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## LPG GAS Leakage Detection and Weight Detection Using GSM Module

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### ABSTRACT

Gas leakage is a major problem with industrial sector, residential premises and gas-powered vehicles like CNG (compressed natural gas) buses, cars. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit at vulnerable places. The aim is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. Gas leakage system consists of GSM (Global System for mobile communications) module, which warns by sending SMS. However, the former gas leakage system cannot react in time. It detects the malfunction of a pressurized gas system, so that accumulation of combustible gases and their explosion can be prevented. It also detects the leakage of gas into the area of an appliance when it is in a shutdown condition and not in operation. This system provides gas detection and monitoring which is economical to manufacture and which may be readily installed in conventional trailers and boats which are normally dependent upon a stored supply of pressurized gas. Gas leakage is a serious problem in household, gas vehicles and industries. Gas leakage leads to various accidents resulting into both financial loss as well as human injuries. In context with these issues, the proposed design is able to detect and monitoring gas leakage.

Keywords : Gas leakage, sensor, GSM, Weight.

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## I. INTRODUCTION

Objective These sensors can be used for various applications, e.g. monitoring and controlling of the explosive level of concentration of gases, finding of various harmful, dangerous, toxic gases, industrial automation etc. In recent years, the biggest advancement made in the sensor tools is the detection of liquefied petroleum gas and has become tip of the iceberg because outburst accidents force to be happened when it leaks excessively. Therefore, the

research work particularly, in the area of wireless sensor network and earlier gas leakage detection (alert system) is imperative. The monitoring, reorganization and controlling of the data are the key concern of Wireless Sensor Network. The inaccessible interface and actual monitoring with the physical world can be done easily by mote of the network. The wireless sensor networks differ from general data networks, because WSN are application oriented, planned and deployed for dedicated purpose. The wireless sensor network provides extensive range of the applications

such as in green monitoring, defense, health, etc. The liveness in plan, enhanced mobility, consistency, broadcast range, reduced power, cost-effective etc. are the good features of these network. Additionally, the system uses the ZigBee technology for wireless communication. This technology is most trustworthy and apposite for interior and outdoor applications. The ZigBee can be configured in star, mesh or peer to peer topology. A demanding subject in scheming WSNs is inadequate power supply for sensor nodes in some application. The breakdown of a mote results in degradation of the entire network. The preference of a topology can play an imperative role in reduction of power consumption. The present system is mainly used for the detection of LPG gas. If gas leakage happens at certain place, the present system detects the LPG gas alerts the peoples by buzzer ring and sending SMS on user's mobile phone using Arduino GSM shield compatible to the Arduino board. The monitoring of the sensor node can be done using C-code created in Arduino. The current system provides genuine instance notifications. This system can be installed in a place where LPG is used as a fuel and leakage happens instantly. The present wireless gas detection system plays imperative role model to industry as well as general public.

## II. LITERATURE SURVEY

Paper [1] This system represented the versatile nature of LPG it is used for many needs such as domestic fuel, industrial fuel, automobile fuel, heating, illumination etc and the demand for LPG is on an exponential raise day by day. The leaked gases when ignited may lead to severe explosion. The number of deaths due to the explosion of gas cylinders has been increasing in recent years. Thus, there is a need for a system to detect and also prevent leakage of LPG.

Paper [2] This paper discussed a product "LPG Gas Leakage Detection and Alert System" The purpose of this project is to detect the presence of LPG leakage as a part of a safety system. Apart from sound alarm, an

SMS alert will inform the authorized person and the solenoid valve will be triggered to shut down the gas supply to prevent any harmful effects due to gas leakage. Gas leakages are a mutual hindrance in household and manufacturing nowadays. It is very life threatening if you will not distinguish and modified right away. The idea behind our project is to give a solution by power cut the gas provision as soon as a gas leakage is perceived apart from activating the sounding alarm.

Paper [3] This system presented the main objective of the work is designing microcontroller based toxic gas detecting and alerting system. The hazardous gases like LPG and propane were sensed and displayed each and every second in the LCD display. If these gases exceed the normal level then an alarm is generated immediately and also an alert message (SMS) is sent to the authorized person through the GSM. The advantage of this automated detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and in turn leading faster diffusion of the critical situation.

## III. EXISTING SYSTEM

This system helps you to upgrade your safety standards. Most importantly protect life and property from disaster by preventing accidents. It detects the malfunction of a pressurized gas system, so that accumulation of combustible gases and their explosion can be prevented. It also detects the leakage of gas into the area of an appliance when it is in a shutdown condition and not in operation. This system provides gas detection and monitoring which is economical to manufacture and which may be readily installed in conventional trailers and boats which are normally dependent upon a stored supply of pressurized gas. Gas leakage is a serious problem in household, gas vehicles and industries. Gas leakage leads to various accidents resulting into both financial loss as well as human

injuries. In context with these issues, the proposed design is able to detect and monitoring gas leakage. The system detects gas leakage and alerts the subscriber through alarm the report consists of a background into the area of PIC16F877A microcontroller and Zigbee Module, how they are communicating to each other. Microcontroller based LPG Gas Leakage Detectors Zigbee Module is the system where lot of researcher working on it for its developments from all over the world. Since then, many systems and devices have been developed to detect, monitor, and alert the leakage of a wide array of gases. In the existing method, different gas sensing technology is used. This gas leakage is detected by the semiconductor sensor.

#### DISADVANTAGES

- Zigbee disadvantages mainly include short range
- Low complexity, and low data speed
- Its high maintenance cost, lack of total solution, and slow materialization,
- Low transmission, as well as low network stability, are also some of its disadvantages that takes it a step back as compared to others
- Replacement with Zigbee compliant appliances can be costly
- Zigbee is not secure like Wi-Fi based secured system
- It does not have end devices available yet.

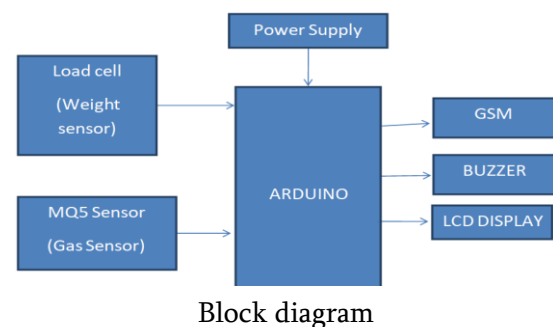
#### IV. PROPOSED SYSTEM

Gas leakages results a serious problem in household and other areas where household gas is used, therefore the proposed gas leakage detection and monitoring system is developed. There are many methods available for booking a Gas Refill, methods include online booking, telephonic booking etc. It will be difficult situation for the one who uses LPG gas for cooking regularly. The aim of this paper is to present a new system automatically books a cylinder when the gas is about to empty is by sending a notification to the gas agency GSM. In addition to that sensor is used to detect

gas leakage at home. If the gas leakage is sensed automatically it will send SMS to the user. GSM is one of the most used networks across the world. Hence, load cell has been used to monitor the weight of the LPG gas regularly. The values are next fed to the microcontroller. If the gas in the cylinder indicates a value where the remaining percentage level is crossed below the threshold level set for gas to be indicated as getting emptied, then a notification will be delivered to gas enterprise automatically to book the new cylinder. Subsequently, reply notification will be sent to the customer about the booking status. At the same time, application software is developed in the gas enterprise to inform and record the booking. This, work this helps the society to specifically indicate gas leakage and also helps both customers and the agency to get the gas booking made automatically using the GSM technique. This device will continuously monitor the level of LPG gas present in the air. Buzzer will on and whenever the gas exceeds solenoid value will turn off. Gas Refill, methods include online booking.

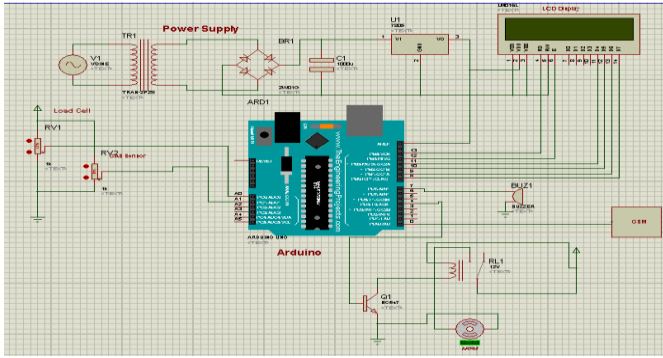
#### ADVANTAGES

- Can monitor pollution with high accuracy
- IOT and Arduino based LPG leakage detection system can be installed in Homes, Hotels, LPG Cylinder storage areas. The main advantage of this project is that it can determine the leakage and send the data over to a website, where it can be monitored and corrective actions can be taken.
- If appropriate measures are taken quickly after it is reported over the GSM, it can help in saving the loss of lives and property.





