characteristics and medical history. Furthermore, AI can assist in drug discovery by predicting how molecules will interact with the body.

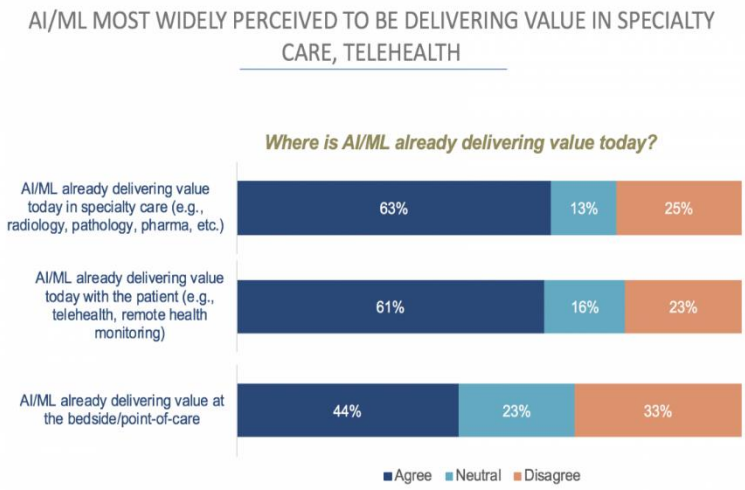


AI can also improve patient care by automating routine tasks and allowing healthcare professionals to focus on more complex cases. AI chatbots can answer patient questions and provide guidance on self-care, reducing the workload of healthcare staff. Moreover, AI can help optimize hospital operations by predicting patient demand and optimizing staff schedules.

1. **Diagnosis And Treatment Planning**
2. **Predictive Analytics**
3. **Drug Discovery And Development**
4. **Virtual Assistants And Chatbots**

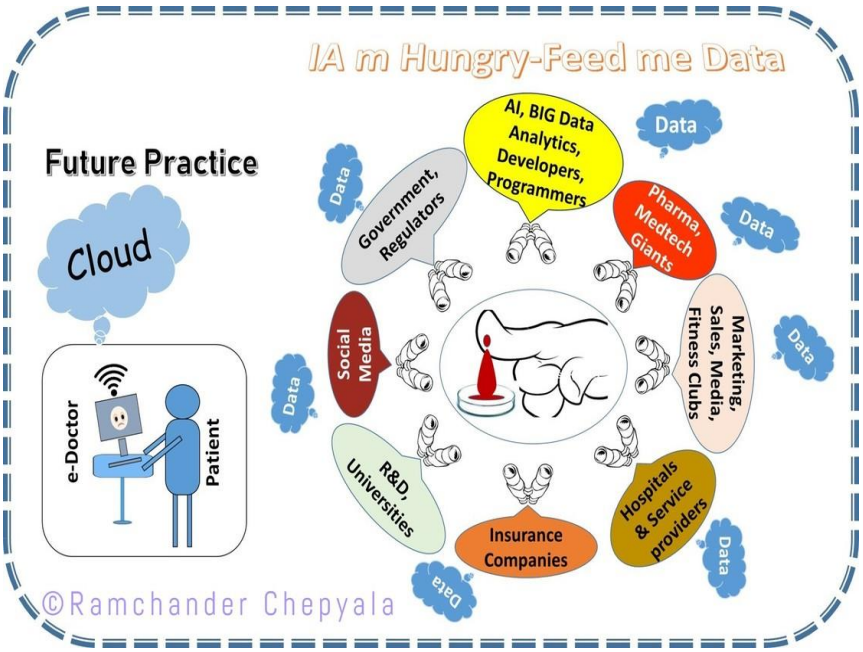
Robotic process automation

This technology performs structured digital tasks for administrative purposes, ie those involving information systems, as if they were a human user following a script or rules. Compared to other forms of AI they are inexpensive, easy to program and transparent in their actions. Robotic process automation (RPA) doesn't really involve robots – only computer programs on servers. It relies on a combination of workflow, business rules and 'presentation layer' integration with information systems to act like a semi-intelligent user of the systems. In healthcare, they are used for repetitive tasks like prior authorisation, updating patient records or billing. When combined with other technologies like image recognition, they can be used to extract data from, for example, faxed images in order to input it into transactional systems.



Challenges of AI in Healthcare:

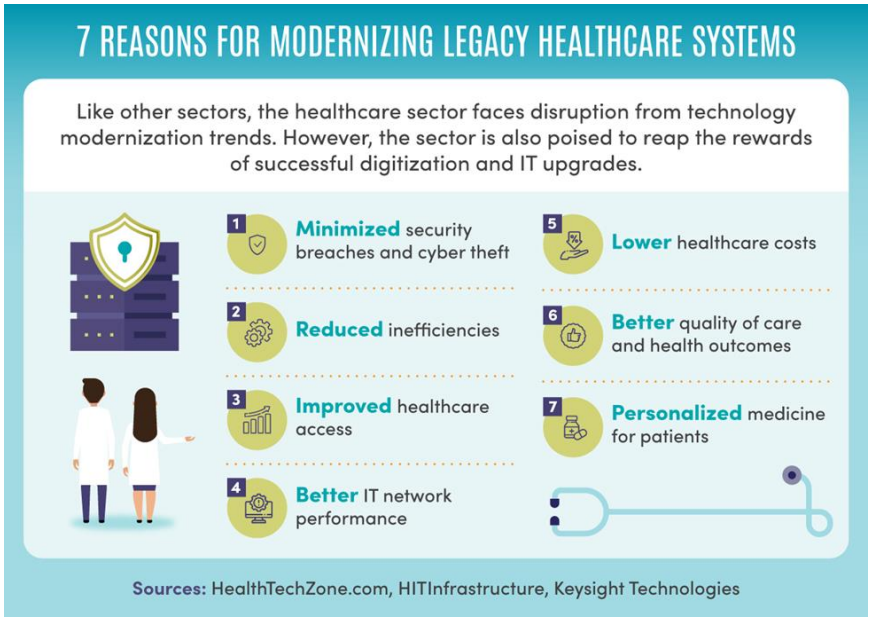
The adoption of AI in healthcare also presents significant challenges related to data privacy, ethical considerations, and regulatory compliance. One of the most significant concerns is the potential for bias in AI algorithms if the data used to train the algorithms are not representative of the population. This could lead to discrimination against certain groups, such as minorities and women. Moreover, there is a need for ethical guidelines for the development and deployment of AI in healthcare.



While the potential benefits of AI in healthcare are clear, there are also significant challenges that must be overcome. Here are five that I find the most important:

1. **Data Privacy And Security:** The use of AI in healthcare requires large amounts of patient data, which raises concerns about data privacy and security. It is important to ensure that patient data is protected from unauthorized access and that patients have control over how their data is used.
2. **Bias In The Data:** AI systems can be biased if the data they are trained on is not representative of the population they will be used to serve. This may lead to inaccurate or unfair results, particularly for marginalized communities.
3. **Lack Of Transparency:** Many AI systems are considered "black boxes" because it is difficult to understand how they arrived at a particular decision. This lack of transparency can make it difficult for doctors and other healthcare professionals to trust the results of an AI system.
4. **Regulation And Governance:** There is currently a lack of clear regulations and guidelines for the use of AI in healthcare. This can make it difficult for healthcare organizations to know how to use the technology responsibly and can also make it difficult for patients to know what to expect when they interact with an AI system.
5. **Lack Of Understanding:** Many healthcare professionals and patients may not have a good understanding of how AI works and what it can and cannot do. This can lead to unrealistic expectations and mistrust of the technology.

Another challenge is the need to ensure data privacy and regulatory compliance. Healthcare data is sensitive and must be protected from unauthorized access or misuse. AI solutions must comply with regulations such as the Health Insurance Portability and Accountability Act (HIPAA) to ensure patient privacy.



III. CONCLUSION

In conclusion, AI has the potential to revolutionize healthcare by improving diagnosis, treatment, and patient care. However, the adoption of AI in healthcare also presents significant challenges related to data privacy, ethical considerations, and regulatory compliance. To ensure the safe and effective deployment of AI in healthcare, it is essential to prioritize data privacy and regulatory compliance, as well as address ethical concerns related to AI.

IV.REFERENCES

[1]. Wang F, Casalino LP, Khullar D. Deep Learning in Medicine-Promise, Progress, and Challenges. JAMA Intern Med 2019; 179:293-4. [Crossref] [PubMed]

[2]. Reddy S, Fox J, Purohit MP. Artificial intelligence-enabled healthcare delivery. J R Soc Med 2019;112:22-8. [Crossref] [PubMed]

[3]. Jiang F, Jiang Y, Zhi H, et al. Artificial intelligence in healthcare: past, present and future. Stroke Vasc Neurol 2017;2:230-43. [Crossref] [PubMed]

[4]. Reddy S, Allan S, Coghlan S, et al. A governance model for the application of AI in health care. J Am Med Inform Assoc 2020;27:491-7. [Crossref] [PubMed]

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Reliable Resource Scheduling in Cloud

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ABSTRACT

We issue to achieve the goal of management multiple virtualization platforms and multiple virtual machine migrations across physical machines without disruption method. This System ensures that load balance when multiple virtual machines run on multiple physical machines. We present a system which is implementation of optimization with Dynamic Resource Allocation dealing with virtualization machines on physical machines. The dynamic results confirmed that the virtual machine which loading becomes too high it will automatically migrated to another low loading physical machine without service interrupt. And let total physical machine loading reaching balance. It is however unclear whether this technique is suitable for the problem at hand and what the performance implications of its use are. We found out that this approach results in a tractable solution for scheduling applications in the public cloud. In the same method becomes much less feasible in a hybrid cloud setting due to very high solve time variances. In the cloud model is expected to make such practice unnecessary by offering automatic scale up and down in response to load variation. It also saves on electricity which contributes to a significant portion of the operational expenses in large data centers. We develop a set of heuristics that prevent overload in the system effectively while saving energy used. It is trace driven simulation and experiment results demonstrate that our algorithm achieves good performance.

Keywords: Cloud Computing, Truthful Approach, Virtual Machine Provision, Dynamic Resource Allocation.

I. INTRODUCTION

Cloud computing is a large-scale distributed computing paradigm in which a pool of computing resources is available to users via the Internet. Computing resources, e.g., processing power, storage, software, and network bandwidth, are represented to cloud consumers as the accessible public utility services. In cloud computing, cloud providers can offer cloud consumers two provisioning plans for computing resources, namely reservation and on-demand plans. In general, cost of utilizing computing resources provisioned by reservation plan is cheaper than that provisioned by on-demand plan, since cloud consumer has to pay to provider in advance. With the reservation plan, the consumer can reduce the total resource provisioning cost. However, the best advance reservation of resources is difficult to be achieved due to uncertainty of consumer's future demand and providers' resource prices[4]. Today, there are more than a hundred million computing devices connected to the Internet and many of them are using cloud computing services daily. According to the IDC"s anticipation,

the SaaS (Software As A Service) market reached $13.1 billion in revenue at 2009 will grow to $40.5 billion by 2014 at a compound annual growth rate (CAGR) of 25.3%. These networked devices submit their requests to a service provider and receive the results back in a timely, manner without the involvement of the service complexity related to information storage and process[7], interoperating protocols, service composition, communications and distributed computation, which are all relied on the network and the backend servers to offer desirable performance. In a cloud computing environment, users can access the operational capability faster with internet application , and the computer systems have the high stability to handle the service requests from many users in the environment. Cloud computing involving distributed technologies[5] to satisfy a variety of applications and user needs. Sharing resources, software, information via internet are the main functions of cloud computing with an objective to reduced capital and operational cost, better performance in terms of response time and data processing time, maintain the system stability and to accommodate future modification in the system. Virtual machine monitors (VMMs) like Xen provide a mechanism for mapping virtual machines (VMs) to physical resources. This mapping is largely hidden from the cloud users. It is up to the cloud provider to make sure the underlying physical machines (PMs) have sufficient resources to meet the needs Testing a Cloud includes availability, security, performance[1][3]], interoperability, disaster recovery and multitenancy testing. Cloud testing are challenged by several problems such as limited test budget, meeting deadlines, High costs per test, large number of test cases, little reuse of tests and geographical distribution of users. The aim of cloud testing is to ensures high quality service delivery and avoiding data outages requires testing inside datacenter or outside the datacenter or in both place. Larger datacenters also mean larger installations with high-speed interfaces and the ability to maintain service availability obligations [6].

II. LITERATURE SURVEY

A. Toward Trustworthy Clouds

Although the cloud offers many performance advantages with respect to both storage and computation, it unfortunately raises many security and privacy exposures. One of the main reasons why businesses and governments still do not store their sensitive data in the cloud is the lack of trust in the service provider. In this paper, we described a number of techniques addressing various security, privacy and dependability challenges in the face of potentially malicious cloud providers and how these techniques can be presented to a customer. At NEC we focus on the performance and functionality covered by these techniques. We have developed space-efficient storage in multi-cloud environments using existing APIs and the most efficient byzantine fault-tolerant distributed storage protocol. We have also developed a highly efficient AONT, and continue to find more efficient solutions to problems such as searchable encryption, access control and verifiable policy enforcement to strengthen our security and dependability portfolio for cloud storage services.

B. Energy-Efficient Management of Data Center Resources for Cloud Computing: A Vision, Architectural Elements, and Open Challenges

This System advances Cloud computing field in two ways. First, it plays a significant role in the reduction of data center energy consumption costs and thus helps to develop a strong, competitive Cloud computing industry. This is especially important in the context of Australia as a recent Frost & Sullivan's report shows that

Australia is emerging as one of the preferred data center hubs among the Asia Pacific countries. Second, consumers are increasingly becoming conscious about the environment. In Australia, a recent study shows that data centers represent a large and rapidly growing energy consumption sector of the economy and is a significant source of CO2 emissions. Reducing greenhouse gas emissions is a key energy policy focus of many countries including Australia. Therefore, we expect researchers world-wide to put in a strong thrust on open challenges identified in this paper in order enhance energy-efficient management of Cloud computing environments.

C. Shamon: A System for Distributed Mandatory Access Control

We developed distributed systems architecture in which MAC policies can be enforced across physically separate systems, thereby bridging the reference monitor between those systems and creating a Shamon. The major insights are that attestation can serve as a basis for extending trust to remote reference monitors and that it is actually possible to obtain effective reference monitor guarantees from a Shamon. This work provides a mechanism and guarantees for building a distributed reference monitor to support distributed applications. In addition, the architecture also enables exploration of MAC, secure communication, and attestation policies and the construction of reference monitors from a set of open-source components. Our bridging architecture enables security policies to be layered based on their complexity, from coarse-grained hypervisor-level policy up to sophisticated application level policy.

III. EXISTING SYSTEM

Existing works on autonomic management systems for virtualized server environments tackle the allocation and placement of virtual servers from different perspectives. Virtual machine monitors (VMMs) like Xen provide a mechanism for mapping virtual machines (VMs) to physical resources. Mapping is largely hidden from the cloud users. Users with the Amazon EC2 service Example do not know where their VM instances runs. It's up to the cloud provider to make sure the underlying physical machines (PMs) have sufficient resources to meet their needs.

Limitations:

- A policy issue remains as how to decide the mapping adaptively so that the resource demands of VMs are met while the number of PMs used is minimized.
- No control over the business assets (data!). The main assets in every company are its data files with valuable customer information.
- Risk of data loss due to improper backups or system failure in the virtualized environment.
- High cost and loss of control.

IV. PROPOSED SYSTEM

We present the design and implementation of an automated resource management system that achieves a good balance between the two goals. We make the following contributions as shown in Fig.1. Overload avoidance: The capacity of a PM should be sufficient to satisfy the resource needs of all VMs running on it. Otherwise, the

PM is overloaded and can lead to degraded performance of its VMs. Green computing: The number of PMs used should be minimized as long as they can still satisfy the needs of all VMs[2]. Idle PMs can be turned off to save energy. We develop a resource allocation system that can avoid overload in the system effectively while minimizing the number of servers used. We introduce the concept of "skewness" to measure the uneven utilization of a server. By minimizing skewness, we can improve the overall utilization of servers in the face of multidimensional resource constraints. We are using clouds for implementations.

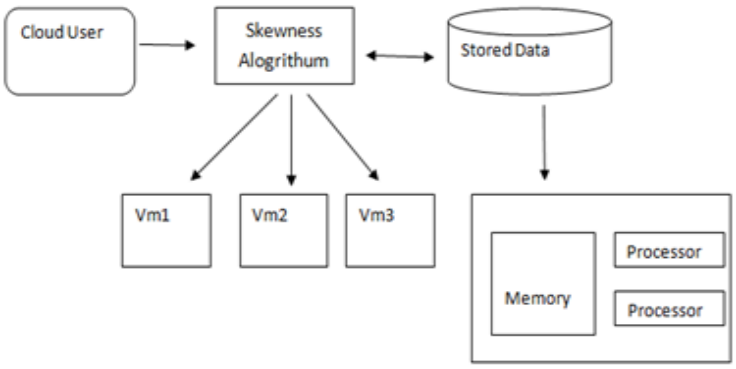

Fig 1. System Architecture

The Proposed System has a many advantages like,

- A flexible, scalable infrastructure management platform has been architected and a prototype implemented
- Measurement of resource usage and end user activities lies hands of the cloud service provider.
- Opaque cost structure due to highly flexible usage of cloud services.
- Stable cost structure.

List of Modules:

- Virtual Machine Creation
- Resource allocation
- Skewness Implementation
- Load Prediction

SKWENESS RESOURCE ALLOCATION ALGORITHM

Cloud computing allows business customers to scale up and down their resource usage based on needs. Many of the touted gains in the cloud model come from resource multiplexing through virtualization technology. The concept of skewness is to measure the unevenness in the multidimensional resource utilization of a server. By minimizing skewness, we can combine different types of workloads nicely and improve the overall utilization of server resources. We aim to achieve two goals in our algorithm:

- Overload avoidance: the capacity of a PM should be sufficient to satisfy the resource needs of all VMs running on it. Otherwise, the PM is overloaded and can lead to degraded performance of its VMs.
- Green computing: the number of PMs used should be minimized as long as they can still satisfy the needs of all VMs. Idle PMs can be turned off to save energy.

The concept of skewness is to quantify the unevenness in the utilization of multiple resources on a server. The skewness algorithm consists of three parts: load prediction, hotspot mitigation, and green computing. Load prediction based on the past external behaviors of VMs. The prediction algorithm plays an important role in improving the stability and performance of our resource allocation decisions.

V. CONCLUSION

We have presented the design, implementation, and evaluation of a resource management system for cloud computing services. Our system multiplexes virtual to physical resources adaptively based on the changing demand. We present a system that uses virtualization technology to allocate data center resources dynamically based on application demands and support green computing by optimizing the number of servers in use. We use the skewness metric to combine VMs with different resource characteristics appropriately so that the capacities of servers are well utilized. Our algorithm achieves both overload avoidance and green computing for systems with multi resource constraints. We have proposed a new strategy that can be included in the Cloud-Analyst to have cost effective results and development and we can conclude from the results that this strategy is able to do so. From the work done, we can conclude that the simulation process can be improved by modifying or adding new strategies for traffic routing, load balancing etc. to make researchers and developers able to do prediction of real implementation of cloud, easily. We develop a set of heuristics that prevent overload in the system effectively while saving energy used. Trace driven simulation and experiment results demonstrate that our algorithm achieves good performance. In the cloud model is expected to make such practice unnecessary by offering automatic scale up and down in response to load variation. It also saves on electricity which contributes to a significant portion of the operational expenses in large datacenters.

VI.REFERENCES

[1]. M.A.Imad, “Toward trust worthy clouds’ Internet scale critical infrastructure,” in Proc. 7th Inform. Security Practice and Experience Conf. LNCS (ISPEC ’11), Berlin, Germany, Jun. 2011, vol. 6672, pp. 73–84, Springer-Verlag.

[2]. R. Buyya, A. Beloglazov, J. Abawajy, Energy-efficient management of data center resources for cloud computing: a vision, architectural elements, and open challenges, in: Proceedings of the 2010 International Conference on Parallel and Distributed Processing Techniques and Applications, PDPTA 2010, Las Vegas, USA, 2010.

[3]. J. M. McCune, T. Jaeger, S. Berger, R. Caceres, and R. Sailer, “Shamon: A system for distributed mandatory access control,” in Proc. IEEE Comput. Soc. 22nd Annu. Comput. Security Applicat. Conf. (ACSAC ’06) , Washington, DC, USA, 2006, pp.23–32.

[4]. I. M. Abbadiand N. Cornelius, “Dynamics of trust in clouds —challenges and research agenda,” in Proc. 6th Int. Conf. Internet Technol. and Secured Trans. (ICITST-2011), Dec. 2011, pp.110–115.

[5]. S. Nuno, P. G. Krishna, and R. Rodrigo, “Towards trusted cloud computing,” in Proc. 2009 Conf. Hot Topics in Cloud Comput. USENIX Association, Berkeley, CA, USA, 2009.

[6]. S. Frederic, F. Andreas, K. Stefan, and E. Claudia, “Improving thes calability of platform attestation,” in Proc. 3rd ACM Workshop on Scalable Trusted Comput. (STC ’08), New York, NY, USA, 2008, ACM.A.

[7]. S. Berger, R. Cáceres, D. Pendarakis, R. Sailer, E.Valdez, R. Perez, W. Schildhauer, and D. Srinivasan, “Tvdc: managing security in the trusted virtual datacenter,” SIGOPS Oper. Syst. Rev., vol. 42, Jan. 2008.

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Exploring The Nature of Dark Matter

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ABSTRACT

I have done studies about the behaviour of dark matter and found that it does not absorb, emit, reflect, or even interact with Electromagnetic radiation but it do interact with Gravity. The -rays coming from the galactic centre has given stronger evidence that there is some other mater that governs the force of gravity. We are finding the correct proofs but still complete evidence yet to be discover for Dark Matter that the empty space comprise of.

Key word - X-ray, galaxy, axion, gravitational lensing, CMB

I. INTRODUCTION

Dark matter research is unsettling. It account for quarter 25% of total energy density. Universe is made of proton neutron electron then how can we fell the presence of other element that only interact with gravity that means there is some matter which binds the galaxies that too 5-6 times the visible matter called as Dark matter. Einstein field theory of relativity (field equation) help to learn more about Dark matter. The primary evidence seen till today is gravitational lensing through which light bent due to a force which is stronger than gravity. So maybe dark matter is a different object we haven't observed at all yet, something called a neutrino is discovered. Since it does not interact with anything so becoming very difficult to detect it. Currently many experiment are going all over the world just to find out evidence for dark invisible substance that is expanding our universe and binding the galaxies.

II. WHY DARK MATTER

Galaxy, stars, planets whatever which we see comprise of just 4% rest all is dark. Ordinary matter has electric charge that's why it is observable and they interact but it's absent in dark matter that's why we can't see them. Since dark matter never observed directly it barely interact with ordinary baryonic matter and radiation Matter and energy distribution in the universe today is divided as:

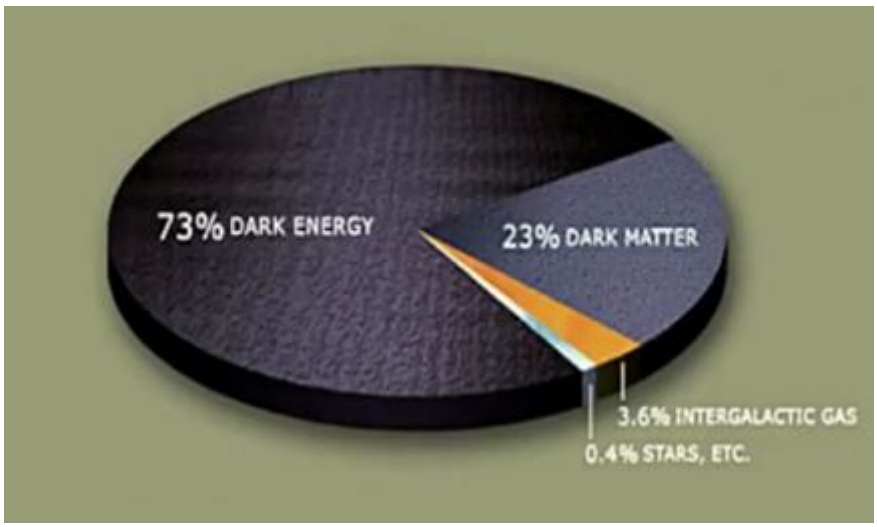

Fig 1 Energy and matter distribution

Fig shows that 95% universe doesn't interact with any electric or magnetic charge hence its dark.

III. EVIDENCE FOR DARK MATTER

A) X-Ray detection

Galaxy collide
↓
Huge cluster build up
↓
X-ray emit
↓
Extra matter is seen
(other than gas)
↓
Centre of mass is separated form centre
↓
This extra matter is Dark matter

If dark matter is made of axion then they should surround sub cluster themselves. Because like the galaxy the cloud of dark matter axion pass through each other and this fig is what exactly where we see lot of matter in violet colour centre on two cluster but this is clearly not the hot gas seen by detector and giving no light i.e. very much look like dark matter. Several other cluster seen showing same behaviour attempts made to explain these without dark matter but in the end the stuff we see is not t h all the stuff there is dark matter.

Fig 2 Optical dark matter X-ray gas

B) The farther the planet or star slower they should rotate due to Newton law of Gravitation there orbital velocities should be decreased but this does not happen as there is some matter that govern make them rotate with the same orbital velocity or sometime larger called as dark matter.

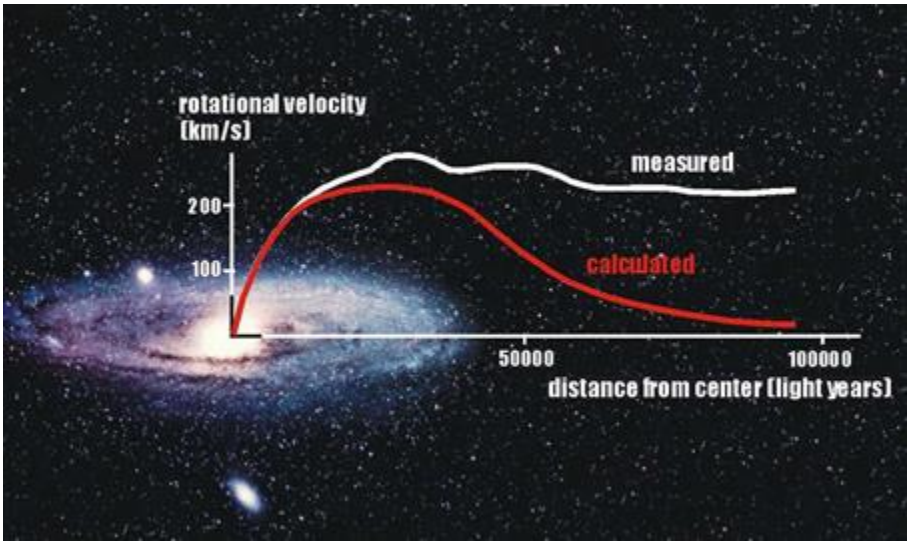

Fig 3 Dark matter orbital velocity curve

C) Big Bang nucleosynthesis.

$\frac{Boron}{Photon} \approx 6 \times 10^{-9}$

In term of mega baron

$\Omega B = \frac{\rho B}{\rho TOTAL} = .04$

Which should be equal to zero. Hence there should be some matter that gives this which is Dark matter which is other than photon neutron and electron.

IV. FUTURE

Once we got the evidence of Dark matter we can upgrade our physics using the new particle generated from it. We can search dark matter using.

a. Large Hadron Collider (LHC) experiments going in LHC at CERN by colliding two particle at speed approx. equal to light to find out new particle.
b. The Large Underground Xenon (LUX) Detector it try to detect dark matter using liquid xenon in Time Protection Chamber.
c. Euclid telescope – launched in oct 2011 to find the depth of physics of dark matter, dark energy till the early universe.

V. CONCLUSION

1. By harnessing Dark matter scientist can learn how to travel faster than speed of light.
2. It will solve the question of our ultimate fate of universe.
3. How and when did dark matter form i.e. we use dark matter to learn what the universe was like a billionth a second after big bang.
4. If hawking radiation is the only thing that escape through black hole then can that be dark matter or dark energy.
5. Once we are able to find the proof of Dark matter we can make them to learn how everything starts.

VI.REFERENCES

[1]. The Dark Matter Mystery by Nassim Bozorgnia
[2]. The 4 Percent Universe by Richard Panek
[3]. In search of dark matter by Ken Freeman
[4]. Dark Matter and Dark Energy: A Challenge for Modern Cosmology
[5]. Particle Physics, Dark Matter and Dark Energy by David Chapple
[6]. DARK MATTER From Wikipedia, the free encyclopedia
[7]. The Invisible Universe: Dark Matter and Dark Energy
[8]. An Introduction to Particle Dark Matter by Stefano Profumo
[9]. Matter, Dark Matter, and Anti-Matter: In Search of the Hidden Universe by A. MAZURE (Ed) and Vincent Le Brun

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A Review on Vibration Analysis and Simulation of Misaligned Shafts

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ABSTRACT

The vibration analysis & mathematical modeling of misaligned shaft by various authors are reviewed in this paper. This paper presents the comparison of the different methodology used by various authors. The objective of present work is to study vibration analysis & mathematical modeling of misaligned shaft.
Motor & shaft has most common applications in many industrial fields. Shaft misalignment is common cause of machinery failure. Perfect Alignment of the driving and driven shafts cannot be achieved in practical applications. If perfect alignment were achieved initially, it could not be maintained over an extended period due to machinery foundation, thermal expansion and contraction, and other similar effects. While misalignment has no measurable effect on motor efficiency, correct shaft alignment ensures the smooth, efficient transmission of power from the motor to the driven equipment. Incorrect alignment occurs when the centerlines of the motor and the driven equipment shafts are not in line with each other. Misalignment produces excessive vibration, noise, coupling, and bearing temperature increases, and premature bearing, coupling, or shaft failure. There are analytical and experimental results on this subject. Shaft misalignment can be divided into two components: offset misalignment, and angular misalignment. Offset (or parallel) misalignment occurs when the centerlines of two shafts are parallel but do not meet at the power transfer point. Angular misalignment occurs when centerline of two shafts intersect at the power transfer point but are not parallel. Often misalignment in actual machinery exhibits a combination of both types of misalignment.

Keywords: Rotor Shaft, Misalignment, Vibration Analysis, Structural analysis, Conditioning & monitoring.

I. INTRODUCTION

José M. Bossio, Guillermo R. Bossio and Cristian H. De Angelo(2009) described the problem of angular shaft misalignment in motors. The load system coupled through flexible couplings is analyzed in this work. A model for the analysis and diagnosis of angular misalignment in induction motors is presented. It allows studying the angular shaft misalignment effects over the motor torque, instantaneous power and currents through dynamic simulation. Additional effects introduced by the mixed eccentricity produced by the shaft misalignment are also analyzed through experiments. The results show that angular misalignment can be detected from electrical

motor variables, but its correct diagnosis is difficult. The study is completed by vibration and thermography analysis.

The author has concluded that the angular misalignment produces oscillations o torque and speed. A motor working under the misalignment of a shaft undergoes perturbation frequency that doubles that of rotation. Such perturbations due to misalignment are produced by the previously mentioned oscillation. In the similar way oscillation effects are also observed on the instantaneous active power consumed by the motor. For a three phase motor at constant load by the motor is constant but due to the misalignment angle, the instantaneous active power undergoes perturbations at the misalignment frequency. The effect of angular misalignment on the current spectrum shows to sidebands around the fundamental component [01].

Vaggeeram Hariharan and PSS Srinivasan(2011) has done experimental studies on a rotor dynamic test apparatus to predict the vibration spectrum for shaft misalignment. A self-designed simplified 3–pin type flexible coupling was used in the experiments. Vibration accelerations were measured using dual channel vibration analyzer for baseline and the misalignment condition. The experimental and numerical frequency spectra were obtained. The experimental predictions are in good agreement with the numerical results. Both the vibration spectra show that misalignment can be characterized primarily by 2X shaft running speed. However, misalignment is not close enough to one of the system natural frequency to excite the system appreciably. Therefore, in some case the misalignment response is hidden and does not show up in the vibration spectrum. The misalignment effect can be amplified, and a high acceleration level at 2X shafts running speed is pronounced in the frequency spectrum.

The rigid and pin type flexible coupling with shaft parallel misalignment is simulated and studied using the both experimental investigation and simulation. Finally the author other concluded that experimental and simulated frequency spectra are similar, the experimental predictions are in good agreement with the ANSYS results. Both the experiment and simulation results prove that misalignment can be characterized primarily by second harmonics (2X) of shaft running speed. He also found that by using new newly designed flexible coupling, the vibration amplitudes due to the shaft parallel misalignment are found to reduce by in percentage [02].

Piotrowski. J. (2006) described importance of misalignment phenomenon as Industry worldwide is losing billions of dollars a year due to misalignment of machinery. The heart and soul of virtually every industrial operation pivots on keeping rotating machinery in good working order. Countless processes are dependent on the successful operation of rotating machines that produce electric power, fuels, paper, steel, glass, pharmaceuticals, the food we eat, the clothes we wear, the buildings we live and work in, and the vehicles that transport us across the surface of the Earth. Just about everything you see around has somehow been influenced by rotating machinery of some kind. The primary objective of accurate alignment is to increase the operating life span of rotating machinery. To achieve this goal, machinery components that are most likely to fail must operate well within their design limits. As the parts that are most likely to fail are the bearings, seals, coupling, and shafts, the accurately aligned machinery will reduce excessive axial and radial forces on the bearings to insure longer bearing life and rotor stability under dynamic operating conditions. Precise alignment will reduce the possibility of shaft failure from cyclic fatigue; it will minimize the amount of wear in the coupling components, alleviate the amount of shaft bending from the point of power transmission in the coupling to the

coupling end bearing, and it will maintain proper internal rotor clearances. In a nutshell, accurate alignment will do nothing, but the good things and the key part of making this happen centers on the people who are responsible for installing, troubleshooting, maintaining, and operating this machinery.

Despite popular belief, misalignment can disguise itself very well on industrial rotating machinery. He observed that the secondary effects of misalignment as it slowly damage the machinery over long periods of time. Some of the common symptoms of misalignment are as follows:

1. Premature bearing, seal, shaft, or coupling failures.
2. Elevated temperatures at or near the bearings or high discharge oil temperatures.
3. Excessive amount of lubricant leakage at the bearing seals.
1. 4. Certain types of flexible couplings will exhibit higher than normal temperatures when running or will be hot immediately after the unit is shut down. If the coupling is an elastomeric type, look for rubber powder inside the coupling shroud.
4. Similar pieces of equipment seem to have a longer operating life.
5. Unusually high number of coupling failures or they wear quickly.
6. The shafts are breaking (or cracking) at or close to the inboard bearings or coupling hubs.
7. Excessive amounts of grease (or oil) on the inside of the coupling guard.
8. Loose foundation bolts, typically caused by a "soft foot" condition, are exacerbated by misalignment.
9. Loose or broken coupling bolts. This is frequently due to improperly torquing the coupling bolts and aggravated by a misalignment condition.

Without a doubt, the greatest loss of revenue attributable to misalignment is due to loss of production. If a piece of machinery fails, then whatever it was producing stops and so does the revenue it was making, which then leads to the second largest amount of financial loss. Now that the machine broke, new parts have to be purchased and someone has to be paid to repair or completely replace the defective components or the entire unit. As production is lost, there is a tendency to rush the installation process, frequently sacrificing the time needed to perform an accurate alignment of the machinery. And the degradation process starts a new.

A large percentage of industrial plants do not understand how bad their misalignment problems are. Conservatively more than half of all the equipment operating today exceeds 4 mils / in. of misalignment when it is running. Disappointingly the vast majority of plant sites cannot produce the alignment records for every piece of rotating machinery they operate. Even in facilities where a good preventive and predictive or condition-based maintenance (CBM) program exists, typically there are 100 times more data collected on vibration, temperature, oil analysis, and motor current than on machinery alignment. The vast majority of people who measure vibration and other data have received incorrect technical information about what symptoms occur on misaligned machinery, frequently resulting in an incorrect analysis of the problem. Additionally, the same people are usually not the ones doing the alignment work, so communication gets scrambled between the people identifying the problem, the people assigning the work, and the people actually doing the work [03].

M. LI, and L. YU (2001) found that misalignment of a gear coupling in a multi rotor system is an important problem; it can cause various faults. In this work the non-linear coupled lateral torsional vibration model of rotor-bearing-gear coupling system is developed based on the engagement conditions of gear couplings. From

the theoretical analysis author concluded that the forces and moments acting on gear couplings due to the initial misalignment are from the inertia forces of the sleeve and the internal damping between the meshing teeth, and depend on the misalignment, internal damping, the rotating speed, and the structural parameters of the gear coupling.

Theoretical analysis also shows that the forces and moments acting on gear couplings due to the initial misalignment are from the inertia forces of the sleeve and the internal damping between the meshing teeth. The amplitudes of the steady state vibration of the system are related to the misalignment, internal damping, the rotating speed, and the structural parameters of the gear coupling [04].

A.W. Lees (2007) described that misalignment of multi bearing rotor systems is one of the most common fault conditions yet it is still not fully understood. There are numerous (and sometimes confusing) accounts in the literature asserting the presence of harmonics in the vibration signal, but no quantitative descriptions are offered. Harmonics may arise, of course, from the nonlinearities in fluid film journal bearings or from the kinematics of flexible couplings, but in this paper only rigidly coupled rotors mounted on idealized linear bearings are considered.

The important feature shown in this work is a cross-coupling between torsional and flexural vibration. Furthermore this cross-coupling applies equally to torque oscillations generated by the coupling itself or from elsewhere in the machine. Not surprisingly the consequences in terms of vibration are significantly more onerous when the coupling is faulty. Note that the degree of excitation and twice rotational speed is increased markedly. Whilst the synchronous term also increases, this will normally be eliminated by trim balancing. Hence, it is the absolute value of the twice pre revolution term, which is important rather than its relationship to the synchronous excitation. It has commonly been assumed that harmonics of shaft speed arise from nonlinearities of the system, in most cases emanating from the bearings, but in reality it appears the situation is somewhat more complex. In the analysis offered here, it is shown that a purely linear model can generate harmonics. The harmonic terms in the response arise from geometric nonlinearities of the motion. In a real system there will, in addition, be nonlinear components which may either enhance or diminish the excitation of response at multiples of shaft speed. Perhaps it is this multiplicity of sources, which imposes some variability on the nature of responses of misaligned machines, and may help to explain why this prominent machine fault is still not fully understood. The models presented in this paper are clearly highly idealized and merely chosen in an attempt to understand the basic mechanisms. Work is currently in hand to formulate these concepts into a form for inclusion into an FE model of a real machine. This will be reported in the near future. In a real machine the situation is somewhat more complicated and torque will be transmitted partially by interfacial friction. Only a detailed model of the coupling can help resolve this issue. Such a detailed model will also be required to establish the appropriate ‘bolt stiffness’ term required to yield a realistic model of a given coupling. There are numerous sources of harmonic response in a real machine. The purpose of this paper, albeit with simplified models, is to illustrate one source of excitation in misaligned rotors with rigid couplings [05].

Arun Kr. Jalan, A.R. Mohanty (2009) described that vibration monitoring is one of the primary techniques of condition monitoring of rotating machines. Shaft misalignment and rotor unbalance are the main sources of vibration in rotating machines. In this work a model based technique for fault diagnosis of rotor–bearing system is described. Using the residual generation technique, residual vibrations are generated from experimental

results for the rotor bearing system subject to misalignment and unbalance, and then the residual forces due to presence of faults are calculated. These residual forces are compared with the equivalent theoretical forces due to faults. The fault condition and location of faults are successfully detected by this model based technique.

Vibration data for healthy (without misalignment and unbalance) as well as with parallel misalignment in horizontal direction and angular misalignment with horizontal axis is taken for this analysis. The author concluded that the amplitudes of displacement, velocity and acceleration are increases due to effect of misalignment (for both parallel and angular). Now, to identify the fault, residual force (introduced due to misalignment) are calculated and compared with numerical model force and the residual forces, for both experimental and numerical, in horizontal and vertical direction for the system without misalignment, with parallel misalignment and with angular misalignment are nearly equal.

This method has thus demonstrated the model based fault detection system for a simple rotor–bearing system. This method may be useful for large systems like in turbine shafts, gearboxes and the like. Such a method has enormous potential in are automated diagnostics process where by the measurement of the responses, the fault condition and location can be detected. Then by simple measurement of the radial vibration alone and applying the proposed model based technique, faults of rotor–bearing system can easily be identified [06].

J.K. Sinha, M.I. Friswell and A.W. Lees, (2004) found out, earlier studies have suggested that the reliable estimation of the state of unbalance (both amplitude and phase) at multiple planes of a flexibly supported rotating machine from measured vibration data is possible using a single machine run-down. This paper proposes a method that can reliably estimate both the rotor unbalance and misalignment from a single machine run-down. This identification assumes that the source of misalignment is at the couplings of the multi-rotor system, and that this will generate constant synchronous forces and moments at the couplings depending upon the extent of the off-set between the two rotors, irrespective of the machine rotating speed. A flexible foundation model is also estimated. The method is demonstrated using experimental data from a machine with two bearings and a flexible coupling to the motor. A sensitivity analysis has also been carried out for the proposed approach with perturbation errors in the rotor and bearing models, to confirm the robustness of the method.

A method to estimate both the rotor unbalance (amplitude and phase) and the misalignment of a rotor–bearing–foundation system has been presented. The estimation uses a priori rotor and bearing models along with measured vibration data at the bearing pedestals from a single run- down or run-up of the machine. The method also estimates the frequency-band-dependent foundation parameters to account for the dynamics of the foundation. The suggested method has been applied to a small experimental rig and the estimated results were excellent. Hence the proposed method seems to be robust and gives reliable estimates of the rotor unbalance and misalignment [07].

Mohsen Nakhaeinejad and Suri Ganeriwala (2009) investigated dynamic effects of angular and parallel misalignments in rotating machinery on machine behavior. Different levels of angular and parallel misalignments were applied to the SpectraQuest Machinery Fault Simulator™ (MFS) rigid, rubber and helical beam couplings. For each case, shaft speed, motor and bearings vibrations, and bearing forces were measured. Forces and vibration signals were studied in time and frequency domain. Results indicate strong effect of coupling stiffness on vibrations and forces. Severe parallel and angular misalignments can generate low

frequency modulations in vibration signals. Also, axial forces due to misalignment were observed in angular and parallel misalignments. Misalignments in rotating machinery can generate bearing forces and excessive vibrations causing machine faults. Time-domain analysis of vibrations and forces is a useful tool for misalignment diagnosis. Bearing housing forces are very sensitive to the type and level of misalignments. Also, stiffness and structural design of the coupling can change the forces and vibrations significantly. Results suggested vibrations and forces of a machine with rigid coupling to be more sensitive to the parallel misalignments than angular misalignments. Regarding the axial forces, higher forces with more variations can be generated in a misaligned rotor coupled with a helical beam coupling than rigid coupling. Investigating axial forces in frequency-domain reveals significant 3X and 5X harmonics for angular and 3X and 6X harmonics for parallel misalignments [8].

Jin Wook Heo and Jintai Chung (2004) described that the dynamic characteristics and responses of a flexible rotating disk are analyzed, when the disk has angular misalignment that is defined by the angle between the rotation and symmetry axes. Based on the von Karman strain theory and the Kirchhoff plate theory, three equations of motion are derived for the transverse, radial and tangential displacements when the disk has angular misalignment. The derived equations are fully coupled partial differential equations through the transverse, radial and tangential displacements. In particular, the equation of transverse motion is non-linear while the others are linear. After these partial differential equations and the associated boundary conditions are transformed into a weak form, the weak form is discretized to a non-linear matrix–vector equation by using the finite element method. The non-linear equation is linearized in the neighbourhood of a dynamic equilibrium position, and then the natural frequencies and mode shapes are computed. In addition, the dynamic time responses are obtained by applying the generalized-a method. The effects of angular misalignment on the natural frequencies, the mode shapes and the dynamic responses are investigated. The analysis shows that the angular misalignment causes the natural frequency split and the out-of-plane mode with only one nodal diameter and no nodal circle has the largest frequency split. It is also found that the angular misalignment yields the amplitude modulations in the transverse, radial and tangential dynamic responses.

The dynamic characteristics and responses are analyzed for the rotating disk with angular misalignment. The equations of motion for the disk are derived considering the rotating speed and acceleration. The derived equations are fully coupled equations between the transverse, radial and tangential displacements. The equation of transverse motion is a non-linear partial differential equation while the equations of radial and tangential motions are linear partial differential equations. After the equations of motion and the associated boundary conditions are transformed into the weak form, the non-linear matrix–vector equation is derived by using the finite element method. Based on the equation linearized around the equilibrium position, the effects of angular misalignment on the natural frequencies and mode shapes are analyzed.

The .author has concluded about the analysis for the natural frequencies and the mode shapes can be summarized as follows:

1. For all the out-of-plane modes with the nodal diameter, the natural frequency is split into two if the rotating disk has angular misalignment.
2. The amount of frequency split increases with the rotating speed as well as the angular misalignment.

On the other hand, the analysis for the non-linear dynamic responses yields the following results:

1. When the rotating disk has angular misalignment, the transverse, radial and tangential dynamic responses demonstrate the amplitude modulation.
2. When the rotating speed is constant, the transverse response for the disk without angular misalignment oscillates about a zero displacement while the response for the disk with misalignment oscillates about a non-zero one.
3. Regardless of the amount of angular misalignment, the vibration periods and the vibration amplitudes decrease with the rotating speed [09].

G.R. Rameshkumar, B.V.A. Rao, K.P. Ramachandran(2012) decribed, shaft misalignment in rotating machinery is one of the major industrial concerns. When the power supply to any rotating system is cut-off, the system begins to lose the momentum gained during sustained operation and finally comes to rest. The exact time period between the power cut-off time and the time at which the rotor stops is called Coast Down Time. In this paper an experimental study was conducted to investigate the effect of angular misalignment in forward curved centrifugal blower test setup. Tests were conducted for various level of angular misalignment at different shaft cut-off speeds. The results show that the coast down time decreases with increase in level of angular misalignment. At higher speed and at higher level of angular misalignment, the impact on percentage reduction in CDT is very high and there is a specific correlation between the percentage reduction, cut-off speeds and the level of introduced angular misalignment. The vibration signatures acquired at different cut-off speeds and at the various level of angular misalignment conditions. The 2X and 3X vibration amplitude components are predominant frequencies and increase as the angular misalignment and shaft rotational speed increases, thereby establishing the fact that the CDT analysis can be used as one of the diagnostic condition monitoring parameter for rotating machinery.

In the present experimental investigation the effect of angular misalignment was studied for different levels of angular misalignment introduced. The baseline CDTs were recorded for different running speeds under normal operating conditions, and are then used as reference for analysis. The CDT decreases as angular misalignment increases, the percentage reductions in CDT, which increases with increase in angular misalignment and rotational cut-off speeds. There is a specific correlation between the reduction percentage in CDT and the level of angular misalignment with rotational speed. This experimental investigation technique provides a simple method of evaluating the effect of angular misalignment on forward curved centrifugal blower using coast down time analysis and shown great potential to use this technique to predict mechanical malfunction. In comparison with vibration analysis, the 2X and 3X vibration amplitude components are gradually increases with increase in angular misalignment and shaft rotational speed. During the course of time, by frequent monitoring of the rotating system and recording the CDT values for selected operating speeds and the corresponding percent reductions in CDT is done. If any variations in the baseline CDT and the obtained CDT values and the corresponding increase in CDT reduction percentage, one can detect, predict and assess the severity of angular misalignment. The traditional vibration analysis is performed along with CDT analysis to identify the angular misalignment, find the root cause and further corrective action can be initiated to avoid serious damage and machinery failure. The industrial case study presented demonstrates how a CDT can be used as a monitoring tool to detect the shaft misalignment fault. This gives supports to the earlier findings that the shaft misalignment fault have an effect on CDTs i.e., CDT value decreases with increase in mechanical

faults. Therefore it proves that CDT could be used as a diagnostic parameter in condition monitoring of industrial rotating machinery[10].

Alok Kumar Verma, Somnath Sarangi and M.H. Kolekar(2013) inspects the misaligned of shaft by using diagnostic medium such as current and vibration. Misalignments in machines can cause decrease in efficiency and in the long-run it may cause failure because of unnecessary vibration, stress on motor, bearings and short-circuiting in stator and rotor windings. In this study, authors investigate the onset of instability on a shaft mounted on journal bearings. Shaft displacement and stator current samples during machine run up under misaligned condition are measured, analyzed and presented here. Verification of shaft alignment is done by precision laser alignment kit. Result shows that misalignment is the parameter that is more responsible for the cause of instability.

In this paper, variation in the displacement of shaft and current samples for the study of misalignment and unbalance of shaft instability in journal bearings is presented using a spectraquest machine fault simulator. Variation in rotor displacement and stator current samples during machine run up under loading condition were measured, analyzed and presented. Misalignment of shaft and especially unbalance appears in both test conducted and harmonics of both the test are also observed. These can be identified easily in the dB scale plot. Some other vibrations components occur with this experiment were also observed and the reason for these vibration components is needs to be investigated in the future study [11].

Ferrando Chacon, Estefania Artigao Andicoberry, and Vassilios Kappatos (2014) describes, shaft angular misalignment (SAM) is a common and crucial problem in rotating machinery. Misalignment can produce several shortcomings such as premature bearing failure, increase in energy consumption, excessive seal lubricant leakage and coupling failure. Vibration analysis has been traditionally used to detect SAM; however, it presents some drawbacks i.e. high influence of machine operational conditions and strong impact of the coupling type and stiffness on vibration spectra. This paper presents an extensive experimental investigation in order to evaluate the possibility of detecting SAM, using acoustic emission (AE) technique. The test rig was operated at under different operational conditions of load and speed in order to evaluate the impact on the AE and vibration signature under normal operating conditions. To the best of the author's knowledge, this is the first attempt to use AE for the detection of SAM under varying operational conditions. A comparative study of vibration and AE was carried out to demonstrate the potentially better performance of AE. The experimental results show that AE technique can be used as a reliable technique for SAM detection, providing enhancements over vibration analysis.

In this work, the detectability of SAM using AE technique and vibration analysis with variable operating conditions has been presented. This is the first attempt to evaluate the detection of SAM using AE technique with varying operational conditions. The shaft

displacement detected with proximity sensors has been compared with vibration analysis and AE technique. AE combined with envelope analysis has shown the capability and reliability to detect SAM. Vibration analysis has been traditionally used to detect misalignment fault in rotating machinery. However, this paper shows that AE offers more reliability and stability and higher SNR in the detection of SAM under varying operational conditions. However, the authors suggest further experiments assessing the impact on the AE envelope spectra for varying misalignment severity. It is worth noting that although the proximity sensor signals show that the

shaft displacement keeps nearly constant with changing load and speed, the impact of load and speed in AE and particularly in vibration signals is rather high. Nonlinear correlation between the different techniques can be observed in the results shown in this investigation. Although this investigation was carried out for SAM detection, any other type of rotor dynamic faults such as unbalance and looseness could be detected using the proposed method since they also cause a periodic displacement of the shaft. The application of the proposed method to other types of rotor dynamic faults would be an interesting subject for further investigations [12].

II. METHOD OF ANALYSIS

Methodology

1. Simulation (Finite Element Analysis)

Rotor shaft and couplings will be modeled using Creo Parametric 2.0 with the exact dimensions which will be used in the experimental setup. The model will be imported to ANSYS software. Using ANSYS meshing, analysis is carried out. The dimensions and the material properties will used as per given in [02]. Coupling is also modeled and analyzed. The misaligned shaft system is run for a few minutes before measuring the vibration signals. These vibration signals are measured at different speeds at non-drive end.

2. Vibration Measurements (Using FFT Analyzer)

A FFT analyzer is used to measure vibrations developed in the shaft due to given misalignment and varying the speed of rotation. Before creating the misalignment, the shaft is checked for alignment. To do this, the two dial gauge method is used to make perfect alignment. First, two shafts are connected by rigid coupling and bolts. The misaligned shaft system is run for a few minutes before measuring the vibration signals. These vibration signals are measured at different speeds at non-drive end.

3. Validations

The validation will be done by comparing the results of 1.1 & 1.2. The results obtained will be used for prediction of failure of system due to combined misalignment of shaft.

III. CONCLUSIONS

In my literature review I have studied near about 30 research papers and research papers. Out of that I selected 12 papers which are most relevant to my work.

From the literature it is clearly understood that misalignment produces significant vibration levels in the system. The number of papers have gives the methods to measure misalignment of system either theoretically or experimentally. The few papers gave the effect of misalignment either parallel misalignment or angular misalignment on the component of rotary system. Few papers have explained effect of parallel misalignment and few papers explain the effect of angular misalignment. But apart from this combined misalignment is also present in the rotary system. Nobody has worked on this topic. So in my project work, vibration analysis of combined misaligned shafts will be done and its effect on the system in order avoid future failure of the system.

IV.REFERENCES

[1]. José M. Bossio, Guillermo R. Bossio, Cristian H. De Angelo, "Angular Misalignment in Induction Motors with Flexible Coupling". Industrial Electronics, 2009. IECON '09. 35th Annual Conference of IEEE.

[2]. Vaggeeram Hariharan and PSS.Srinivasan "Vibration analysis of parallel misaligned shaft with ball bearing system" Songklanakarin Journal of Science and Technology 33 (1), 61-68, Jan. - Feb. 2011

[3]. Piotrowski, J. 2006. Shaft Alignment Handbook. 3rd edition.M. Dekker, Inc. New York, U.S.A.

[4]. M. LI, and L. YU , "Analysis of the coupled lateral torsional Vibration of a rotor-bearing system with a misaligned gear coupling", Journal of Sound and vibration (2001) 243(2), 283}300 doi:10.1006/jsvi.2000.3412.

[5]. A.W. Lees, "Misalignment in rigidly coupled rotors", Journal of Sound and Vibration 305 (2007) 261–271

[6]. Arun Kr. Jalan, A.R. Mohanty, "Model based fault diagnosis of a rotor–bearing system for misalignment and unbalance under steady-state condition", Journal of Sound and Vibration 327 (2009) 604–622.

[7]. J.K. Sinha, M.I. Friswell and A.W. Lees, "Estimating unbalance and misalignment of a flexible rotating machine from a single run-down", Journal of Sound and Vibration 272 (2004) 967–989.

[8]. Mohsen Nakhaeinejad and Suri Ganeriwala, "OBSERVATIONS ON DYNAMIC RESPONSES OF MISALIGNMENTS", Tech Note, SpectraQuest Inc. (Sep. 2009)

[9]. Jin Wook Heo and Jintai Chung, "Vibration analysis of a flexible rotating disk with angular misalignment", Journal of Sound and Vibration 274 (2004) 821–841

[10]. G.R. Rameshkumar, B.V.A. Rao, K.P. Ramachandran, "Coast Down Time Analysis to Analyze the Effect of Misalignment in Rotating Machinery", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-1, Issue-4, April 2012

[11]. Alok Kumar Verma, Somnath Sarangi and M.H. Kolekar, "Shaft Misalignment Detection using Stator Current Monitoring", International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online): 2277-7970) Volume-3 Number-1 Issue-8 March-2013

[12]. Juan Luis Ferrando Chacon, Estefania Artigao Andicoberry, and Vassilios Kappatos, "Shaft angular misalignment detection using acoustic emission", Applied Acoustics 85 (2014) 12–22, _ Elsevier Ltd.

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A Review on Narrow Track Cars with Auto-Tilting Mechanism

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ABSTRACT

As there is an increased tendency of rolling in narrow track cars, there is need of making such a tilting mechanism that must be able to increase the stability of a vehicle along with the comfort of passenger. The primary objective is to provide banking to a car for overcoming the unbanked turns to run at high speed. The central front suspension has been utilized for having proper vehicle stability. This vehicle has the ability of minimizing rolling tendency of a narrow track car by implementing an auto-tilting mechanism which improves the vehicle handling with better comfort to the travellers due to reduced rolling tendency with banking to the car.

Keywords: Auto-Tilting Car, Car Banking, Narrow Track Structure, Central Front Suspension, High Comfort Level.

I. INTRODUCTION

In today's world, a few automotive manufacturers are manufacturing narrow track cars along with the prototypes for reducing the problem of parking and congestion of traffic. But, there is a need of electrification of these cars for having a better future with an auto-tilting mechanism.
An auto-tilting car has the ability of tilting to an angle so as to provide banking to car on an unbanked turn for running at high speed. The principle of the tilting mechanism consists of a motor turning the back lyre and tilting the chassis which leads the front lyre.[1]

Figure 1: Three-wheeled Narrow Track Vehicle [11]

In the present work, an effort has been made for studying the design of tilting mechanism and developments in the fabrication of narrow track cars. This mechanism assists the car for tilting into any curve during negotiation. This mechanism of tilt improves the speed of car while tackling even any sharp curve. The present mechanism also advances the comfort of passenger and handling of vehicle.

II. OBJECTIVE OF THE STUDY

The basic objective of this paper is to study the design of tilting mechanism and developments in the fabrication of narrow track cars for reducing the rolling tendency on sharp curves.
This study describes the banking offered to the car on unbanked turns for running the vehicle at a high speed than that of present narrow track cars with an increase in passenger comfort by improving handling.

III. LITERATURE REVIEW

Salim Maakaroun [1] et al. presented a paper for discussing the geometric depiction of the tilting mechanism in a car.
J. Gohl [2] et al. explained and described the modelling and control of a narrow tilting car with advanced mechanisms for conquering the sharp curves at low speed.
T. K. Garrett [3], K. Newton, W. Steeds explained all types of suspension systems used in hatchbacks, sedans and sports utility vehicles for running on different terrains whether on-road or off-road conditions.
George Murray [4], Charles V. White, Wolfgang Weise described the properties of all materials along with the structural details of crystalline solids for the proper selection of material for making an auto-tilting mechanism for narrow track cars.
Jörnsen Reimpell [5], Helmut Stoll, Jürgen W. Betzler described all types of suspension systems along with the drivetrains with the steering mechanism to provide better control in a narrow-track car during a sharp curve on an unbanked road.
Heinz Heisler [6] explained the suspension systems for better comfort, steering systems for better handling and braking system for better control of a car on uneven road surfaces and unbanked curves.
David A. Crolla [7] described the suspension systems deeply with the implementation of suspension system in any vehicle as per the road surface with better steering control by using specific type of steering system and braking system in a car.
S. Srinivasan [8] summarized all types of suspension systems used in different vehicle applications and described all the steering mechanisms to provide better control of the vehicle on the road.
Jack Erjavec [9] explained and illustrated automotive suspension systems in detail and described the maintenance of the suspension as well as braking system with full control on sharp curves at a high speed with a typical automobile.
R. B. Gupta [10] described the basic concepts of suspension system for all on-road and off-road vehicles with the servicing steps and better control of steering system and braking system.

Shankar Indran [11] et al. explained and developed a tilting mechanism for a narrow track car to give it the flexibility of a motorcycle.

Vyom Bhushan [12] et al. designed and fabricated auto-tilting mechanism for a narrow track car.

IV. METHODOLOGY

The primary component of narrow track car for implementing auto-tilting mechanism is suspension system. The central front suspension has been implemented for providing better vehicle stability to improve the level of comfort for the passenger sitting inside the vehicle during a sharp turn. It permits and allows the vehicle for swaying during cornering. It provides a high centre of gravity for allowing the vehicle to have a sway motion to occur inactively.

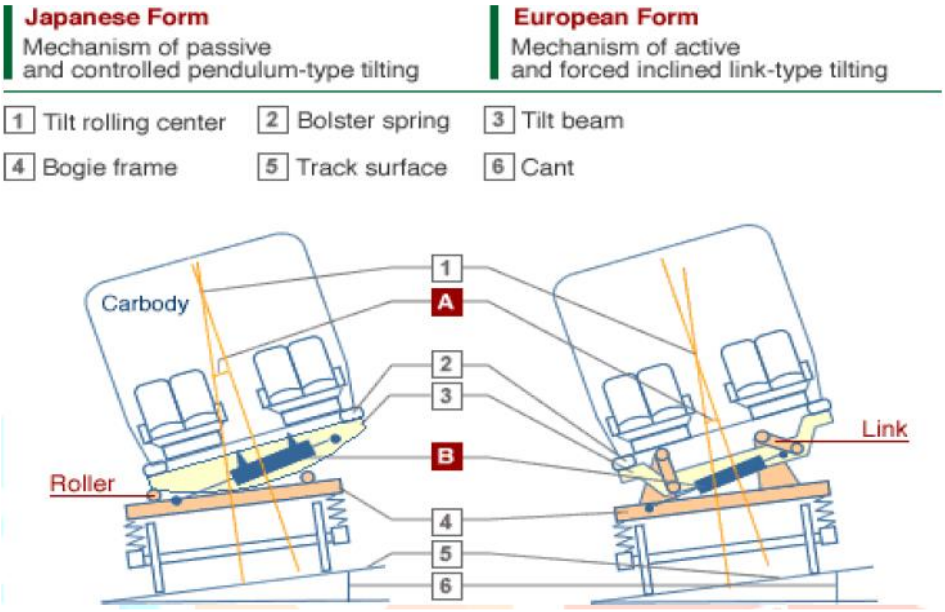

Figure 2: Japanese Tilting Mechanism [11]

The geometry of the suspension linkages guides the relative angle between vehicle body and the wheels. The relative angle may be altered by controlling the length of vertical linkage. The angle of tilt of any vehicle varies from 11º to 13º.

V. DESIGN STUDY OF THE MODEL

The designs under the study have a lot of scientific applications of scientific with technical information and high level of imagination for a new and enhanced mechanism for a vehicle for performing a particular task with the maximum economy and efficiency. In present available designs, the modelling of model of the auto-tilting mechanism has been performed in CATIA and NX-CAD softwares.

Figure 3: F 300 Life-Jet front cornering view [2]

Most of the reliable designs have a triangular structured frame for maintaining vehicle stability vehicle during a sharp turn at a high speed with the designed auto-tilting mechanism. This system has been equipped with a central steering along with the central suspension system for maintaining the stable speed of car without losing the control on the sharp turn at higher speeds.

VI. FABRICATION STUDY OF THE MODEL

The most preferred models fabricated by the researchers have a triangular structured frame with the coil spring suspension system, steering system with a comfort grip wheel along with an independent supporting frames for upper and lower suspension systems. This triangular structured frame upholds the weight distribution of the car. The central suspension has been implemented for minimizing the stability loss over the vehicle with an increase in handling of the vehicle that enhances the passenger comfort. The central steering system tilts the vehicle by applying less effort on the suspension system and the steering ratio can be preserved to control the vehicle speed on any sharp turn.

VII. WORKING STUDY OF THE MECHANISM

Consider the vehicle is taking a right turn.

- First, the steering wheel is rotated to the right.
- The wheels also rotate to the right.
- The front suspension linkage moves to the right side.
- The steering column tilts to the right side as a result.
- Finally, the right half section of lower wishbone goes downside and the left half section of lower wishbone uplifts.

VIII. ADVANTAGES

The main advantages:

- This system reduces the vehicle rolling in the narrow track cars on sharp turns.
- The present system offers banking to the vehicle on unbanked turns for running the car at a high speed.
- It improves the comfort of passenger inside the vehicle.
- It enhances the handling of the vehicle on the sharp turn.

IX. CONCLUSION

The design of enhanced auto-tilting mechanism for narrow track cars has been studied This system minimizes the tendency of rolling of the vehicle especially on sharp turns and offers banking to the vehicle on unbanked turns for running at a high speed than that of present narrow track cars. It also improves the comfort of passenger by enhancing the vehicle stability. It enhances the handling of the vehicle on sharp turns by the implementation of central steering and central suspension system which boosts auto-tilting ability of the vehicle.

X. FUTURE ENHANCEMENT

The electric auto-tilting car having narrow track can be developed for today's world. The solar panels can also be implemented at the top of the roof of vehicle for charging itself from direct sunlight.
Further, the vehicle may also be equipped as fuel cells to have zero emissions.

XI. REFERENCES

[1]. Salim Maakaroun, Wisama Khalil, Maxime Gautier, Philippe Chevrel, "Geometric model of a narrow tilting car using robotic formalism", 15th International Conference on Methods and Models in Automation and Robotics, August 2010, Miedzyzdroje, Poland, paper 9011, 2010.

[2]. J. Gohl, R. Rajamani, P. Starr, L. Alexander, "Development of a novel tilt-controlled narrow commuter vehicle", Final Report, Intelligent Transportation Systems Institute, Department of Mechanical Engineering, University of Minnesota, May 2006.

[3]. T. K. Garrett, K. Newton, W. Steeds, "The Motor Vehicle", Butterworth Heinemann, Thirteenth Edition, New Delhi, 2001.

[4]. George Murray, Charles V. White, Wolfgang Weise, "Introduction to Engineering Materials", CRC Press, Second Edition, Boca Raton, 2012.

[5]. Jörnsen Reimpell, Helmut Stoll, Jürgen W. Betzler, "The Automotive Chassis: Engineering Principles", Butterworth Heinemann, Second Edition, Great Britain, 2001.

[6]. Heinz Heisler, —Advanced Vehicle Technology", Butterworth Heinemann, Second Edition, Great Britain, 2002.

[7]. David A. Crolla, —Automotive Engineering – Powertrain, Chassis System and Vehicle Body", Elsevier-Butterworth Heinemann, First Edition, United States of America, 2009.

[8]. S Srinivasan, —Automotive Mechanics", Tata McGraw Hill Education Pvt. Ltd., Second Edition, New Delhi, 2012.

[9]. Jack Erjavec, —Automotive Technology", Delmar Cengage Learning, Fifth Edition, United States of America, 2010.

[10]. R. B. Gupta, —Automobile Engineering", Satya Prakashan, Fifth Edition, New Delhi.

[11]. Shankar Indran, S. Murugan, C.Aravind, Monik Jeffrin, "Design of a Tilting Mechanism for a Narrow Tilting Car to Increase the Maximum Speed in Curves", International Journal of Creative Research Thoughts (IJCRT), Volume 9, Issue 4, April 2021, pp. 639-669.

[12]. Bhushan, Vyom, Parhad Atul Waman, and Nikam Sachin Arjun. "Design and Fabrication of an Auto-Tilting Car".

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Wine Quality Prediction Using Artificial Intelligence and Machine Learning

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ABSTRACT

The wine quality is important for the consumers as well as for the wine industry. The traditional (expert wine tester) way of measuring wine quality might be expensive and time-consuming. Nowadays, machine learning models are foremost tools to replace human intervention. Machine Learning is a subfield of Artificial Intelligence that seeks to comprehend the underlying structure of data and develop models that can be applied to new data in order to accomplish a desired task. Machine Learning has been widely used in various sectors such as Businesses, Medical, Astrophysics to name a few and many other scientific problems. Inspired by success of Artificial Intelligence in various different sectors here, we can use it for wine quality prediction based on various physicochemical properties of wine. Among various machine learning methods, we analyze the performance of Extremely randomized trees (Extra trees), Extreme Gradient Boosting (XG Boost) and Light gradient-boosting machine (LightGBM) ensemble ML methods. This study showcases the utilization of statistical data analysis in identifying the key factors that govern wine quality even before the production process begins. This will make it easier for wine producers to manage the wine's quality before it is produced.

Keywords: Machine Learning, Artificial Intelligence, Machine Learning methods, wine quality.

I. INTRODUCTION

Wine consumption has increased rapidly over the last decade not only for recreational purposes or socializing but also because of its benefits to the human heart. Nowadays, all industries are applying new techniques and implementing new methodologies to maximize its production and making the whole process efficient and smoother. These processes are becoming expensive with time, and their demands are also increasing with time. Unlike wines have various purposes, but the chemicals used in them are more or less the same, but the type of chemicals used needs to be assessed therefore, we adopt these methods to verify the quality of wine. Wine once considered a luxury commodity today is steadily liked by an extensive range of consumers. Portugal, which is a semi-presidential republic, ranks as the 11th largest wine producer globally. Certification and evaluation of wine are essential elements in wine industry which prevent contamination and are vital for quality assurance. Unlike old times, when there was a lack of resources and technology, the testing and quality assertion of wines

couldn't be achieved, which is a critical aspect today because of the quality standards and to stay in the market is not easy, given the competition in the market. Wine has many attributes, such as pH, acidity, chlorides, sulphates, and other acids. Wine quality can be measured either using physiochemical test, or sensory test. The former test can be established without the human intervention, whereas the later can be possible under the supervision on human expert. Producers will use the predictions from this model to improve wine quality, certification agencies to better understand the factors that are essential for quality and to allow consumers to decide while purchasing it. Numerous authors have developed predictive models for wine quality assessment, as part of the automation process. [2] used logistic regression to detect the predominant features. Authors also used ordinal logistic regression model that minimized the sum of squared errors, it failed the parallel line test so the multinomial logistic regression technique was used. In the experimentation on White Wine and Red Wine datasets, it was found that the multinomial logistic regression model was relatively less affected by outliers compared to other models proposed. Authors concludes the better prediction heavily rely on the correct set of feature variables.

Data Description and Preprocessing

Data Source and Description

In this survey we conclude that authors are using the publicly available wine quality dataset that can be obtained from the UCL Machine Learning Repository or Kaggle website which contains a large collection of datasets that have been widely used by the machine learning community [4]. Among the two types of wine quality dataset (red wine and white wine), authors generally choose red wine data for their study because of its popularity over the white wine. The red wine dataset contains 11 physiochemical properties: fixed acidity (g[tartaric acid]/dm3),volatile acidity (g[acetic acid]/dm3), total sulfur dioxide (mg/dm3), chlorides (g[sodium chloride]/dm3), pH level, free sulfur dioxide (mg/dm3), density (g/cm3), residual sugar (g/dm3), citric acid (g/dm3), sulphates (g[potassium sulphate]/dm3), and alcohol (vol%). Alongside these properties, a sensory score was acquired from several different blind taste testers which graded each wine sample with a score ranging from zero (worst) to 10 (best). The median was recorded and serves as the response variable [5]. The dataset contains the records of many random samples of the manufactured wine. Various statistical analyses were concluded to understand the nature of the dataset as presented in table-1.

Feature Scaling

As displayed in table-1, the variables are spread widely. For instance, the values of total Sulphur dioxide are extremely large as compared to the chlorides.Such a large value of one variable can have dominance over other quantities during the training process of machine learning models. For example, while doing K-nearest neighbor KNN [9], or SVM if individual doesn't standardize the non-uniform data, the datapoints with high distance will dominate the performance of the KNN or SVM model. So, feature scaling is a very important step individual need to take care of, before training any machine learning model. There are various feature scaling methods. The most common and popular techniques that have been using in the ML communities are standardization and normalization. There is no conceptual evidence of claiming which method works best and

give good results. To scale the features of a dataset standardization has widely been used. The formulae used to calculate the standardization is as follows:

$$z = \frac{x - mean}{std}$$

where *z*is *standardization value.* The value *x, mean,* and *std* are standardized input, input, mean and standard deviation of the feature, respectively.

Data Partition

In most of the cases, the data is split into training data set and testing data set in the ratio is 3:1 or 8:2. Authors train the data and use it to find the relationship between target and predictor variables. The main objective of the splitting data is to avoid overfitting. If overfitting occurs, the machine learning algorithm could perform extraordinarily in the training dataset, but perform poorly in the testing dataset.

Machine Learning Algorithms

A wide range of machine learning algorithms such as linear regression, logistic regression, support vector machine, and kernel methods, neural networks and many others are available for the learning process [11]. Each technique has its strength and weakness. In this work, authors use the supervised learning algorithms to predict wine quality.

Table 1: Descriptive statistics of the variables of the red wine data.

Sr. No.	Variable Name	Mean	Standard deviation	Min.
1	Fixed acidity	6.854	0.843	3.8
2	Volatile acidity	0.278	0.1	0.08
3	Citric acid	0.334	0.121	0
4	Residual sugar	6.391	5.072	0.6
5	Chlorides	0.045	0.021	0.009
6	Free sulphur dioxide	35.3	17	2
7	Total sulphur dioxide	138.4	42.49	9

II. LITERATURE SURVEY

Dahal, K., Dahal, J.,Banjade, H. and Gaire, S. they used algorithms like Ridge regression, support vector machine, gradient boosting regressor and Artificial neural network and found out that the Gradient Boosting showed better performance. If we are able to increase the training datasets, then we might be able to get the benefits of prediction performance of artificial neural network. They used a small dataset with limited values, focusing on red wine dataset only.

Perpetual Opoku Agyemang used the methods Ordinal logistic regression, Multinomial Logistic Regression and found out that the ordinal logistic regression model minimized the sum of squared errors.It failed the parallel

line test so the multinomial logistic regression technique was used. The multinomial logistic regression model was less sensitive to outliers and the resultant output observed was accuracy rate for the red wine is 60.3% and white wine is 53.8%. We can say that accuracy is too low using these two models as compared to the other machine learning models.

Gongzhu Hu, Tan Xi, Faraz Mohammed, Huaikou Miaoused the machine learning algorithms like Decision tree, Adaboost, Random Forest. They concluded that Synthetic Minority Oversampling Technique (SMOTE), a statistical technique can be used for increasing the number of cases in the dataset in a balanced way. It is observed that SMOTE was applied on these three ML models and can be applied on various dataset(s) and feed it to other ML models.

Fengjiao Fan, Jianping Li, Guoming Gao, Chenxi Maauthors used machine learning methods like fitting analysis, variance analysis, Q cluster analysis. It was observed by them that the optimized model of principal component analysis can't obtain correct evaluation results only by the grape and the physical-chemical indicators. These models use a very large number of effective and reliable raw data and related information to solve the problem step by step.

SatyabrataAich, Ahmed Abdulhakim Al-Absi, Kueh Lee Hui, and Mangal Sain used a Machine learning method SVM Classifier which gave the result as the SVM classifier performed better compared to all other classifiers for red wine and white wine data sets. Accuracy was ranging from 95.23% to 98.81% with different feature sets. Limitations that can be observed is that authors used a small dataset and experimented it using SVM only, having the opportunity they could have computed the performance of the other available ML models as well.

Sunny Kumar, Kanika Agrawal, Nelshan Mandan proposed to use ML methods like Naïve Bayes algorithm, Support Vector Machine, Random Forest and found out that accuracy obtained for Naïve Bayes algorithm, Support Vector Machine, Random Forest are 55.91% and 55.89%, 67.25% and 68.64%, 65.83% and 65.46% respectively and concluded that they used only red wine dataset which has imbalanced data that's why accuracy is low.

Akanksha Trivedi, Ruchi Sehrawat used Logistic Regression, Random Forest and did a comparative analysis and concluded that the accuracy estimated by Random Forest model is 84% while Logistic Regression has 76% accuracy rate. Authors managed to compute analysis using many physicochemical features and a small dataset which has imbalance class data and attributes that are not useful for the research point of view.

Shruthi P used methods like Naive Bayes Classifier, Simple Logistic Classifier, KStar Classifier, JRip Classifier and found out that The Naive Bayes classifier is the simplest and fastest classification algorithm. It handles continuous and discrete values to make probabilistic predictions and concluded that if the training set becomes big, the better classifier can be chosen by repeatedly applying the data set to different classifiers using cross validation.

Piyush Bhardwaj, Parul Tiwari, Kenneth Olejar, Wendy Parr, Don Kulasiriused machine learning methods like XGB, Extra trees classifier, RF and Gradient Boosting Classifier and found out that Six features are extremely essential since they rank in the top 10 in at least three methods (from here onwards they call them essential variables). Two variables (Ethyl octanoate and 4-ethyl-2-methoxyphenol) out of six were determined to be significant by all four methods and concluded that Pinot Noir red wine's 7 physiochemical and 47 chemical features and can try using other features as well which might change the resultant output.

Mohit G, Vanmathi C used methods like Decision tree, random forest, support vector machine and found out that for white wine Random Forest returned 68.4±2.3 accuracy. For red wine, Random Forest is 68.7±4.0, with a Kappa of 49.6 and concluded that they can try using more datasets/data with relevant physicochemical properties.

Rohan Dilip Kothawade did a comparative analysis and used methods like SVM, Naive Bayes, ANN and found out that he achieved the best accuracy result from the artificial neural network (ANN) on both red and white wine datasets and concluded that to improve the accuracy of the classifier, the algorithm or the data must be adjusted. The process of extracting features from raw data by applying domain knowledge is referred to as feature engineering, feature extraction, or feature discovery. Using potential relationships between the wine quality and chemical properties and applying boosting algorithm one can build a strong classifier from the number of weak classifiers.

Mahima, Ujjawal Gupta, Yatindra Patidar, Abhishek Agarwal used methods like Random Forest, K-Nearest Neighbor and found that the quality value ranges from 4 to 7 which is classified using the decision tree. Among various machine learning algorithms, the regression tree exhibited the highest accuracy and provided the best results. Conclusion is that Regression tree does not classify extreme quality values i.e., 0–3 and 7–10. The parameters used in the dataset form a complex dimensional representation of each type of wine.

Leonardi, Luigi Portinalefound that the classification algorithms used for the authenticity assessment has been addressed without expensive and hyper-specialized wine chemical analyses by learning as well as suitably evaluating different standard classifiers on the resulting chemical profiles. They used limited number of available samples in a dataset. Their future work was to focus on investigating ensemble learning techniques in particular stacking in order to evaluate its impact on this specific application.

Paulo Cortez, Juliana Teixeira, Ant´onioCerdeira, Fernando Almeida, Telmo Matos, and Jos´e Reis used methods like support vector machine, multiple regression, neural network methods and concluded that The performance of several machine learning methods including multiple regression and neural network were compared, and the results showed that the support vector machine performed significantly better and achieved promising results. Such model is useful for understanding how physicochemical tests affect the sensory

preferences One can evaluate using other data mining algorithms that specifically build rankers, such as regression trees.

Bipul Shaw, Ankur Kumar Suman and Biswarup Chakraborty used methods like Support Vector Machine, Random Forest, Multilayer Perceptron and established the result that Random Forest algorithm gave the best accuracy was achieved by the method with the highest performance, while the support vector machine had the lowest accuracy. Their future work is train and test other classification algorithms and find that which can give better accuracy and result than the random forest algorithm.

III. TAXONOMY CHART

Table-2 shows the comparison of some of the prominent existing work by various researchers and the proposed model. In the table, the numbers in the square brackets show the number of the reference paper listed in the reference section of the research table.
In our proposed system, we will try to embed all the missing features of the system already in existence.

Table 2: Representationof Taxonomy Chart.

Features → / Systems ↓	Handle Imbalance data	Use large dataset	Use Ensemble Methods	Use Red & White wine	Use 11 physicochemical wine properties
Reference [1]	✓	✗	✗	✓	✓
Reference [2]	✓	✗	✓	✗	✗
Reference [3]	✓	✗	✗	✗	✓
Reference [9]	✓	✗	✓	✗	✗
Proposed System	✓	✓	✓	✓	✗

IV. CONCLUSION

The results of Machine Learning models can be important for the global wine market, such a model could be used to enhance the training of enology students and improve the quality of wine. Synthetic Minority Oversampling Technique (SMOTE) can be applied on various imbalanced datasets also in other application domains. Various performance measures and other machine learning techniques can be applied for better comparison on results. Better algorithms can be developed which involves the combination of best features of all other data mining techniques. If certain adjustments in the hyperplane, and balanced tree technique along with the appropriate probability are used then much better accuracy can be observed.

V. ACKNOWLEDGEMENT

It gives us a great pleasure in presenting the paper on “Survey on Wine Quality Prediction using Artificial Intelligence and Machine Learning”. We would like to take this opportunity to thank Dr. Pankaj Agarkar, Head of Computer Engineering Department, for giving us all the help and support we need during the course of the Paper writing work. We are really grateful to him. Our special thanks to Dr. F.B. Sayyed, Principal who motivated us and created a healthy environment for us to learn in the best possible way. We also thank all the staff members of our college for their support and guidance.

VI.REFERENCES

[1]. "Prediction of Wine Quality Using Machine Learning Algorithms" written by K. R. Dahal, J. N. Dahal, H. Banjade, S. Gaire, published by Open Journal of Statistics, Vol.11 No.2, 2021.

[2]. Perpetual Opoku, A. (2010)'Modelling the preference of wine quality using logistic regression techniques based on physiochemical properties', YOUNGSTOWN STATE UNIVERSITY, http://hdl.handle.net/1989/10638, (p.48).

[3]. G. Hu, T. Xi, F. Mohammed and H. Miao, "Classification of wine quality with imbalanced data," 2016 IEEE International Conference on Industrial Technology (ICIT), 2016, pp. 1712-1217, doi: 10.1109/ICIT.2016.7475021.

[4]. Fengjiao Fan, Jianping Li, Guoming Gao and Chenxi Ma, "Mathematical model application based on statistics in the evaluation analysis of grape wine quality," 2015 12th International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP), 2015, pp. 107-110, doi: 10.1109/ICCWAMTIP.2015.7493956.

[5]. S. Aich, A. A. Al-Absi, K. Lee Hui and M. Sain, "Prediction of Quality for Different Type of Wine based on Different Feature Sets Using Supervised Machine Learning Techniques," 2019 21st International Conference on Advanced Communication Technology (ICACT), 2019, pp. 1122-1127, doi: 10.23919/ICACT.2019.8702017.

[6]. S. Kumar, K. Agrawal and N. Mandan, "Red Wine Quality Prediction Using Machine Learning Techniques," 2020 International Conference on Computer Communication and Informatics (ICCCI), 2020, pp. 1-6, doi: 10.1109/ICCCI48352.2020.9104095.

[7]. A. Trivedi and R. Sehrawat, "Wine Quality Detection through Machine Learning Algorithms," 2018 International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering (ICRIEECE), 2018, pp. 1756-1760, doi: 10.1109/ICRIEECE44171.2018.9009111.

[8]. P. Shruthi, "Wine Quality Prediction Using Data Mining," 2019 1st International Conference on Advanced Technologies in Intelligent Control, Environment, Computing & Communication Engineering (ICATIECE), 2019, pp. 23-26, doi: 10.1109/ICATIECE45860.2019.9063846.

[9]. Piyush, B. Parul, T. Kenneth, O. Wendy, P. Don, K. 'A machine learning application in wine quality prediction', Machine Learning with Applications, Volume 8, 2022, 100261, ISSN 2666-8270, https://doi.org/10.1016/j.mlwa.2022.100261.

[10]. Gupta, Mohit & Chandrasekaran, Vanmathi. (2021). A Study and Analysis of Machine Learning Techniques in Predicting Wine Quality. International Journal of Recent Technology and Engineering. 10. 314-321. 10.35940/ijrte.A5854.0510121.

[11]. R. D. Kothawade, 'Wine quality prediction model using machine learning techniques', Dissertation, 2021.

[12]. Mahima, Gupta, U., Patidar, Y., Agarwal, A., Singh, K.P. (2020). Wine Quality Analysis Using Machine Learning Algorithms. In: Sharma, D.K., Balas, V.E., Son, L.H., Sharma, R., Cengiz, K. (eds) Micro-Electronics and Telecommunication Engineering. Lecture Notes in Networks and Systems, vol 106. Springer, Singapore. https://doi.org/10.1007/978-981-15-2329-8_2

[13]. Leonardi, G., Portinale, L. (2017). Applying Machine Learning to High-Quality Wine Identification. In: Esposito, F., Basili, R., Ferilli, S., Lisi, F. (eds) AI*IA 2017 Advances in Artificial Intelligence. AI*IA 2017. Lecture Notes in Computer Science(), vol 10640. Springer, Cham. https://doi.org/10.1007/978-3-319-70169-1_3

[14]. Cortez, P., Teixeira, J., Cerdeira, A., Almeida, F., Matos, T., Reis, J. (2009). Using Data Mining for Wine Quality Assessment. In: Gama, J., Costa, V.S., Jorge, A.M., Brazdil, P.B. (eds) Discovery Science. DS 2009. Lecture Notes in Computer Science(), vol 5808. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-04747-3_8

[15]. Shaw, B., Suman, A.K., Chakraborty, B. (2020). Wine Quality Analysis Using Machine Learning. In: Mandal, J., Bhattacharya, D. (eds) Emerging Technology in Modelling and Graphics. Advances in Intelligent Systems and Computing, vol 937. Springer, Singapore. https://doi.org/10.1007/978-981-13-7403-6_23

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RF Energy Harvesting

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ABSTRACT

An experimental RF energy harvesting system is presented in this paper.Based on thisconcept, the project is developed to transfer power within a small range. This project can be usedfor charging batteries which can't be charged physically such as pace makers. The patient isrequired to be operated every year to replace the battery. This project can charge rechargeablebatteriespurposely.ThisprojectisbuiltuponusinganelectroniccircuitwhichconvertsAC230V 50Hz to AC 12V, High frequency. The output is fed to a tuned coil forming as primary ofan air core transformer. The secondary coil develops a voltage of HF 12volt. Thus the transfer ofpower is done by the primary (transmitter) to the secondary that is separated with a considerabledistance(say3cm).Henceitcanbeseenaswirelesspowertransmissionfromprimarytosecondary toload.Moreover this technique can be used in number of applications, like to chargeamobilephone,iPod,laptopbattery,propellerclockwirelessly.Thereisalowerriskofelectrical shock as it is galvanically isolated. This concept is an Emerging Technology, and infuture the distance of power transfer can be enhanced as the research across the world is stillgoingon.

KEYWORDS: Highfrequency(HF)transformer, Surfacemountdevices(SMD),Globalsystemformobile(GSM)

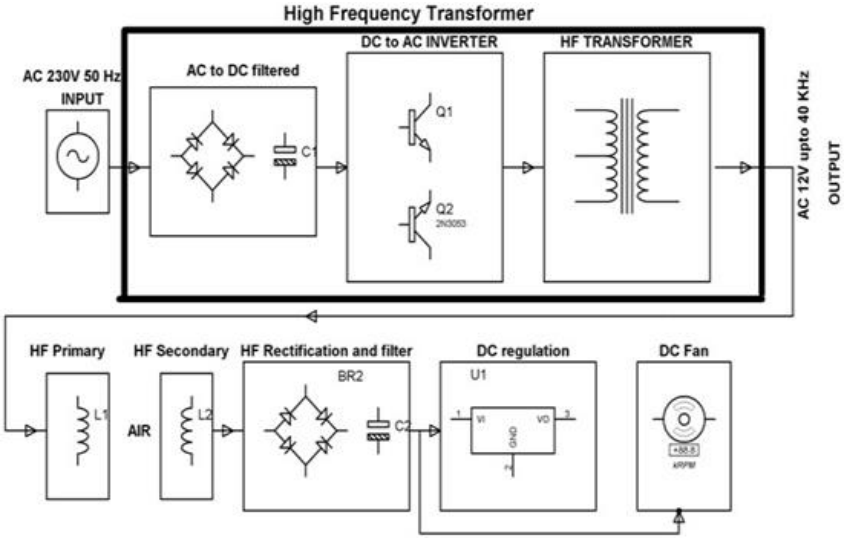
I. INTRODUCTION

In recent years there has been an increasinginterest in the development of Wireless SensorNetworks(WSNs).Thesenetworkscanbeuses in different scenarios as intelligent officespaces,medicalmonitoringandmilitaryapplications;thereisalwaysanissuetochangebatteriesfrequently,which haslimited its use of WSN. Energy harvesting isone of the key techniques used to solve thisproblem. There are many interesting ways forenergy harvesting from the ambient sources,such as light, heat, vibration, RF, and so on.Amongall,RFsignalsareavailableeverywhere as well as every time. Some of themostprominentRFsourcesareFMradiosystems,TVTransmission,CellTowerTransmission,Wi-Fi,AMTransmissionandmobilephonesetc.Icanget continuoussource ofenergyfromcelltowers.Harvestingambient RF energy would provide an alternateenergysourcefor low power applications.

I have made the educational model whichshows the same concept but as it requiredSMDcomponentsathigherfrequencyranges so we generated our own frequencyand amplified it for using it as a chargingmedia.

- TheRadioFrequencyEnergyHarvestingmodeldeviceconsistsofthreeprimary subsystems. The first subsystem is thereceiving antenna, which is solely responsiblefor capturing all of the RF energy, but at smallrangeapplicationsitsefficiencyvariesasdistanceincreases or decreases.
- Thesecondmainsubsystemistherectificationcircuitry,whichwillefficientlyconvertthetimevaryinginputenergyintoa constantoutputvoltage.
- Thethirdsubsystemisthedcregulationsystem,whichisresponsibleforstoringallcapturedenergyandprovidinga constant output voltage to power the attacheddevice.

II. SYSTEM OVERVIEW



2.1 Highfrequencytransformer:

The transformeris simplest,mostused electronicdevice.Transformersarewidelyusedaseconomicmeans of power transmission over long distances.Highfrequencytransformersusedtotransferelectricpower.Thephysicalsizeisdependentonthepowertobetransferredandalsoontheoperatingfrequency.Thehigherthefrequencysmalleristhephysicalsize.Thebandoffrequenciesisusuallybetween20and100kHz.Mainlythecore materialisof Ferrite

2.2 voltageregulator7805:

A voltage regulator is an electrical regulator whichis designed to automatically maintain a constantvoltage level. A voltage regulator may be a simple"feed-forward"designormayincludenegativefeedbackcontrolloops.

2.3 Filter:

Electronic filters are electronic circuits which areusedtoperformsignalprocessingfunctions.Specifically used to remove unwanted frequencycomponents from the signal, to enhance wantedones,or both.

2.4 Rectifier:

Arectifierisanelectricaldevicethatconvertsalternatingcurrent(AC),whichperiodicallyreverses direction, to direct current (DC), currentthat flows in only one direction, a process knownasrectification.Usesofrectifiersareincomponents ofpower supplies and as detectors ofradiosignals.

2.5 Electromagneticcoil:

A coil is a series of loops. A coiled coil is a structurewhere the coil itself is in turns, also these objects areused commonly and are very important, some of theirfunctionsmaybeinbikes,carstrainsandplanes.Alsoitisusedinconjunctionwithathread.

III. CONCLUSION

ThispaperpresentsthedesignofRFEnergyHarvesting System. The potential utilization ofRFsignaltoDCpowerisexperimentallyinvestigated.Severalstepsaretakento achievethis methodology. A thorough study of varioustopologiesofImpedanceMatching,Antenna,andVoltageMultiplierhasbeendiscussed.Basedonthat,Wehavechoseneffectivetopologyforeachblock.Asaresultofthisoverview,LC circuit designedtogiveconstantimpedance overthe selected frequency range.Basedonmeasurementandsimulation,itcanbeconcludedthatitispossibletouseradiation,off-airRFsignalasasourceforenergyharvesting.Eventhoughtheoutputpowersofsuchharvesterarerelativelylow,itcanbesufficientforrunninglowconsumptionsensorand switches.

Improvement on efficiency of the RF signalharvestingisimportant.Thiswillhelpstoenablemorecurrenttoberecycledandoperate low-power circuit. The possibility ofusingthisharvesterinenergizingsensornetworks appears to be the most practical useatthemoment.

Finally,herepresentedanewtechnologythat cangiverevolutiontheway wechargeournumerous mobile devices. It helps portabilityofdeviceswithout carrying chargersaround.

IV.REFERENCES

[1]. G.Kumar,M.Arrawatia,andM.S.Baghini,“Rfenergyharvestingsystemfromcelltowersin900mhzband,” IEEE,vol.11, no.978-161284-091-8,2011

[2]. A.R.Djordjevi,A.G.Zaji,M.M.Ili,and G.L.Stber,“Optimizationofhelicalantennas,”IEEEAntennasandPropagationMagazine,vol.48,pp.107–116,December2006

[3]. H.M.GamalandM.A.E.Saad,“Novelradiofrequencyenergyharvestingmodel,” IEEEInternationalPowerEngineeringandOptimization Conference, pp. 209–213, june2012.

[4]. W.C Brown, J.R Mims and N.I Heenan,“AnExperimentalMicrowave-PoweredHelicopter”965IEEEInternationalConventionRecordVo.13,Part5,Pp.225-235.

[5]. S.SheikMohammed,K.Ramasamy,T.Shanmuganantham"WirelessPowerTransmission–ANextGenerationPowerTransmissionSystem",©2010InternationalJournalofComputerApplications(0975–8887)Volume 1– No. 13

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Design and Development of Multi- Crop Thresher

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ABSTRACT

Presently majority of villages in rural India do not get un-interrupted electric supply with close to 10 hours of load shedding many agriculture activities have to be done manually we have produced a multi-crop thresher for crops like (Wheat / Jowar / Bajra / Barley) and specially Corn which will be operated using bi-cycle. Also we have added a automatic screening mechanism to it so that the threshed produce will also be screen an cleaned automatically and the farmer will directly get the grains ready to pack saving lot of human energy time and cost. The present paper focuses on solving the problem faced by the farmers in separating the seeds from the sunflower. Farmers use the manual methods due to unavailability of suitable machinery for sunflower threshing. During manual sunflower production, the most time and labour-consuming operation is the threshing of sunflower by beating the sunflower heads with a stick, rubbing wear heads against a rough metal surface or power tiller treading machine. The aim of the project is to fabricate a machine which will separate the seeds from the sunflower. The main components required to fabricate the machine are Blades, Shaft, Pulley, Disk plates, Blower, Hopper, Tray, Sieves, Motor, V-Belt and Pillow Block Bearings.

Keywords: - Design and Fabrication, Sunflower, Seed Extractor, sunflower, heads, thresher, teeth, performance

I. INTRODUCTION

Farm machinery is an important and fundamental element for agricultural development and crop production in modern agriculture of many countries. Farm machinery significantly de-creases the time required for farmers to accomplish farm tasks. The richness of a country and it's wealth status is always judges or know on compositions (steel) in proper conditions, etc. India has a very large population. But other countries like Japan, Germany and USA are pioneers in steel making. Earlier, India was flourishing in trade and commerce. But the entrance of East India company changed the whole scenario. The British started exploiting the Indian resources. They made their market for finished goods in India. Then came the Industrial revolution and the industries started prospering again. Then in 1992, came the law that multi-nationals can come and set up their industries, the whole scenario changed, more stress on quality and accuracy was given than the quantity. Thus came the need for the SPM as GPM could not live up to the expectations of the customers. In engineering, many processes are required and different parts require different processes. But the properties of materials and other

things change with the processes. Project is a mission of creating something new, which is innovative i.e. manufacturing of a new product. The prime requirements of an effective project organization therefore are:

1) Flexibility
2) Autonomy
3) Group functional integration
4) Small group size
5) Common work location for all project members
6) Team spirit among group members.

II. METHODS AND MATERIAL

DESIGN METHODOLOGY

2.1 Market Study The methodology for this project begin with knowing the farmer requirements related to threshing machine under consideration. This involved extensive evaluation of the various type of individual threshing machines and precise overview of the Indian market scenario. In our attempt to design a special purpose machine we have adopted a very a very careful approach, the total design work has been divided into two parts mainly;

2.2 System Design System design mainly concerns with the various physical constraints and ergonomics, space requirements, arrangement of various components on the main frame of machine no of controls position of these controls ease of maintenance scope of further improvement ; weight of m/c from ground etc.

2.2.1 System selection based on physical constraints :- While selecting any m/c it must be checked whether it is going to be used in large scale or small scale industry In our care it is to be used in small scale industry So space is a major constrain .The system is to be very compact it can be adjusted to corner of a room. The mechanical design has direct norms with the system design hence the foremost job is to control the physical parameters so that the distinction obtained after mechanical design can be well fitted into that.

2.2.2 Arrangement of various component :- Keeping into view the space restriction the components should be laid such that their easy removal or servicing is possible moreover every component should be easily seen & none should be hidden every possible space is utilized in component arrangement.

2.2.3 Components of system :- As already stated system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact A compact system gives a better look & structure.

2.2.4 Man –m/c Interaction :- The friendliness of m/c with the operation is an important criterion of design. It is application of anatomical. Following are some e.g. of this section :- ϖ Design of machine height ϖ Energy expenditure in hand operation ϖ Lighting condition of m/c.

2.2.5 Chances of failure :- The losses incurred by owner in case of failure of a component are important criteria of design. Factor of safety while doing the mechanical design is kept high so that there are less chances of failure there over periodic maintenance is required to keep the m/c trouble free.

2.2.6 Servicing facility :- The layout of components should be such that easy servicing is possible especially those components which required frequent servicing can be easily disassembled.

2.2.7 Scope of future improvement :- Arrangement should be provided to expand the scope of work in future such as to convert the m/c motor operated this system can be easy configured to required one.

2.2.8 Height of m/c from ground :- Fore ease and comfort of operator the height of m/c should be properly decided so that he may not get tired during operation .The m/c should be slightly higher than that the level also enough clearance be provided from ground for cleaning purpose.

2.2.9 Weight of machine :- The total weight of m/c depends upon the selection of material components as well as dimension of components. A higher weighted m/c is difficult for transportation & in case of major break down it becomes difficult to repair.

2.3 Mechanical Design Mechanical design phase is very important from the view of designer .as whole success of the project depends on the correct deign analysis of the problem. Many preliminary alternatives are eliminated during this phase. Designer should have adequate knowledge above physical properties of material, loads stresses, deformation, failure. Theories and wear analysis , He should identify the external and internal forces acting on the machine parts.

These forces may be classified as ; a) Dead weight forces. b) Friction forces. c) Inertia forces. d) Centrifugal forces. e) Forces generated during power transmission etc. Designer should estimate these forces very accurately by using design equations .If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions which will almost satisfy the functional needs. Assumptions must always be on the safer side. Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The correction in the theoretical stress values are to be made according in the kind of loads, shape of parts & service requirements. Selection of material should be made according to the condition of loading shapes of products environment conditions & desirable properties of material. Provision should be made to minimize nearly adopting proper lubrications methods .In mechanical design the components are listed down & stored on the basis of their procurement in two categories,

- Design parts.
- Parts to be purchased.

For design parts a detailed design is done & designation thus obtain are compared to the next highest dimension which is ready available in market. This simplification the assembly as well as post production service work. The various tolerance on the work are specified. The process charts are prepared & passed on to the work are specified. The parts to be purchased directly are selected from various catalogues & specification so that anybody can purchased the same from the retail shop with the given specifications.

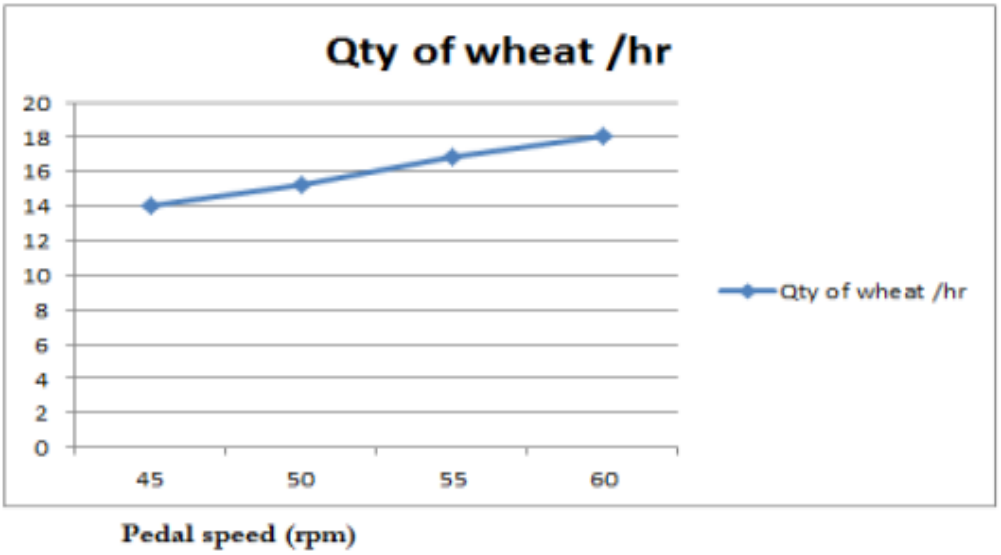
III. RESULTS AND DISCUSSION

Test and Trial On Agriculture Multi crop Thresher

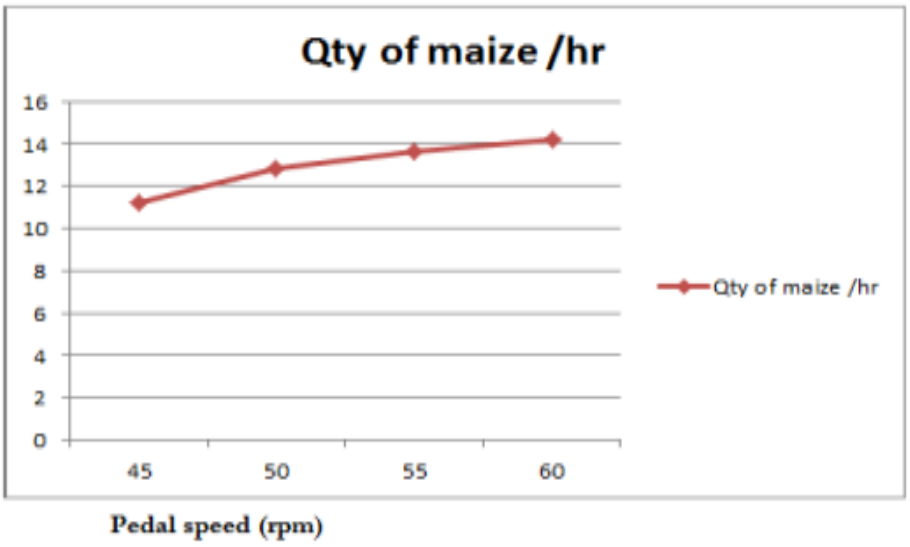
Results for Manual operated mechanism:

Sr. No	Pedal Speed (rpm)	Qty. of Wheat Threshed / hr.	Qty. of Maize Threshed /hr.
01	45	14 kg	11.2
02	50	15.2 kg	12.8
03	55	16.8 kg	13.6
04	60	18 kg	14.2

Graph of Wheat threshed / hr by Thresher Vs Pedal speed.



The quantity of wheat threshed by the thresher increases with the increase in pedal speed as the blade speed increases.



The quantity of maize threshed by the thresher increases with the increase in pedal speed as the blade speed increases.

Result for motor operated Mechanism

Sr. No	Motor Speed (rpm)	Qty. of Wheat Threshed / hr.	Qty. of Maize Threshed /hr.
1	1440	26	18.4

Result for motor operated Mechanism

Sr. No	Motor Speed (rpm)	Folder cut per hour
1	1440	30 pendi

3.1 Advantages

1) TIME FACTOR The process of agave fibre extraction can cut the material at fast rate reducing the time consumption.
2) SPACE The floor space required for the machine is very small also. It requires no foundation (heavy) reducing the cost further.
3) VIBRATIONS During the working of the machine various cutting forces act on the machine elements. These forces cause the vibrations in the machine elements. But the machine is much robust to take up the vibrations.
4) LUBRICATION The machine uses ball bearings which are pre lubricated with bearing grease and are provided with dust covers thereby eliminating the need fore frequent lubrication.
5) MAINTENANCE The machine is simple is construction with minimal maintenance cost and extreme simplicity in replacement of parts in case of failure.
6) ENVIRONMENT The machine derives pulp from the agave leaf which can be used as fed for earth worms in vermin-culture propose in preparation of organic composed manure.

3.2 Disadvantages

1) Increases cost of tread mill because modifications are to be made.
2) Dynamo and flywheel will increase the cost.
3) Noise will increase –but very slightly.
4) The machine has limited capacity.

3.3 Applications

1) Domestic electricity generation applications in homes. 2) Can be modified appropriately to suit rural areas by merely modifying the excitation arrangement.
2) Can be modified to make mobile charging system.
3) Harvesting of Sunflower, Jowar, Bajra, Wheat, Nachani etc.
4) Multi- crop thresher is used for maize de-seeding

IV. CONCLUSIONS

1. This machine with better flexibility and performance.

2. A versatile thresher machine for Wheat, Jowar, Bajra, Nachni, Sunflower, maize.
3. Additional vibrating screen mechanism is provided for cleaning and screening simultaneously without wasting time.
4. The labour cost and maintenance cost is reduces.
5. To make it light weight to its full extent.
6. An innovative mechanism for threshing, screening and fodder cutting was developed that can be operated either manually or by use of motor.

4.1 Future Scope

1) Size of thresher unit can be increased to increase productivity.
2) Number of blades can be increased on thresher drum.
3) Larger screen can be used.
4) DC motor can be used to operate the, machine in absence of electricity.

V. REFERENCES

[1]. Azharuddin Kazi, Mir Safiulla, Narasimhan .M.Manohar & Pavan kumar: "Design and Fabrication of Sunflower Seed Extracting Machin" International Journal of Latest Technology in Engineering, Management & Applied Science (IJLTEMAS) Volume V, issue Vi June 2016| ISSN 2278-2540 .

[2]. Nasser Mohammednour Ibrahim Ahmed "Evaluation Of The Performance Of A Sunflower Thresher" International Journal of Technology Enhancements And Emerging Engineering Research, VOL 2, Issue Vi 2014|ISSN 2347-4289.

[3]. Somposh Sudajan , Vilas M. Salokhe : "Power Requirement and Performance Factors of a Sunflower Thresher" issue in March 2015.

[4]. A.K. Goel, D. Behera, S. Swain and B.K. Behera : "Performance Evaluation Of A Low – Cost Manual Sunflower Thresher" Indian J.Agric. Res, 43(1):37-41, 2009.

[5]. Shivanand H. Kakhandaki, M. Anantachar, & M.S. Madhusudhan: "Performance Evaluation Of High Capacity Sunflower Thresher", International Journal of Agricultural engineering |Volume 5|Issue 2|October, 2012|138-141.

[6]. Hamada El-Khateeb, Husain Sorour and M. I. Saad ,"Operating factors affecting using two different threshing machines for threshing sunflower heads. The 15th Annual Conference of the Misr Society of Ag. Eng., 12-13 March, 2008.

[7]. Hunt, D.R. (2001). Farm power machinery accumulated R&M costs to be lower than the actual data management. 10th Ed.,Iowa State University for the first period of machine life and also predicts some Press. Ames. IOWA. U.S.A.

[8]. Design Of Machine Elements :- V B BHAN

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A Review on Seismic Response of Multi-Storied RC Building with Different Shear Wall and Bracing Systems

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ABSTRACT

From the history of mankind, uncountable deaths were occurred due to unplanned social system, as lesson learnt from disaster of Bhuj earthquake, thousands of people died and lakhs were injured. Present ground reality scenario of suffering people due to disasters, demand stechnical solutions, so it is necessity of following and implementation of Indian standards codes including national building codes, as a result structures performs as anseismic resistant and efficiently transfers lateral loads. During seismic shakes, designed structures should consist of lateral load transfer mechanisms such as shear wall and bracing systems which enhance the damping properties in addition to seismic vulnerabilities. This paper concerned with different study cases of RCC buildings which consist of dissimilar types of shear wall i.e. I, T, L etc. and bracing systems i.e. X, V, Knee etc., their effect on parameters like bending moment, shear force, lateral displacement, fundamental time period, seismic base shear, storey drift. This project work concluded performance of shear wall and bracings under exposed conditions covering various geometries and orientations through structure analysis using software research applications.

KEYWORDS: Disaster, Bhuj Earthquake, Earthquake Resistant Structure, Indian Standard Codes, Shear Wall, Bracing, Fundamental Time Period, Software Research Applications.

I. INTRODUCTION

Earthquake with 7.9 magnitude struck Gujarat on January 26. 2001 when people of India were preparing to celebrate their 52nd republic day, over 20,000 persons were reported dead and about 1.7 lakhs were injured [1]. It is the major turning point in India towards agenda of revised Indian standards codes and seismic risk reduction [2]. The basic requirement of seismic design of building mainly depends upon the type and location of structure and proper application on seismic criteria and design. To make the building more resistant to earthquake, various Indian standards codes should be properly implemented to survive through both direct and indirect actions of earthquakes, provides information related to basic design criteria, quality control, ductile detailing and seismic considerations for particular structure in specific seismic zones [19][20][21][22][23]. According to IS 1893 (PART 1):2002, dynamic analysis should be done for regular buildings greater than 40m in

height in zones IV and V, and those greater than 90m in height in zones II and III, for irregular buildings greater than 12m in height in zones IV and V, and those greater than 40m in height in zones II and III. In the field of advance structure engineering, engineering software contribute vibrant part which is much faster and accurate combined process of analysis and design than conventional academic methods and capable to analyse advance structures having complex configurations allowed for varieties of building codes of different countries and its site conditions considered under software resembling STAAD. Pro, ETABS and MIDAS etc. [24][25][26].

Taller is the building, lower is the stiffness and higher the mass causes low natural frequency which is very vulnerable for tall buildings as it is easily available for resonance condition. So by adding shear wall and bracing, stiffness and damping properties increased. Almost all the structures carryover gravity loads but to perform as perform as earthquake resistant structures should propagate lateral loads as well. Structures must contain lateral load transferring mechanisms such as shear wall and bracing which enhances the energy absorption capacity of the structure under critical conditions.

Every structure experience static and dynamic forces, dynamic forces which magnitude, direction and positions varies with time. Similarly, structure response to dynamic load, i.e. the resulting stresses and deflections also time varying or dynamic [27]. Horizontal forces in buildings, such as those produced by earthquake motion or wind action, are often resisted by structural elements called shear walls [28]. Shear wall should be top to bottom, aligned, parallel and free from offsetting. The minimum thickness of shear wall is 150mm. it is provided in different locations under various situations.

Bracing reduces stress concentrations and provides smooth passage of forces thus reduces lateral displacement by stiffness to structure. These are mainly used in steel structures and occupy less space. Eccentric bracing reduces lateral stiffness of building as it is helpful for energy dissipation during earthquake. Its property of providing lateral stiffness to the structure mainly depends upon stiffness of the flexural and compression members such as beams and columns as it exerts point load on it. Concentric bracing provides better lateral stiffness to structure succeeding with increased natural frequency. It also decreases bending moments and shear forces on adjacent members. These kinds of above-mentioned structural techniques resist the seismic shakes. Finally, it is the necessity to implementation of new techniques to control the disaster in India [29].

II. OBJECTIVE

1. To show the importance of building codes for seismic resistant structures.
2. Reflecting advances in structural engineering based on various study cases of shear wall and bracing systems.
3. To compare braced and shear wall frames.
4. To represent various research work methodologies taken up by researches.
5. To show new advance researches, its necessities to implement on ground reality by construction and its organisations.
6. Give message to aware people about problem of disasters, its elated issues and lesson learnt. Furthermore importance and implementation of structure drawings through structure designers only.

III. LITERATURE REVIEW

Anes B et al. (2017), deal with effect of steel bracings on RC framed structures. Reinforced concrete building (G+9) was shaped and analysed in three parts comprising model sans steel bracing and shear wall, with dissimilar bracing systems, with shear wall. Bracings and shear wall were positioned at the middle bays and all these simulations were analysed for seismic forces at seismic zones II, III, IV and V using ETABS 2015. As per conclusion chevron category of steel bracing was originate to be more effectual in zones II and III, X type bracing was originate to be more effective in zones IV and V. Steel braced building significantly decreases the lateral drift when associated with shear wall building.

Rakshith (2017), examined effect of bracings on Multi-Storied RCC building under dynamic loading. RCC building (vertical regular and vertical irregular) having (G+9) stories with different bracing systems were analysed by response spectrum method using ETABS. Outcomes corresponded to displacement, storey drift and storey shear was compared.

In this research , researchers concluded that both regular and irregular RCC frame structures X- bracing gives less displacement, storey drift and base shear. Regular frame bears more stiffness than irregular frame. Steel bracing were used to strengthen and retrofit existing structures.

Mohammad A. et al. (2016), donea numerical approach to show dissimilarity between shear wall and steel bracing systems. The new methodology of this research was to strengthened lateral force resisting system via steel bracing. A measured has been done step by step to show understandable contrasts between systems. The overall investigation has been carried out by response spectrum using ETABS 9.7 that is of six case studies. It is coherent that model 1 (shear wall at core) is the safest among six models assessed in the research tenacity. Positioning of shear wall is a principal point. Besides, the orientation in floor bracing is of less significant dissecting with the vertically oriented bracing systems. Further modification in floor bracing will escort good formulation as seismic force resisting system.

Priyanka et al. (2016), carried analysis of Multi-Storied buildings with different heightsand shear wall locations. Buildings having (G+10), (G+20) and (G+26) were modelled and analysed in zone II with considering all loads included dead load, live load, wind load and seismic load as per Indian standards with different shear wall locations by means of STAAD.Pro software. Parameters studied were inter- storey drift, base shear and lateral displacement.

Researchers concluded that (G+10) building generated less value of deformations and stresses at location 1 as compared to location 2. Also, concluded that (G+20) building generated less value of stresses and deformation on location 2 than at location 1. Also location 2 shear wall decreased efficiency of structure.

Kasliwal N.A et al. (2016), studied seismic analysis of reinforced concrete building with unrelated positions and numbers of shear wall. The reinforced concrete building having (G+9) stories with seismic zone V is analysed by using response spectrum method as per IS 1892 (PART 1):2002. Dynamic analysis has been done to know base shear, storey drift and displacement using ETABS. In this research, they concluded that building with complete shear wall shows lesser lateral displacement as compared to other frames. Also frame with shear wall from first storey carried good results and corner shear wall is good with low cost type.

Patil S.P. et al. (2016), studied comparison of shear wall and bracing in RCC framed structure with different locations. Fifteenth storey balanced RC frame is comprehensively deliberated for seismic loading under response spectrum method. The base shear, frequency, period and displacement were calculated. When shear wall is delivered, displacement and storey drift reduced, storey shear and base shear raised. As thickness and width of shear wall increases, displacement and storey drift decreased, storey shear and base shear up surged, when it is balanced and well distributed along periphery displacement decreased. Steel bracing declined flexure and shear mandate on beams and columns, transfers lateral loads through axial load mechanism. **Amey (2016),** RCC building of dissimilar heights and different typical plan shapes but equivalent area placed in solapur subjected to earthquake loading in zone III were deliberated. An earthquake load was calculated seismic method using 1893 (PART 1):2002 and detailed as per IS 13920:1993. These analyses were performed using ETABS 2013. A study has been carried out to regulate effect of RC shear wall on earthquake resistance of a multi-storied building by changing shear wall location. Different cases of shear wall locations of diverse heights and plan have been analysed. Also optimum percentage of shear wall is resolute with respect to perimeter of buildings. All rectangular shaped buildings i.e. (G+30), (G+35) and (G+40) were deliberated, it is detected that R/40/20/2 permutation gives more stable fallouts to structure along with optimum results. **Mohammad A. et al. (2015),** done comparative analysis of reinforced concrete frame building with bracing and shear wall. The reinforced concrete building (OMRF) having (G+15) storied were analysed in seismic zones II to V by using linear static method as per IS 1893 (PART 1):2002 in STAAD.Pro V8i. In this research, researchers concluded that shear wall element resist more lateral deflection than braced frame and bare frame. Also location of shear wall and bracings has significant effect on performance of the building. X bracing showed minimum possible bending moments comparison to other forms of bracings, reduced 35% to 45% lateral displacement of the building.

Prof.Bhosle et al. (2015), studied analysis of RCC building with different arrangements of concrete and steel (ISA110X110X10) bracing systems, various types of bracing (Diagonal, V, Inverted V, Combined V, K and X). Reinforced concrete building (G+12) located in zone III and analysed as per 1893 (PART 1):2002 using ETABS. Amount of displacement reduction has been found out and concluded that X-type of concrete bracing was found to most efficient for storey overturning moment, better resist lateral displacement which improves strength, stiffness of structure and capacity of building.

Suchita et al. (2015), analysis has been done on Multi-Storey building for optimum location of shear wall using Genetic Algorithm. Six study cases were taken up to identify optimization of shear wall with Genetic Algorithm, which is coded in MATLAB and objectives were analysed by ETABS 2015. Constraints like lateral displacement are determined by using equivalent static method [IS 1893 (PART 1):2002]. Finally it is concluded that, genetic algorithm provides good path to structural analysis techniques, best clarification among numerous solutions, model-2 demonstrated finest place of shear wall in (G+10) building. By providing shear wall to high rise building, structuralseismic behaviour performs better, also stiffness and strength of building was increased.

Biradar et al (2014), studied on seismic response of RC structure by using different bracing systems. The seven models have been made and behaviour of all cases was determined by linear static and dynamic analysis, non-linear static and dynamic analysis using ETABS. Results comprised fundamental time period, base shear, storey drift has been evaluated and equated with bare frame. The conclusion is that cross bracing giving less seismic

response leading to serviceable and stiff model, base shear obtained from IS code is not on a good agreement with values obtained from equivalent static and response spectrum analysis.

Thorat et al (2014), had investigated seismic behaviour of RC Multi-Storied building with different shear wall versus bracing systems. The elastic dynamic method, response spectrum method was used to find out lateral displacement collaborated STAAD.Pro V8i. Comparison of floor displacement and axial force in members were done. Seismic zone III was considered for analysis. They come to the point that centrally situated shear wall and bracing elements resisted lateral displacements very efficiently as when shear wall is provided at core of the building reduced action of forces, lateral deflection or displacement and drift.

Anshul S. et al. (2014), calculated effect of shear wall on seismic response for RC moment resisting frame. The different locations were adopted to find out seismic reaction of structure. Four different types of shear wall that core, symmetrically external bays (centrally) and adjacent exterior bays. These frames were analysed under load combinations recommended by IS 1893 (PART 1):2002, concluded that frame with shear wall at core gives less reduction in lateral displacement, bending moment and shear force, also determined that shear wall at core gave minimum lateral displacement than centrally placed.

Patil S.S. et al. (2013), studied linear dynamic analysis for performance of high rise building through STAAD.Pro.Response spectrum analysis was considered for RC moment resisting frame having (G+14) situated in zone IV as per IS 1893 (PART 1):2002. The different study cases were taken to find out lateral displacement, base shear, storey shear, Storey drifts and time period. Three cases was performed i.e. pure frame or RC bare frame, braced frame and shear wall frame systems and concluded that both brace and shear wall configurations give less reduction in lateral displacements and building with short time period tends to suffer higher accelerations but lesser displacements.

Shaik K. M. A et al. (2013), studied structural behaviour of Multi-Storied RC framed building with shear wall. Contrary arrangements for the same were considered for evaluation of seismic performance of building. All models were analysed by elastic response spectrum method and inelastic pushover analysis using ETABS. Comparison of simulations was done on the basis of strength, stiffness and damping characteristics. Study resolved that shear wall in the outermost RC moment resisting frame gave superior seismic management, also influence of shear wall significantly upsurges damping properties and period at the performance point of tall buildings.

Viswanath et al (2010), evaluates seismic response of steel braced reinforced concrete frames. The different bracing systems were used in RC frame, the cross (X) bracing and diagonal bracing with different regular stories were used to resist structure or frame. Numerous cases i.e. four, eight, twelve and sixteen storied buildings were considered, where four storey building was analysed for rehabilitation purposes and other three for displacement. These structures were performed by means of STAAD.Pro and IS 1893 (PART1):2002. The response of dissimilar cases are determined in zone IV and concluded that steel bracing reduces shear and flexure demands on beam and columns.

IV. CONCLUSION

To make the structure safe to environmental forces and human errors, hence for that time to time new technologies has been discovered to minimise the impact of disasters, also advances in structural engineering, revised building codes comes into existence for safe, economic, stiffer, durable and seismic resistant structures by symmetrically transfers loads (whether dynamic or static) from one to another member. There are many significant observations in the field of research related to load transferring mechanisms (gravity and horizontal) through structure components i.e. the arrangements of shear wall and bracing by structure designer. Following are the outcomes consist of technical merits listed from the remarks of researchers:-

1. Building with shorter time period tends to admit higher acceleration but smaller displacement.
2. Shear wall has more significant influence on lateral strength in taller buildings except for shorter height buildings while it has more potency on lateral stiffness in case of shorter buildings besides taller buildings.
3. Inter storey drift being critical for columns got reduced with provision of shear wall.
4. Position of shear wall has effective role on the performance of buildings that von-misses stresses got reduced simultaneously, as centrally located shear wall and brace components were best observed.
5. Genetic algorithm has convenient manner for optimization amongst several solutions and structure analysis, which can be handily used by professional designers.
6. Confined configuration in plan extended high stability but it does not cause any perceivable change in base shear. Column axial force induced in brace frame is more as equated to shear wall frame.
7. Steel bracing can be used as an alternative to other retrofitting techniques, in addition total weight of existed building will not change significantly. Steel bracing usage reduced tension forces, bending moment, shear demands on beams and columns.
8. Lateral displacement of building got miniaturized maximum by the use of X- type of bracing system. Bracing incorporated building showed storey drift within limit as specified in IS 1893 (PART 1):2002.
9. Bracings X, combined V added on base shear by 60% to 65%, indicates that stiffness of the building has increased. Concrete bracing enhances overturning moment by 61% to 65%, whereas steel bracing by 48% to 53%.
10. RSA exhibits very much non-linear behaviour and simulating to practical situation which then helps designers to choose proper analysis procedure.

V. REFERENCES

[1]. Dr.Alok G (2001), “The Great Gujarat Earthquake 2001- Lesson Learnt”, 22nd Asian conference on remote sensing organised under CRISP, SISV and AARS, National university of Singapore.

[2]. Sudhir K. J. (2004), “Implications of 2001 Bhuj Earthquake for Seismic Risk Reduction in India”, 13th world conference on earthquake engineering, paper no. 3244, B.C., Canada.

[3]. Anes B, Dr.Chandan K, Patnaikuni, Dr.Balaji, Santhosh K (2017), “Effect of Steel Bracings on RC Framed Structure”, International Journal of Mechanisms & Solids, Volume 9, No. 1.

[4]. Rakshith K L, Smitha (2017), "Effect of Bracing on Multi-Storey RCC Frame Building under Dynamic Loading", International Journal of Advance Research, Ideas and Innovations in Technology, Volume 3, Issue 4.

[5]. Mohammad. A, Syed H (2016), "Comparative Study of Seismic Analysis of Multi-Storey Building with Shear Wall and Bracing Systems",International Journal of Advanced Strucyures& Geotechnical Engineering, Volume 5, No. 3.

[6]. Priyanka S, Purushottam L.T, Vikky K, (2016), "Structural Analysis of Multi-Storied Building of Different Shear Wall Location and Heights",International Journal of Engineering Trends and Technology, Volume 32, Issue 1.

[7]. Kasliwal N.A, Rajguru R. S (2016), "Effect of Numbers and Positions of Shear Wall on Seismic Behaviour of Multi-Storied Structure",International Journal of Science, Engineering and Technology Research, Volume 5, Issue 6.

[8]. Patil S.P, Desai R.M., Khurd V.G (2016), "Comparison of Shear Wall and Bracing in RCC Framed Structures", International Journal for Research in Applied Science & Engineering Technology, Volume 4, Issue 12.

[9]. Amey D. K. (2016), "Assessment of Location and Optimum Percentage of Shear Wall for Typical Plans", International Journal of Engineering Development and Research, Volume 4, Issue 3.

[10]. Mohammad A, Prof. Laxmikant V, Vikrant N (2015), "Comparative Study on Seismic Analysis of Multi-Storey Building Stiffend with Bracing and Shear Wall", International Research Journal of Engineering & Technology, Volume 2, Issue5.

[11]. Prof. Bhosle A.T, Prof. Sheikh A.N. (2015), " Analysis of Reinforced Concrete Building with Different Arrangement of Concrete and Steel Bracing System", IOSR Journal of Mechanical & Civil Engineering, Volume 12, Issue 5.

[12]. Suchita T, Fernandes (2015), "Optimum Location of Shear Wall in a Multi-Storey Building Subjected to Seismic Behaviour using GeneticAlgorithm", International Research Journal of Engineering And Technology, Volume 2, Issue 4.

[13]. Biradar and Mangalgi S (2014), "Seismic Response of Reinforced Concrete Structure by using Different Bracing Systems", International Journal of Research in Engineering and Technology, Volume 3, Issue 9.

[14]. ThoratS.R. and SalunkeP.J. (2014), "Seismic Behaviour of Multi-Storey Shear Wall Frame versus Braced Concrete Frames", International Journal of Advanced Mechanical Engineering, Volume 4, No. 3.

[15]. Anshul S, Raghav S.S, Poonam (2014), " Effect of Different Shear Wall Configurations on Seismic Response of a Moment Resisting Frame",European Scientific Journal, edition ISSN: 1857-7881 (print) e – 1857-7431.

[16]. Prof. PatilS.S., Miss. GhadgeS.A., Prof. KonapureC.G., Prof. Mrs.GhadgeC.A. (2013), "Seismic Analysis of High Rise Building by Response Spectrum Method", International Journal of Computational Engineering Research, Volume 3, Issue 3.

[17]. Shaik K. M. A, Vinod H (2013), "Seismic Performance Evaluation of Multi-Storeyed RC Framed Buildings with Shear Wall", International Journal of Scientific and Engineering Research, Volume 4, Issue 1.

[18]. Viswanath K. G, PrakashK.B., Anant D (2010), " Seismic Analysis of Steel Braced Reinforced Concrete Frames", International Journal of Civil And Structural Engineering, Volume 1, No. 1.
[19]. IS 1893 (PART 1):2002. "Indian Standard Criteria of Practice for Earthquake Resistant Design of Structures", Bureau of Indian Standards,New Delhi, India.
[20]. IS 4326:1993, "Indian Standard Code of Practice for Earthquake Resistant Design and Construction of Buildings", Bureau of Indian Standards,New Delhi, India.
[21]. IS 13920:1993, "Indian Standard Code of Practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces",Bureau of Indian Standards, New Delhi, India.
[22]. IS 456:2000, "Indian Standard Code of Practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi, India.
[23]. National Building Codes, Bureau of Indian Standards, New Delhi, India.
[24]. Technical Reference Manual of STAAD.Pro (2016), a Bentley Trademark.
[25]. User's Guide Manual of ETABS 2016, a CSI Trademark.
[26]. Civil Manuals of Midas (2016), Midas Information Technology Co., Ltd.
[27]. Ray W. C & Joseph P (1995), "Dynamics of Structures", Objectives of Structure Dynamics, Page No.1, 3rd edition, Computer & Structures, Inc., USA.
[28]. Mario P (2004), "Structure Dynamics", 2nd edition, Page No. 132, CBS Publishers & Distributers Pvt. Ltd., New Delhi, India.
[29]. Book of Disaster Management India (2017), Government of India.

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Experimental Study of Bendable Concrete by Using Admixture and Fiber

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ABSTRACT

This paper suggests the need for developing a new class of FRCs which has the strain-hardening property but which can be processed with conventional equipment. It is demonstrated that such a material, termed engineered cementitious composites or ECCs, can be designed based on micromechanical with strain capacity of about 3 to 5% compared to 0.01% of normal concrete. The result is a moderately low fiber volume fraction (<2%) composite which shows extensive strain-hardening. Ductile property of normal concrete can be improved by using PVA fibers in place of coarse aggregate and cement partially replaced by fly ash. For these purpose concrete cubes, cylinders, beams and slabs are experimentally investigated. This paper also focuses on significant pattern of cracks developed during testing of specimens.

KEYWORDS: Engineering Cementitious Composites, Recron3s, Polypropelene, ECC, Ecc concrete

I. INTRODUCTION

Conventional concretes are almost unbendable and have a strain capacity of only 0.1% making them highly brittle and rigid. This lack of bendability is a major cause of failure under strain and has been a pushing factor in the development of an elegant material namely, bendable concrete also known as Engineered Cementitious Composites abbreviated as ECC. This material is capable to exhibit considerably enhanced flexibility. A bendable concrete is reinforced with micromechanically designed polymer fibres. ECC is made from the same basic ingredients as conventional concrete but with the addition of High-Range Water Reducing (HRWR) agent is required to impart good workability. However, coarse aggregates are not used in ECCs (hence it is a mortar rather than concrete). The powder content of ECC is relatively high. Cementitious materials, such as fly ash, silica fume, blast furnace slag, silica fume, etc., may be used in addition to cement to increase the paste content. Additionally, ECC uses low amounts, typically 2% by volume, of short, discontinuous fibres. ECC incorporates super fine silica sand and tiny Polyvinyl Alcohol-fibres covered with a very thin (nanometer thick), slick coating. Thus an ECC deforms much more than a normal concrete but without fracturing. The different ingredients of ECC work together to share the applied load. ECC has proved to be 50 times more flexible than traditional concrete, and 40 times lighter, which could even influence design choices in

skyscrapers. Additionally, the excellent energy absorbing properties of ECC make it especially suitable for critical elements in seismic zones.

II. FILLERS USED

ECC Concrete is homogenous mixture of Cement, sand, fly ash, water, an optimal amount of fibers and small amount of admixtures. In the mix coarse aggregates are deliberately not used because property of ECC Concrete is formation of micro cracks with large deflection. Coarse aggregates increases crack width which is contradictory to the property of ECC Concrete.

The fillers that are used in experimental process are as follows:

Taller is the building, lower is the stiffness and higher the mass causes low natural frequency which is very vulnerable for tall buildings as it is easily available for resonance condition. So by adding shear wall and bracing,

2.1 CEMENT: Ordinary Portland cement (OPC) – 53 grade (Ultratech Cement) was use .

SAND: Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. soil containing more than 85% sand-sized particles. Sand is used ingredients of mortar and concrete and for polishing and sandblasting. The weight varies from 1,538 to 1,842 kg/m3, depending on the composition and size of grain. The fine aggregate obtained from river bed of Koel, clear from all sorts of organic impurities was used in this experimental program. The fine aggregate was passing through 4.75 mm sieve and had a specific gravity of 2.68. The grading zone of fine aggregate was zone III as per Indian Standard specifications

2.2 FLY ASH: Fly ash used was pozzocrete dirk 60Fly Ash are the waste materials produced from the industries which can used as a replacement for fillers and also the cost is very low. The Fly Ash that is used in the project Work is obtained from Adhunik.

2.3 SUPER PLASTISIZER: Super plasticizer used was Melamide Formaldehyde

2.4 POLYPROPELYNE FIBRE: Fibers are usually used in concrete to control cracking due to both plastic shrinkage and drying shrinkage. The function of the polypropylene fiber mixed into concrete is not to replace the steel but to avoid the creation of micro cracks in the concrete .This increase the lifetime of the structure. Polypropylene fibers in concrete, in diameter range of 22 to 35 micron by 19mm long, reduce the flow of water through the concrete matrix by preventing the transmission of water through the normal modes of ingress,

e.g. capillaries, pore structure, cover concrete, etc.

2.5 RECRON 3S: Recron 3s prevents the micro shrinkage cracks developed during hydration, making the structure/plaster/component inherently stronger. Further, when the loads imposed on concrete approach that of failure, cracks will propagate, sometimes rapidly. Addition of Recron 3s to concrete and plaster arrests cracking caused by volume change (expansion and contraction), simply because 1 kg of Recron 3s offers millions of fibres which support mortar/concrete in all directions. Cut length: 6 mm or 12 mm Shape of fiber: Special for improved holding of cement aggregates.

Tensile strength: 4000-6000 kg/cm2 Melting point :> 250 °C

2.6 WATER : Soft waters also produce weaker concrete. Water has two functions in a concrete mix. Firstly, it reacts chemically with the cement to form a cement paste in which the inert aggregates are held in suspension until the cement paste has hardened. Water fit for drinking is generally considered fit for making concrete Secondly, it serves as a vehicle or lubricant in the mixture of fine aggregates and cement.

III. MIX PROPORTION FOR ECC

3.1 Proportioning of concrete

The mix design for ECC Concrete is basically based on Micromechanics design basis. Micromechanics are a branch of mechanics applied at the material constituent level that captures the mechanical interactions among the fiber, mortar matrix, and fiber–matrix interface. Typically, fibers are of the order of millimeters in length and tens of microns in diameter, and they may have a surface coating on the nanometer scale. Matrix heterogeneities in ECC, including defects, sand particles, cement grains, and mineral admixture particles, have size ranges from nano to millimeter scale. Hence the ideal mix proportion given in the literature of ECC-ECC Concrete was used as the guidelines to determine the proportion of various constituents in the concrete. The ideal Mix proportion which was taken as reference is given below:

Mix designation	cement	sand	Fly ash	water	super plasticizer	fiber	w/c ratio
M40	320	1820	110	150	4.6	6	0.36

(Note: - SP is in % with binder material (Cement + Fly ash)

3.2 PLACING, COMPACTION & CASTING OF CONCRETE SPECIMENS.

Before placing of concrete, the concrete mould must be oiled for the ease of concrete specimens stripping. The oil used is a mixture of diesel & kerosene. Special care was taken during the oiling of the moulds, so that there are no concrete stains left on the moulds. Once the workability test of ECC Concrete was done, the fresh concrete must be placed into the concrete moulds for hardened properties tests. During the placing of fresh concrete into the moulds, tamping was done using Tamping rod in order to reduce the honeycombing. After placing the concrete into the moulds, vibrations were done using a table vibrator. The vibration of concrete allows full compaction of the fresh concrete to release any entrained air voids contained in the concrete. If the concrete were not compacted to a proper manner, the maximum strength of the concrete cannot be achieved. After vibration operation, the leveling of concrete was done on the surfaceof the concrete. Leveling is the initial operation carried out after the concrete has been placed & compacted. After the leveling of the fresh concrete was done, the concrete in the mould was left overnight to allow the fresh concrete to set.

3.3 CURING OF CONCRETE SPECIMEN.

After leaving the fresh concrete in the moulds to set overnight, the concrete specimens in the moulds were stripping. The identification of concrete specimens was done. After 24 hours, all the concrete specimens were

placed into the curing tank with a controlled temperature of 25 0C in further for 28 days for the hardened properties test of concrete. Some of the cubes were cured in the Accelerated Curing Tank due to time limit. Curing is an important process to prevent the concrete specimens from losing of moisture while it is gaining its required strength. Lack of curing will lead to improper gain in the strength. After 28 days of curing, the concrete specimens were removed from the curing tank to conduct hardened properties test of ECC Concrete

IV. TESTING ON CONCRETE

4.1 TESTING ON HARDENED CONCRETE

There are many ways that we can used to indicate the strength of concrete. The testing for the strength if concrete is very important in the civil works. This chapter consists of two types of hardened concrete testing. They are compression test and split tensile test. All the procedure used was according to the indian standard code

4.1.1 CRUSHING TEST- (TEST ON CUBES)

The cubes of size 150 x 150 x 150 mm are placed in the machine such that load is applied on the opposite side of the cubes as casted. Align carefully and load is applied, till the specimen breaks. The formula used for calculation: Compressive Strength = Total Failure Load/Area of the Cube

Figure 3: Compressive Test on Concrete

4.1.2 FLEXURAL STRENGHT ON BEAM

The test is carried out to find the flexural strength of the prism of dimension 100 x 100 x 500 mm. The prism is then placed in the machine in such manner that the load is applied to the uppermost surface as cast in the

mould. Two points loading adopted on an effective span of 400 mm while testing the prism. The load is applied until the failure of the prism. By using the failure load of prism

Flexural Strength = 3Pl/2bd2 P – Failure load of the prism l

Length of the prism b –Breadth of the prism d –

Depth of the prism

V. RESULT

SR.NO	% OF FIBER	NO. OF DAYS	LOAD AT FAILURE	COMP. STRENGH (N/mm^2)
1	0.5	14	250	16
		28	400	26.33
2	1.5	14	310	20.66
		28	567	37.66
3	2.5	14	360.5	24.03
		28	460	30.66

SR.NO	% OF FIBER	NO. OF DAYS	LOAD AT FAILURE	FLEXURAL STRENGH (N/mm^2)
1	0.5	14	8	6.96
		28	12	9.28
2	1.5	14	10	7.88
		28	18	13.8
3	2.5	14	8	6.96
		28	16	12.6

Result using polypropelene fiber Result using Polypropelene as a fiber :

SR.NO	% OF FIBER	NO. OF DAYS	LOAD AT FAILURE	FLEXURAL STRENGH (N/mm^2)
1	0.5	14	8.9	6.675
		28	12.96	9.720
2	1.5	14	10.5	7.875
		28	20	15
		14	8	6.1
3	2.5	28	16.5	12.6

Result using Recron 3s as a fiber :(FLEXURAL STRENGHT)

VI. COST ANALYSIS

SR. NO	DISCRIPTION	AMOUNT
1	Cost of cement	= Rs 6/kg
2	Cost of sand	=4500/brass
3	Cost of fly ash	=Rs6.8/kg
4	Cost of polypropelene	=Rs 350/kg
5	Cost of recron3s	=Rs 300/kg
6	Cost of melamydeformaladehyde	=Rs 275/litre
7	Cost of water	=-----

(Figure 4 : Flexural Test of Prism)

VII. CONCLUSION

According to test results, the beam is withstanding high load and a large deformation without succumbing to the brittle racture typical of normal concrete, even without the use of steel reinforcement. The significant properties of ECC Concreteare ductility, durability, compressive strength, and self-consolidation.

VIII. REFERENCES

[1]. Dr. A. W. Dhawale, Mrs. V. P. Joshi (april 2013)" Engineering Cementatious composites for Structural Applications" International Journal of Application or Innovation in Engineering and Management (IJAIEM) Volume 2, Issue 4,April 2013.

[2]. Yu Zhu, Yingzi Yang and Yan Yao (2012), "Use of slag to improve mechanical properties of engineered cementitious composites (ECCs) with high volumes of fly ash", Journal of Construction and Building Materials, Vol. 36, pp.1076- 1081.

[3]. Pajak M and Ponikiewski T (2013), "Flexural behaviour of self-compacting concrete reinforced with different types of steel fibres", Journal of Construction and Building Materials, Vol. 47, pp. 397- 408.

[4]. Jian Zhou, Shunzhi Qian, Guang Ye, Oguzhan Copuroglu, Klaas van Breugeland Victor C Li (2012), "Improved fiber distribution and mechanical properties of engineered cementitious composites by adjusting the mixing sequence", Journal of Cement & Concrete Composites, Vol. 34, pp. 342–348.

[5]. Victor C Li (2012), "Improved fiber distribution and mechanical properties of engineered cementitious composites by adjusting the mixing sequence", Journal of Cement & Concrete Composites, Vol. 34, pp. 342–348.

[6]. Qian S Z, Zhou J and Schlangen E (2010), "Influence of curing condition and precracking time on the self- healing behaviour of Engineered Cementitious Composites", Journal of Cement &

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Water Pollution Monitoring and Detection Techniques : A Review

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ABSTRACT

Now a day's water pollution became a global issuedue to agricultural waste, industrial waste, sewage waste and so on. This paper gives highlight about various water pollutants, their resources, and methods available for the pollutant's detection and identification. Also, it explains about the different sensors and sensors networks. Sensors haveability to Control andmonitor the quality of waterandable to detect the contaminants added due to human generating activities. Sensors can be used for the detection and identification of the pollutants present in water. Various pollutants found in water arepesticides, harmful chemicals, heavy metals, nutrients, etc.

Key Words: Water Quality, Water Pollutants, Chemical Sensors, Smart sensors, Biosensors, Wireless Sensor Network, Internet of Things.

I. INTRODUCTION

Water plays vital role in our life; it keeps us alive. Clean water is requirement of all living being. But due to anthropogenic and naturalsources, water gets polluted.Majorly impurities are get added by industrial and agricultural discharge into clean water, rivers, and various water sources. Removal of theses Pollutants added in to water are needed to remove whether it is added by intentionally or unintentionally to protect human health from various types of diseases. These polluted water affects not only environment but also human beings too.Chemical contaminants present in water are color less so it cannotbe detected by observing human eye. The main chemicals available in water are pH, dissolved oxygen-O2 (or DO), temperature, electrical conductivity Oxidation reduction potential (ORP), turbidity and dissolved ions (Fluoride (Fluoride (F-), Calcium (Ca2+), Nitrate (NO3-), Chloride (Cl-), Iodide (I-), Cupric (Cu2+), Bromide (Br-), Silver (Ag+), Fluoroborate (BF4-), Ammonia (NH4), Lithium (Li+), Magnesium (Mg2+), Nitrite (NO2-), Perchlorate (ClO4), Potassium (K+), Sodium (Na+). etc.

Pollution of water occur when harmful chemicals, substances or pesticides contaminate added into river, lake, sea, well, ocean or other water bodies. According to fundamental rights of human, pure and clean water is the top most priority of life.

Chemical Pollutionoccurs when chemicals resulting into the environment by human activity.For examples water, soil, acid rain, greenhouse gases and ozonegas contaminating air [1].Surface water get fills into rivers, lake, sea, ocean etc. as per survey maximum area of rivers, streams and lake has been polluted which cannot be used for swimming, fishing or dinking purpose.Agriculture pollution plays a major role in water pollution. Large quantity of drugs, pesticides, saline and agrochemicals are drain into the river or other water bodies.Sewage and wastewateris nothing but the used water. Our day-to-day life examples of waste water are our sinks, showers, industrial and agricultural activities. There is other term called as storm water runoff, it may occur when rainfall carries roadside impurities, oil, grease, chemicals, pesticides which laterally added into rivers and lakes or sea.

Table 1.1:Sources of Water Pollutants with effects and their solutions

Sources	Effects	Solutions
Industries effluents 1. Electroplating and electronic plants 2. Beverage and food processing industries 3. Rubber industry	1. In organism highly toxic accumulate through food chain 2. Human nervous disorder may cause lack of presence of mercury 3. Waste water contains contaminates like sulfide, hydrogen	1. Effluents should be treated before discharging it into water. 2. Make a separate suit for dumping the hazardous wastes.
1. Untreated sewage contains domestic waste and human	**Solid Suspended** 1. Penetration of light has been reduced 2. Decompose process require high oxygen for suspended solids like biodegradable, microorganisms	1. Sewage should be treated before dumping into rivers 2. Farm lorry should be stop for entering ponds or rivers
1. Domestic waste contains detergents and food waste	**Detergent** 1. Oxygen supply reduce due to hard detergents foam 2. Soft detergents contain high phosphate as its biodegradable, it rise eutrophication.	1. Use of low phosphates biodegradable detergents

II. RELATED WORK

Few pollutants occur naturally like heavy metals, nitrogen oxide etc. Some are formed during their chemical reaction with naturally occurring components in agriculture or pharmaceuticals industries while use of concentration and transformation of chemical substrate.

Atif Alamri et al. have entitled about the infrastructure of sensors cloud, their approaches, and discussed about the layers used for transforming data from sensors to cloud services [2].

R. Karthik Kumar et al. have developed a solar monitoring system by using wireless sensor networks. Role of solar node is to provide power supply to sensor network by using MATLAB result has been displayed on GUI [3].

Pradeepkumar M et al. introduced the architecture of cloud computing into IoT as well as sensors network to make that sensor data accessible worldwide [4].

Kedia Nikhil et al. this paper designed a sensor cloud-based network for water monitoring in rural area. This system can directly contact to government in case of quality issue of water as system has facility of mobile network operator [5].

Shahid Ahmedet al. Heavy metals, pesticides,agriculture waste and petrochemical hydrocarbon are examples of pollutants. The syntheses of pesticides, plastics, petrochemicals are the main source of pollutants created in the environment [6].Initially there was a smaller number of researches to monitor for water environment perception it was based on sensor networks and identification and selection of perfect solution on water pollution monitoring. Water environment is not easy to monitor its complex and challenging task. For examples, waves, reflection of water, colordifference of water increase the level of difficulty for visual perception.

Cengiz Koparan et al.have discussed with the help of main parameters like dissolved oxygen, temperature, pH, electrical conductivity we are able to monitor the quality of water in lakes, ponds, and rivers. Concentration of dissolved oxygen must be low; temperature and pH must be undesirable are led to poor quality of water. Pollutants carried out by storm water may content bacteria, nutrients, litter, oils, heavy metals, and sediments [7].

Peter Krusehas studied about the pollutants present in water by using Chemical Sensors, electrical sensors, electrochemical sensors he tested some parameters like pH, turbidity, temperature of water, humidity of surrounding environments etc.[8].

Manish Kumar Jha et al. have designed a web portal for real time monitoring ofwater. He has used Arduino UNO, Raspberry pi as a controller and pH Sensor to detect pH, temperature Sensor to measured water temperature, turbidity sensor to calculate turbidity, also measured the EC of polluted water. He has used multiple sensors to measured individual pollutants so the entire system became too costly [9].

Nikhil Kumar Konditala et al. have entitled as previous model system require heavy computing devices like Arduino UNO, Raspberry pi etc. but in this system, author has been used node MCU which is light weighted to monitor and control the water parameters. This system is cost effective also Provided Email alerts and real time access to data visualization of water parameters [10].

Evizal Abdul Kazilet al. have tested water sample in laboratories and on the basis of laboratories result he has designed a sensor network with the help of Thermistor, Glass electrode, flow Sensor, water level sensor, paleography (it's a laboratory method) to detect the parameters like temperature, dissolved oxygen, pH, conductivity, flow rate, water level etc. author has been used Sink node for water monitoring and communication purpose. [11].

Cengiz Koparan et al. has designed an UAV (unmanned ariel vehicle) system having Sensor nodes, water sampling cartridge and microcontroller. It measured parameters like EC, DO, temperature, pH etc. This system first land on water surface and collect only three water samples in bottle that too only 130ml. [12].

Sathish Pasika et al. has able to identify and detect the percentage of water pollutants like turbidity, temperature, and pH. By using Turbidity Sensor, DHT11, pH Sensor resp. ArduinoMega is used for controlling the system. Node MCU Think Speak application has been used to measure water quality [13].

Annasamy Gowri et al. We all know that clean water is more important than anything else. We cannot compromise in it. Water pollution is disturbing aquatic environment because of introduction of harmful contaminants into water bodies. Now a day's water pollution became a global issue, it requires some evaluation ideas and water monitoring to control n avoiding water pollution. There are categories of water pollutants like bacteria, disease causing agents, viruses, parasitic worms all are enter into sewage systems. Second category of pollutants is waste that can be decomposing by oxygen requiring bacteria [14].

Navin G Haswani et al. Wireless sensor networks using Arduino meet our objectives of the project with less cost, long range, and increases the network lifetime. However, Sensor networks are considered as the key enablers for the different application like u agriculture monitoring and controlling, Industry monitoring, home automation etc. [15].

III. RESEARCH GAP

Peter Kruse et al. have suggested in future Data processing algorithm need to develop for establishment of sensor network to provide better platform for water pollution monitoring [8].Manish Kumar Jha et al. In future its require to identify a single sensor to analyzing multiple pollutant parameters also machine learning and Ai algorithm should be used to detect and monitor water quality [9].Nikhil Kumar Konditala et al. Suggestedadding more quality sensors which can detect other chemical and physical parameters affecting the quality of water can improve our results and thus making our system effective [10].Evizal Abdul Kazilet al suggested existing system not able to detect some advanced pollutants like BOD, COD, TSS [11]. Cengiz Koparan et al. mentioned UAV cannot operate at narrow area of pond or river. Vehicle battery is compensating for 2.1kg payload only. This is the main reason for shorter endurance. [12].Sathish Pasika et al. mentioned this system not measured the advanced pollutants like DO, BOD, COD, and hydrogen sulfide etc[13].

Comparative Study of Water pollutant metrics

Table 1.2: Parameter quality for Water Resources [16,17]

Parameters	Range (Europe)	WHO	Sensing principle
pH	6.5 – 9.5	-	Chemical
Copper	2 ppm	2 ppm	Chemical
Nitrate	50 ppm	50 ppm	Electrochemical
Zinc	5ppm	-	Anodic stripping voltammetry
Sulfide	-	-	Electrochemical
Lead	10 ppb	10 ppb	Chemical
Ca2+, Mg2+	-	-	Electrochemical
Dissloved Oxygen	-	-	Electrochemical

IV. EXISTING SENSOR BASED WATER POLLUTANT DETECTION METHODS

4.1 Wireless Sensor Networks

In traditional methods all samples are collected by manually and send it to laboratories for finding the contaminants available in polluted water. This traditional method of finding contaminants in water required special instruments and equipment's, highly knowledgeable and trained person to monitor. Main drawback of traditional methods are, it is more time consuming, very costly, and monitoring for real time is not possible. To overcome this drawback of traditional methods situ methods has been designed for real time monitoring for water pollution. With this process it is possible to monitor quality of water, store that data. But drawback is its difficult to send data automatically to the user for next process. So to overcome this failure researchers have given maximum attention towards wireless sensor networks (WSN) to monitor the quality of water. Sensor is able to collect the real time data, on site fixing is possible, adjustable sampling frequency, visualization and data processing can possible at any time. Remotely monitoring and controlling can be possible [18].

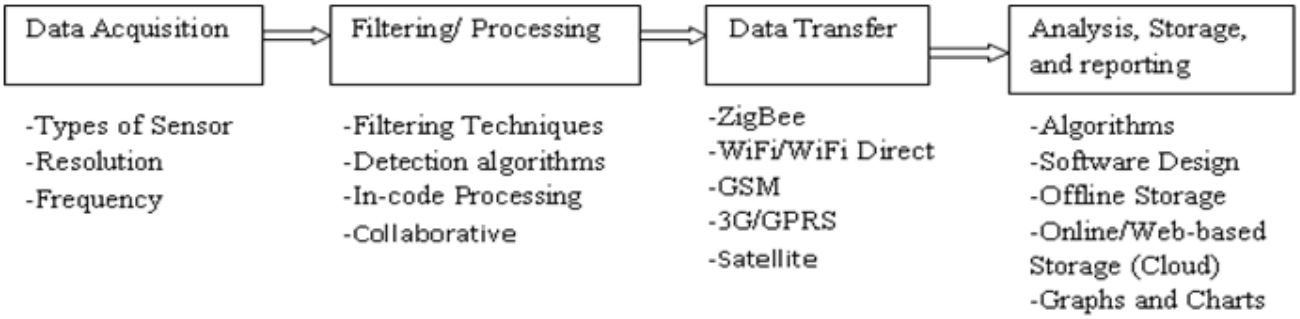

Figure 1.1:WSN for Water Pollutant detection

Figure presents the WSN pipeline as composed of four building blocks which represent the main operations that need to be performed by the system, namely data acquisition, filtering/processing, data transfer, and final analysis, storage, and reporting. In the first block, data acquisition, the spatially distributed wireless sensor

nodes acquire samples from the water source at periodic intervals. In the second block, Filtering processing, the samples collected during the acquisition phase are processed. This phase requires specialized computation and benefits from devices that are able to perform computationally intensive operations locally. Filtering techniques and efficient algorithms for detecting the required water quality parameters are implemented. The next functional block is represented by the data transfer, which describes the way in which the data is moved from the source to the destination. The data transfer is largely dependent on the architecture of the network. The choice of routing protocol and their efficiency becomes an important consideration. Several technologies are available for this, including ZigBee, WiFi, WiFi-Direct, LTE, GSM, or WiMAX. The final block of the WSN-based WQM pipeline consists of the data analysis, storage, and reporting. In this phase, the system performs some additional computations, andorganizes and classifies the data collected by the WSN. Data can also be stored usingoffline storage media, online storage media, and/or the cloud. The data is then presentedto the user in the form of graphs, charts, and tables.

4.2 Smart Sensors

Figure 1.2: Smart Water Sensor Board with Probe

Smart sensors comes under intelligent devices, it can easily take or captured input from environmental factors. Smart sensors built in programmable microprocessors. Basically Smart sensors are sensing element, used for amplification of signals, filtering process for the combination of compensation and software data processing [19]. The data of real time monitoring of water quality by using the multisensory network given by cloeteet[20].All monitored data has been processed analytically and later it transmitted wirelessly to the allocated destination nodes to provide the information to the end user about water quality monitoring. It content parameters like temperature, pH, turbidity,dissolved oxygen and conductivity.

4.3 Chemical Sensors

Chemical sensors are ambiguous in nature. Researchers of sensors community stipulated that sensing refers a continuous process of perception. Chemical sensors are small scale device that can able to detect and measure online information of specific pollutants present in samples [21]. Complicated network of sensing system

elaborates recognition principles, sensitive layer, signal processing and evaluation of software. chemical sensor" should be restricted to those devices which acquire information continuously, while sensing systems which obtain information in discrete steps should be named as"analytical assays. These specifications are made because the term sensor is often used to refer to a probe or indicator that communicates the presence of an analytic via modulation of an analytical signal. A chemical sensor as a device provides information about the system under study through the integration of a transducer with a micro zone where a chemical reaction takes place. This device can result in either a "probe" able to sense the analytic in batch mode in a flow-system continuous recording, Finally, according to IUPAC, A chemical sensor is a device that transforms chemical information, ranging from the concentration of a specific sample component to total composition analysis, into analytically useful signal. The chemical information mentioned above may origin from a chemical reaction of the analyte or from a physical property of the system investigated [21].

4.4 Biosensors

A biosensor is an independent device, which provides specific quantitative or semi-quantitative analytical information using a biochemical receptor [22]. A biological component act as a receptor for a specific analyte, this interaction results in a signal is transformed using a transducer into a quantitative signal which can be detected. The main advantages of biosensors are, miniature device, ability to perform in complex solutions, easy sample preparation and on-site usage. But several of such devices are not able to compete with the conventional sensors with respect to accuracy and reproducibility. A variety of biorecognition methods like, molecularly imprinted polymer, immunochemical, whole-cell and DNA elements, enzymatic, non-enzymatic receptor, are available, owing to which biosensors can be classified into types: electrochemical, optical, piezoelectric and thermal biosensors, based on their transducing mechanism [21]. Biochemical specificity of bioreceptor defines the function of biosensor. Biosensors can also be classified as enzymatic biosensors, immunosensors, genosensors or DNA biosensors, or tissue-based biosensors depending on the type of bioreceptor [23].

V. CONCLUSION

As per the overall survey of water quality monitoring we realized that it is more challenging to find out the actual method for pollutants detection and monitoring of water. As per previous methods discussed in papers we have found some limitations and drawbacks in techniques like advance pollutants BOD, COD, TSS, hydrogen sulfide have not found by sensor network, to identify these pollutants laboratory methods are required. In overall reviews techniques should be satisfied the conditions like early warning detection, quick response, cost effective, reliable, more important it continuously detection the contaminants in water. Real and continuous water monitoring is a hard task. The appropriate use of various methods for pollutants monitoring and different sensor to monitor and control water contaminants has been discussed in this paper. This paper focus on functionality and working of biosensors,smart sensors and chemical sensors at various environmental conditions. Now a day's sensors technology is more appreciable as it more accurate and suitable for water pollutants monitoring. The combination of analytical methods (techniques) and smart sensors leads with the effective implementation result in water pollutant monitoring process.

VI.REFERENCES

[1]. Dwivedi, A. K. (2017). Researches in water pollution: A review. International Research Journal of Natural and Applied Sciences, 4, 118–142. Water Pollutants: Origin and Status

[2]. Atif Alamri, Wasai Shadab Ansari, Mohammad Mehedi Hassan, M. Shamim Hossain, AbdulhameedAlelaiwi, and M.Anwar Hossain, "A Survey on Sensor-Cloud: Architecture, Applications, and Approaches", International Journal of Distributed Sensor Networks, Volume 2013

[3]. R.Karthik Kumar, M.Chandra Mohan, S.Vengateshapandiyan, M.Mathan Kumar, R.Eswaran. "Solar based advanced water quality monitoring system using wireless sensor network" 2014, International Journal of Science, Engineering and Technology Research, 2014.

[4]. Pradeepkumar M, MonishaJ. "The Real Time Monitoring of Water Quality in IoT Environment" 2016 International Journal of Innovative Research in Science, Engineering and Technology, 2015 ISSN(Online) : 2319-8753

[5]. Kedia, Nikhil. "Water Quality Monitoring for Rural Areas- a Sensor Cloud Based Economical Project" 2015 1st International Conference on Next Generation Computing Technologies (NGCT), 2015, doi:10.1109/ngct.2015.7375081.

[6]. Shahid Ahmed and Saba Ismail "WATER POLLUTION AND ITS SOURCES, EFFECTS & MANAGEMENT: A CASE STUDY OF DELHI" International Journal of Current Advanced Research Volume 7; Issue 2(L); February 2018.