## Circuit diagram



Circuit diagram

## V. METHODOLOGY

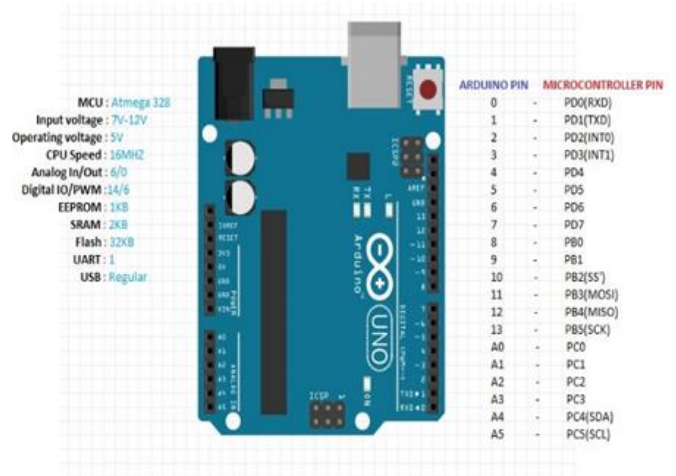
GSM and Arduino based LPG leakage detection system senses the LPG gas with the help of an LPG gas sensor. LPG gas sensor interfacing with Arduino is implemented in this project. The Signal from this sensor is sent to the Arduino microcontroller. The microcontroller is connected to an LCD, Buzzer and GSM module LPG leakage detector project is implemented using a sim 900. The T module then sends the data over to a website. Once the gas leakage is detected, the buzzer is turned ON and a 'Leakage detected' message is displayed on the LCD. The Pre-requisite for this LPG gas leakage detection and the smart alerting project is that the Wi-Fi module should be connected to a Wi-Fi zone or a hotspot. We have used various components in the IOT and Arduino based LPG leakage detection system. LPG Gas Sensor is used to detect the gas leakage. Arduino is used to turning ON the buzzer, to send a message to LCD and to send data to the IOT module. LCD is used to display an informative message. A buzzer is used to signal the gas leakage. And GSM is used to send data network. This device will continuously monitor the level of LPG gas present in the air. Buzzer will on and whenever the gas exceeds solenoid value will turn off. Gas Refill, methods include online booking.

## VI. HARDWARE IMPLEMENTATION

### COMPONENTS DETAILS

- Arduino Controller
- Powersupply
- Gsm
- Lcd Display
- Gas Sensor
- Load Cell
- Buzzer
- Relay

### ARDUINO CONTROLLER



The Arduino Uno is one of the most common and widely used Arduino processor boards. There are a wide variety of shields (plug in boards adding functionality). It is relatively inexpensive (about \$25 - \$35). The latest version as of this writing (3/2014) is Revision 3 (r3):

- Revision 2 added a pull-down resistor to the 8U2 HWB line, making it easier to put into DFU (Device Firmware Update) mode
- Revision 3 added o SDA and SCL pins are now brought out to the header near the AREF pin (upper left on picture). SDA and SCL are for the I2C interface o IOREF pin (middle lower on picture that allows shields to adapt to the voltage provided o Another pin not connected reserved for future use

The board can be powered from the USB connector (usually up to 500ma for all electronics including shield), or from the 2.1mm barrel

jack using a separate power supply when you cannot connect the board to the PC's USB port.

#### MQ5 GAS SENSOR

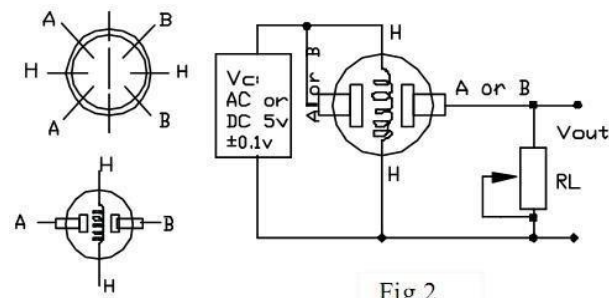


Fig.2

#### LOAD CELL

A load cell (or loadcell) is a transducer which converts force into a measurable electrical output. Although there are many varieties of force sensors, strain gauge load cells are the most commonly used type. Except for certain laboratories where precision mechanical balances are still used, strain gauge load cells dominate the weighing industry. Pneumatic load cells are sometimes used where intrinsic safety and hygiene are desired, and hydraulic load cells are considered in remote locations, as they do not require a power supply. Strain gauge load cells offer accuracies from within 0.03% to 0.25% full scale and are suitable for almost all industrial applications. A load cell works by converting mechanical force into digital values that the user can read and record. The inner working of a load cell differs based on the load cell that you choose. There are hydraulic load cells, pneumatic load cells, and strain gauge load cells. Strain gauge load sensors are the most commonly used among the three. Strain gauge load cells contain strain gauges within them that send up voltage irregularities when under load. The degree of voltage change is covered to digital reading as weight. Load cells represented the first major design change in weighing technology. In today's processing plants, electronic force sensors are preferred in most applications, although mechanical lever scales are still used if the operation is manual and the operating and maintenance personnel prefer their simplicity.

## VII. RESULTS AND DISCUSSION



## VIII. CONCLUSION

An overall conclusion GSM based toxic gas detector, or GSM technology has come a long way since it was conceptualized two decades ago. It has become more efficient, more applicable to today's applications and smarter. The work presented in this project was directed towards pushing GSM technology to the next level. The work has presented solutions to several problems and issues that have not been addressed in previous work. The principle of operation of Operation of GSM based gas leakage and monitoring system was shown by operating the Arduino model attached with embedded system with required input and output gas level with the help of gas sensors. This results in a more efficient in operation because it is connected to a common web page specially built to notify the responsible authority automatically so reduces the stress of constant monitoring. The choice of using a

real time gas leakage monitoring and sensing the output levels of gas has been clearly observed by the help of this system.

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# AIR Pollution Monitoring System

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## ABSTRACT

The position of pollution is adding fleetly due to factors like diligence, urbanization, adding in population, vehicle use which can affect mortal health. IOT Based Air Pollution Monitoring System is used to cover the Air Quality over a web server using Internet. It'll spark an alarm when the air quality goes down beyond a certain position, means when there's sufficient amount of dangerous feasts present in the air like CO<sub>2</sub>, smoke, alcohol, benzene, NH<sub>3</sub> and NO<sub>x</sub>. It'll show the air quality in on the LCD so that air pollution can be covered veritably fluently. The system uses MQ5 detector for covering Air Quality as it detects most dangerous feasts and can measure their quantum directly and it's largely sensitive SnO<sub>2</sub>. A pH detector is one of the most essential tools that's generally used for water measures. This type of detector is suitable to measure the quantum of alkalinity and acidity in water and other results. When used rightly, pH detectors are suitable to insure the safety and quality of a product and the processes that do within a waste water or manufacturing factory.

**Keywords :** Air pollution, sensor, IOT, pH detector.

## I. INTRODUCTION

### Overview

Environment refers to the girding of the natural world. It comprises of the air, water, land and its interdependence with other living beings on this earth. Everything- be it the foliage, the soil, the jewels, the swash, abysses and swell, the fauna along with the innards of the earth or the earth's climate, everything together empires to form the terrain. Etymologically speaking, pollution comes from the Latin word, 'polluter', which basically means to pollute. thus, as the name itself suggests, pollution is a reality that

contaminates the terrain. It basically means the presence of foreign patches in air, water or land which has a wide adverse effect on the living organisms and on the terrain in general. More specifically speaking, pollution is caused due to the release of dangerous pollutant- the poisons similar as the emigrations from the artificial factory, domestic waste, energy emitted from the transportation vehicles, thermal power shops, chemical waste, as well as manage waste. Pollution not only damages the general terrain, it also extensively affects the public health and hygiene of the population across the world.

## II. LITERATURE REVIEW

2.1 Water Quality Monitoring System Based on IOT was presented by Vaishnavi V. et.al [2017]

Water pollution is one of the biggest fears for the green globalization. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. In this paper we present a design and development of a low cost system for real time monitoring of the water quality in IOT (internet of things). The system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on internet using WI-FI system.

2.2 Suitable Recurrent Neural Network for Air Quality Prediction with Backpropagation Through Time was presented by Widya MasSeptiawan et.al [2018]

Air pollution currently occurs in developed and developing countries and can disrupt environmental conditions and public health. Determining the level of air pollution (air pollutants) or air quality can be seen from a group of sensitive parameters such as NO<sub>2</sub>, O<sub>3</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and SO<sub>2</sub>. This study predicts data on air pollutant concentrations over time (time series data) to determine future air quality conditions that are good or bad for health and the environment. Data predictions can use algorithms from artificial neural networks, one of which is the Back Propagation Through Time (BPTT) algorithm.

2.3 A Development of Low-Cost Devices for Monitoring Indoor Air Quality in a Large-Scale Hospital was presented by Phattaratorn Lasomsri [2018] Poor Indoor Air Quality (IAQ) is an issue of environmental health problems that cause headaches, fatigue, irritation of the eyes and skin. IAQ in hospital areas is a serious concern since there are many occupants i.e. patients, medical practitioners, and staffs.

Furthermore, medical material, medicine, medical gases can cause the quality of air deteriorate. IAQ then requires to regularly check the service areas in order to maintain a good level of air quality. The instrument to measure IAQ is usually expensive.

## III. EXISTING SYSTEM

Air pollution monitoring is a growing concern in the field of environmental engineering. By air pollution monitoring we mean that discovery and communication of colourful pollutant attention similar as nitrogen dioxide, sulphur dioxide, carbon monoxide, carbon dioxide in real time. Pollution covering system consists of a single chip microcontroller, air pollution detector array which are integrated and communicated through GSM Transceiver. The conventional fashion of measuring the quality of water is to gather the samples manually and send it laboratory for analysis, but this technique is time inviting and not provident. Since it's not doable to take the water sample to the laboratory after every hour for measuring its quality. The water quality measuring system can measure the essential rates of water in real time. The system consists of multiple detectors to measure the standard of water, microcontroller and GSM to shoot the information to the watching centre.