[7]. Cengiz Koparan, Ali BulentKoc *, Charles V. Privette and Calvin B. Sawyer, In Situ Water Quality Measurements Using an Unmanned Aerial Vehicle (UAV) System, Water 2018, 10, 264; doi:10.3390/w10030264

[8]. Peter Kruse, "Review on water quality sensors" Journal of Physics D: Applied Physics, J. Phys. D: Appl. Phys. 51 (2018)

[9]. Manish Kumar Jha, Rajni Kumari Sah et al. "Smart Water Monitoring System for Real-time water quality and usage monitoring", Proceedings of the International Conference on Inventive Research in Computing Applications (ICIRCA 2018)

[10]. Nikhil Kumar Koditala, Dr.Purnendu Shekar Pandey, "Water Quality Monitoring System using IoT and Machine Learning", 978-1-5386-2599-6/18/$31.00 ©2018 IEEE

[11]. Evizal Abdul Kadir, Abdul Syukur, "Smart Sensor Node of WSNs for River Water Pollution Monitoring System", at: https://www.researchgate.net/publication/333965946, Conference Paper · April 2019

[12]. Cengiz Koparan, Ali Bulent Koc et al., "Autonomous In Situ Measurements ofNoncontaminantWater Quality Indicators andSample Collection with a UAV", Department of Agricultural Sciences, Clemson University, Clemson, SC 29634, USA; ckopara@clemson.edu (C.K.); privett@clemson.edu (C.V.P.); calvins@clemson.edu (C.B.S.) * Correspondence: bulent@clemson.edu; Tel.: +1-864-656-0496, March 2019

[13]. Sathish Pasika *, Sai Teja Gandla, "Smart water quality monitoring system with cost-effective using IoT", journal homepage: www.cell.com/heliyon, Heliyon 6 (2020) e04096

[14]. Annasamy Gowri and ArunkumarKathiravan, Fluorescent Chemosensor for Detection of Water Pollutants, © Springer Nature Singapore Pte Ltd. 2020 D. Pooja et al. (eds.), Sensors in Water Pollutants Monitoring: Role of Material,

[15]. Navin Haswani, "Web-based realtime underground drainage or sewage monitoring system using Wireless Sensor Networks", 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA)

[16]. The Council of the European Union 1998 European Union Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption Official Journal of the European Communities 41 32–54

[17]. World Health Organization 2011 Guidelines for Drinking- Water Quality 4th edn (Geneva)

[18]. KOFI SARPONG ADU-MANU, CRISTIANO TAPPARELLO, and WENDI HEINZELMAN, University of Rochester FERDINAND APIETU KATSRIKU and JAMAL-DEEN ABDULAI, University of Ghana, "Water Quality Monitoring Using Wireless Sensor Networks: Current Trends and Future Research Directions", ACM Transactions on Sensor Networks, Vol. 13, No. 1, Article 4, Publication date: January 2017.

[19]. Charef, A., Ghauch, A., Baussand, P., & Martin-Bouyer, M. (2000). Water qualitymonitoring using a smart sensing system. Measurement, 28(3), 219–224. https://doi.org/10. 1016/S0263-2241(00)00015-4. Springer Nature Singapore Pte Ltd. 2020 D. Pooja et al. (eds.),

[20]. Cloete, N. A., Malekian, R., & Nair, L. (2016). Design of smart sensors for real-time water quality monitoring. IEEE Access, 4, 3975–3990. https://doi.org/10.1109/ACCESS.2016. 2592958.Springer Nature Singapore Pte Ltd. 2020 D. Pooja et al. (eds.),

[21]. G.A. Ibañez and G.M. Escandar*_Fluorescence and Phosphorescence Chemical Sensors Applied to Water Samples S.C. Mukhopadhyay & A. Mason (Eds.): Real-Time Water Quality Monitoring, SSMI 4, pp. 45–64.DOI: 10.1007/978-3-642-37006-9_3 © Springer-Verlag Berlin Heidelberg 2013

[22]. Richa Soni, Mahesh Soni and Dericks Praise Shukla, Emerging Techniques and Materialsfor Water Pollutants Detection, © Springer Nature Singapore Pte Ltd. 2020 D. Pooja et al. (eds.), Sensors in Water Pollutants Monitoring: Role of Material, Advanced Functional Materials and Sensors,

[23]. Ivars-Barceló, F., Zuliani, A., Fallah, M., Mashkour, M., Rahimnejad, M., &Luque, R. (2018). Novel applications of microbial fuel cells in sensors and biosensors. AppliedSciences, 8(7), 1184. https://doi.org/10.3390/app8071184. Springer Nature Singapore Pte Ltd. 2020 D. Pooja et al. (eds.), Sensors in Water Pollutants Monitoring: Role of Material, Advanced Functional Materials and Sensors.

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Energy-Efficient and Cost-Effective Sewage Treatment Using Phytorid Technology

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ABSTRACT

The process of design, construction and operation of sewage treatment plant (STP) requires multi-disciplinary approach. Numerous conventional methods are available for design of sewage treatment plants. The process involved in these treatments is either aerobic, anaerobic or combination requiring number of mechanical and electrical items thereby requiring substantial energy. The ever growing need of energy makes the design, operation and maintenance of STP a challenging task. The conventional method of sewage treatment can be made efficient by advanced technologies and intelligent supervision but this in turn increases the total cost. However, root zone technology developed by National Environmental Engineering Research Institute treats the sewage by phytorid plant. It is found from the study carried out on nine STPs at various locations in Pune and Mumbai in Maharashtra (India) that the sewage treatment by phytorid technology uses only 20% of the energy as compared to conventional sewage treatment plants. It is thus concluded that phytorid technology is the future for sewage treatment.

Keywords: sewage treatment plant, aerobic, anaerobic, phytorid

I. INTRODUCTION

Primary water source is polluted to a great extent through discharge of harmful substances. It is estimated that every 1 m3 of contaminated water once discharged into water bodies will contaminate further 8 to 10 m3 of pure water. Out of the 31 diseases that are major cause of death in developed countries, as many as 21 are due to contaminated water. The above facts highlight the need to find improved water treatment to meet the problems of food security, water availability and use of water efficiently. It is beyond any doubt that energy will be the main concern of the nations in coming years. Identification and adoption of appropriate technology to overcome these pressures is therefore absolutely essential. The object of sewage treatment is to stabilize the organic matter present in sewage so as to produce an effluent liquid and sludge, which can be disposed-off into the environment without causing health hazard or nuisance. The endeavour should be to adopt modern and cost- effective technologies and equipment to achieve value for money and maximum user satisfaction. The septic tanks which treat the sewage by pure anaerobic process can be considered as preliminary STP. The

requirement for better treatment of sewage coupled with development of technology lead a way forward towards aerobic process. This requires pumping and blower operation which is energy consuming. Thus conventional STP requires energy for achieving better results. The aerobic process requires oxygen to be provided to the bacteria. Chong et al. [1] discussed the recent developments in photo catalytic water treatment technology. The ability of this advanced oxidation technology has been widely demonstrated to remove persistent organic compounds and micro-organisms in water. Novak and Horvat [2] discussed the structured mathematical models which combined the use of oxygen electrode and biological waste water treatment to optimize the position of electrode in the bio-reactor for efficient transfer of oxygen. The ever growing need of energy makes the design, operation and maintenance of STP a challenging task. Poch et al. [3] deliberated on improvement of conventional wastewater treatment through an intelligent integrated supervisory system. Recently developed concept of treating the sewage by root zone technology provides aerobic and anaerobic treatment simultaneously in one tank. Yang [4] used phyto-remediation for treating contaminated site and concluded that it is an efficient, economical, and environment friendly Eco technology. Besides these advantages, phytoremediation has considerable potential for environmental restoration of contaminated sites. Pawaskar [5] has suggested modification in root zone technology that overcomes the limitation of huge area requirement for application of constructed wetland (CW). The modified CW can be effectively used within the nallah area to treat incoming waste water with techno-economical feasible option. Vymazal [6] discussed that horizontal sub-surface flow constructed wetlands in the Czech Republic are designed to take an advantage of many of the same processes that occur in natural wetlands. The results of the observations by the author also indicate that constructed wetlands can be used as tertiary treatment systems to polish organics and suspended solids. Zhang et al. [7] carried out comparison between the cost of a conventional wastewater treatment processes and CW. The results showed that the CW does not have any advantage in construction cost. However, it has advantage in operation and maintenance cost. The operation and maintenance cost of conventional plan was found to be Rs 16/m3 whereas CW was Rs 1/ m3 . The main objective of this study was to identify energy-efficient design parameters for a conventional STP and comparison of construction, operation and maintenance cost of STPs vis-à-vis sewage treatment by phytorid technology. Based on the different systems and technology, nine STPs were visited for the study. The emphasis was on construction cost along with operation and maintenance aspects.

II. MATERIALS AND METHODOLOGY

The visits to the STPs having different capacities and different systems were made to study and compare the construction, operation and maintenance costs. The study included (i) process employed (ii) initial cost of construction (iii) maintenance costs and (iv) usage of treated waste water. The emphasis was given to maintenance cost considering electrical load and chemicals used. The norms and guidelines of Central Pollution Control Board were taken into account during the study. Energy efficiency parameters were identified and comparisons made to arrive at the best fit solution. The visits to the STPs and material received have helped in deducing the following energy-efficient design parameters which dictate the energy requirements: (i) Pumps- The aerobic, anaerobic or any other combination system of STPs require pumps for operation. Besides there is a

requirement to run the pumps continuously either for raw sewage, sludge or filter water, etc. Thus the main consumers of electricity are pumps. (ii) Blowers-The maximum energy is consumed by blowers since they are of higher ratings and run 24 hrs. (iii) Diffusers-These are the network of pipes laid in the tanks having holes of various sizes and alignments. The efficiency of the system depends on the matrix of holes which in turn dictates energy consumption. (iv) Media - The consumption of energy and efficiency in STP depends on the surface area and typical media used for bacterial growth. Moving media bio-reactor will use less energy compared to activated sludge. (v) Chemicals - These are required for flocculation, coagulation and disinfection. The use of chemicals contributes towards cost. (vi) Advanced Oxidation Process - Employs ultraviolet radiation for efficient oxidation but requires substantial electricity consumption. (vii) Automation - It achieves intelligent supervision for efficient operation and maintenance of sewage treatment plant. (viii) Operator- The human element is irreplaceable. However, some systems like phytorid requires less supervision.

III. RESULTS AND DISCUSSIONS

The cost of construction depends on the availability of existing facility for treating the sewage i.e. septic tank, type of construction (over ground/underground) and type of material. The cost is also governed by degree of treatment desirable i.e. primary, secondary or tertiary. The data obtained from the STP sites are as shown in Table I, II, and III. It is observed from Table I that the cost of construction of aerobic and anaerobic STP is generally the same. The average cost of construction/m3 is Rs 15-20. However, cost of STP using phytorid technology is on higher side since the structure is bigger requiring more space. The operation and maintenance costs depend on the type of system employed in STP i.e. aerobic, anaerobic, combination of both and phytorid. It can be seen that the operation & maintenance cost is very high for aerobic and anaerobic STP and maximum being for combination of aerobic and anaerobic (Rs 3000/day). However, it is least in case of phytorid. The design parameters such as pumps, blowers and ozonation unit required for a typical STP has been studied for connected and consumption load as seen in Table II. It can be seen that the cost of O & M depends on the number and type of electrical and mechanical equipments installed and duration of work. The cost is also contributed by usage of chemicals especially in anaerobic STP. Table III gives the O & M cost of STP which includes cost of electrical load as well as chemicals for a 200 m3 capacity. It is observed from Table III that the cost of operation and maintenance per day of the conventional aerobic and anaerobic STP is Rs 1600 and Rs 2700 respectively. However, the cost of operation and maintenance of STP on phytorid technology is just Rs 200/day. In order to understand the implications of O & M costs in the longer run say for 25 years, annual costs O & M are determined and displayed in Table IV. The Table IV clearly depicts that the percentage saving in operation and maintenance cost of STP by phytorid technology is 80% with respect to aerobic process and 88.8% with respect to anaerobic process. Thus phytorid technology is best suited from the aspects of energy saving maintenance aspects

Sr No	Name of STP	Capacity (m^3/day)	System of process treatment	Constructed cost (in Lakhs)Rs	Operating Cost (Rs per day)
1	SIT	250	Combination (conventional)	31	3000
2.	Nagar Road,	100	Combination (conventional)	27	2700
3.	MIDC, Pune	200	Aerobic	32.5	1500
4.	CME Pune.	100	Aerobic	35	1200
5.	Pride Purple	250	Anaerobic	37	2800
6.	Swiss Pune	250	Anaerobic	38	2900
7.	AWHO(Pune)	100	Anaerobic	30	2000
8.	Mumbai University	50	Phytorid	30	120
9.	Siemens (Thane)	500	Phytorid	70	200

TABLE I CONSTRUCTION AND OPERATION COST OF STP

IV. CONCLUSION

Detailed study was carried out on the STPs employing different process system and the comparisons were made categorically on the construction and operating cost. The emphasis was given on maintenance cost considering the electrical load and chemicals used. The conventional type of STPs employing the aerobic, anaerobic or combination of both can be made efficient by advanced technologies and intelligent supervision but this in turn increases the total cost. The entire problem of energy requirement, maintenance and supervision in conventional STPs is saved by adopting phytorid technology. The conclusions drawn are as under:(i) The cost of construction of STPs of various technologies is almost same. (ii) However, the maintenance cost varies significantly among aerobic, anaerobic and phytorid technology. Sewage treatment by phytorid technology uses only 20% of the energy as compared to conventional sewage treatment plants. (iii) The details gathered and enumerated in table of comparisons points to clear choice of phytorid technology as the STP of future. The following table concludes the study.

Average(Rs in Lakhs)	Aerobic Process	Anaerobic Process	Phytorid Technique
Construction cost	35	33	43
Operating cost/year	5.5	9.85	1.10

Annual cost of operation

V. REFERENCES

[1]. Meng Nan Chong, Bo Jin Christopher, W.K. Chowc and Chris Saint, “Recent developments in photocatalytic water treatment technology”, Science Direct, Water Research, 44, 2010, pp 2997-3027.

[2]. Mario Novak and Predrag Horvat, "Mathematical modelling and optimization of a waste water treatment plant by combined oxygen electrode and biological waste water treatment model", Applied Mathematical Modelling, Science Direct, 36, 2011, pp 3813-3825.

[3]. M. Poch I.R. Roda, J. Comas, J. Baez, J. Lafuente, M. Sànchez-Marrè and U. Cortés, "Wastewater treatment improvement through an intelligent integrated supervisory system", Contributions to Science, 4, 2000, pp 451-462.

[4]. Lei Yang, "Phytoremediation: An Eco technology for Treating Contaminated Sites" ASCE, Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management, 12 (4), 2008, pp 290–298.

[5]. S. R Pawaskar, "Application of modified root zone treatment system for waste water treatment within nallah area", Journal of Ecology and Environmental Sciences, 3(1), 2012, pp 46- 49.

[6]. Jan Vymzal, "Horizontal sub-surface flow constructed wetlands Ondrejov and Spalen Porcı in the Czech Republic – 15 years of operation", Science Direct, Desalination, 247, 2008, pp 227–238.

[7]. Dongqing Zhang, Richard M. Gersbergb and Tan Soon Keatc, "Constructed wetlands in China", Science Direct, Ecological Engineering, 35, 2009, pp

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Behaviour and Design of Plus (+) Shape of Diagrid Structure

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ABSTRACT

Rapid population expansion and high land costs have a significant influence on the construction sector, which leads to an upward trend in building construction. However, when building heights rise, lateral load resisting systems become more critical than gravity load resisting structural systems. Some common systems for resisting lateral loads include rigid frame, shear wall, wall-frame, braced tube system, outrigger system, and tubular system. Because of the structural efficiency and aesthetic possibilities given by the system's distinctive geometric design, the diagonal grid structural system has recently become popular for tall structures. Because of the layout and efficiency of a diagrid system, the number of structural elements required on the outside side of buildings is reduced, resulting in fewer blockages to the outside view. The structural efficiency of the diagrid system also aids in the avoidance of interior and corner columns, allowing for great floor plan flexibility. The "Diagonal Grid System," also known as the "Diagrid method," is the most recent high-rise building system that has gained popularity among today's designers. The Diagrid system is made up of multiple diagonal components that join to produce a triangulated or grid-shaped design. The name "diagrid" is derived from the phrase's "diagonal" and "grid." A diagrid structure is a sort of structural system that consists of diagonal grids connected by horizontal rings to provide a beautiful and redundant structure that is particularly useful for high-rise structures. Due to its triangulated configuration, diagrid structures differ from braced frame systems in that diagonal as key structural components contribute in supporting gravity load as well as lateral load, obviating the requirement for vertical columns. A diagrid system's column-free structure has various advantages, including great architectural freedom, elegance, and huge day illumination due to its small outside surface.

Keywords: Diagrid structure, ETABS, Spectrum analysis, Seismic analysis, Wind load analysis.

I. INTRODUCTION

Diagrid is a type of space truss in which there are no traditional columns on the structure's external perimeter. Diagrid is made up of the series 2 of triangulated truss system, which is produced by intersecting diagonal columns and horizontal beams. When compared to bending of vertical columns in a framed tube construction, shear and over-turning moments are resisted by axial action of these diagonals. The core's vertical columns are solely meant to sustain gravity loads, but the diagrid can handle both gravity and lateral stresses.

Structural steel members are used in diagonalized applications to provide effective solutions. Both in terms of strength and stiffness are not new, but there is a revived interest in them, as well as a widespread use of diagrid, in long span and high rise structures, particularly when they have complicated geometries and curved shapes. The advancement of braced tube constructions led to the diagrid systems. The main difference between a braced tube building and a diagrid building is that the diagrid building has no vertical columns around its perimeter. The diagonal members of diagrid constructions serve as both inclined columns and bracing components, and their triangulated design causes the members to experience mostly internal axial forces because shear can be carried by the diagrid on the perimeter, diagrid structures do not require high shear rigidity cores.

II. METHODOLOGY

The study of a 48-story diagrid structure with a plus (+) form is described in this work. As per Indian Standard, lateral forces owing to earthquakes and wind effects are taken into account. The structure was analysed using IS 1893:2016 and IS 800:2007. The ETABS program is used for modelling and analysis of diagrid systems. Earthquake loads are subjected to response spectrum analysis. Beams and columns are treated as flexural elements for linear static and dynamic analysis, whereas diagonals are modelled as truss elements. The main focus of this study is on the behaviour of high-rise buildings using Diagrid systems of various angles for structures with a plus (+) form and find optimum diagrid angle in seismic zone III by using static, dynamic and wind analysis.

Phase-I

ETABS software was used to model 48-story high-rise structures using Diagrid systems by defining material and section attributes and having the same height with varying diagrid angles.

Phase-II

Define several forms of loads and their combinations on the structure's plus (+) shape initially. Define the functions necessary for the response spectrum in dynamic analysis. Finally, using the findings of the study, examine the behavior of the plus (+) form structure using Diagrid systems of the same height and different angle in seismic zone III.

Phase-III

The collecting of data for plus (+) shape of structures in the form of distinct metrics like Storey shear and Story Drift and evaluate all seismic zone III criteria to determine the best angle of plus (+) form of structures with each and every combination of 2-storey, 4-storey, 6-storey, and 8-storey modules.

III. DATA COLLECTION AND ANALYSIS

The primary data will be collected through analysis buildings with diagrid structure by using ETABS software. The secondary data will be collected from previous literature papers, IS codes and books. The result will come through analysis of high-rise buildings i.e. primary data will be compared with secondary data and experimental results will be carried out. A parametric study will be carried out after the validation of result. Validation will be made to show up the conclusion of study.

IV. DIAGRID CONFIGURATION

A diagrid (diagonal grids) structure is a set of triangulated beams, straight or curved, and a horizontal ring that together form a skyscraper's structural system (Tall Building). In a nutshell, it's made up of diagonal and horizontal components that intersect. In comparison to a traditional steel frame, it uses less structural steel. Diagrid has a pleasing look and is easily identifiable. A diagrid system's layout and efficiency minimize the amount of structural elements necessary on a building's facade, resulting in fewer blockages to the outside view. The diagrid system's structural efficiency also aids in the avoidance of interior and corner columns, allowing for great floor design freedom. When compared to a standard perimeter "diagrid" system, the perimeter "diagrid" system saves around 20% structural steel weight than conventional moment-frame structure.

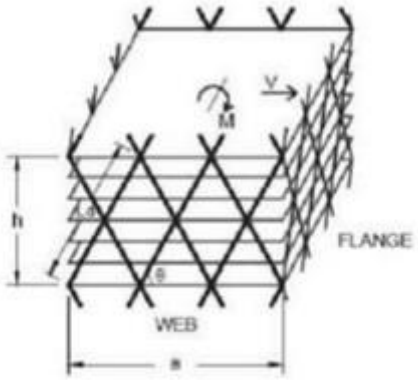

Fig. 1. Diagrid configuration

A diagrid structure is modelled on the ground as a vertical cantilever beam that is segmented longitudinally into modules following the repeated diagrid pattern. A single level of diagrid that span numerous levels defines each module. The instance of a 6-story module is depicted in the diagram. To more correctly estimate the lateral stiffness provided by diagrid, the needed lateral stiffness is distributed to the perimeter diagrid and core structures, as shown in Figure 1. Depending on the loading direction, the faces serve as web planes (planes parallel to the wind) or flange planes (i.e. planes perpendicular to wind). Because the diagonal elements are considered to be pinned, the transverse shear and moment are solely resisted by axial action. The design challenge is reduced to estimating the cross-sectional area of typical web and flange members for each module with this idealization. Member sizes for the modules may be calculated using Equations (1) and (2) adjusted for each design instance, using the design process described by Moon et al (2007). d, w.

$$A_{d,w} = \frac{VLd}{2NdwE\ hJ\ cos2\theta\ T} \quad (1)$$

$$A_{d,f} = \frac{2MLd}{(Nd,f+G)B2Ed\ Fhsin2\theta\ T} \quad (2)$$

The area of each diagonal on the web is referred to as ad,w. The area of each diagonal on the flange is given by Ad,f. Shear force is denoted by the letter V. The letter M stands for moment. Ld is the diagonal length. Steel's modulus of elasticity is called Ed. is the diagonal members' angle. x is a Shear strain in the transverse direction. Curvature is represented by the letter y. The number of diagonals on each web plane is Nd,w. The number of diagonals on each flange plane is Nd,f. The contribution of web diagonals to bending rigidity is denoted by G. In the direction of applied force, B is the building breadth. Under the design loading, optimal stiffness-based design corresponds to a condition of homogeneous shear and bending deformation. Only statically determined structures can have uniform deformation states. On the ground, tall building structures may be treated as vertical cantilever beams, and homogeneous deformation can be accomplished for the deflection at the top u. (H).

( )= ∗ + ∗ 22 (3)

H is the building height; y* is the desired uniform transverse shear strain; x*is the desired uniform curvature.

V. GEOMETRIC PARAMETERS OF THE BUILDING MODELS

Structure type: Steel structure
Shapes of building used: plus (+) shape
Number of stories: 48
Size of plan for plus shape: 48m x 48m
Spacing between bays: 4m
Spacing between diagrid along perimeter: 8m
Height of each storey: 3.5m
Number storeys per module: 2, 4, 6 & 8 storey
Grade of structural steel (Fy): Fe 500
Grade of concrete (Fck): M40

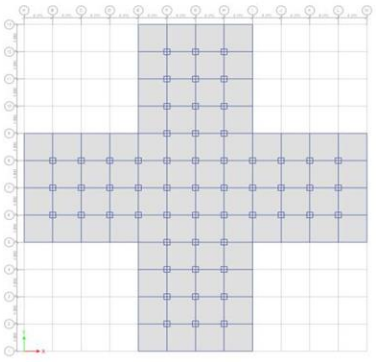

Fig. 2. Plan of Plus (+) shape building model

A. Basic design consideration

The building is subjected to following Loads as per IS 875 (part 1 and 2)-2015:

Dead load: 2 kN/m2

Live Load: 3 kN/m2

The following table shows that basic design consideration in seismic zone III.

Zone	Zone factor	Location of building	Basic wind speed of city in m/s	Soil type
III	0.16	Pune	39	Hard(site type 1)

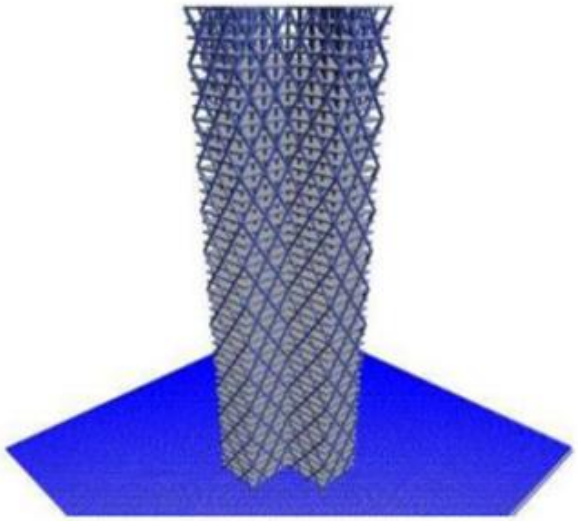

Fig. 3. 3D rendered view of plus (+) shape structure

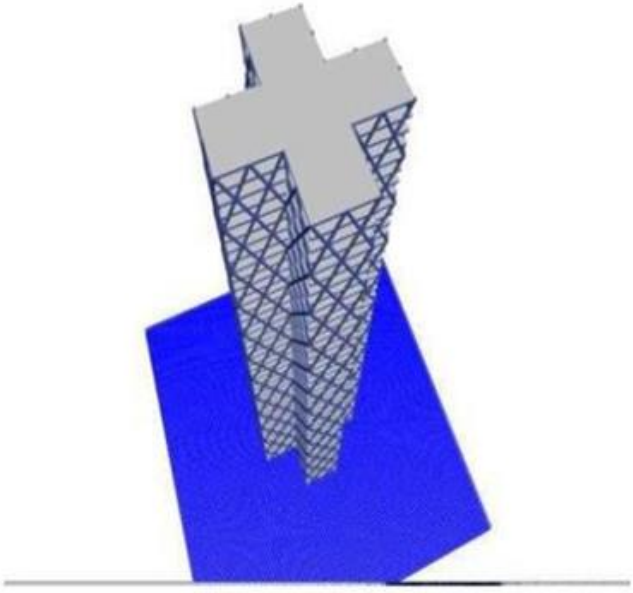

Fig. 4. Top view of plus (+) shape structure

B. Section properties for plus (+)

In zone III, all section attributes were the same in any building shape. Steel tubes are utilized for columns and Indian standard wide flange beam sections are used for beams. Steel pipes are utilized for diagrid members. The section properties for all storey modules of the building model with diagrid systems are shown in Table (Table 1).

Table 1 Section properties for Plus (+) structure

Story	Beam	Column [tube section]	Diagrid [pipe section]
1-16	ISMB 550	750 X 750 X 50	750 X 25
17-32	ISMB 500	700 X 700 X 45	750X 25
33-48	ISMB 500	600 X 600 X 35	750 X25

The values of diagrid angles for the corresponding story modules of the plus (+) form of construction are shown in the table below (Table 2). The angle of diagrid rises as the storey module increases. The study diagrid angles range from 41 to 74 degrees.

Table 2 Diagrid angle for plus (+) shape of building

Number storeys per module	Angle
2	41.18^0
4	60.25^0
6	69.14^0
8	74.05^0

VI. RESULT ANALYSIS

The zone factor value for the Plus (+) shape of building in Seismic Zone III is 0.16. Because our structure is included in the importance service, the importance factor was set to 1.5. The structure is located in Pune city for wind load consideration, and the fundamental wind speed is 39 m/s.

Because the aim of the diagrid structure is to serve as a hospital, the structure's average likely design life is 100 years, and the risk coefficient of 1.06 is used. Our structure belongs to the 3rd category. The structural class is C because the structure's greatest dimension, or height, exceeds 50 meters. The k4 factor is 1.30, which is determined by the kind of structure. The coefficients for windward and leeward are 0.8 and 0.6, respectively. Dynamic analysis is used to do response spectrum analysis. In this case, the SSRS and CQC methods are taken

into account. The damping ratio is assumed to be 5%. The extent of diaphragms approach is utilized in ETABS for wind analysis. First, all scale factors are taken into account, and because dynamic base shear is less than 80% of static base shear, it was altered.

Fig. 5. Maximum storey displacement for all modules in zone III

The graphical depiction of maximum storey displacement of 48 story building modules in zone III is shown in the graph above. This is the graphical representation for wind load analysis because, in contrast to seismic and response spectrum analysis, wind load analysis offers maximum values of narrative displacement in zone III. Modules vs. maximum storey displacement are presented on a graph. In the 8-module diagrid, the maximum storey displacement is 245.48 mm. The greatest storey displacement with the least value is 187.2 mm, which is found for the four-story module. The minimum value of maximum story displacement is found to be between 60 and 70 degrees. The highest allowable storey displacement is 336 mm, and all modules in zone III have maximum story displacements that are within the allowable limit. When eight module diagrid is compared to four and six module diagrid, the maximum story displacement for four and six module diagrid is lowered by 23.74 % and 14.83 % respectively.

Fig. 6. Maximum storey drift for all modules in zone III

The previous graph (Fig. 6) depicts the maximum storey drift of 48 story building modules in zone III graphically. Modules vs. maximum storey drift are presented on a graph. Eight modules have a greater maximum storey drift of 0.001839 m. The smallest maximum storey drift value is 0.001317 m, which may be found in the four-story module diagrid. The maximum allowable storey drift is 0.014 m, and maximum story drift for all modules in zone III is observed to be within this limit. When eight module diagrid is compared to four and six module diagrid, the maximum narrative drift for four and six module diagrid is lowered by 28.38 % and 15.82 % respectively.

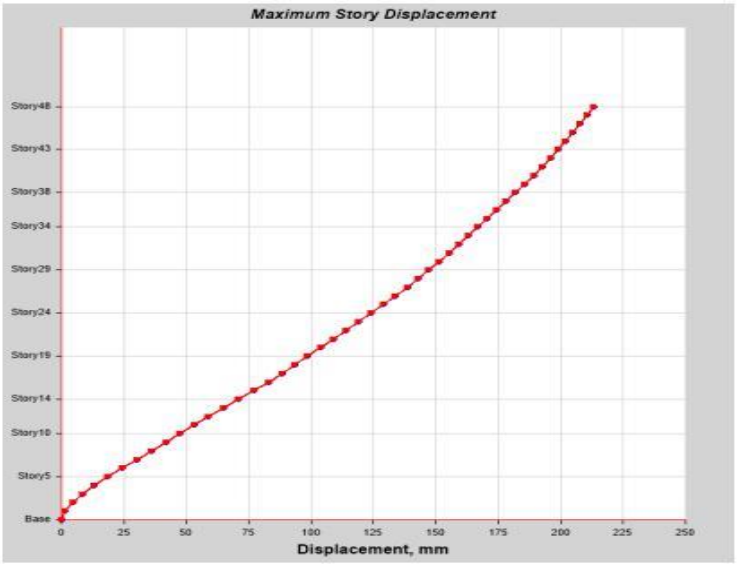

Fig. 7. Maximum storey displacement by wind load analysis

The maximum story displacement by wind load analysis for combination modules made up of two, four, six, and eight in zone III is shown in the graph above (Fig. 7). For wind load analysis, many load combinations are examined, as shown below. 5.8 in the table The combination of 1.5(D.L+ WL-X), 1.5(D.L+ WL-Y), and (0.9 D.L+ 1.5 WL-Y) yielded the highest story displacement of 223.27 mm.

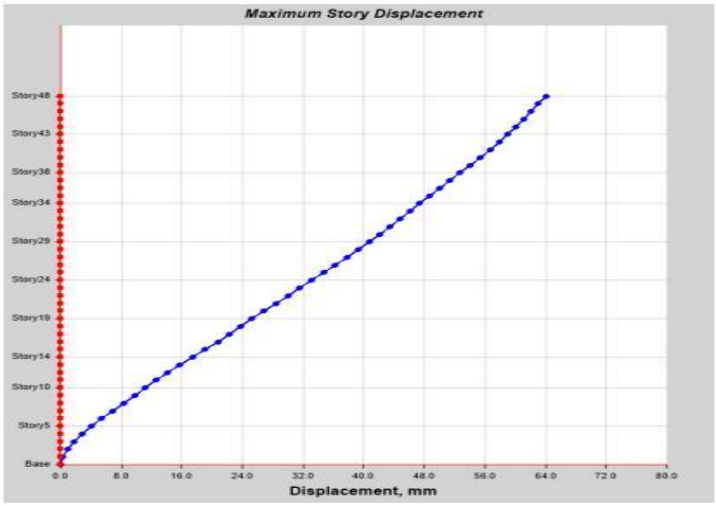

Fig. 8. Maximum storey displacement by seismic analysis

The maximum storey displacement by seismic load analysis for combination modules made up of two, four, six, and eight in zone III is shown in the graph above (Fig. 8). For seismic load analysis, many types of load combinations are examined, as shown in table 5.8. Combinations of 1.5(D.L+ EQ-X), 1.5(D.L+ EQ-Y), and (0.9 D.L+ 1.5 EQ-Y), (0.9 D.L+ 1.5 EQ-X), (0.9 D.L- 1.5 EQ-Y), and (0.9 D.L- 1.5 EQ-X) have resulted in a maximum story displacement of 64 mm.

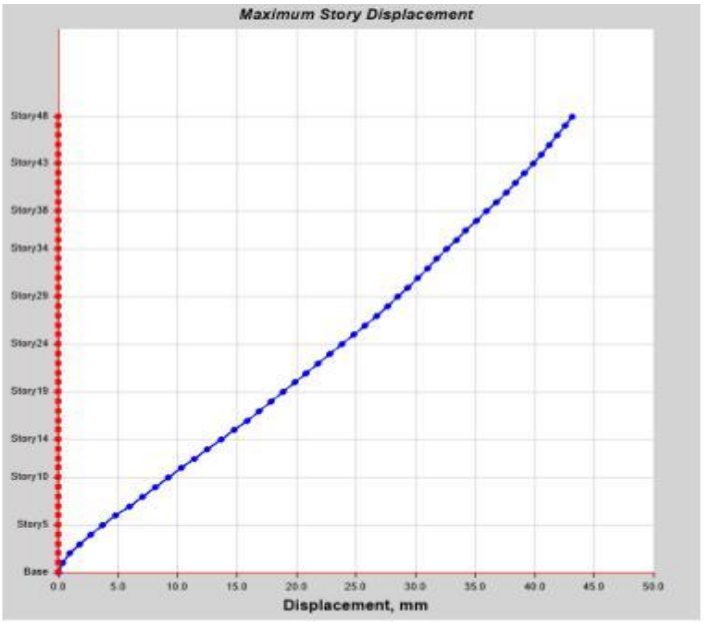

Fig. 9. Maximum storey displacement by response spectrum analysis

The previous graph (Fig. 9) depicts the maximum narrative displacement calculated using reaction spectrum analysis for a combination module made up of two, four, six, and eight in zone III. For response spectrum analysis, many types of load combinations are investigated, as shown in table 5.8. It was discovered that the combination of 1.5 (D.L+ RS-X), 1.5(D.L+ RS-Y), (0.9 D.L+ 1.5 EQ-Y), (0.9 D.L+ 1.5 RS-X), and (0.9 D.L- 1.5 RS-Y) resulted in the highest story displacement of 43.16 mm.

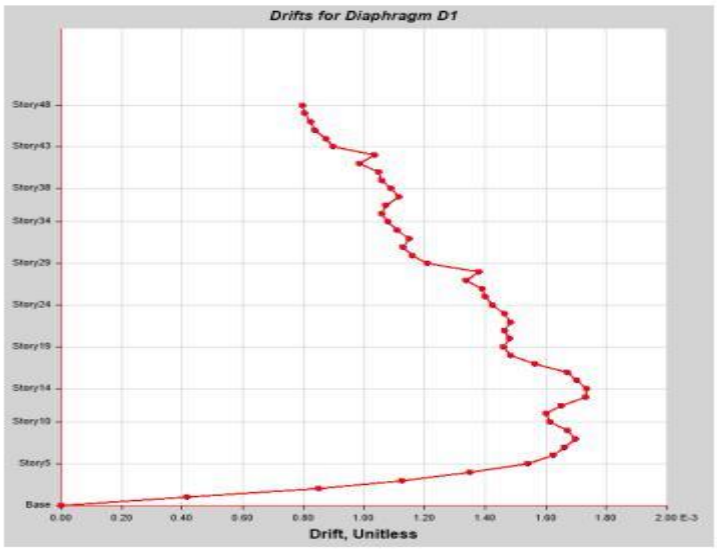

Fig. 10. Maximum storey drift by wind load analysis

Maximum story drift by wind load analysis for combination module made up of two, four, six, and eight in zone III is shown in the graph above (Fig. 10). For wind load analysis, many types of load combinations are examined, as shown in table. The greatest value of drift for all combinations was evaluated, and it was discovered that the combinations 1.5(D.L+ WL-X), 1.5(D.L+ WL-Y), and (0.9 D.L+ 1.5 WL-Y) gave the largest story displacement of 0.001734 m.

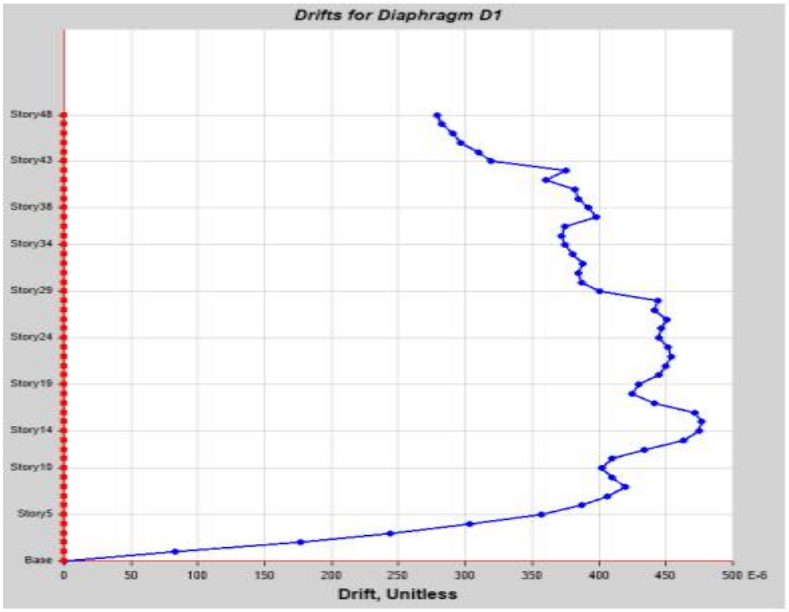

Fig. 11. Maximum storey drift by seismic analysis

The previous graph (Fig. 11) depicts the maximum story drift calculated using seismic load analysis for a combination module made up of two, four, six, and eight in zone III. For seismic load analysis, many types of load combinations are examined, as shown in table. The maximum value of drift was examined for all combinations, and it was discovered that the combinations 1.5(D.L+EQ-X), 1.5(D.L+EQ-Y), and (0.9 D.L+ 1.5 EQ-Y) produced the highest story drift of 0.00047m.

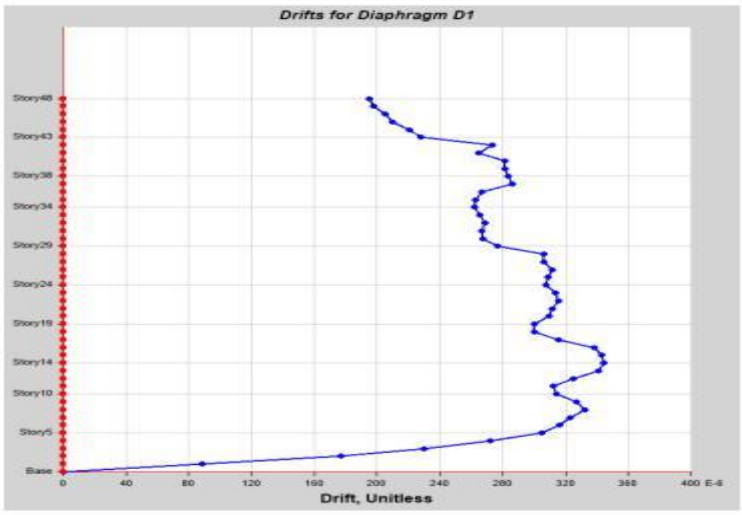

Fig. 12. Maximum storey drift by response spectrum analysis

Maximum narrative drift by response spectrum analysis for combination module consisting of two, four, six, and eight in zone III is shown in the graph above (Fig. 12). For seismic load analysis, many types of load combinations are examined, as shown in table. The maximum value of drift was calculated for all combinations and determined to be 0.000334 m for 1.5(D.L+ RS-X), 1.5(D.L+ RS-Y), and (0.9 D.L+ 1.5 RS-Y), (0.9 D.L+1.5 RS-X), and (0.9 D.L- 1.5 RS-Y).

Following are the details which shows the tabular representation of story displacement & story drift for plus (+) shape of building in seismic zone III.

Table 3 Story displacement & story drift

Plus(+) shape	III	2	216.93	71.34	39.52	0.001581	0.000522	0.0003
		4	187.20	64.13	40.27	0.001317	0.000465	0.000303
		6	209.06	66.05	42	0.001548	0.000481	0.000361
		8	245.48	70.42	45.93	0.001839	0.000522	0.000354
		Combination	213.65	63.324	43.51	0.001734	0.000477	0.000344

Wind load has the highest value of story displacement and story drift in the plus(+) form of building when compared to earthquake load, and the 8-story diagrid module has the highest value of story displacement and story drift in the plus(+) shape of building. In comparison to 2-storey, 6-storey, and 8-storey modules, the 4-storey module in (+) form of building delivers smaller value of maximum store displacement and maximum storey drift.

VII. CONCLUSION

In this paper the basic design consideration with their geometric parameters of the building models has been discussed. The graphical representation & results of seismic analysis, spectrum analysis, and wind load analysis has been clearly studied.

Diagrid angle in the region of 60° to 70° provides more stiffness to the diagrid structural system which reflects the less top storey displacement.

Static analysis, dynamic analysis and wind load analysis are performed on diagrid structure and it observed that, maximum story displacement and maximum story drift are maximum in case of wind load analysis as compare to earthquake analysis and response spectrum analysis in plus (+) shape of building.

VIII. REFERENCES

[1]. Denet Priya Mascarenhas and Deeptishree S. Aithal, “Study on diagrid structures with various aspect ratio under the action of wind”, International Journal of Advanced Research, Ideas and Innovations in Technology, Vol. 3, Issue 4, 2017.

[2]. Gopisiddappa, M. Divyashree, Sindhuja, “Performance study of high rise building with diagrid system under dynamic loading,” International Research Journal of Engineering and Technology.

[3]. Trupti A. Kinjawadekar and Amit C. Kinjawadekar, "Comparative study of seismic characteristics of diagrid structural systems in high rise construction", International Journal of Civil Engineering and Technology, Vol. 9, Issue 6, 2018.

[4]. Akshat and Gurpreet Singh, "A review on structural performance of diagrid structural systems for high rise buildings", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 7, Issue 2, 2018.

[5]. Sawan Rathore, Prof. Sumit Pahwa. (2019). Dynamic analysis of diagrid structural system for R.C building structure. International Journal for Research in Applied Science & Engineering Technology, Vol. 7, Issue 12, 2019.

[6]. IS 1893-2016: Criteria for Earthquake Resistant Design of Structures, Part1: General Provisions and Building. Bureau of Indian Standards. 6th Ed. (15).

[7]. IS 800:2007, General Construction in Steel – Code of Practice (Third Revision), Bureau of Indian Standard, New Delhi.

[8]. IS 875(Part 3):1987, Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 3 Wind Loads (Second Revision), Bureau of Indian Standard, New Delhi.

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Remote Green House Monitoring by IoT Based Wireless Imaging and Sensor Node System

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ABSTRACT

Green house are controlled area environment to grow plants the limitation of existing greenhouse plants is that's it is not operated automatically nd has to be operated manually in order to achieve the optimum growth of plants ,the continues monitoring and controlling of environment parameters such as temperature humidity, soil moisture, light intensity are necessary for green house system. The system will screen the undeniable common conditions, for instance moistness, soil immersion, temperature, all the environment parameters data are sent to cloud using WIFI ESP8266,If any condition crosses certain limits relted actuator will be turned ON. The microcontroller will as soon turn on the motor, the user can screen and control parameters through mobile and computer.

Keywords: - Arduino Uno, Sensors.

I. INTRODUCTION

A greenhouse is a closed environment that provides optimal conditions for plant growth A complete greenhouse remote monitoring system first detects indoor environment elements through various sensors and the uploads the measurement signals to the control platforms through wired or wireless methods, and the control platforms remotely controls various terminal valves in the room (water valves, heating temp).The greenhouse remote monitoring system mainly measures indoor, temp, humidity, light, soil moisture.
The greenhouse remote monitoring system can also be called the greenhouse environment control system.

II. LITERATURE SURVEY

Designed intelligent greenhouse environment monitoring control system which is based on zigbee and embedded technology.This system consists of three main components:upper machine processors environmental factors acquisition nodes intelligent control terminal block.It is mainly made up of S3C2440 microprocessor with the ARM920T core, power, clock, reset circuit, LCD TOUCH screen, intelligent control terminal module zigbee coordinator and environmental factors detection terminal nodes.In this system

predictions is done to find out the required solution if any problems occurs in any device connected to the system. the home appliances can be controlled via smartphones using wifi. here Arduino used as a server system and wifi as communication protocol.

III. PROCEDURE FOLLOWED IN THE PROPOSED SYSTEM

A. MECHANISM:

- Arduino based greenhouse monitoring system.
- Arduino is programmed with Arduino software.
- LCD display used for information and display reading.
- Sensors are used for sensing all the components.

B. SOFTWARE IMPLEMENTATION:

- Arduino uno (IDE) used for programming (software).
- java language used for programming.

C. HARDWARE COMPONENTS:

- Arduino uno.
- Temperature sensor.
- Light sensor.
- Humidity sensor.
- Soil moisture sensor.
- ESP8266

IV. METHODOLOGY

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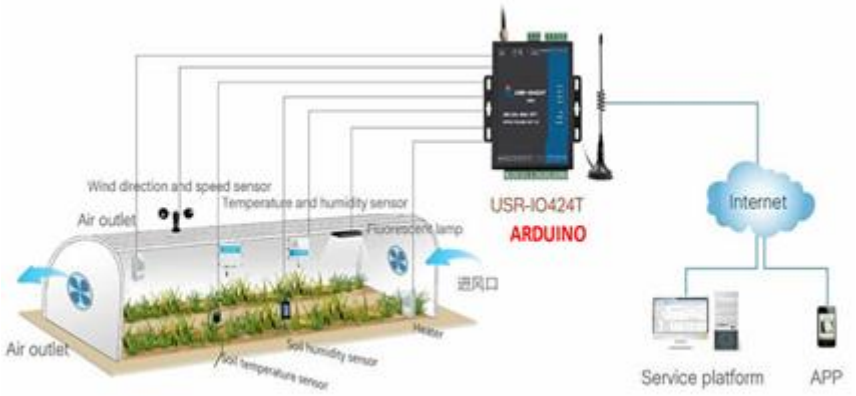
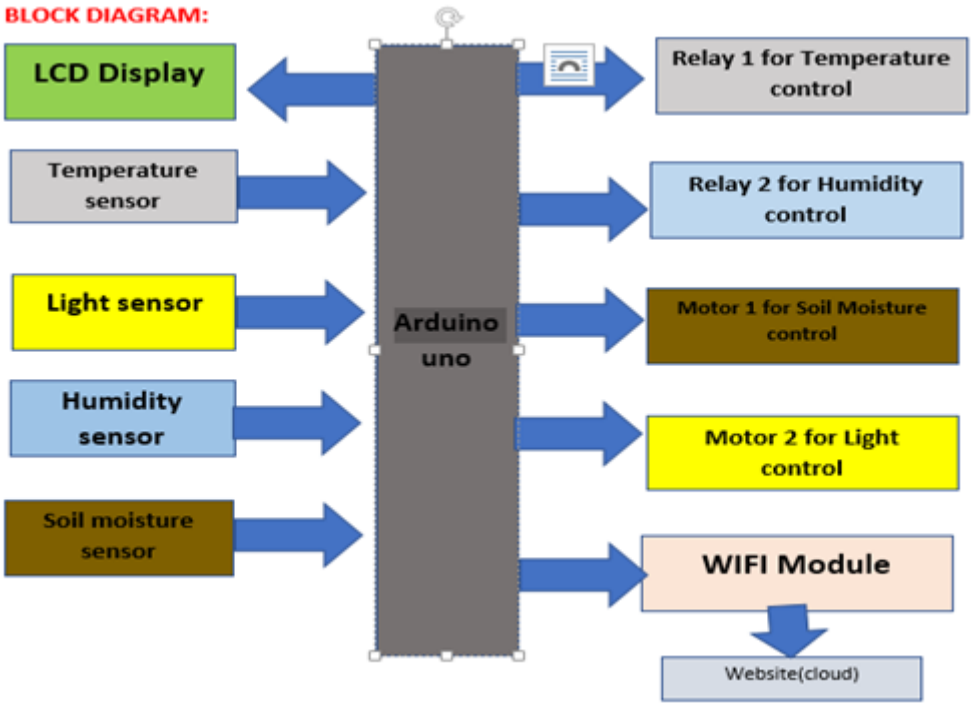
- ESP8266

The system temperature monitor and control system works according to the temp value set by the user. First it gets the value from the user and maintains the temp on the LED screen for user reference. The temp of the greenhouse is reduced by the fan is placed inside the greenhouse. The temp of greenhouse is increased by using heater which is placed at the floor of the greenhouse to ensure that the whole greenhouse is warmed equally. LDR detects this, and the light bulbs re switched ON. When there is lighter the light bulbs are turned OFF. But at the light control system controls the light falling on the greenhouse .when there is not enough light the night the system will automatically get turned ON and this has harmful effects on the plants therefore a switch is placed to OFF the lights at times when e feel the lights areunnecessary. Similarly humidity and soil moisture system works

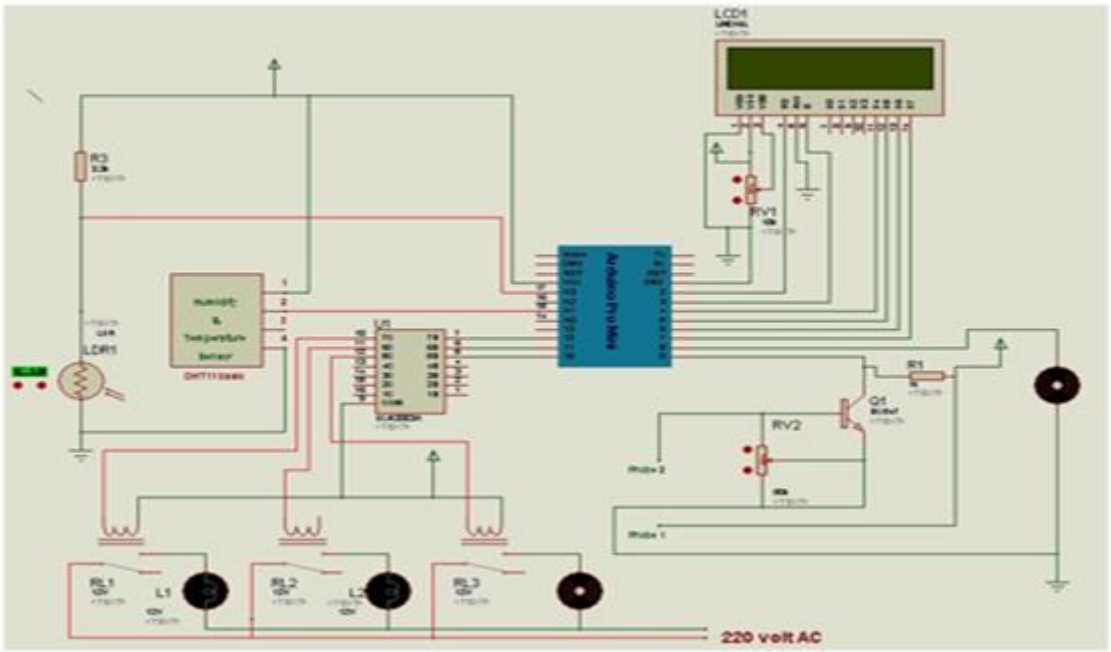




COMPONENT DISCRIPTION

1. IOT and Arduino based greenhouse environment monitoring and controlling project use four sensors to detect the temp, light , humidity and soil moisture in the greenhouse.
2. Temperature sensors is used to detect the temp inside the greenhouse. the Arduino is connected to diff relays. **One** of the relays is connected to a blower. if the temp is above or below the threshold value ,the Arduino would send signals to turn ON the fan.
3. Light sensor is used to detect the amount of sunlight inside the greenhouse .if the sunlight is above the threshold value, the Arduino would send signals to turn ON the relays which would, in real time, be a shade that would reduce the amount of sunlight.
4. Humidity sensor is used to detect the humidity value and the soil moisture sensor is used to detect the soil moisture .if the humidity value detected by the sensor is above the blower to decrease the humidity and will open the water outlet to increase the moisture in the soil.
5. Soil moisture sensor waster supply for plants is very imp for good growth .so I have used a water pump and the soil moisture for detecting soil moisture.
6. ARDUINO: Arduino is a microcontroller based open source electronic prototyping board which can be programmed with an easy to use Arduino IDE.
7. ESP8266:ESP8266 is a chip used for connecting Arduino to the wifi network.

CIRCUIT DIAGRAM



V. RESULT

The greenhouse remote monitoring system will measures indoor, temp, humidity, light, soil moisture.
The greenhouse remote monitoring system will also be used for the greenhouse environment control system.

VI. CONCLUSION

The greenhouse monitoring and control system was able to monitor the variation in the temperature humidity light intensity and as well the soil moisture of the greenhouse .the various sensors were able to trigger an actuator based on the various changes in the environment.

Obtained data by using the system will be able to provide the data support for vegetables planting in greenhouse. The system reliable and runs stably. The man machine interface of the software system is friendly .this system provides a good solutions for centralized management of the greenhouse group

VII. REFERENCES

[1]. Prof. Naseem Siddiqui 'IOT Based Environment change Monitoring &Controlling in greenhouse

[2]. Sandip Khot 1 , Dr . M. S. Gaikwad 2,' Green House Parameters Monitoring System using Raspberry Pi and Web Server', International

[3]. Vimal, P. V., &Shivaprakasha, K. S.: " IOT based greenhouse environment monitoring and controlling system using Arduino platform," 2017 (ICICICT

[4]. Pranjali D. Shiyale, Hemangi Thombre, Gautam Tyagi, Aarti Chauhan, "IOT-Based Smart Greenhouse Automation" Department of Electronics Engineering Nagpur, India, IJCRT may 2020.

[5]. Pooja P. Korade1, Amruta A. Pandav2, Varsha R. Kamble3,Varsha M. Swami 4, Madhuri N. Sachane, "IOT BASED ADVANCED GREENHOUSE SYSTEM" Department of Electronics &Telecommunication Engineering Sharad Institute of Technology, College Of Engineering Yadrav, Maharashtra India June 2020

[6]. Manasi R. Kulkarni , Neha N. Yadav , Sanket A. Kore-Mali, Prof. Saurabh R. Prasad, "GREENHOUSE AUTOMATION USING IOT" ,Department of Electronics and Telecommunication Engineering, DKTE Society's, Textile and Engineering Institute, Ichalkaranji, India, April 2020

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Speckle Noise Removal from SAR Images Using Different Techniques

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ABSTRACT

Noise, often known as speckle noise, is a drawback of SAR imaging. This noise degrades the image quality; therefore, it is vital to decrease the speckle noise. This study proposes five filters, including a median filter and a Fourier Ideal Filter. Homomorphic Butterworth Filter Homomorphic Fourier Ideal Filter The Butterworth Filter is a method for reducing speckle noise in satellite photographs. a similarity One of the most prevalent approaches for digital image correction is homomorphic filtering, which is especially useful when the input image has poor illumination. This kind of filtering has been used in a variety of imaging applications. By applying a high-pass type filter in the frequency domain, homomorphic filtering lowers the impact of low frequency components. We were able to achieve greater results than the previous system.

Keywords—Input noisy image ; Filters ;DWT (Discrete wavelet transform).

I. INTRODUCTION

The interference of waves reflected from many elementary scatterers causes speckle, which appears as granular noise in synthetic aperture radar (SAR) images. Image interpretation is made much more challenging by speckle in SAR pictures, which impacts the effectiveness of image segmentation and classification. Speckle is a serious issue in SAR, making image interpretation challenging. The cause is the coherent processing of backscattered signals from numerous dispersed objects. A approach for creating fine-resolution images from a resolution-limited radar system is synthetic aperture radar (SAR). It necessitates the radar to move in a straight path, whether on an airplane or in space, as with NISAR. SAR exceeds the resolution limits of what can be placed in orbit in this way, providing for considerably higher-quality photos and science than would be possible if the antenna size was employed as is. SAR exceeds the resolution limits of what can be placed in orbit in this way, providing for considerably higher-quality photos and science than would be possible if the antenna size was employed as is.

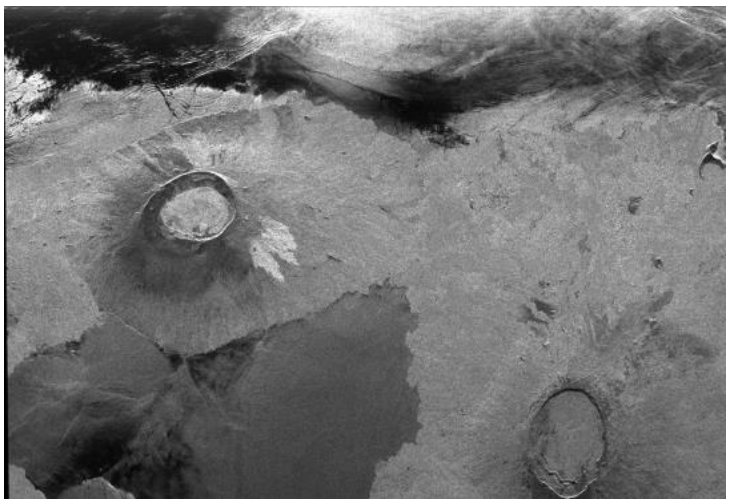


Fig 1. A radar view of part of Isla Isabella in the western Galapagos Islands.

One type of speckle filtering method that has been proposed to reduce the noise influence in SAR images is the spatial filtering approach, which is based on a statistical model of the speckle and scenes. For instance, the Median filter [1] [2] [3] Fourier Ideal Filter Butterworth [4] Holomorphic Fourier Ideal Filter [5] and Fourier Ideal Filter The DWT transform with the Butterworth Filter Fusion of images necessitates the use of a moving kernel to replace the value of the pixel of interest with a weighted sum of the nearby pixel values. The DWT filter creates the pixel's DN values and the average DN of neighbor pixels by combining geometric and statistical factors using moving windows.The Median filter can remove the spike while maintaining the edges between two features. Because different filtering methods require varied processing, the ability of different filtering methods to preserve structural information in the backscatter signal should be investigated. When used in vegetation biophysical modeling, radar backscatter contains critical structural information.

II. RELATED WORK

A novel variation convex optimization model for single SAR picture SR reconstruction with speckle noise, which is the core contribution of this research, is one of the first attempts in this field. The basic idea is to use the maximum a posteriori (MAP) estimator and propose an effective regularization based on a combination of sparse representation, total variation (TV), and a novel feature space based soft projection tool to combine the benefits of sparse representation, total variation (TV), and a novel feature space based soft projection tool. [1].

In this paper, they provide a novel unsupervised representation learning technique for CD in SAR pictures, which is based on multiscale self-attention (SA) deep clustering with octave convolution. A convolutional neural network (CNN) can extract important features buried in input images, but it does so with the help of annotated data.[2].

SAR images are becoming more widely available, and they can be utilized for a wide range of environmental monitoring purposes.[3]

In this endeavor, they undertake research. Multiplicative sounds are prone to being muddled as the attention shifts. When a CD project is used, the speckle sounds frequently cause misdetection and a high rate of false

alarms. The ability to detect has greatly diminished. As a result, reducing the effect of speckle disruptions is the key problem in the SAR picture CD sector.[4]

The papers in this collection can be found here. There are two types of these techniques: supervised and unsupervised.[5]-[6]

Supervised algorithms require available ground-truth data to learn.[7]

As a result, unsupervised CD techniques have received a lot of attention and are now widely used. As various studies have revealed, they are frequently connected with differencing operators. Because they are simple and effective, the log- and mean-ratio operators are popular ways for getting a difference image (DI) from two temporal images. Because ratio operators may turn multiplicative speckle into additive speckle, they can better resist speckle sounds than difference operators. The neighborhood-based ratio approach, the generalized likelihood ratio test-based method, and the iterative feedback-based method are all advanced approaches based on the ratio operator.[8]-[9]

The interior bodily parts are checked utilizing a number of radiometric scanning techniques in the realm of medicine to evaluate or appraise them. There are methods available. CT (Computerized Tomography), MRI (Magnetic Resonance Imaging), and Position PET (positron emission tomography) are among of the most commonly utilized scanning modalities; nevertheless, the images of diverse body regions produced by these scanning techniques have their own set of benefits and drawbacks.[10]

In recent years, DNNs have gained a lot of attention. In the field of image processing, picture classification, semantic segmentation, and remote sensing interpretation have all been effective.[11].

III. PROPOSED SYSTEM

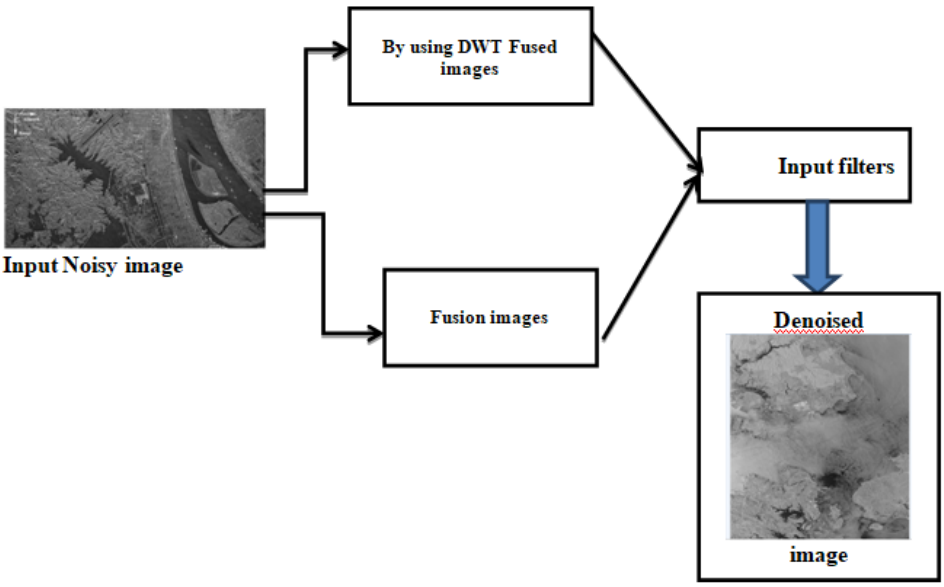


Fig 2.System Architecture

In recent years, several tecniques have been utilised to eliminate noise in SAR images, and the design and development of a proposed approach to reduce noise presence in SAR images has been proposed. Speckle noise

is a type ofgranular noise. This noise can be seen in both SAR (Synthetic Aperture Radar) and Ultrasound images. When radarwaves interact constructively or destructively, speckle noise is created, which is the bright and dark pixel in a picture. Almost any remotely sensed image that uses coherent radiation will show speckle noise. Waves from the active sensor interact with the target area and travel in phase. These waves are out of phase after engaging with the target area due to different travel distances.As a result, speckle noise is produced, which is made up of light and dark pixels. There's a multiplicative component to the noise.

$$p(z) = \frac{z^{\alpha-1}}{(\alpha-1)!\, a^{\alpha}} e^{-\frac{z}{a}}$$

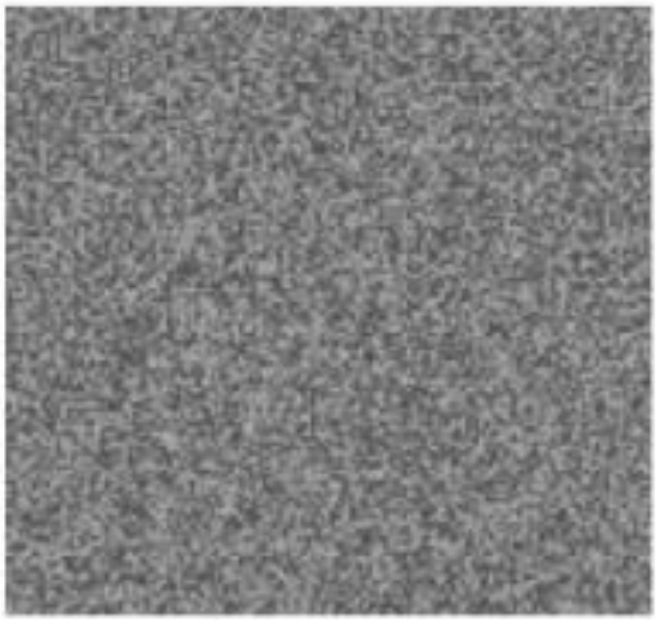


Fig3.Speckle noise

Reduced speckle noise is essential for improved scene target recognition and automatic image segmentation. To reduce speckle noise, spatial filtering is widely utilised.The speckle reduction approach, regardless of whatever method is utilised to lessen the effect of speckle noise, preserves the edges between distinct areas and textural information

IV. METHDOLOGY

4.1 Discrete Wavelet Transform:

One of the first attempts in this sector is a novel variation convex optimization model for single SAR picture SR reconstruction with speckle noise, which is the research's main contribution. The basic idea is to combine the benefits of sparse representation, total variation (TV), and a novel feature space based soft projection tool by using the maximum a posteriori (MAP) estimator and proposing an effective regularisation based on a combination of sparse representation, total variation (TV), and a novel feature space based soft projection tool.

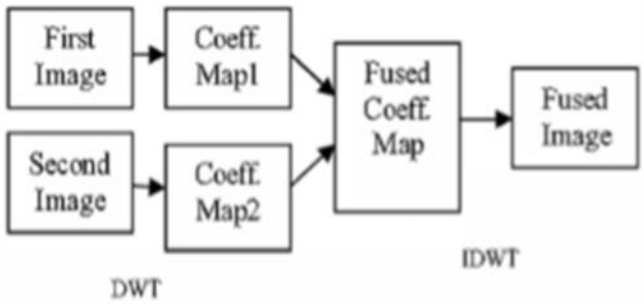


Fig 4.Image fusion process using DWT

Once the operation is completed, the approximation and detail components can be separated. 2-D Discrete Wavelet Transformation is used to transfer the image from the spatial domain to the frequency domain (DWT). The first-order of multi-scale representation of an image feature employing multiple frequency subbands is depicted in this image, which is separated into vertical and horizontal lines. It's a well-known signal-processing method. The image can be broken into four components using DWT decomposition.

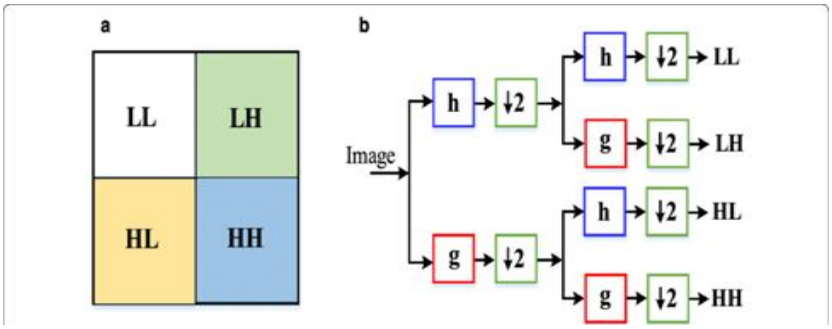


Fig 3. DWT Composition

The wavelet transform can be used on a large number of layers. Only the LL image is used in the next stage of deconstruction. As a result, four sub images, each half the size of the LL image, have been formed. To construct a fusion decision map based on a set of fusion rules, the wavelet transform is first applied to each source image. The fused wavelet coefficient map can be constructed using the fusion decision map and the wavelet coefficients of the source pictures.

4.2 Median Filter :

The median filter is a sliding-window spatial filter. Like the mean filter, the median filter is commonly employed to reduce image noise. It does, however, a better job than the mean filter at preserving relevant detail in the image. The non-linear edge preserving smoothing filter class includes this filter. For two photos, this meansA(x) and B(x)median[A(X) + B(X)] 6 = median[A(X)] + median[B(X)]..[1]

4.3 Fourier Ideal Filter:

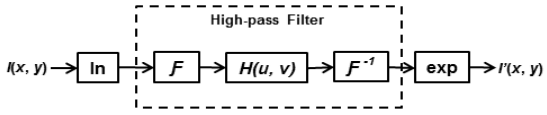
A Fourier filter is a sort of filter that manipulates a signal's frequency components. It works by inversely modifying the output after performing a Fourier transform on the signal and attenuating or boosting specific frequencies.

4.4 Butterworth Filter:

The Butterworth filter is a frequency domain filter that produces Gaussian smoothing in the spatial domain. The computational cost of frequency domain filters is unaffected by the filterfunction, whereas the cost of spatial filters rises as the standard deviation rises.

4.5 Homomorphic Fourier Ideal Filter:

Homomorphic filtering reduces the impact of low frequency components by using a high-pass type filter in the frequency domain. In the literature, however, several mathematical equations have been used to present this filter. For one or more bands of frequencies, an ideal filter is thought to have a nonzero magnitude, while for one or more bands of frequencies, it is thought to have a zero magnitude.



Frequency domain techniques are more difficult to execute when the picture model is based on illumination-reflectance. The fundamental reason for this is that the model's lighting and reflectance components are not separate. To improve the appearance of an image, it is required to separate the two components by compressing the brightness range and raising the contrast. As you may recall, an image's lighting and reflectance can be mathematically defined using the formula below.:

F (x,y) = I(x,y) *R(x,y)…[1]

Where does the multiplicative noise come from High Pass is one way for removing it. Befor

We usually take the logarithmic values of both sides when using high pass filtering. i.e

ln (F (x;y)) = ln (I(x,y)*R(x;y))…[2]

We already know that if we take the log of both sides, we may write log(intensity) as the sum of log(illumination) and log(intensity) (reflectance)

ln(F(x;y)) =ln (I(x;y)*R(x;y))..[3]

Operation steps of Homomorphic filtering:

Following are the steps for Homomorphic filtering:

1. We'll start by making the image float.
2. Replace the image next to the log domain with the converted image.
3. Use either the spatial or frequency domains to apply the high pass filtering.
4. Apply an inverse filter on the result and keep the real part.
5. Invert the log transform using the exponential function. Using the if display() function, you may see the homomorphic filtered image.

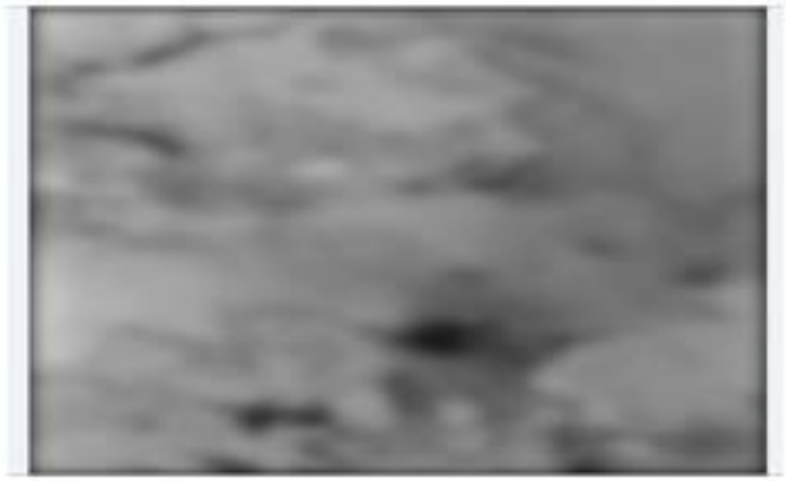
V. RESULT AND DISCUSSION

5.1 Effect of All filters we have discussed in below :

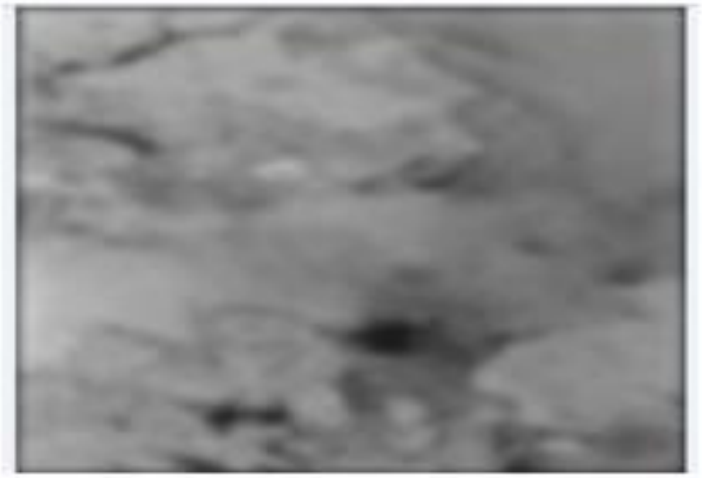
1. In below images we have achieved result parameters with Designed developed model According to design filters and their affects with A different frequency gives effective changes in images and experimentally reduce speckle noise with goodness of clear images we find.
2. In below images we by using Homographic Butterworth filter to obtain results in frequency between 10to 50 of cut off frequency and their better performance than input images we have achieved. With this filter.
3. In below result page we have obtain result with Homographic Ideal filter in between Cit off frequency off 10 to 50 and there is obtains result Accuracy with changes of i/p frequency.
4. The below result we obtained from median filter with removing speckle noise from images gives better images in different pixel sizes.