## DISADVANTAGES

- In this system we can't able to monitor the three types of pollution. Noise pollution is not in this system.
- Many of the GSM technologies are patented by Qualcomm and hence licenses need to be obtained from them.
- In order to increase the coverage repeaters are required to be installed.
- GSM provides limited data rate capability, for higher data rate GSM advanced version devices are used.
- GSM uses FTDMA access scheme. Here multiple users share same bandwidth and hence will lead to

interference when more number of users are using the GSM service. In order to avoid this situation, robust frequency correction algorithms are used in mobile phones and base stations.

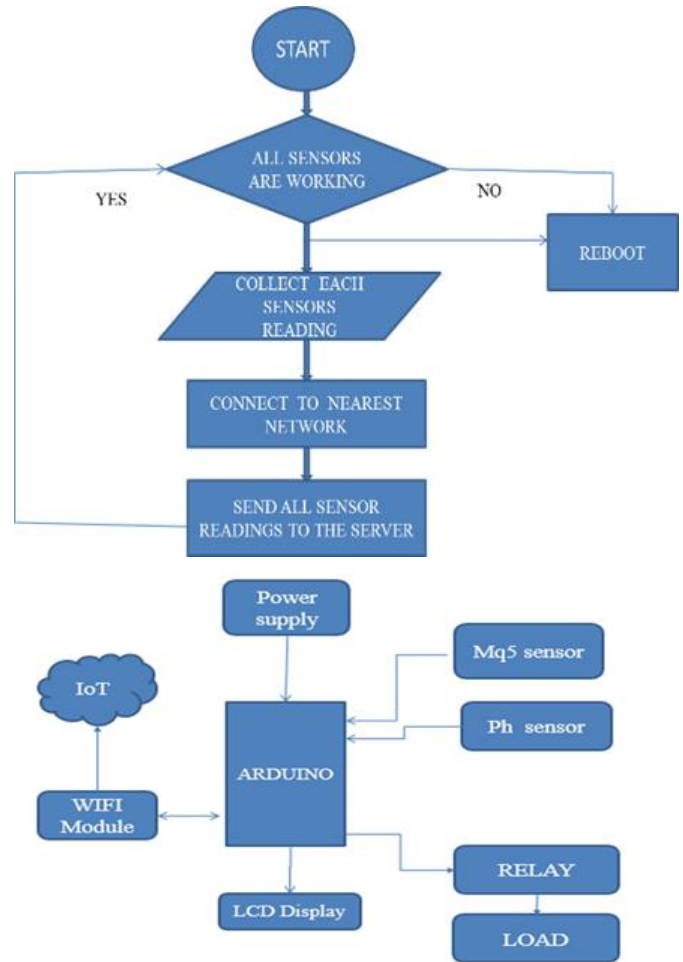
#### IV. PROPOSED SYSTEM

The main aim is to make a kit which will be installed in the required location for monitoring. The kit will basically include Arduino, on which all the sensors will be configured and Wi-Fi module for data transfer. Collect the respective pollution readings after certain time interval. All the readings recorded by the kit will be transferred to the main station (server) by Wi-Fi module. Readings from all the kits will be recorded and saved into the database at the server end. Visualization of collected data from the different location is done using statistical and user-friendly methods such as tables and line graphs. A website will spread the pollution data collected by all the sensors, different colours will be allotted for different ranges of pollution meaningfully to give an idea about the level of pollution. Generation of reports are done per week on a regular interval and also real-time notifications are sent by appropriate authorities when the pollution level exceeds the normal range threshold value.

#### ADVANTAGES

- A. Can monitor pollution with high accuracy
- B. It is easy to add or move Wi-Fi clients or Wi-Fi stations to the Wi-Fi network created by AP (Access Point).
- C. Installation is very quick and easy. It does not require technical knowledge of Wi-Fi rowlan system and its protocols.
- D. Access to the Wi-Fi network can be availed from anywhere within the Wi-Fi AP (Access point) coverage range.

#### PROPOSED SYSTEM FLOW CHART



#### BLOCK DIAGRAM

#### V. METHADODOLOGY

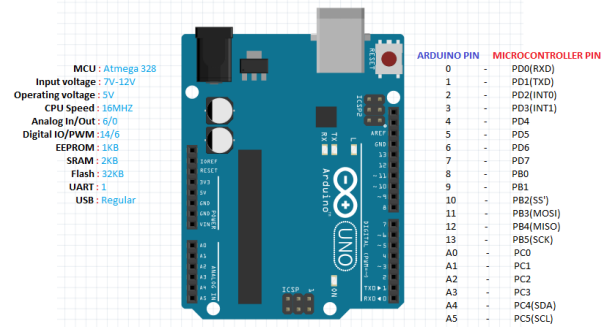
In hardware specification, the components for the proposed system are sensors, Arduino, Wi-Fi module. Three types of sensors are used for monitoring the different types of pollution. The Wi-Fi module is used to send the data collected by the different sensors to the main server. Due to low cost, easy interface, compactness and ability to connect to various devices, Arduino UNO was selected as a main controller. The board features 14 Digital pins and 6 Analog pins. It operates at 5V with input voltage ranging from 8-20V. Arduino has Static Random Access Memory of size 2KB along with flash memory of size 32 KB which makes it quite swift and efficient. ATmega328 is an MCU belonging from the AVR family; Arduino is an it

8-bit device hence its internal registers and data-bus architecture can handle 8 data signals parallel simultaneously. The Wi-Fi Module is a system on chip in which TCP/IP protocol stack is integrated such that can give any microcontroller access to any available Wi-Fi network. The Wi-Fi Module is used for hosting an application or it can offload all functions of Wi-Fi networking from any other application processor. AT commands are used to program the Wi-Fi Module. A program in AT commands is written to connect the Wi-Fi Module to the Arduino device. The Wi-Fi Module is extremely cost effective. Three different sensors are used in our kit. For monitoring the air pollution, the MQ-135 gas sensor is used. In clean air MQ5 Module sensor has less conductivity. The conductivity of the MQ-5 gas sensor is higher along with the gas concentration in the surrounding environment rises. Convert change of conductivity to correspond output signal of gas concentration. MQ5 gas sensor is highly sensitive to Ammonia (NH<sub>3</sub>), Sulphide (S<sub>2</sub>) and Benzene (C<sub>6</sub>H<sub>6</sub>). MQ-5 also senses the smoke and other hazardous gases in the surrounding. It enhances the system's ability to monitor pollution to a minute level. CZN-15E is second sensor

## ***HARDWARE DESCRIPTION*** **COMPONENTS DETAILS**

1. ARDUINO CONTROLLER
2. POWERSUPPLY
3. WIFI MODULE
4. IOT
5. LCD DISPLAY
6. GAS SENSOR
7. PH SENSOR
8. RELAY

## **ARDUINO CONTROLLER**



The Arduino Uno is one of the most common and widely used Arduino processor boards. There are a wide variety of shields (plug in boards adding functionality). It is relatively inexpensive (about \$25 - \$35). The latest version as of this writing (3/2014) is Revision 3 (r3): Revision 2 added a pull-down resistor to the 8U2 HWB line, making it easier to put into DFU (Device Firmware Update) mode · Revision 3 added o SDA and SCL pins are now brought out to the header near the AREF pin (upper left on picture). SDA and SCL are for the I2C interface o IOREF pin (middle lower on picture that allows shields to adapt to the voltage provided o Another pin not connected reserved for future use The board can be powered from the USB connector (usually up to 500ma for all electronics including shield), or from the 2.1mm barrel jack using a separate power supply when you cannot connect the board to the PC's USB port.

## **IOT**

The Internet of things refers to a type of network to connect anything with the Internet based on stipulated protocols through information sensing equipment's to conduct information exchange and communications in order to achieve smart recognitions, positioning, tracing, monitoring, and administration.

## **LCD DISPLAY**

- The 16×2 LCD Board makes it easy to interface a module with low cost microcontroller development

board which do not have built in support for LCD modules. This board has the following

- 16x2 LCD module (you can choose either a green or a blue backlight LCD)
- Backlight current limiting resistor.

### GAS SENSOR

A GAS sensor or a GAS Detector is a type of chemical sensor which detects/measures the concentration of gas in its vicinity. Gas sensor interacts with a gas to measure its concentration. They are used in various industries ranging from medicine to aerospace. Various technologies are used to measure Gas concentration such as semiconductors, oxidation, catalytic, infrared, etc.

Used for family, Surrounding environment noxious gas detection device, apply to ammonia, aromatics, sulphur, benzene vapour, and other harmful gases/smoke, gas detection, tested concentration range: 10 to 1000 ppm.



### pH sensor

A pH sensor is one of the most essential tools that's typically used for water measurements. This type of sensor is able to measure the amount of alkalinity and acidity in water and other solutions. When used correctly, pH sensors are able to ensure the safety and quality of a product and the processes that occur within a wastewater or manufacturing plant.

## VI. INTRODUCTION OF EMBEDDED SYSTEM

### EMBEDDED SYSTEM

An embedded system is a computer system designed for specific control functions within a larger system, often with real time computing constraints. It is

embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs.

Embedded systems contain processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task. Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance.

### CLASSIFICATION OF EMBEDDED SYSTEM

#### HARD REAL TIME SYSTEM

**HARD** real time systems have very narrow response time.

The correctness of response includes a description of timeliness. Deadlines are specified as points in time that occur at fixed time intervals following an event.

#### SOFTWARE REAL TIME SYSTEM

- a) **SOFT** real-time system has reduced constraints on "lateness" but still must operate very quickly and repeatably.
- b) Soft timeliness requirements are specified as time constraints that may be violated.
- c) Example: Railway reservation system-takes a few seconds the data remains valid.

### APPLICATIONS OF EMBEDDED SYSTEM

- Communication device mobile phone, pager, PDA, etc.,
- Household appliance –home control systems, microwave oven, automatic washing machines, digital watch, video game player. etc.,



## VII. SOFTWARE USED

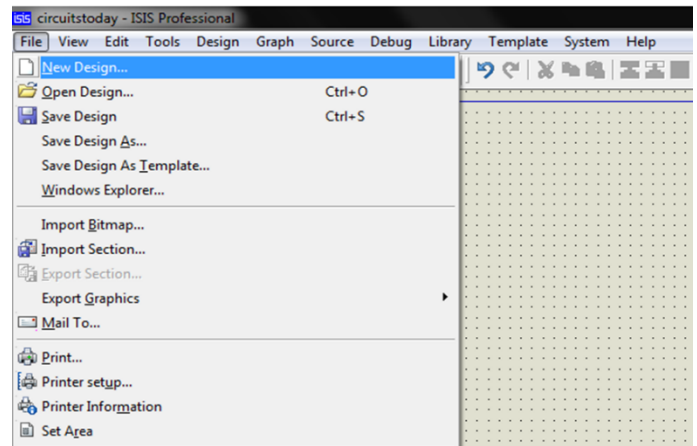
### PROTEUS PROFESSIONAL

Proteus Professional design combines the ISIS schematic capture and ARES PCB layout programs to provide a powerful, integrated and easy to use tools suite for education and professional PCB design. As professional PCB design software with integrated shape based auto router, it provides features such as fully featured schematic capture, highly configurable design rules, interactive spice circuit simulator, extensive support for power planes, industry standard CAD/CAM and OD++ output, and integrated 3D viewer. We will use ISIS for simulating PIC response, it has many variety modelling libraries, and its powerful concentrates in MCUs and MPUs modelling, along with wide range of supporting chips such that AVR MCU series, 8051 MCU series, Basic stamp, HC11 MCU series, ARM CPU, Z80, Motorola 68K CPU, and most PIC's families, also it has a debugger, registers contents viewer and many other features.

#### About Proteus

It is a software suite containing schematic, simulation as well as PCB designing.

1. **ISIS** is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation.
2. **ARES** is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components.
3. The designer can also develop 2D drawings for the product.



#### Features

ISIS has wide range of components in its library. It has sources, signal generators, measurement and analysis tools like **oscilloscope**, voltmeter, ammeter etc., probes for real time monitoring of the parameters of the circuit, **switches**, **displays**, loads like motors and lamps, discrete components like resistors, capacitors, inductors, transformers, digital and analog Integrated circuits, semi-conductor switches, relays, microcontrollers, processors, sensors etc.

ARES offers PCB designing up to 14 inner layers, with surface mount and through hole packages. It is embedded with the foot prints of different category of components like ICs, transistors, headers, connectors and other discrete components. It offers Auto routing and manual routing options to the PCB Designer. The schematic drawn in the ISIS can be directly transferred ARES.

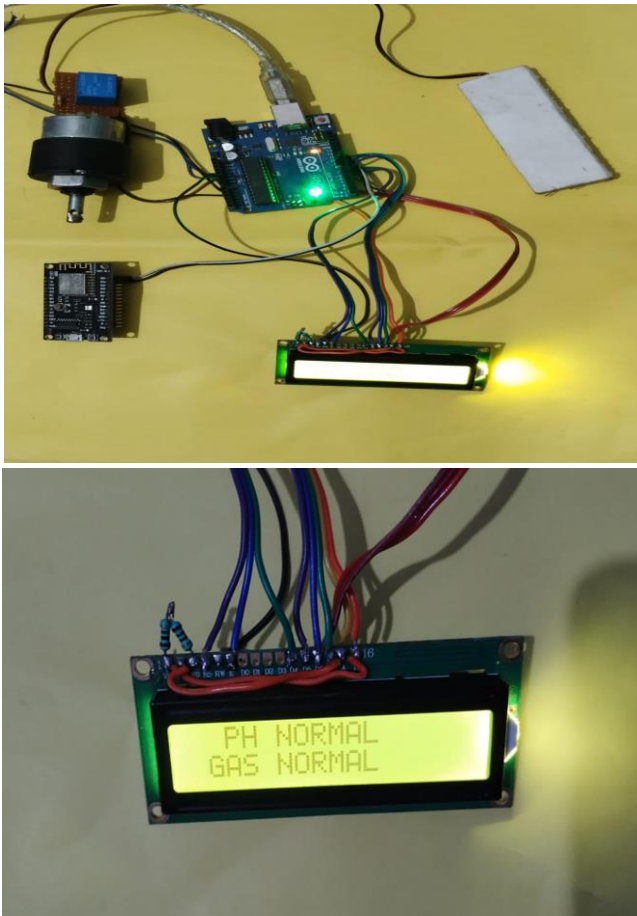
## VIII. RESULT & DISUSSION

### RESULT

The Arduino collects data from the different sensors. The sensors located in different places collect pollution details in the surrounding of the kit. These sensor readings are send to the server with the help of Wi-Fi-Module. These readings are displayed on a website. If the values obtained by the sensors are in normal range, then they are displayed in green colour on the website.

If the sensor readings exceed the threshold value set by the government then all those values are displayed in red on the website. Weekly charts and graphs are plotted and displayed on the website showing the pollution levels at different periods of the week. In a certain area if the pollution level is beyond the threshold value continuously then an alert message is displayed on the website, in order to make people aware of highly polluted areas. This way the common people will know about the pollution levels and their surroundings

## OUTPUT



## IX. CONCLUSION

The pollution monitoring system is solution to contribute to avoid the biggest threat. This monitoring system makes people aware about the highly-polluted areas in their surroundings. It supports the new

technology and effectively supports the healthy life concept. People can view the weekly statistics of the pollution in their surroundings. This will help them be aware about when the pollution around their surrounding is highest and can try to avoid it. So, it becomes very reliable and efficient for the Municipal officials along with the Civilians to monitor environment. Letting civilians also involved in this process adds an extra value to it. As civilians are now equally aware and curious about their environment, this concept of IOT is beneficial for the welfare of the society as well as it is implemented using the latest technology with a low implementation cost.

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# Secure Farming System Using IOT

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## ABSTRACT

Smart Husbandry is an arising conception, because IOT detectors are able of furnishing information about husbandry fields and also act upon grounded on the stoner input. The point of this paper includes development of a system which can cover position of water, humidity and indeed the color change in crops if any happens in the field which may destroy the crops in agrarian field through detectors and the pump motor is used to pump the water from the tank when the field is dry using Arduino UNO board. The design aims at making use of evolving technology i.e. IOT and smart husbandry using robotization. Once tackle has been developed depending on the change in conditions and technology the software needs the updating. The streamlined tackle is called new interpretation of the software. This new interpretation is needed to be tested in order to insure changes that are made in the old interpretation work rightly and it'll not bring bugs in other part of the software. This is necessary because streamlining in one part of the tackle may bring some undesirable goods in other part of the tackle.

**Keywords :** Humidity, Color change, Pumb motor, Arduino UNO

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## I. INTRODUCTION

The Agriculture Parameters are exercising an IOT Technology and system vacuity that draw in these objects to assemble and deal information." The IOT enables effects named honored or potentially forced ever cornerwise over completed the process of being configuration, manufacture open gateways for all the fresh egreious merge of the substantial earth into PC grounded fabrics, in addition to admitting caught capacity, perfection and cash connected favored station. Precisely when IOT is extended with detectors and selectors, the enhancement modify into an

occasion of the all the redundant wide order of electronic physical structures, which in like manner in commercial marches, for case, clever grids, splendid homes, canny moving and smart civic groups. All is especially specific through its introduced figuring configuration anyway can interoperate within the current Internet establishment.

## II. LITERATURE SURVEY

1. IoT based Smart Agriculture was presented by Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar

IOT use growers to get related with his hearthstone from wherever and at whatever point. Remote detector structures are employed for watching the grange conditions and bitty scale regulators are employed to control and denuclearize the home shapes. To see ever the conditions as picture and videotape, remote cameras have been used. IOT development can dwindle the cost and modernize the productivity of standard developing.

2. Wireless Sensor Network in Precision Agriculture Application was presented by Mohamed Rawidean, Mohd Kassim,

An algorithm was developed with threshold values of temperature and soil humidity( Rawls and Turq formulas) that was programmed into a microcontroller- grounded gateway to control water volume. In this paper, we apply a platform for perfection husbandry which allows to collect abecedarian physical marvels needed for the perfection husbandry, which will be treated to calculate the need for water demanded for optimal irrigation.

3. IoT based smart security and monitoring devices for agriculture was presented by R. Balaji, N. Prakash

This device can be controlled and covered from remote position and it can be enforced in agrarian fields, grain stores and cold stores for security purpose. This paper is acquainted to accentuate the styles to break similar problems like identification of rodents, pitfalls to crops and delivering real time announcement grounded on information analysis and processing without mortal intervention.