5.2 Effect of Butter worth filter :

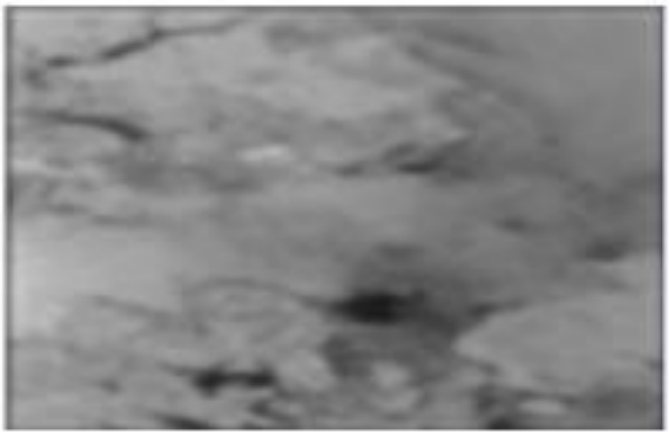
(a) Image Butterworth filter (Cut off frequency =10)



(b) Image Butterworth filter (cutoff frequency =30)

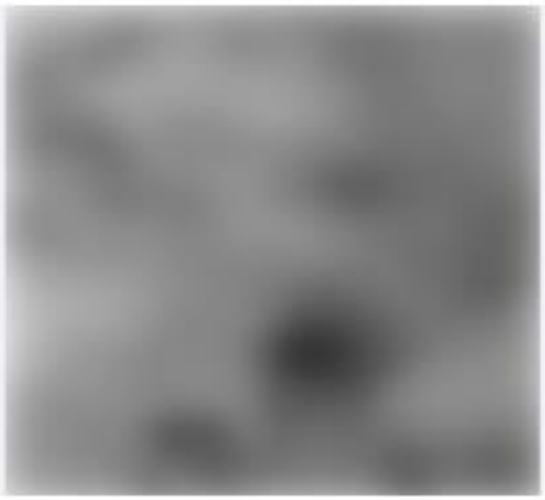


(c) Image Butter worth filter (cut off frequency =40)

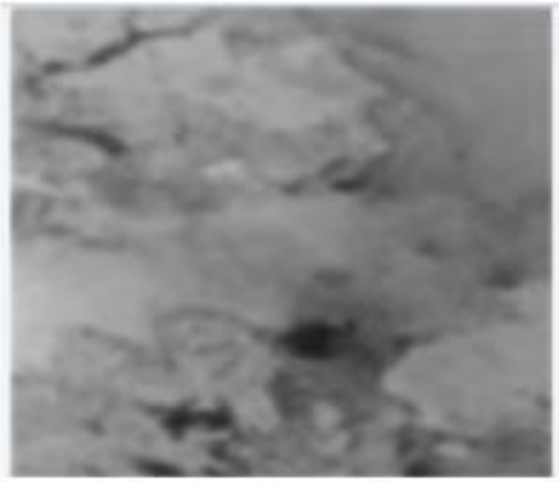


(d) Image Butter worth filter (cut off frequency =50)

5.3 Effect of Homographic Butterworth filter :



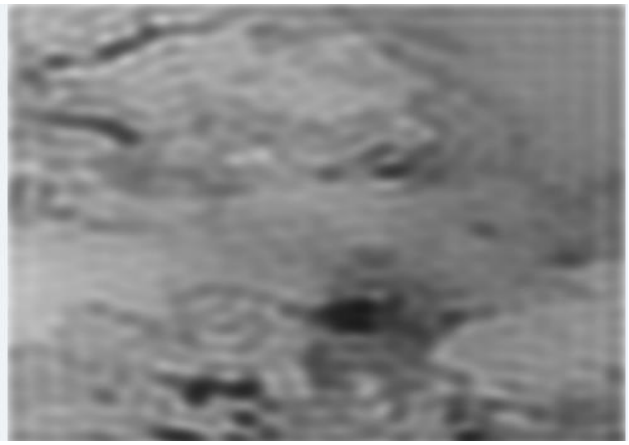
(e) Homographic Butterworth filter (cut off frequency =10)



(f) Homographic Butterworth filter (cut off frequency =50)

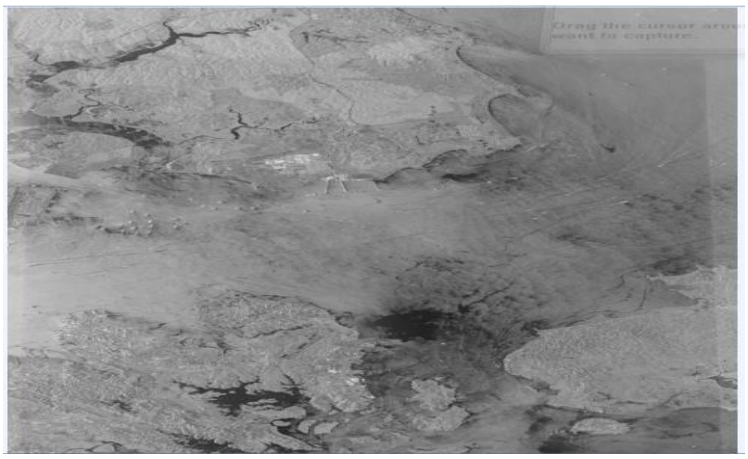
5.4 Effect of Homographic Ideal filter :

(g) Homographic Ideal filter (cut off frequency =10)

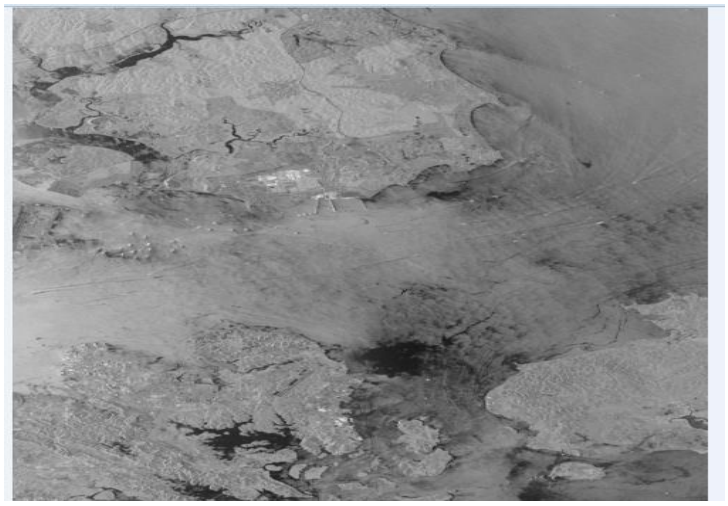


(g) Homographic Ideal filter (cut off frequency =50)

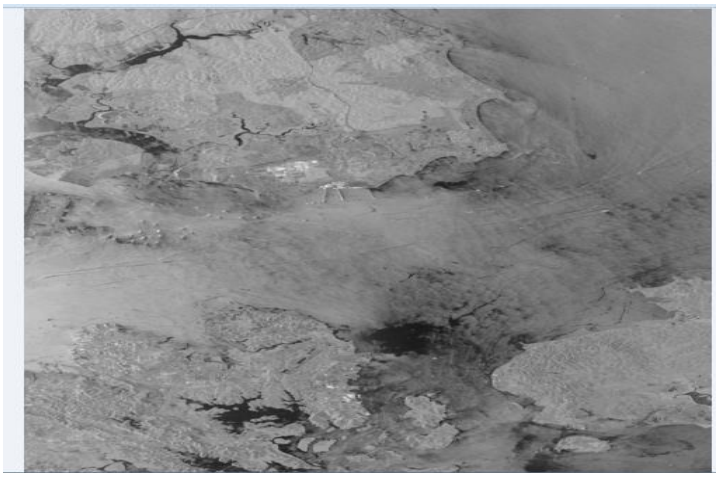
5.5 Effect of Median filter :



(i) Median Filter [3*3]



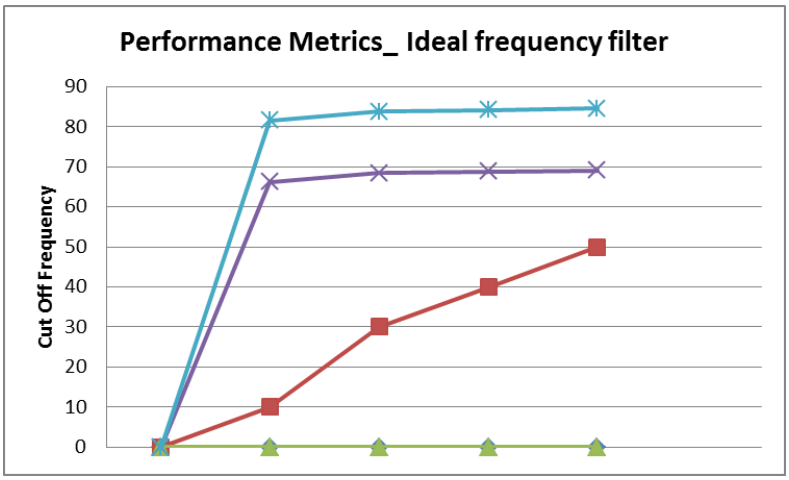
(j) Median Filter [5*5]



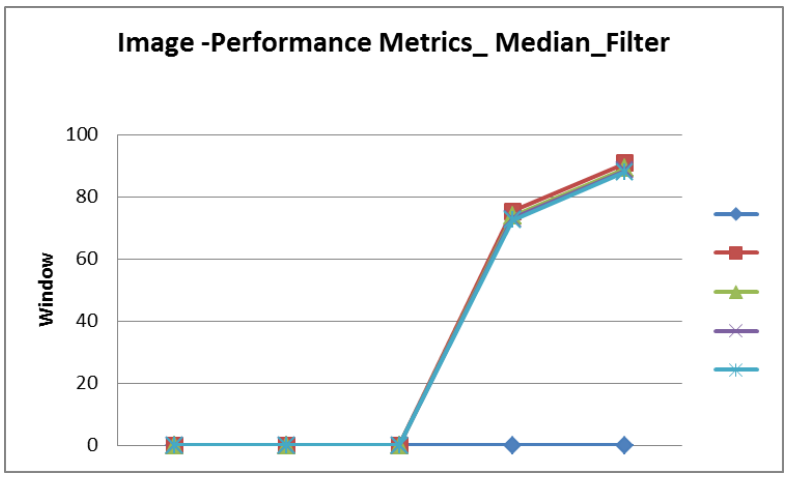
(k) Median Filter [7*7]

5.6 Performance analysis

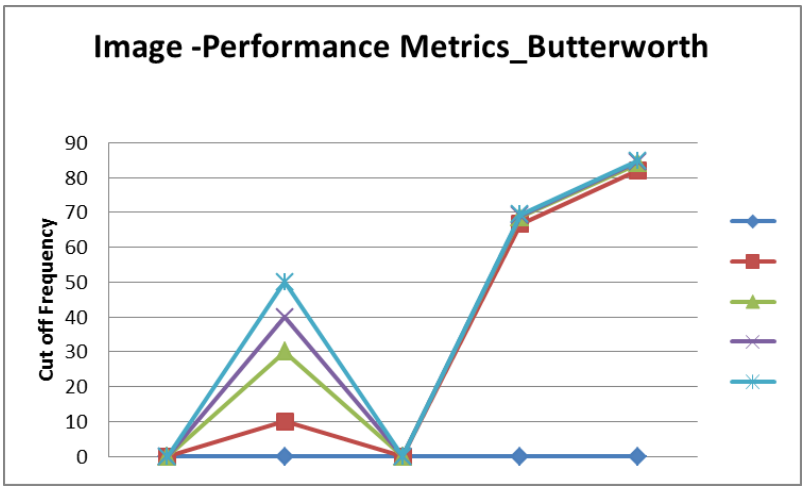
we are obtain performance analysis based on with rating of different cut –off frequency .



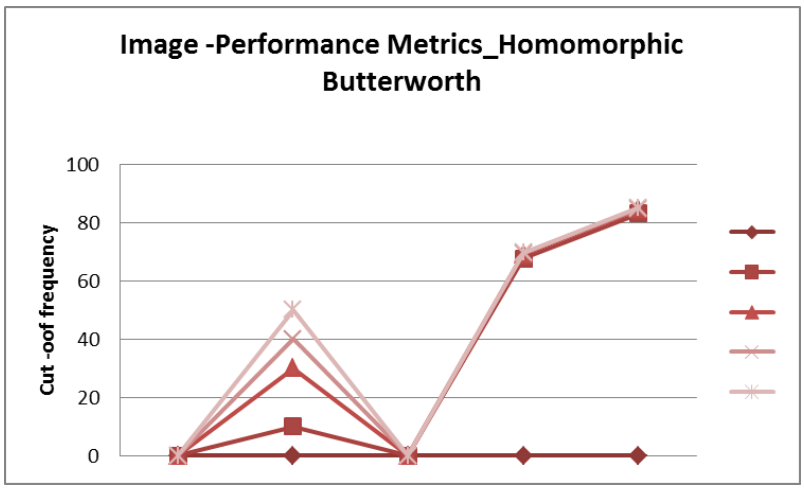
(A)Image -Performance Metrics_ Ideal frequency filter



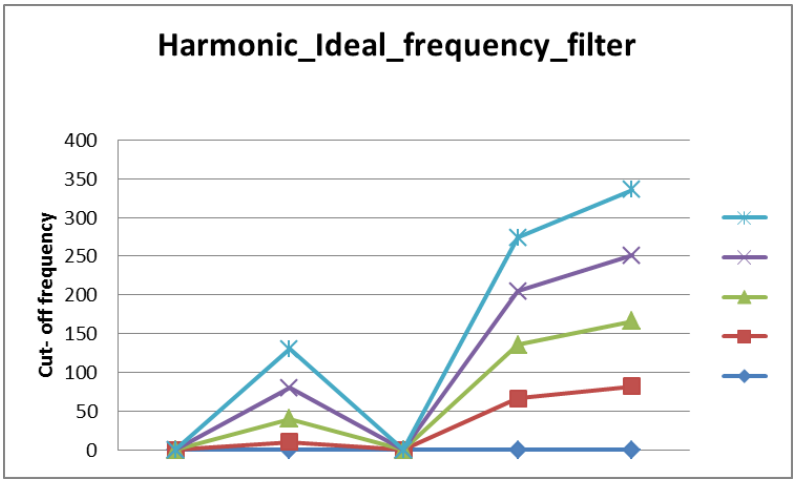
(B) Image -Performance Metrics_ Median_Filter



(C)Image -Performance Metrics_Butterworth



(D)mage -Performance Metrics_Homomorphic Butterworth



(E)Harmonic_Ideal_frequency_filter

VI. CONCLUSION

This research proposed a new technique for reducing speckle noise in SAR data by fusing the images using a pre-processed DWT transform. Various filters, such as the median filter, Fourier Ideal Filter Butterworth Filter, Homomorphic Fourier Ideal Filter, and Homomorphic Butterworth Filter, have been tested, as well as a newly presented approach. SAR pictures were used to compare their performance. In terms of visual analysis and quantitative evaluation with parameters, experimental results suggest that denoised images from model perform better than adaptive filters.

VII. REFERENCES

[1]. N. Karimi and M.R. Taban, A convex variational method for super resolution of SAR image with speckle noise, Signal Processing: Image Communication (2020),doi: https://doi.org/10.1016/j.image.2020.116061.

[2]. Dong, H., Ma, W., Jiao, L., Liu, F., & Li, L. (2021). A multiscale self-attention deep clustering for change detection in SAR images. IEEE Transactions on Geoscience and Remote Sensing, 60, 1-16.

[3]. Z. Cui, Q. Li, Z. Cao, and N. Liu, "Dense attention pyramid networks formulti-scale ship detection in SAR images," IEEE Trans. Geosci. Remote Sens., vol. 57, no. 11, pp. 8983–8997, Nov. 2019

[4]. H. Dong, W. Ma, Y. Wu, J. Zhang, and L. Jiao, "Self-supervisedrepresentation learning for remote sensing image change detection based on temporal prediction," Remote Sens., vol. 12, no. 11, p. 1868, Jun. 2020.

[5]. R. Wang, J. Zhang, J. Chen, L. Jiao, and M. Wang, "Imbalanced learning-based automatic SAR images change detection by morphologically supervised PCA-net," IEEE Geosci. Remote Sens. Lett., vol. 16, no. 4, pp. 554–558, Apr. 2019.

[6]. H. Chen, L. Jiao, M. Liang, F. Liu, S. Yang, and B. Hou, "Fastunsupervised deep fusion network for change detection of multitemporal sar images," Neurocomputing, vol. 332, pp. 56–70, Mar. 2019.

[7]. L. Mou, L. Bruzzone, and X. X. Zhu, "Learning spectral-spatialtemporalfeatures via a recurrent convolutional neural network for change detection in multispectral imagery," IEEE Trans. Geosci. Remote Sens., vol. 57, no. 2, pp. 924–935, Feb. 2019.

[8]. H. Zhuang, Z. Tan, K. Deng, and G. Yao, "Adaptive generalized likelihood ratio test for change detection in SAR images," IEEE Geosci. Remote Sens. Lett., vol. 17, no. 3, pp. 416–420, Mar. 2020.

[9]. M. Zhao, Q. Ling, and F. Li, "An iterative feedback-based change detection algorithm for flood mapping in SAR images," IEEE Geosci. Remote Sens. Lett., vol. 16, no. 2, pp. 231–235, Feb. 2019.

[10]. Vora, P. D., & Chudasama, M. N. (2015). Different image fusion techniques and parameters: a review. Int J Comput Sci Inf Technol, 6(1), 889-892.

[11]. H. Zhu, W. Ma, L. Li, L. Jiao, S. Yang, and B. Hou, "A dual–branch attention fusion deep network for multiresolution remote–sensing image classification," Inf. Fusion, vol. 58, pp. 116–131, Jun. 2020.

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Performance Appraisal in the Construction Industry

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ABSTRACT

Performance Appraisal is the method of evaluating the behavior of the employees in the workplace, normally including both quantitative and qualitative aspect of the job.
How the employee is performing, how the employee can develop, what the superior can do to make it happen and how the job isgoing.

Performance Appraisal is conducted for the following:

- Provide information about the performance ranks. Decision regarding salary revision, confirmation, promotion anddemotions.
- Provide feedback about level of achievement and behavior of thesubordinate.
- Provide information which helps to counsel the employees.
- Provide information to diagnose the deficiency of theemployees.
- Provide training and development needs of the employees.
- To identify the strengths and weaknesses of employees to place right men on rightjob.
- To maintain and assess the potential present in a person for further growth anddevelopment.
- To provide feedback to employees regarding their performance and related status.
- It serves as a basis for influencing working habits of theemployees.
- To review and retain the promotional and other trainingprograms.compensation packages, wage structure, salaries raises,etc.

I. INTRODUCTION

Performance Appraisal is the systematic evaluation of the performance of employees and to understand the abilities of a person for further growth and development. Performance appraisal is generally done in systematic ways which are as follows:

- The supervisors measure the pay of employees and compare it with targets andplans.
- The supervisor analyses the factors behind work performances ofemployees.
- The employers are in position to guide the employees for a better performance.

Objectives of Performance Appraisal

Performance Appraisal can be done with following objectives in mind:

Organizational • Set and Measure Goals • Measure Individual Performance • Give Feedback • Get Performance Improvement	Administrative • Award Pay Increases • Promotion Screening/Decisions • Career Advancement • Downsize/Layoff Decisions • Legal Documentation
Individual • Motivate/Provide Recognition • Coaching and Mentoring • Counsel Problem Performers • Development/Training Needs	Control • Management Direction • Employee Compliance

II. IDENTIFY, RESEARCH AND COLLECT IDEA

- Identify construction companies which are using Performance Appraisal system for theiremployees
- Study and gather information for existing Performance Appraisalsystem
- Identify the flaws, drawbacks of existing PA system. Also, interview 4-5 employees and take their feedback about the performance appraisal system
- Propose a customized Performance Appraisal System which suits to the organizations existing PA system. Encourage construction companies of the importance of proper Performance Appraisal and explain them the benefits of the new proposed system
- Comparison between proposed PA system and existingsystem.

Characteristics of Performance Appraisal

Virtually all performance appraisal programs have the following characteristics:

- Outside Judgment- Using the performance standards, each employee's individual actual work performance, behaviors, production, or traits are compared with the performance standards by someone other than theemployee.
- Specified Time Period- Employee ratings, judgments, and assessments relate to a specific time period rather than a particular work product or project (typically quarterly and/or annually).
- Standardization- The process is systematically applied to all employees or class ofemployees.
- Mandatory- The process is typically mandatory although certain upper-level executives may beexcluded.
- Documented- The results of the ratings, judgments, or assessments are recorded and preserved by someone in the organization other than the ratedemployee.

Factors Considered for Performance Appraisal

The following factors are considered for Performance Appraisal

- PerformanceFactor
- BehavioralFactor
- GradingSystem
- PersonalEffectiveness

Performance Factor- Below are the performance related factors considered for Performance Appraisal

1. **Job Knowledge (knowledge of duties and responsibilities ofposition)**
   - Unable to complete job duties, poor understanding ofjob
   - Lacks knowledge of some phases ofwork
   - Has adequate grasp of job requirements, able to learn new aspects ofjob
   - Understands all phases of work, most job dutiesmastered
   - Has completely mastered job, strives to learn more/improve job skills
2. **Quantity of Work (amount of work done during workday)**
   - Minimum requirements not met, volume of work generallyunsatisfactory
   - Volume of work is generally below what is expected, does just enough to getby
   - Volume of work meets job requirements; when situation requires, production increases
   - Volume of work frequently above that expected
   - Produces consistently high volume of work, extremely productive andfast
3. **Initiative (origination and development of vital jobprocedures)**
   - Develops new ideas and methods to improve quality ofresults
   - Seeks additional knowledge pertaining to job
   - Follows formal instructions asnecessary
   - Shows little interest in current practices relating to job
   - Unwilling to demonstrate interest in gaining newknowledge

Behavioral Factor- Below are the behavioral related factors considered for Performance Appraisal

1. **Responsibility and Dependability (willingness to take on assignments and be heldaccountable)**
   - Requires minimum of supervision; seeks additional responsibility; is veryreliable
   - Reliable, requires little supervision, carries througheffectively
   - Usually takes care of necessary tasks and completes them with reasonable promptness
   - Frequently requires prompting, often fails to meetdeadlines
   - Unreliable, requires close supervision, does not acceptresponsibility
2. **Attendance and Punctuality (conformity to work hours; timely attendance atmeetings)**
   - Absent often, frequently late, chronic offender
   - Lax in attendance or reporting time, allows personal factors tointerfere
   - Usually present and on time, generally reliable
   - Very prompt, shows responsibility toward regular attendance
   - Superior attendance and promptness, alwaysdependable

Grading System - Below are the Grading System related factors considered for Performance Appraisal

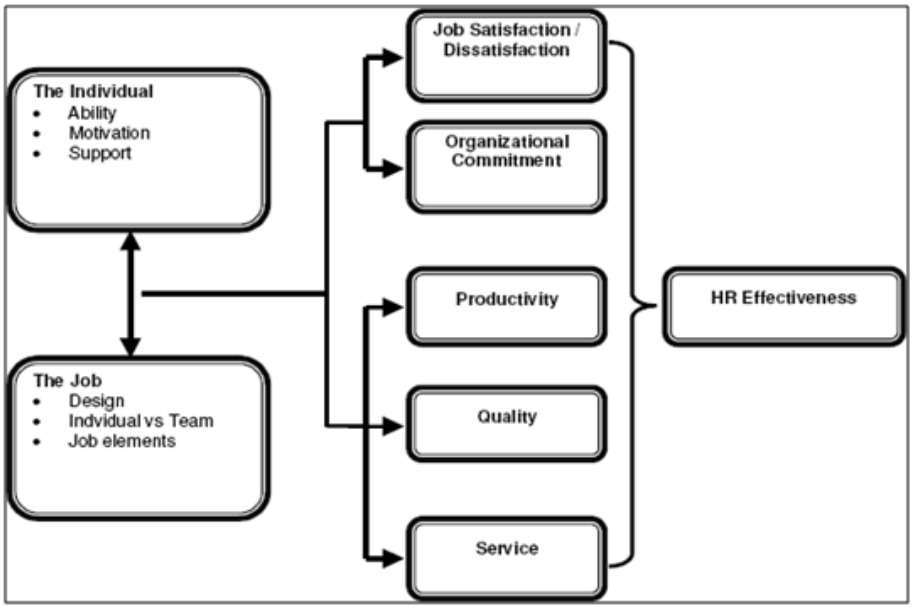
1. **Effective use of time** (ability to organize, prioritize and schedule)
   - Ineffective in routine tasks, cannot plan or schedule
   - Difficulty in determining priority and schedule ofduties
   - Completes assignments within time expected, meets schedules

- Plans skillfully, handles unusualsituations
- Extremely capable in coordinating tasks in changing situations

Personal Effectiveness - Below are the Personal Effectiveness related factors considered for Performance Appraisal

1. **Quality (correctness, completeness, and accuracy of work dutiesperformed)**
   - Requires minimum of supervision, consistently thorough andaccurate
   - Requires little supervision, is exact and precise most of the time, seldom makes errors
   - Usually accurate, makes minimum number of mistakes
   - Makes above average number of errors, final product often needs revision or correction
   - Makes frequent and recurrenterrors
2. **Interpersonal Relations (communication and cooperation with fellowemployees)**
   - Goes out of way to promote good interpersonal relations, verycooperative
   - Effectively handles difficult interpersonal relations
   - Adapts self to others and to most situations, seeks guidance when needed, user friendly
   - Sometimes rigid and defensive, does not foster good working environment
   - Fails to consider others, not courteous, lacksunderstanding
3. **Internal Control (performance as related to individual's internal controlresponsibilities)**
   - Has a minimum understanding of internal controlprocedures
   - Internal control practices are somewhat below normalexpectations
   - Has an adequate knowledge of internal control practices andprocedures
   - Internal control practices and procedures are frequently above thoseexpected
   - Has completely mastered internal control policies and procedures fordepartment

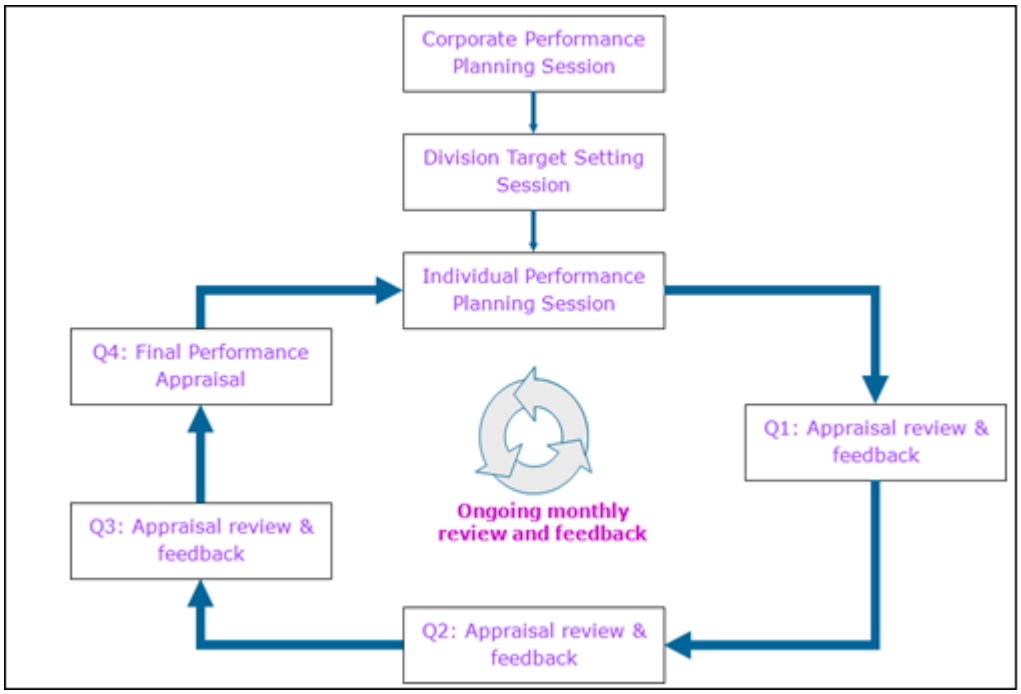
Model of Individual / Organizational Performance



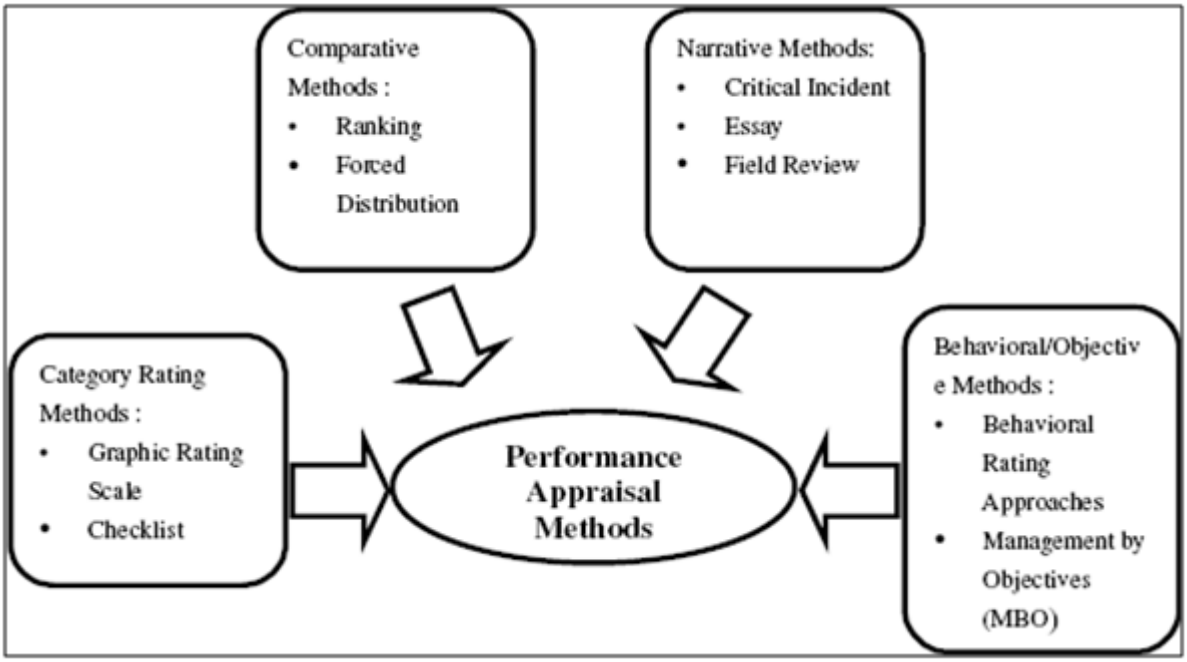
Stages of a Performance Appraisal

- Planning
- Performing
- Evaluating
- Finalization of results

Overall Performance planning Cycle



Methods of Performance Appraisal



Graphic Rating Scales

- A graphic scale 'assesses a person on the quality of his or her work (average; above average; outstanding; orunsatisfactory).'
- Assessment could also be trait centered and cover observable traits, such as reliability, adaptability, communication skills, etc.
- Although graphic scales seem simplistic in construction, they have application in a wide variety of job responsibilities and are more consistent and reliable in comparison with essay appraisal
- The utility of this technique can be enhanced by using it in conjunction with the essay appraisal technique.

Typical Graphic Rating Scale

EmployeeName..... **Job title.....**

Department..... **Rate .....**

Data .....

Checklist Method

- Another simple type of individual evaluation method is thechecklist.

Example:

Is the employee really interested in the task assigned? Yes/No

Is he respected by his colleagues (co-workers) Yes/No

Does he give respect to his superiors? Yes/No

Does he follow instructions properly? Yes/No

Does he makemistakesfrequently? Yes/No

Criteria	Unsatisfactory(1)	Fair (2)	Satisfactory (3)	Good(4)	Outstanding (5)
Quantity of work: Volume of work under normal working conditions					
Quality of work: Neatness, thoroughness and accuracy of work Knowledge of job					
A clear understanding of the factors connected with the job					
Attitude: Exhibits enthusiasm and cooperativeness on the job					

Ranking Method

This is one of the oldest and simplest techniques of performance appraisal. In this method, the appraiser ranks the employees from the best to the poorest on the basis of their overall performance. It is quite useful for a comparative evaluation

Forced Distribution

- Unlike the field review method, the forced-choice rating method does not involve discussion with supervisors.

- Although this technique has several variations, the most common method is to force the assessor to choose the best and worst fit statements from a group ofstatements.
- These statements are weighted or scored in advance to assess the employee. The scores or weights assigned to the individual statements are not revealed to the assessor so that she or he cannot favor any individual.
- In this way, the assessor bias is largely eliminated and comparable standards of performance evolved for anobjective.
- However, this technique is of little value wherever performance appraisal interviews are conducted.

Critical Incidence Method

Under this method, the manager prepares lists of statements of very effective and ineffective behavior of an employee. These critical incidents or events represent the outstanding or poor behavior of employees on the job

Essay appraisal method

- The assessor writes a brief essay providing an assessment of the strengths, weaknesses and potential of thesubject.
- In order to do so objectively, it is necessary that the assessor knows the subject well and should have interacted with them.
- Since the length and contents of the essay vary between assessors, essay ratings are difficult to compare.

Field review method

- Since individual assessors differ in their standards, they inadvertently introduce bias in their ratings.
- To overcome this assessor-related bias, essay and graphic rating techniques can be combined in a systematic review process. In the field review method, 'a member of the HRM staff meets a small group of assessors from the supervisory units to discuss each rating, systematically identifying areas of inter-assessordisagreement.'
- It can then be a mechanism to help each assessor to perceive the standards uniformly and thus match the otherassessors.
- Although field review assessment is considered valid and reliable, it is very timeconsuming.

Behaviorally anchored rating scales (BARS)

- This is a relatively newtechnique.
- It consists of sets of behavioral statements describing good or bad performance with respect to importantqualities.
- These qualities may refer to inter-personal relationships, planning and organizing abilities, adaptability andreliability.
- These statements are developed from critical incidents collected both from the assessor and the subject.

Management by Objectives

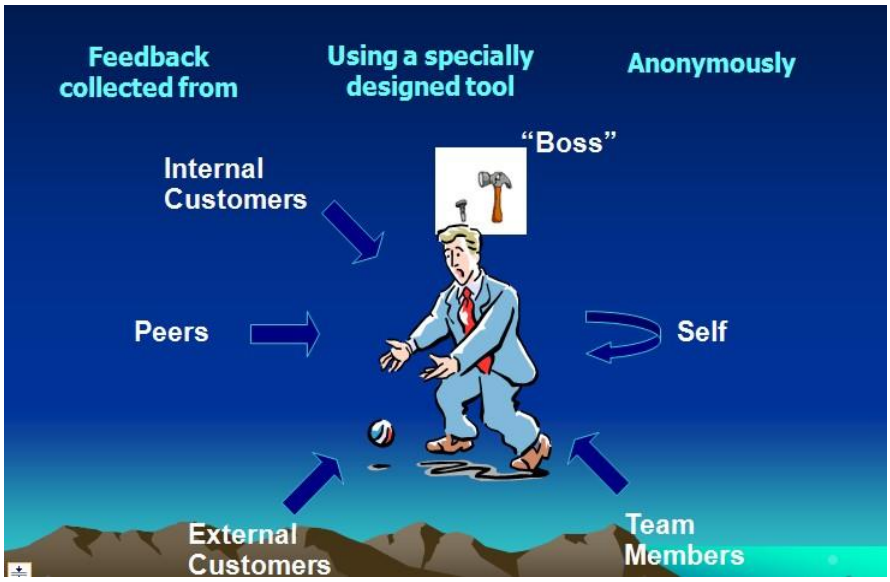
- The employees are asked to set or help set their own performancegoals.
- This avoids the feeling among employees that they are being judged by unfairly highstandards.
- This method is currently widely used, but not always in its truespirit.
- Even though the employees are consulted, in many cases management ends up by imposing its standards

andobjectives.

- In some cases employees may not like 'self- direction or authority.' To avoid such problems, the work standard approach isused.

360-Degree Feedback

360 Degree Feedback is a multi - rater feedback system where an individual is assessed by a number of assessors including his boss, direct reports, colleagues, internal customers and external customers



III. CONCLUSION

Utilizing the concept of using four multifactorial evaluation model in the performance appraisal system could ease the changes need to be made in this system whenever it is necessary. The system also has a monitoring function that uses all performance evaluation data without any removal. Thus the proposed appraisal system overcomes all the drawback of existing Performance Appraisal System of the company which will provide employees a fair system and can improve the overall productivity of the employee and also helps the employee as well as organisation. This system helps to define new processes, review & optimize existing processes & templates to improve productivity and/or quality and estimation techniques in order to analyze work-load and resource needs.

IV.REFERENCES

[1]. S.A Sirwardana and Y. Ruwanpura "A conceptual model to develop a worker performance measurement tool to improve construction productivity". A paper on Construction Research Congress 2012 © ASCE 2012

[2]. Todd Grubb "Performance Appraisal Reappraised: It's Not All Positive" (Todd Grubb Troy University) Journal of Human Resource Education, Vol. 1, No. 1, Summer 2007, 1-22

[3]. Kenneth Sullivan, Dean Kashiwagi , Brad Carey , "Analysis of the Use of Performance Information in the Construction Industry." -Advancing and Integrating Construction Education, Research & Practice, August 4-5, 2008

[4]. Arik Prasetya, KATO, Masanori, "Correlation among Corporate Productivity, Performance Assessment System and Salary System (A Numerical Representation of a Qualitative Survey)" - Research Journal of International Studies - Issue 16 (September, 2010)

[5]. Mohamed S. Abdel-Wahab , Andrew R.J. Dainty , Stephen G. Ison "A review of the relationship between skills and productivity in construction" Department of Civil and Building Engineering, Loughborough University, Loughborough, LE11 3TU, UK.

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IOT based Smart Farm Monitoring System Using Raspberry PI and Arduino Uno

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ABSTRACT

This Paper is aimed to implement Intelligent System that uses a Linux based webserver with Embedded System for smart farm monitoring using Raspberry Pi and Arduino Uno. The proposed system outcomes will be monitoring and control of environmental condition at farm. As well as it will show serial peripheral communication & USB protocol communication between Raspberry Pi and Arduino Uno. In proposed system Raspberry pi is used as Embedded Web server & Arduino Uno is used to Read sensor value. With Embedded Web Server system Internet of thing system is implemented. The findings of this study found that the system may monitor Combine climate as well as wetness, temperature, climate quality, The system was found to be impactful for farmers to use as they may effectively manage the farm at remote area as well, leading to price reduction, quality saving, and productive management in target farming

Keywords—Raspberry Pi; Arduino Uno; Webserver; DHT11;

I. INTRODUCTION

The primary function of a web server is to store, process and deliver web pages to clients. The communication between client & server takes place by using the Hypertext Transfer Protocol (HTTP). Pages delivered are most frequently HTML documents, which may include images, style sheets and scripts in addition to text content.

A user agent, commonly a web crawler or web browser, originates communication by making a request for a specific resource using HTTP and the server responds with the content of that resource or an error message if unable to do so. The resource is basically a real file on the secondary storage of the server, but this is not essential the case and only depends on how the web server is implemented.

While the primary function is to serve content, a full implementation of HTTP also includes ways of receiving content from clients. For submitting web forms, including uploading of files this feature is used. Many generic web servers also support server-side scripting using Active Server Pages (ASP), PHP, or other scripting languages.

This indicates that the nature of the webserver can be scripted in separate files. while the actual server software remains unchanged. Usually, this function is used to generate HTML documents dynamically ("on-the-fly") as opposed to returning static documents. While the actual server software remains unchanged. The former is initially used for modifying and/or retrieving information from databases. The latter is typically much faster and more easily cached but cannot deliver dynamic content.

Web servers are not always used to serve the (WWW) World Wide Web. They can also be found embedded in devices such as printers, routers, webcams and serving only a local network. The web-server may then be used as a part of a system for administering and/or monitoring the device in question. This usually means that no additional software has to be installed on the client computer, since only a web browser is required (which now is included with most operating systems).common features of web server includes:

- Virtual hosting to serve many web sites using one IP address
- Large file support to be able to serve files whose size is greater than 2 GB on 32 bit OS
- To limit the speed of responses in order to unsaturated the network and to be able to serve many clients by Bandwidth throttling.
- Server-side scripting to generate dynamic web pages, still keeping web server and website implementations separate from each other

In proposed project we are using web server to access different sensors data as well as to control different Farm applications for power management purpose.

Without web servers the internet as we know it would cease to exist. Web-servers are an unavoided part of the way the internet works. The web hosting industry is simply used to lease out web servers, providing average business owners and individuals with the opportunity to use high-tech servers that make it possible to expand their outreach to the entire world. Without rental web servers the internet would be a fraction of the size it is today, as most web site owners can afford to buy their own web server in cash.

Web servers are the gateway between the average individual and the world wide web.

II. LITERATURE REVIEW

This analysis has targeted on the employment of recent technology to assist manage animal farming, which implies farm management automation in numerous ways that. ManakantIntarakamhaeng and et al [4] studied the model of farm management computerization tools with RFID, Result; the approval of RFID, or radio-frequency identification of objects and animals aswell as five sorts of animal: oxen, buffalo, sheep, pigs and rabbits were with success singly known and recorded mechanically.MdSaifudaullah Bin Bahrudin and Rosni Abu Kassim [5] conferred fireplace|afireplace|a hearth} warning device in a very period observance system that detected the presence of smoke within the air attributable to fire and captured pictures via a camera put in within an area once a hearth happens. The embedded systems accustomed develop this hearth warning device were Raspberry Pi and ArduinoThe key aspect of the system is that the ability to remotely send AN alert once a hearth is detected. once the presence of smoke is detected, the system can show a picture of the space state in a very website. The system can would like the user confirmation to report the event to the fire- eater employing

a Short Message Service (SMS). The advantage of mistreatment this method is that it'll cale back the chance of false alert according to the fire eater. The camera can solely capture a picture, thus this method can consume solely slightly storage and power. Kumar associate degreed Hancke [6] given an animal health observation System (AHMS) for observation the physiological parameters

A. Web Server

A web server is an information technology that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can indicate either to the whole computer system&an appliance, or specifically to the software that accepts and supervises the HTTP requests.The process is an example of the client/server model. All computers that host Web sites should contain Web server programs. Leading Web servers include Apache (the most widely-installed Web server), Microsoft's Internet Information Server (IIS) and nginx (pronouncedengine X) from NGNIX. Other Web servers includes Google, Novell's NetWare server, Google Web Server (GWS) &IBM's family of Domino servers.Web servers often come as part of a larger package of Internet- and intranet-related programs for serving email, downloading requests for File Transfer Protocol (FTP) files, and building and publishing Web pages. Considerations in choosing a Web server must consider that how better it works with the operating system (OS) and other servers, its ability to handle server-side programming, security characteristics, and the particular publishing, search engine and site building tools that come with it.Web server means every Website sits on a computer. This server is always connected to the internet. Every Web server that is connected to the Internet is given a unique address made up of a series of four numbers between 0 and 255 separated by periods. For example, 68.178.157.132 or 68.122.35.127.

When you register the address of the web, which is also known as a domain name, like tutorialspoint.com you have to specify the IP address of the Web server that will host the site.

There are four leading web servers – Apache, IIS, lighttpd and Jagsaw. Now we will see these servers in bit more detail.Apart from these Web Servers, there are other Web Servers also available in the market but they are very expensive. Major ones are Netscape's iPlanet, Bea's Web Logic and IBM's WebSphere.

In the absence of web servers the internet as we know it would cease to exist. Web servers are an integral part of the way the internet works. The web hosting industry is basically used to lease out web-servers, giving average business owners and individuals with the opportunity to use high-tech servers that make it possible to expand their outreach to the entire world. Without rental web servers the internet would be a fraction of the size it is today, as most web site owners can afford to buy their own web server in cash.

Web servers are the gateway between the(WWW) World Wide Web and average individual. keeping in mind all these necessities we are using web server to show controlling and monitoring of different data.

B. Raspberry Pi

Raspberry Pi [7] is a small computer board working on theLinux operating system which connects to a computermonitor, keyboard, and mouse. Raspberry Pi can be applied to a electronic structure and programming network work, it canalso served as a personal computer and Apache Webserver,MySQL could be installed in the board.A GPIO [10] pin can be used as either a digital input or adigital output, and both operate

at 3.3V. Unlike the Arduino,the Raspberry Pi which does not have any analog inputs. Forthat you should use an external analog-to-digital converter(ADC) otherwise connect the Pi to an interface board must be used.

C. Arduino

Arduino is an open-source microcontroller compatible withdeveloped platforms. The controller appears not to beexpensive and uses low electrical power, 5.5 volts. C and C++ were employed for this development. Arduino can connect toa computer via the Universal Serial Bus (USB) and performwith compatible connected accessories in both analog signaland digital signal.The Arduino [7] is a microcontroller platform, mounted ona board that plugs easily into most computers.

D. Gas sensor :

MQ-135 gas sensor module are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, i-butane, propane, methane ,alcohol, Hydrogen, smoke. it has following features :

i. Fast response
ii. Adjustable sensitivity
iii. Covers LPG, i-butane, methane, alcohol, Hydrogen etc Useful for gas leakage detecting Grove connector compatible

E. Humidity sensor

A humidity sensor senses, measures and regularly reports the relative humidity in the air. It measures both moisture and air temperature. Relative humidity, expressed as a percent, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature canhold.The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature.

F. LDR

A Light Dependent Resistor(LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistanc

III. SYSTEM DEVELOPMENT

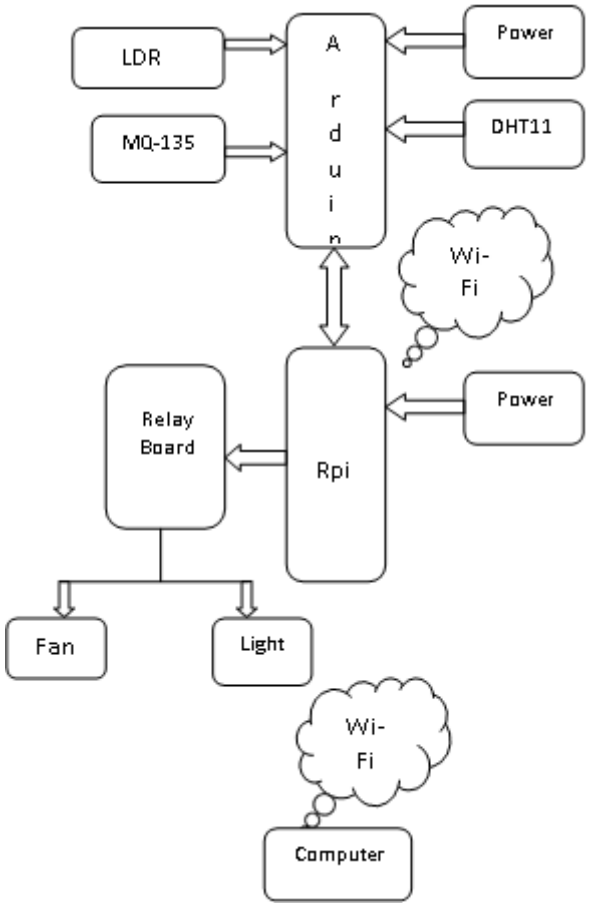

Fig. 1 Block Diagram

ARM 11 is chief system in our project. This is used to control, monitor and decision making for application. For ARM 11 we are using raspberry pi. Raspberry Pi hardware has evolved through several versions that feature variations in hardware performance, memory capacity, and peripheral device support.

The SoC used in the first generation Raspberry Pi is somewhat equivalent to the chip used in older smartphones (such as iPhone / 3G / 3GS). The Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SoC), which includes 700 MHz ARM1176JZF-S processor, VideoCore IV GPU, and RAM. It has a Level 1 cache of 16 KB and a Level 2 cache of 128 KB. The Level 2 cache is used primarily by the GPU.

Performance of first generation model

While operating at 700 MHz by default, the first generation Raspberry Pi provided a real world performance roughly equivalent to 0.041 GFLOPS. On the CPU level the performance is similar to a 300 MHz Pentium II of 1997-1999. The GPU provides 1 Gpixel/s or 1.5 Gtexel/s of graphics processing or 24 GFLOPS of general purpose computing performance. The graphics capabilities of the Raspberry Pi are roughly equivalent to the level of performance of the Xbox of 2001.

The LINPACK single node compute benchmark results in a mean single precision performance of 0.065 GFLOPS and a mean double precision performance of 0.041 GFLOPS for one Raspberry Pi Model-B board. A

cluster of 64 Raspberry Pi Model-B computers, labeled "Iridis-pi", achieved a LINPACK HPL suite result of 1.14 GFLOPS (n=10240) at 216 watts for c. US$4,000.

Raspberry Pi 2 is based on Broadcom BCM2836 SoC, which includes a quad-core Cortex-A7 CPU running at 900 MHz and 1 GB RAM. It is described as 4–6 times more powerful than its predecessor. The GPU is identical.

SENSORS:

As shown in block diagram three sensors are used they are :

i. Gas sensor
ii. Light sensor
iii. Humidity Sensor

Output of sensors is fed to raspberry pi via Arduino.The respective sensors values are shown on web page using IOT application.

Light Sensor:

It is used to sense intensity of light. According to intensity level sensing respective signal is sent to ARM 11 which in turn to be displayed on web page.

Gas sensor:

This is a simple-to-use liquefied petroleum gas (LPG)sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-135 can detect gas concentrations anywhere from 200 to 10000ppm.

This sensor has a high sensitivity and fast response time.

The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.

Power supply used for ARM 11 is of 12V and .7 A. it's a Standard adapter come along ARM 11.All controlling and monitoring of data in this project is done by web page. for development of webpage we are using php system.

IV. RESULT AND CONCLUSION

The implemented system has been tested over farm. it is been found that system is working very well, The main component of the system like arduino and raspberri pi are communicating well with each other for sensor value readings. The sensor values are well read by webpage using webserver system. This system has valuable and impactful role in smart farm monitoring. This system will be definitely Lighthouse for further research over smart farming.

V. REFERENCES

[1]. G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (references)

[2]. J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol.2. Oxford: Clarendon, 1892, pp.68-73.

[3]. I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4]. K. Elissa, "Title of paper if known," unpublished.

[5]. R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

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Use of Aluminium Foil and Glass Powder Waste in Fly Ash Brick Production

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ABSTRACT

In this paper,waste materials such as aluminium foil and glass powder waste are used in manufacturingfly ash bricks.Such wastes which cannot be recycled and takes longer time for breakdown can be considered as analternative to raw materials.Recycling or reusing of such wastes is a very positive contribution in saving our naturalenvironment.In order to utilize the waste material in an effective manner we have replaced sand by aluminium foil inrange of 10-20% and cement by glass powder in the range of 10-30%. It is observed that bricks made using aluminiumfoil and glass powder wastecan be used as an alternative to other bricks.

KEYWORDS: Flyash,waste, aluminium foil, glass powder, cost.

I. INTRODUCTION

The cost of construction materials is increasing day-by-day and also the cost of construction, so it is necessary to findalternatives to those costly materials which should not affect brick properties,waste material can be used as analternative and various researches and experiments have been carried out and it was observed that using waste materials in bricks are more effective and obtained good results in every aspect as compared to conventional bricks.By usingwastes in brick its effective properties can be usefulto bricks. In this project we have used waste materials such asaluminium foil waste and waste glass powder. Aluminium foil is more harmful than plastic to environment. It'sgenerally easy to recycle aluminium foil if it is clean but aluminium foil is usually contaminated by grease and oils from food or, in a lab setting, adhesives and tapes. Since contaminants can damage recycling equipment and create aninferior end product, countless tonnes of waste foil are landfilled or incinerated every year. Glass is used in a variety of applications right from construction, automobiles, nosediving submarines, doors andwindows, utensils, waste containers, windscreen, medicinal bottles, soft-drink bottles, tube lights, bulbs, electronicequipment, etc. Hence, the usage of glass has increased considerably, which has in essence, contributed to the increaseof waste disposal. In addition, glass waste is considered as non-decaying material that pollutes the surroundingenvironment. Most of recovered waste glass is used by glass manufactured company in the production of new glasses such as bottle and etc. But only a limited amount from the waste glass collect is that can be used toward the productionof new glass.

The objective of this project is to use wastes in bricks to produce eco-friendly bricks. Beneficial properties ofaluminium foil and glass powder waste will enhance properties when added in mixture of fly ash bricks,therefore manufacturing fly ash bricks using such wastes will be cost effective and will consist of more properties ascompared to normal bricks.

II. MATERIALS

A). Aluminium foil waste:

Aluminium foil is light in weight, good in ductility, has a high barrier to water, steam, light and fragrance, and is notaffected by theenvironment and temperature. The aluminium foil is stable at high and low temperature. It does notshrink at – 73 ~ 371 °C, and has good thermal conductivity.

Fig.(a) Aluminium foil

B). Fly ash:

Fly ash is a residue resulting from combustion of pulverized coal or lignite in thermal power plants. About 80% ofthe total fly ash is in finely divided form which is carried away with flue gases and is collected by electrostaticprecipitator or other suitable technology. The balance 20% of ash gets collected at the bottom of the boiler and isreferred to as bottom ash. Fly ash got into a fine powder in the comparable to cement.

Fig.(b)Fly ash powder

C). Sand:

The silica material was utilized as a fine aggregate in concrete and mortars. Natural river sand is the mostpreferred choice as a fine aggregate material. River silica sand is a product of natural weathering of rocks over aperiod of millions of years. It is mined from the river beds. River sand is far superior for construction purposesthan any other sand used in construction.

D). Waste Glass powder

Glass is a transparent material produced by melting a mixture of materials such as silica, soda ash, andCaCO3 at high temperature followed by cooling during which solidification occurs without crystallization. Aglass powder is also used as a binder with partial replacement of cement which takes some part of reaction at thetime of hydration; also it is act as a filler material. A denser (less porous) and more homogeneous structure isproduced when milled waste glass is used as partial replacement for cement, which benefits the resistance tomoisture sorption and the long-term durability of cementitious materials.

Fig. (c) Glass powder

E). Cement:

The manufacturing of Cement was conducted by heating limestone (calcium carbonate) with small quantities ofother materials (such as clay). A cement is a binder, a substance used for construction that sets, hardens, and adheresto other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel(aggregate) together cement will act as a binding material.

III. METHODOLOGY

1. Collection of raw material& waste material:

It includes collection of materials to be used in manufacturing brick such as fly ash, cement, sand, aluminium foil waste, glass powder waste. Aluminium foil waste can be collected from garbage collectorand other materials from nearby dealers.

2. Mixing material in rotary mixer in proportion:

All collected materials are mixed by rotary mixer as per the mix proportion mentioned in below table.

Physical properties of cement

SR.NO.	TEST	STANDARDS
1	Initial setting time	30 MINUTES
2	Final setting time	600 minutes
3	Fineness	Not less than 90%
4	Sp. Gravity	3.10 to 3.15
5	Standard consistency	30 to35%

3. Moulding:

The mixed material is placed and compacted in mechanical compression machine to gain required shape and size.

4. Curing:

The prepared bricks are cured for 7days and 21days and dried in regular temperature. The curing of bricksis done by covering it with gunny bags and moisture is maintained regularly.

IV. RESULTS

1. COST ANALYSIS

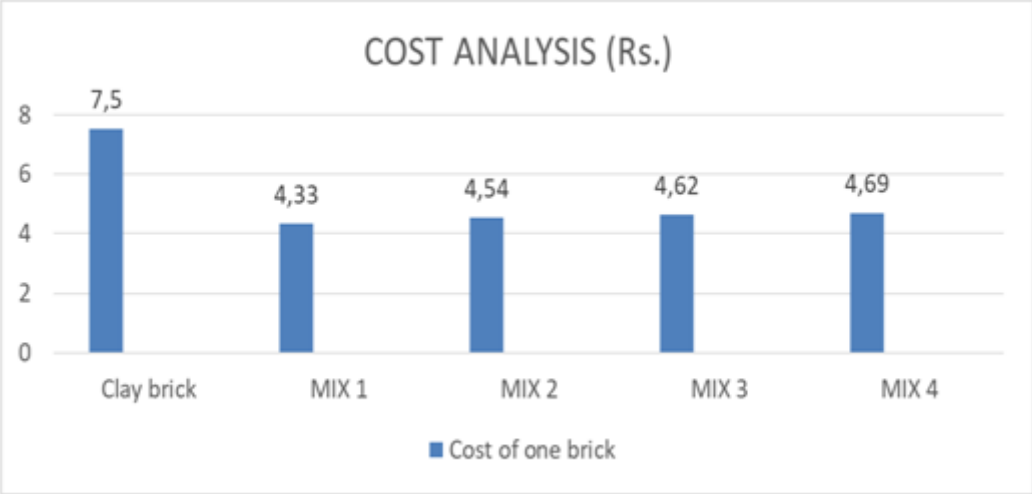
Let us consider the batching process is performed in a pan mixer of capacity of 500kg and find the cost for one brick.Calculation:

Calculating for 500kg total input material according to mix 2.

Materials Proportion

NO.	MIX PROPORTION (in %)				
	FLY ASH	SAND	CEMENT	ALUMINIUM FOIL	GLASS POWDER
1)	50	40	10	-	-
2)	50	33	9	7	1
3)	50	30	8	10	2
4)	50	27	7	13	3

Materials	Proportion (%)	Weight (kg)	Rate (Rs./kg)	Amount (Rs.)
Fly ash	50	250	1	250
Sand	33	165	0.7	115.5
Cement	9	45	6	270
Aluminium foil	7	35	2	70
Glass Powder	1	5	5	25
Total Cost				730.5



2. COMPRESSIVE STRENGTH

The compression testing machine is used for testing the compressive strength of bricks. After the curing period of7days and 21days gets over bricks are kept for testing. To test the specimens the bricks are placed in the calibratedCompression testing machine of capacity 2000 kN applied a load uniform at the rate of 2.0 kN/min. The load at failureis the maximum load at which specimen fails to produce any further increase in the indicator reading on the testingmachine.

No.	Material proportion (in %)					Compressive strength (Mpa)
	Fly ash	Sand	Cement	Aluminium foil	Glass powder	
1)	50	40	10	-	-	7.5
2)	50	33	9	7	1	5.5
3)	50	30	8	10	2	5.6
4)	50	27	7	13	3	5.4

ENVIRONMENTAL IMPACT

- Aluminium foil is actually far worse for the environment than plastic wrap across the board, use of fossil fuels,water pollution, human health impacts, and greenhouse gas emissions. Mining bauxite (the raw material inaluminium) and processing it takes a lot of energy. To produce one ton of plastic wrap uses 83% less energyand 88% less greenhouse gas emissions than the same amount of aluminium foil. It is a material which takesaround 400 years to breakdown and also makes the soil infertile during landfill. Recycling centers do notaccept foil and trays due to the fact that they often contain food waste which can contaminate collection. So itis necessary to handle this aluminium foil waste properly.
- The waste glass is one of the issues of environmental problem. The usage of glass has increased considerably, which has in essence, contributed to the increase of waste disposal. In addition, glass waste is considered asnon-decaying material that pollutes the surrounding environment. Manufactures collect only a limited amountfrom the waste glass that can be used toward the production of new glass and exclude waste glass that mixedwith colour. Such mixed coloured glass wastes are discarded can ends up causing pollution.
- Such rejected aluminium foil and mixed coloured glass waste can be used in fly ash brick and we can avoidsuch wastes from polluting the environment.

V. CONCLUSION

From the above research it can be concluded that

1) This brick can be used as an alternative to clay bricks where it proves to be cost effective and provide better strength as compared to clay bricks.
2) Aluminium foil is lighter in weight this helps in reducing weight of brick and the glass powder helps in increasingthe strength of brick.
3) Cost of brick using aluminium foil and glass powder material is slightly higher than normal fly ash brick but as thisbrick will be lighter in weight, more bricks can be transported during transportation as compared to other bricks atsimilar transportation cost.
4) As aluminium foil does not absorb water and glass powder absorbs less water, the water absorption of brick will beless.
5) Using aluminium foil waste and glass powder waste as brick material is a solution to the problem of waste disposaland land pollution.

VI.REFERENCES

[1]. N. R. Ekere, J. N. Ihedioha, Agwogie Aiyehirue Bright. Synthesis of potashalum from waste Aluminium foil and Aluminium scrap. Int. journal of chemical science. Jan. 2017.vol.12(4). ISSN 0972-768X. pg.no.1145-115

[2]. Pankaj Phatangade, Ankita Takawade, Bhagyashri Chaudhari, Ankita Bhagat.Economical method of manufacturing brick by using plastic and aluminium foil waste, OAIJSE, Volume 5/Issue 9/Sep 2020, ISSN: 2456-3293, pg no. 56-59

[3]. Omoniyi, T.E. Akinyemi B.A, Fowowe A.O, Effects of Waste Glass Powder as Pozzolanic Material in Saw Dust Cement Brick, Scholars Journal of Engineering and Technology (SJET) ISSN 2321-435X,2014; 2(4A), pg.no.517-522

[4]. Rakesh Kumara, A. D. Kulkarnib, S. J. Attarc, K. S. Kulkarni. Utilization of Fly Ash for Bricks Manufacturing. International Journal of Advanced Engineering Technology E-ISSN 0976-3945IJAET/Vol.II/ Issue III/July September,2011. pg. no.359-362

[5]. N.Sudharsan , T.Palanisamy Feasibility of using waste glass powder in fly ash bricks, International Journal of Advanced Engineering Technology, Vol.VII/Issue II/April-June,2016, E-ISSN 0976-3945, pg.no.684-688

[6]. Kathiravan, Ms. Nirmala, Dr. Dhanalakshmi. Performance of Fly Ash Bricks using Waste Materials. International Research Journal of Engineering and Technology (IRJET). Volume: 05 Issue: 02 Feb-2018 - ISSN: 2395-0056pg.no.1693-1696.

[7]. B. Venkatesan, N. Sakthieswaran Experimental Studies on Waste Glass Powdering Manufacturing of Fly Ash Bricks, International journal of innovative research& development, April, 2015 Vol 4 Issue 4, ISSN 2278 – 0211, pg.no.332- 337

[8]. Rihan Maaze, Vinod Kumar, Sandeep Kumar Mishra. Influence of Marble and Aluminium Waste Powder on the Performance of Bricks. IJEDR. January 2016vol.4(2). ISSN 2321-9939. pg.no. 907-912

[9]. Irshad Ali, Behavior of Concrete by using Waste Glass Powder and Fly Ash asa Partial Replacement of Cement. International Journal of Engineering Research& Technology (IJERT) ISSN: 2278-0181,Vol. 4 Issue 05, May-2015,pg.no.1238-1243.

[10]. D.Sabitha, P.Muthanand, An Experimental Investigation of Fly Ash Brick with Addition of Waste Glass Powder and Copper Slag. International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Issue 4,April 2016,ISSN: 2319-8753,pg no.4922-4929

[11]. Prof. Niklesh r.Murekar, Prof. Roshan Satpute.Using Waste Material for Making Light Weight Bricks. International Conference on Recent Trends in Engineering Science and Technology. Jan.2017. Volume 5(1). ISSN: 2321-8169 pg.no. 467 – 470.

[12]. P.P.Gadling,Dr. M.B. Varma.Comparative Study on Fly Ash Bricks and Normal Clay Bricks. IJSRD - International Journal for Scientific Research & Development. Jan 2016 vol.4(9).ISSN 2321-0613. pg.no.673-676.

[13]. Yogesh Dudhagamwar, Saurabh Umbarkar, Hitesh Andraskar, Raj BedmuthaUse of Plastic Bottle as Bricks. International Advanced Research Journal in Science, Engineering and Technology ISSN 2393-8021. Vol. 4, Special Issue3, January 2017 pg.no. 90-91

[14]. Nutan C. Patel, Prof. Jayesh Kumar Pitroda Fly Ash Brick: Glass Fibre the innovative concept for getting higher strength brick. International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 3, March 2013.

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Study of Road Projects Using ERP Hit-Office – Literature Review

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ABSTRACT

India is very fast developing country in compare to construction industry. In India Construction Industry have various type of working areas and different projects, all this projects have different activity, completion time and cost, in this project we try to compare Road Infrastructure Projects with each other in simulation network using ERP software HIT-office and make some conclusions to make an organization more productive and more profitable which depends on selection of different or same project through which we can make organization Specialized or Technically strong in same project. In this project comparison of Road Construction Project with each other will take place and from that we will determine the Activity profit ratio with respect to time, determine the cost required during project completion with the help of Simulation network, the simulation network will again compare the relative projects each other depends upon practical input and give the Desired results, this results can help to organization to determine the project profit ratio with each other, decision making to commencement of project.

Keyword: ERP, Activity, Duration of projects, Cash flow, Profit and loss, Quality, Economical work.

I. INTRODUCTION

This research paper studies the literature review of Implementation of Enterprise Resource Planning system in construction industry and the Project management. India is very fast developing country in compare to construction industry. In India construction industries have various type of project. Example – A) Infrastructures- Road, Bridge, Building, Compound Wall, B) Irrigation Projects- Pipe line, Dam, Elevated Storage Reservoirs C) Earth Work – Earth Excavation and Transportation, Canal Lining and widening, cement concrete Bandara. This various types of project have different Factor for Completion with time and cost.

To complete this project required well planning with respect to Activity, cost, time, quality of work and also organization profit. This factors depends on some Practical Measures and Construction management Study which will try to increase the organization Productivity and performance, it means keeping cat‘s eye on the technical performance, schedule of working within budgetary cost for maintaining the profit ratio. To do this entire best object is Enterprise Resource Planning system ERP.

In this research paper we study about Enterprise Resource Planning system ERP. The different factors affecting the project success. In order to achieve the effective execution of Infrastructure projects, this research relates

with projects success dimensions as shown in Figure 1 as functional success, management success, investment and ownership success, organizational success, business success and strategic success.

II. PROBLEM STATEMENT

In Construction industry we have two types of road projects. Rigid pavement and Flexible pavement they have different or same activity to competition, for this different activity we required, different material, machinery, Labors, cost and time of completion.

Organizations have various opportunities to take different project but depends upon the time of completion, and cash flow it affects the productivity so for specialization and Profitability of company we compare different road project with each other. Organization also improves the performance by selecting same types of project if it is beneficial to organization or not this will find in this study also cash flow requirement for all this activity and allocation of cash flow requirement also define. Depends upon the comparison we try to improve the organization performance, profitability and management strategies to specialization in same activity or project.

III. OBJECTIVE

- To review ERP HIT-OFFICE, various features of HIT-office, execution of projects using HIT- office.
- To seek out out the varied infrastructure projects Activity, duration of completion and price .
- To research the various infrastructure project Constraints with reference to income at the time of labor .
- To guess the productivity of varied Infrastructure projects with reference to organization profitability.
- To guess methodology for increasing the profitability of organization with reference to road constructions.
- To guess actual Cost working of Project by live working in single project.
- To match exact Cost required for with ANN Technique.

IV. LITERATURE REVIEW

"RESEARCH ANALYSIS FOR SUCCESSFUL FUNCTIONING OF ERP SYSTEM IN CONSTRUCTION INDUSTRY"

This research is administered over two construction firms to spot the main and supporting factors which are required for successful function of ERP system in housing industry . With the help of SPSS tool the responses of the workers from these two firms were measured. the result of SPSS tools facilitated to spot major & supporting factors in successful functioning of ERP system in Project oriented Construction firms.

ERP could also be a computer based system that attempts to unify all systems of departments together into one integrated software program based and uses one database so as that departments can more easily share information and communicates with each other. The method of ERP systems includes data registration, evaluation, and reporting.

This paper tried to identify the most and supporting factors that affect successful functioning of ERP in construction firm. supported the responses received from Kolte Patil and Kalpataru Builders through a structured questionnaire and analyzed using independent sample t-test research technique, it's been concluded that factors or variables like output, image, result demonstrability, internal support, consultant support, system reliability, perceived usefulness and perceived simple use are often considered for successful functioning of ERP system.

"PERFORMANCE EVALUATION OF CONSTRUCTION ENTERPRISE RESOURCE PLANNING SYSTEMS"

This research has studied the impacts of the ERP using both theoretical and practical ways. The study targeting the results of C-ERP within the project environment. With the help of system dynamics principles, this study identified the main variables that influence the successful evaluation of C-ERP within the housing industry . Qualitative system dynamics modeling was utilized to review the effect that a variable has on each other . First, a scientific view of the C-ERP life cycle was designed. Next, this basic model was expanded to incorporate the success factors during the implementation phase. Finally, the use phase was expanded to include the results of C-ERP within the project environment. the main variables identified were validated with data from a survey. The validation quantified associations between variables and perceived benefits from ERP stakeholders of construction firms.

"ANALYZING ENTERPRISE RESOURCE PLANNING SYSTEM IMPLEMENTATION SUCCESS FACTORS IN THE ENGINEERING– CONSTRUCTION INDUSTRY"

This study identifies and analyzes critical factors that need to be considered to form sure successful ERP system implementation within the construction industry . Enterprise resource planning offer various benefits to the construction industry. Many construction firms recognize the benefits of ERP system implementation; however, they still hesitate to adopt these systems because of high cost, uncertainties, and risks. First, this paper identifies the factors associated with the success and failure of ERP systems, and provides indicators to guage the success of such systems. Then, the paper develops an information system success model to research the relationships between factors and success indicators. Finally, the paper provides recommendations for successful ERP systems supported the analysis. The derived success factors should help senior managers in construction firms make better decisions and improve their business value by implementing the foremost effective EPR systems.

"DEVELOPING ERP SYSTEMS SUCCESS MODEL FOR THE CONSTRUCTION INDUSTRY"

The main purpose of this research was to point out the event process of the ERP success model and identify the factors and indicators related to the ERP success. To guide a successful ERP implementation project and to spot success factors for ERP systems implementation. The paper identifies factors related to the success and failure of ERP systems, and develops a hit model to research the relationships between key factors and therefore the success of such systems. The proposed ERP systems success model adapts the technology acceptance model and De Lone and McLean's information systems success model and integrates those with key project management principles. The goal of the ERP systems success model is to raised evaluate, plan, and implement ERP projects and help senior managers make better decisions when considering ERP systems in their organization. However,

these integrated systems within the construction sector present a group of unique challenges, different from those within the manufacturing or other service sectors. There are many cases of failure in implementing ERP systems within the past, so it's critical to spot and understand the factors that largely determine the success or failure of ERP implementation within the housing industry

"IMPLEMENTING ENTERPRISE RESOURCE PLANNING SYSTEM IN A LARGE CONSTRUCTION COMPANY"

The main objectives of this study is to define the major challenges facing construction firms during the implementation process, and identify the critical success factors and quantify their impact on ERP implementation in construction. The first objective will be achieved through a literature review study that includes previous research in the construction area. The second objective are going to be achieved employing a questionnaire survey designed to gather data from ERP users. The collected data will be analyzed to investigate the perceptions of ERP users in terms of implementation success of such systems. The findings of this research are expected to provide leaders in construction firms with guidance to implement ERP systems effectively and efficiently.

This paper aimed at finding the most CSFs impacting the implementation process from the point of view of ERP users working in a large construction company which is already started the implementation process. Total 26 factors identified from the literature and a survey which was conducted among ERP users. The data were collected from 25 users who experienced the method of ERP implementation. The statistical results show that top management involvement and awareness, training and support for users, and implementation team composition are the foremost significant factors of ERP implantation success. The findings are of this report agreed with the findings of previous studies. These critical factors can enhance implementation performance. However, the ERP implementation process is an IT process in its core, most of the critical success factors point that the human factors are the foremost critical.

"STRATEGIC COST MANAGEMENT FOR CONSTRUCTION PROJECT SUCCESS"

The objective of the research is to explicitly declare the scope of the research to by considering only the scope, time, cost and quality as process success parameters and the way specifically the value element would influence the project success when all other elements or factors aside from cost are represented in terms of cost factor along side the contract conditions as basic rules or constraints that drive the strategic cost supported applying the CRASP methodology concept. The big constructions are inherently complex and dynamic. Many projects start with better ideas, big investments and best efforts. However, most of them don't achieve much success. A major contribution to unsuccessful projects is that the lack of understanding on scope, time, cost and quality.

"CRITICAL SUCCESS FACTORS: EN ROUTE FOR SUCCESS OF CONSTRUCTION PROJECTS"

The study of critical success factors may be a means of improving effectiveness and efficiency of projects. Critical success factors are identified in various contexts but there's no general agreement. Most of those studies are too generic and pose an issue of applicability on a selected industry like construction. Therefore, the aim of this paper is to spot critical success factors through a critical literature review with special attention on project

execution stage of construction projects and to identify research gaps to be filled within the future. 40 external factors and 34internal factors were identified. 19 internal factors and 10 external factors are repeated in more than 3 research papers. More researches are needed on the connection between critical human resource management factors and project success.

"ESTIMATION OF COSTS AND DURATIONS OF CONSTRUCTION OF URBAN ROADS USING Artificial Neural Networks ANN AND SVM"

The paper presents a search of precision which will be achieved while using AI for estimation of cost and duration in construction projects. Both artificial neural networks (ANNs) and support vector machines (SVM) are analyzed and compared. Estimation of costs and time period of construction is achieved by using of models for separate estimation of costs and time. The reason for this lies primarily within the different influence of input parameters on the estimation of costs as compared with the estimation of duration of the project. By integrating them into one model a compromise in terms of the importance of input file is formed, leading to the lower precision of estimation when it comes to ANN models.

"ANALYSIS OF COST OVERRUN IN ROAD CONSTRUCTION ACTIVITIES"

This is the review study of cost overrun in road construction. Cost overrun is the common factor in road construction in India. And during these research the most critical factor were found out which was mostly affect the Indian road projects. A questionnaire survey was done within various private and government organizations. From this research it was observed that many organization mainly focused to complete the project within the budget amount to control the cost overrun. The most predominant factors from the study are based on respondents perspective which includes the issues in land acquisition, cost escalation of workers' wages and material, financing and payments for completed works, design changes during construction phase, delays in shifting existing utilities, increase in quantities of materials due to actual site conditions, non-availability of material required for construction, design errors, unstable interest rates.

"PROJECT MANAGEMENT: COST, TIME AND QUALITY"

This paper presents the elements of the Iron triangle and their mutual connection. Quality is what project contractor desire and not what a project manager want. One of the biggest problem of the project managers is to harmonize project cost, time and quality. It is difficult to achieve this because cost, time and quality are related in the way that changes of one influence on the other two. Project managers try to balance the cost, time and quality when commencing project objectives, but they may trade-offs among the cost, time and quality during project implementation in order to meet objectives and satisfy customers. There are many examples in practice that projects were delivered on time and within budget but failed to meet the expectations of end users.

V. CONCLUSION

The construction industries struggled a lot with inefficient processes. In order to meet the challenge for building a good construction industry we must become more efficient by using fewer resources like ERP systems, simulation Networks, actual Rates calculation, Small changes in the operational cost, completing the work in time, all the activities running smoothly without any issues , also increase the efficiency which will defiantly make changes in profit. By using ERP system, we can increase the specialization of organization and increase the productivity of organization. Which directly effect on actual profit and loss sheet of organization. Increasing the profit of organization using ERP system and Initial proper knowledge and information should be provided among the management team and other people in organization to gain maximum profit in minimum productive time.

VI.REFERENCES

[1]. Parvathy Mohandas, "RESEARCH ANALYSIS FOR SUCCESSFUL FUNCTIONING OF ERP SYSTEM IN CONSTRUCTION INDUSTRY"(International Journal of Engineering Research and Technology),Nov-2013,Vol. 2 issue 11.

[2]. Omer Tatari,"Performance Evaluation of Construction Enterprise Resource Planning Systems"(Journal of management in engineering),Oct-2008.

[3]. Boo Young Chung,"Analyzing Enterprise Resource Planning System Implementation Success Factors in the Engineering–Construction Industry"(Journal of computing in civil Engineering),Dec-2008.

[4]. Miroslaw, "Developing ERP Systems Success Model for the Construction Industry"(Journal of construction engineering and management),March- 2009.

[5]. Abdulaziz Aldhoiene,"Implementing Enterprise Resource Planning ERP System in a Large Construction Company"(International conference on enterprise information system),2019.

[6]. T.G.K.Vasista, "STRATEGIC COST MANAGEMENT FOR CONSTRUCTION PROJECT SUCCESS", (Civil Engineering and Urban Planning: An International Journal),March 2019, Vol.-4, No. 01

[7]. Prof.Susil Kumara Silva 1, Prof. Warnakulasuriya B N F 2, Dr. Arachchige B J H 3, "CRITICAL SUCCESS FACTORS: EN ROUTE FOR SUCCESS OF CONSTRUCTION PROJECTS", (International Journal of Business and Social Science), March 2016, Vol.-07

[8]. Igor Pesko 1, Vladimir MuIenski 2, Milos Seslija, "ESTIMATION OF COSTS AND DURATIONS OF CONSTRUCTION OF URBAN ROADS USING ANN AND SVM", 3 December 2017

[9]. Rajakumar A C,"Analysis of Cost Overrun in Road Construction Activities"(International research journal of engineering and technology),Apr- 2016,Vol. 3, Issue 04.

[10]. Bojan Stojcetovic 1, Dragan Lazarevic 2,"PROJECT MANAGEMENT: COST, TIME AND QUALITY", (International Quality Conference), May 2014.

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Solar Powered Metallic and Dust Scrap Collecting Vehicle

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ABSTRACT

This project focuses on a conceptual design of a conveyor system that can be used to differentiate between metallic and non-metallic materials, as well as to perform transferring on the mentioned materials. Also, the metallic waste will get collected using magnets & dust will get collected using vacuum system. The project should be started by means of research on metallic waste sorting machines in the market like magnetic conveyor systems. A conveyor system is mechanical handling equipment that moves materials from one location to another and magnetic pulley has been used to separate metal and non-metal waste. Standard design process flow is to be followed e.g., conceptual design and detailed design to be produced prior to i.e., fabrication. Analysis equipment nt has been done by doing calculations such as calculation of gear and motor torque prior to fabrication. The complete system gets operated using battery, whereas battery gets charged using Solar panel. The expected result of the fully automated conveyor system fat can be used for metallic waste management application is described in detail in this paper.

Keywords: Solar Ferrous, Non- Ferrous, Conveyor, Battery.

I. INTRODUCTION

A conveyor system is a common place of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available, and are used according to the various needs of different industries. Belt conveyors are the mo.st commonly used powered conveyors because they are the mo.st versatile and the least expensive. A conveyor belt consists of two or more pulleys, with a continuous loop of material, the conveyor belt that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward.

Many different types and grades of metals at present fall in the category where recovery is extremely economical with high levels of metals being recovered. Recycling basically occurs on three recognized levels. First is manufacturing in which this operation is normally well organized and often occurs in-house, incorporated into the production of primary metal in many cases. Second is industrial or post-sales scrap and

residues and third is household scrap collected by a local scrap merchant or local authority via a local municipal solid waste (MSW) refuse collection system (Emery et al., 2002). To have a truly successful recycling operation, the backing and participation of the general public, industry and the government is required. The scrap metal industry gathers waste scrap metals to ultimately produce a valuable raw material end product for use by the metal manufacturing industries. If the scrap metal industry did not exist then there would be vast quantities of waste polluting our environment as well as an increased burden on primary resources (Emery et al., 2002).

II. MATERIALS

Scrap metals, in general, are divided into two basic categories:
1. FERROUS 2. NON-FERROUS.
FERROUS scrap is metal that contains iron, NON-FERROUS metals are metals that do not contain iron. Common Sources of Recycled Metals Ferrous scrap comes from sources such as:

- Used construction beams, plates, pl CS, tubs wiring, and shot,
- Old automobiles and other automotive scraps.
- Boat scrap, railroad scrap, and railcar scrap,
- Miscellaneous scrap metal

2.1. Types of scrap metals:

The metal industry is divided into ferrous and non-ferrous metals (Turkish Metal Industry Report, 2010), The scrap metal industry is also classified along these two kinds of metals.

Ferrous scraps

Ferrous scrap metals containing iron. Iron and steel scrap play an important role in the processing and final production of new ferrous products. Recycling of ferrous scraps prevents the environmental burden of large accumulations of scrap building up in land fill sites and other disposal areas. Recycling is also energy efficient. It is estimated that every ton of steel that is recycled saves approximately 1,000,000 kg of iron ore, 600 kg of coal and 54 kg of limestone (Emery ef. ,2000). This results in reduced mining activities for the raw materials, again reducing the environmental burdens. Other environmental benefits occur in the form of 86% less air pollution, 7% less water pollution, 40% reduction in water used, and a 1.28 tons reduction in the generation of solid wastes (Emery ct ,2000). Sources of ferrous scraps for recycling can be broadly classified into three (Fenton, 1998; Javaid and Essadiqi, 2003).

1. Internal Arising Scrap — This includes reject metal from casting, rolling mill and other manufacturing processes. With more efficient steel production, these scrap quantities have fallen over recent years.
2. Prompt Industrial Scrap is produced from normal machining, stamping and other fabrication operations, normally of a fairly high quality. In a large number of cases, manufacturers sell directly to steel makers.
3. Obsolete or Capital Scrap — when a product has served its useful life and is then discarded. Large scale examples are decommissioned power stations, shipping Jeets down to small-scale examples such as cars and domestic appliances.

Non-ferrous scraps

Non-ferrous scrap comprises metals that do not contain iron. New changes in modern technology have reduced quite substantially the amounts of non- ferrous scrap generated as products are being made from thinner gauge metal and also with the increased use of other materials such as plastics for products including drink cans and plumbing. The most common nonferrous metals that are recycled and are traditionally found and segregated in domestic waste in sufficiently large quantities are aluminum, copper, lead and brass. Aluminum is the most abundant metal (by volume) found in domestic waste, consisting mainly of drink cans (Emery et a1., 2000).

Sources of non-ferrous scraps can also be grouped into three, similar to that of ferrous metals. Source of aluminum scraps include vehicle and transportation, construction and building sites, aluminum packaging waste, cable wire and electronic equipment from homes (Emery et al., 2000; Mochon and Eder, 2010).

PROPOSED WORK METHODOLOGY :

Methodology of working process

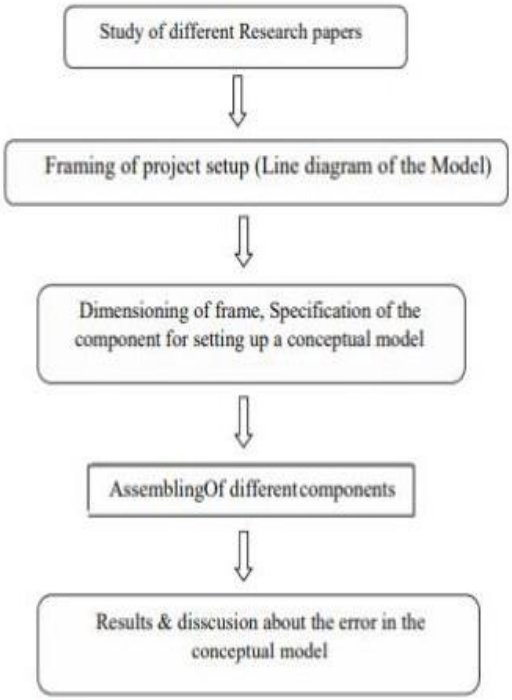

Fig. S Flow Chart For Working Process

III. SYSTEM DESIGN & COMPONENT

ln our attempt to design as a special purpose machine we have adopted a very careful approach, the total design work has been divided into two parts mainly:

A. System Design

Mechanical Design System design mainly concerns with the various physical constraints and space requirements, arrangement of various components on the main frame of machine no of controls position of

these controls ease of maintenances cope of further improvement; weight of m/c from ground etc. In Mechanical design the component in two categories:

B. Design parts

Parts to be purchased Major Components in the Proposed Machine The proposed machine consists of the following components Hopper It is an arrangement to store the seeds. The shape of the hopper ls rectangular box so the wastage of the seed can be avoided. It is made up of galvanized iron 20G sheet it reduces the weight of the hopper. Sliding Plate, the base of the hopper consists of a sliding plate with holes spacing in equal distance. The sliding plate reciprocates to and from above the base of the hopper. It is made up of mild steel plate.

SYSTEM CAD DESIGN :

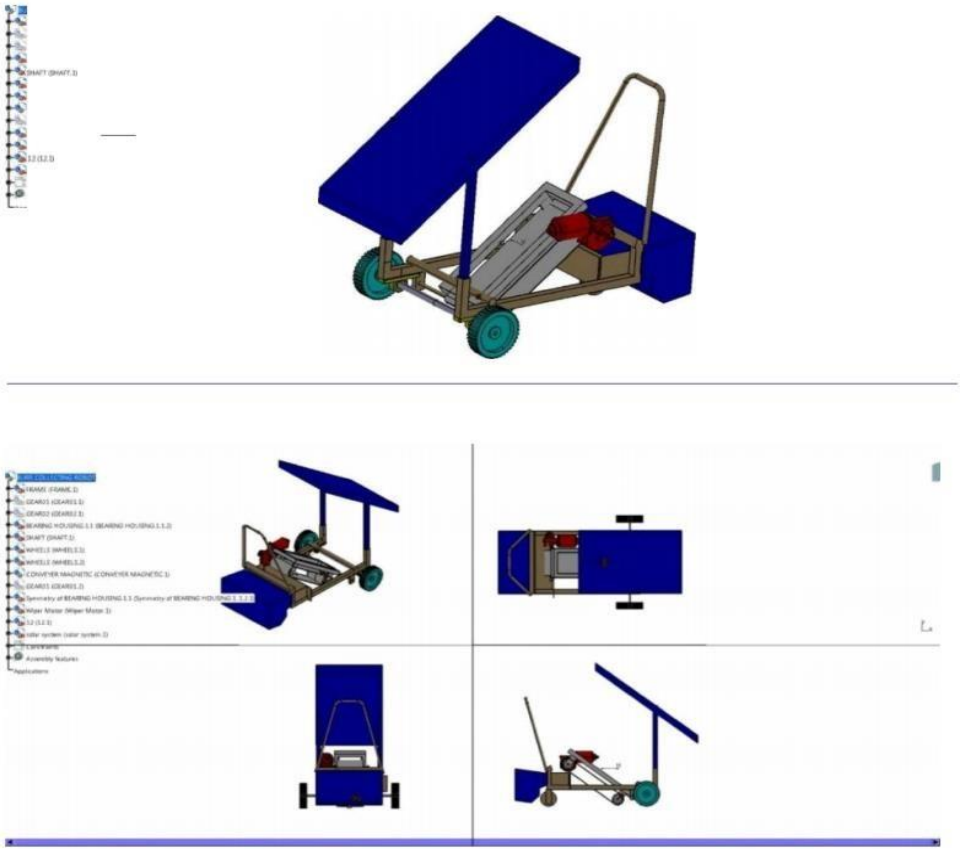

Fig. Component Assembled System 3D-CAD Design

Experimental Working:

When the vehicle will move on the shop floor it will collect the ferrous particles using the fusing magnetic conveyor system. The trolley wheels will drive to the conveyor roller. Once the roller starts rotating it will collect the ferrous particle and transport it towards the collecting chamber. At the end vacuum nozzles are fitted which will collect the dust particles in storage area. The complete setup is portable & maintenance free.

- Automatically collect the scrap and store in trays.

- Portable system which can be used for any machine or can drive on the shop floor.
- Also dust gets collected using vacuum system.
- System should be driven by battery which is charged using solar panel.
- The complete setup is portable & maintenance free

IV. CONCLUSION

Magnetic slide conveyors feature: in oil-filled chain guide which requires no lubrication, a watertight submersible frame, powerful magnet assemblies enclosed in stainless steel and a stainless-steel bed. The conveyors have external moving parts (except the drive), are easily installed and are virtually maintenance free.

- A stable, encased supporting structure
- Low-maintenance roller chains
- High-performance magnetic systems
- An anti-magnetic stainless steel slide surface
- A reversing unit with automatic chain tensioning
- A drive anvil with drive motor Magnetic slide conveyors are manufactured to low maintenance standards in a number of widths and heights.

V. REFERENCES

[1]. H.M.T. Production Technology – Handbook", 2000 Tata McGraw Hill.
[2]. Saab, S.S. and R.A. Kaed-Bey, 2001 Parameter Identification of a DC Motor: An Experimental Approach. IEEE International Conf. on Elec. Circuit and Systems (ICECS), 4: 981-984.
[3]. R.K. Jain "Production Technology" Khanna Publication,17th edition, 2004.
[4]. Lankarany, M. and A. Rezazade 2007 Parameter Estimation Optimization Based on Genetic Algorithm Applied to DC Motor. IEEE International Conf. on Electrical Engineering (ICEE), pp: 1-6
[5]. V. B. Bhandari," Design Of Machine Elements"1st Edition, Tata McGraw Hill Education, 2007
[6]. Magnetic Scrap handlin_004.pdf - Google Drive
[7]. Scrap handlin_001.pdf - Google Drive
[8]. 068_Scrap handlin_003.pdf - Google Drive

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Detection of Diabetic Retinopathy Severity

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ABSTRACT

Diabetic retinopathy is an eye condition that can cause vision loss and blindness in people who are suffering from 'Type-II Diabetes. It's caused by damage to the blood vessels of the light-sensitive tissue in the Retina (at the back of the eye). Unfortunately, it is not a reversible process and can cause complete blindness if not treated early. Therefore, early medical diagnosis is essential to prevent the severe side effects of Diabetic Retinopathy. Manual detection of diabetic Retinopathy can consume time, effort, and cost and is even prone to misdiagnosis. An automated computer-aided diagnostic system can quickly detect the problem and suggest a follow-up treatment. This system detects the severity of the disease which can go undetected through a manual medical diagnosis and gives accurate results to ensure that the patient is diagnosed as soon as possible to begin his precautionary methods.

Keywords: Deep Learning, Machine Learning, CNN, Random forest, diabetic retinopathy, eye diseases.

I. INTRODUCTION

DIABETIC RETINOPATHY

Nearly 171 million individuals worldwide have been diagnosed with diabetes in 2000, and it is further expected that this number rises to 366 million by the year 2030. It is caused due to low or increased glucose levels in the body resulting in anomalous metabolic functions and complications like cardiovascular diseases, kidney failures, neural disorders, diabetic retinopathy (loss of vision), etc.

Diabetic Retinopathy is another major cause of prolonged diabetes affecting the retina of the human body which is irreversible. Diabetes makes it harder for the patient to control their blood pressure and cholesterol. At earlier stages, patients are often asymptotic. Hence, it is critical to detect the disease at earlier stages and provide an accurate diagnosis and staging to possibly reduce the disease complications and the risk of vision loss. The disease can also lead to heart attack, stroke, and other problems as well. But the early detection and treatment of DR can reduce blindness significantly i.e., retinal abnormalities such as hemorrhages, cotton wool spots, microaneurysms (MA), retinal neovascularization, and exudates.

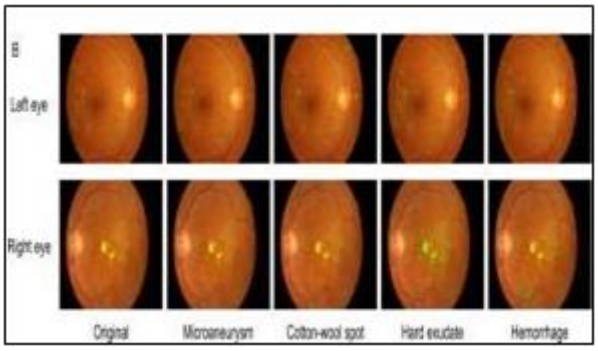

Figure 1: Types of retinal abnormalities Diabetic Retinopathy is caused due

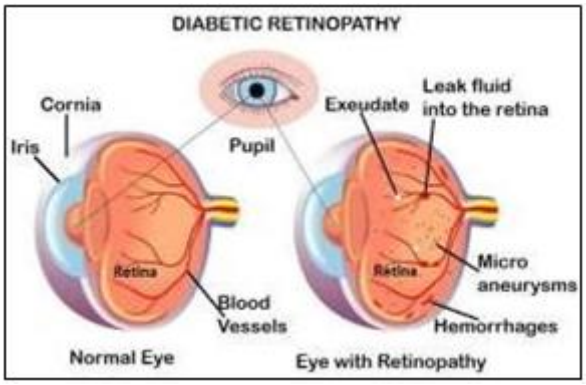

Figure 2: Comparison between normal eye and eye with DR

to excess glucose molecules in the blood which later combine in the vessels and disrupt circulation, this is known as Ischemia. Their blood vessel deterioration produces microaneurysms, which is a saccular enlargement of the venous end of a retinal capillary by the short supply of blood circulation. This causes the blood vessels to lose their permeability properties resulting in leaks such as hemorrhages or lipid sweating.

Due to this Ischemia, two major problems occur in the retina, where firstly the production of cytokine protein is done which causes the generation of new blood vessels from existing ones known as Neovessels. This can cause low blood circulation in the body and these new blood vessels only grow further until they tend to burst, producing bleeding in the vitreous cavity or may even pull the retina apart. This contributes to the blindness of the patient suffering from diabetes. Secondly, the problem is the leakage of plasma which is caused due to fat accumulation which further alters the macula and leads to vision loss. The major symptoms of diabetic retinopathy which can help in diagnosing the disease are:

1. Black Spots
2. Blurred Vision
3. Poor glucose control
4. Raising fat level in the blood
5. Difficulty in reading
6. Sudden loss of vision

Diabetic Retinopathy can be classified from an early stage to a more severe stage examined through retinal images. DR is developed when a patient has had diabetes for at least 10 years without a diagnosis and is unaware of it. In this regard, DR can be prevented if it is detected early enough by health check-ups and systematic treatment of diabetes. The severity is classified into two major categories Non-Proliferative Diabetic Retinopathy (NPDR) and Proliferative Diabetic Retinopathy (PDR). Moreover, NPDR presents three subcategories slight, medium, and severe. The damage of this first category is limited and does not go beyond the retina's inner limiting membrane. DR is proliferative when there is ischemia damage resulting in blood vessels growing beyond the retina. PDR contains early, high-risk, and advanced sub-levels.

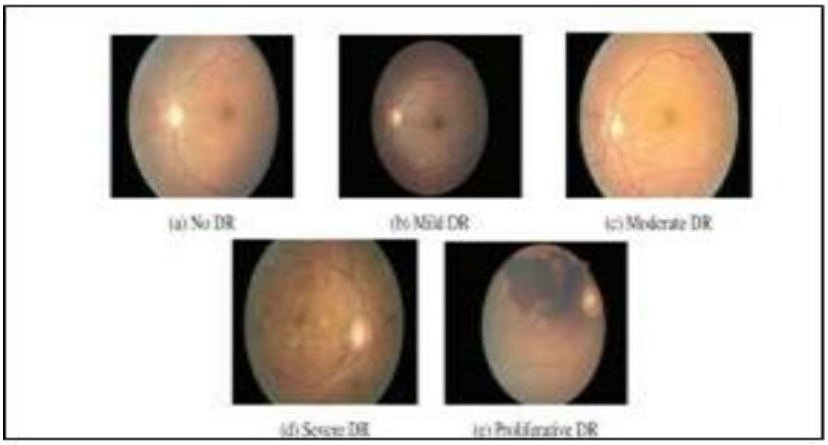

Figure 3: Diabetic retinopathy stages

For this work, PDR is used as a single class containing the early, high-risk, and advanced subtypes to display the severity of the disease.

No DR: patient without retinal alterations due to diabetes.

Mild DR: in this case, microaneurysms, exudates, cotton-wool spots, and retinal hemorrhages are considered.

Moderate DR: the fundus oculi present hemorrhages, severe microaneurysms, or venous rosaries in some retina quadrants.

Severe DR: two of three criteria from the medium DR exist in the fundus oculi.

Proliferative DR: proliferative retinal neovessels appear in the retina's image.

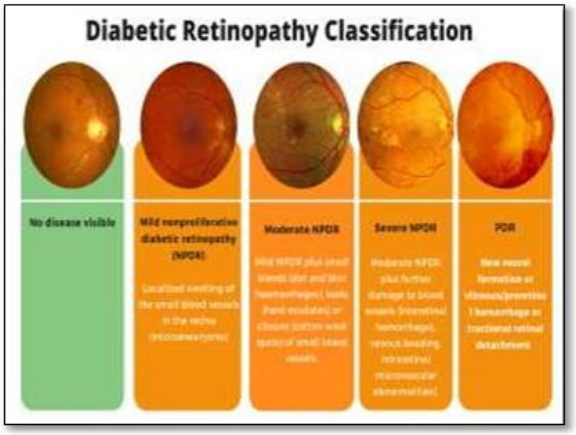

Figure 4: Diabetic retinopathy classification

Deep Learning

Deep learning (DL) is a branch of machine learning techniques that can involve hierarchical layers of non-linear processing stages for unsupervised feature learning as well as for classifying patterns. Deep learning is the most popular approach among researchers which can be used for detection, prediction, forecasting, and classification task in various fields for a long time, particularly in the medical field of diabetic retinopathy it is revealing many possibilities for the prevention of such a dreadful disease. It has the characteristic of successfully learning the features of input data even when many heterogeneous sources are integrated. There are various DL-based methods such as restricted Boltzmann Machines, convolutional neural networks (CNNs), auto-encoder, and sparse coding. The performance of these methods can increase when the number of training data increases in the learned features, unlike various machine learning methods. Also, DL methods do not require hand-crafted feature extraction.

Convolutional Neural Networks (CNN)

Convolutional Neural Networks (CNNs) are a branch of deep learning which has an impressive record for applications in image analysis and interpretation, including medical imaging. Network architectures designed to work with image data were routinely built already in the 1970s with useful applications and surpassed other approaches to challenging tasks like handwritten character recognition. However, it wasn't until several breakthroughs in neural networks such as the implementation of dropout rectified linear units and the accompanying increase in computing power through graphical processor units (GPUs) that they became viable for more complex image recognition problems. Presently, large CNNs are used to successfully tackle highly complex image recognition tasks with many object classes to an impressive standard. CNN's are used in many current state-of-the-art image classification tasks such as the annual ImageNet and COCO challenges.

Convolutional neural networks (CNNs) have been used for diagnosing diabetic retinopathy (DR) by analyzing fundus images and have proven their potential in detection and classification tasks. For diabetes, DR is a major complication that can eventually result in vision loss as well as lead to blindness. It is caused due to damage occurring to the retina blood vessels as increased levels of blood sugar further block minute blood vessels that are responsible for supplying blood to the retina. Diabetic Retinopathy can further be classified into five stages, which are mild non-proliferative DR (NPDR), moderate NPDR, severe NPDR, proliferative DR (PDR), and macular edema (ME). Mild NPDR is the disease's earliest stage that may advance to proliferative diabetic retinopathy where vision loss occurs and the eye is filled with interstitial fluids Two major issues exist within automated grading and particularly in CNN. One is by achieving a desirable offset in sensitivity (patients being correctly identified as having DR), and specificity (patients being correctly identified as not having DR). This is significantly harder for a national criterion which is a five-class problem in normal, mild DR, moderate DR, severe DR, and proliferative DR classes. Furthermore, overfitting can be a major issue in neural networks. Skewed datasets can cause the network to over-fit to the class which is most prominent in the dataset. Previously proposed system by Nayak where his developed CNN model which identifies non-DR, NPDR, and PDR. Morphological processing techniques and texture analysis methods were applied to fundus images of 140 subjects to detect features such as hard exudates and blood vessels. A classification accuracy of 93%, a sensitivity of 90%, and a specificity of 100% were achieved. Pratt has proposed CNN and data augmentation

that can potentially identify features such as hemorrhages, micro- aneurysms, and exudates on the retina, and further can differentiate between these five stages of the disease. The network has been trained on a Kaggle dataset of 80,000 fundus images which use a graphical processing unit (GPU). The proposed CNN has achieved an accuracy, sensitivity, and specificity of 75%, 30%, and 95%, respectively. Furthermore, Shaban has introduced a CNN which has been trained on 101 fundus images that can accurately identify these particular four stages of the disease (i.e. non-DR, NPDR, severe NPDR, and PDR). A leave-one-out approach was used for this testing. The proposed method successfully has attained an accuracy of 80.2%, a sensitivity of 78.7%, and a specificity of 84.6%. Moreover, Dekhil has also introduced a fine-tuned VGG-16 trained on a public Kaggle dataset classifying subjects with an accuracy of 77% and a quadratic weighted kappa score of 78%.

II. LITERATURE SURVEY

Diagnosis of diabetic retinopathy using machine learning techniques. R. Priya and P. Aruna (2013). In this paper, an automated approach for the classification of the disease diabetic retinopathy using fundus images is presented. The DR has been classified into two categories NDR and PDR using PNN, Bayes theorem, and SVM. All three techniques used for the classification were good in performance.

In this study, we focus on several ML techniques for DR detection. It is found that the early detection of DR can reduce the risk of vision loss by up to %76 [24]. Also, this work presents a novel model to diagnose DR based on ML techniques. Among all of these techniques, it can be said that SVM is the best with a percentage of 97.3, Naive Bayes Classification % of 86.4, and PNN with a percentage of %78 K-Means Clustering %81 percent. It can be concluded from the study that the results are promising. . But SVM is more efficient than PNN and Bayes theory from the obtained results.

Detection of diabetic retinopathy using image processing. S.Sagar, B.Divya, K.Madhulika, D.Sandeep (2020). The principal objective of this paper was to explain the basic concepts and techniques for medical image processing and to promote interest in further study and research in medical imaging processing. The proposed method exhibits less computational time to automatically detect the important clinical features of retinal images such as blood vessels, hard exudates, and optic discs. The Diabetic Control and Complications trial clearly showed that very intensive glycemic control can reduce the incidence of DR by 76%. This work stated that the data in the given algorithm cannot be sufficient enough to improve the accuracy.

Diabetic retinopathy improved detection using deep learning. Angel Ayala, Tomás Ortiz Figueroa, Bruno Fernandes and Francisco Cruz. (2021). In this work, we implement a convolutional neural network model to process a fundus oculi image to recognize the eyeball structure and determine the presence of diabetic retinopathy. Presented a model to detect diabetic retinopathy at early stages as an auxiliary diagnostic tool. The Messidor and APTOS dataset helped to check the model's feature acquisition for different stages of DR directly from examination images. The progression of DR can be reduced by 56%.

Detection of diabetic retinopathy using deep learning methodology Gazala Mushtaq and Farheen Siddiqui (2021). We trained our proposed model using DenseNet-169 on a combination of datasets from Kaggle, a Global

health observatory data repository. Machine Learning classifiers like SVM, DT & KNN are composed with the proposed system, where the best accuracy among all was obtained and it also classifies the images into more classes. As there are many images taken under different conditions, the dataset needs to undergo a lot of pre-processing which results in some missing features.

Diabetic retinopathy improved detection using deep learning by Angela Ayala Brruno Fernandes (2021). We proposed a DL model to classify retina fundus images and detect the presence of DR in its different stages. The model was optimized using transfer learning from Dense Net121 to differentiate between a healthy eyeball and a proliferated one. The messy door and APTOS dataset helped to check the model's feature acquisition for different stages of DR. directly from examination images. The model achieved better validation and testing results trained over the APTOS dataset with an accuracy of 81% and 59% for each phase in predicting diabetic retinopathy presence in fundus oculi images. Many data competitions have no public test label making it difficult to compute the test metrics.

Early detection of diabetic retinopathy based on deep learning and ultra-widefield fundus images. Kangaroo Oh, Hae Min Kang, Dawson Leem, Hyngyu Lee, Sanchal Yoon. (2021). A Diabetic retinopathy detection system based on ultra-wide-field fundus photography and deep learning. In experiments, we show that the use of early treatment diabetic retinopathy study 7- standard field image extracted from ultra-wide- field fundus photography outperforms that of the optic disc and macula-centered image in a statistical sense. Conventional fundus camera captures the optic nerve and macula with a FOV between 20 degrees and 50 degrees with high-resolution UWF imaging up to 82% of the retinal surface can be captured in a single image. Our proposal was tested over two datasets using a cross-testing method checking the complexity to acquire features from each. The model achieved better validation and testing results trained over the APTOS dataset with an accuracy of 81% and 59% for each phase in predicting diabetic retinopathy presence in fundus oculi images. A large portion of the retina is still not captured. The far periphery of the retina in images may contain eyelids and eyelashes.

The deep convolutional neural network has also performed an important role in the segmentation and detection of exudates using digital fundus images. Tan developed a convolutional neural network to automatically discriminate and segment microaneurysms, hemorrhages, and exudates i.e. reported method describes that only one CNN can be used for the segmentation of retinal features using a huge amount of retinal datasets with appropriate accuracy. Furthermore, Garc´ıa et al. investigated three classifiers: multilayer perceptron (MLP), radial basis function (RBF), and support vector machine (SVM) to detect the hard exudates. Machine learning-based algorithms contain supervised and unsupervised learning approaches. A. R. Chowdhury applied a random forest classifier for the detection of retinal abnormalities. The technique was based on a K-means segmentation of fundus photographs and preprocessing performed by machine learning approaches based on statistical and low-level features. Moreover, a novel approach was introduced by Perdomo et al. For the detection of diabetic macular edema based on exudates' locations using machine learning techniques. Furthermore, Carson Lam applied pre-trained models, namely, AlexNet and GoogleNet, for the detection of diabetic retinopathy i.e. reported article recognized different stages of diabetic retinopathy using convolutional neural networks. The authors highlighted multinomial classification models and discussed some issues about misclassification of disease and CNN's inability in the article.

The literature review has helped us identify the accuracy of all the projects and the algorithms which can be used. The use of various algorithms such as KNN, Bayes Theorem, PNN, and CNN have been used and a basic comparison has been made among them that has helped us choose the algorithm which gives us the most accuracy with the detection of Diabetic Retinopathy severity.

III. PROPOSED SYSTEM

Detection of diabetic retinopathy system allows users to get instant output on the severity of their diabetic retinopathy issues through an intelligent machine learning system. Users can give high-resolution retina images and symptoms as input. The application then takes the user's input and checks the severity of diabetic retinopathy that could be associated with it using a prediction algorithm. The output is a graph depicting the accuracy of the model's prediction and the severity of the disease. The system also provides the users with suggestions for doctors in their region whom they can consult for treatment of their predicted illness. The product will be available for use as a web application and is intended to be simple and easy to use.

User classes and characteristics

Detection of diabetic retinopathy system is intended for two types of users:

For Patients: They can log in and give in their symptoms with the help of which the application would predict the disease and suggest a doctor for consultation. Payment details and mode would be provided.

For Doctors: They would be provided with patient reports and consultation time and mode.

This application helps patients to get information regarding the severity of their diabetic retinopathy based on the provided symptoms and retina images from anytime and anywhere. It also helps doctors to provide online consultations to patients, which proves to be extremely useful in situations when the patient and the doctor cannot meet physically.

For this system we give input as a retina image – the higher the resolution the more accurate the prediction will be. After taking the input, the model processes the data to remove noise, resize the image to the required dimensions and eliminate unnecessary details. Next features are extracted from the image which is used to classify the image and predict the severity of DR.

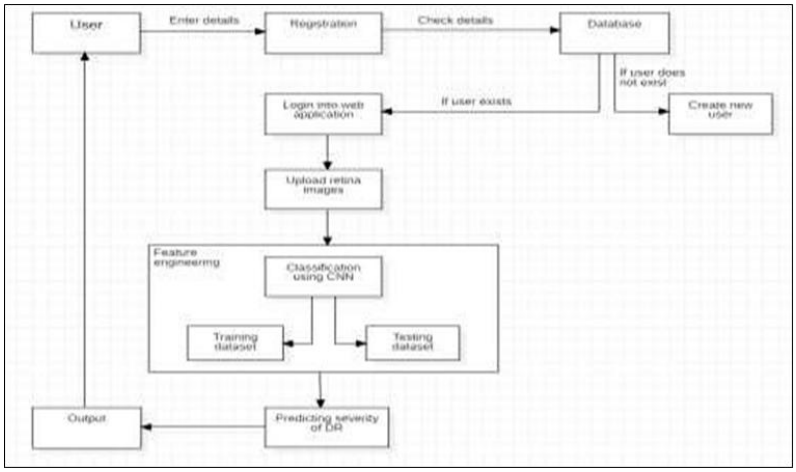

Figure 5: System Architecture

IV. UML DIAGRAMS

4.1. Use Case Diagram

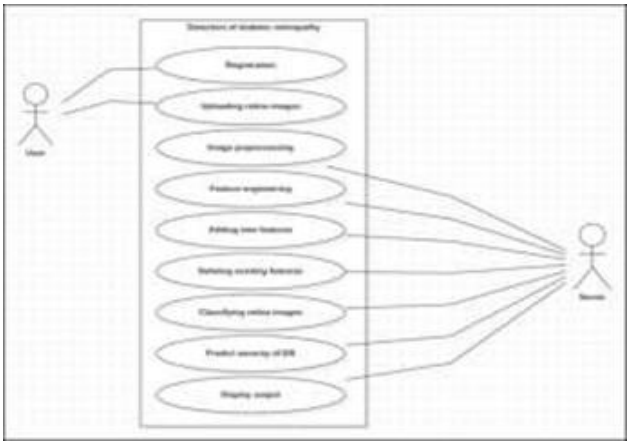

Figure 6: Use case diagram

4.2. Sequence Diagram

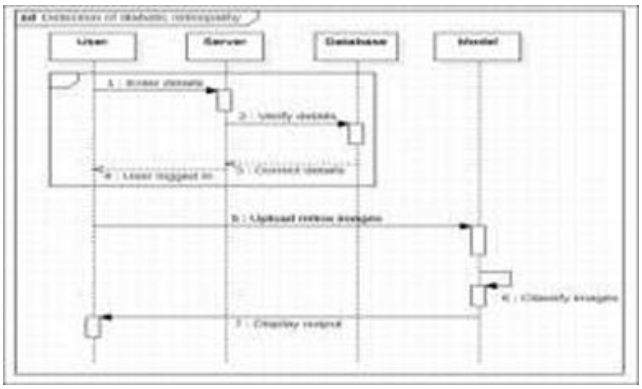

Figure 7: Sequence Diagram

4.3. Activity Diagram

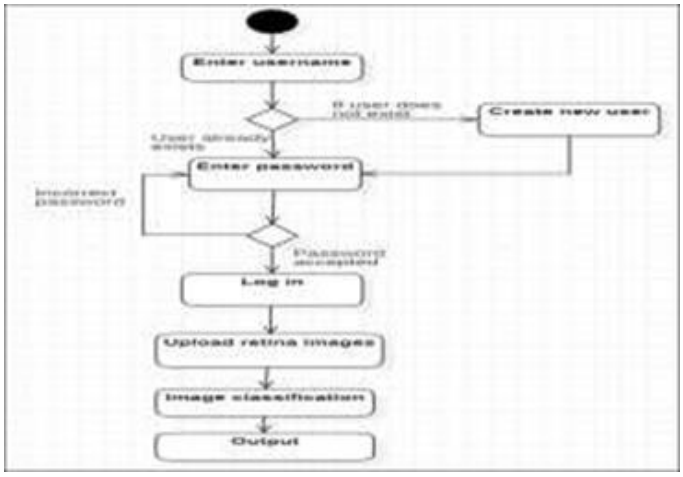

Figure 8: Activity Diagram

V. CONCLUSION

Our study has successfully categorised DR into five classes which is approached using a CNN method. Our project is able to efficiently learn the features required to classify the retinal images, accurately classifying the majority of proliferative cases and cases with no DR and other stages of DR. As in other studies using large datasets with high specificity has caused a lower sensitivity. Our method produces comparable results to these previous methods without any feature-specific detection and using a much more general dataset.
Hence, the accuracy of the proposed approach outperforms the other existing techniques for the detection of retinal hemorrhages and microaneurysms. In future work, the proposed framework can be modified to predict severity within the range of mild to moderate diabetic retinopathy and increase the accuracy of the system. To conclude, we have shown that CNNs have the capability to identify the features of Diabetic Retinopathy in fundus images. CNN's have the potential to be very useful for medical experts in the future as the networks and the datasets continue improving and they will as well as offer real-time classifications. Moreover, the proposed framework can also be extended to diagnose soft and hard exudates and plasma leakage for diabetic retinopathy and to use a much larger dataset for the diagnosis of the disease.

VI. ACKNOWLEDGEMENT

It gives me great pleasure and immense satisfaction to present this Project report on “Detection of Diabetic Retinopathy Severity” which is the result of the unwavering support, expert guidance, and, focused direction of our guide Prof. Priti Rathod to whom we express our deep sense of gratitude and humble thanks for her valuable guidance throughout the presentation work. The success of this Project Report has depended upon exact cooperation work and unending co-operation and guidance, extended to us by the superiors at our college. Furthermore, I am indebted to Prof. Priti Rathod, our HOD of the Computer Engineering Department Dr. Pankaj Agarkar, and our Principal Dr. Farook Sayyad whose constant encouragement and motivation inspired us to give our best. Lastly, we sincerely thank our colleagues, the staff, and all others who have directly or indirectly helped us and made numerous suggestions which have surely improved the quality of our work.

VII. REFERENCES

[1]. Qilei Chen, Xinzi Sun, Ning Zhang, Yu Cao, Benyuan Liu (2019) Mini Lesions Detection on Diabetic Retinopathy Images via Large Scale CNN Features.
[2]. Gazala Mushtaq and Farheen Siddiqui 2021 Detection of diabetic retinopathy using deep learning methodology
[3]. Diabetic Retinopathy Improved Detection Using Deep Learning, Angel Ayala, Tomás Ortiz Figueroa, Bruno Fernandes 1 and Francisco Cruz
[4]. Kangrok Oh1,6, Hae Min Kang, Dawoon Leem, Hyungyu Lee, KyoungYul Seo & Sangchul Yoon, Early detection of diabetic retinopathy based on deep learning and ultra-wide-field fundus images

[5]. Wejdan L. Alyoubi, Wafaa M. Shalash, Maysoon F. Abulkhair Diabetic retinopathy detection through deep learning techniques: A review.

[6]. C.M. Patil, Y.Kumaran: A brief review of the detection of diabetic retinopathy in human eyes using pre-processing & segmentation techniques

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In Vitro Assessment of Antioxidant and Antimicrobial Activities of Crude Gymnemic Acids of Gymnema Sylvestre

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ABSTRACT

The present study reports in vitro antioxidant and antimicrobial activities of Crude Gymnemic acids obtained from stem and leaves of plant Gymnema sylvestre. The gymnemic acids obtained from stem & leaves were screened for antioxidant and antimicrobial activity. Antioxidant activity of crude gymnemic acids was evaluated using butylated hydroxyl anisole (BHA) and butylated hydroxyl toluene (BHT) as standards. Antioxidant activity of stem gymnemic acids which was comparable with that of BHT and BHA was found to be superior to other samples in 2, 2-diphenylpicrylhydrazyl (DPPH), -carotene bleaching and ABTS radical scavenging assays. This indicated strong antioxidant capacity of the gymnemic acid obtained from stem. Determination of the total phenolic content by Folin-Ciocalteau reagent indicated much higher phenolic content in stem gymnemic acids, which supported the observed antioxidant activity. The antimicrobial activities of samples were investigated against eight bacterial strains. All the samples exhibited prominent activity against Pr. mirabilis, B. subtilis and P. asplenii. A moderate activity was indicated by crude stem gymnemic acid against E. coli and C. albicans.

Keywords: Antimicrobial activity, Antioxidant assays, G. sylvestre R. Br., Gymnemic acids, DPPH assay, -carotene bleaching and ABTS radical scavenging assays,

I. INTRODUCTION

Free radicals are responsible for oxidative damage known to cause various chronic diseases like atherosclerosis, Parkinson's diseases, Alzheimer's diseases, stroke, cancer chronic inflammatory, diseases, arthritis, and other degenerative diseases [1].

Reactive oxygen species (ROS) are responsible for several disorders like aging, various inflammatory diseases, carcinogenesis neurodegenerative diseases and diabetes [2]. It is well known that diabetes is usually accompanied by increased production of ROS and impaired antioxidant defence [3]. ROS are usually scavenged by the antioxidants like glutathione peroxidase, catalase and superoxide dismutase, which are naturally present in the body [4]. In situation where endogenous antioxidant defences are not totally efficient, antioxidant supplementation is required to diminish the oxidative damage. Available synthetic antioxidants such as

butylated hydroxyl anisole (BHA) and butylated hydroxyl toluene (BHT) are associated with some side effects [5, 6]. Consequently, there has been much attention in the antioxidant activity of naturally occurring substances [7]. Many natural products [8] and medicinal plants possessing antioxidant properties are known to reduce oxidative stress8. Extracts from plants namely *Albizia amara, Achyranthes aspera, Cassia fistula, Cassia auriculata* and *Datura stramonium* possess antioxidant activity [9]. Extract of leaves and stem of *Raphanus sativus* L. possess radical scavenging activity [10].

Gymnema sylvestre R.Br. (Family: Apocynaceae, subfamily: Asclepiadaceace), commonly known as 'Gurmar', is a well-known indigenous medicinal plant used in the treatment of diabetes and many other ailments. The plant is woody climber, located in central and western India, Tropical Africa and Australia. A recent review describes the antimicrobial, hepatoprotective, antihypercholesterolemic and anti-inflammatory activities of leaves of this plant and states that they are used for making antidiabetic formulations in folk, ayurvedic and homeopathic medicines [11]. The recent review articles shows that *Gymnema sylvestre* R. Br, has been employed to control diabetes, obesity, atherosclerosis etc., by traditional medicinal practitioners of India for nearly two millennia [12,13,14]. The leaves have a unique property of inhibiting ability to taste sweet substances [15]. Leaves are also used in the treatment of bronchitis, jaundice and asthma [16]. Formulations of the active constituents from leaves were also useful against obesity [17]. Due to the large range of biological activities, considerable work has been done to isolate and identify chemical constituents of these leaves. It is well known that a group of more than twenty saponin glycosides of olenane-type including mixture of gymnemic acids I-XVIII (antisweet compounds) and gymnema saponins are the active constituents of these leaves [18]. The content of gymnemic acid are present in different parts of the plant like root, flowers, internodes, seeds and stalks, though leaves of *G. Sylvestre* were the major source of gymnemic acids [19]. Besides these, other constituents present in the leaves include lupeol, stigmasterol, flavones, anthraquinones, phytin, inositol, tartaric acid, Choline, β-amyrinn, resin, α and β Chlorophyll, betain, alkaloids, triethylamine and d-quercitol [20]. Alongwith this aqueous leaf extract of *G. sylvestr*e shows lavicidal effect on *Culex qinquifaciatus* mosquito larvae [21]

It is evident from the available literature that some of the antidiabetic plants possess antioxidant activity. Antioxidant property of alcoholic leaf extract [22] and antibiotic activity of *G. sylvestre* extracts [23] was reported. Also, there is limited number of reports on antimicrobial activities of *G. sylvestre* [24, 25]. Literature survey indicates that the antioxidant properties of the extract of stem *G. sylvestre* plant and its component stem gymnemic acid, is hitherto unknown. A study was therefore undertaken to evaluate and compare the antioxidant and antimicrobial activity of crude gymnemic acid from leaf extract (LGA) and crude gymnemic acid from stem extract (SGA). In our ongoing programme on developing bioactive extracts, antioxidant properties of *Gymnema sylvestre* leave essential oil were recently demonstrated [26].

II. METHODS AND MATERIAL

Plant material

The plant of G. sylvestre (2 Kg) was collected from 'Pune'(Mulashi) from Maharashtra state in India. The plant was authenticated by Botanical Survey of India, Pune (BSI). The material has been deposited at AHMA herbarium at BSI (Voucher No.SVS-1/783).

Chemicals

Butylated hydroxyl anisole (BHA), Butylated hydroxyl toluene (BHT) and Tween-20 were purchased from Loba Chemicals, linoleic acid was purchased from SRL and β-carotene from HIMEDIA, Folin-Ciocalteu reagent was purchased from Qualigens. All these are Indian companies. 2, 2-Diphenyl-1-picrylhydrazyl (DPPH), 2, 2-azinobis-(-3-ethyl benzothiazoline-6-sulphonic acid) diammonium salt (ABTS) and ammonium persulphate were purchased from Fluka, USA. All the solvents used were of analytical grade.

Cultures of Bacteria

Pseudomonas aeruginosa (Gram –ve, ARICHM-1), Bacillus subtilis (Gram +ve, ARICHM-2), Bacillus cereus (Gram +ve, ARICHM-3), Escherichia coli (Gram –ve, ARICHM-4), Staphylococcus aureus (Gram –ve, ARICHM-5), Proteus mirabilis (Gm –ve, ARICHM-6), Pseudomonas asplenii (Gram –ve, ARICHM-7) and Candida albicans (ARICHM-8) were obtained from the culture collection of ARI.

Extraction of leaf gymnemic acid (LGA) from leaves of G. Sylvestre

The extraction of gymnemic acid from leaves of gymnema plant was done by reported method [27]. Dried and powdered leaves (500 g) of G. sylvestre were subjected to cold extraction with n-hexane (1.5 lit) at room temperature (4 x 16 h). The dried powder was then extracted with distilled water (1.5 lit) at room temperature (3 x 6 h). The combined water extract was concentrated under reduced pressure at 60°C. The extraction was then carried out using water: ethanol (1:1) at room temperature. The combined extract was concentrated under reduced pressure to one third of its volume and was acidified with hydrochloric acid (10%, 40 ml) when a brownish precipitate of gymnemic acid was obtained. It was then filtered and dried. Crude gymnemic acid thus obtained was recrystallized using methanol to obtain the crystals of gymnemic acid.

Extractions of stem gymnemic acid (SGA) from stem of G. Sylvestre

Dried and powdered stem (450 g) of G. sylvestre was extracted with n-hexane (1.5 lit) at room temperature (4 x 16 h). The defatted powder was extracted with distilled water (1.5 lit) at room temperature (3 x 6 h). The combined water extract was concentrated under reduced pressure at 60°C. The extraction was then carried out using water: ethanol (1:1) at room temperature (5 x 6 h). The combined extract was concentrated under reduced pressure to one third of its volume and was acidified with hydrochloric acid (10%, 40 ml). A brownish precipitate thus obtained was filtered and dried. The crude gymnemic acid was recrystallized using methanol to obtain crystals of gymnemic acid.

Color test to confirm gymnemic acid

The conformation of crude gymnemic acid was done by reported method [28]. The gymnemic acid gave positive test for phenolic, steroids and glycosides.

1) **Phenolic test:** Gymnemic acid (2 mg) was dissolved in methanol (2 ml). Then a few drops of 1 % alcoholic ferric chloride were added.
2) **Steroid Test:** Gymnemic acid was dissolved in $CHCl_3$ (2 ml) and acetic anhydride (1 ml). A few drops of conc. H_2SO_4 were added from the sides of test tube.

3) **Glycoside test:** A pinch of gymnemic acid was taken in a dried test tube and dissolved in 2 ml of methanol. Alpha naphthol alcoholic solution (1 ml) was added from the sides of the test tube.

In above tests the change of colour of solution was observed.

Antioxidant assay

Determination of free radical scavenging activity (DPPH)

The standard protocol of DPPH assay [29] was followed with slight modifications. Solutions of different concentrations of samples with standard, BHT, (20, 40, 60,100 µg/ml) in methanol were prepared. To the test solution (1 ml), DPPH solution (0.1mM, 1 ml) in methanol was added. Total volume was made upto 4 ml using methanol. After 30 minutes' incubation in the dark, absorbance was recorded at 515 nm. The percentage inhibition activity was calculated by the following formula:

$$\% \text{ Inhibition} = \frac{[A_0-(A_t- A_b)] \text{ X}100}{A_0}$$

Where, A_0 = absorbance of control, A_t = absorbance of test solutions/standard, A_b = absorbance of blank solution. Antioxidant activity of the samples is expressed as IC_{50} values. The IC_{50} value is defined as that concentration of sample which inhibits 50 % of DPPH radicals. All the experiments were performed in triplicate.

Determination of antioxidant activity using β-carotene bleaching assay

Antioxidant activity was measured using standard protocol [30] with slight modifications. To 3.34 mg of β-carotene in chloroform solution (1 ml), 40 mg linoleic acid and 400 mg Tween-20 were added. The chloroform was then removed at 40°C under vacuum using a rotary evaporator. The resulting mixture was diluted with 10 ml distilled water and was mixed well. The emulsion was further made up to 100 ml by adding 0.01M hydrogen peroxide. The test solutions of concentrations (1 mg/ml and 5 mg/ml of each sample and the standard solutions of BHA and BHT (1 mg/ml) in methanol were prepared. Aliquots (2 ml) of the emulsion were transferred into different test tubes containing 0.1 ml of test samples and standards in methanol. In this experiment, BHA and BHT were used as standards. A control containing 0.2 ml methanol and 4 ml of the above emulsion was prepared. The test tubes were placed in water bath at 50°C. Absorbance of all the samples at 470 nm were taken at zero time and after every 15 mins till the colour of β-carotene disappeared in the control. The blank was prepared as described above without β-carotene. The % inhibition was determined by the following equation:

$$\% \text{ Inhibition} = \frac{(A_{A(105)} - A_{C(105)}) \text{ x } 100}{(A_{C(0)} - A_{C(105)})}$$

Where, $A_{A(105)}$ is the absorbance of antioxidants at 105 min., $A_{C(105)}$ is the absorbance of control at 105 min., $A_{c(0)}$ is the absorbance of control at 0 min. All the experiments were performed in triplicates.

ABTS radical cation decolorisation assay

Known ABTS assay [31] was used to evaluate the ability of extracts and gymnemic acids to scavenge the $ABTS^{\cdot+}$ radical. $ABTS^{\cdot+}$ radical cations were generated by reacting ABTS solution (7 mM, 3 ml) with ammonium persulfate (2.45 mM, 15 ml). The reaction mixture was allowed to stand at room temperature for 16 h before use. The test solutions (100 µg /ml and 500 µg /ml) of each sample and the standard solutions of BHA and BHT (100 µg /ml) in methanol were prepared. The ABTS solution (0.6 ml) was added to each test tube containing test solution and standards (1 ml each) and the final volume was made upto 2 ml. The control was prepared by adding methanol (1.4 ml) to ABTS solution (0.6 ml) while blank was prepared in the identical manner as the test solution but without ABTS solution. Absorbance was read at 745 nm. All the samples were analysed in triplicates.

$$\% \text{ Inhibition} = \frac{(\text{Control} - \text{Test}) \times 100}{\text{Control}}$$

All the experiments were performed in triplicates.

Total Phenolic content

The total phenolic content was determined by the reported method [32] using Folin-Ciocalteau reagent. A solution of the sample of concentration 100 µg/ml in methanol was prepared. To 1 ml of this solution, 1 ml Folin-Ciocalteau reagent was added. After 5 min. 10 ml of Na_2CO_3 (7%) was added to the mixture. This solution was diluted to 25 ml using distilled water. After incubation for 90 min. at room temperature, the absorbance against reagent blank was determined at 750 nm. Total phenolic content of the samples was expressed as mg gallic acid equivalent (GAE) / 1 g. All the experiments were performed in triplicates.

Antimicrobial Activity

Antimicrobial activities were examined by well-diffusion method [30]. Pure cultures of bacteria, Pseudomonas aeruginosa (Gram –ve, ARICHM-1), Bacillus subtilis (Gram +ve, ARICHM-2), Bacillus cereus (Gram +ve, ARICHM-3) and Escherichia coli (Gram –ve, ARICHM-4), Staphylococcus aureus (Gram –ve, ARICHM-5), Proteus mirabilis (Gm –ve, ARICHM-6), Pseudomonas asplenii (Gram –ve, ARICHM-7) and culture of fungus Candida albicans (ARICHM-8) obtained from the culture collection of ARI.

The mother cultures of each micro-organism were allowed to stand for 24 h in order to reach the stationary phase of growth before the assays. Petri dishes containing the mother cultures with proper sterile media (MH Agar medium) were used for bacteria. The media were inoculated to obtain the micro-organism concentration of 130 x 10^7 colony forming units per ml (cfu / ml). The wells were made by sterile cock borer (6 mm dia.). Each well was loaded with 40 µl sample (30 mg / ml). All the plates were kept at 5^0C for half an hour for diffusion. The plates were then incubated for 24 h at 37^0C and the diameters of growth inhibition zones were measured using methanol as a blank. Each assay was performed in triplicates on three independent experimental runs.

The minimum inhibitory concentration (MIC) of aqueous extracts and gymnemic acids indicating clear inhibition was determined by well diffusion method [30].

Statistical analysis

All the statistical analyses were performed using SPSS version 11.0. Values are presented as a means ± standard deviation. One-way Analysis of variance was carried out and differences between variables were tested for significance by post hoc Tukey's HSD multiple comparison test. Differences were considered statistically significant at $p<0.05$.

III. RESULTS AND DISCUSSION

1. Extraction of gymnemic acids from stem and leaves

The extraction of the defatted leaves with water yielded 160 g (32%) of the residue as a dark viscous semi solid. Similarly, the extraction of stem yielded 115 g (23%) of the residue. Each of the residues yielded 3 g (0.6%) of leaf gymnemic acids (LGA) and 2.3 g (0.46%) of stem gymnemic acids (SGA) on further processing [Table1].

Table1. Yield (%), Phenolic Content and IC_{50} values of samples of G. Sylvestre.

Sr. No	Compound/Extract	LGA	SGA	BHT
1.	Yield (%)	0.6%	0.46%	-
2	IC_{50} (µg/ml) as determined by DPPH assay	27.7	13.33	20
3.	Phenolic content (mg/GAE dry weight)	94 ± 1.84	310± 0.19	-

2. Colour test for Crude Gymnemic acid

Phenolic test gives dark blue color, which indicates that, the presence of OH group in the molecule. In steroid test, red color ring was formed when few drops of conc. H_2SO_4 were added from sides of the tube containing a pinch of gymnemic acid in a solution of 2 ml chloroform. The formation of bluish ring indicated that the presence of glycosides.

3. DPPH radical scavenging activity

The free radical scavenging capacities of stem, leaf extracts and gymnemic acids were determined by DPPH assay. The results are shown in Figure 1 and Table 1. Known antioxidants, BHT and BHA, were used to validate this assay. Relatively stable DPPH radical has been widely used to test the ability of compounds to act as free radical scavengers or hydrogen donors. The IC_{50} value for stem gymnemic acid (SGA) and leaf gymnemic acid was found to be 13.33µg /ml (Figure 1b) and 27.7 µg /ml (Figure 1a & Figure 1b) respectively in comparison to that of standard BHT (20 µg/ml) [Table 1].

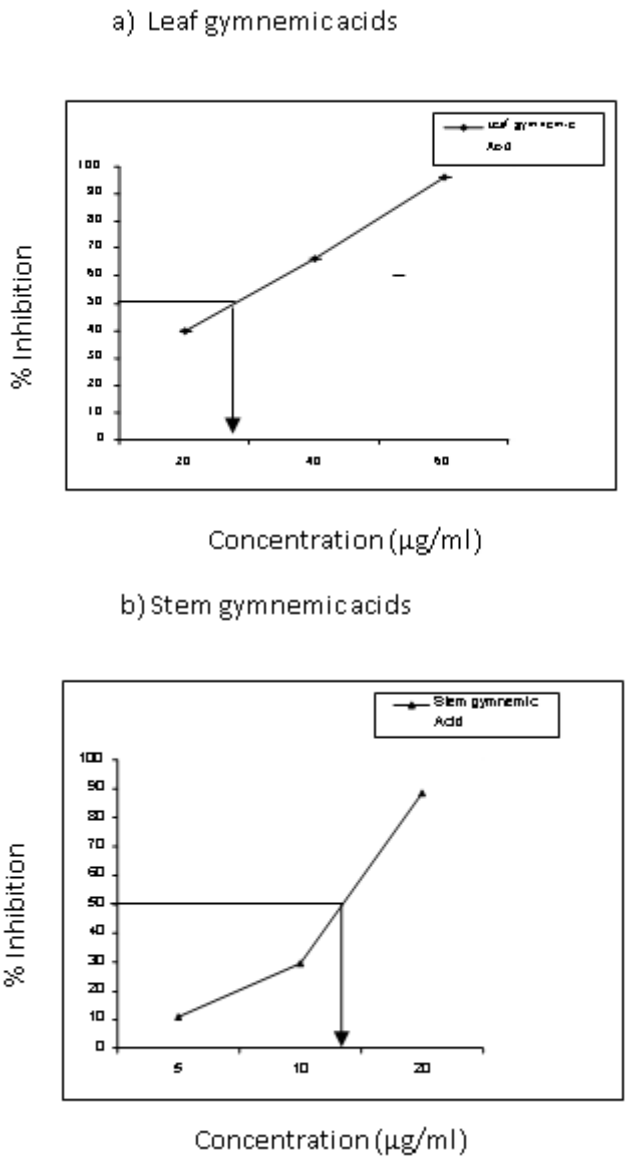

Fig. 1 DPPH free radical –scavenging activity of Leaf and Stem Gymnemic acid.

This indicates the significant activity of SGA. It is noteworthy that the observed antioxidant activity of SGA is much superior to that of the total leaf extract reported recently, as evident from the respective IC_{50} value [33].

4. β - carotene bleaching assay

Results of the assay are presented in Figure 2 and Table 2. The percent inhibition was calculated after 90 minutes. In linoleic acid- β - carotene bleaching method, oxidation of linoleic acid was significantly inhibited by SGA at both the concentrations, i.e. 100µg/ml and 500µg/ml. The control showed decrease in the absorbance with time due to the formation of peroxides in absence of antioxidants (Figure. 2a and Figure 2b). An inhibitory activity (87.0 ± 46%) equivalent to that of standard, BHA (87 ± 0.06%) and superior than that of BHT (80.8 ± 0.22%) was exhibited by SGA at a concentration of 100 µg. β - carotene bleaching activity of Stem extract was studied earlier and showed moderate activity (67.6 ± 0.41%).

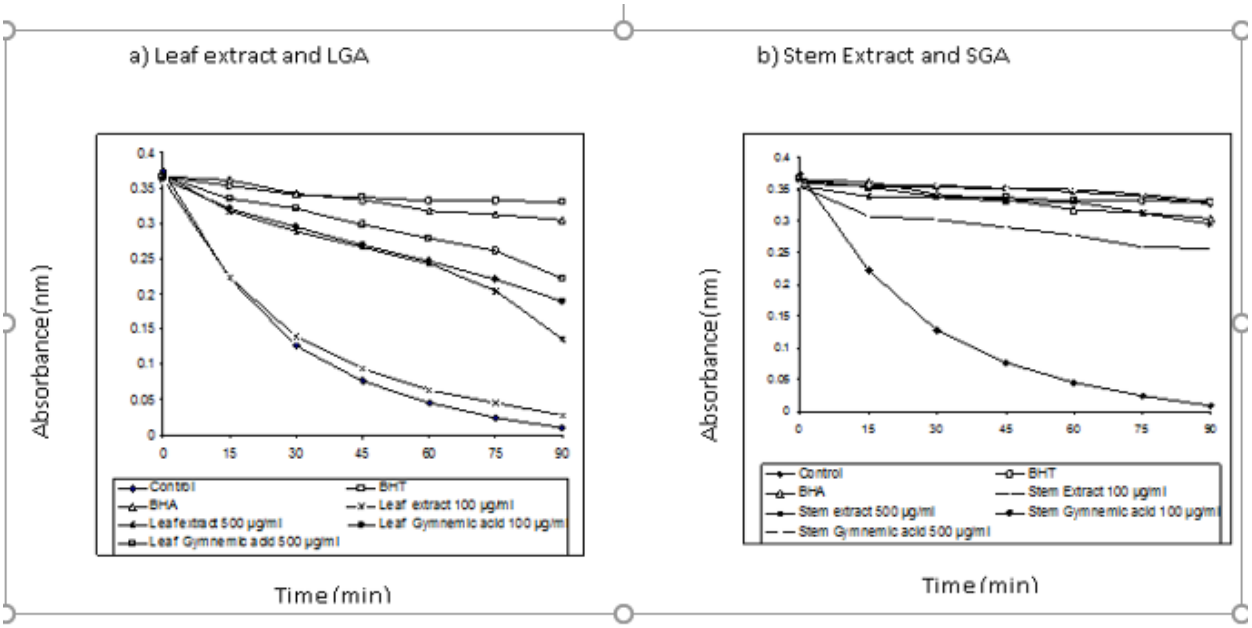

Fig. 2 Variation of antioxidant activity of G. sylvestre extract and Crude gymnemic acid.

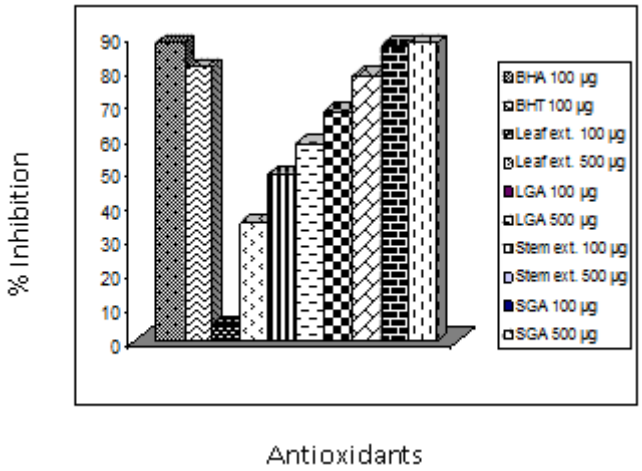

Fig. 3. Antioxidant activity by β-carotene method

Table 2 : Antioxidant activity of the samples from G. sylvestre.

Sr. No.	Compound/ Extract	β-Carotene-Linoleic acid assay % Inhibition**		ABTS assay % Inhibition	
		100 µg *	500 µg *	100 µg *	500 µg *
1.	BHT	80.8 ±0.22	-	100 ±0.00	-
2.	BHA	88 ±0.06	-	100 ±0.00	-
3.	SGA	87.0 ±0.46	87.8 ±0.17	95.9 ±0.22	100 ±0.02
4.	LGA	49.2 ±0.69	58.3 ±0.21	51.45 ±0.00	71.5 ±0.14

Values are expressed as means ± Standard deviations (n=3)
* Concentration in reaction mixture
** % Inhibition after 90 min

LGA showed 49.2 ± 0.68% inhibition at 100 µg ($p<0.01$). The activity of LGA did not increase much at 500 µg concentration, 58.3 ± 0.24% inhibition **[Fig. 3, Table 2].** In this assay the leaf gymnemic acid showed stronger activity than leaf extract at 100µg/ml and 500µg/ml as reported earlier.

5. ABTS radical cation decolorization assay

The antioxidant activity of aqueous extracts and crude gymnemic acids of leaf and stem were examined using $ABTS^{\cdot+}$ radical cation decolorisation assay. The inhibition by the test samples in the ABTS assay is shown in Figure 4 and Table 2. BHT and BHA were used as standards to validate this assay.

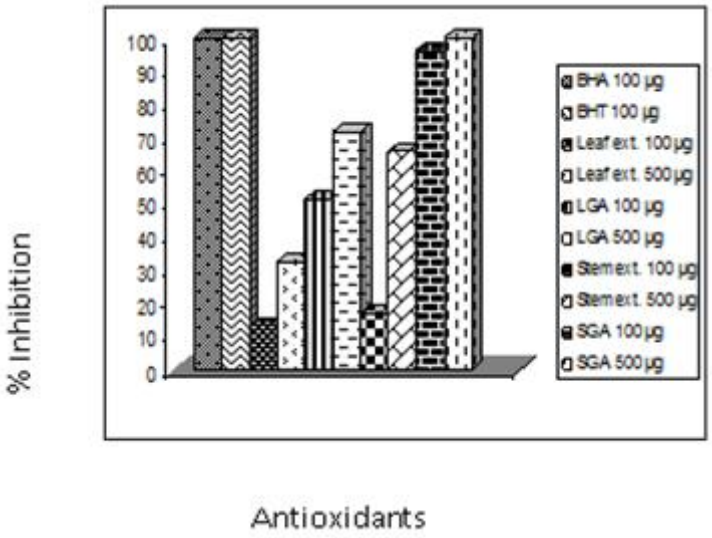

Fig. 4 Antioxidant activity by ABTS method

As depicted in the above two assays, the SGA exhibited very strong antioxidant activity. At 100 µg concentration SGA exhibited inhibition (95.9 ± 0.12%), which was highest among the test samples and slightly lower than standards ($p<0.01$). LGA showed moderate activity (51.4 ± 0.00%) while the activities shown by stem and leaf extracts were low at 100 µg concentration ($p<0.01$). The inhibition of SGA at 500 µg concentration was 100 ± 0.22%, while that of LGA was 71 ± 0.15%. At this concentration, stem extract and leaf extract showed moderate activities i.e. 65.9 ± 0.13% and 32.11 ± 0.24% respectively.

6. Total phenolic contents

SGA showed highest phenolic content (310mg GAE/g dry weight) among the test samples followed by LGA (94.75mgGAE/g dry weight). The presence of antioxidants in the G. sylvestre plant is indicated by the strong inhibition shown in various antioxidant assays. SGA exhibited most potent antioxidant activity among the test samples ($p<0.0001$). This may be due to high total phenolic content in stem gymnemic acids. LGA exhibited moderate antioxidant activity and lower total phenolic content as compared to Crude SGA. The difference in antioxidant property of SGA and LGA may be due to the variation in relative content of gymnemic acids present in them [19] which causes difference in their reducing capacity. This needs further investigation. Present results show that SGA has remarkable DPPH and ABTS radical scavenging capacity. SGA also shows strong inhibition of lipid peroxidation in β-carotene bleaching assay.

7. Antibacterial activity

The antibacterial activities exhibited by gymnemic acids are given in Table 3. This activity was better to that of earlier reported activity of ethanolic leaf extract [24] but lower than that of saponin fractions [25] of G. sylvestre leaves. Among the test samples, Crude SGA indicated superior antimicrobial activity against six bacterial strains with greater zone of inhibition including E-coli which is resistant to external agents like hydrophilic dyes, antibiotics and detergents due to lypopolysaccharides in their outer membrane [34] [Table 3].

Table 3. Antimicrobial activity of samples from G. sylvestre against various microbial strains

Microbial strains	LGA	SGA	Gentamycin
Pseudomonas aeruginosa	-	-	18
Pseudomonas asplenii	17	18	20
Escherichia coli	-	11	20
Bacillus subtilis	14	15	25
Proteus mirabilis	16	16	25
Staphylococcus aureus	-	-	-
Bacillus cereus	-	-	-
Candida albicans	13	12	11

- indicates no zone of inhibition, Methanol is used as Blank.

Measurement of MIC indicate that LGA has strong inhibition in the growth of strains P. asplenii (16 mm with MIC of 25 mg/ml) and B. subtilis (12 mm with MIC of 30 mg/ml), whereas SGA exhibited similar inhibition in the growth of these strains, P. asplenii (16 mm with MIC of 30 mg/ml),B. subtilis (14 mm with MIC of 30mg/ml) and P. mirabilis (14 mm with MIC of 30 mg/ml).

Table 4. Minimum Inhibitory Concentration (MIC) of samples from G. sylvestre plant against various microbial strains

Microbial strains /Sample	LGA	SGA
Pseudomonas aeruginosa	-	-
Pseudomonas asplenii	25	30
Escherichia coli	-	50
Bacillus subtilis	30	30
Proteus mirabilis	25	30
Candida albicans	25	25

In the previous study, the ethanolic extracts saponins fractions of G. Sylvestre leaves were found to possess antimicrobial activity. However, there are no reports on antimicrobial activity of stem aqueous extract and SGA.

8. Abbrevations

BHA, Butylated hydroxyl anisole; BHT, Butylated hydroxyl toluene; DPPH, 2, 2-Diphenyl-1-picrylhydrazyl; ABTS, 2, 2-azinobis-(-3-ethyl benzothiazoline-6-sulphonic acid) diamonium salt; SGA, crude stem gymnemic acids; LGA, crude leaf gymnemic acids.

IV. CONCLUSION

The leaves of G. sylvestre are well known for a very long time as an antidiabetic drug in the traditional system of Ayurvedic Medicine. The diabetes is usually accompanied by increased production of reactive oxygen species (ROS) and impaired oxidative defence. Several studies using in vitro models of diabetes have demonstrated that plant extracts decreased oxidative stress and enhanced the activities of components of the endogenous antioxidant system. Plant based phenols are known to exhibit antioxidant activity through a variety of mechanism including scavenging of ROS and inhibiting lipid peroxidation. In our present study, we have demonstrated that the antioxidant activity of stem gymnemic acid is twofold stronger than that of leaf gymnemic acid and leaf extract. The antioxidant activity exhibited by stem extract is also superior to that of leaf gymnemic acid and leaf extract. We therefore conclude that the potential of the stem gymnemic acid and stem extract as an antidiabetic drug is much more effective than the traditionally used leaf extract of gymnema plant.

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V. REFERENCES

[1]. Halli B., Grootvele M. (1987). The measurement of free radicals reactions in humans. FEBS Lett. 213, 9-14.

[2]. Baynes, J. W. Thorpe S. R. (1999). Role of oxidative stress in diabetic complications: a new perspective on an old paradigm. Diabetes, 48, 1-9.

[3]. Narvez-mastache J. M. Soto C. Delgado G. (2007). Antioxidant evaluation of Eysenhardtia species (Fabaceae): Relay synthesis of 3-O-Acetyl-11□,12□-epoxy-oleanan-28,13□-olide Isolated from E. platycarpa and its protective effect in experimental diabetes. Biol Pharm Bull. 30(8),1503-1510.

[4]. Aruoma O. I. (1994). Nutrition and health aspects of free radicals and antioxidants. Food Chem. Toxicol. 32, 671-683.

[5]. Jafri, M. A. Farah, J. K. Singh, S. (2001). Evaluation of the gastric antialcerogenic effect of large cardamom (fruits of Ammomum subulatum Roxb.). J. Ethanopharmacol., 75, 89 – 94.

[6]. EI – Abhar H. S. Abadia D. M. Saleh, S. (2002). Gastro protective activity of Nigella sativa oil and it's constitute, thymoquinone, against gastric mucosal injury induced by ischemia/reerfusion in rats. J. Ethanopharmacol. 84, 251-258.

[7]. Hiruma – Lima, C. A. Gracioso, J. S. Rodriguez J. A. Haun, M. Nunes, D. S. Souza Brito A.R.M. (2000). Gastro protective effect of essential oil from Croton cajucara Benth. (Euphorbiaceae.). J. Ethanopharmacol. 69, 229-234.

[8]. Soto C. Recoba, R. Barron, H. Alvarez, C. Favari L. (2003). Silymarin Increases antioxidant enzymes in alloxan-induced diabetes mellitus in rat pancreas. Comparative Biochem. & Physiol. 136C, 205-212.

[9]. Kumar P. S. S. Sucheta V. S. Deepa P. Selvamani and Latha S. (2008). Antioxidant activity in some selected Indian medicinal plants. African J. of Biotechnol. 7 (12), pp. 1826–1828.

[10]. Beevi L. Syed Sultan N. Mangamoori L. Gowda B. B. (2010). Polyphenolics Profile, Antioxidant and Radical Scavenging Activity of Leaves and Stem of Raphanus sativus. Plant Foods for Human Nutrition, 65(1) 8.

[11]. Kanetkar, P. Singhal, R. Kamat M. (2007). Gymnema sylvestre: A Memoir. J Clin Biochem and Nutr. 41, 77-81.

[12]. Subramaniyan Vijayakumar and Srinivasan Prabhu (2014), Gymnema sylvestre – A Key for Diabetes Management – A Review, Pharmacol. & Toxicol. Res., 1(1), 1-10.

[13]. Surendra Kumar M., Astalakshmi N., Arshida. P. T., Deepthi. K., Nidhin Devassia. M., Shafna. P.M. and G. Babu. (2015). A Concise Review on Gurmar-Gymnema Sylvestre R. Br. World J. of Pharm. and Pharmaceutical Sci. 4(10), 430-448.

[14]. Lalit Kishore, Navpreet Kaur and Randhir Singh. (2014). Role of Gymnema sylvestre as Alternative Medicine, J. Homeop. Ayurv. Med, 3:4.

[15]. Maeda M. Iwashita T. Kurihara, Y. (1989). Studies on taste modifiers. II. Purification and structure determination of gymnemic acids, antisweet active principle from Gymnema sylvestre leaves. Tetrahedron Letters, 30, 1547-1550.

[16]. Nakamura Y. Tsumura Y. Shibatam T. (1989). Fecal steroid excretion is increased in rats by oral administration of gymnemic acids contained in Gymnema sylvestre leaves. J. Nutr. 129, 1214-1222.

[17]. Yoshikawa, K. Kondo Y. Arihara, S. Matsuura, K. (1993), Antisweet natural products IX structures of gymnemic acids XV-XVIII from Gymnema sylvestre R.Br. Chem. Pharm. Bull. 1730-1732.

[18]. Agarwal S. K. Singh S. S. Verma S. Lakshmi V. Sharma A. (2000) Chemistry and medicinal uses of Gymnema sylvestre (Gur-mur) leaves: A review. Indian Drugs 37, 354-360.

[19]. Deokule S. S. Pokharkar A. A. (2009) In vitro production of callus Bionmass by using plant growth egulators and comparative study of Gymnemic acid from Gymnema sylvestre (retz.0 R.Br. ex shultz., J. of Biotech. 3, 20-30.

[20]. Tiwari P. Mishra B. N. Neelam S. S. (2014). Phytochemical and Pharmacological Properties of Gymnema sylvestre: An Important Medicinal Plant. Biomed. Res. Int. 830285.

[21]. Khanna, V. G. Kannabiran K. (2007), Larvicidal effect of Hemidesmus indicus, Gymnema sylvestre, and Eclipta prostrata against Culex qinquifaciatus mosquito larvae. Afri. J. of Biotech. 3, 307–311.

[22]. Kang M. H. Lee M. S. Choi M. K. Min K. S. Shibamoto T. (2012). Hypoglycemic activity of Gymnema sylvestre extracts on oxidative stress and antioxidant status in diabetic rats. J. of Agri. and Food Chem. 60 (10), 2517–2524.

[23]. Saumendu D. R. Sarkar K. Dipankar S. Singh T. Prabha B. (2010). In vitro antibiotic activity of various extracts of Gymnema sylvestre. Inte. J. of Pharma. Res. and Deve. 2, 1–3.

[24]. Satdive, R. K. Abhilash P. Futele D. P., (2003) Antimicrobial activity of Gymnema sylvestre leaf extract. Fitoterapia. 74(7-8), 699-701.

[25]. Khanna V. G. Kannabiran K. (2008). Antimicrobial activity of saponin fractions of the leaves of Gymnema sylvestre and Eclipta prostate. Word J. Microbiol. Biotechnol, 24, 2737-2740.

[26]. Naik D. G., Dandge C. N., and Rupanar S.V. (2011) Chemical Examination and Evaluation of Antioxidant and Antimicrobial Activities of Essential Oil from Gymnema sylvestre R. Br. Leaves. J. of Essential Oil Res. 23, 12-19.

[27]. Maeda M. Iwashita T. Kurihara, Y. (1989). Studies on taste modifiers. II. Purification and structure determination of gymnemic acids, antisweet active principle from Gymnema sylvestre leaves. Tetra. Lett. 30, 1547-1550.

[28]. R. Balamurali, Sujitha R. Reddy Reddy Harika, Javangula D. Swapnak. Jagadeeswara R. (2012). Isolation and characterization of gymnemic acid from Gymnema sylvestre r.br. in control of diabetes, Int. J. of Life Sci. and Pharma Res. 2(1).

[29]. Khanahmadi M. Rezazadeh S. H. Taran M. (2010). .In vitro antimicrobial and antioxidant properties of Smyrnium cordifolium boiss. (Umbelliferon) extract. Asian J. of Plant Sci. 9, 99-103.

[30]. Mokbel M. S. Hashinaga F. (2005). Antibacterial and antioxidant activities of Banana (Musa, AAA cv. Cavendish) Fruits Peel. Am. J. of Biochem. & Biotech. 1, 125-131.

[31]. Pellegrini R. Re N. Proteggente A. Pannala A. Yang M. & Rice-Evans C. (1999). Antioxidant activity applying an improved ABTS radical cation decolorization assay. Free Rad. Biol. Med. 26, 1231-1237.

[32]. Singleton V. L. Rossi J. A. (1965). Colorimetry of total phenolic with phosphomolybolic-phosphotungstic acid reagents. Am. J. Enol. Vitic., 16, 144-158.

[33]. Rachh P. R. Patil S. R. Hirpara H. V. Rupareliya, M. T. Rachh M. R., Bhargava A. S. Patel N. M. Modi D.C. (2009). In vitro evaluation of antioxidant activity of Gymnema sylvestre leaf extract. Rom J. Biol. Plant Biol., 54, 141-148.

[34]. Khaled F. El-Massry Ahmed H. EI-Ghorab, Shaaban H., Shibamoto T. (2009). Chemical compositions and antioxidant/antimicrobial activities of various samples prepared from Schinus terebinthifolius leaves cultivated in

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Development of Fire Fighting Robot

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ABSTRACT

Fire incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. They can also suffer from prolonged psychological and trauma. Fire fighters are primarily tasked to handle fire incidents, but they are often exposed to higher risks when extinguishing fire, especially in hazardous environments such as in nuclear power plant, petroleum refineries and gas tanks. They are also faced with other difficulties, particularly if fire occurs in narrow and restricted places, as it is necessary to explore the ruins of buildings and obstacles to extinguish the fire and save the victim. With high barriers and risks in fire extinguishment operations, technological innovations can be utilized to assist firefighting. Therefore, this paper presents the development of a firefighting robot dubbed QRob that can extinguish fire without the need for fire fighters to be exposed to unnecessary danger. QRob is designed to be compact in size than other conventional fire-fighting robot in order to ease small location entry for deeper reach of extinguishing fire in narrow space. QRob is also equipped with an ultrasonic sensor to avoid it from hitting any obstacle and surrounding objects, while a flame sensor is attached for fire detection. This resulted in QRob demonstrating capabilities of identifying fire locations automatically and ability to extinguish fire remotely at particular distance. QRob is programmed to find the fire location and stop at maximum distance of 40 cm from the fire. A human operator can monitor the robot by using camera which connects to a smartphone or remote devices.

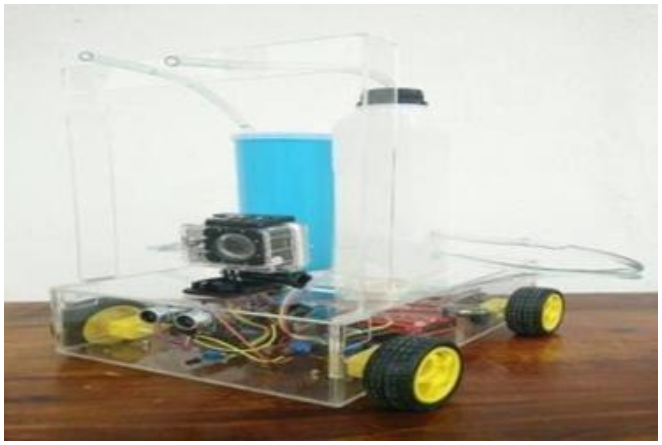
Keywords: Robot, Fire, QRob, Fire fighting

I. INTRODUCTION

Firefighting refers to the act of extinguishing destructive fires, where a firefighter needs to quickly and safely put out the fire, prevent further damage, and rescue victims to a safer location. With the advancement of technology, the gap between firefighting and machines has been bridged, resulting in a more efficient and effective method of fire control. Robots have been developed to detect fires before they spread uncontrollably, and they could potentially work alongside firefighters to reduce the risk of injury to victims.

This study introduces a new compact and small firefighting robot named XeRob, which stands for Rescue Robot. This robot has the ability to avoid obstacles, search for fires, and extinguish them. Additionally, it can increase productivity, safety, efficiency, and quality of the assigned task. XeRob is more compact and flexible than previous robots such as Thermite and FireRob. Moreover, it can enter small or narrow spaces, which is a

significant advantage. A robot is an automated device that can perform functions typically attributed to humans or machines that have repetitive or flexible sets of actions. Research has shown that robots can be beneficial in various fields, such as medicine, rehabilitation, rescue operations, and industry. Over the years, robotics has been introduced in various industries, where industrial robots are multi-functional manipulators designed for specialized materials, divisions, gadgets, or devices through various programmatic movements to perform various tasks. Recent robotic development projects have embedded machine learning algorithms to increase the intelligence of robots, which will increase productivity while reducing the cost and electronic waste in the long run.



Studies on the use of humanoid robots are actively carried out to minimize firefighter injuries and deaths, as well as to increase productivity, safety, efficiency, and quality of the assigned task. Robots can be divided into several groups, such as tele robots, telepresence robots, mobile robots, autonomous robots, and androids robots. The primary function of this robot is to become an unmanned support vehicle developed to search for and extinguish fires. There are several existing types of vehicles for firefighting at home and extinguishing forest fires. Our proposed robot is designed to work autonomously or be remotely controlled. By utilizing such robots, fire identification and rescue activities can be performed.

II. METHODS AND MATERIAL

The development of a fire extinguishing robot involved the use of Google SketchUp software and AutoCad for the production of 3D and 2D schematics. The main body of the QRob comprises two front and two rear wheels that ensure stability and 360-degree rotation for optimal movement and speed. The body is constructed from acrylic plates that shield the electronic circuit and can resist temperatures of up to 200 º C, making it easy to cut and drill. The acrylic chassis has perforations that facilitate mounting various sensors and mechanical components.

The front section of the robot houses the ultrasonic and flame sensors, which prevent collisions with obstacles and detect fires, respectively. Moreover, a mini camera was installed in front of the robot to monitor conditions and transmit visual data to a smartphone. Fig. 1 and Fig. 2 demonstrate the design of the fire extinguishing robot.

Implementation of Hardware Components

The electronic components of QRob play a vital role in its development, including various types of sensors, a microcontroller, DC motors with wheels, a transmitter, remote control, and a water pump. **Figure 3** Illustrates the QRob's operational block diagram, which receives input from the ultrasonic and flam.

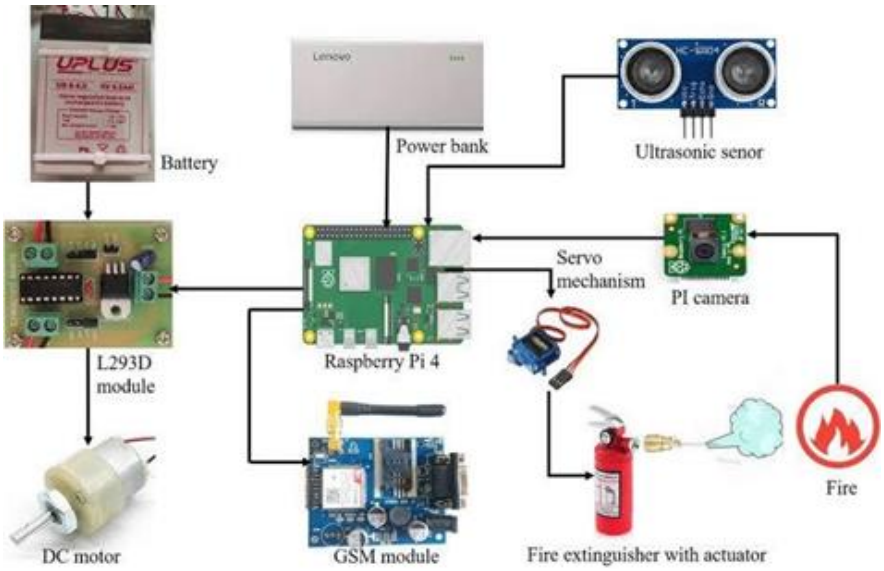


Figure 3: QRob's operational block diagram

1) **Flame sensor**: In most firefighting robots, fire sensors perform an essential part in investigations, which are always used as robot eyes to discover sources of fire [1]. It can be utilized to identify fire based on wavelength of the light at 760 nm to 1100 nm. The detection angle and distance are roughly 60 degrees and distance 20 cm (4.8V) to 100 cm (1V) respectively. Flame sensor has two signal pins that are Digital Output (DO) and Analog Output (AO). DO pins will give two kind of information that it's has flame or non-flame whileAO pins will detect exact wavelength of different light.
2) **Ultrasonic sensor**: One of the most crucial aspect in inventing an autonomous target detection robot is a barrier and Obstacle avoidance. A sensor must be compact, low cost, Simple to produce and functional on a larger scale. Moreover, It should be able to sense things with enough limits to let Robots to react and travel appropriately. The existing sensors That suit all these requirements are ultrasonic sensors. The HC- SR04 ultrasonic sensor is utilized in this study to determine the distance within the range of 2 cm to 400 cm with an angle 15 degrees. This sensor transmits waves into the air and Receive reflected waves from the object. It has four output pin Such as reference voltage (VCC) (operate around 5V), ground Pin (GND), digital output (DO) and analog output (AO).
3) **DC motor with wheel**: DC geared motor with rubber Wheel are suitable material for this project. These DC motors are Suitable to replace 2 WD and 4 WD car chassis. The working Voltage for DC motor is around 5V to 10 V DC. While the Ratio of the gear is 48:1. Suitable current for this motor is 73.2 mA. DC motor is used to move the robot to the fire location.

4) **Water pump**: The water pump is important part in this Robot as it will pump water or soap to extinguish the fire. Depending on the class of fire that occurs. Small-size and Light-weight category of water pump has been selected for use in this project. Moreover, it has low noise, high effectiveness and minimal Power consumption. The optimal voltage for this water pump is 6V. Working voltage for this water pump is around 4V to 12V with the working current 0.8A.

5) **Transmitter and remote control**: In this study, the Wireless remote control transmitter and receiver with 4 control Modes will be used. Model number f this receiver or remote is S4C-AC110. This remote have four buttons. The operating Voltage for this remote control is AC 100 – 120 V, while the Working voltage range of relay are AC 110 – 240 V or DC 0-28 V. The model number of the transmitter is C-4. The Distance of the remote control is 100 m or 300ft. Power supply for this transmitter are 12 V. The transmitting frequency is 315 MHz / 433 MHz. By utilizing the transmitter and remote Control, QRob can be controlled from distant places where the Operator who controls it will be in a safe place while the robot will enter into a dangerous fire area.