### III. EXISTING SYSTEM

The soil humidity grounded irrigation control uses Tensiometric and Volumetric ways, which are fairly simple but these amounts are related through a soil water characteristic wind that's specific to a soil type. Also the detectors use bear routine conservation for proper performance. Intelligent automatic factory irrigation system concentrates soddening shops regularly without mortal monitoring using a humidity

detector. The circuit is make around a comparator Op-amp( LM324) and a timekeeper which drives a relay to switch on a motor. The system uses a tackle element, which is subordinated to variation with the environmental conditions. A real- time wireless smart detector array for scheduling irrigation prototyped a real- time, smart detector array for measuring soil humidity and soil temperature that uses off- theshelf factors was developed and estimated for scheduling irrigation in cotton. This system is specific for a crop and hence its operation is limited. Proper scheduling of irrigation is critical for effective water operation in crop product, particularly under conditions of water failure. The goods of the applied quantum of irrigation water, irrigation frequence and water use are particularly important. To ameliorate water effectiveness there must be a proper irrigation scheduling strategy. In this paper a simple system is mentioned using a microcontroller to automate the irrigation and watering of small potted shops or crops with minimum homemade interventions. If it's a homemade mode also regulator keep checking for the incoming communication and if it gets a new communication also regulator reads the content of the communication and if it contains ON also it makes the separate Relay ON by transferring the high signal to the motorist.

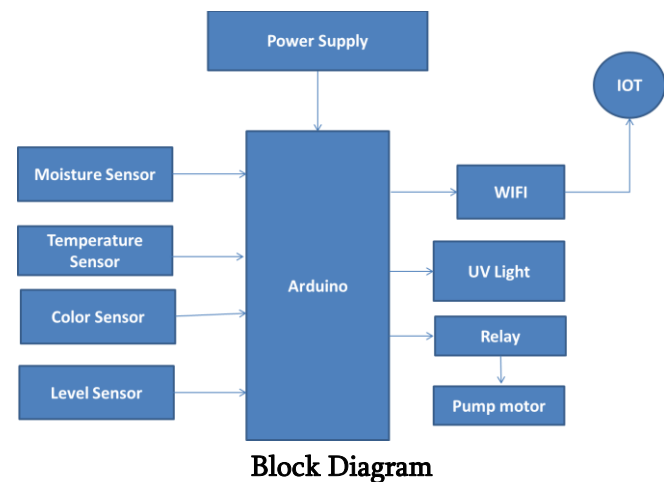
### DISADVANTAGES

- Many of the GSM technologies are patented by Qualcomm
- In order to increase the coverage repeaters are required to be installed.
- GSM provides limited data rate capability, for higher data rate GSM advanced version devices are used.

### IV. PROPOSED SYSTEM

The design uses a Wi- Fi module( ESP8266- 12) which connects the system to internet. This module controls a motor for supplying water to the field on the

information attained from a moisture index and soil humidity detectors. A new color detector for agrarian monitoring. The detector communicates ever with a anthology using backscatter bistatic norms. This whole system is covered and controlled by android App through internet. The design also depicts the conception of Internet of effects( IoT).

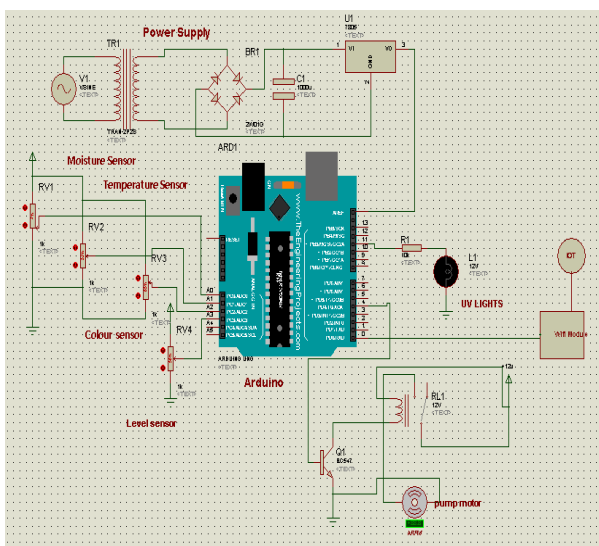


**Block Diagram**

**ADVANTAGES**

- water levels based on things such as soil moisture and weather predictions.
- Local and commercial farmers can monitor multiple fields in multiple locations
- Real-time insight and process automation through low cost sensors and IoT platform implementation

**CIRCUIT DIAGRAM**

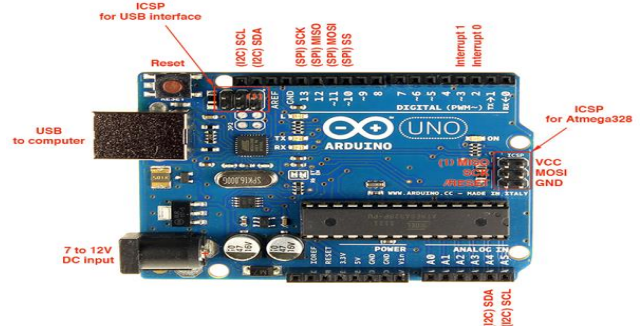


**HARDWARE DESCRIPTION**

- Arduino Controller
- Power Supply
- Moisture Sensor
- Temperature Sensor
- Colour Sensor
- Wifi
- Uv Light
- Water level sensor
- Relay
- Pump motor

**ARDUINO CONTROLLER**

The Arduino Uno is one of the most common and extensively used Arduino processor boards. There are a wide variety of securities( draw in boards adding functionality). It's fairly affordable( about\$ 25-\$ 35). The rearmost interpretation as of this jotting(3/2014) is modification 3( r3). modification 2 added a pull-down resistor to the 8U2 HWB line, making it easier to put into DFU( Device Firmware Update) mode. modification 3 added o SDA and SCL legs are now brought out to the title near the AREF leg( upper left on picture). SDA and SCL are for the I2C interface o IOREF pin( middle lower on picture that allows securities to acclimatize to the voltage handed. Another leg not connected reserved for unborn use. The board can be powered from the USB connector.

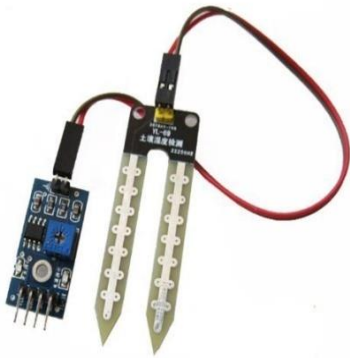


**Pin diagram of Arduino Controller**

**MOISTURE SENSOR**

This humidity detector can read the quantum of humidity present in the soil girding it. This detector

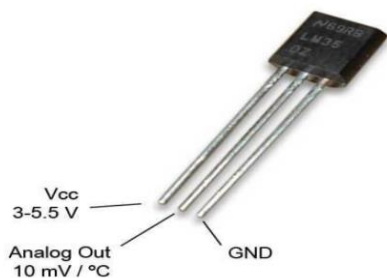
uses the two examinations to pass current through the soil, and also it reads that resistance to get the humidity position. further water makes the soil conduct electricity more fluently( lower resistance), while dry soil conducts electricity inadequately( more resistance). It'll be helpful to remind you to water your inner shops or to cover the soil humidity in your theater .



**Soil Moisture Sensor**

**TEMPERATURE SENSOR**

A temperature detector is a device, generally, a thermocouple or RTD that provides for temperature dimension through an electrical signal. A thermocouple( T/ C) is made from two different essence that induce electrical voltage in direct proportion to changes in temperature.



**Temperature sensor**

**COLOR SENSOR**

In the TCS3200, the light- to- frequency motor reads an 8 x 8 array of photodiodes. Sixteen photodiodes have blue pollutants, 16 photodiodes have green pollutants, 16 photodiodes have red pollutants, and 16 photodiodes are clear with no pollutants. In the TCS3210, the light- to- frequency motor reads a 4 x 6 array of photodiodes. Six photodiodes have blue

pollutants, 6 photodiodes have green pollutants, 6 photodiodes have red pollutants, and 6 photodiodes are clear with no pollutants.



**TCS3200 Colorsensor**

**UV LIGHT**

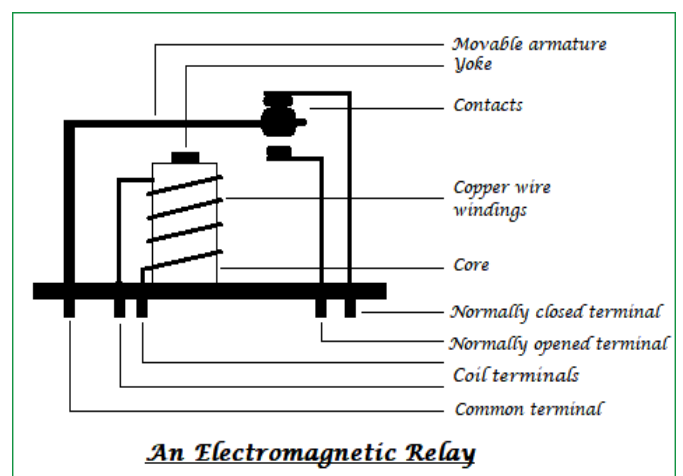
Ultraviolet( UV) is electromagnetic radiation with wavelength from 10 nm( with a corresponding frequency of roughly 30 PHz) to 400 nm( 750 THz), shorter than that of visible light but longer than X-rays.

**WIFI Module**

The ESP8266 WiFi Module is a tone contained SOC with integrated TCP/ IP protocol mound that can give any microcontroller access to your WiFi network

**RELAY**

The main operation of the Relay was seen in the history for transmitting and entering the information, that was called as Morse law where the input signals used to be moreover 1 or 0, these change in signals were mechanically noted in terms of ON and OFF of a light bulb or a beep sound



**An Electromagnetic Relay**

**Electromagnetic Relay**

## PUMP MOTOR

The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitations. Small DC Submersible water pumps push fluid to the face as opposed to spurt pumps having to pull fluids. Submersibles are more effective than spurt pumps.