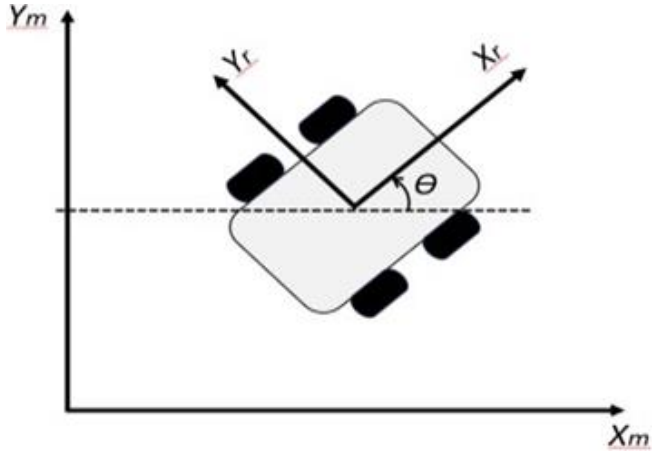


Fig2. Relationship between QRob coordinate plane with main surface plane

Autonomous target detection robot needs to avoid barriers and obstacles, which requires a sensor that is affordable, small, easy to manufacture, and functional on a larger scale. Ultrasonic sensors meet all these requirements. This study uses the HCSR04 ultrasonic sensor, which can detect distances from 2 cm to 400 cm within a 15-degree angle. It emits waves and receives reflected waves to sense objects. It has four output pins, including VCC (operating at around 5V), GND, DO, and AO.

For this project, the robot is equipped with a DC geared motor with a rubber wheel, which can replace 2 WD and 4 WD car chassis. The motor has a working voltage of 5V to 10V DC and a gear ratio of 48:1. Its suitable current is 73.2 mA. The DC motor moves the robot to the fire location.

The water pump is an essential part of this robot because it pumps water or soap to extinguish the fire. The water pump selected for this project is small-sized, lightweight, and has low noise, high effectiveness, and minimal power consumption. Its optimal voltage is 6V, while its working voltage is 4V to 12V with a working current of 0.8A.

To control the QRob from a safe distance, a wireless remote control transmitter and receiver with 4 control modes are used. The model number for the receiver or remote is S4C-AC110, which has four buttons. Its

operating voltage is AC 100-120V, while the working voltage range of the relay is AC 110- 240V or DC 0-28V. The transmitter's model number is C-4, with a transmitting frequency of 315 MHz / 433 MHz and a distance range of 100m or 300ft. The power supply for this transmitter is 12V. The remote control allows the operator to control QRob from a safe location while it enters dangerous fireareas.

```
#define R1 2
#define R2 3
#define ENR 9

#define L3 4
#define L4 5
#define ENL 10

#include <Ultrasonic.h>
#define TRIGGER_PIN  12
#define ECHO_PIN     11

#define btnC 8
#define sensorM A1

int btnInput;
int btnInputState = LOW;
int sensorMV;
```

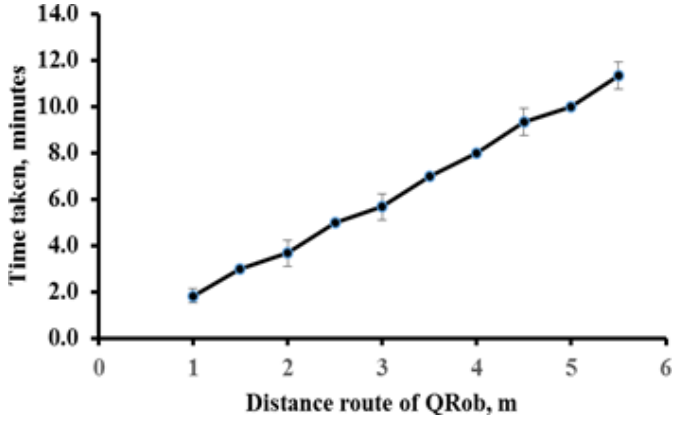
Fig. 5. Declaration Code.

```
void forward()
{
  analogWrite(ENR, 200);
  analogWrite(ENL, 180);
  digitalWrite(R1, LOW);
  digitalWrite(R2, HIGH);
  digitalWrite(L3, LOW);
  digitalWrite(L4, HIGH);
}
```

```
void reverse()
{
  analogWrite(ENR, 255);
  analogWrite(ENL, 255);
  digitalWrite(R1, HIGH);
  digitalWrite(R2, LOW);
  digitalWrite(L3, LOW);
  digitalWrite(L4, LOW);
  delay(1000);
}
```

III. RESULTS AND DISCUSSION

This study aims to develop a firefighting automaton called QRob. This segment will delve into the robot's control sequence. The project has accomplished the following objectives:



1) Flame Sensor Connectivity

a) The QRob will remain inactive if the sensor is not activated, and it will respond when the sensor becomes operational.

b) This sensor is linked to a DC motor.

c) When there is no fire detected, this sensor will turn off, and the DC motor and Ultrasonic Sensor will activate.

d) When the fire is detected, this sensor will turn on, and the DC motor and Ultrasonic Sensor will automatically switch off, When Flame Sensor = 1; DC Motor = 0, Ultrasonic Sensor = 0, When Flame Sensor = 0; DC Motor = 1, Ultrasonic Sensor = 1.

2) Ultrasonic Sensor Connectivity

a) This sensor will identify surrounding objects.

b) This sensor will switch on when the DC motor is operational, but the Flame Sensor is inactive.

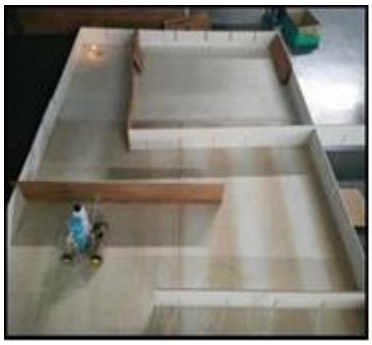
c) This sensor will switch off when the Flame Sensor is active. When Ultrasonic Sensor = 1; DC Motor = 1, Flame Sensor = 0. When Ultrasonic Sensor = 0; DC Motor = 0, Flame Sensor = 1.

3) DC Motor

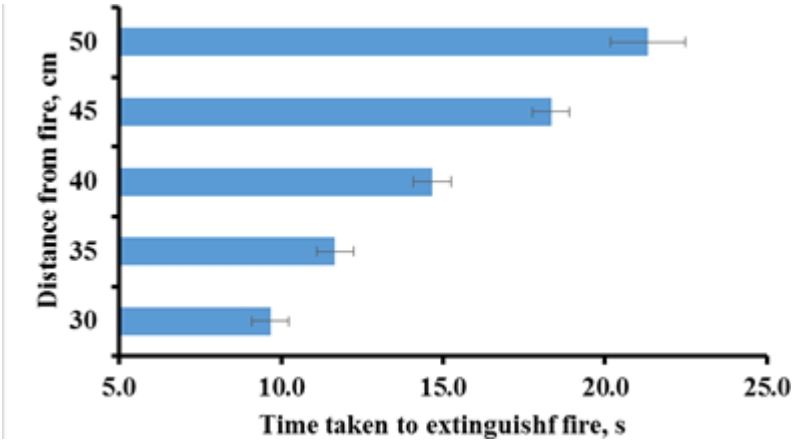
a) This motor is attached to the driver motor and Arduino Uno.

b) This motor will switch on when the Ultrasonic Sensor is active, and the Flame Sensor is inactive.

c) This motor will turn off when the Flame Sensor is active, When DC Motor = 1; Ultrasonic Sensor = 1, Flame Sensor = 0, When DC Motor = 0; Ultrasonic Sensor = 0, Flame Sensor = 1.



The firefighting robot (QRob) was developed to automatically locate and extinguish fires using a flame sensor and an ultrasonic sensor. These sensors were connected to an Arduino Uno microcontroller, which controlled the DC motor's movements. When the flame sensor detected a fire, the DC motor stopped 40 cm away from the fire, and the operator extinguished it using a remote control from a distance. The operator could also monitor the QRob using a smartphone-connected camera.



The time it took to extinguish the fire depended on the distance between QRob and the fire source, as shown in Fig. 8.

Fig. 9 shows an image of the fire extinguishing process. From the experimental results, it can be seen that when the Distance between QRob and fire is greater, the longer it takes to extinguish fire. For future planning, it is needed to determine the optimal distance between QRob and fire. This is because to prevent QRob being too close to the fire and at the Same time can extinguish the fire in a short time. B. Ability of QRob to Find Fire Location at Different Distance Route QRob is equipped with ultrasonic sensor that allows it to Avoid obstacles surrounds it. Thus, the maze has been designed to test whether the sensor works well and can avoids the Barrier

IV. CONCLUSION

In summary, we have successfully developed a firefighting Robot that can be controlled from a distance. The QRob has various beneficial features such as automatic fire detection, a Lightweight and compact body, and an ultrasonic sensor that Prevents collisions with surrounding objects. Due to its compact Structure, the QRob can be used in narrow entrances or confined Spaces. The operator can extinguish fires from a safe distance

using a remote control. Additionally, the smartphone-connected Camera allows the operator to monitor the environment during Firefighting. The experimental results indicate that the QRob can detect smoke and fire accurately and quickly. In conclusion, the "Development of Fire Fighting Robot (QRob)" project has successfully met its objectives and goals.

V. REFERENCES

[1]. Jeelani, S., et al., Robotics and medicine: A scientific rainbow in hospital. Journal of Pharmacy & Bioallied Sciences, 2015. 7 (Suppl 2): p. S381-S383.

[2]. Aliff, M., S. Dohta, and T. Akagi, Simple Trajectory Control Method of Robot Arm Using Flexible Pneumatic Cylinders. Journal of Robotics and Mechatronics, 2015. 27(6): p. 698-705.

[3]. Aliff M, D.S., and Akagi T, Control and analysis of simple-structured robot arm using flexible pneumatic cylinders. International Journal of Advanced and Applied Sciences, 2017. 4(12): p. 151-157.

[4]. Aliff, M., S. Dohta, and T. Akagi, Control and analysis of robot arm using flexible pneumatic cylinder. Mechanical Engineering Journal, 2014. 1(5): p. DR0051-DR0051.

[5]. M. Aliff, S. Dohta and T. Akagi, Trajectory controls and its analysis for robot arm using flexible pneumatic cylinders," IEEE International Symposium on Robotics and Intelligent Sensors (IRIS), 2015, pp. 48-54.

[6]. M. Aliff, S. Dohta and T. Akagi, Trajectory control of robot arm using flexible pneumatic cylinders and embedded controller, IEEE, International Conference on Advanced Intelligent Mechatronics (AIM), 2015, pp. 1120-1125.

[7]. C. Xin, D. Qiao, S. Hongjie, L. Chunhe and Z. Haikuan, Design and Implementation of Debris Search and Rescue Robot System Based on Internet of Things, International Conference on Smart Grid and Electrical Automation (ICSGEA), 2018, pp. 303-307.

[8]. Yusof, M., and Dodd, T., Pangolin: A Variable Geometry Tracked Vehicle with Independent Track Control, Field Robotics, pp. 917-924.

[9]. Day, C.-P., Robotics in Industry—Their Role in Intelligent Manufacturing. Engineering, 2018. 4(4): p. 440-445.

[10]. J. Lee, G. Park, J. Shin and J. Woo, Industrial robot calibration method using denavit — Hatenberg parameters, 17th International Conference on Control, Automation and Systems (ICCAS), 2017, pp. 1834-1837.

[11]. Sani, N. S., Shamsuddin, I. I. S., Sahran, S., Rahman, A. H. A and Muzaffar, E. N, Redefining selection of features and classification algorithms for room occupancy detection, International Journal on Advanced Science, Engineering and Information Technology, 2018, 8(4-2), pp. 1486-1493.

[12]. Holliday, J. D., Sani, N., and Willett, P., Calculation of substructural analysis weights using a genetic algorithm, Journal of Chemical Information and Modeling, 2015, 55(2), pp. 214-221.

[13]. Holliday, J. D., N. Sani, and P. Willett, Ligand-based virtual screening using a genetic algorithm with data fusion, Match: Communications in Mathematical and in Computer Chemistry, 80, pp. 623-638.

[14]. SamsiahSani, N., Shlash, I., Hassan, M., Hadi, A., and Aliff, M, Enhancing malaysia rainfall prediction using classification techniques, J. Appl. Environ. Biol. Sci, 2017, 7(2S), pp. 20-29.

[15]. Sani, N.S., Rahman, M.A., Bakar, A.A., Sahran, S. and Sarim, H.M, Machine learning approach for bottom 40 percent households (B40) poverty classification, International Journal on Advanced Science, Engineering and Information Technology, 2018, 8(4-2), pp.1698-1705.

[16]. Kim, J.-H., S. Jo, and B.Y. Lattimer, Feature Selection for Intelligent Firefighting Robot Classification of Fire, Smoke, and Thermal Reflections Using Thermal Infrared Images. Journal of Sensors, 2016. 2016: p. 13.

[17]. Tanaka, F., et al., Telepresence robot helps children in communicating with teachers who speak a different language, in Proceedings of the 2014 ACM/IEEE international conference on Human-robot interaction. 2014, ACM: Bielefeld, Germany. p. 399-406.

[18]. J. Ahn and G. J. Kim, Remote collaboration using a tele-presence mobile projector robot tele- operated by a smartphone, IEEE/SICE International Symposium on System Integration (SII), 2016, pp. 236-241.

[19]. Harik, E.H. and A. Korsaeth, Combining Hector SLAM and Artificial Potential Field for Autonomous Navigation Inside a Greenhouse. Robotics, 2018. 7(2): p. 22.

[20]. Acosta Calderon, C.A., E.R. Mohan, and B.S. Ng, Development of a hospital mobile platform for logistics tasks. Digital Communications and Networks, 2015. 1(2): p. 102-111.

[21]. H. Hyung, B. Ahn, B. Cruz and D. Lee, Analysis of android robot lip-sync factors affecting communication, 11th ACM/IEEE International Conference on Human-Robot Interaction (HRI), 2016, pp. 441-442.

[22]. R. N. Haksar and M. Schwager, Distributed Deep Reinforcement Learning for Fighting Forest Fires with a Network of Aerial Robots, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018, pp. 1067-1074.

[23]. J. Raju, S. S. Mohammed, J. V. Paul, G. A. John and D. S. Nair, Development and implementation of arduino microcontroller based dual mode fire extinguishing robot, IEEE International Conference on Intelligent Techniques in Control, Optimization and Signal Processing (INCOS), 2017, pp. 1-4.

[24]. Tushar Nandkishor Satbhai, R.M.K., Anant Vijay Patil, Manish Patil, Fire Fighting Robot. International Journal on Recent and Innovation Trends in Computing and Communication (IJRITCC), 2016. 4(4): p. 799- 803.

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Review Article: Virtual Helping Hand Tool for Online Donations in India

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ABSTRACT

The present review work undertaking that aims to address a significant challenge facing our world today. A number of donation websites have become popular for charitable causes. In this literature review, overview of this webpage, its impact on social media & its importance are covered. The review also gives the information about use of PHP, HTML, CSS, JavaScript, and My SQL to power. This study also involves the development of a new technology that has the potential to make a positive impact on society. This study is focused on using engineering innovation to solve real-world problems. Virtual helping hand tool is very useful for needy people all over the world. Our research focuses on increasing knowledge about the non-profit sector and improving the practices of giving, volunteering, fundraising, non-profit organization management, and other aspects of philanthropic activity.

Keywords: Online tool, Helping hand, website, donations Engineering and Technology.

I. INTRODUCTION

A number of online platforms are available to get information about donations. In most of the online tool user can browse through several lists and choose the donation accordingly. Many times, needy people can't get help because they don't have a network where they can ask for it. For such people, donation websites become very useful as they contain their own large network. They can ask for help on such platforms, and donors who are able to help them can help them solve their problem. Online donation tools can help us cover the costs associated with materials, equipment, and testing, as well as provide us with the resources we need to continue our research and development. One more advantage of such platforms is that they promote human transparency—transparency about information, financial actions, etc. The donor and receiver can also contact each other directly through such platforms. The donor must feel confident that their donation is received by really needy people, and this can be achieved by such online platforms. To make the donation process as easy and user-friendly as possible, we have integrated payment gateways such as PayPal, Stripe, and Square into our website. These secure payment options allow you to donate online using your preferred payment method.

Online donation tools can help us to cover the costs associated with materials, equipment, and testing, as well as provide us with the resources we need to continue our research and development. One more advantage of such platforms is that they promote human transparency—transparency about information, financial actions, etc. The donor and receiver can also contact each other directly through such platforms. The donor must feel confident that their donation is received by really needy people, and this can be achieved by such online platforms[1].

To make the donation process as easy and user-friendly as possible, we have integrated payment gateways such as PayPal, Stripe, and Square into our website. These secure payment options allow you to donate online using your preferred payment method. Additionally, we provide clear information on the different types of donations we accept and how they can support our project.

Though online donation platforms have so many benefits, there are challenges they may face. Donors may refuse to help through online platforms due to concern about the security of their financial information. They may also be concerned about the misuse of funds and fraud. A review of literature reveals that donation behaviours have been extensively studied, especially in social psychology and marketing. Extant research has employed several terms to reflect donation behaviours such as prosodical, altruistic, helping, charitable-giving, volunteering, contribution, and donation. In 2020, Americans donated $471 billion to charitable organizations (Giving USA, 2021). These charities and non-profits are tasked with addressing some of the world's most pressing problems. Whether trying to cure cancer, protecting human and animal rights, caring for the sick or elderly, or advocating for the environment, charities are critical to the functioning of human society. Most non-profits rely on voluntary.

1. Online Donations tool available in India:

Today is the age of the internet; many jobs, even teaching, go on online platforms; likewise, philanthropy also goes on online platforms. These platforms allow people to get information about needy people all over the world. The user can browse through several lists and choose the donation accordingly [2].

Many times, needy people can't get help because they don't have a network where they can ask for it. For such people, donation websites become very useful as they contain their own large network. They can ask for help on such platforms, and donors who are able to help them can help them solve their problem.

One more advantage of such platforms is that they promote human transparency—transparency about information, financial actions, etc. The donor and receiver can also contact each other directly through such platforms. The donor must feel confident that their donation is received by really needy people, and this can be achieved by such online platforms [3].

These days, donation websites have become popular for charitable causes. In this literature review, our team tries to cover a few points, like an overview of this webpage, its impact on social media, its importance, etc.

2. List of some Donations platforms in India

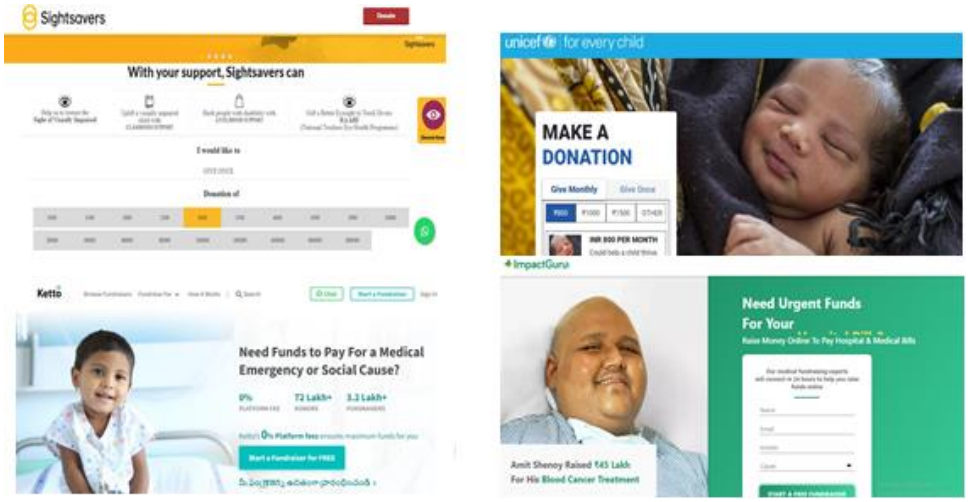
[1] Give India – Give India is one of the largest online donation platforms in India. It allows users to donate to a wide range of causes, including education, healthcare, and disaster relief. Give India has partnered with over 1,000 nonprofits across India and has raised over Rs. 2,000 crore in donations.

[2] Milaap - Milaap is another popular online donation platform in India. It allows users to donate to various causes, including healthcare, education, and disaster relief. Milaap has raised over Rs. 1,500 crore in donations and has helped over 500,000 people.

[3] Ketto - Ketto is a crowd funding platform that allows users to raise funds for various causes, including medical emergencies, education, and animal welfare. Ketto has raised over Rs. 1,000 crore in donations and has helped over 3, 00,000 people.

[4] Impact Guru – Impact Guru is another crowd funding platform that allows users to raise funds for various causes, including medical emergencies, education, and social causes. Impact Guru has raised over Rs. 1,000 crore in donations and has helped over 1, 00,000 people.

[5] Akshaya Patra - Akshaya Patra is a nonprofit organization that provides mid-day meals to school children across India. They have an online donation portal where users can donate to support their cause.



3. Need for Online Donation tools:

As there are many people who seeks financial help, but they were unfortunate to get it! So the Online Donation tools provides them a platform with which they can fulfill their needs such as food, cloth, education, shelter etc. Such website also focused on the animal and cultural heritage as well as the plantation. With the help of this website, most of the problem can be solved. Donation website is designed to make it easy for people to support charities and causes that align with their values and passions. We understand that there are many organizations and causes that require funding to carry out their important work, and we strive to provide a platform that connects generous donors with those in need[4-6].

Demand of user-friendly and secure websites increases day by day. Users can browse through the list of charities and causes on online platform to find one that resonates and then make a donation in just a few clicks.

II. CONCLUSION

There are many online donation tools/platform available in India. Especially after covid 19 pandemic people were looking for many safe and convenient websites/ways to donate to various causes. Platforms available on

the internet are mainly raising funds for various different causes. They set a goal of certain amount while raising any fund and once they reach their goal they donate it. Many multinational companies, various NGOs, as well as individuals donate to various causes. Donation websites have become a very useful and important tool for promoting philanthropy and social responsibilities. Donors and receivers both have access to contacting each other all over the world. However, to make such platforms more impactful, they must overcome any challenges they may face. Effectively designed websites can positively enhance the donors' perceptions so as to facilitate online donations .We can bring such technologies, to the market and make a positive difference in people's lives.

III. ACKNOWLEDGEMENT

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IV.REFERENCES

[1]. https://dribbble.com/tags/website
[2]. https://openai.com/blog/chatgpt, AI Tool
[3]. https://www.apnacollege.in/
[4]. https://www.codewithharry.com/videos/which-programming-language-to-learn-first/
[5]. Adrian Sargeant and Elaine Jay, 2003, The fundraising performance of charity websites: A US/UK comparison.
[6]. A literature review of experimental studies in fundraising, Abhishek Bhati, Ruth K. Hansen Journal of Behavioural Public Administration, 3(1), pp. 1-19, DOI: 10.30636/jbpa.31.129.

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Review article : Online Voting System

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ABSTRACT

E-voting means the process of voting in which electronic devices are used. No one is visiting the voting places because of their hectic schedules these days. Due to their rigid timetables, the majority of us must wait in line for extended periods of time to cast our votes. So we developed an online voting mechanism. Think about a corporate voting system that uses the internet to pick the organization's president, secretary, or other important administrators once a year. A safe, verifiable online voting system is shown in our proposal. It enables voters to cast a secret ballot in the public system to take advantage of early voting and is extremely helpful in pandemics like COVID-19. The proposed system is intended to support the election process by using the unique identification of the voter. Since this method is electronic, it may be evaluated online from any legitimate personal space in the world.

Keywords: Online voting, ballot, election, unique identification.

I. INTRODUCTION

Voting is now required in democratic cultures in order to resolve any social issue. Making voting easier and more effective is, therefore, increasingly crucial. Elections are held everywhere. Voters must, however, travel to the voting place in order to cast their ballot. Voting is advanced through a rather complicated procedure called political membership. It requires manual labour. Government elections are held by area. The voter must be present at the voting site in order to cast their vote. This might decrease voter support, yet web-based voting makes this task simpler. As a result, Ballet will become more usable and productive. Voters will be able to cast their ballots at their convenience from a distance using the online web-based voting method. Identity theft is a possible danger to online voting system. But this can be overcome by verifying the E-mail id entered by the voter. Hence this will help to maintain the security of the voting system.

Our proposed system includes a website for E-voting. Therefore, there is a strong argument for proposing novel designs, protocols, methodologies, and tools for their design and development, as well as their security evaluation, given the prevalence of security concerns in e-voting systems and their rising popularity.

II. METHODS AND MATERIAL

Electronic commerce, e-democracy, e-government, and other technology-related fields are becoming increasingly digital thanks to the fast advancement of technology and the popularity of the Internet. The modern states are attempting to provide individuals who can engage in and profit from online services by expanding the number of activities related to this new medium in order to save expenses in public departments. One of the most significant Internet-related activities is electronic voting. Advantages of the e-voting can be stated as: (1) By using electronic voting, unfavorable human mistakes can be reduced or eliminated., (2) in addition to being reliable, the online voting system does not need geographical proximity of voters which increase the number of participating voters, (3) e-voting saves a lot of time for voters and reduce the cost when counting the voted ballots.

1) Our approach

In order to vote using this system, the voters will first have to register themselves on the platform. Registration can be done using their E-mail id. Once verification of the Email-id provided by the voter is done then the voter will be eligible to cast a vote. For the time being, this website is made with 'No Code Development'.
Augmented reality is an interesting field for the application of this concept, as it enables user interaction with different technologies. The purpose and design goal of the system is to provide a solution for problems that are listed in the abstract section. Design goals are specification which the system needs to achieve. The website will be easily scalable and extensible to add new features. And also, it will be easily modifiable to make changes on the functionalities. To achieve these good functionalities an open documentation of the system is very important. The maintainability of the system includes: adding new functionalities or changes to the system, adapting changes to the government policy, fixing errors on the system and increase system's maintainability and reliability. This system will be effective, reliable, secure and user friendly.

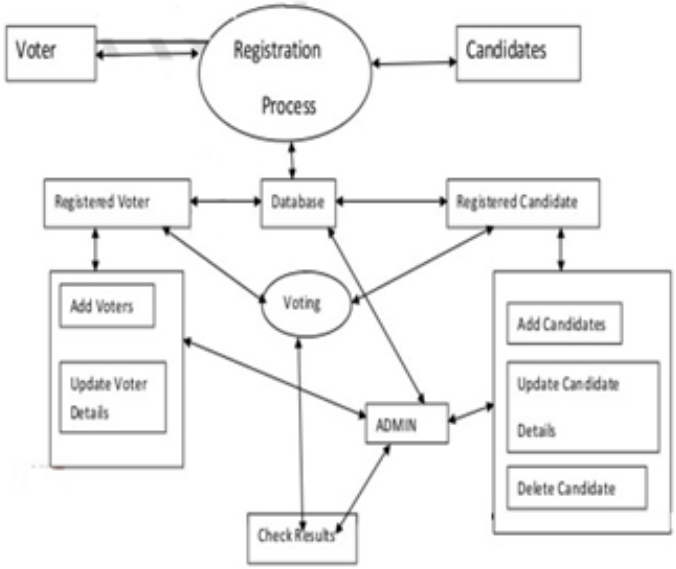
2) Future approach

Security and unique identification of the voter is necessarily required. Hence in the upcoming days we will be using the voter's Aadhar card number for unique identification. Aadhar number of every resident is linked to their very own phone number. This will allow us to send One Time Password (OTP) to the voter for verification purpose. In this way, unique identification of the voter can be done and the voter will be able to cast a single vote. Hence problems such as identity theft and multiple voting can be avoided in a more systematic way. Along with the implementation of verification using Aadhar card number, this website will be made using php programming language in the future.

III. RESULTS AND DISCUSSION

The project will consist of two ends. One is a website which provides interface for user/voter, and other is server side which will be used to store all information related to our system. First we will create admin activity. The system, where admin can login, add candidates and create poll. We need to store the information in server.

The server will be having database management system, and all the implementation for storing the data are need to be done. Also it will provide retrieving the existing data for client. The client is nothing but application user interface .Once after this main work is done, we will be able to implement application for user. In which the users can register themselves and login to the application after the Aadhar number authentication and the voters will cast their votes and result calculation will be done.



Results can be reported and published faster by using this system. By being able to vote independently from their location, voters can save time and money. This may increase the overall voter turnout. Online voting system is of incredible efficiency. With traditional paper-based voting there are a lot of steps involved, from printing ballots to counting votes by hand. One can avoid all of that with online voting. With an online system, you can send out electronic ballots to all of your voters in just a few clicks. And once the voting period is over, the system will automatically tally the results, so you don't have to do it yourself, saving your organization a lot of time and money.

- **Minimize mistakes**

By eliminating the use of physical post and manual vote counting you can avoid result-distorting mistakes such as loss of voting documents and miscounted notes. Automatic vote counting with online voting allows you to access results shortly after the election. Results can also be checked with an outside tool. Double-voting and double counting of votes are not possible in this system. With just a click of the mouse, you'll get accurate election results.

- **Future scope and enhancement**

As this website provides better way of election between voter and political parties; hence we suppose that this project has a greater scope and is important requirement to provide a compact and stable system of voting. Data may be effectively and securely maintained on the cloud. We will developed the online voting system for only one particular booth, this should be extended to all polling booths in India.

IV. CONCLUSION

This paper focused on the analysis of E-voting website. If utilized in a genuine election process, this technology will be quite usable. Voting will be made extremely simple by utilizing this website, which will be useful for those who want to participate. After the system has been proven, we will likely add further functionality for security constraints and uniqueness, which will offer very good protection for the private vote information.

V. REFERENCES

[1]. J. P. Gibson, R. Krimmer, V. Teague, and J. Pomares, "A review of E-voting the past, present and future", Annals of Telecommunications, pp. 18, [2016].

[2]. "Survey on Digital E Voting System by using Blockchain Technology," International Journal of Advance Scientific Research and Engineering Trends, 2019.

[3]. Rachid Anane, Richard Freeland and Georgios Theodoropoulos, "E-voting requirements and implementation", in The 9th IEEE CEC/EEE 2007. IEEE, pp. 382-392, [2007].

[4]. Pavel Tarasov and Hitesh Tewar, "The Future of E-Voting", Iadis International Journal on Computer Science and Information Systems Vol. 12, No. 2, pp. 148-165, ISSN: 1646-3692, [2017].

[5]. Yi Liu and Qi Wang, "An E-voting Protocol Based on Blockchain"; ACM, [2010].

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Development of Friend Zone App with Advanced Features: Grippy!

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ABSTRACT

We understand that making new friends can be challenging, whether you're moving to a new city, starting a new job, or simply looking to expand your social circle. That's why we've created this app, designed to help you meet like-minded individuals who share your interests, hobbies, and values. With our app, you can create a profile that showcases your personality and interests, browse through other profiles, and start chatting with potential new friends. You can also join groups based on your interests, participate in virtual events, and even organize your own meetups and can make your own community based on interest. Our mission is to make it easy and fun for you to find new friends and foster meaningful connections. Whether you're looking for a hiking buddy, a workout partner, or just someone to grab a coffee with, our app is the perfect place to start. There's "The Fault in Our Stars" by John Green, which tells the story of two teenagers, Hazel and Gus, who meet at a cancer support group and develop a deep connection. As they navigate the challenges of their illness, their friendship blossoms into something more, showing that even in the darkest of times, friendship can bring light and hope. These works of literature remind us of the importance of friendship and the power it has to enrich our lives. Whether we're reading about the adventures of Tom Sawyer and Huck Finn, the struggles of Amir and Hassan, or the love between Hazel and Gus, we're reminded of the beauty and complexity of this special bond

Keywords: Friendzone app, Social media, Grippy, app

I. INTRODUCTION

The functions of this app enable the user to hunt a number of varieties of traits in a person, match them with theirs and get to know them on the basis of their likings. Making such apps can also come in handy for people with introverted characteristics since it'll allow them to know people faster than usual. It also can prove to be a platform for social awareness or various different kinds of things. Grippy doesn't solely aim to be a single purpose app. Its functionalities and qualities will allow it to be all inclusive and accessible for all categories of people. Also, things that make it unique include novel features and ideas for the sake and comfort of our users.

Since we envision our app to be the ideal place of meet, talk, entertainment, work and whatever else the mob wants it to be in the near future.

II. METHODS AND MATERIAL

GGr Grippy is a social media app designed mindfully for the purpose of giving people an opportunity to connect with each other and know their interests in a unique way. Having a guide buddy to help you socialize in an effective way can prove to be very beneficial in today's world. Where it might seem very difficult or rather impossible to approach someone in person, Grippy makes sure that you get in touch with those in your radar of similar interests making it way easier to make connections. This also includes individuals from various different sectors and age groups since we aim our app to be all inclusive and easy to use for all [1].

The aim of a friendship app is to create a platform that helps people connect with others and build meaningful relationships. The objectives of such an app may include:

Facilitating social connections: The app should enable users to find and connect with like-minded individuals who share their interests, hobbies, and values. This can be achieved through features such as customizable profiles, search filters, and chat functions[2].

Fostering community: The app should create a sense of community among its users, promoting a positive and supportive environment where people feel comfortable sharing their experiences and making new friends.

Encouraging communication: The app should encourage open and honest communication among its users, providing opportunities for dialogue and engagement through features such as discussion forums, virtual events, and group messaging.

Ensuring safety and security: The app should prioritize the safety and security of its users, implementing measures such as user verification, content moderation, and reporting mechanisms to prevent harassment and abuse.

Providing value-added services: The app should offer value-added services that enhance the user experience and facilitate meaningful connections, such as personalized recommendations, icebreaker activities, and social events.

Community where you can share similar mindset and ideas that will help you to build a project or something extraordinary.

Overall, the aim and objectives of a app should revolve around creating a platform that helps people find and foster genuine community or people, fostering a positive and supportive community, and providing a safe and enjoyable user experience.

Recommended features

A friendship or community building app could have several features to help users connect and build relationships. Here are some potential features:

Profile creation: Users should be able to create a profile that highlights their interests, hobbies, and personality traits.

Search functionality: Users should be able to search for other users based on common interests, location, or other criteria.

Matching algorithm: The app could use a matching algorithm to suggest potential friends based on shared interests, personality traits, and other factors.

Messaging: Users should be able to send and receive messages within the app to start conversations and build relationships.

Group creation: Users could create or join groups based on shared interests, such as hiking, cooking, or book clubs.

Event planning: The app could have a feature that allows users to plan and organize events, such as meetups or group outings.

User reviews: Users could leave reviews or ratings for other users they have connected with to help build trust and credibility within the community.

Privacy settings: Users should have control over their privacy settings, including who can view their profile and who can send those messages.

In-app notifications: The app could send notifications to users when they receive a new message, when someone matches with them, or when an event is planned in their area.

Integration with social media

Posting options can share their interests through pictures or videos. Creating an interesting username or an f-name for making the profile interesting and fun.

III. RESULTS AND DISCUSSION

Some foreign social media apps such as Whats App, Facebook, Instagram and Snap chat used by a huge crowd in India serve as an example of how effective the online mode of exploration can be for many people. Similar Indian apps include,

1) Share Chat
2) Moj
3) Public
4) Josh etc.

Most of these have replaced the Chinese app “Tik Tok” proving to be replaceable and efficient in the same way that most foreign apps can be. However, we still feel the need to upgrade our productivity standards when it comes to the proposal and execution of such apps, since thinking global is the need of the hour.

IV. CONCLUSION

There exist many such platforms that make it possible for humans to interact with each other, some might even suggest making another app like this as non-retrospective or baseless. But we need to understand that something simple can always give birth to something extraordinary. Where people get involved, the outcomes

are sensational and one such opportunity of doing it is our app Grippy. In the making of this platform, we make sure that it remains personal and secure for the user. Since security is one of the main goals of our team no user data can be harmed in the process. An effectively designed app can positively enhance people's perception so as to facilitate online social engagement and make it user-friendly. Bringing such technologies in the market has great impact on the public, let us make a positive one if we can.

V. REFERENCES

[1]. Conceptualizing the Friend zone Phenomenon, Leah LeFeberv, 35 2022, Imagination, Cognition, and Personality.

[2]. A review of the Social Impacts of Culture and Sport, Peter Taylor, Larissa Davies, Peter Wells, Jan Gilbertson and William Tayleur,2015.

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Cancer Classification Using Machine Learning Techniques

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ABSTRACT

Cancer affects more women than any other type of cancer worldwide, and it is getting more common in developing nations where the majority of cases are found at advanced stages. The projects that have already been put forth demonstrate a comparison of machine learning algorithms utilising various methodologies, including ensemble methods, data mining algorithms, and using blood analysis, among others. On the Wisconsin Diagnostic Breast Cancer (WDBC) dataset, which is taken from a digitised image of an MRI, this paper compares six machine learning (ML) algorithms: Random Forest (RT), Nearest Neighbour (KNN), Support Vector Machine (SVM), and Decision Tree (DT). The dataset was divided into training and testing phases in order to implement the ML algorithms. The website's backend will employ the algorithm that produces the best results, and the model will categorise the tumour as benign or malignant.

Keywords— Breast cancer classification, Breast cancer prediction, benign, malignant, Naïve, KNN, Support Vector Machine, Artificial Neural Network, Random Forest, Decision tree.

I. INTRODUCTION

This study used machine learning and other methods like ultrasonography to compile data from ten separate studies on breast cancer. blood testing, etc. The initiative by S. Gokhale makes use of the ultrasonography (USG) technique, a potent tool for identifying breast mass features that are typically not visible even by mammography. Another effort by Pragya Chauhan and Amit Swami is based on the ensemble method, which is typically employed to improve breast cancer prediction accuracy. For the prediction of several models, a genetic algorithmbased weighted average method that takes crossover and mutation into account is used. Additionally, a project by Abien Fred M. Agarap classifies the dataset into benign and malignant using a variety of techniques, including GRU-SVM, NN, multilayer perceptron (MLP), and softmax regression. The comparison of less invasive techniques like Classification and Regression Trees (CART), random forest, nearest neighbour, and boosted trees is shown in a project by Priyanka Gupta. The best accurate model for predicting cancer survivability rate is extracted from these four classification models. The blood analysis dataset from UCI is used in yet another study by Muhammet Fatih Aslan, Yunus Celik, Kadir Sabanci, and Akif Durdu. It pulls information from techniques like the Extreme Learning Machine (ELM), ANN, etc. Additionally, MATLAB GUI environment for classification with ANN has been added.AUC values, Fmeasure metrics, and prediction

accuracy values are three indicators utilised in a project by Yixuan Li and Zixuan Chen to compare the performance of these five classification models. Other studies demonstrate that the random forest model can perform and adapt more effectively than the other four approaches. a project by Mumine Kaya Keles that compares the categorization algorithms used in data mining. This research applies four data mining methods from another project by Sang Won Yoon and Haifeng Wang: support vector machine (SVM), naive and adaBoost tree. Furthermore, because it has a significant impact on the effectiveness and efficiency of the learning process, feature space is extensively discussed in this paper. Last but not least, a project by Wenbin Yue and Zidong Wang demonstrates the algorithms that assisted them in diagnosing and predicting the dataset they used.

II. PROBLEM STATEMENT

One of the most prevalent cancers in women worldwide is breast cancer. Breast cancer survival rates and patient outcomes can be greatly enhanced by early and accurate identification. However, there are drawbacks to the current techniques for diagnosing breast cancer, such as mammography and biopsy, including low sensitivity and specificity as well as the possibility of false positives and negatives. Consequently, a more precise and trustworthy method of diagnosing breast cancer is required. In order to increase the precision and effectiveness of breast cancer detection, the objective of this project is to design and test a machine learning algorithm for breast cancer diagnosis utilising clinical data and imaging features.

III. AIM

The aim of this study is to develop a machine learning algorithm for breast cancer diagnosis that can accurately classify breast lesions as malignant or benign using clinical and imaging data, with the goal of improving the accuracy and efficiency of breast cancer diagnosis. This study will explore the use of feature selection techniques and advanced machine learning algorithms, such as random forests and support vector machines, to optimize the performance of the model. The ultimate aim of this study is to provide clinicians with a reliable and effective tool for early and accurate breast cancer diagnosis, which can ultimately lead to better patient outcomes and survival rates.

IV. OBJECTIVE

The objective of this study is to develop and evaluate a machine learning algorithm for breast cancer diagnosis that can accurately classify breast lesions as malignant or benign using clinical data.

V. LITERATURE REVIEW

"**Machine Learning in Cancer Diagnosis and Prognosis" by N. Yousaf and M. Bhatti (2017)** - This paper reviews the application of machine learning techniques in cancer diagnosis and prognosis, focusing on breast cancer, lung cancer, and leukemia. (Journal of Medical Systems)

"**A Review of Machine Learning Methods for Cancer Prediction and Diagnosis" by A. Mohan and V. Mishra (2018) -** This paper provides an overview of machine learning algorithms used for cancer prediction and diagnosis, including support vector machines, decision trees, and artificial neural networks. (Journal of Medical Systems)

"A Survey on Machine Learning Techniques for Cancer Detection and Diagnosis" by S. Sundararaman et al. (2020) - This paper surveys recent machine learning techniques used for cancer detection and diagnosis, including convolutional neural networks, random forests, and K-nearest neighbors. (Journal of Ambient Intelligence and Humanized Computing)

"A Review of Machine Learning Methods for Cancer Survival Prediction" by L. Wu et al. (2019) - This paper reviews machine learning methods used for predicting cancer survival, including Cox proportional hazards regression, decision trees, and random forests.
(Expert Review of Molecular Diagnostics)

"Machine Learning for Cancer Detection and Diagnosis: A Systematic Review" by R. Srinivasan et al. (2019) - This paper provides a systematic review of machine learning algorithms used for cancer detection and diagnosis, including logistic regression, support vector machines, and deep learning models.
(Journal of Computational Science)

"A Review of Machine Learning Approaches for Cancer Genomic Data Analysis" by Y. Guan et al. (2018) - This paper reviews machine learning approaches used for analyzing cancer genomic data, including gene expression analysis, mutation detection, and pathway analysis.
(Briefings in Bioinformatics)

"Machine Learning in Cancer Diagnosis and Prognosis: A Review" by M. Taghizadeh et al. (2019) - This paper reviews the application of machine learning techniques in cancer diagnosis and prognosis, focusing on breast cancer, prostate cancer, and lung cancer.
(Journal of Medical Imaging and Health Informatics)

"Machine Learning for Cancer Immunotherapy Outcomes Prediction: A Review" by S. Sinha et al.
(2021) - This paper reviews the use of machine learning for predicting outcomes of cancer immunotherapy, including response rates and survival outcomes. (Frontiers in Immunology)

"Machine Learning Approaches in Cancer Diagnosis and Prognosis" by V. Arora and R. Gupta (2020) - This paper reviews machine learning approaches used in cancer diagnosis and prognosis, including clustering algorithms, decision trees, and support vector machines. (Expert Review of Molecular Diagnostics)

"Machine Learning-Based Approaches for Cancer Detection and Diagnosis: A Comprehensive Review" by A. Rezaei and H. Rabbani (2019) - This paper provides a comprehensive review of machine learning-based approaches used for cancer detection and diagnosis, including feature selection, classification algorithms, and model validation methods. (Computers in Biology and Medicine)

"Machine Learning for Cancer Detection: A Review" by J. Ye et al. (2020) - This paper reviews recent machine learning approaches used for cancer detection, including deep learning, transfer learning, and unsupervised learning. (Journal of Healthcare Engineering)

"Machine Learning Methods for Cancer Drug Discovery" by S. Srinivasan et al. (2020) - This paper reviews machine learning methods used for cancer drug discovery, including virtual screening, QSAR modeling, and pharmacophore-based approaches. (Expert Opinion on Drug Discovery)

"Machine Learning Techniques for Cancer Prognosis and Prediction: A Review" by J. Wang et al. (2020) - This paper reviews machine learning techniques used for cancer prognosis and prediction, including feature selection, classification algorithms, and survival analysis methods. (Computational and Structural Biotechnology Journal)

"A Comprehensive Review on Machine Learning Techniques in Cancer Diagnosis" by R. Patil et al. (2020) - This paper provides a comprehensive review of machine learning techniques used in cancer diagnosis, including decision trees, support vector machines, and neural networks. (Artificial Intelligence in Medicine)

"Machine Learning for Cancer Diagnosis and Prognosis: A Review of Literature" by S. Sathishkumar et al. (2018) - This paper reviews the application of machine learning techniques in cancer diagnosis and prognosis, focusing on breast cancer, colorectal cancer, and lung cancer. (International Journal of Computer Applications)

"Machine Learning Methods for Cancer Classification and Prediction" by M. Majumder et al. (2019) - This paper reviews machine learning methods used for cancer classification and prediction, including ensemble methods, feature selection, and data preprocessing techniques. (Journal of Molecular Biology)

"A Review of Machine Learning Techniques for Cancer Classification and Prediction" by A. Albadr et al. (2019) - This paper provides an overview of machine learning techniques used for cancer classification and prediction, including decision trees, support vector machines, and random forests. (Journal of Medical Systems)

"A Review of Machine Learning Methods for Cancer Diagnosis and Prognosis" by M. P. Rahman and M. Islam (2021) - This paper reviews machine learning methods used for cancer diagnosis and prognosis, including neural networks, decision trees, and ensemble methods. (Journal of Medical Imaging and Health Informatics)

"Machine Learning for Cancer Diagnosis and Prognosis: A Review of Recent Advances" by A. H. A. Al-Sharafi et al. (2020) - This paper reviews recent advances in machine learning for cancer diagnosis and prognosis, focusing on deep learning, transfer learning, and explainable AI methods. (International Journal of Environmental Research and Public Health)

"A Review on Machine Learning Techniques for Cancer Diagnosis and Prognosis" by A. M. A. Zaman and M. M. Hassan (2019) - This paper provides a review of machine learning techniques used for cancer diagnosis and prognosis, including feature selection, classification algorithms, and model evaluation methods. (Journal of Medical Imaging and Health Informatics)

"A Systematic Review on Machine Learning Techniques for Cancer Diagnosis and Prognosis" by S. U. Rehman et al. (2020) - This paper provides a systematic review of machine learning techniques used for cancer diagnosis and prognosis, including feature selection, classification algorithms, and survival analysis methods. (Expert Review of Molecular Diagnostics)

"Machine Learning for Cancer Diagnosis and Prognosis: A Review of Applications and Challenges" by H. Farhadi et al. (2020) - This paper reviews the application of machine learning techniques in cancer diagnosis

and prognosis, highlighting the challenges associated with data quality, feature selection, and model interpretability. (Frontiers in Artificial Intelligence)

"Machine Learning-Based Approaches for Cancer Diagnosis and Prognosis: A Comprehensive Review" by S. M. Hossain et al. (2020) - This paper provides a comprehensive review of machine learningbased approaches used for cancer diagnosis and prognosis, including feature selection, classification algorithms, and model evaluation methods.

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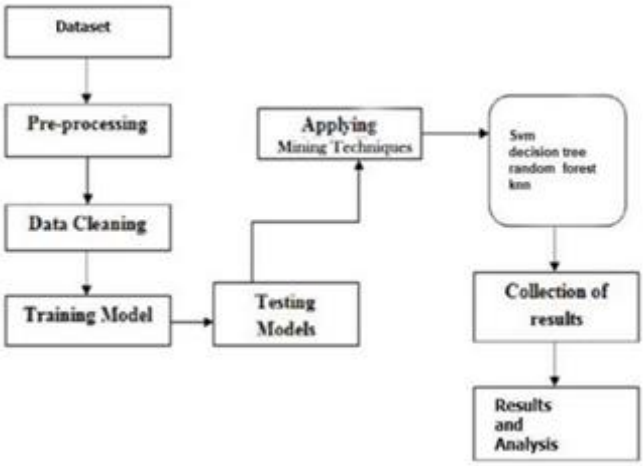
"Machine Learning Techniques for Cancer Detection: A Review" by S. K. Gupta et al. (2019) - This paper reviews machine learning techniques used for cancer detection, including decision trees, support vector machines, and neural networks. (Journal of Medical Systems)

"Machine Learning for Cancer Diagnosis and Prognosis: A Review" by X. Liu et al. (2020) - This paper provides a comprehensive review of machine learning techniques used for cancer diagnosis and prognosis, including deep learning, transfer learning, and explainable AI methods. (Briefings in Bioinformatics)

VI. SYSTEM DESIGN



Description of the Block Diagram:

- Data Collection: Collect clinical and imaging data from breast cancer patients.
- Preprocessing: Preprocess and clean the data to remove missing values and outliers, and normalize the data to ensure that features are on the same scale.
- Feature Extraction: Extract relevant features from the data, including imaging features such as texture, shape, and density, as well as clinical features such as age and family history.
- Feature Selection: Select the most relevant features using methods such as correlation analysis or feature importance ranking.

- Model Development: Develop a machine learning algorithm, such as a random forest or support vector machine, that can accurately classify breast lesions as malignant or benign.
- Training: Train the model using the extracted and selected features and appropriate training methods, such as cross-validation and regularization.
- Evaluation: Evaluate the performance of the model using appropriate metrics such as accuracy, sensitivity, specificity, and area under the ROC curve.
- Comparison: Compare the performance of the machine learning model to existing methods of breast cancer diagnosis, such as mammography and biopsy.
- Deployment: Deploy the machine learning model in a clinical setting and assess its clinical utility and impact on patient outcomes.
- Improvement: Continuously improve the machine learning model and system by incorporating new data, features, and techniques.

VII. RESEARCH METHODOLOGY

Methodology:

- Data Collection: Collect clinical data from breast cancer patients using a variety of sources, such as medical records, radiology reports, and pathology reports.
- Data Preprocessing: Preprocess and clean the data to remove missing values and outliers, and normalize the data to ensure that features are on the same scale. This may involve methods such as imputation, standardization, and outlier detection.
- Feature Extraction: Extract relevant features from the data, including imaging features such as texture, shape, and density, as well as clinical features such as age and family history. This may involve methods such as image segmentation, feature engineering, and dimensionality reduction.
- Feature Selection: Select the most relevant features using methods such as correlation analysis, mutual information, or feature importance ranking. This will help reduce overfitting and improve the interpretability of the model.
- Model Development: Develop a machine learning algorithm, such as a random forest or support vector machine, that can accurately classify breast lesions as malignant or benign using the extracted and selected features.
- Model Training and Validation: Train the model using appropriate methods such as cross-validation and regularization to ensure that it is robust and generalizes well to new data. Validate the model using appropriate metrics such as accuracy, sensitivity, specificity, and area under the ROC curve.
- Comparison to Existing Methods: Compare the performance of the machine learning model to existing methods of breast cancer diagnosis, such as mammography and biopsy, to assess its potential clinical utility and impact on patient outcomes.
- Deployment and Evaluation: Deploy the machine learning model in a clinical setting and assess its clinical utility and impact on patient outcomes. This may involve methods such as decision curve analysis, cost-effectiveness analysis, and patient satisfaction surveys.

- Improvement: Continuously improve the machine learning model and system by incorporating new data, features, and techniques. This may involve methods such as transfer learning, ensemble methods, and deep learning.
- Overall, the methodology for this study involves a combination of data preprocessing, feature extraction and selection, machine learning model development and validation, comparison to existing methods, and deployment and evaluation in a clinical setting. The methodology emphasizes the importance of robustness, generalizability, and clinical utility of the developed algorithm.

VIII. ALGORITHMS

A. Random Forest Algorithm

Random Forest is a popular machine learning algorithm that belongs to the supervised learning technique. It can be used for both Classification and Regression problems in ML.

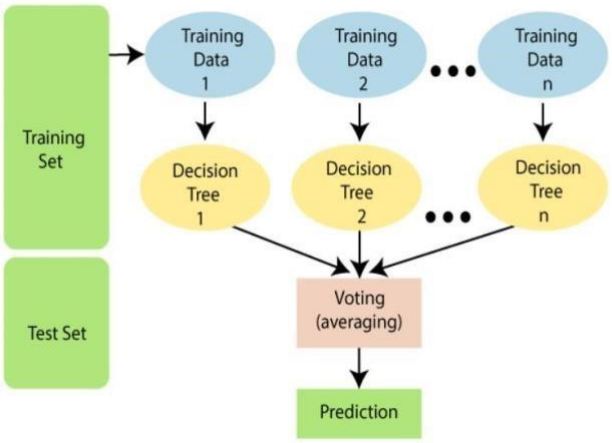


Figure1.1: Random Forest Algorithm

B. Assumptions for Random Forest:

Since the random forest combines multiple trees to predict the class of the dataset, it is possible that some decision trees may predict the correct output, while others may not. But together, all the trees predict the correct output. Therefore, below are two assumptions for a better Random forest classifier: There should be some actual values in the feature variable of the dataset so that the classifier can predict accurate results rather than a guessed result.The predictions from each tree must have very low correlations

C. Working of Random Forest Algorithm:

Data Preparation: The first step in using Random Forest is to prepare the data. This involves collecting and cleaning the data, and then splitting it into training and testing sets.

Building Decision Trees: Random Forest creates a large number of decision trees, each of which is trained on a subset of the training data. Each tree is built using a random subset of the features and a

random subset of the data. This helps to reduce overfitting and improve the generalization of the model. Voting: Once all the trees are built, they are used to make predictions on the testing data. Each tree predicts the class label for the given data point, and the final prediction is made by taking the majority vote of all the trees. This voting process is known as bagging or bootstrap aggregation.

Improving Performance: Random Forest can be further optimized by tuning hyperparameters such as the number of trees, the depth of each tree, and the number of features used in each split. Cross-validation can also be used to evaluate different combinations of hyperparameters and select the best model. Prediction: Once the Random Forest model is trained and optimized, it can be used to make predictions on new data. The new data is input into the model, and the model outputs a prediction for the class label of the data. Overall, Random Forest is a powerful machine learning algorithm that combines the predictive power of multiple decision trees to create a more accurate and robust model. Its ability to handle complex datasets with many features and its high accuracy and speed make it a popular choice in many applications, including healthcare, finance, and marketing.

D. Support Vector Machine (SVM):

Support Vector Machine (SVM) is a powerful supervised learning algorithm used for binary classification tasks. The main idea behind SVM is to find the optimal hyperplane that separates the two classes with the maximum margin. In other words, it finds the hyperplane that maximizes the distance between the closest data points of each class.SVM works by first transforming the input data into a higherdimensional feature space using a kernel function. This allows the data to be separated by a hyperplane that may not be linear in the original input space. The most commonly used kernels are linear, polynomial, and radial basis function (RBF). The optimal hyperplane is found by solving an optimization problem that aims to minimize the classification error while maximizing the margin. The margin is defined as the distance between the hyperplane and the closest data points of each class. SVM selects the hyperplane that maximizes the margin, which ensures better generalization performance on new, unseen data.

SVM has several advantages over other classification algorithms. It can handle high-dimensional data and non-linear boundaries, and it is less prone to overfitting. SVM can also handle unbalanced datasets, where the number of data points in each class is not equal.

E. K-Nearest Neighbors (KNN):

K-Nearest Neighbors (KNN) is a simple, nonparametric, lazy algorithm used for classification tasks. In KNN, the classification of a new data point is based on the class of its k-nearest neighbors in the training set. The value of k is a hyperparameter that needs to be chosen by the user.KNN works by first computing the distance between the new data point and all data points in the training set. The most commonly used distance metric is the Euclidean distance, but other metrics such as Manhattan distance and Minkowski distance can also be used. Then, the k-nearest neighbors are selected based on their distance to the new data point.The classification of the new data point is based on the majority class of its k-nearest neighbors. If k=1, then the new data point is assigned to the same class as its nearest neighbor. If k>1, then the class with the highest frequency among the k-nearest neighbors is assigned as the output.KNN has several advantages, such as being easy to understand and

implement. It can also handle non-linear decision boundaries and is less sensitive to outliers. However, KNN can be computationally expensive for large datasets since it requires computing the distance between the new data point and all data points in the training set. KNN is also sensitive to the value of k, and selecting the optimal value of k can be a challenging task.KNN is commonly used in pattern recognition, image processing, and recommendation systems. It can also be used in combination with other algorithms, such as in ensemble learning, to improve the overall classification performance.

IX. EXPECTED OUTCOME

The expected outcome of this study is a machine learning algorithm for breast cancer diagnosis that can accurately classify breast lesions as malignant or benign using clinical and imaging data, with a high degree of accuracy, sensitivity, and specificity. The algorithm will be trained and validated using appropriate methods such as cross-validation and feature selection to ensure its robustness and generalizability to new data. The algorithm will also be compared to existing methods of breast cancer diagnosis, such as mammography and biopsy, to assess its potential clinical utility and impact on patient outcomes.

It is expected that the developed algorithm will improve the accuracy and efficiency of breast cancer diagnosis, leading to earlier detection of breast cancer and better patient outcomes. In addition, the algorithm will provide clinicians with a reliable and effective tool for breast cancer diagnosis, which can reduce the need for invasive procedures such as biopsies and improve the overall patient experience. Overall, the expected outcome of this study is a significant advancement in the field of breast cancer diagnosis and an important contribution to the improvement of cancer care.

X. REFERENCES

[1]. ” Ultrasound characterisation of breast masses”, The Indian journal of radiology imaging by S. Gokhale., Vol. 19, pp. 242-249, 2009. K. Elissa, “Title of paper if known,” unpublished.

[2]. “Breast Cancer Prediction Using Genetic Algorithm Based Ensemble Approach” by Pragya Chauhan and Amit Swami, 18 October 2018

[3]. “On Breast Cancer Detection: An Application of Machine Learning Algorithms on the Wisconsin Diagnostic Dataset” by Abien Fred M. Agarap, 7 February 2019

[4]. “Analysis of Machine Learning Techniques for Breast Cancer Prediction” by the Priyanka Gupta and Prof. Shalini L of VIT university, vellore, 5 May 2018.

[5]. “Breast Cancer Diagnosis by Dierent Machine Learning Methods Using Blood Analysis Data“by the Muhammet Fatih Aslan, Yunus Celik , Kadir Sabanci and Akif Durdu, 31 December, 2018

[6]. ” Performance Evaluation of Machine Learning Methods for Breast Cancer Prediction”, by Yixuan Li, Zixuan Chen October 18, 2018

[7]. “Breast Cancer Prediction and Detection Using Data Mining Classification Algorithms: A Comparative Study” by Mumine Kaya Keles, Feb 2019

[8]. "Breast Cancer Prediction Using Data Mining Method" by Haifeng Wang and Sang Won Yoon, Department of Systems Science and Industrial Engineering State University of New York at Binghamton Binghamton, May 2015.

[9]. "Machine Learning with Applications in Breast Cancer Diagnosis and Prognosis" by Wenbin Yue, Zidong Wang, 9 May 2018

[10]. Miller, K.D.; Ortiz, A.P.; Pinheiro, P.S.; Bandi, P.; Minihan, A.; Fuchs, H.E.; Martinez Tyson, D.; Tortolero-Luna, G.; Fedewa, S.A.; Jemal, A.M.; et al. Cancer Statistics for the US Hispanic/Latino Population, 2021. CA A Cancer J. Clin. 2021, 71, 466–487. [CrossRef]

[11]. Munkácsy, G.; Santarpia, L.; Gy˝orffy, B. Gene Expression Profiling in Early Breast Cancer—Patient Stratification Based on Molecular and Tumor Microenvironment Features. Biomedicines 2022, 10, 248. [CrossRef]

[12]. Brewczy ´nski, A.; Jabło ´nska, B.; Mazurek, A.M.; Mrochem-Kwarciak, J.; Mrowiec, S.; Snietura, M.; Kentnowski, M.; Kołosza, Z.; ´ Składowski, K.; Rutkowski, T. Comparison of Selected Immune and Hematological Parameters and Their Impact on Survival in Patients with HPV-Related and HPVUnrelated Oropharyngeal Cancer. Cancers 2021, 13, 3256. [CrossRef] [PubMed]

[13]. Ahmed, Z.; Mohamed, K.; Zeeshan, S.; Dong, X. Artificial Intelligence with Multi-Functional Machine Learning Platform Development for Better Healthcare and Precision Medicine. Database 2020, 2020, baaa010. [CrossRef]

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AI Enabled Trash Boat

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ABSTRACT

The primary objective of this project is to eliminate floating debris in urban drains and prevent sewage blockages, thus saving lives. An automated robot is employed in this proposed system to accomplish this task, reducing contact with hazardous gases and mosquitoes. The system includes a PiNoIR camera that uses image processing to detect waste, and an automated robotic arm that gathers the floating debris and stores it in a bin on the boat. Once the bin is full, an IR sensor detects it, and the boat automatically navigates to the hub using GPS assistance to dispose of the trash. This system is particularly innovative as it employs image processing to collect non-degradable floating waste, further enhancing its effectiveness.

Keyword: Object detection, Raspberry pi, GPS Module, Bluetooth, Load cell

I. INTRODUCTION

Water is a fundamental necessity for all human beings. Although there is an abundance of water on Earth, not all of it is suitable for human consumption. Water impurities can make it even more hazardous. Wastewater generated from our homes, industries, commercial activities, and certain plants contains harmful chemicals. The use of chemicals to clean such water can lead to various respiratory diseases.
The municipality faces significant challenges in dealing with these types of water. Water damage is categorized into three types: clean water, grey water, and black water. Clean water comes from broken water supply or leaky faucets. If left untreated, it can turn into grey or black water. Grey water is contaminated water that can cause illness. It can be caused by washing machine overflow, toilet and dishwasher overflow, and urine overflow. Black water is highly contaminated and can cause severe illness. It results from microbial growth on unwanted debris that has been floating for an extended period.

II. LITERATURE SURVEY

1. Paper name: Self Monitoring, Failure-Detection and Decision Making System to Support E-TrashBot (EEPIS Trash Bin Robot) Operations: Preliminary Report Author: Kisron Department of Informatics and Computer Engineering Abstract: This paper proposes a self-monitoring and decision making system which is applied to E-Trash Bot (EEPIS Trash Bin Robot) to support its operations in collecting trashes.

To support its task, we equipped it with an ability to monitor its availability status by considering the remaining batteries condition and the level of fullness of its bin. A bayesian approach is used to decide when the robot should always works or stop by considering three status: the level of fullness of the bin, the level of battery voltage used by motors, and the level of battery voltage used by the embedded personal computer (PC). The robot is also equipped with an ability to communicate with the operator over internet of things (IoT) which is specifically developed by us using TelegramBot. It can sends its status when the robot decides to stop due to a certain condition or it is experiencing a failure or it is contacted by the operator. Our preliminary experiments show that each sub-system can work as we expected

2. Paper name: Artificial Intelligence Enabled Robotic Trash Boat to Drive and Harvest Floating Trash from Urban Drain Author:P. Elavarasi1 , S. A. Meenuppriya2 , M. Monira3 , P. Priya4 , P. Reni5 Assistant Professor1 , Student 2 Abstract:The main aim of the project is to remove down the floating trash in the urban drain, to reduce down the blockage of sewage. By cleaning down this urban drain without the manual help will save many lives. In this proposed system, an automated robot is used to clean down the floating trash. Hence the contact with the harmful gases and the mosquitoes will be reduced. The system has an PiNoIR camera which detects down the waste by image processing and the automated robotic arm will collect the floating trash and this will have a bin in the boat where the trash will be stored. Once the trash has been filled the IR sensor will detect it. when IR sensor gives out this information automatically the boat will move to the hub with an help of GPS and the trash will be thrown over there. This system will be more advanced as this would collect down the floating non degradable wastes with the help of the image processing.
3. Paper name: Miniature Water Surface Garbage Cleaning Robot Author: Xiaohong Gao, Xijin Fu Abstract: In light of the problem of garbage cleaning in small water area, an intelligent water surface garbage cleaning robot with unmanned driving and convenient operation is designed.
4. Paper name: IWSCR: An Intelligent Water Surface Cleaner Robot for Collecting Floating Garbage Author:Shihan Kong , Manjun Tian, Changlin Qiu, Zhengxing Wu , and Junzhi Yu Abstract: robot system for intelligent water surface cleaner named IWSCR is developed to collect floating plastic garbage. It is able to accomplish three major tasks autonomously, i.e., cruise and detection, tracking and steering, and grasping and collection
5. Paper name: Design and Hydrodynamic Modeling of A Lake Surface Cleaning Robot Author:Zhongli Wang, Yunhui Liu, Hoi Wut Yip1, Biao Peng, Shuyuan Qiao, and Shi He , Abstract:This paper presents the design and hydrodynamic model of an autonomous robot for cleaning rubbish floating on the surface of a lake. We first address criteria and technical issues in designing such a lake surface cleaning robot (LSCR).

III. SYSTEM ARCHITECTURE

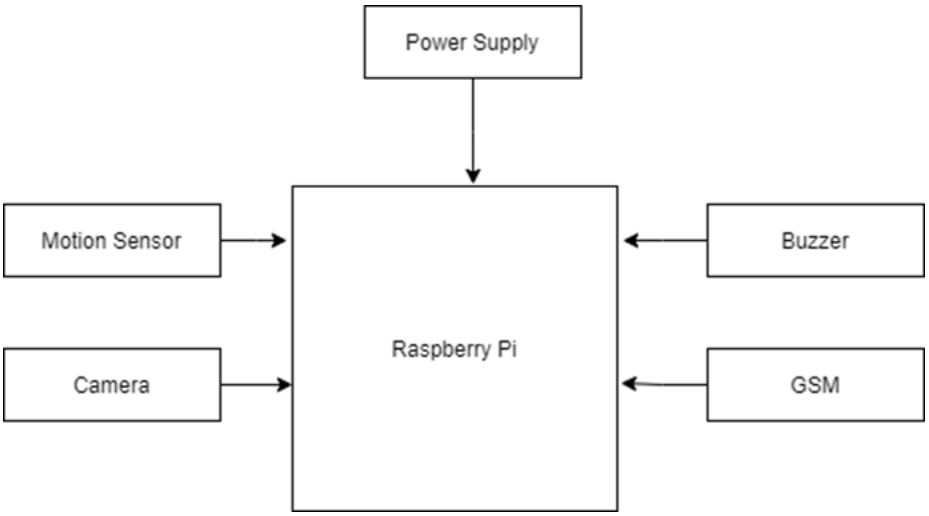


Fig. Block Diagram

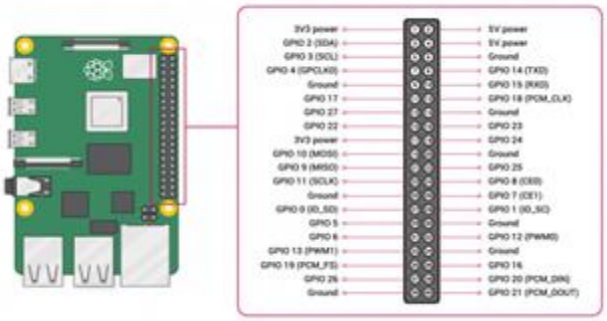
IV. METHADOLOGY

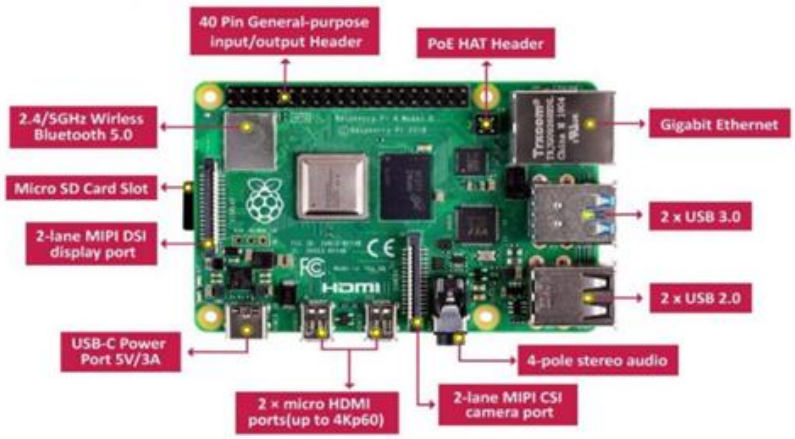
This system involves the creation of a specialized boat that is capable of navigating through drainage streams. The boat will be equipped with ultrasonic that can detect waste. As drainages often contain a significant amount of floating debris, such as plastic waste and bottles, that can obstruct the flow of water, the boat will also have a robotic arm that can be deployed to collect any debris it comes across. This process will continue until the bin on the boat is full, at which point the garbage will be deposited into a hub.

A. Raspberry Pi :

Raspberry Pi is defined as a minicomputer the size of a credit card that is interoperable with any input and output hardware device like a monitor, a television, a mouse, or a keyboard – effectively converting the set-up into a full-fledged PC at a low cost

Diagram





B. Ultrasonic Sensor:

Ultrasonic Sensor module

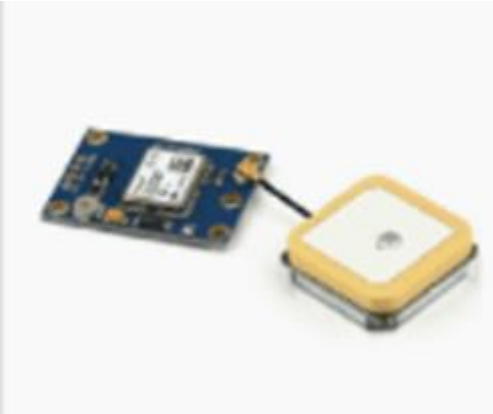
An ultrasonic transducer is an apparatus that employs sound waves beyond the range of human hearing (ultrasonic waves) to assess distance, detect objects, and determine the velocity of objects. Ultrasonic transducers are extensively used in various fields, including robotics, industrial automation, and automotive systems.

Ultrasonic sensor modules commonly include a transducer that produces and detects ultrasonic waves, a signal processing circuit, and an interface for linking to a microcontroller or another device. The sensor emits a high-frequency sound wave that reflects off an object and returns to the sensor. The sensor then gauges the time taken for the sound wave to travel to the object and back and determines the distance to the object using the speed of sound.

Diagram

C. GPS Module :

GPS is a system of 30+ navigation satellites circling Earth.A GPS receiver in your phone listens for these signals. Once the receiver calculates its distance from four or more GPS satellites, it can figure out where you are.



D. Load Cell :

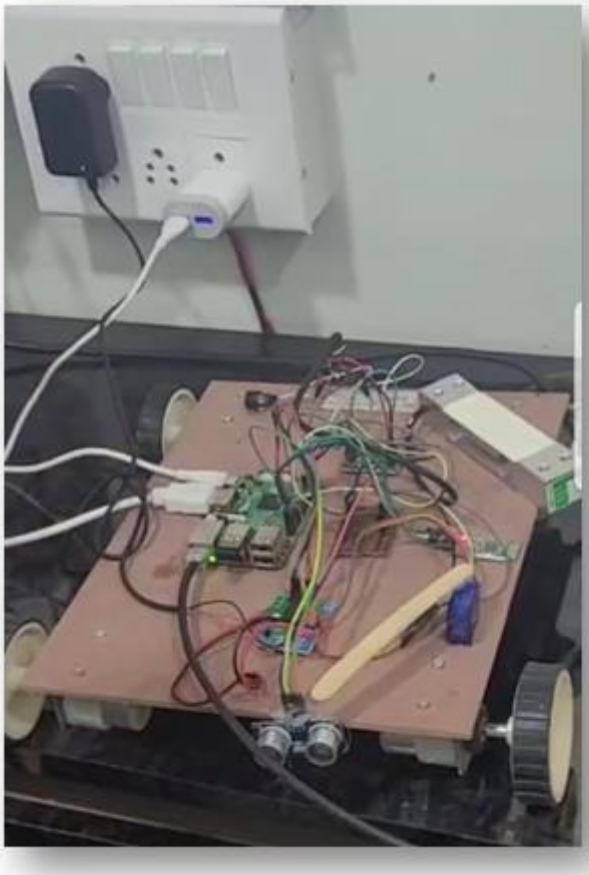
load cell (or loadcell) is a type of transducer, specifically a force transducer. It converts an input mechanical force such as load, weight, tension, compression or pressure into another physical variable, in this case, into an electrical output signal that can be measured, converted and standardized.

E. Bluetooth:

A Bluetooth mobile phone, for example, can wirelessly connect to a headset to make hands-free calling easier or can send pictures to another phone or computer.

V. RESULTS

Urban areas commonly face the issue of floating trash, which can obstruct the flow of water and cause drainage systems to overflow. This can result in stagnant water, which in turn can lead to the production of mosquito larvae and pose a significant health risk to the local population. For these reasons, it is crucial to remove this waste from drainage systems in a timely and efficient manner.



VI. CONCLUSION

As this approach utilizes advanced programming, it can accurately locate floating objects. This robotic system is time-efficient, portable, affordable, and requires minimal power. It can be further improved to increase its effectiveness, making it a valuable solution. These automated machines utilize state-of-the-art technology and are capable of cleaning industrial and urban drainage systems effectively. In India, such a system would be particularly useful for cleaning drains, treating waste water, and facilitating irrigation and toilet cleaning. During the rainy season, this robotic system will prove to be especially beneficial as drainage blockages are more common.

VII. REFERENCES

[1]. Kumar, Sudhanshu, et al. "Wireless Controlled Lake Cleaning System." International Conference on Intelligent Computing & Smart Communication 2019. Springer, Singapore, 2020.

[2]. Nagesh, Bh, Mr M. Upendra, and Ms T. Hadassah. "innovative and novel concept in river surface cleaning using river trash skimmer of zero emissions–it's implementation, approach & methodology." Journal of Offshore Structure and Technology 6.3 (2020): 1-8.

[3]. Niu, Guanchong, et al. "SuperDock: A Deep Learning-Based Automated Floating Trash Monitoring System." 2019 IEEE International Conference on Robotics and Biomimetics (RO BIO). IEEE, 2019.

[4]. Khekare, Ganesh S., et al. "Design of Optimized and Innovative Remotely Operated Machine for Water Surface Garbage Assortment." (2019).

[5]. Tiwari, Raj Vaibhav, et al. "Design and fabrication of project on water bodies cleaning robot." International Journal of Engineering and Management Research (IJEMR) 8.3 (2018): 15-

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Hybrid Approach for Classification and Learning Using Machine Learning Approach for Clinical Data

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ABSTRACT

Machine learning using Random Forests are measured for classification of multisource sensing and geographic data similar to (Health care, climate data, Stock market data etc). different ensemble classification methods have been projected in recent years. These methods have been demonstrated to improve classification correctness considerably. The most widely used ensemble techniques are boosting and bagging. Boosting is support on sample re-weighting as well as bagging uses bootstrapping. The Random Forest classifier uses bagging, or bootstrap aggregating, to appearance an ensemble of categorization and regression tree like classifiers. In accumulation, it searches only a random subset of the variables for a split at each node, in order to minimize the association between the classifiers in ensemble. This method is not responsive to noise or overtraining, as the re sampling is not based on weighting. in addition, it is computationally greatly lighter than methods based on boosting and somewhat lighter than uncomplicated bagging. In the research work, the use of Random Forest classifier for decision tree classification is explored. Finally compare the accuracy of the Random Forest classifier to other better-known ensemble methods on health care data.

Keywords: Random Forests, Classification, Decision trees, Multisource remote sensing data

I. INTRODUCTION

Classification has always been a challenging problem [1]. The explosion of information that is available to companies and individuals further compounds this problem. There have been many techniques and algorithms addressing the classification issue. In the last few years we have also seen an increase of multiple classifier systems based approaches, which
have been shown to deliver better results than individual classifiers [2]. However, imperfect information inevitably appears in realistic domains and situations. Instrument errors or corruption from noise during experiments may give rise to information with incomplete data when measuring a specific attribute. In other cases, the extraction of exact information may be excessively costly or unviable. Moreover, it may on occasion be useful to use additional information from an expert, which is usually given through concepts of the type: small, more or less, near to, etc. In most real-world problems, data have a certain degree of imprecision.

Sometimes, this imprecision is small enough for it to be safely ignored. On other occasions, the imprecision of the data can be modeled by a probability distribution. Lastly, there is a third kind of problem where the imprecision is significant, and a probability distribution is not a natural model. Thus, there are certain practical problems where the data are inherently Therefore, it becomes necessary to incorporate the handling of information with attributes which may, in turn, present missing and imprecise values in both the learning and classification phases of the classification techniques. In addition, it is desirable that such techniques be as robust as possible to noise in the data. Here, we will focus on how to start from a multiple classifier system with performance comparable to or better than the best classifiers and extend it to handle imperfect information (missing values and values) and make it robust to noise in nominal attributes and to outliers in numerical attributes [3,4]. To build the multiple classifier system, we follow the random forest methodology [5], and for the processing of imperfect data, we construct the random forest using a decision tree as base classifier. Therefore, we try to use the robustness of both, a tree ensemble and a decision tree, the power of the randomness to increase the diversity of the trees in the forest, and the flexibility of logic and sets for imperfect data management.

II. LITERATURE SURVEY

"Machine learning for clinical data analysis" by Obermeyer and Emanuel (2016): This paper provides an overview of machine learning applications in clinical data analysis, including predictive modeling, diagnosis, and treatment recommendation.

"Machine learning for healthcare: On the verge of a major shift in healthcare paradigm" by Rajkomar et al. (2018): This review article discusses the current state and future potential of machine learning in healthcare, including clinical data analysis, patient monitoring, and personalized medicine.

"A review of machine learning in clinical decision making" by Caruana et al. (2015): This paper reviews the use of machine learning in clinical decision making, including classification, prediction, and risk modeling.

"Machine learning methods for clinical forms of depression" by Chekroud et al. (2018): This study applies machine learning techniques to clinical forms of depression, including major depressive disorder and post-traumatic stress disorder, to improve diagnosis and treatment.

"Predictive modelling with electronic medical records: A machine learning approach" by Liao et al. (2017): This paper describes a machine learning approach to predictive modeling using electronic medical records, including feature engineering and model selection

Research work in the zone of Random Forest goes for each enhancing exactness, or enhancing presentation (lessening time required for instruction and arrangement), or both. Specific work goes for examination with Random Forest utilizing online unbroken stream information, which is vital today because of information streams accepting produced by different applications. Irregular Forest vicinity an outfit method, explores are finished with its base classifier, e.g. Fluffy Decision Diagram as base classifier of Arbitrary Forest. We have done efficient audit of ebb and flow uncompleted exploration on Random Forest and propelled a "Scientific classification using the Random Forest Classifier". In this segment, we leading elaborate in detail the work completed and then current the Taxonomy. Basically machine learning (ML) systems remained developed to

examine the medicinal data sets. The comprehension of the medical opinion is derived from the previous history. The derived classifier can be used to estimation the new datasets with further reliability, speed and correctness. The ML system is other useful to resolve medical opinion problems because of its honest performance, the ability to convention with lost data, the ability to explain the choice and transparency of knowledge [1]. In choice tree algorithm of Arbitrary Forest, the tree is constructed dynamically with connected fitting procedure. A random forest is an extensive modification of bagging. The generation of trees is based on two steps. First the tree is constructed on a bootstrap repeat of original dataset and another random feature subset, of static predefined size, is considered for excruciating the node of the tree.

To choose a biggest split Gini Index is utilized. In aggregate classifier like arbitrary woodland the measure of the aggregate relies on upon 1) the coveted accuracy, 2) the computational rate, 3) the nature of the characterization troublesome, and 4) the quantity of accessible PCs. In existing strategies the extent of the group is dictated by one of the three ways. 1) the technique that preselect the aggregate size, 2) the strategy that post select the aggregate size ,3) strategies that select the aggregate size amid preparing some determination strategies. In pre choice technique, the extent of the group is controlled by the client. The second sort of upright determination technique, over – create and select system is utilized to decision the outfit from the tarn of classifier. The technique which picks the measure of the group in preparing stage is resolved animatedly. At first the Random woods is built from the bootstrap rehash and in each stride, the new classifier is considered for the aggregate determination. In the event that its commitment to the group is huge then the classifier is saved. A few strategies are chooses the group, when an adequate number of order trees in self-assertive woodland have been made. The procedure smoothest the out-of-sack using so as to shortcoming chart a sliding window of size five. In the wake of smoothing has been done, the technique looks at windows of size 20 and decides the most extreme rightness inside of that window. It keeps preparing windows of the comparative size until the most extreme accuracy inside of that window no more developments. As of right now, the halting rule has been gotten a handle on and the calculation gives back the outfit with the greatest accuracy from inside of that window.

The proposed strategy, the structure of tree in view of established Random Forest, Random woods with Relief, arbitrary backwoods with numerous estimators, RK Random Forests, and RK Random Forests with various estimators [2]. Irregular Forest with Relief assesses partitioning force of credits as indicated by how well their qualities separate between comparative occasions. A trademark is given a high score if its qualities separate parallel perceptions with unique class and don't isolate parallel examples with the same class values. Relief trials the occasion space, registers the progressions in the middle of expectations and standards of the properties and structures a math measure for the closeness of the likelihood densities of the characteristic and the session. Its quality assessments can be clarified as the rate of the clarified class values. Allotted quality assessments are in the reach [¡1;1]. The computational multifaceted nature for assessment of a components is O (m¢ n ¢ a), where m is the quantity of redundancies [8]. In RK –Random Forest the number K of elements discretionarily chose at every hub amid the tree presentation process. The new Forest-RK choice tree presentation strategy can be condensed as beneath:

1) Let N be the span of the imaginative preparing set. N occurrences are discretionarily drawn with substitution, to frame the bootstrap illustration, which is then used to manufacture a tree.

2) Let M be the dimensionality of the first component space. Subjectively set a number K 2 [1; M] for each hub of the tree, so that a division of K elements is haphazardly drawn without extra, among which the best partitioned is then chosen.
3) The tree is consequently worked to spread its most extreme size. No hacking is performed. Bolster Vector Machines depend on the idea of result planes that characterize result limits. An outcome plane is one that isolates among an arrangement of substances having unique class participations. Instinctively, a not too bad detachment is finished by the limits that have the biggest space to the bordering preparing information purpose of any class called practical edge, subsequent to all in all the more noteworthy the edge the minor the speculation issue of the classifier.

III. RELATED WORK

Random Forest produce an ensemble of choice trees. To accomplish variety among base decision trees, Breiman particular the randomization method this works well with bagging or arbitrary subspace methods [10], [11]. To generate every only tree in Random Forest Breiman followed below steps:
If the number of records in the exercise set is N, then N records are tested at random but with additional, from the innovative data, this is bootstrap taster. This example will be the training set for mounting the tree. If there are M number of input variables, then a number m << M is selected such that at each node, m variables are specific at random out of M and the top divided on these m attributes is used to divided the node. The value of m is held invariable during forest rising. Each tree is developed to the main extent possible. There is no pruning. In this way, many trees are induced in the forest; the numbers of trees are pre-decided by the parameter N tree. The number of variables (m) selected at every node is also referred to as m try or k in the literature. The deepness of the tree can be controlled by a given parameters node size (i.e. number of instances in the leaf node) which is usually set to one. Once the forest is accomplished or built as explained above, to classify a new occurrence, it is run across all the trees grown in the forest. Every tree provides categorization for the new occurrence which is recorded as a division. The votes from all trees are joint and the class for which full votes are counted (majority voting) is declaring as categorization of the new instance. This process is referred to as Forest RI in the literature [11]. Here ahead, Random Forest means the forest of choice trees generated using Forest RI procedure. In the forest building process, when bootstrap section set is drawn by sample with replacement for each tree, about 1/3rd of original cases are left out. This set of cases is called OOB (Out-of-bag) data. Each tree has its individual OOB data set which is used for error approximation of individual tree in the forest, called as OOB error estimation. Random Forest algorithm also has in-built facility to compute variable position and proximities [11]. The proximities are used in swapping absent values and outliers.

IV. PROBLEM STATEMENT

In the given research work to design and implement the boosting and sampling techniques for better classification and prediction for high dimension (imbalance) data with maximum truthiness using Random Forest Classifier.

V. PROPOSED SYSTEM

In the proposed research work scheme have to process the termination scenario of Random woodland, Binomial sharing, multinomial sharing and in order probability ratio test (SPRT) are used. In the proposed system stops the random woodland previous evaluated with existing Random Forest approaches. The supervised learning model similar to support vector machine takes a set of inputs and examine the inputs and identify the desired patterns.

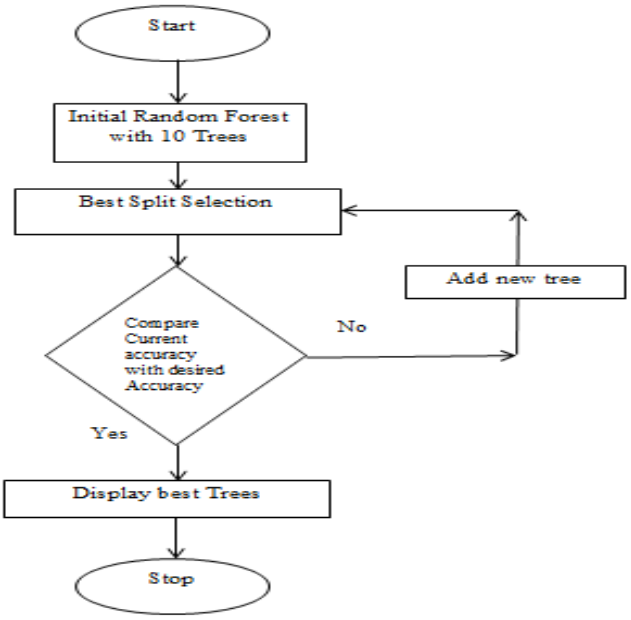

Figure 1: Proposed System architecture

a) Forest structure: at first a forest is constructed from ten trees. For that classical random forest is joint with performance measurement criteria's like Relief and numerous estimators. More particularly random forests with ReliefF, random forests with many estimators, RK Random Forests, and RK Random Forests with many estimators along with Classical Random Forest are constructed. The forest construction is revealed below. At first, the forest started with ten trees and select a greatest fit is selected from the residual dataset and the construction is made. The similar process is continual up to the 100 tree.

b) Polynomial fitting process: Forest construction is an iterative process .Each time a latest dataset is chosen for the construction. The choice based on the correctness of the predicted ensemble. The next polynomial equation is applied for selecting greatest fit.

$fn–1\ (x) = pn\ xn + pn–1\ xn–1 + \cdot + p0,\ n= 2, 9.$

c) The annihilation criteria: In the implementation of the forest correctness, correlation and the grouping accuracy and correlation is used. The principle correctness is based on the consecutive fitted curve. In correlation, the evaluation is made flanked by the fitted curve and original. The polynomial of two to eight would be apply to choose a best one. In the third criterion, the correctness and correlation are combined to choose a finest curve.

VI. ALGORITHM

In this work we propose to use Algorithm 1 to generate a random forest whose trees are decision trees, proposing, therefore, a basic algorithm to generate a Random Forest (FRF). Each tree in the forest will be a tree generated following the guidelines of [6], adapting it where is necessary.

Algorithm 1: Random Forest Initialization

Following are the general steps for using the Random Forest algorithm in a machine learning approach for clinical data:

1. Data collection and preparation: Collect and clean clinical data from various sources, including electronic health records (EHRs), medical imaging, and patient monitoring systems. Prepare the data by transforming it into a suitable format for analysis, removing missing values and outliers, and encoding categorical variables.
2. Feature selection: Identify relevant features or variables that are most predictive of the target variable (e.g., disease diagnosis, treatment outcome) using techniques such as correlation analysis, univariate analysis, or machine learning-based feature selection algorithms.
3. Data splitting: Split the data into training and testing sets to evaluate the performance of the model on new, unseen data. The training set is used to fit the model, and the testing set is used to evaluate its performance.
4. Model training: Use the Random Forest algorithm to train the model on the training set. Random Forest is an ensemble learning method that builds multiple decision trees and aggregates their predictions to make a final prediction.
5. Model tuning: Fine-tune the model parameters (e.g., number of trees, tree depth, minimum sample split) using cross-validation techniques to optimize the model's performance on the validation set.
6. Model evaluation: Evaluate the performance of the model on the testing set using metrics such as accuracy, precision, recall, and F1-score. Compare the model's performance to that of other algorithms and baseline models.
7. Model interpretation: Interpret the model's predictions by examining the importance of each feature, identifying patterns and relationships in **the data, and visualizing the decision boundaries of the model.**
8. Deployment: Deploy the model in a clinical setting, integrating it with existing clinical workflows and systems, and ensuring compliance with regulatory and ethical standards.

VII. CONCLUSION

In this research work, we presented approaches for improving performance of Random Forest classifier using machine learning in conditions of correctness, and or time for learning and classification. In case of correctness improvement, investigation is done using dissimilar attribute evaluation measures and combine purposes. In conclusion, machine learning has the potential to revolutionize clinical data analysis and healthcare by enabling more accurate diagnosis, personalized treatment, and better patient outcomes. The studies discussed in this context provide evidence of the success of machine learning in various clinical applications, including

predicting pneumonia risk, guiding clinical decision-making, and predicting drug efficacy. However, challenges such as data quality, privacy concerns, and interpretability still need to be addressed to fully harness the potential of machine learning in healthcare. Further research and development are needed to overcome these challenges and ensure the ethical and responsible use of machine learning in healthcare.

VIII. REFERENCES

[1]. Obermeyer, Z., & Emanuel, E. J. (2016). Machine learning for clinical data analysis. Jama, 315(6), 551-552.

[2]. Rajkomar, A., Dean, J., & Kohane, I. (2018). Machine learning for healthcare: On the verge of a major shift in healthcare paradigm. Npj Digital Medicine, 1(1), 1-8.

[3]. Caruana, R., Lou, Y., Gehrke, J., Koch, P., Sturm, M., & Elhadad, N. (2015). Intelligible models for healthcare: Predicting pneumonia risk and hospital 30-day readmission. In Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (pp. 1721-1730).

[4]. Chekroud, A. M., Zotti, R. J., Shehzad, Z., Gueorguieva, R., Johnson, M. K., Trivedi, M. H., ... & Krystal, J. H. (2018). Cross-trial prediction of treatment outcome in depression: A machine learning approach. The Lancet Psychiatry, 5(5), 417-425.

[5]. Liao, K. P., Cai, T., Gainer, V., Goryachev, S., Zeng-treitler, Q., Raychaudhuri, S., ... & Murphy, S. N. (2017). Electronic medical records for discovery research in rheumatoid arthritis. Arthritis Care & Research, 69(8), 1151-1157.

[6]. Shah, S. J., Majmudar, M. D., Kitzman, D. W., Alhanti, B., Kattan, M. W., Kho, A. N., & Sweitzer, N. K. (2020). Developing learning healthcare systems to guide clinical decision making: A framework for using real-world evidence. Jama Cardiology, 5(2), 200-209.

[7]. Luo, L., Zhang, X., Li, S., Wang, S., & Zeng, T. (2020). A machine learning framework for prediction of individualized clinical pathways in the management of diabetes. Scientific Reports, 10(1), 1-10.

[8]. Shin, H. C., Roth, H. R., Gao, M., Lu, L., Xu, Z., Nogues, I., ... & Do, S. (2016). Deep convolutional neural networks for computer-aided detection: CNN architectures, dataset characteristics and transfer learning. IEEE Transactions on Medical Imaging, 35(5), 1285-1298.

[9]. Zhang, Q., & Cui, P. (2019). Diagnosis of Alzheimer's disease using medical imaging and machine learning techniques. Journal of Healthcare Engineering, 2019, 1-16.

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Sedimentation Analysis of Khadakwasla Dam Using Spatial Data

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ABSTRACT

Reservoirs are a vital source of water supply, provide hydroelectric power, support diverse aquatic habitat, and provide flood protection. Sediment deposition has gradually reduced the effectiveness of reservoir operation over the years and decreases in storage capacity. This research presents geographic information systems (GIS) based application for investigating sediment deposits of Khadakwasla Dam. Spatial data were collected from aerial photographs, bathymetric data, and satellite images corresponding to the study area. This research was performed in many stages as survey planning, survey execution and storage, data preparation and pre-processing, spatial data and attributes data creation, database building, and the results presentation and analysis. This method for assessment of reservoir sedimentation uses the fact, that the water spread area of reservoir at various elevations keeps on decreasing due to sedimentation. GIS technique gives us directly the water- spread area of the reservoir at a particular elevation on the date of pass of the satellite. This helps us to estimate sedimentation over a period of time. Traditional methods are inconvenient, expensive and time consuming. Since applying the remote sensing technique has a greater speed and precision compared to traditional methods. The purpose of the present study is to estimate the amount of suspended sediment in the dam basin using the remote sensing facilities and satellite images of powerful sensors in the field of water studies and then comparing the results with sediment data.

Key Words: Geographical Information System (GIS), Sediment Deposition in dam, ARC-GIS software, Satellite Remote Sensing (SRS)

I. INTRODUCTION

A reservoir will generally be located towards the end of a large watershed and receive inflows from major rivers. On the other hand, reservoirs have a shorter residence time but a much larger watershed which can be more difficult to control. Therefore, capacity surveys are important for proper allocation and management of water in a reservoir. Knowledge about the quantum of sediment and its deposition pattern in various zones of a reservoir is very essential to assess the balance life of reservoir. In view of this, systematic capacity surveys of a reservoir should be conducted periodically. Using the Remote Sensing techniques, it has become very efficient and convenient to quantify the sedimentation in a reservoir and to assess its distribution and deposition pattern.

Remote Sensing technology, offering data acquisition over a long period of time and broad spectral range, can provide synoptic, repetitive and timely information regarding the sedimentation characteristics in a reservoir. Reservoir water spread area for a particular elevation can be obtained very accurately from the satellite data. Reduction if any, in the water spread area for a particular elevation indicates deposition of sediment at that level. This when integrated over a range of elevations using multi-date satellite data enables in computing volume of storage lost due to sedimentation.

The flow of river brought sediment particles originate from soil erosion processes in catchment. When this flow of water is stored in reservoir, sediment settles in reservoir which results in the reduction of storage capacity, cover fish spawning grounds, clog drainage canals and passage and reduce downstream water quality. Hence estimation of sediment deposition becomes very important for river morphology, conservation planning of water and soil, design of erosion control structure and proper management and working of reservoirs. Certain Conventional methods such as, hydrographic surveys, inflow and outflow approaches, are used for estimation of reservoir sedimentation. But these methods are inconvenient, expensive and time consuming. So simple methods should be developed, which is less time consuming and economical.

Reservoirs offer many benefits to the communities including flood control, water supply, fish, and hydropower. Determining the impacts of sediment on the reservoir operations is critical to maintaining current operations and planning for future needs. Sedimentation within the reservoirs is the main problem that could reduce the reservoir capacity and therefore affecting its economic life. Proper management of the reservoir requires that current reservoir volumes and sedimentation rates be determined. Current trend towards a more efficient management of reservoir is using the application of Geographical Information System (GIS). The geographic information system (GIS) is used for importing, analysing, modelling, visualizing, and reporting information for the reservoir and gives functionalities of spatial data management, mapping and analysis to assist decision-making.

1.1. Area of Study

Pune is the ninth popular city in India and the second largest in the state of Maharashtra after the state capital Mumbai. The district covered geographical area is 16642sq.km. It is located in the west part of the State and East bank of the Mutha River. Khadakwasla is the village situated near to Khadakwasla dam. It is the main source of water for Pune and its suburbs. Total capacity of dam is 374 million cubic metre. The height of dam is 31.79 m. It lies between latitude 18.750 N and longitude 73.440 E. The climate is tropical in Khadakwasla. The summers are much rainier than the winters in Khadakwasla. The average annual temperature in Khadakwasla is 24.70 C. The average annual precipitation is 1083 mm. Now-a-Days, Pune city has been become an auto web, host to IT and Automotive companies, large Industrial region and highly ranked an Educational Institutes. Migration of people is too large for various purposes in Pune city. Therefore, city requires all facilities with their population demand including water. Due to high demand, there is water scarcity in Pune city, so it is need to recharge a surface below the ground thus, by increasing the storage capacity of reservoir.

Fig -1: Location of Study Area – Khadakwasla Dam

II. LITERATURE REVIEW

Reservoir is the very important and valuable hydraulic structure for storage of water so that this resource can be used for vast area of society and different aspects. And the capacity of reservoir is continuously reducing due to entering of eroded soil carried by water, wind, ice and movement of particles due to gravity force. A huge quantity of sediment is deposited annually by Indian rivers in lakes, reservoirs, estuaries, bays and oceans. Loss of storage capacity due to reservoir sedimentation affects both obtains ability of water and operation schedules.

The study concluded that there is a possibility that the satellite images are prepared in different climatic conditions and different days of the year, given that the land has its own conditions in various conditions, different reflectance is reflected from the land. As a result, there is a possibility of change in the average reflectance of Landsat bands. So different situation should be considered; in this thesis the 10 and 15% of applied coefficients for sensitivity analysis are applied on the average value of the Landsat reflectance band and then analyze the changes that had occurred in sediment values. The analysis of sensitivity analysis by applying the coefficient of 10 and 15% of increase and decrease in the average reflectance of Landsat band 7. [1]

Research study gives and confirmed Geographical Information System (GIS) based technique for the determination of sediment source areas and the estimation of sediment yield from catchments. The Integrated Land and Water Information System (ILWIS) GIS package and Earth Resources Data Analysis System (ERDAS) Imagine image processor has used for geographic analyses and the digital analysis of satellite data for deriving the land cover and characteristics of the catchments soil. Using this study to determine soil erosion and sediment yield in a reservoir watershed using GIS technique. The spatial disaggregation of catchment area into uniform cells is done to get the sedimentation by using USLE along with determination of sediment delivery ratio and various parameters. The effect of DEM resolution on sediment yield is analyzed using two different resolutions of DEM. [2]

After analyzation, the data from Liss III images and google earth images from 1990 to 2020 has been carried out using GIS technology, Superimposition of the bank lines on these images have indicated that river is migrating

within and adjacent flood plain in the study area. In the central part of the river more erosion has been observed. In this part, erosion is mainly confined in the northern side and deposition in the southern side that is on right and left bank. More erosion and less deposition indicate that sediments flow in the river from upstream to downstream is being checked in the reservoir of successive dams constructed in the catchment area. Probably it is due to checking of the sediments by the dams located in the upstream. Erosion is more pronounced on both banks than the sedimentation. A large part of agricultural land as well as plantation and rural settlements are affected by erosion every year. [3]

While working on catchment area, gives a method for estimation of sedimentation yield from catchment area by using GIS method. In this method, they uses spatial Disaggregate of the catchment into cells having monotonous soil erosion properties. The erosion from surface of each discretized cells is routed to the catchment outlet using the help of sediment delivery ratio, which is defined as a ratio of sediment yield to total surface erosion. The total sediment yield of catchment is a sum of individual sediment given by each cell. The spatial disintegration of catchment and essential properties of erosion from each cell is computed by GIS technique by using the Integrated Land and Water Information Systems (ILWIS) package. [4]

Research on a GIS based model, Soil and Water Assessment Tool (SWAT) which is used to determine sediment transport from the 17 sq.km watershed located. This has property of mixed land use and on on-stream sediment control structures called check dam. By simply comparing observed data and measured data, a calibration (1996) and validation (1997- 2001) of surface runoff and sediment yield is performed with SWAT model on both a daily and monthly basis. Calibration and validation of the SWAT model is performed with and without check dams to test its ability in visualizing the impacts of sediment control structures in the watershed. The model shows that loss of sediment from the watershed could be decreased more than 64% by acquiring check dams as a barrier for sediment. [5]

This techniques can be used to model bathymetry and the spatial distribution of sediments. The use of Remote Sensing technique to estimate suspended sediment has been reported by several investigators determined siltation in the dam reservoir by comparing reflectance values in the green and red portions of the spectrum. Research findings indicate that siltation during the flood period was largely confined to the main river channel of the reservoir and large embankments. Areas of extensive siltation were identified and the amounts of deposition were determined through ground surveys. This information was used to predict the distribution of silt deposits in the reservoir. It uses a visual interpretation technique on large scale imagery of Landsat-MSS to estimate the water-spread area at different levels to evaluate the capacity of the reservoir and concluded that the results are comparable with hydrographic survey observations and similar to the curves obtained from the conventional methods. A digital technique in which density slicing of Landsat-MSS Near-infrared (NIR) data was performed for extracting the water-spread area and correlated computed reservoir capacity based on the surface area obtained using cone formulae. [6]

The sedimentation survey for the high dam reservoir to determine the amount and distribution of sediment deposition through the reservoir. Since year, 1973 the bathymetric surveys were conducted for only few known cross sections because of the reservoir size to investigate the reservoir sedimentation progress by using the traditional survey method. However, from year, 1999, it was proposed an alternate method of mapping the reservoir bottoms by using a hydro acoustics system with a Differential Global Positioning System (DGPS) and

Echo sounder to collect depth measurements and locations. The new technology provides the bathymetry data in suitable format that can be used to create digital maps. The work focuses on the using of geographic information system (GIS) technique to perform the analysis and process the bathymetric data to produce sedimentation maps for the bottom of the reservoir in different years. In addition, it was discussed the benefits of using GIS approach over the traditional methods for determination of the sedimentation locations and thickness of it, in the reservoir. [7]

III. METHODOLOGY

At the first use of ENVI for atmospheric and geometric correction. Removing the influence of the atmosphere is a critical pre-processing step in analyzing images of surface reflectance. Properties such as the amount of water vapor, distribution of aerosols, and scene visibility must be known. Because direct measurements of these atmospheric properties are rarely available, they must be inferred from the image pixels. Hyper spectral images in particular provide enough spectral information within a pixel to independently measure atmospheric water vapors absorption bands. Atmospheric properties are then used to constrain highly accurate models of atmospheric radiation transfer to produce an estimate of the true surface reflectance.

A GIS represents both features and surfaces. Features are geographic objects with well-defined shapes (such as political boundaries). Surfaces are geographic phenomena with values at every point across their extent. Elevation is a common example, but surfaces can also represent temperature, chemical concentrations, and many other things.

Surfaces are usually modeled with raster datasets. A raster is a matrix of cells, also called pixels, organized in rows and columns and covering some part of the world (or even the whole world). Each cell in the matrix represents a square unit of area and contains a numeric value that is a measurement or estimate for that location. Before continuing GIS for pixel values in this step we can use digital elevation.

Satellite images include pixels or the components of image that in this pixel the reflectance values are recorded. In this study, using ARCGIS Software we calculated the reflectance values in each Landsat band and number of repetitions. Then the mean of the reflectance values for each band were calculated in the basin.

The calculation of sediment based on the samples measured at the hydrometric stations. Due to the lack of accurate statistics of the erosion and deposition of sediment at the watershed in most cases the sediment measurement curve prepared by discharge and sediment concentration data or sediment discharge are used. At the hydrometric stations sampling suspended sediment concentration is performed at the base discharges or in low flood discharges. However, the variability of flow and sediment relationships in flood discharges is much higher due to changes in rainfall and catchment (soil moisture, presence of sediment and subcortical water content) and thus, the efficiency of rating curve depends on the accuracy of the obtained data.

Considering the different reservoir levels between dead storage level (D.S.L) and Full storage level (F.S.L) on various dates in between 2013 to 2020 for covering full range of live storage of reservoir. The original elevation-area capacity curve/table and the reservoir level of year 2014 to 2020 have also been used in the analysis.

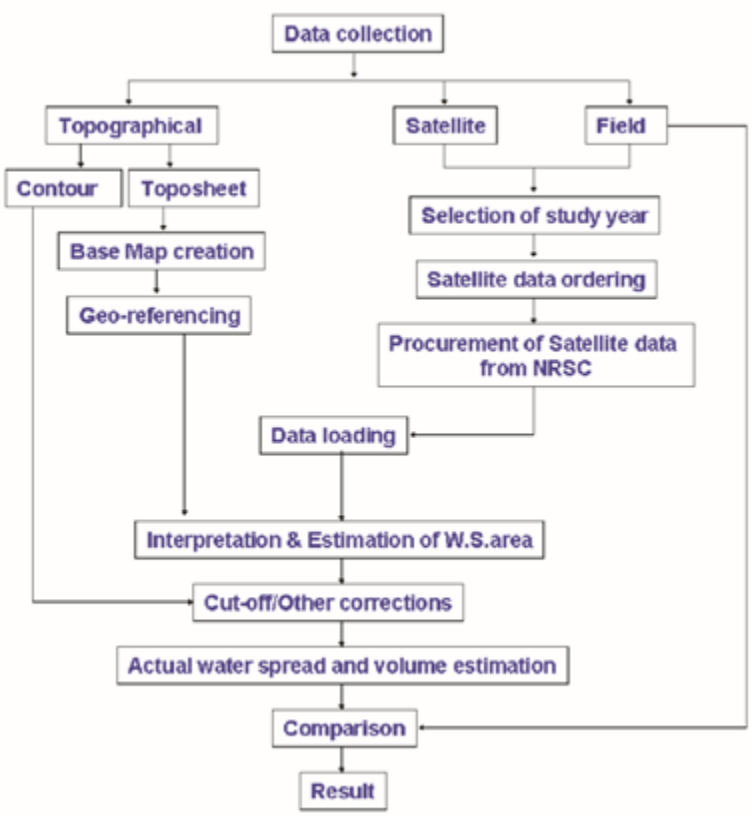

Chart -1: Methodology flow chart

3.1. Procedure for Sedimentation Analysis

1) For analysis of sedimentation in water of a region required data is collected by year wise such as contour maps & rainfall from Department of Meteorological Department, groundwater levels in during monsoon, pre monsoon and post monsoon from Ground Survey and Development Agency.
2) Annually rainfall data for the period of some years has collected from Meteorological Department. Many rainfall stations take into consideration for analyzing annual rainfall pattern and seasonal rainfall pattern has been calculated. The collected data has processed and analyzed by preparing various graphs, maps and figures using GIS software.
3) For assessment of sediments some thematic maps are created by using following:

- Digitization of scanned toposheets
- Editing for elimination of errors
- Topology Building

Above three steps are involved in ArcGIS which are basic operations required for mapping.

4) ArcGIS software has been used for digitization, editing, and topology creation. Integration of multi-thematic information and delineation of groundwater prospect map created through GIS processing. The groundwater prospect map is created through this technique has been verified with field data. Thus, sedimentation map is prepared.
5) Various favorable sedimentation thematic maps have been integrated into a single groundwater prospect zone with the application of GIS techniques. This required four steps, which are as follow:

- Spatial database building
- Spatial database analysis
- Data integration through GIS
- Generation of groundwater potential zones map

The require data is collected from different department as per their requirements. From IMD (Indian Meteorological Department) rainfall data is collected, Ground levels are collected from GSDA (Ground Survey and Development Agency).

3.2. Analysis

Thematic map will be created by using ArcGIS. The main aim of maps is to shows the location of a place and distribution of variables. Some maps are prepared with special themes. Such maps are called thematic maps. Through such maps, distribution of various variables in a region is shown below. Distribution of sedimentation, soil, slope, land cover and water depth is shown on the map according to the data of these variables.

GIS Data Gridding: Gridded depths were used in all analysis and presentation for the research. The gridded data were chosen because the GIS process used to identify change from each subsequent survey required gridded data. ArcGIS software was used to create the difference grids for the bathymetric survey of the reservoir. Difference grids were created using the Raster Calculator function in software. Grid extent, cell size and the horizontal position of the grid nodes were consistent between surveys to ensure accuracy in the output grids. The values of the difference grid nodes were created by subtracting the grid of 1999 data from the grid of 2001, and 2019 data.

Sediment Deposition Mapping: The sediment deposition maps from the different surveys years 1999, 2001, and 2019 covering the same geographic area were produced and compared to identify changes in the reservoir bed elevations and illustrate the sediment deposition in the reservoir. The presentation of this analysis was images color coded by the amount of change. Areas of sediment deposition & areas of no overlapping data or erosion are indicated with different colors for the significance change. It is detected that more than 80 percent of the deposition thickness was more than 2.50 meters. The larger changes from year 1999 to year 2019 occurred in the wider entrance of the reservoir. These maps were generated volumes are based on a more accurate method that uses data for the entire reservoir and not just data from along a few cross sections. The accuracy of these maps may be affected by the density of the data coverage. Ideally, data should be collected in a grid pattern dense enough to allow the maps to identify all of the bottom features. The results from the analysis of these maps are being used to track sediment migration pattern with high resolution than can be modeled.

IV. RESULTS AND DISCUSSIONS

Analysis of data from satellite images and google earth images from 1990 to 2020 has been carried out using GIS technology, Superimposition of the bank lines on these images have indicated that river is migrating within and adjacent flood plain in the study area. In the central part of the river more erosion has been observed. In this part, erosion is mainly confined in the northern side and deposition in the southern side that is on right and left bank, respectively. Since there is a possibility that the satellite images are prepared in different climatic

conditions and different days of the year, given that the land has its own conditions in various conditions, different reflectance is reflected from the land. As a result, there is a possibility of change in the average reflectance of bands received by sensor. So different situation should be considered; in this thesis the 10% and 15% of applied coefficients for sensitivity analysis are applied on the average value of the reflectance band and then analyze the changes that had occurred in sediment values.

V. CONCLUSION

This study indicated that the combination of hydro acoustics, GPS, and GIS are capable of producing bed elevations maps comparable in accuracy and quality to traditional surveying method. A key difference between the traditional and GIS analysis approaches is that the GIS approach calculates sediment volumes over the entire reservoir area by comparing digital surfaces, whereas the traditional approach applies an average area method to calculate volumes based on a limited number of cross sections. A future benefit of the GIS analysis approach will be the ability to view time perspective of sediment change and support automated sedimentation analysis. However, certain issues and problems were recognized during this study.

VI.REFERENCES

[1]. Kasra Hossein Mostofi et al. “River Sediment Monitoring using Remote Sensing and GIS” (2019), By Civil Engineering Department, University of Aveiro, ISSN (e): 2250-3021, ISSN (p): 2278-8719, Vol. 09||S (I) || PP 23- 30.

[2]. R. K. Jaiswal “Assessment of Reservoir Sedimentation in Chhattisgarh State using Remote Sensing and GIS” (2017), By National Institute of Hydrology, Bhopal, pp. 526–534 Article ID: IJCIET_08_04_059 ISSN Print: 0976- 6308 and ISSN Online: 0976-6316.

[3]. Rahul Panchal et al “Change Analysis of Bank Line Migration, Erosion and Sedimentation Patterns at lower reaches of Mahi River, Gujarat using Remote Sensing And GIS” (2017), By Department of Civil Engineering, L.D. College of Engineering, Ahmedabad, India, Volume 4, Issue 5 e-ISSN (O): 2348-4470 p-ISSN (P): 2348-6406.

[4]. Deependra Dadoria, H. L. Tiwari “Assessment of Sedimentation by GIS” (2016), By International Journal of Engineering and Technical Research (IJETR) ISSN: 2321-0869 (O) 2454-4698 (P), Volume-5, Issue-3, July 2016.

[5]. C. Todosi et al “Reservoir Sedimentation Analysis using GIS Techniques in the Bahluiet Catchment in the Perspective of Sustainable Agricultural Development” (2016), By Department, Geography and Geology Faculty, ‘Alexandru Ioan Cuza’ University of Iasi, 20A Carol I Street, 700 505 Iasi, Romania, Journal of Environmental Protection and Ecology 17, No 3, 1095–1104 (2016).

[6]. Kamuju Narasayya et al “Assessment of Reservoir Sedimentation using Remote Sensing Satellite Imageries, A Geographical Information System (GIS)” (2012), By Central Water and Power Research Station, P.O. Khadakwasla, Pune.

[7]. Dr. Hossam El-Sersawy "Sediment Deposition Mapping in Reservoir Using Geographic Information System (GIS)" (2003), By Researcher, Nile Research Institute (NRI), National Water Research Center (NWRC),P.O. Box 13621, Egypt.

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Overview of Data Mining Techniques

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ABSTRACT

Data mining is also known as Knowledge Discovery in Database (KDD). It is also defined as the process which includes extracting the interesting, interpretable and useful information from the raw data. There are different sources that generate raw data in very large amount. Data mining is a process of discovering patterns, correlations, and trends from large datasets. It involves analyzing large datasets using statistical and computational methods to extract valuable insights that can aid in decision-making. This paper provides an overview of various data mining techniques, including clustering, classification, association rule mining, and outlier detection. We discuss the basic concepts, advantages, and disadvantages of each technique, as well as the applications in which they are commonly used.

Keywords— Educational Data Mining (EDM), Knowledge Discovery in Database (KDD), Learning Management System (LMS),

I. INTRODUCTION

to Data mining techniques (DMT) are used to transform raw data to useful information or knowledge. Data itself is nothing, but to process it, is very useful and interesting [1]. Data mining has become a crucial aspect of business and scientific research as it allows organizations to extract valuable information from their datasets. The process of data mining involves using various techniques to analyze large amounts of data and discover hidden patterns and relationships that can be used for decision-making purposes. Data mining is used in a wide range of applications, including healthcare, finance, marketing, and scientific research.
There are many advance technologies that use data as useful information intelligently. For example, Knowledge Discovery in Database (KDD) is the process of required output extraction in different formats from raw data. KDD is also defined as the process to view useful patterns in data [2]. A generic and most common diagram of data mining or KDD is shown in Fig.1.

Educational Data Mining (EDM) is a research field that applies data mining and machine learning techniques to educational data in order to extract useful insights and knowledge. The goal of EDM is to use data-driven approaches to improve the educational process and outcomes for students, teachers, and institutions.

EDM involves the collection, analysis, and interpretation of data from a variety of educational sources, such as student performance records, course materials, and educational software. The data is then analyzed using statistical and machine learning techniques to identify patterns and relationships that can help improve educational practices.

These data can contain user information, location, login history and activities. There are two main sources of data production in EDM that are traditional classrooms and distance education. In case of classrooms, teachers and students are present physically. It involves higher, elementary, primary, private and public education. Educators observe students' behavior by attendance, course information, exams, curricular activities and planning. Educational data mining helps each individual associated with institution. For example, institutions need to know which student can be enrolled in particular course. Administration needs information like class enrollment size and admission requirements. Student needs to understand how to choose or select courses based on prediction which course is the best. Instructors need to know which teaching experiences are the best and most contributive to the class. Educational systems generate data travelling online through web. Data contain student information, course information, administrative information and academic information. Data mining techniques (classification, clustering, text mining, pattern matching etc.) are applied on the data obtained from web. Not only in education, data mining is used by all departments like administration, accounting, Human Resource (HR) and many more. Table 1, shows different tools used in EDM along with their task.

TABLE 1: Data Mining Tools

Tool Name	Mining Task
Mining tool	Association and patterns
MultiStar	Association and classification
Data Analysis Center	Association and classification
EPRules	Association
KAON	Text mining and clustering
TADA-ED	Classification and association
O3R	Sequential patterns
Synergo/ColAt	Statistics and visualization
GISMO/CourseVis	Visualization
Listen tool	Visualization
TAFPA	Classification
iPDF-Analyzer	Text Mining

RESEARCH WORK IN DATA MINING

As data mining has become most popular and its use has become most common. It makes automated systems by applying different data mining techniques to data flow. Many algorithms are applied in data mining techniques

to solve real life problems. There are many advantages of data mining like it is helpful in banking, finance, accounting, retail, marketing, manufacturing, governments and many more [7]. In the same way, it also has many disadvantages as there are security issues, privacy issues, misuse of information, use of inaccurate information, risk of data loss etc. With the passage of time, data mining is growing and has been improved. There are many journals and articles written about it. Data mining can be used in different perspective with respect to dataset given to solve a specific real time issue [8].

In case of distance education, different techniques are applied to grant access to the students who are far from space and time of lectures in traditional class rooms. Distance education involves internet education, web-based education, multimedia education and videotape education. Web-based education is common among all of them. This type of education creates the history of users' accesses in web logs [9].

It is compulsory to convert the data into particular format to use in a suitable data mining algorithm [10]. Some important processes used to format the data before implementation of data mining algorithms, are given in Table 2.

TABLE 2: Data formatting processes

Process name	Objective
Data Cleaning	Irrelevant data is removed from the raw data. Only useful data is left that is needed for the specific mining algorithm
User identification	Referring associated the specific page to the user
Transaction identification	It makes smaller units of sessions as per transaction
Data transformation	It is creation of new attributes from the existing data
Data integration	Data is integrated and synchronized
Data reduction	Data is reduced according to dimensions

There are many challenges and requirements of data mining like controlling various types of data, time complexity of data mining algorithms, certainty of results obtained through data mining, expressions of data mining results, data security and privacy [11].

Data mining can be classified on the basis of different factors. For example, database, knowledge type, technique used and applications adapted. It involves many disciplines like machine learning, neural networks, logic programming, Bayesian learning. According to N. Jain and V. Srivastava [12], data mining has five major elements that are extract data, store data, provide data to IT professionals, analyze data and show data in proper format. S. H. Liao [13] categorized EDM techniques into three areas that are architecture, knowledge and

analysis. These three areas are the main parameters with different perspective, having larger impact on data mining.

CATEGORIES OF DMT

Data mining techniques are applied with respect to different aspects of data mining as data obtained from different sources can be different and asynchronous. Data mining is a vast field and found in every field and department. So a specific technique or algorithm is applied for specific type of problem to resolve efficiently. There are nine categories of DMT [13], that are discussed below:

Information Systems

Information systems provide a bridge between business world and computer science field. Information system has become the most popular field among all other fields.

System Optimization

Original term used for system optimization was 'Linear Programming', in the past. System optimization selects the best element from a set of different available elements.

Knowledge-based Systems

Knowledge-based systems are the core of artificial intelligence. There are many tools that are artificially intelligent and produce intelligent decisions through justification [14]. Their base is Artificial intelligence. In these systems; scripts, frames and various rules are used to represent knowledge.

Modeling

It is a process in software engineering that uses different data modeling techniques to create a data model. A model in software engineering creates ease of implementing software. It is used to understand a complex structure and flow of a system through different perspective. Modeling techniques are used to analyze the data quantitatively.

System Architecture Analysis

System architecture analysis uses a conceptual model that explains the structure, views and behavior of a system. Architecture is a formal description and representation of a system structure. It exposes all components of a system that work together to implement the complete system, their relation and behavior impacting the overall system. A system architecture concerns with the internal interface of system components. A system has hardware architecture, operating system architecture, enterprise architecture and software architecture.

Algorithm Architecture

An algorithm is defined as a finite list of instructions to solve a problem. Algorithms are used for data processing and calculation. Algorithm is a main factor effecting the time complexity, cost, and efficiency of a system to resolve a real time problem. Steps involved in the development of an algorithm are shown in Fig. 2.

Figure 2: Algorithm development

Figure 3: DMT categories

Intelligence Agent Systems (IAs)

Intelligent Agent Systems (IAs) are the part of Artificial intelligence, which affect an environment. They can learn and try to achieve their goals using knowledge.

Dynamic prediction-based approach

Dynamic prediction-based approach is a mathematical model that is used in modeling molecules. Moreover, it is also used to find the applications in stock market.

Neural Networks

Neural networks or artificial neural networks (ANNs) are traditionally referring to biological neuron circuits. Their modern use refers to artificial neural networks that are made of artificial neurons or nodes. They are computational model that are very useful in the field of computer science and many other research fields. Neural networks are composed of neural units or neurons. So each neuron is linked with many other neurons. These systems are not explicitly programmed. However, they are self-learned and trained instead. The goal of ANNs is to work like human brain to solve the problems.

Taxonomy of data mining categories is shown in Fig. 3.

DATA MINING TECHNIQUES

Data mining is a vast field and it has a large number of applications, so it has become interesting subject to research. Data mining techniques are classified into characterization, generalization and association [15]. There

are different measures to use data mining techniques as the use of data mining is tricky but helpful if properly used [16]. Some data mining methods are classified and briefly discussed below:

Clustering

Clustering is a data mining technique that involves dividing data into groups or clusters based on their similarity. It is commonly used in market segmentation, image processing, and social network analysis. The primary advantage of clustering is that it helps to identify patterns in data that may not be apparent through traditional data analysis techniques. However, clustering can be challenging when dealing with large datasets or datasets with complex structures.

It is the focus on a single aspect of data with respect to some other aspect of data, called predictor variable. Prediction is used to predict some unknown result on the basis of previous experience or history.

Relationship Mining

Relation mining also known as relational data mining is commonly used for relational database. In relationship mining, a relationship is discovered among different variable within a data set. In database, relational data mining algorithm search for pattern among different patterns. Relationship between variables must satisfy two things: interestingness and significance [17].

Outlier Detections

Generally, if the new observation is different from the existing one compared, it is named as outlier. Outlier detection compares different values with smallest or largest values in a data set and finds the deviation among values.

Text Mining

This data mining technique described as the text data in data mining is specific with text data. Text data include documents, emails, messages, and html files. Text mining can be classified as document processing, document summarization, indexing, topic clustering and mapping [18]. It is commonly used in education and business. Organizations have a big collection of documents and use text mining and obtain information needed [19]. Text mining involves machine learning, statistics and natural language processing. Some of the text mining applications are publishing, telecommunication, information technology (IT), banks, public administration and pharmaceutical companies.

Social Network Analysis (SNA)

Social network analysis is a process that uses graph theory and networks to investigate social structures. In this process, relationship between different entities in network information is detected. It is commonly used to analyze the activities of a group or community.

Process Mining

Process mining analyzes the business processes on the basis of event log. It extracts the knowledge that is related to process of event log. This event log is noted by the information system for clear representation.

Data Distillation for Judgment

In this method, data is represented intelligently. This technique uses visualization and summarization. This is useful to see and explore large amount of data at a time.

APPLICATIONS OF DATA MINING METHODS

There are many applications of data mining methods.

Some of them are discussed below:

Statistics

In the data mining, user of applications is the main subject. Some tools use form usage statistics that are AccessWatch, WebStat, and Analog. One example of usage statistics is measuring the number of visits. If data produce a relational database, then SQL provide many functions such as sample size and mode. All the techniques convert large data into specific visual display. Commonly, large data are described as charts, graphs and 3D representation. These visualized data can be about assignments, exams, courses and marks. Instructors can get information about their students and distance classes.

Web data minings

Web data mining is also an application of DM. Here, information is filtered from data obtained from web. Web data include web structure, web content and web usage. The main purpose of web data mining is to facilitate users with information they seek [20].

TABLE 3: Data mining techniques and its applications

Data mining technique / category	Description	Implementation / Tools	Limitation	Applications
Statistics	Graphical and tabular representation of data	WebStat, AccessWatch, Analog	Fail to analyze individual item, Not implemented on heterogeneous data, A small error brings to misleading	Measuring the number of visits on web, Large data is described as charts, graphs, 3D representation
Web data mining	Data mining related to web	Winautomation, import.io, CrawalMonster etc.	Invasion of privacy, Irrelevant contents	Determining the web structure, web contents, web usage
Classification	Grouping of data objects	Generation of groups with same attributes and characteristics		

Useless for heterogeneous data Reduction of information complexity, streamlining in data collection, helpful in planning

Clustering Grouping of data with samilarities Cluster 3.0, Java TreeView, PYCLUSTER etc. Don't support shared storage, operational errors Fault tolerance, maintenance

Sequential pattern Ordering of objects with a particular sequence XAffinity(TM), SPMF, Miningco
Big storage for database, Shelf in a shop, disaster prediction,
proceeding medication detection

Association rule
Antecedent and consequent or if then statements
FPM, Bart Goethals, FrIDA, KNIME, Magnum Opus Research effort goes to improve the algorithm used, in e-learning, algorithm used has too many parameters
Used in LMS, stock trading

Casual data mining
Prediction in data relationship Weka, RapidMiner, KNIME, Rattle
Quality, security, privacy of data Used in healthcare, business, finance, banking, education

Outlier detection
Detection of deviation of one observation from many other observations

CMSR Data Miner
Need mathematical justification, need probabilistic data model that is complexImage processing, detection of industrial damage,
fraud detection, intrusion detection, inside trading detection,
public health and medical

Text mining

Driving information from text
Carrot2, GATE, Gensim, OpenNLP, Orange, Stanbol, KNIME, PLOS, PubGene A lot of free text in data collection, data is unstructured, syntactic and semantic erros in data, resource development is difficultRecord management, intelligence, social media, searching,
publishing, life sciences, security (encryption, decryption), customer relationship management, education, digital humanities

Social network analysis
Use of network to investigate social structures Commetrix, Cytoscape, Cuttlefish, EgoNet, Gephi, Graph-tool, GraphChi, Graphviz etc.
Risk of fraud, Time wastage, Invasion of privacy
Worldwide connectivity, information sharing, targeted advertising

Decision trees
A tree like model of decisions and their consequences SilverDicisions, Gambit, Simple Decision Tree, GATree, KNIME,
RapidMiner, Smiles, YaDT, Complexity, loss of innovation, a small change in data set brings a great change in decision trees, difficult to move because of its size and shape etc.
Modeling techniques, feature selection, data preparation, interpretation of data

Nearest neighbor technique

A method used for classification and regression Face recognition, recommendation engines, spam filtering, Weka, Kaldi, MEKA, mlpy, MODLEM,
sgmweka,
Finding the value of k, determining the parameters to be used, high computation cost Adaptive websites, bioinformatics, cheminformatics, game playing, computer vision, marketing, medical, economics, search engines, stock market analysis, information retrieval, speech recognition

According to Paul B [21], classification technique is used
to
Select students with same characteristics
Find student misuse
Find student who are hint-driven in multiple choice questions
In the data mining, common web mining techniques are clustering, classification, text mining, association rule, outlier detection and sequential pattern. These are briefly discussed below:
Classification and clustering
Classification and clustering are almost defined the same. Clustering make groups of pages with same contents or users. Classification characterizes the group of user profile and course sessions.
Sequential patterns and association rules
Association rules show relation of attributes of a dataset with each other. This relation among attributes creates if-then statements. Sequential patterns tell that which content gives access to the other content.
Michael J. Shaw applied data mining in marketing to support marketing. Sung Ho Ha applied data mining tools in hotel data mart. Usama Fayyad interprets data mining in fraud detection, marketing, manufacturing and

telecommunication. Fraud can be associated with different fields like bank fraud, securities fraud, commodities fraud, insurance fraud and any other financial fraud. These all types of fraud are related to financial fraud. Fraud and other related crimes can be categorized to solve and detect through data mining [26]. The firm issuing the fraudulent financial statements can be detected through data mining [27]. Data mining is applied almost in every industry and field. Mrs. Bharati collected some challenges that were faced by some companies in USA, and gave the solutions through data mining [28]. Data mining is beneficial for business as it reduces the cost of business, improves the profit, and enhances the quality [29]. Data mining answers many question of business, which were very difficult and time consuming in the past [30]. It solves many issues of medical field [31]. Nada Lavrac analyzed the medical data using data mining [32]. B.
D. Pitt used data mining to load profiling [33]. Andrew M. Wilson elaborated the usage of data mining in pharmacovigilance [34]. Data mining techniques are applied to detect heart disease intelligently [35]. Two or more than two data mining techniques are merged to get better result. Kesheng Wang applied different data mining techniques in enterprise manufacturing process [36]. Data mining techniques are the valuable parameters in chronic kidney diseases [37]. Data mining methods are applied by Sunith Bandaru for knowledge discovery in multi-objective optimization [38].
Data mining techniques, limitations and applications are shown in Table 3.

LIMITATIONS AND OPEN ISSUES

As discussed before, data mining is an important entity, useful in every field. It is categorized and classified into different aspects. We surveyed data mining, its techniques, categories and applications. It is a vast field used by each individual. Learners or students use data mining to personalize e-learning. Better learning experiences are

suggested by the data mining. Educators or instructors use data mining to get feedback about instructions. They analyze student's behavior and learning. They also predict the performance of students to improve the customization of courses. Researchers use data mining to choose the best data mining technique to develop data mining tools for specific purpose. Data mining is used by organization and companies to enhance the efficiency in the decision making process. Administration use data mining to find the best way to manage resources and to utilize the resources in the most efficient way.
Data mining has not only advantages, there are also some drawbacks. The main problem in data mining is quality, security and privacy of data [41]. These issues are growing day by day, and researchers are trying to improve and make data efficient by applying proper algorithm. In future, data mining should perceive the complex inputs from the users and should generate the useful and desired results [42].

CONCLUSION

Data mining techniques are powerful tools for extracting valuable insights from large datasets. Clustering, classification, association rule mining, and outlier detection are among the most commonly used data mining techniques. Each technique has its advantages and disadvantages and is suited to different types of data analysis tasks. The choice of data mining technique depends on the nature of the data, the research question, and the available computational resources. The main issue faced today, is data privacy and data security. In case of

global data sharing, privacy becomes more important, especially for web. Therefore, our future work includes the data privacy and security by applying a specific security algorithm that would not harm the data efficiency.

II. REFERENCES

[1]. "Spatial data mining and geographic knowledge discovery—An introduction," Comput. Environ. Urban Syst., vol. 33, no. 6, pp. 403–408, 2009.

[2]. M. Goebel and L. Gruenwald, "A Survey of Data Mining and Knowledge Discovery Software Tools," SIGKDD Explor. Newsl., vol. 1, no. 1, pp. 20–33, 1999.

[3]. A. Dutt, M. A. Ismail, and T. Herawan, "A Systematic Review on Educational Data Mining," vol. 3536, no. c, 2017.

[4]. H. M. Nagy, W. M. Aly, and O. F. Hegazy, "An Educational Data Mining System for Advising Higher Education Students," vol. 7, no. 10, pp. 622–626, 2013.

[5]. P. Ristoski and H. Paulheim, "Web Semantics : Science , Services and Agents on the World Wide Web Semantic Web in data mining and knowledge discovery : A comprehensive survey," vol. 36, pp. 1–22, 2016.

[6]. A. L. Buczak and E. Guven, "A Survey of Data Mining and Machine Learning Methods for Cyber Security Intrusion Detection," vol. 18, no. 2, pp. 1153–1176, 2016.

[7]. A. K. Choudhary, J. A. Harding, and M. K. Tiwari, "Data mining in manufacturing: A review based on the kind of knowledge," J. Intell. Manuf., vol. 20, no. 5, pp. 501–521, 2009.

[8]. C.-L. Huang, M.-C. Chen, and C.-J. Wang, "Credit scoring with a data mining approach based on support vector machines," Expert Syst. Appl., vol. 33, no. 4, pp. 847–856, 2007.

[9]. J. Srivastava, R. Cooley, M. Deshpande, and P.-N. Tan, "Web usage mining," ACM SIGKDD Explor. Newsl., vol. 1, no. 2, pp. 12–23, 2000.

[10]. B. Krawczyk and F. Herrera, "Neurocomputing A survey on data preprocessing for data stream mining : Current status and future directions," vol. 239, pp. 39–57, 2017.

[11]. M.-S. Ming-Syan Chen, J. Jiawei Han, and P. S. Yu, "Data mining: an overview from a database perspective," IEEE Trans. Knowl. Data Eng., vol. 8, no. 6, pp. 866–883, 1996.

[12]. N. Jain and V. Srivastava, "Data Mining Techniques: a Survey Paper," IJRET Int. J. Res. Eng. Technol., vol. 2, no. 11, pp. 116– 119, 2013.

[13]. S.-H. Liao, P.-H. Chu, and P.-Y. Hsiao, "Data mining techniques and applications – A decade review from 2000 to 2011," Expert Syst. Appl., vol. 39, no. 12, pp. 11303–11311, 2012.

[14]. C. F. Chien and L. F. Chen, "Data mining to improve personnel selection and enhance human capital: A case study in high- technology industry," Expert Syst. Appl., vol. 34, no. 1, pp. 280– 290, 2008.

[15]. J. Han and J. Han, "Data mining techniques," in Proceedings of the 1996 ACM SIGMOD international conference on Management of data - SIGMOD '96, 1996, vol. 25, no. 2, p. 545.

[16]. L. Geng and H. J. Hamilton, "Interestingness measures for data mining," ACM Comput. Surv., vol. 38, no. 3, pp. 1–32, 2006.

[17]. R. Baker, "Data mining for education," Int. Encycl. Educ., 2010.

[18]. Y.-H. Tseng, C.-J. Lin, and Y.-I. Lin, "Text mining techniques for patent analysis," Inf. Process. Manag., vol. 43, no. 5, pp. 1216– 1247, 2007.

[19]. W. Fan, L. Wallace, S. Rich, and Z. Zhang, "Tapping the power of text mining," Commun. ACM, vol. 49, no. 9, pp. 76–82, Sep. 2006.

[20]. R. Iváncsy and I. Vajk, "Frequent pattern mining in web log data," Acta Polytech. Hungarica, vol. 3, no. 1, pp. 77–90, 2006.

[21]. P. Baepler and C. Murdoch, "Academic Analytics and Data Mining in Higher Education," Int. J. Scholarsh. Teach. Learn., vol. 4, no. 2, Jul. 2010.

[22]. M. J. Shaw, C. Subramaniam, G. W. Tan, and M. E. Welge, "Knowledge management and data mining for marketing," Decis. Support Syst., vol. 31, no. 1, pp. 127–137, 2001.

[23]. S. H. Ha and S. C. Park, "Application of data mining tools to hotel data mart on the Intranet for database marketing," Expert Syst. Appl., vol. 15, no. 1, pp. 1–31, 1998.

[24]. U. Fayyad, G. Piatetsky-Shapiro, and P. Smyth, "From Data Mining to Knowledge Discovery in Databases," AI Mag., vol. 17, no. 3, p. 37, 1996.

[25]. E. W. T. Ngai, Y. Hu, Y. H. Wong, Y. Chen, and X. Sun, "The application of data mining techniques in financial fraud detection: A classification framework and an academic review of literature," Decis. Support Syst., vol. 50, no. 3, pp. 559–569, 2011.

[26]. S. Wang, "A comprehensive survey of data mining-based accounting-fraud detection research," 2010 Int. Conf. Intell. Comput. Technol. Autom. ICICTA 2010, vol. 1, pp. 50–53, 2010.

[27]. E. Kirkos, C. Spathis, and Y. Manolopoulos, "Data Mining techniques for the detection of fraudulent financial statements," Expert Syst. Appl., vol. 32, no. 4, pp. 995–1003, 2007.

[28]. M. Ramageri, "Data Mining Techniques and Applications," Indian J. Comput. Sci. Eng., vol. 1, no. 4, pp. 301–305, 2010.

[29]. C. Apte, B. Liu, E. P. D. Pednault, and P. Smyth, "Business applications of data mining," Commun. ACM, vol. 45, no. 8, pp. 49– 53, Aug. 2002.

[30]. C. Yen and H. Wang, "Applying data mining to telecom churn," vol. 31, pp. 515–524, 2006.

[31]. R. Bellazzi and B. Zupan, "Predictive data mining in clinical medicine: Current issues and guidelines," Int. J. Med. Inform., vol. 77, no. 2, pp. 81–97, 2008.

[32]. "Selected techniques for data mining in medicine," Artif. Intell. Med., vol. 16, no. 1, pp. 3–23, 1999.

[33]. B. D. Pitt and D. S. Kitschen, "Application of data mining techniques to load profiling," in Proceedings of the 21st International Conference on Power Industry Computer Applications. Connecting Utilities. PICA 99. To the Millennium and Beyond (Cat. No.99CH36351), 1999, pp. 131–136.

[34]. A. M. Wilson, L. Thabane, and A. Holbrook, "Application of data mining techniques in pharmacovigilance," Br. J. Clin. Pharmacol., vol. 57, no. 2, pp. 127–134, Sep. 2003.

[35]. S. Palaniappan and R. Awang, "Intelligent Heart Disease Prediction System Using Data Mining Techniques," IEEE/ACS Int. Conf. Comput. Syst. Appl., pp. 108–115, 2008.

[36]. K. Wang, "Applying data mining to manufacturing: the nature and implications," J. Intell. Manuf., vol. 18, no. 4, pp. 487–495, Jul. 2007.

[37]. S. Tahmasebian, M. Ghazisaeedi, M. Langarizadeh, and M. Mokhtaran, "Applying data mining techniques to determine important parameters in chronic kidney disease and the relations of these parameters to each other," vol. 6, no. 2, pp. 83–87, 2017.

[38]. S. Bandaru, A. H. C. Ng, and K. Deb, "Data mining methods for knowledge discovery in multi-objective optimization : Part A - Survey," Expert Syst. Appl., vol. 70, pp. 139–159, 2017.

[39]. B. Boubacar, B. Kamsu-foguem, and F. Tangara, "Data mining techniques on satellite images for discovery of risk areas," Expert Syst. Appl., vol. 72, pp. 443–456, 2017.

[40]. C. Romero and S. Ventura, "Educational Data Mining: A Review of the State of the Art," IEEE Trans. Syst. Man, Cybern. Part C (Applications Rev., vol. 40, no. 6, pp. 601–618, Nov. 2010.

[41]. V. S. Sheng, F. Provost, and P. G. Ipeirotis, "Get another label? improving data quality and data mining using multiple, noisy labelers," in Proceeding of the 14th ACM SIGKDD international conference on Knowledge discovery and data mining - KDD 08, 2008, p. 614.

[42]. H.-P. Kriegel, K. M. Borgwardt, P. Kröger, A. Pryakhin, M. Schubert, and A. Zimek, "Future trends in data mining," Data Min. Knowl. Discov., vol. 15, no. 1, pp. 87–97, Jul. 2007.

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Failure of Screw Jack on Inclined Surface

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ABSTRACT

Screw jack is a device which converts rotary motion to translatory motion, basically screw jack works on the principal of inclined plane. Generally, jack is designed to work in ideal condition i.e. when it is placed on flat surface it works smoothly but when jack is in non-ideal condition i.e when it is placed on inclined surface it fails.

Keywords: Screw Jack, Inclined Plane, Optimization, Robust parameter Design

I. INTRODUCTION

A Screw Jack is a device which is used to lift the loads. When ideal condition is there (Horizontal Surface)the jack works smoothly but when jack is to work in non-ideal condition it fails to lift the load. As todays era demands flexibility in design it is necessary to redesign the screw jack for non- ideal condition also.
Screw on flat surface Screw is the back bone of the screw jack,it works on the principal of inclined plane.

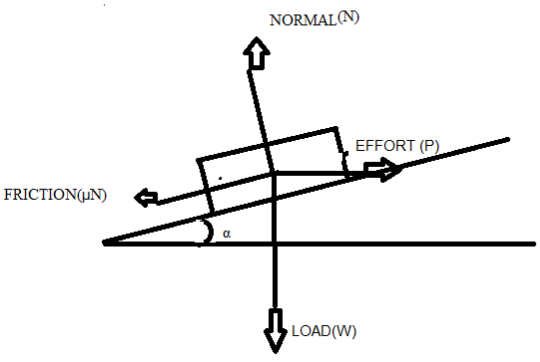

Fig.1.1 Load on Horizontal Position.

In above figure,
N=Normal Reaction, μN=Frictional Force , P= Effort required to raise the load, W= load to be lifted.
Resolving the forces along the horizontal will get,

$P=NSin(\alpha) + \mu NCos(\alpha)$ ----------(I)

Resolving forces along the Vertical,

$W= N Cos(\alpha) - \mu NSin(\alpha)$----------(II)

Dividing expression I by II will get,

$P = W (\mu + \tan (\alpha)) /(1-\mu \tan(\alpha))$----------(III)

But we Know that ,

$\mu = \tan (\phi)$

Hence,

Equation will be further modified as ,

$P= W \tan(\phi + \alpha)$----------(IV)

So this is Effort required to raise the load. Now, it is necessary to consider the torque required to raise the load.

Torque requirement is given as,

Mt= Force * Perpendicular Distance

$Mt= W \tan(\phi + \alpha) *(dm/2)$----------(V)

Where d_m = Mean diameter of screw jack.

II. SCREW DESIGN

Now will consider one case [1] where it is necessary to design a screw to lift 100kN load up to 500 mm

The first step in design is material selection, generally material for screw jack is 30C8[1]

Next step in design is calculating its possible diameter, So direct stress on screw will be given as

$$\sigma = \frac{W}{A}$$

Where W= load to be lifted,

A= area of screw

σ = Compressive Stress

The value of compressive stress is given as 400 N/mm^2 & the factor of safety Considered is 5.

Hence, σ=80 N/mm^2

Therefore,

$$\sigma = \frac{4W}{\pi * (dc) * (dc)}$$

Therefore dc =39.89 or 40mm

As a first trial 60 mm nominal diameter & pitch(p)=9mm selected

$$dc = d - 0.5 * p$$

That will provide core diameter as 55.5mm

$$\tan(\alpha) = \frac{l}{\pi * dm}$$

As the screw is single start l=p=9 mm

Therefore α = 2.95 degree.

By using equation (IV) will get torque .

Mt =648316.03 N-m

Shear stress in screw is given as

$$\tau = \frac{16Mt}{\pi * dc * dc * dc}$$

=24.89 N/mm^2

And the direct stress is given as,

$$\sigma = \frac{W}{A}$$

=48.95 N/mm^2

It is also needed to calculate the Bending stress which is given as,

$$\sigma b = \frac{32Mb}{\pi * dc * dc * dc}$$

Here Mb (bending moment) is given asu

$Mb = P * l$

Here l is considered as lifting length & additional length which will be needed to hold the screw in assembly,

Mb=410400 N-mm

Putting this value in equation of bending stress which gives

σ b= 31.51 N/mm^2

Here total Stress will be the effect of bending & shear stress,

$$\tau = \sqrt{(\sigma b/2)^2 \ + \tau}$$

τ = 29.46

But factor of safety is given as

fs=0.5S_{yt}/ τ_{max}

S_{yt} =400

fs =6.79

As the factor of safety is more than 5 Hence the design is safe.

Next step is buckling consideration,

For that slenderness ratio is required,

Slenderness ratio = l/k

Where, l= length of screw

k= Radius of gyration

$$k = \sqrt{I/A}$$

Therefore k =43.14

Since the one end is fixed & other end is free the end fixity coefficient is 0.25.The borderline between short & long column is given by,

$$\frac{Syt}{2} = \frac{n * \pi^2 * E}{(\frac{l}{k})}$$

Therefore l\k becomes 50.33

Hence the value 43.14 is less than 50.33 Hence the column is short one.

Hence we can use Here Johnsons Equation Here to find Out the Critical Load(Pcr).

$$Pcr = Syt * A[1 - \frac{Syt}{(4 * n * \pi^2 * E)} * (\frac{l}{k})]$$

Pcr =5193860.04 N

The factor of safety from buckling consideration is ivem as,

$$fs = \frac{Pcr}{W}$$

From buckling consideration factor of safety is 5.19, again the design is safe.

III. SCREW ON INCLINED SURFACE

When the above designed screw is placed on inclined surface let us assume that the inclination of the ground with the horizontal is β , The exact figure will look like

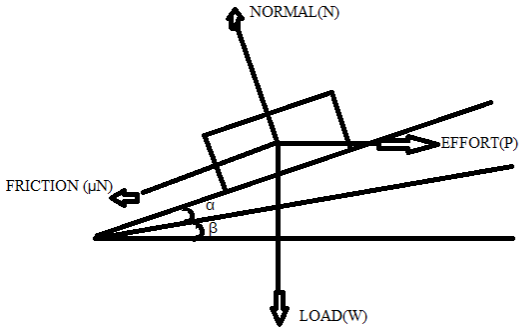

Fig.2.Screw On inclined Surface

Hence above equations(I,II,III,IV) will modify as below,

$P=NSin(\alpha+\beta) + \mu NCos(\alpha+\beta)$ ----------(VI)

Resolving forces along the Vertical,

$W= N Cos(\alpha+\beta) - \mu NSin(\alpha+\beta)$ ----------(VII)

Dividing expression I by II will get,

$P = W (\mu + \tan (\alpha+\beta)) /(1-\mu \tan(\alpha+\beta))$ ----------(VIII)

But we Know that ,

$\mu = \tan (\phi)$

Hence,

Equation will be further modified as ,

$P= W \tan(\phi + \alpha+\beta)$----------(IX)

So this is Effort required to raise the load. Now, it is necessary to consider the torque required to raise the load.

Torque requirement is given as,

Mt= Force * Perpendicular Distance

$Mt= W \tan(\phi + \alpha +\beta) *(dm/2)$----------(X)

Where d_m = Mean diameter of screw jack.

IV. FAILURE OF SCREW ON INCLINED SURFACE

Now let us assume that the screw is placed on inclined surface this inclination is 15°
Therefore,
β= 15°
Therefore, Effort required from Equation VI will become,
P= $100*10^3(\tan(10.20+2.95+15))$
P=53507.22 N
Hence the equation of torque (X)
Mt=1484825.522 N-mm
Mt= 1484.825 K N-mm
This torque is very much more as compared to torque on Horizontal Surface.

Now Shear Stress is Given As

$$\tau = \frac{16Mt}{\pi * dc * dc * dc}$$

τ= 57.03N/mm^2
Bending Stress is given As,

$$\sigma b = \frac{32Mb}{\pi * dc * dc * dc}$$

But Mb is equal to,

Mb=P*l
Mb=0.9*2*400*570
Mb=410400 N-mm
Putting this value in formula for bending stress we will get

$$\sigma b = \frac{32Mb}{\pi * dc * dc * dc}$$

σb = 31.51 N-mm
Again this stress is far more as compared to bending stress obtained on Horozontal surface.
Total Principal Shear stress is given as

$$\tau = \sqrt{(\sigma b/2)^2 \ + \tau}$$

τ_{max}= 59.19 N/mm^2

Factor of safety is given as,

$fs=0.5S_{yt}/ \tau_{max}$

fs =(0.5*400)/59.19

fs=3.37

As this factor of safety is quit lesser than 5 Hence we can conclude that the Designed Screw will fail at an inclination of 15°. Hence, We can conclude that screw is need to be Redesigned.

V. CONCLUSION

As the stresses induced on Inclined surface are much more as that of horizontal urface hence it is very necessary to redesign this screw,results obtained from the calculations are summarized below

Parameter	Horozontal Surface	Inclined Surface ($\beta = 15°$)
Shear Stress (τ)	29.46 N/mm^2	57.03N/mm^2
Bending Stress (σ)	31.51 N/mm^2	31.51 N/mm^2
Maximum Shear Stress (τ_{max})	29.46N/mm^2	59.19N/mm^2
Factor of Saftey	6.79	3.37

Table.1.0 Horizontal Vs Inclined Surface Calculation

Hence from the above table we can conclude that the design Will fail for inclined surface.

VI. FUTURE SCOPE

As the screw is failing to lift the load on inclined surface it is necessary to redesign the screw, for redesigning the screw it very necessary to optimize the design parameters . For optimization process we can use Taguchi's Robust parameter Design Method [6], In order to get optimal settings of the design parameters.

VII. REFERENCES

[1]. V.B. Bhandari, "Design of Machine Elements", Third Edition, Tata McGraw Hill Education Pvt. Ltd. pp(208-210)

[2]. Prashant Kumar Srivastava, Vipin Kumar Pandey,, Shailesh Kumar Maurya,Ajit Tiwari, Prof. Jawed Rafiq, , S.K. Dwivedi, " Highly Efficient Motorized Screw Jack", International Journal of Computational Engineering Research,Vol, 03,(2013),Issue, 5.

[3]. Prof.Faijubhai R.,Malek Harsheel H.Panchasara,"Design Optimization of Mechanical Screw Jack", International Journal of Futuristic Trends in Engineering and Technology,ISSN: 2348-5264 (Print), ISSN: 2348-4071 (Online) ,Vol. 1 (06), 2014.pp 39-42.

[4]. Reena M Arora, M.K. Sonpimple, Kiran R. Kaware, Dilip L Budhlani, "Design Optimization of Power Screw Jack",IJAEST ,Vol No. 9, Issue No. 2, 171 – 177

[5]. Nitinchandra R. Patel, Dipen B. Rokad, Ankit V. Vekariya, Pratik J. Chauhan "Consideration of Material Alternatives in Enhancement to get Unique Solution in Design of Screw Jack", International Journal of Engineering Science and Innovative Technology (IJESIT) , ISSN: 2319-5967 ,Volume 3, Issue 2, March 2014

[6]. Nitinchandra R. Patel, Dipen B. Rokad, Ankit V. Vekariya, Pratik J. Chauhan "Consideration of Material Alternatives in Enhancement to get Unique Solution in Design of Screw Jack", International Journal of Engineering Science and Innovative Technology (IJESIT) , ISSN: 2319-5967 ,Volume 3, Issue 2, March 2014

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The Use of Fuzzy Logic Technique to Optimise Gas Metal Arc Welding Process

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ABSTRACT

Fuzzy logic systems are widely used for control, system identification, and pattern recognition problems. The most successful application area of fuzzy systems is the area of fuzzy controllers. In this paper we use fuzzy controller's expert system to optimise the GMAW arc welding process. In this problem we wish to minimize the sum of the squares of errors in approximating the data. A general fuzzy controller consists of four modules: a fuzzy rule base, a fuzzy inference engine, and fuzzification and defuzzification modules. Fuzzy controllers, contrary to classical controllers, are capable of utilizing knowledge elicited from human operators. The process parameters, namely arc current, arc voltage, depth of penetration are optimised with considerations of the performance characteristics. Experimental results are provided to confirm the effectiveness of this approach.

Keywords: Gas Metal Arc Welding, Fuzzy Logic System.

I. INTRODUCTION

Gas Metal Arc Welding (GMAW) is a welding process which joins metals by heating the metals to their melting point with an electric arc. The arc is between a continuous, consumable electrode wire and the metal being welded. The arc is shielded from contaminants in the atmosphere by a shielding gas. GMAW can be done in three different ways: Semiautomatic (Hand held) Welding, Machine Welding, Automatic Welding.

II. INFLUENCE OF PROCESS PARAMETERS

The welding parameters influence the weld bead geometry and weld microstructure, which is related to mechanical properties. It indicates the necessity to establish the relationship between process variables and weld quality characteristics. The Gas Metal Arc welding processes are highly nonlinear and coupled multivariable systems. It suggests the need for an intelligent system to evaluate the process [3].

Physics of Welding

The welding process is a multi energy process having phenomenon such as plasma physics, heat flow, fluid flow and heat and metal transfer. An Arc is the core of physics of welding process. In welding a high energy density heat source is applied on the surfaces to join and is moved along the path of the joint. When filler is added on joint, the heat source must be sufficient to melt the filler material. In case of arc welding the energy input is arc energy. It is quantity of energy transferred per unit length of weld from a heat source in joules per meter or millimetre. Thus energy input is defined as ratio of total input power (p) of the heat source in watts to its travel velocity (R) expressed in mm/sec.

If heat source is in arc then heat input energy is

Where E is voltage (volts) and I is current (amps). Taking efficiency of heat transfer into account, the net energy input is given as

H net = $\eta_t H = \frac{\eta_t P}{R} = \frac{\eta_t EI}{R}$ ..... (1)

Welding arc can be viewed as a gaseous conductor that converts electrical energy into heat energy. The heat energy in an arc is generated by electrical reactions at cathode and anode regions within plasma. The characteristics features of welding arc are plasma, temperature, radiation, electrical features, magnetic fields and arc blow. Plasma includes molten metal, slags, vapours and molecules. Formation of plasma is governed by the Ideal gas law and law of mass action. It has temperature in the range of 5,000 to 15,000 0k.Welding arc acts like impedance to the flow of electric current in power supply circuit. The power dissipated in the arc is sum of power in three regions of the arc, the anode, the cathode and the plasma. Metal transfers are result of balance of forces acting on metal droplets. Sum of surface tension force and vapour jet force is equal to sum of gravitational force, aerodynamic force and electromagnetic force.

III. SELECTION OF PROCESS PARAMETERS

In an arc welding process formation of weld pool is a common characteristic. Upon solidification of the weld pool the liquid metal converts into weld bead. One of the most important factor determining quality of weld is the degree of penetration. Depending on the penetration depth being equal to, less than or more than the work piece thickness, we get full or partial penetration. The important input parameters are welding speed, welding voltage, welding current, gas flow rate, nozzle to plate distance, torch angle. Three levels could be considered for input process parameters. The output parameters are bead height, bead width and bead penetration

IV. LITERATURE REVIEW

The bead geometry is dependent on a number of input process parameters. These parameters are interconnected in such a way that it is difficult to identify the contribution of these parameters towards the

desired output. An expert welder from his experience selects a set of parameters, which may yield fairly good results. However, the obtained results may not be optimum. It could be avoided, if a suitable mathematical model could be developed, which could forecast the output. Welding process consists complicated natural phenomena, all of which may not be fully understood. In such situations, models are made from the outcomes of experiments performed as per some statistical designs and then analyzed by regression methods to predict the required output.

The regression equations could be either linear or non-linear. Yang and Chandel (1993), and Yang et al. (1993) performed both linear as well as non-linear regression analysis to model submerged arc welding process. Non-linear regression equations are generally used to model welding phenomena but it was observed by Yang et al. (1993) that linear regression equations were equally suitable. The above statistical regression analysis yielded more or less satisfactory results. The statistical methods are global in nature. The usual practice is to establish a single working relationship between the inputs and an output for the entire domain of interest. As a result it might be possible to predict the results accurately at the anchor points only [4, 5].

However, there might be some deviations in prediction at the intermediate points. To overcome this problem, Ganjigatti et al. (2007) developed a new methodology to model the input–output relationships by carrying out regression analysis cluster-wise. It took care of the forecasting of intermediate points [6]. Gunaraj and Murugan (1999, 2000a) performed experiments with submerged arc welding of stainless steel pipes, based on central composite design (CCD) with four factors. Regression equations were used to predict bead geometric parameters like bead height, bead width and weld penetration. Those models were found to be good in predicting an output from a given set of input parameters [7,8].

Taguchi (1990) developed a method of conducting experiments based on orthogonal array. It gives a much reduced variance for the experiment with optimal setting of control parameters. In this method, we get the amalgamation of Design of experiments with optimization of control parameters to obtain the best results. Orthogonal arrays provide a set of well balanced experiments. Signal-to noise ratios served as the objective function [10]. The Taguchi method was utilized by Tarng and Yang (1998) to analyze the effect of each welding process parameter on the weld-bead geometry. Based on the concept of signal-to noise ratio and analysis of variance, the set of optimal welding process parameters were obtained and verified [11]. Tarng et al. (2002) used a grey relational analysis to investigate multiple performance characteristics in the Taguchi method for the optimization of submerged arc welding process. The use of the above approach greatly simplifies the optimization procedure in the submerged arc welding process [12]. Gunaraj and Murugan (2000b) minimized weld volume for the submerged arc welding process using an optimization tool in Matlab. Bead height, bead width and bead penetration (BP) were taken as the constraints. The above optimization problem was solved using Quasi-Newton method [9].

No one has used fuzzy logic technique as an optimisation tool in GMAW process. It optimises desired value from set of values of input and output variables. These set of values are determined from experimental or analytical results. Fuzzy controllers are special expert systems. Each employs a knowledge base, expressed in terms of relevant fuzzy inference rules, and an appropriate inference engine to solve a given control problem.

V. EXPERIMENT

The welding experiment is performed according to Box Behenken Method. Semiautomatic Gas Metal Arc Welding process is used. The results of the experiment are shown in the table – 01.

Table - 01

S.N.	Current (A)	Voltage (V)	Depth of Penetration (mm)
1	5	30	2.044
2	7	30	2.446
3	5	40	2.335
4	7	40	1.66
5	5	35	2.311
6	7	35	2.708
7	5	35	2.255
8	7	35	2.379
9	6	30	2.448
10	6	40	2.332
11	6	30	2.421
12	6	40	2.335
13	6	35	2.211
14	6	35	2.411
15	6	35	2.311

VI. FUZZY LOGIC SYSTEM

Fuzzy controller—. Fuzzy controllers vary according to nature of control problem. Control problems range from complex task to simple goals. Fuzzy controllers are capable of utilizing knowledge elicited from human operators. Human operator performs well under the circumstances. A general fuzzy controller consists of four modules, fuzzification, fuzzy rule base, fuzzy inference engine and defuzzification. A fuzzy controller operates by repeating a cycle of above four steps.

Fuzzification – Measurement's are taken of all variables, these measurements are converted into appropriate fuzzy sets. Select meaningful linguistic states for each variable and express them by appropriate fuzzy sets. These fuzzy sets are fuzzy numbers which represent linguistic labels such as approximately zero, positive small, negative small, positive medium, negative medium, positive large, negative large. Two conditions are monitored by the controller, an error (e) defined as the difference between the actual value of controlled variable and its desired value and the derivative of error (e'), which expresses rate of change of error. Using values of e and e', fuzzy controller produces values of controlling variable (v). The linguistic states are represented by a triangular shaped fuzzy numbers, we get fuzzy quantization's for variables e, e' and v as shown in figure 1.

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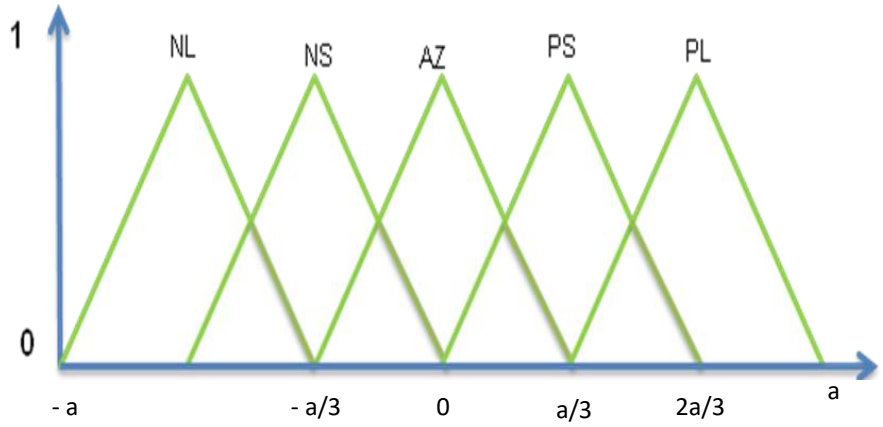


Fig. 01

Membership function (error function) is defined as

Derivative of error function – The derivative of left side and right side should be equal, then function is said to be continuous and its derivative exists.