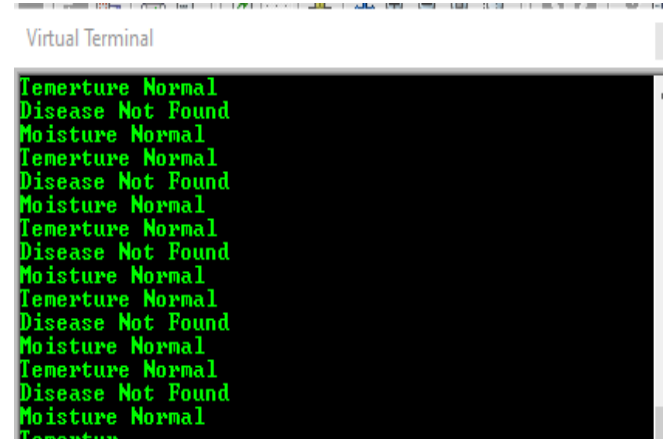
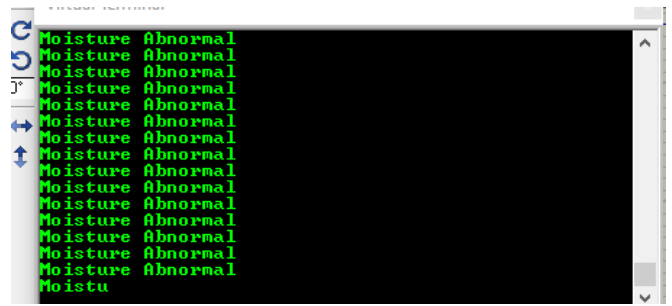
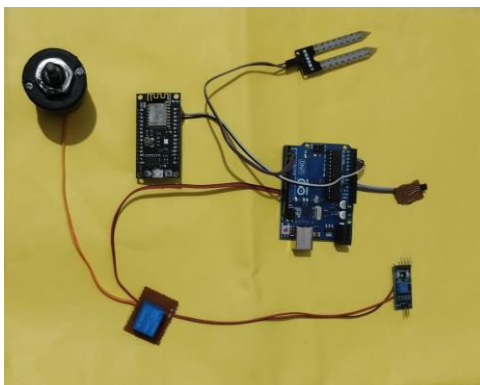
Pump motor

## V. RESULT AND DISCUSSION

### RESULT

The Arduino controller collects the details from different sensor. The sensors are located in different places and collecting the data. These sensor readings are send to the server with the help of WI-FI module. the output are displayed in using app. Suppose the sensors value is normal the app will be display on like moister is normal or temperature is normal then the sensor value is increased or decreased the app will be display on like moister is abnormal or temperature is abnormal. The pumb motor is used for measuring the water level. The water level is below particular range the motor is automatically going to ON state.

### OUTPUT



## VI. CONCLUSION

The agriculture field is being monitored and controlled by android app at user end. The ESP8266 is the device at field end which receives the messages from broker network and manipulates it and will perform the function mentioned in message. After it will send the messages to broker network and in turn it will be published to the Client (user end). The ESP8266 is the best device for IoT projects. Since it is small, compact, lightweight, easily programmable, and easily installable and has enough GPIO pins to use them. Agriculture irrigation system is developed with low complex circuitry. A two sensors are used efficiently those are temperature and moisture of soil in the circuit to get the calibrated information to the system. Two sensors and microcontrollers of all three Nodes are successfully interfaced various Nodes. All observations and experimental tests prove that proposed is a complete to field activities, irrigation problems. Implementation of such a system in the field can definitely help to improve the field of the crops and overall production.



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# Analytical Study on Indian Coastal Shipping with Reference to Container Trade

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## ABSTRACT

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India currently has a modest level of container penetration. Approximately 54% of all general cargo that can be transported in containers is actually containerized and exported, which is lower than the average global rate of 80%. Although shipping in containers is more efficient, a sizable portion of domestic general freight is still handled in bulk. However, in the upcoming decades or years, this could drastically change. Continuous GDP growth will raise the volume of containerized imports, while rising industrial production will raise the volume of containerized exports. A multimodal/intermodal transport system was created as a result of the containerization of maritime transport and the merging of maritime and land transport modes. The intermodal transport chains and organizations must use a telecommunications system in order to function. This study will look into two separate but connected research streams in order to gain a wider understanding of coastal shipping concerns and to study the Indian instance in this broader perspective. In contrast to road transportation, coastal shipping can only be used as a link in a multimodal transportation network. The complete multimodal/intermodal chain, including the land legs, must be functional and economical for coastal shipping to be commercially viable. In order to create a successful, multi-modal transport system that can serve present and future business needs, achieve modal balance, and reduce carbon emissions, India should regard coastal shipping as an intrinsic part of its transportation policy.

Keywords : Multimodal Transportation Network, Transportation Policy.

## I. INTRODUCTION

Coastal shipping is the movement of goods by water without travelling across an ocean. An Indian-registered ship with a solely Indian crew engaged in

transporting cargo or people by sea between Indian ports is referred to as a coastal vessel. The Director General of Shipping may also grant a coastal trade license to any other ship for a specific time period. According to the 1958 Merchant Shipping Act, only

ships carrying the Indian flag are allowed to transport cargo between Indian ports. If no Indian flag ships are available, however, foreign flag vessels are allowed to deliver cargo between Indian ports. Environmental issues and climate change brought on by Green House Gas (GHG) emissions have forced nations all over the world to prioritise rivers for transportation above roads and trains. Compared to other modes of transportation, coastal shipping has a number of benefits, including better fuel efficiency, lower unit transportation costs, environmental friendliness, and lack of congestion.

In light of the aforementioned, coastal shipping has recently drawn more attention in India as well. The growth rate of maritime coastal freight transportation in India from 2001 to 2010 was 3.3% annually. The majority of the existing domestic transportation demand is met by the road and rail networks, which account for 57% and 30% of the demand, respectively. Coastal shipping contributes only 7% of domestic freight transit, which is extremely low when compared to other prosperous nations [1]. Though Indian seaborne trade has been growing substantially, the Indian shipping tonnage is not growing in pace with the fast growing maritime trade. India has 846 coastal boats as of January 1, 2015, however only 146 of those were cargo ships with a GRT of 0.66 million. Only one vessel was registered under the category "RO-RO" (Roll on - Roll off) with a GRT of less than 1000 tonnes, whereas the biggest number of vessels (287) were registered under the category "Tug" with a GRT of roughly 104 thousand. The average age of Indian coastal vessels, which have a tonnage of 665 thousand GRT, is over 20 years. India is rated fifteenth in the world by gross tonnage and has one of the largest merchant shipping fleets among developing countries. However, the Indian shipping industry only makes up about 1% of the total global fleet in terms of fleet size. The coastal shipping in India also experiences constraints, most of which are infrastructure-related. The government-backed infrastructure development projects, along with the current and planned ports,

create new opportunities for the coastal shipping industry.

## II. LITERATURE

This study will look into two separate but connected research streams in order to gain a wider understanding of coastal shipping concerns and to study the Indian instance in this broader perspective. It will look at the studies and reports that different committees and experts conducted in India over the last 20 years. On the other hand, it will look at empirical research done in nations such as those in the Association of Southeast Asian Nations (ASEAN), Australia, New Zealand, Greece, Europe, the United States, etc., where coastal shipping has drawn a lot of interest and where research on the coastal shipping industry is in progress. In regard to the four research objectives, this study will look at the lessons learned from these and other studies.

India's coastal shipping has been a challenge for the last three or four decades. The first to recognise recurring issues was the Lokpur Committee (Rail Sea coordination committee) in 1957. Since then, the same issues have been identified by every panel or committee established to look at coastal shipping and its issues [1-10]. To encourage coastal shipping in India, a number of study groups, committees, organisations, consultants, etc. have published a range of papers and conducted studies during the past 20 years [6]. India Ports and Shipping Sector Research Sector of Coastal Shipping. The 1993 Afsal Purkar Report The Ministry of Surface Transport established a working group to examine the growth of coastal shipping, and a wide range of organisations were represented. One of the suggestions was to remove coastal ships from the strict daily inspection of the Customs Act of 1962. It was also advised to build smaller ports along the coastline and to deepen and enlarge the Pampan Channel to encourage East-West commerce [7].

Report of the Expert Committee on a Comprehensive Approach to Global Product Flow (1999) - The Indian Ministry of Commerce created this committee to provide guidance on a comprehensive approach to product export/import. The committee proposed that all ports should have a minimum container handling facility because the cargo transported by coastal ships will progressively be containerized. Another suggestion made was that coastal shipping be given infrastructure status [8]. The Study on Development of Coastal Shipping & Minor Ports (2003) was carried out by Tata Consultancy Services for the DG Shipping, Ministry of Shipping, Government of India [9]. This article offers a system for encouraging the switch from road/rail to water transportation for products. The study group also recommended an integrated transportation system that includes a road, rail, coastal, and inland waterway network [10].