With the variables e, e' and v, the inference rules have the canonical form

If e = A and e' = B then V = C, ----------Rule (1)

Fuzzy Rule Base

V	e'					
		NL'	NS'	AZ'	PS'	PL'
	NL	PL		PL	PS	AZ
	NS			PS	AZ	NS

e	AZ	PS		AZ	NS
	PS	PS	AZ	NS	
	PL	AZ	NS	NL	NL

e' / e	NS'	AZ'	PS'
NS	PM	PS	AZ
AZ	PS	AZ	NS
PS	AZ	NS	NM

Table – 02 Table - 03

The linguistic states NL, PL, NL', PL' do not participate in this very restricted set of inference rules. As it is case of optimization so extreme large values to be omitted. So minimum set of fuzzy rule base to stabilize welding process are shown in Table 03.

A set of input output data is determined by $\{(X_k, Y_k, Z_k / k \in K\}$, where X_k, Y_k are values of input variables e and e' respectively. Z_k is desirable value of output variable V. K is an index set. A (X_k), B (Y_k), C (Z_k) denotes largest membership grades in fuzzy sets representing the linguistic state of variables e, e' and V respectively. Then degree of relevance of rule (1) can be defined by the formula,

$i_1 [i_2 (A (X_k), B (Y_k), C(Z_k)]$ where i_1 and i_2 are t-norms.

$A (X_k) = 1$, $B (Y_k) = 0.4$ and $C(Z_k) = 1$ for all k.

$i_2 ((A (X_k), B (Y_k))$

$i_2 (1, 0.4)$

$= 0.4$ (standard rule of t-norm),

$i_1 [0.4, 1]$

$= 0.4$ (standard rule of t-norm)

This degree calculated for all rules allows to avoid conflicting rules in the fuzzy rule base. The rules that conflict one another, select one with largest degree of relevance.

Fuzzy Inference Engine –The purpose of inference engine is to combine the measurements of input variables to make inferences regarding output variables. The given fuzzy inference rule (1) can be converted into simple fuzzy conditional proposition of the form,

If (e, e') is (A x B) then V is C

Where $[A \times B] (x, y) = \min [A(x), B(y)]$

For all $x \in [-a, a]$ and all $V \in [-b, b]$

Also express the fuzzified input measurement $fe(x_o)$ and $fe'(y_o)$ as a single joint measurement as

$(e_o, e_o') = fe(x_o) \times fe'(y_o)$

So $(e_1, e_1') = fe(x_1) \times fe'(y_1)$

$= 1 \times 0.4$

$= 0.4$

Similarly for all nine rules value is 0.4

Also [A x B] (x, y) = min [A(x), B(y)]

= min [1, 0.4]

= 0.4 for all x ∈ [-5, 5] & y ∈ [-5, 5]

When fuzzy rule base consist of nine fuzzy inference rules, then the rule form is,

1: If (e, e') is (A_1 x B_1), then V is C_1, i.e. (e_1, e_1') is [-5, 0] x [-4,-1], C_1= [0.1, 0.6]

2: If (e, e') is (A_2 x B_2), then V is C_2, i.e. (e_2, e_2') is [-5, 0] x [-1.5, +1.5], C_2 = [0.1, 0.6]

3: If (e, e') is (A_3 x B_3), then V is C_3, i.e. (e_3, e_3') is [-5, 0] x [1, 4], C_3= [-0.15, 0.35]

4: If (e, e') is (A_4 x B_4), then V is C_4, i.e. (e_4, e_4') is [-2.5, +2.5] x [-4,-1], C_4= [0.1, 0.6]

5: If (e, e') is (A_5 x B_5), then V is C_5, i.e. (e_5, e_5') is [-2.5, +2.5] x [-1.5, +1.5], C_5= [-0.15, 0.35]

6: If (e, e') is (A_6 x B_6), then V is C_6, i.e. (e_6, e_6') is [-2.5, +2.5] x [1, 4], C_6= [-0.4, 0.1]

7: If (e, e') is (A_7 x B_7), then V is C_7, i.e. (e_7, e_7') is [0, 5] x [-4,-1], C_7= [-0.15, 0.35]

8: If (e, e') is (A_8 x B_8), then V is C_8, i.e.(e_8, e_8') is [0, 5] x [-1.5, +1.5], C_8 = [-0.4, 0.1]

9: If (e, e') is (A_9 x B_9), then V is C_9, i.e. (e_9, e_9') is [0, 5] x [1, 4], C_9= [-0.4, 0.1]

Fact: (e, e') is fe (x_o) × fe' (y_o)

Conclusion: V is C

Symbols A_j, B_j, C_j, (j = 1, 2... 9) denote fuzzy sets that represent linguistic states of variables e, e', V respectively.

Defuzzification -- Three methods are predominant in fuzzy control, center of area method, centre of maxima method and mean of maxima method. By center of area method the defuzzified value $d_{CA}(C)$ for discrete case in which C is defined on finite universal set { z_1, z_2, z_3,..., z_n },the formula is,

$$d_{CA}(C) = \frac{\sum_{k=1}^{n} C(z_k) z_k}{\sum_{k=1}^{n} C(z_k)}$$

Putting the values in the above equation,

d_{CA}(C)= { 3[-0.4,0.1]+3[-0.15,0.35]+3[0.1,0.6]}/9

= [-0.15,0.35]

The results obtained by other two methods are also same as obtained by this method.

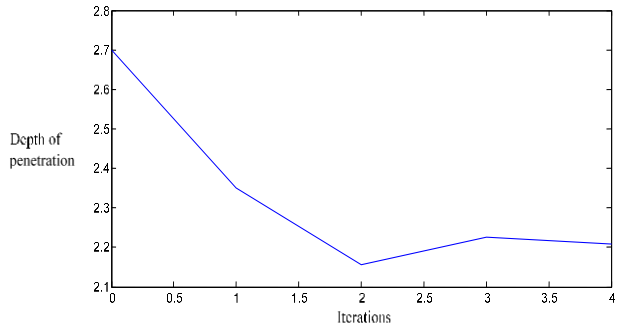
Results Obtained Using Fuzzy Controller:

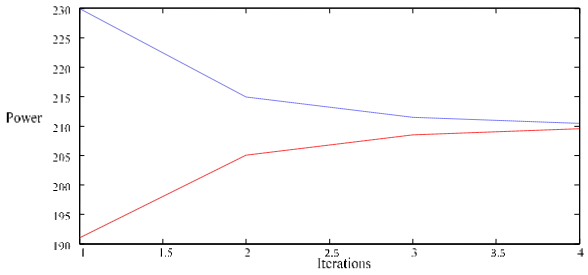
Desired Value of Power (P) = η VI=210 Watt,

Desired value of Depth of Penetration (DOP) =2.3 mm

S.N	Parameter	Input Values	Output Iterations			
			1st	2nd	3rd	4th
1.	Power (P)	[150, 280]	[191, 230]	[205.1, 214.9]	[208.5, 211.5]	[209.55, 210.45]
2.	DOP	[1.66, 2.70]	[2.05, 2.35]	[2.245, 2.155]	[2.173, 2.227]	[2.1919, 2.2081]

VIII. GRAPHS





IX. CONCLUSION

The optimization methodology presented in this paper offers substantial improvement over conventional methods in welding technology. The method can be applied to wide range of problems. It is observed that as voltage is kept constant and current increases then DOP tends to increase. Also current is kept constant and voltage increases then DOP tends to increase. When the product of current and voltage is nearest to optimum value, a constant DOP is achieved.

X. REFERENCES

[1]. George J. Klir & Bo Yuan."Fuzzy sets and fuzzy Logic: Theory and applications", Third edition, Prentice-Hall, Inc., Englewood cliffs, N.J.,U.S.A.(Oct. 2000). ISBN-81-203-1136-1

[2]. Miller Electric Mfg. Co., " Guidelines For Gas Metal Arc Welding GMAW)", An Illinois Tool Works Company,1635 West Spencer Street, Appleton, WI 54914 ,USA,2010

[3]. International Journal of Manufacturing Research 2011-Vol.6, No.1 pp.15-19.

[4]. Yang, L.J., Chandel, R.S., 1993. An analysis of curvilinear regression equations for modeling the submerged-arc welding process. Journal of Materials Processing Technology 37, 601–611.

[5]. Yang, L.J., Bibby, M.J., Chandel, R.S., 1993. Linear regression equations for modeling the submerged-arc welding process. Journal of Materials Processing Technology 39, 33–42.

[6]. Ganjigatti, J.P., Pratihar, D.K., RoyChoudhury, A., 2007. Global versus cluster-wise regression analyses for prediction of bead geometry in MIG welding process. Journal of Materials Processing Technology 189, 352–366.

[7]. Gunaraj, V., Murugan, N., 1999. Prediction and comparison of the area of the heat-affected zone for the bead-on-plate and bead-on-joint in submerged arc welding of pipes. Journal of Materials Processing Technology 95, 246–261.

[8]. Gunaraj, V., Murugan, N., 2000a. Prediction and optimization of weld bead volume for the submerged arc process—Part 1. Welding Journal 78, 286s–294s.

[9]. Gunaraj, V., Murugan, N., 2000b. Prediction and optimization of weld bead volume for the submerged arc process—Part 2.Welding Journal 78, 331s–338s.

[10]. Taguchi, G., 1990. Introduction to Quality Engineering. Asian Productivity Organisation, Tokyo.

[11]. Tarng, Y.S., Yang, W.H., 1998. Optimization of the weld-bead geometry in gas tungsten arc welding by the Taguchi method. International Journal of Advanced Manufacturing Technology 14 (8), 549–554.

[12]. Tarng, Y.S., Juang, S.C., Chang, C.H., 2002. The use of grey-based Taguchi methods to determine submerged arc welding process parameters in hardfacing. Journal of Materials Processing Technology 28, 1–6.

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Literature Review on Advancements on Lifting Mechanisms

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ABSTRACT

Human body mechanics of pushing and pulling for analyzing the factors of task-related strain on the musculoskeletal system were studied .The study was conducted to ascertain the important factors of musculoskeletal strain developing from pushing and pulling tasks such as tyre handling. The study found that tyre which is the most influential parameter and must be given consideration for actions like pushing and lifting of heavy tyres. While handling masses like tyre there is no advantageous grip position and handlers should allow different hand position with task experience and techniques to reduce the risk of injury.
In a study of current research focused on pulling and pushing the author argued that despite the efforts to contain the problems, severity and cost of injuries remains unchanged or continue to grow. Also In view of review of the prominent papers dealing with the developments in Tyre lifting mechanisms and their applications. It is concluded that the literature is available only pertaining to lifting the Vehicle through jacking action and not to assist in Tyre wheel handling. Similarly, the literature available pertaining to effect of push and pull on strain on the musculoskeletal system of human body also indicate that the excessive pushing and pulling action leads to sever muscle strain, back pain and fatigue. As Tyre wheel handling process is very laborious, hectic and is affecting the human body health, Therefore, there is an urgent requirement of Mechanized solution to reduce the human efforts.Hence new idea is to design & develop Manual tyre lifting Mechanism which is discussed in this research paper

KEYWORDS: Musculoskeletal system, tyre lifting Mechanism, pushing and pulling tasks, jacking action

I. INTRODUCTION

The transportation has become the part of our daily life. Transportation includes medium like (a) By Air (b) By Railway (c) By Water and (d) by Roadway. The mostly used medium is the roadways for daily life work like for reaching in office, transportation of goods and other work. The total vehicles used in India are 25,33,11,000. Mostly used vehicles by Indian peoples are the two Wheelers, which contributes 18,70,91,000. Cars are also used and becomes the second contributors in population of vehicle which contributes 3,36,88,000. The commercial vehicles like freight carriers play an important role in the growth of GDP and contributes the third prominent contributor in population of vehicles with 1,22,56,000. The buses are contributing 18,64,000. (The

Data is for No of Registered Vehicle in India till 2017 (Source: Road Transport Year Book 2016-2017). Only in Maharashtra State 3,20,17,000 vehicles have been registered Up to the year 2017. Daily nearly 55,000 freight carriers are running on Indian roads and drivers and conductors indulged in transporting goods for thousands of kilometers. During journey different problems have been confronted by them, such as, engine failure, gearbox failure, propeller shaft failure, etc. One of the prominent and most hectic and laborious problem, which they face is the Tyre punctured or burst. Literature review and general field observation indicates that the replacement of Tyre is a manual process. Recent research reported that, one can safely push the weight upto 20% of his body weight and pull up to 30% of his body weight.

II. EXISTING METHODS

Figure.1 (a): Semblance of Tyre Wheel Replacement Process.

Figure.1 (b): Semblance of Tyre Wheel Replacement Process

Figure.1 (c): Sophisticated Tyre fitting operation by Robotic Arm

Fig. 1 (a), depicts the tyre changing operation where a man trying to change a tyre wheel assembly by using tie rod from stud of axle hub. If one scrupulously observes this operation, then he may find that the posture acquired by a person is not appropriate and it gives mussel strain which then turn into backache problem. In Fig. & 1 (b), a person holding the tyre will then trying to match the holes with the bolts where excessive human energy deployed, thus this becomes very hectic, laborious and fatigue prone operation with time consumption.

If an excessive push or pull force is given then it may leads to muscle strain as shown in fig. 1(b), severe backache problem [4]. Some automatic solutions are available for this Tyre replacement, but they have certain limitations like, bulky size, very costly, require adaptation of external source because of heavy motors [17] and hydraulic units [5]. Thus, it becomes difficult to carry such bulky machines with every vehicle. The only way which is left, is to provide the portable Tyre lifting mechanism to drivers and conductors, so that they will replace the Tyre very easily. Keeping this idea the present research is planned. A possible solution is proposed through present research by using manually operated Tyre Lifting Mechanism, which will provide facility to a person for easily handling the Tyre wheel. As this mechanism will help a person to take out Tyre wheel from Axle and fitting of Tyre wheel in axle accordingly.

III. LITERATURE REVIEWS

Part-A				
SN	Author Name	Research Paper Name	Factors study/Findings	Conclusion/ Remark
1	Andreas Argubi-Wollesen et_al [01] 2016	Human body mechanics of pushing and pulling: Analyzing the factors	Musculoskeletal strain originating from tyre pulling -pushing and lifting.	Push-pull system With lifting mechanism should be developed to avoid injury.

2	Andrew I Todd [02] 2005	Current Trends In Research Focused on Pushing and Pulling	Effect of pushing and pulling on injuries and its severity.	Push-pull system With Lifting mechanism should be developed to avoid injury.
3	Kyung S. Park et_al' [03] 2005	A Bio-mechanical Evaluation of Two Methods of Manual Load Lifting	Forces on the erector spine muscles and the lumbosacral disc through mathematical modelling	The straight back method is recommended only for lifts when the object is initially close to the spine

Andreas Argubi Wollesen et_al [01] : Human body mechanics of pushing and pulling: Analyzing the factors of task-related strain on the musculoskeletal system

1) Human body mechanics of pushing and pulling for analyzing the factors of task-related strain on the musculoskeletal system were studied [1].
2) The study was conducted to ascertain the important factors of musculoskeletal strain developing from pushing and pulling tasks such as tyre handling.
3) The study found that tyre which is the most influential parameter and must be given consideration for actions like pushing and lifting of heavy tyres. While handling masses like tyre there is no advantageous grip position and handlers should allow different hand position with task experience and techniques to reduce the risk of injury.

Andrew I Todd [02] : Current Trends In Research Focused on Pushing and Pulling.

In a study of current research focused on pulling and pushing the author [2] argued that despite the efforts to contain the problems, severity and cost of injuries remains unchanged or continue to grow.

Kyung S. Park et_al [03] : A Biomechanical Evaluation of Two Methods of Manual Load Lifting.

Forces on the erector spine muscles and the lumbosacral disc through mathematical modelling was studied [3] to evaluate the method of manual load lifting to ascertain the injury to the handler. It was concluded that when the object is initially close to the spine, the straight back method for lifting is recommended but even if the grip is not proper it will cause injury to the handler.

Part-B				
SN	Author Name	Research Paper Name	Factors study/Findings	Conclusion/ Remark
4	Matus Cuchora et_al [23] 2021	Engineering design of lifting device weighing up to 3.5 tons	The thesis deals with the design of a lifting device for lifting cars up to 3.5 tons,	Heavy Scissor Mech-anism is used to lift the Cars in work-station, which is costlier and required external sources of Hydraulic & electrical

				arrangements (**The jacking action is given to car and not for handling tyre wheel**).
5	Kshitij Singh et_ai [17] 2021	Motorized Screw Jack in Automobiles	Authors suggest mend-ment of contemporary day mech. jack with the usage of an electric powered DC motor with inside the screw in an effort to make load lifting easier	D.C. motor and heavy jack are required to lift the car. (**The jacking action is given to car and not for handling tyre wheel)**
6	Deepti Patneet_al [16] 2020	Automatic Car Jack and Pressure Monitoring System	This automatic car jack will minimize the human efforts which is required to operate a jack manually and the pressure monitoring system will be a precautious step to avoid a flat tire as it indicates the pressure level in the tires.	D.C. motor and tyre pressure sensors are Required. (The jacking action is given to Car and not for handling tyre wheel)
7	Moksh Patel et_al [18]	Review on Electric Car Jack Used in Automobile	The work is focused on car jack that adapts D.C. Motor (12-Volts) with the chain-sprocket set to design a suitable machine regarding the problem.	D.C. motor and heavy jack are required. (The jacking action is given to car and not for handling tyre wheel)
8	'M H Fouladi et_al' [05] 2018	"Design and Simulation of an Innovative Tire Lifting Device"	In it he described on pneumatic or Electrical design having low portability due to the wire or hose length Author has chosen hydraulic cylinder as the lifting mechanism	But this design suffer from leakage as well as long hydraulic oil hose length (The jacking action is given to car and not for handling tyre wheel)
9	Mylarapu Shiva Sai et_al [15] 2017	Android based Advanced Car Lifting System Using Bluetooth	In this paper, a new work is initiated to the next generation motor vehicles where all the repair works shall be done by robots.	Skilled persons are Required. (The jacking action is given to car and not for handling tyre wheel)
9	Benjamin Ezurike et_al [22] 2017	Modified Screw Jack for Lifting Operation in Industrial	In this paper the Authors has given the brief introduction of the crank and gear mechanism, which would help to reduce difficulty	crank and gear mechanism is used. Cost of used gear is the disadvantage. (The jacking

		Setting	in operation, reduce time, increase efficiency and effectively control the difficulties encountered in Ergonomics-which is an ultimate sensitivity in design process.	action is given to car and not for handling tyre wheel)
10	Osueke et_al [21] 2016	Design and fabrication of motorized screw jack using local content for higher workshop productivity.	In this paper, the outstanding issues in automotive maintenance on how to reduce human effort in load carriage and how to increase the efficiency of the screw jack applicable in automotive workshop is discussed	Heavy jack is required. (The jacking action is given to car and not for handling tyre wheel)

IV. NEED OF PROJECT

As it is clearly indicated from the former Literature Review and The field observations of Procedure to replace Tyre wheel, the need of the present research are discussed below.

1. The replacement of Tyre wheel is a manual process.the posture acquired by a person during wheel replacement is not appropriate and general ergonomics restricts such posture,Recent research reported that, one can safely push the weight upto 20% of his body weight and pull up to 30% of his body weight. If an excessive push or pull force is given then it may leads to muscle stain, sever backache problem.
2. The Tyre wheel replacement requires sufficient muscle strength, which depends on age group and genders.
3. Some Stationary automatic solutions are available for this Tyre replacement, but they have certain limitations like, bulky in size, very much costlier, require adaptation of external source because of heavy motors and hydraulic units.

V. AIMS AND OBJECTIVES

Aim: The main Aim of the present research is to establish the optimized design parameters for the newly proposed Tyre lifting mechanism by designing and developing the Mechanism..

Objectives:

The objectives of the current research is as below:

1. To design and develop the semi-automatic lifting mechanism for assembly of Tyre wheel in on road manual operation and at workstation.
2. To minimize the human efforts during assembly/replacement of Tyre wheel.

VI. PROBLEM IDENTIFICATION

The replacement of Tyre wheel is included following sequential operation:

- Removing nuts from the hub assembly and removing the cover plate with the help of Tie rod.
- Removing or carry the Tyre wheel from hub assembly by manually pulling. This operation requires twisting and turning movements several times.
- Carry the Tyre wheel to the place, where the Punctured wheel will be repaired.

VII. CONCLUSION

In view of above stated review of the prominent papers dealing with the developments in Tyre lifting mechanisms and their applications.

It is concluded that the literature is available only pertaining to lifting the Vehicle through jacking action and not to assist in Tyre wheel handling.

Similarly, the literature available pertaining to effect of push and pull on strain on the musculoskeletal system of human body also indicate that the excessive pushing and pulling action leads to sever muscle strain, back pain and fatigue.

As Tyre wheel handling process is very laborious, hectic and is affecting the human body health, Therefore, there is an urgent requirement of Mechanized solution to reduce the human efforts.

VIII. REFERENCES

[1]. Andreas Argubi-Wollesen, Bettina-Wollesen, Martin Leitner, Klaus Mattes, “Human ody mechanics of pushing and pulling: analyzing the factors of task related strain on the musculoskeletal system”, SHAW-186,14 July 2016:1–14.

[2]. Andrew I Todd, “Current trends in research focused on pushing and pulling”, Research Gate, Jan’ 2005: 42 – 53.

[3]. Kyung S. Park, “A Biomechanical Evaluation of Two Methods of Manual Load Lifting”, 2015

[4]. Andrew I Todd, “Current trends in research focused on pushing and pulling”, Research Gate, Jan’ 2005: 42 – 53.

[5]. Kyung S. Park, “A Biomechanical Evaluation of Two Methods of Manual Load Lifting”, 2015

[6]. S. Gallagher, “Back injury control measures for manual lifting and seat design”, 2007

[7]. M H Fouladi,“Design and Simulation of an Innovative Tire Lifting Device”, Springer 13-Special Issue, 2018: 1303-1319.

[8]. R. K. Nanwatkar , Pranita B. Daphal, Pratiksha S.Nilange, Vrushali H.Dongre, “Design and fabrication of Mechanical lift for transportation”, GRD Journals,Vol-2,Issue-1, Dec’2016

[9]. Gaffar G Momin, “Design, Manufacturing & Analysis of Hydraulic Scissor Lift” IJERCS, Volume 3, Issue 2, Part 2, Mar-Apr’2015.

[10]. Divyesh Prafulla Ubale, ““Design, Analysis and Development of Multi Utility home equipment using Scissor Lift Mechanism”, IJSRM, Vol-3, Issue-3, 2015: 2405-2408.

[11]. Vitus M. Tabie, "Weight Optimization of a Lift-Tipping Mechanism for Small Solid Waste Collection Truck", IJSTR, 2014.
[12]. K.Sainath, ""Design of Mechanical Hydraulic Jack", IOSR, 2014.
[13]. Ayaulym Rakhmathulina, "2nd World Conference on Educational Technology Researches – WCETR-2012, Elsevier Procedia –Social and Behavioural Sciences,2013: 689 – 692.
[14]. Jaydeep M. Bhatt, Milan J.Pandya, "Design and Analysis of an Aerial Scissor Lift", JOIKR,2013.
[15]. Ramachandra C G, Krishna Pavana, Shivraj Shet, Venugopal Reddy, "Design and Fabrication of Automotive Hydraulic Jack System For Vehicles", IJAER, Vol. No. 6, Issue No. VI, Dec'2013.

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Study of Dairy Wastewater Treatment by Using Constructed Wetland

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ABSTRACT

Dairy industries have shown tremendous growth in size and number in most countries of the world. These industries discharge wastewater which is characterized by high chemical oxygen demand, biological oxygen demand, nutrients, and organic and inorganic contents. Such wastewaters, if discharged without proper treatment, severely pollute receiving water bodies. In this article, the various recent advancements in the treatment of dairy wastewater have been discussed and stress is given on the lowest cost of the best possible treatment. The objective of the research was to evaluate the performance of a laboratory-scale biological treatment unit for dairy-industry wastewater and to determine the kinetic parameters. The quality of wastewater decides the line of treatment. The study undertaken involved the characterization of wastewater and the dairy waste is selected for this purpose. Constructed wetlands treat the sewage water using highly effective and ecologically sound, design principles that use plants, microbes, sunlight and gravity to transform wastewater into gardens and reusable water. There for we use constructed wetland for treating the dairy waste water to convey the best result and pollution free climate.

Keywords: Dairy Wastewater, Characterization of Wastewater, laboratory-scale biological treatment, Ecofriendly and low cost treatment method, constructed wetland, Development of society.

I. INTRODUCTION

1.1 DAIRY WASTEWATER

The dairy industry wastewaters are primarily generated from the cleaning and washing operations in the milk processing plants. It is estimated that about 2 % of the total milk processed is wasted into drains. Dairy wastewaters are characterized by high Biological-Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), Dissolved Oxygen (DO) concentrations, and generally contain fats, nutrients, lactose, as well as detergents and sanitizing agents. Dairy effluents decompose rapidly and deplete the dissolved oxygen level of the receiving streams immediately resulting in anaerobic conditions and release of strong foul odour due to nuisance conditions. The receiving water becomes breeding place for flies and mosquitoes carrying malaria and other dangerous diseases like dengue fever, yellow fever, chicken guniya.

It is also reported that higher concentration of dairy wastes are toxic to certain varieties of fish and algae. The casein precipitation from waste which decomposes further into a highly odorous black sludge at certain dilutions the dairy waste is found to be toxic to fish also. Dairy effluent contains soluble organics, suspended, solids, trace organics. They decrease do, promote release of gases, cause taste and odour, impart colour or turbidity, promote eutrophication. Due to the high pollution load of dairy wastewater, the milk-processing industries discharging untreated/partially treated wastewater cause serious environmental problems. Moreover, the Indian government has imposed very strict rules and regulations for the effluent discharge to protect the environment. Thus, appropriate treatment methods are required so as to meet the effluent discharge standards.

1.2 WASTEWATER GENERATION AND CHARACTERISTICS

Dairy industries are involved in the manufacturing of various types of milk products such as fluid milk, butter, cheese, yogurt, condensed milk, flavored milk, milk powder, ice cream, etc. Typical by-products obtained include buttermilk, whey, and their derivatives. A chain of operations involving receiving and storing of raw materials, processing of raw materials into finished products, packaging and storing of finished products, and a group of other ancillary operations (e.g., heat transfer and cleaning) are examples of some of the great variety of operations performed in the dairy industries. The initial operations such as homogenization, standardization, clarification, separation, and pasteurization are common to most plants and products. Clarification (removal of suspended matter) and separation (removal of cream for milk standardization to desired butterfat content), generally, are accomplished by specially designed large centrifuges.

Drying, condensing, etc. are also used in dairy industries for the production of various products. In the dairy industry, some amount of wastewater gets produced during starting, equilibrating, stopping, and rinsing of the processing units (flushing water, first rinse water, etc.). However, a majority of wastewater gets produced during cleaning operations, especially between product changes when different types of products are produced in a specific production unit and clean-up operations. The dairy industry is one of the most polluting of industries, not only in terms of the volume of effluent generated, but also in terms of its characteristics as well.

Dairy effluent contains soluble organics, suspended solids, trace organics. All these components contribute largely towards their high Biological Oxygen Demand (BODS) and Chemical Oxygen Demand (COD).The characteristics of a dairy effluent contain Temperature, Color, pH (6.5-8.0), DO, BOD, COD, Dissolved solids suspended solids, chlorides sulphate, oil & grease. The waste water of dairy contains large quantities of milk constituents such as casein, inorganic salts, besides detergents and sanitizers used for washing. It has high sodium content from the use of caustic soda for cleaning. Typical Characteristic of dairy industry waste water reported by various authors. Figure 1.1 explains in detail the units involved in milk processing industries and shows the flowchart of Effluent generation from various units.

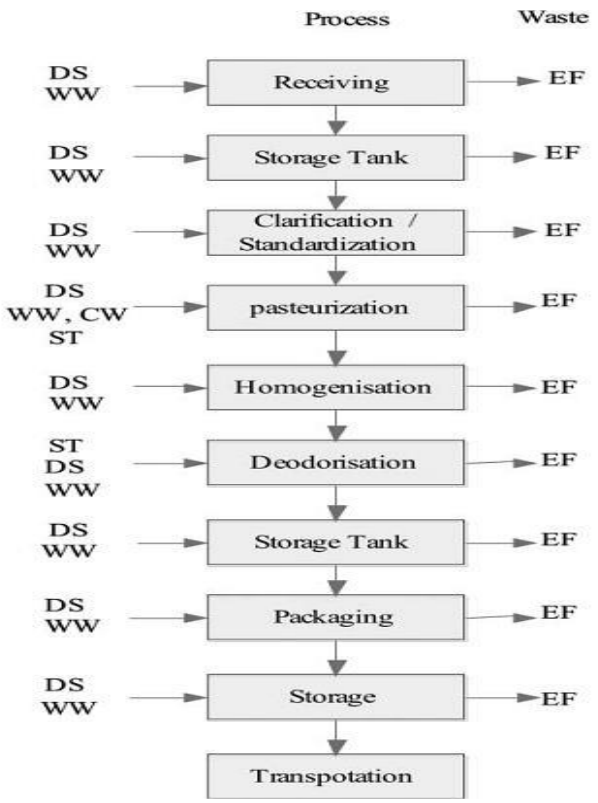

Fig. No. 1.1:- Effluent Generation From Various Units of Milk Processing. DS-detergents and sanitizing agents, WW-wash water, ST-steam, CW-cooling water.(Sources: Comparative Study of Various Treatments For Dairy Industry Wastewater Mrs. Bharati S. Shete, Dr. N. P. Shinkar)

1.3 DAIRY WASTEWATER TREATMENT

Common techniques for treating dairy industry wastewaters include grease traps, oil water separators for separation of floatable solids, equalization of flow, and clarifiers to remove SS. Biological treatment consists of the aerobic and anaerobic process. Sometimes anaerobic treatment followed by aerobic treatment is employed for the reduction of soluble organic matter (BOD) and Biological Nutrient Removal (BNR) is employed for the reduction of nitrogen and phosphorus. Aerobic biological treatment involves microbial degradation and oxidation of waste in the presence of oxygen. Conventional treatment of dairy wastewater by aerobic processes includes processes such as activated sludge, trickling filters, aerated lagoons, or a combination of these. But there are more advanced techniques which will be beneficial to us by providing energy generation and Reuse and energy conservation have become the words of the day and anaerobic processes have emerged with a new potential so we study here some of the anaerobic processes studied by different scientists.

Table no. 1.1:- Comparison of advantages and disadvantages of aerobic and aerobic treatment of dairy industry waste waters.(Sources: Comparative Study of Various Treatments For Dairy Industry Wastewater Mrs. Bharati S. Shete, Dr. N. P. Shinkar).

FACTORS	AEROBIC PROCESS	ANAEROBIC PROCESS
Reactors	Aerated lagoons, oxidation ditches, Stabilization ponds, Trickling filters and Biological discs	UASB, Anaerobic filter, Upflow packed bed reactor, CSTR, Down flow fixed-film reactor, Buoyant Filter Bioreactor,
Reactor size	Aerated lagoons, oxidation ditches, Stabilization ponds, Trickling filters and Biological discs requires larger land area but SBR needs comparatively lower area.	Smaller reactor size is required.
Effluent Quality	Excellent effluent quality in terms of COD, BOD and nutrient removal is achieved.	Effluent quality in terms of COD is fair but further treatment is required. Nutrient removal is very poor.
Energy	High energy is required.	These processes produce energy in the form of methane.
Biomass yield	In comparison to anaerobic process, 6-8 times greater biomass is produced	Lower biomass is produced.
Loading rate	Maximum 9000 g COD/m3 d is reported in literature.	Very high Loading rate of 31 kg COD/m3 d has been reported. This is the reason for smaller reactor volume and lesser area.
Oil and grease removal	These do not cause serious problems in aerobic processes (Komatsu et al., 1991).	Fats in wastewater shows the inhibitory action during anaerobic treatment of dairy wastewaters
Shock loading	Excellent performance in this regard.	Anaerobic processes showed not good responses to this shock loading.
Alkalinity addition	No need.	There is need for alkalinity addition to maintain the pH because pH changes during the digestion of lactose.

II. WETLANDS

Wetlands are transitional areas between land and water. The boundaries between wetlands and uplands or deep water are therefore not always distinct. The term “wetlands” encompasses a broad range of wet environments, including marshes, bogs, swamps, wet meadows, tidal wetlands, floodplains, and ribbon (riparian) wetlands along stream channels. All wetlands - natural or constructed, fresh-water or salt - have one characteristic in common: the presence of surface or near-surface water, at least periodically. In most wetlands, hydrologic

conditions are such that the substrate is saturated long enough during the growing season to create oxygen-poor conditions in the substrate.

The lack of oxygen creates reducing. (oxygen-poor) conditions within the substrate and limits the vegetation to those species that are adapted to low-oxygen environments. The hydrology of wetlands is generally one of slow flows and either shallow waters or saturated substrates. The slow flows and shallow water depths allow sediments to settle as the water passes through the wetland. The slow flows also provide prolonged contact times between the water and the surfaces within the wetland. The complex mass of organic and inorganic materials and the diverse opportunities for gas/water interchanges foster a diverse community of microorganisms that break down or trans-form a wide variety of substances. Most wetlands support a dense growth of vascular plants adapted to saturated conditions.

This vegetation slows the water, creates microenvironments within the water column, and provides attachment sites for the microbial community. The litter that accumulates as plants die back in the fall creates additional material and exchange sites, and provides a source of carbon, nitrogen, and phosphorous to fuel microbial processes.

2.1. WETLAND FUNCTIONS AND VALUES

Wetlands provide a number of functions and values. (Wetland functions are the inherent processes occurring in wetlands; wetland values are the attributes of wetlands that society perceives as beneficial.) While not all wetlands provide all functions and values, most wetlands provide several. Under appropriate circumstances. constructed wetlands can provide:

1. Water quality improvement
2. Flood storage and the resynchronization of storm rainfall and surface runoff
3. Cycling of nutrients and other materials
4. Habitat for fish- and wildlife
5. Passive recreation, such as bird watching and photography
6. Active recreation, such as hunting
7. Education and research
8. Aesthetics and landscape enhancement.

2.2. COMPONENTS OF CONSTRUCTED WETLANDS

A constructed wetland consists of a properly-designed basin that contains water, a substrate, and, most commonly, vascular plants. These components can be manipulated in constructing a wetland. Other important components of wetlands, such as the communities of microbes and aquatic invertebrates, develop naturally.

2.2.1. Water

Wetlands are likely to form where landforms direct surface water to shallow basins and where a relatively impermeable subsurface layer prevents the surface water from seeping into the ground. These conditions can be created to construct a wetland. A wetland can be built almost anywhere in the landscape by shaping the land surface to collect surface water and by sealing the basin to retain the water. Hydrology is the most important

design factor in constructed wetlands because it links all of the functions in a wetland and because it is often the primary factor in the success or failure of a constructed wetland. While the hydrology of constructed wetlands is not greatly different than that of other surface and near-surface waters, it does differ in several important respects:

1. Small changes in hydrology can have fairly significant effects on a wetland and its treatment effectiveness
2. Because of the large surface area of the water and its shallow depth, a wetland system interacts strongly with the atmosphere through rainfall and evapotranspiration (the combined loss of water by evaporation from the water surface and loss through transpiration by plants).
3. The density of vegetation of a wetland strongly affects its hydrology, first, by obstructing flow paths as the water finds its sinuous way through the network of stems, leaves, roots, and rhizomes and, second, by blocking exposure to wind and sun.

Substrates used to construct wetlands include soil, sand, gravel, rock, and organic materials such as compost. Sediments and litter then accumulate in the wetland because of the low water velocities and high productivity typical of wetlands. The substrates, sediments, and litter are important for several reasons:

1. They support many of the living organisms in wetlands.
2. Substrate permeability affects the movement of water through the wetland.
3. Many chemical and biological (especially microbial) transformations take place within the substrates.
4. Substrates provide storage for many contaminant.
5. The accumulation of litter increases the amount of organic matter in the wetland. Organic matter provides sites for material exchange and microbial attachment, and is a source of carbon, the energy source that drives some of the important biological reactions in wetlands.

The physical and chemical characteristics of soils and other substrates are altered when they are flooded. In a saturated substrate, water replaces the atmospheric gases in the pore spaces and microbial metabolism consumes the available oxygen. Since oxygen is consumed more rapidly than it can be replaced by diffusion from the atmosphere, substrates become anoxic (without oxygen). This reducing environment is important in the removal of pollutants such as nitrogen and metals.

2.2.2. Vegetation

Both Vascular Plants (the higher plants) and Non-Vascular Plants (algae) are important in constructed wetlands. Photosynthesis by algae increases the dissolved oxygen content of the water which in turn affects nutrient and metal. Constructed wetlands attract waterfowl and wading birds, including mallards, green-winged teal, wood ducks, moorhens, green and great blue herons, and bitterns. Snipe, red-winged blackbirds, marsh wrens, bank swallows, red-tailed hawks, and Northern harriers feed and/or nest wetlands.

2.2.3. Constructed wetlands media

Hydraulic conductivity according to the time of media

1. Coarse gravel, high permeability: of the order of 10-2 m/s
2. Gravel, good permeability: of the order of 10-4 m/s
3. Fine to medium sand, poor permeability: of the order of 10-5 m/s

4. Loamy sand, permeable with difficulty: of the order of 10-6 m/s
5. Fine-particulate clay, very poor permeability: of the order of 10-8 m/s

Depending on the kind of plants used, hydraulic conductivity increases with time as old rhizome channels remain open after the rhizomes decayed thereby creating a series of pores through the bed. They can develop in any significant quantity after three to five years.

2.2.4. Gravel rocks and crushed stones

The media used in Subsurface Flow Constructed Wetlands (SSFCW) is fundamental; it is crucial that the gravel or sand be clean, washed and without impurities. When available, volcanic rock is the best medium but other materials such as limestone, river rocks, recycled concrete and recycled crushed glass to desired diameter are also being used. The gravel is the growth medium for microorganisms, works as a sieve and determines hydraulic residence time.

2.2.5. Aesthetics and landscape enhancement

While wetlands are primarily treatment systems, they provide intangible benefits by increasing the aesthetics of the site and enhancing the landscape. Visually, wetlands are unusually rich environments. By introducing the element of water to the landscape, constructed wetlands, as much as natural wetlands. Add diversity to the landscape. The complexity of shape, color, size, and interspersion of plants, and the variety in the sweep and curve of the edges of landforms all add to the aesthetic quality of the wetlands. Constructed wetlands can be built with curving shapes that follow the natural contours of the site, and some wetlands for water treatment are' indistinguishable, at first glance, from natural wetlands.

1. Vascular plants contribute to the treatment of wastewater and runoff in a number of ways: they stabilize substrates and limit channelized flow.
2. They slow water velocities, allowing suspended materials to settle.
3. They take up carbon, nutrients, and trace elements and incorporate them into plant tissues.
4. They transfer gases between the atmosphere and the sediments.
5. Leakage of oxygen from subsurface plant structures creates oxygenated microsites within the substrate.
6. Their stem and root systems provide sites for microbial attachment.
7. They create litter when they die and decay.

Constructed wetlands are usually planted with emergent vegetation (non-woody plants that grow with their roots in the substrate and their stems and leaves emerging from the water surface). Common emergent used in constructed wetlands include bulrushes, cattails, reeds, and a number of broad-leaved species.

2.2.6. Microorganisms

A fundamental characteristic of wetlands is that their functions are largely regulated by microorganisms and their metabolism (Wetzel 1993). Microorganisms include bacteria, yeasts, fungi, protozoa, rind algae. The microbial biomass is a major sink for organic carbon and many nutrients. Microbial activity:

1. Transforms a great number of organic and inorganic substances into innocuous or insoluble substances.

2. Alters the reduction/oxidation (redox) conditions of the substrate and thus affects the processing capacity of the wetland.
3. It is involved in the recycling of nutrients. Some microbial transformations are Aerobic (that is, they require free oxygen) while others are Anaerobic (they take place in the absence of free oxygen). Many bacterial species are facultative anaerobes, that is, they are capable of functioning under both aerobic and anaerobic conditions in response to changing environmental conditions. Microbial populations adjust to changes in the water delivered to them. Populations of microbes can expand quickly when presented with suitable energy-containing materials. When environmental conditions are no longer suitable, many microorganisms become dormant and can remain dormant for years (Hilton 1993). The microbial community of a constructed wetland can be affected by toxic substances, such as pesticides and heavy metals, and care must be taken to prevent such chemicals from being introduced at damaging concentrations.

2.2.7. Animals

Constructed wetlands provide habitat for a rich diversity of invertebrates and vertebrates. Invertebrate animals, such as insects and worms. contribute to the treatment process by fragmenting detritus and consuming organic matter. The larvae of many insects are aquatic and consume significant amounts of material during their larval stages, which may last for several years. Invertebrates also fill a number of ecological roles; for instance, dragonfly nymphs are important predators of mosquito larvae. Although invertebrates are the most important animals as far as water quality improvement is concerned, constructed wetlands also attract a variety of amphibians, turtles, birds, and mammals.

III. CONSTRUCTED WETLANDS AS TREATMENT SYSTEMS

A constructed wetland is a shallow basin filled with some sort of substrate, usually soil or gravel, and planted with vegetation tolerant of saturated conditions. Water is introduced at one end and flows over the surface or through the substrate, and is discharged at the other end through a weir or other structure which controls the depth of the water in the wetland.

3.1. How wetlands improve water quality-

A wetland is a complex assemblage of Water, Substrate, Plants (vascular and algae), Litter (primarily fallen plant material), Invertebrates (mostly insect larvae and worms). and an Array of Microorganisms (most importantly bacteria). The mechanisms that are available to improve water quality are therefore numerous and often interrelated. These mechanisms include:

1. Settling of suspended particulate matter.
2. Filtration and chemical precipitation through contact of the water with the substrate and litter.
3. Chemical transformation.
4. Adsorption and ion exchange on the surfaces of plants, substrate, sediment, and litter.
5. Breakdown and transformation of pollutants by microorganisms and plants.

6. Uptake and transformation of nutrients by microorganisms and plants.
7. Predation and natural die-off of pathogens.

The most effective treatment wetlands are those that foster these mechanisms. The specifics for the various types of wastewater and runoff are discussed in the wastewater-specific volumes.

3.2. ADVANTAGES OF CONSTRUCTED WETLANDS

Constructed wetlands are a cost-effective and technically feasible approach to treating waste-water and runoff for several reasons:

Wetlands can be less expensive to build than other treatment options.

1. Operation and maintenance expenses (energy and supplies) are low.
2. Operation and maintenance require only periodic, rather than continuous, on-site labor.
3. Wetlands are able to tolerate fluctuations in flow.
4. They facilitate water reuse and recycling.

There are more advantages in addition:

1. They provide habitat for many wetland organisms.
2. They can be built to fit harmoniously into the landscape.
3. They provide numerous benefits in addition to water quality improvement, such as wildlife habitat and the aesthetic enhancement of open spaces.
4. They are an environmentally-sensitive approach that is viewed with favor by the general public.

3.3. LIMITATIONS OF CONSTRUCTED WETLANDS

There are limitations associated with the use of constructed wetlands:

1. They generally require larger land areas than do conventional wastewater treatment systerns. Wetland treatment may be economical relative to other options only where land is available and affordable.
2. Performance may be less consistent than in conventional treatment. Wetland treatment efficiencies may vary ‘seasonally in response to changing environmental conditions, including rainfall and drought. While the average performance over the year may be acceptable, wetland treatment cannot be relied upon if effluent quality must meet stringent discharge standards at all times.
3. The biological components are sensitive to toxic chemicals, such as ammonia and pesticides.
4. Flushes of pollutants or surges in water flow may temporarily reduce treatment effectiveness.
5. They require minimum amount water if they are to survive. While wetlands can tolerate temporary drawdown, they cannot withstand complete drying.

3.4. TYPES OF CONSTRUCTED WETLANDS:-

There are several types of constructed wetlands: surface flow wetlands, subsurface flow wetlands, and hybrid systems that incorporate surface and subsurface flow wetlands. Constructed wetland systems can also be combined with conventional treatment technologies. The types of constructed wetlands appropriate for

domestic wastewater, agricultural wastewater, coal mine drainage, and storm water runoff are discussed in the wastewater-specific volumes.

3.4.1. Surface flow wetlands

A Surface Flow (SF) wetland consists of a shallow basin, soil or other medium to support the roots of vegetation, and a water control structure that maintains a shallow depth of water. The water surface is above the substrate. SF wetlands look much like natural marshes and can provide wildlife habitat and aesthetic benefits as well as water treatment. In SF wetlands, the near-surface layer is aerobic while the deeper waters and substrate are usually anaerobic. Storm water wetlands and wetlands built to treat mine drainage and agricultural runoff are usually SF wetlands. SF wetlands are sometimes called free water surface wetlands or, if they are for mine drainage, aerobic wetlands. The advantages of SF wetlands are that their capital and operating costs are low, and that their construction, operation, and maintenance are straightforward. Fig. no. 1.3 shows the Surface flow constructed wetland used for treatment waste water. The main disadvantage of SF systems is that they generally require a larger land area than other systems.

3.4.2. Subsurface flow wetlands

A Sub-Surface flow (SSF) wetland consists of a sealed basin with a porous substrate of rock or gravel. The water level is designed to remain below the top of the substrate. In most of the systems in the United States, the flow path is horizontal, although some European systems use vertical flow paths. SSF systems are called by several names. Including vegetated submerged bed, root zone method, microbial rock reed filter, and plant-rock filter systems. Because of the hydraulic constraints imposed by the substrate, SSF wetlands are best suited to wastewaters with relatively low solids concentrations and under relatively uniform flow conditions. SSF wetlands have most frequently been used to reduce 5-day biochemical oxygen demand (BOD5) from domestic wastewaters. The advantages cited for SSF wetlands are greater cold tolerance, minimization of pest and odor problems, and, possibly, greater assimilation potential per unit of land area than in SF systems.

It has been claimed that the porous medium provides greater surface area for treatment contact than is found in SF wetlands, so that the treatment responses should be faster for SSF wetlands which can, therefore, be smaller than a SF system designed for the same volume of wastewater. Since the water surface is not exposed, public access problems are minimal. Several SSF systems are operating in parks. With public access encouraged. The disadvantages of SSF wetlands are that they are more expensive to construct, on a unit basis than SF wetlands. Because of cost, SSF wetlands are often used for small flows. In Fig. no. 1.4 subsurface flow constructed wetlands used for treatment waste water have been shown. SSF wetlands may be more difficult to regulate than SF wetlands, and maintenance and repair costs are generally higher than for SF wetlands. A number of systems have had problems with clogging and unintended surface flows.

3.4.3. Vertical flow SSF constructed wetland

Sewage water is pumped at regular intervals (every 2 to 6 hours, depending on design and treatment levels sought) through a network of pipes laid on top of a bed filled with gravel-type media of generally 3 different granulometries through which the water percolates. Vertical Flow CWs generally require 2/3 of the space of an

horizontal flowCW and can raise treatment quality in certain parameters yet they are less passive systems as they rely on a controlled source of energy.

3.4.4. Horizontal flow SSF constructed wetland

Sewage effluent fills the space between the gravel and circulates horizontally, naturally, each time water comes into the system. There is no external energy dependency (and therefore no contribution to pollution output).

IV. WINTER AND SUMMER OPERATION

Wetlands continue to function during cold weather. Physical processes, such as sedimentation. Continue regardless of temperature, providing that the water does not freeze. Many of the reactions take place within the wetland substrate, where decomposition and microbial activity generate enough heat to keep the subsurface layers from freezing. Water treatment will continue under ice. To create space for under-ice flow, water levels can be raised in anticipation of freeze, then dropped once a cover of ice has formed.

Rates of microbial decomposition slow as temperatures drop and the wetland may need to be made larger to accommodate the slower reaction rates. For agricultural wetlands, which rely on microbial activity to break down organic wastes, it may be prudent to store the wastewater in the pretreatment unit during the cold months for treatment during the warm months. The high flows that are common in winter and spring because of snowmelt, spring rains, and high groundwater tables can move water so quickly through a wetland. that there is not enough retention time for adequate treatment. Because removal rates are much higher during warm weather, the agricultural wetland can often be smaller than if the water were treated year-round. Wetlands lose large amounts of water in the summer through evapotranspiration. The adequacy of flow in the summer must be considered since it will affect water levels in the wetland and the amount of wetland effluent available for recycling (if this is part of the design). A supple-mental source of water may be required to maintain adequate moisture in the wetland.

V. CONSTRUCTED WETLAND FOR WASTEWATER TREATMENT

Constructed Wetlands (CWs) are engineered systems that have been designed and constructed to utilize the natural processes involving wetland vegetation, soils, and the associated microbial assemblages to assist in treating wastewaters. They are designed to take advantage of many of the same processes that occur in natural wetlands, but do so within a more controlled environment. CWs for wastewater treatment may be classified according to the life form of the dominating macrophyte, into systems with free-floating, floating leaved, rooted emergent and submerged macrophytes. Further division could be made according to the wetland hydrology (free water surface and subsurface systems) and subsurface flow CWs could be classified according to the flow direction (horizontal and vertical. A simple scheme for various types of constructed wetlands water 2010.

The major characteristics of various types of constructed wetlands for wastewater. treatment. H = horizontal, V = vertical. The first experiments aimed at the possibility of wastewater treatment by wetland plants were

undertaken by Käthe Seidel in Germany in the early 1950s at the Max Planck Institute in Plön. Seidel then carried out numerous experiments aimed at the use of wetland plants for treatment of various types of wastewater, including phenol wastewaters, dairy wastewaters or livestock wastewater. Most of her experiments were carried out in constructed wetlands with either Horizontal (HF CWs) or Horizontal Flow Subsurface flow Constructed Wetland Vertical Flow (VF CWs) subsurface flow, but the first fully constructed wetland was built with Free Water Surface (FWS) in the Netherlands in 1967. However, FWS CWs did not spread substantially in Europe where subsurface flow constructed wetlands prevailed in the 1980s and 1990s. In North America, FWS CWs started with the ecological engineering of natural wetlands for wastewater treatment at the end of the 1960s and beginning of the 1970s. This treatment technology was adopted in North America not only for municipal wastewaters but all kinds of wastewaters. Subsurface flow technology spread more slowly in North America but, at present, thousands of CWs of this type are in operation. Various types of constructed wetlands may be combined in order to achieve higher treatment effect, especially for nitrogen. Hybrid systems comprise most frequently VF and HF systems arranged in a staged manner but, in general, all types of constructed wetlands could be combined in order to achieve more complex treatment efficiency.

VI. BIOLOGICAL TREATMENT OF DAIRY WASTE WATER USING ACTIVATED SLUDGE

The objective of the researched by Ambreen Lateef , Mohmaad Nawaj, Shazia Iliyas (2013) was to evaluate the performance of a laboratory-scale biological treatment unit for dairy-industry wastewater and to determine the kinetic parameters for the activated sludge process. A laboratory-scale treatment unit comprising an aeration tank and final clarifier was used for this purpose. The treatment unit was operated continuously for three months by varying the hydraulic retention times from 2 to 12 days. The biological oxygen demand (BOD) of the influent and effluent and the mixed liquor suspended solids of the aeration tank were determined at various detention times to generate data for the kinetic coefficients. The kinetic coefficients k (maximum substrate utilization rate), Ks (half velocity constant), Y (cell yield coefficient), and Kd (decay coefficient) were found to be 4.46 day 1, 534 mg/l, 0.714, and 0.038 day 1, respectively, based on the BOD. These coefficients may be used for the design of activated sludge process facilities for dairy wastewater.

Biological treatment processes offer a cost effective method to remove organic compounds and nitrogen from the wastewater. Treatment designs are continually evolving to provide greater treatment efficiency, at a lower cost. Biological wastewater

treatment is the primary method of preparing food processing wastewater flows for return to the environment. Increasing industry wastewater loads on existing plants and more stringent government discharge requirements have put considerable pressure on the food-processing industry to refine and understand better the design and management of biological wastewater treatment processes. Dairy wastewater is generally treated using biological methods such as activated sludge process, aerated lagoons, trickling filters, sequencing batch reactor, up flow anaerobic sludge blanket reactor, anaerobic filters, etc. Biological methods, like activated sludge process, are invariably employed for the secondary treatment of a large number of industrial wastewater. Knowledge of the microbial kinetics and determination of the kinetic coefficients for a particular wastewater are, therefore, imperative for the rational design of treatment facilities.

VII. ROOT ZONE METHOD FOR DAIRY WASTE WATER

(By Ashwani Dubey and Omprakash Sahu gives the root zone method for dairy waste water treatment)
The consumption of large volumes of water and the generation of organic compounds as liquid effluents are major environmental problems in milk processing industry. The volume of freshwater required by this industry can be significantly reduced by recovering the intrinsic water present in dairy industry. This amount of freshwater will depend on the process technology. In recent years, the environmental effects of industrial activities have increased considerably, and current perspectives indicate that the trend for this problem is to be worsening. In this regard study is to treat the waste water generated from the dairy industry by a new technique called Root zone method. Physico-chemical and organic parameters of water samples of the dairy were examined to determine the quality and extent of pollution. By which the pH, COD, BOD, TDS, Turbidity, Hardness, Alkalinity, Electrical conductivity are reduced.
Waste water is generated in milk processing unit, mostly in pasteurization, homogenization of fluid milk and the production of dairy products such as butter, cheese, milk powder etc. Most of the milk processing unit use "clean in place" (CIP) system which pumps cleaning solutions through all equipment in this order water rinse; caustic solution (sodium hydroxide) wash, water rinse, acid solution (phosphoric or Nitric acid) wash, water rinse, and sodium hypo-chlorite disinfectant. These chemicals eventually become a part of waste water.
It is one of the largest sources of industrial effluents in many countries like (Europe and India). A typical European dairy factory generates approximately 50m3 waste water daily with considerable concentration of organic matter (fat, protein and carbohydrates) and nutrients mainly (Nitrogen and phosphorous) originating from the milk and the milk products.

VIII. WASTEWATER MANAGEMENT IN DAIRY INDUSTRY, POLLUTION ABATEMENT AND PREVENTIVE ATTITUDE

Increase in demand for milk and their products many dairies of different sizes have come up in different places. The dairy industry involves processing raw milk into products such as consumer milk, butter, cheese, yogurt, condensed milk, dried milk (milk powder), and ice cream, using processes such as chilling, pasteurization, and homogenization. The typical by-products of milk are buttermilk, whey, and their derivatives. The effluents are generated from milk processing through milk spillage, drippings, washing of cans, tankers bottles, utensil, and equipment's and floors. The dairy industry generate on an average 2.5-3.0 litres of wastewater per litre of milk processed. Generally this wastewater contains large quantities of fat, casein, lactose, and inorganic salts, besides detergents, sanitizers etc. used for washing. These all contribute largely towards their high biological oxygen demand (BOD), chemical oxygen demand (COD) and oil and grease much higher than the permissible limits. Among the biological treatments trickling filter and activated sludge process involve more economy high power requirement, more chemical consumption and large area requirement. Use of a dairy wastewater for irrigation after primary treatment in an aerated lagoon may also be good for the disposal of dairy wastes.

IX. WASTEWATER TREATMENT WETLAND – A CASE STUDY

Lovisa Lagerblad the scientist events the study on waste water treatment wetland in 2010.

Water is a prerequisite for life on earth. Without adequate water sanitation several hazardous health and environmental consequences will follow. In many developing countries the fast urbanization rate is putting a great stress on the, if even existing, poorly developed treatment systems. A sustainable way for wastewater treatment, with or without additional purification, is the use of natural wetlands.

A new wastewater treatment plant is constructed in Ja-Ela, a suburb to Colombo, Sri Lanka. The area is of great interest due to its many industries and highways. The river Dandugam Oya is today working as a recipient for treated wastewater. Dandugam Oya is suffering from pollution and the performed studies show that the nutrient level is high and the oxygen level is very low. This may cause eutrophication and fish death, which earlier has been observed in Negombo Lagoon. A small wetland (≈5 ha) is today located between the river and the wastewater outfall, and this study has focused on its treatment capacity. The wetland vegetation stands for a potential treatment, but the vegetation is not the only reason to wetland removal efficiencies. The major mechanisms for pollutant removal in wetlands include both bacterial transformations and chemical processes including adsorption, precipitation and sedimentation. In these processes wetland characteristics such as size, depth and retention time are important. It was observed that the levels of pathogens coming from the old wastewater treatment plant were exceeding the recommended levels. Coliforms can be removed through adaptation to gravel and submersed plant parts biofilms. The studied wetland was not useful for this treatment purpose, mainly because its retention time was too short. For the same reason a large nutrient treatment is not to be expected, which demands the retention time to be fairly long because the nitrate molecules and the denitrification bacteria need time to interact.

X. CONCLUSION

1. The removal efficiency of TSS, COD and BOD in modified root zone treatment system (MRZTS) is found to be well within the limits.
2. Removal efficiency increases with the increase in retention time.
3. Comparison of the conventional STP, conventional RZTS with modified RZTS indicates that the modified RTZS perform best in the removal of TSS, BOD.
4. The removal efficiency through MRZTS is found to be low.
5. Growth of plants in root zone treatment system is very fast because of large availability of nutrients in domestic sewage.
6. Technical equipment requires minimal supervision

XI. REFERENCES

[1]. Cooper, P. F., and B.C. Findlater (eds.). 1990. 'Constructed Wetlands in Water Pollution Control. Proceedings of the International Conference on the Use of Constructed Wetlands in Water Pollution Control', Cambridge, UK, 24-28 September. WRc, Swindon, Wiltshire, UK. 605 pp

[2]. Crites, R. and G. Tchobanoglous. 1998. 'Small and Decentralized Wastewater Management'. McGraw-Hill, Boston.

[3]. G. D. Najafpour, M. Tajallipour, M. Komeili, and M. Mohammadi, 4 August, 2009 'Kinetic model for an up-flow anaerobic packed bed bioreactor'. Dairy wastewater treatment African Journal of Biotechnology Vol. 8 (15), pp. 3590-3596,

[4]. G. Srinivasan, R. Subramaniam and V. Nehru kumar 2009; 'A Study on Dairy Wastewater Using Fixed-Film Fixed Bed Anaerobic Diphasic Digester' American Eurasian Journal of Scientific Research 4 (2): 89-92.

[5]. Hammer, D. A. (ed.). 1989. 'Constructed Wetlands for Wastewater Treatment: Municipal, Industrial and Agricultural'. Lewis Publishers, Chelsea, MI. 831 pp.

[6]. Jai prakash kushwaha, Vimal chandra srivastava, and Indra deo mall (2011), 'An Overview of Various Technologies for the Treatment of Dairy Wastewaters Critical Reviews in Food Science and Nutrition', 51:442–452

[7]. Metcalf and Eddy, Inc. 2003. 'Wastewater Engineering: Treatment and Reuse', Fourth Edition. McGraw-Hill, Boston.

[8]. P. Sankar Ganesh, E. V. Ramasamy, S. Gajalakshmi, R. Sanjeevi and S. A. Abbasi, April 2007, 'Studies on treatment of low-strength effluents by UASB reactor and its application to dairy industry wash waters' Indian Journal of Biotechnology, Vol 6, pp 234-238.

[9]. Reddy, K.R., and W.F. DeBusk,1985. 'Nutrient RemovalPotential of Selected Aquatic Macrophytes'. J.Environ. Qual. 14:459-462.

[10]. Steiner, G.R., J.T. Watson, D.A. Hammer, D.F. Harker, (1987). 'Municipal Waste water Treatment with Artificial Wetlands -A TVA/ Kentucky Demonstration'. In Aquatic Plants for Water Treatment and Resource.

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Smart and Brilliant Transportation System with Information Safety and Security

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ABSTRACT

To increase the usability of a public transport system it needs to go under revolutionary changes in its operating procedure. It is an attempt to make this possible using recent computer technology, mobile computing advancements and Wi-Fi or GPRS.The Intelligent Public Transport Information System will be specifically developed for Commercial public Transport. In this System passenger can get information about all buses, routes, timings of buses and all stops in any particular route. This system includes two phases. One is for user and other for administrator. At user side, user can request for information about all buses, routes, timings of buses and all stops in any particular route using Wi-Fi or GPRS technology from his mobile or PDA. At administrator side, administrator can update, delete and insert information about all buses, routes, timings of buses, all stops in any particular route and helpline numbers. Administrator can have all rights about database operations. The administrator requires the authentication of smart card for addition or deletion of information from commercial public transport.

I. INTRODUCTION

As mobile devices become smaller, cheaper, better and more connected, they are changing the way people access and work with information. The convenience and powerful functionality offered by mobile devices such as PDAs, has encouraged many industries to investigate the benefits of using them. Wireless and handheld devices abound as vendors pitch the common themes of one-to-one computing, instant communication and anytime, anywhere information access [2]. Originally, the PDA was intended to be an electronic version of a “personal organizer”; however, with the introduction of more powerful CPUs, operating systems and memory, today's PDAs are being customized for great variety of applications. Unlike desktop PCs and laptops, mobile devices have many constraints such as screen display size, interaction techniques and bandwidth over mobile networks [3]. Despite these constraints, PDAs are the preferred mobile device for business applications because they are highly portable, have the ability to communicate with PCs and can access information from remote locations. Transportation system is the key factor in the development of a particular region. With the development of city, a need for powerful transport is generated. The network of this system is vast and ever

increasing. So it is very difficult to get the correct information about buses, their timings and routes. So our current project is entitled to help the user in all ways. The Intelligent Public Transport Information System will be specifically developed for Bus Transport. In this System passenger can get information about all buses, routes, timings of buses and all stops in any particular route.

This project includes two phases. One is for user and other for administrator. At user side, user can request for information about all buses, routes, timings of buses and all stops in any particular route using Wi-Fi or GPRS technology. At administrator side, administrator can update, delete and insert information about all buses, routes, timings of buses, all stops in any particular route and helpline numbers. But for the authentication purpose the administrator is provided with smart card & to the CPU of bus a card reader is connected. The administrator has to plug his card into card reader. Then by entering required password using WI-FI enabled mobile administrator can take access of database of buses & perform operation on them.

II. SYSTEM OBJECTIVE

The objectives of this project are:

1. To design and implement data access points and client applications for transport information system on web based application or Internet.
2. To develop transport information system using a suitable interface with the computer.
3. To help passengers, administrator in transport information system using Mobile application and Wi-Fi or GPRS technology.

III. LITERATURE SURVAY

A. J2ME

Sun Microsystems defines J2ME as "a highly optimized Java run-time environment targeting a wide range of consumer products, including pagers, cellular phones, screen-phones, digital set-top boxes and car navigation systems." Announced in June 1999 at the Java One Developer Conference, J2ME brings the cross-platform functionality of the Java language to smaller devices, allowing mobile wireless devices to share applications. With J2ME, Sun has adapted the Java platform for consumer products that incorporate or are based on small computing devices.

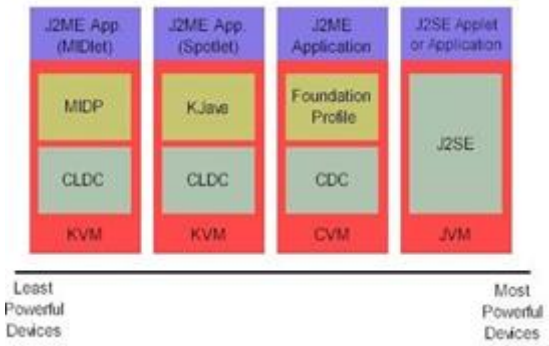

Figure 1 General J2ME Architecture

B. MIDlet:

The Mobile Information Device Profile (MIDP) is geared toward devices like cellular phones and pagers. MIDP, like KJava, also is built upon CLDC. The MID Profile provides a standard run-time environment that allows new applications and services to be deployed dynamically on end-user devices. Now we will see MIDlet life cycle,

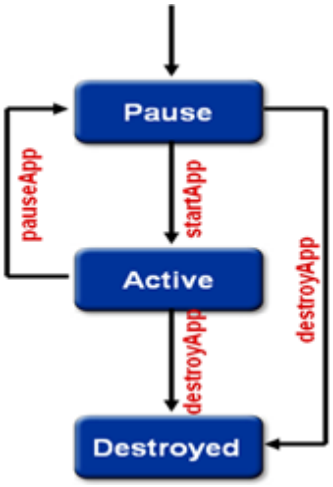

Figure 2 MIDlet Life Cycles

A MIDlet is a Java class that extends the javax.microedition.midlet.MIDlet abstract class. It implements the startApp (), pauseApp (), and destroyApp () methods, which you can think of as being similar to J2SE's start (), stop (), and destroy () methods in the java.applet.Applet class. MIDP applications are known as "MIDlets"
MIDlets move from state to state in the lifecycle, as indicated.

- Start – acquire resources and start executing
- Pause – release resources and become quiescent (wait)
- Destroy – release all resources, destroy threads, and end all activity

IV. METHODOLOGY

A. Design Overview

The passenger requests from mobile application and the web server responses consist of a multiple series of discrete requests and responses (see Figure I) which represent the various stages of data between a mobile application and web server (see Figure I). This data transfer mechanism is best suited for devices with mobile application and valid network connectivity for transportation system. The following block diagram also explains about system design.

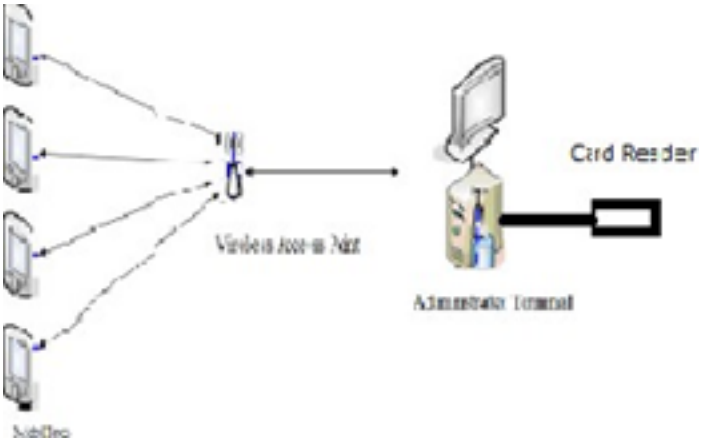

Figure 3 Logical Wireless Diagram

Intelligent Public Transport Information System can be developed using 802.11g and J2ME technology. The system architecture includes the following components:

1. The first part i.e. Mobile Application will be written using J2ME technology for a Wi-Fi/GPRS enabled device and its communication with a centralized database located on a server and Wi- Fi/GPRS enabled device.
2. A Centralized Relational Database (CRD) developed using MySQL.
    1. Server Side software written using J2SE & card detection using jsp.
    2. to administer the database from the administrative terminal & to identify the administrator.
    3. Wireless connectivity using 802.11g standard Between a Wi-Fi/GPRS enabled device (mobile) and a web server.

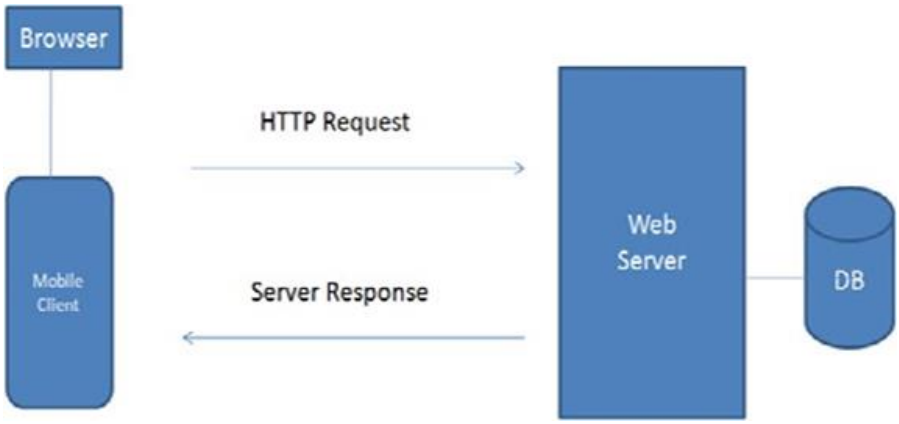

Figure 4 System Overview

The Transport Information System needs to request to Server for information from a small computing device (e.g. Mobile, PDA, etc) through the internet by using SOAP protocol. For placing a request Client can use the Transport Information System application in a small computing device (e.g. Mobile, PDA, etc) which have Wi-Fi support. The client program in the small computing device provides the information menu for the passenger. After any request is received from client, server will give reply to the client.

The overall system architecture is shown below (See figure II).

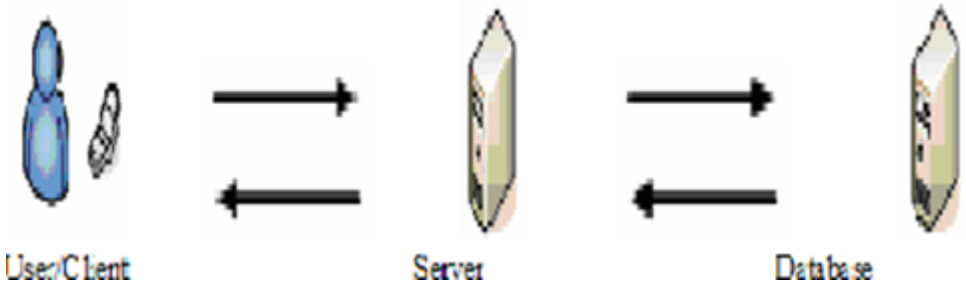

Figure 5 System Architecture

System architecture clearly shows the transfer of request and response. The three active entities are User or Client, Server and the Database. User request is sent to server and the server in turn contacts the database for configuring the response to user request. The response is then sent to client by server.

B. Deployment of Mobile Application

The developed mobile application will be deployed to the users after completion for use. The process is very simple and automated and is shown below in the diagram. User needs to search for the application on web where it will be hosted and needs to be downloaded.

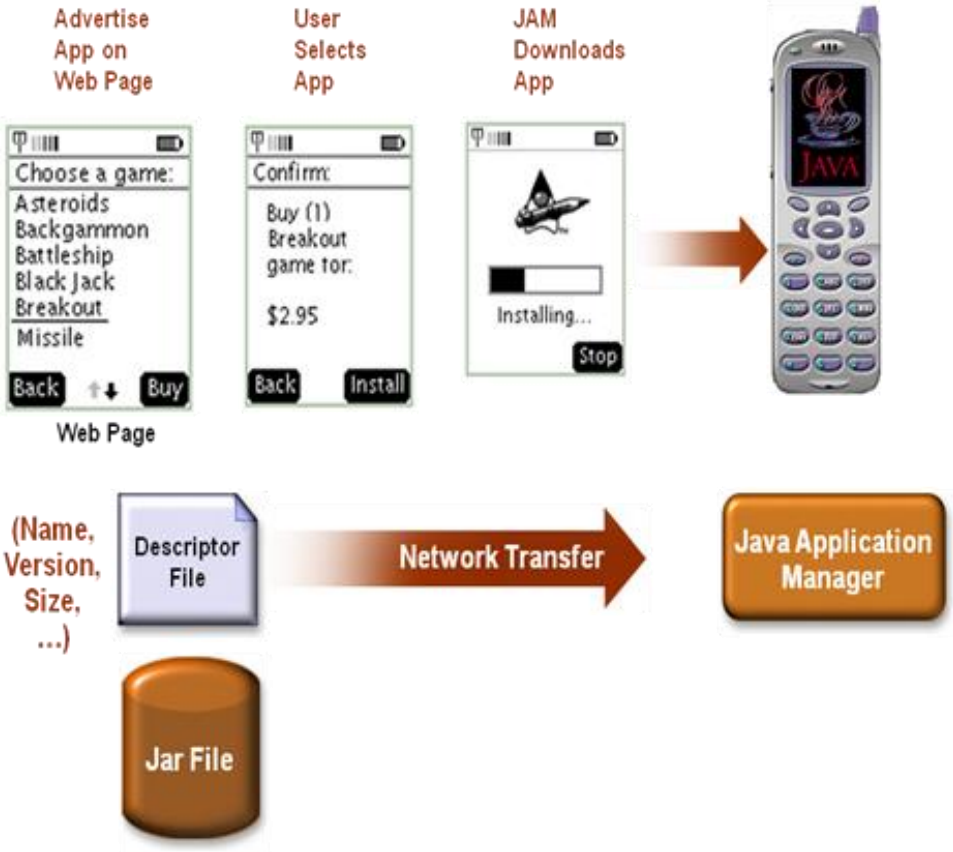

Figure 6 Deploying Mobile Application

V. DESIGN & IMPLEMENTATION

We will see implementation details of the system components one by one.

A. Centralized Database Design

We use MySQL as database. The database is the core of the IPTIS (Intelligent Public Transport Information System). The mobile client will communicate with the database to get the information for the system. It contains the table to store data and the graphical user interface to access the database. The whole data resides on server. Database is organized as relational database i.e. data is stored in the form of tables. Following tables are used to store data:

1) **Bus_no_details table:** This table is used to store bus_no and after adding, every bus_no will have auto generated bus_id which is a primary key and avoids duplicates.
2) **Stop details table:** This table stores list of stops and each is given stop_id. Both stop_name and stop_id are primary keys.
3) **Bus_route_details table:** These table stores details of a particular route which include all stops in that route, the timing bus arrives there and fare up to that stop. Every route is given route_id. Three columns in this table are route_id, route_details and bus_id.
4) **Helpline details table:** This table stores depot_names and their contact_number for emergency contact facility.

B. Administrator Side Design

Administrator side is for the use by Administrator which here stands for Depot Manager specifically. This side is developed as web based interface so that it can be hosted on internet and passengers can use search facility through their mobiles 24*7 using GPRS. This is developed using JSP (Java Server Pages) and Java Servlets are used to handle database operations and automatic response generation in case of search option.

1. **Admin login form:** The first page is authentication page to limit the access to required people only and its GUI is as shown below.

Figure 7 Admin Login

Without password, nobody is allowed to log to the system.

2. **Route Entry Form:** This is to enter route into the database. Depot Manager has to enter route for every new bus added to the depot. Sample GUI is shown below.

Figure 8 Route Entry form

Here the format in which to enter the data is shown for the convenience of user so that data is provided to database correctly. Likewise the forms for adding buses, stops are designed and options for deleting, updating are provided.

C. Passenger Side Design

Passenger side is a mobile application developed using J2ME (Java 2 Micro Edition CLDC 1.1). User should install this application in his mobile to avail of the system. For this mobile should have Wi-Fi facility. After installation this application is available as other general apps provided with mobile.

1. **Search Option Form:** This form asks the user to enter source and destination of his interest and then sends the data to server for further processing when user clicks Ok from menu options. Its GUI is shown below.

Figure 9 Search Option Form

It is provided with two editable text boxes, one each for source and destination.

2. **Result Display Form:** After user submits the information, response is sent from server and is displayed on user mobile. Technical details we will see afterwards. Result consists of Bus Number, Stop name, time and fare up to that stop.

E.g. If source is Alandi and destination is Bhosari then one of the result entry would be like

20 – Dehuphata – 8:25AM - 2

Figure 10 Result Display Form.

D. Connection with Server

1) When user presses Ok button after entering search data, automatically a HttpConnection is created with the distant Server.
2) Using SOAP (Simple Object Access Protocol) the parameters are sent to Server and the intended Servelet is invoked and gets executed. The output data is sent to the invoking mobile device.
3) The sent data is displayed to the screen in particular fashion.
4) The communication takes place over Wireless media.

VI. LIMITATIONS

After configuring the equipment, the testing was done successfully using one mobile. Testing using more than one mobile is not yet completed; however, considering the system's simple operation we do not see any technical issues. However, considering the nature of the application, we strongly believe WPA is secure enough for request and reply.

VII. APPLICATIONS

Applications of this project are:

1. Will improve the city bus transport system.
2. Aid the naive passengers get information without a word of scold.
3. Empower the city bus transport system with the newest technology.
4. Increasing the productivity and profit gains of the public transport system.

VIII. FUTURE WORK

In addition to mobile and wireless technology, the location identification feature provided by Global Positioning System (GPS) can be integrated into IPTIS to deliver latest information to passengers. The current system shows only buses, their routes, and distances to user. But it can be further extended to show the exact position of the buses to the user using GPS. For this every bus must have a GPS transmitter which will send information to the server. A server then sends position information.

IX. CONCLUSION

Overall, the project design will achieve its objectives. The project will provide a client/server application for public transport system and can successfully built using J2SE, J2ME software. It will provide a more convenient and accurate method for retrieving the information about bus details. Users will have all the information about bus details on their finger tips.

The mobile devices have been widely used to provide easily access to the web content. We presented a wireless Public Transport System based on web services over a wireless integrated wide area network, which will implement wireless data access to the servers and IPTIS system functions through both desktop PCs and mobile devices. The system will be based on secure web service architecture and can increase efficiency for transport system by reducing human errors and by providing higher quality customer service.

X. REFERENCES

[1]. C. Branigan (2001), Wireless, handheld solutions prevail at NECC 2001, retrieved January10, 2007.

[2]. F. Turiso and J. Case, “Wireless and Mobile Computing”, First Consulting Group, 2001. Retrieved January10, 2007 From http://www.dir.state.tx.us/pubs/wireless/wireless.htm

[3]. James Keogh, J2ME: The Complete Reference, Tata McGraw Hill Publication, Fourth Edition

[4]. Herbert Schildt, J2SE: The Complete Reference, Tata McGraw Hill Publication, Fifth Edition.

[5]. Khairunnisa K., Ayob J., Mohd. Helmy A. Wahab, M. Erdi Ayob, M. Izwan Ayob, M. Afif Ayob. P. Hawking, A. Stein, P. Sharma, D. Nugent, L. Dawson and S. Foster; MASAUM Journal of Computing, Volume 1 Issue 2, September 2009 The Application of Wireless Food Ordering System- “Emerging Issues in Location Based Tourism Systems”; Proceedings of the International Conference on Mobile Business, 2005.

[6]. Z. Dejin, G. John, and H. John, “Generating mobile device user interfaces for diagram-based modeling tools”, Seventh Australasian User Interface Conference(AUIC2006), Hobart, Australia, 16-19 January 2006, vol 50, pp. 91-98.

[7]. IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY, VOL. 4, NO. 4, DECEMBER 2009.

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