### III. CRITICAL EXAMINATION OF THE REASONS FOR THE UNDER UTILIZATION OF COASTAL SHIPPING IN INDIA

India's already crowded transportation system, particularly its road and rail networks, is put under further stress by its rapidly growing population and a significant increase in freight. Highway congestion and delays can have a severe effect on the safety and security of persons, freight, and vehicles in addition to reducing the overall reliability and predictability of transportation services. Ineffective terminal and intermodal operations are frequently the result of congestion at ports and in transportation networks. Transport operators suffer losses as a result of reduced travel owing to traffic and operational delays, which are frequently passed on to shippers and eventually to consumers. In addition, a large number of ports, terminals, and other intermodal infrastructure are situated in or close to populated regions. Due to the presence of old bridges and limited connecting roads, trucks travelling to or from these sites are usually forced to use local streets and roads that are not strong

enough for huge vehicles. Locally, there is more noise and air pollution as a result of more traffic on the roads and highways. Although rail is a sizable and growing service alternative, its usefulness as a truck replacement is limited by high infrastructure development costs and network capacity constraints. One strategy to reduce the aforementioned consequences and significantly increase the capacity available for freight transfers across the nation is to increase the use of coastal shipping. Coastal shipping in India has not developed into a significant component of the nation's transportation infrastructure despite having obvious advantages over land-based means of transportation. This is partially due to the industry not receiving the attention it requires from a governmental and industrial standpoint. In order to find a workable solution in such a competitive atmosphere, it is preferable to make sure that problems are fully and extensively understood before addressing them. This essay aims to critically examine the various factors that contribute to India's underutilization of coastal shipping.

India's coastal shipping has been a problem for at least the past four decades. Coastal shipping issues were initially brought up in the Rail Sea coordination (Lokpur) committee report, 1957 (ADB & Planning Commission Report (1990)3), and the most of them still persist today. The review of the pertinent literature makes it clear that all groups or committees established in India to study coastal shipping have since repeated the same issues with minor alterations. The coastal shipping industry in India faces policymakers with a variety of exceedingly difficult problems. The growth of coastal shipping is not entirely the fault of the Ministry of Shipping and DG Shipping. It must be coordinated with the State Governments/Maritime Boards, the Ministry of Petroleum and Natural Gases, the Ministry of Railways, the Ministry of Road, Transportation, and Highways, and the Ministry of Finance. India needs a single, integrated ministry with a distinct mission to create a

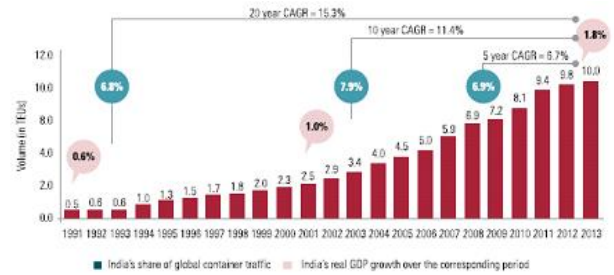
multimodal transportation network that supports the nation's larger development objectives. The current ministries should be changed into departments in charge of setting up the necessary facilities and offering transportation-related services.

#### IV. THE EFFECT OF FAST-GROWING CONTAINERIZATION IN CATALYSING COASTAL SHIPPING IN INDIA

The shipping industry, and specifically the container shipping trade, has experienced significant waves of change both globally and in India. The container changed the global economic system by making transportation more affordable. How crucial the container is to the world economy and, consequently, to the Indian economy, cannot be measured. The predominance of sea transport in the transportation of goods involved in international trade has been influenced by containerization, multimodal transport services, advanced marine engineering technology, and computerization. Commodities started to flow directly from Indian producers to retail outlets in the United States, Europe, and other international destinations as container transportation evolved into multimodality and made it possible for the seamless movement of containers between ships, trucks, and trains.

For many years, the shipping industry's fastest-growing sector has been the container trade. India's increased container traffic is highly dependent on the state of the world economy and the growth of containerization. Only a few businesses currently run on restricted routes. To make the trip economically possible, some of the ships make port calls in Pakistan and Sri Lanka. Ports on the east coast are quickly catching up to west coast ports in terms of the container trade. In India, containerization levels increased at a CAGR of 15% from 1993 to 2013, compared to a global CAGR of 7%. The growing

containerization of goods like electronics, textiles, and autos may be to blame for this impressive expansion.



Note: "Year" stands for the financial year ending March  
Source: Indiastat, IFA, KPMG Analysis

Figure 1. India : Container Traffic

However, India now has a general cargo containerization rate of about 54%, which is lower than the global average of 73%. The containerization of bulk items like rice, wheat, maize, and sugar is expected to increase over the coming years. It is projected that increased containerization penetration will increase domestic traffic volumes. The total expansion of traffic on the inland waterway system around the world has been dominated by container traffic since 1990. Containerization is expected to be one of the key reasons boosting coastal shipping in India as well. Currently, containerized coastal shipping, which has a very minor function, is only used to deliver clay, tiles, marble, plywood, white goods, and chemicals. Before the era of units and containers, general merchandise including spices, tea, coffee, cashew nuts, and coir was transported down the coast by Indian coastal ships.

By the time road and rail sectors took up the movement of containerized cargo, coastal shipping in India had just recently adopted containerization. Comparatively, from 1990 onwards, the number of containers transported by domestic shipping in Europe and China increased by roughly 38.6% annually<sup>40</sup>. It should be noted, too, that containerization has been progressively increasing in Indian coastal shipping as well, increasing by 3.2% between FY2004 (14.8%) and

FY2010 (18%). Due to the segment's comparatively modest volume, shipping corporations have not yet found it to be appealing. The coastal containerized freight movement is depicted in the IPA statistics under "others," and an analysis of this data from 2005–2006 to 2014–2015 is displayed in the Table 1 which exhibits a trend of increasing increase. This is mainly due to increase in containerized general cargo movement.

ANALYSIS OF CONTAINER COASTAL TRAFFIC IN COCHIN - 2006-2013

Year	Container Throughput at ICTT, Vallarpadam, Cochin	Total Coastal Container Traffic	% of Coastal on total traffic
2006	217518	25167	12
2007	239723	39646	17
2008	268341	66459	25
2009	277032	85412	31
2010	310578	92236	30
2011	303904	85322	28
2012	323836	93760	29
2013	341762	118214	35

Source: DP World, Cochin & Various Shipping Lines

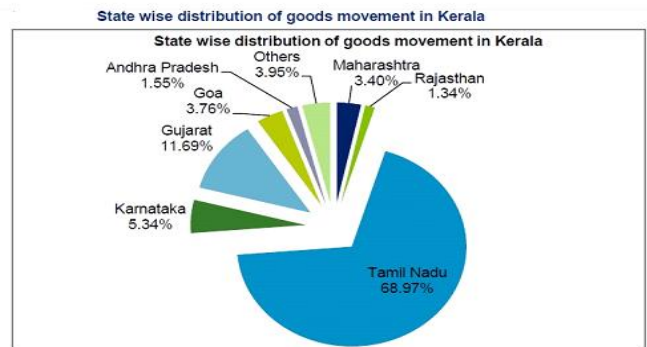
Table 1. An analysis of coastal container growth

Only a few businesses currently run on restricted routes. To make the trip economically possible, some of the ships make port calls in Pakistan and Sri Lanka. Ports on the east coast are quickly catching up to west coast ports in terms of the container traffic. One of the busiest west coast coastal container routes, the Gujarat Cochin route, displays a considerable increase rate in container traffic in this industry. From 12% in 2006 to 35% in 2013, coastal container traffic's share of ICTT, Vallarpadam's overall traffic has increased. Due to the ships' need to go throughout Sri Lanka, there is a restriction on the transit of containers between the East and West coasts. In this industry, railroads are preferred for the movement of containers. Nevertheless, M/S Shreyas Shipping has begun a liner service connecting India's East and West coastlines, which is anticipated to increase container trade between the two coasts. The rapid expansion of India's railway and road systems directly threatens container shipping by sea. The road is the ideal means of transportation for containers travelling less than 300 kilometres. The ratio of container transit by road and

rail for routes between 300 and 500 kilometres is roughly 50:50. However, trains are currently the preferred mode of transportation for any routes longer than 500 kilometres.

### V. OPPORTUNITIES FOR CONTAINER COASTAL SHIPPING

One of the benefits of containerization is India's growing domestic market. The Indian retail sector is swiftly emerging as the next big growth area. The domestic LCL market, which combines tiny packages to create a full container load, is unexplored. The domestic LCL market should be promoted appropriately because it has enormous potential for coastal container traffic. States like Kerala rely heavily on services. Kerala is a consumer state, hence the majority of its needs for all goods are met by imports from other states. From other states, these items are primarily carried by road.



Source: Commercial Taxes Department, Deloitte analysis

Figure 2. State wise distribution of goods in Kerala

Over 20,000 cars are thought to transport goods from neighbouring states to Kerala every day. An additional 2000 trucks are reportedly transporting supplies from Kerala to neighbouring states. When feasible, these commodities, ranging from food items to durables and industrial goods, might be aggregated, packed into containers, and transported by coastal shipping.

India is becoming one of the world's most popular outsourcing locations for manufacturing, giving higher containerization possibilities. India's increasing

## VI. CONCLUSION

industrialization will enhance containerization in the country. Original equipment manufacturers (OEM), such as Samsung and LG Electronics, as well as providers of electronics manufacturing services (EMS), such as Solectron, Flextronics, and Jabil, have already constructed facilities in India. Components of products are typically produced as semi-manufactured goods, re-exported in containers, and incorporated into finished products for modern manufacturing processes. These finished goods may also be exported in containers. In recent decades, the increase in semi-manufactured items and the usage of transshipment have contributed to the expansion of container throughput.

Movement of Over Dimensional Cargo (ODC), often known as project cargo, is the burgeoning activity within the logistics industry. It includes transporting machinery and materials of varying sizes in containers with open tops and flat racks. The movement of project cargo is increasing in industries such as electricity, oil and gas, mining, etc. The government's decision to achieve energy independence has resulted in the approval of the construction of power plants around the nation.

Even though all survey respondents believe that containerization is one of the important trends that will push Indian coastal shipping to greater heights, the development of this sector requires resolving several difficulties that are becoming obstacles for the expansion of Indian coastal shipping. India requires a programme to incentivize and assist the transition of container transportation from road and rail to water. By 2030, the European Union plans to transfer over fifty percent of its road and rail freight to short marine transportation. For any policy intervention to be effective, a thorough analysis and comprehension of a number of sector-specific challenges are necessary.

India's economic development has been more characterised by globalisation and the continual effort to improve industrial processes. And manufacturing and distribution organisations integrate transport activities under their managerial responsibilities. Due to its fuel efficiency, environmental friendliness, and reduced unit transportation cost, water transport has become a viable alternative to road transport, which is the primary method in India. Most international gateway ports are also connected to all three modes of transportation (road, rail, and sea coastal/IWT), allowing for the efficient evacuation of cargo, which reduces port congestion and boosts productivity. India too should follow suit to ensure uninterrupted domestic supply chain. In addition, as the Indian economy becomes increasingly intertwined with global supply networks, container penetration will expand. Instead of just managing and supervising the national fleet, India should adopt policies that actively encourage and promote investments in International shipping services under the Indian flag and amend its laws to facilitate this.

All stakeholders should collaborate to ensure that some of these difficult problems are better understood by the business community through various means. However, the Indian shipping industry's competitive position must be enhanced further. In addition, as the Indian economy becomes increasingly intertwined with global supply networks, container penetration will expand. The difficulties affecting the coastal shipping sector cannot be resolved by a single party alone. All parties involved should collaborate to ensure that these difficult issues are better understood and then solved. As crucial as the physical infrastructure itself are the rules and procedures that govern its operation

The researcher envisions an Indian Marine Transportation System that is safe, secure, environmentally friendly, globally compatible, and nationally integrated in order to ensure the uninterrupted and reliable flow of commerce along the

national maritime highways, inland waterways, and intermodal connections. Several policy decisions, tactics, and investments must be executed in order to reach this desired end state.

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# Effect of Virtual Reality Based treatment in Geriatric Population on Static Balance, Dynamic Balance and Risk of Fall

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## ABSTRACT

**Background:** With advancing age, the postural control mechanism becomes less efficient due to ageing. Reduced peripheral sensation, muscle weakness, and increased reaction time are significant contributing factors to postural instability in the elderly. Thus age can affect both static and dynamic balance in elderly which will eventually have impact on fear of fall and risk of fall. Virtual Reality Training (VRT) focuses on exercise intensity and feedback that provides the patient with safe and effective training and rehabilitation. The aim of this study is to evaluate the effects of kinect based virtual reality training on Static balance, Dynamic balance and Risk of Fall.

**Methodology:** Ethical clearance was obtained by the Ramaiah Medical College and Hospitals. Based on the inclusion criteria, patients were screened using Time up and go test (TUG) as a screening tool for balance, 31 participants were recruited. Pre and post assessment of static and dynamic balance was done by Four Stage Balance Test (FSBT) and TUG. Explanation and instruction were given to patient about the game controls and exergames with a demo.

**Results and Conclusion:** 30 min of Exergame training for 8 sessions for two week were administered. Paired t-test was used to test for significant change. Pre-post comparison of TUG and FSBT scores showed that there is significant change. ( $p < 0.001$  and  $< 0.001$  respectively which is statistically significant). VRT can be an effective means of training basic motor skills to improve the balance, and use of VR in the area of motor learning can be of great benefit in improving balance.

**Keywords:** Exergames; Virtual Reality Training; Virtual Rehabilitation; Balance; Risk of fall; Geriatrics

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## I. INTRODUCTION

Ageing affects the nervous system as well as other systems of our body. When people age, they suffer

from lack of memory and have difficulties to learn, it can also make them lose balance. With advancing age, the postural control mechanism (balance) becomes less efficient because of changes

in its individual components of different body system such as Musculoskeletal, Cardiovascular and Neurological systems<sup>1</sup>. Changes have been reported in muscle response strategies in older adults during balancing activities; the somatosensory, vestibular, and visual systems have also shown a reduction in function. Reduced peripheral sensation, muscle weakness, and increased reaction time are significant contributing factors to postural instability in the elderly population. Thus age affects the balance in elders. Both static and dynamic balance can be affected. Balance is considered a complex motor skill necessary for functional performance of the individual, especially in daily living activities. Balance relies on proprioceptive, vestibular and visual system inputs which are processed by the central nervous system, requiring the integrated functioning of sensory, motor and cognitive systems. Exercise can be used as a stand-alone falls prevention intervention or as a component of a multifaceted program. Multifaceted interventions can prevent falls in the general community, in those at greater risk of falls, and in residential care facilities. In recent years, technological improvements have allowed for the creation of Virtual Reality (VR) environments for different uses, especially in the training of pilots, astronauts, medical staff, soldiers, and athletes. In regards to physical activity, V.R. is currently being used in two main fields: Exergaming and Rehabilitation<sup>2</sup>. The use of video games with a VR device has been gaining ground in rehabilitation processes. VR refers to a simulated interactive environment. According to Leon et al. VR aims to create a visual, auditory and sometimes tactile and olfactory environment that appears real and enables the human user to become immersed in the interactive experience<sup>3</sup>. Leon et al Problems of elderly population in balance treatment are adherence, compliance to the exercise and physical limitation

of exercises (ROM, Strength and Endurance) Hence, Kinect based Virtual Reality Training (VRT) can be an alternate treatment for balance in elderly population. As VRT has advantages over the other forms of interventions such as, home situation, monitoring performance, external focus of attention, personalized, training both motor control and cognitive function as well, it is also motivational and engaging<sup>4</sup>. The use of Xbox in urban population is affordable and convenient. Kinect based events are commonly available consumer device games inbuilt into system, and can be used in home setup rather than going out of the home which can be problem of commute. Aim of the study is to know the effect of VRT on static balance and dynamic balance in geriatric population and to know the effect of VRT on risk of fall in geriatric population Indian urban set up.

## II. METHODS

The Study Design is case series, Study Type is pre-post design, and Study Setting was set up at Physiotherapy rehabilitation center, Ramaiah Memorial hospital. The Participants who were included in the study were elderly Individuals with impaired balance above 60 year in the community, Sampling Design was Convenient sampling. Source of participants were community dwellers from M.S.R Nagar, Bangalore. Ethical Clearance was obtained from M.S Ramaiah Medical college and Hospital (EC/433/2017). Sample Size Determination was 19 samples<sup>5</sup>. Sample size was calculated using the data from the reference article Seline Wuest, 2014. Material were used the material used to set up VRT set up were TV/projector, Xbox 360 console, Kinect device, Kinect Exergames (sports and adventure), Joystick (controller) and a Laptop. Inclusion criteria for the study were people above the Age 60-80 (male and female), people with impaired balance, people Able to walk without any assistive device, MMSE

score 24 and above, Diabetic and Hypertensive under medication. Exclusion criteria for the study were- People with Vestibular disorders, Visual disorders, seniors with Cognitive decline, chronic cardiac, orthopedics, and neurological conditions seniors with a serious fall event that led to medical attention (fracture) within 1 year prior to the start of the study.

Outcome Measures used were four stage balance test for Static balance, Timed up and go test for Dynamic balance and Time up and go test for Risk of fall

**PROCEDURE:**

Ethical clearance was obtained. Written consent form from each participant was obtained. Screening of the subjects was done to select according to inclusion criteria. Pre intervention outcome results were obtained. Explanation and understanding of VRT was given to patients with a demo. Thirty minutes of virtual

8 sessions of VRT intervention involving exergaming activities. Pre assessment for static and dynamic balance will be done by screening test (TUG test) and patients will be explained in detail about the exergames and set up. Clear instruction will be given to patient about the game controls with a demo. 30 min of exergames training for 8 sessions will be done and at the end of 8 sessions, post intervention assessment for static and dynamic balance data will be collected and results will be drawn from the outcome measure data obtained post intervention in the study.

**STATISTICAL ANALYSIS:**

Statistical software SPSS 16 was used for analysis and Microsoft Word and Excel were used to generate tables and graph. The normality of the data was confirmed using Shapiro Wilk Test

**III. RESULTS**

2 weeks of VRT training for 8 sessions showed a significant improvement in both static and dynamic balance. Time taken to complete TUG pre-test with mean  $13.42 \pm 1.36$  reduced to  $12.12 \pm 1.10$  sec. and this shows reduction in time for Tug which implies that there will be improvement in dynamic balance and risk of fall. On the other hand there is increase in time taken to perform FSBT post intervention and with mean time pre-test  $5.14 \pm 2.59$  increased to  $8.52 \pm 2.09$  sec. this shows improvement in the FSBT scores which implies that there is improvement in static balance. Post intervention data shows significant improvement in both TUG and FSBT with  $p < 0.001$ .

	TUG pre	TUG post	FSBT pre	FSBT post
<b>MEAN</b>	$13.42 \pm 1.36s$	$12.12 \pm 1.10$	$5.14 \pm 2.59$	$8.52 \pm 2.09$
<b>SEM</b>	0.31	0.25	0.59	0.48

Table 1 Descriptive data about the patient pre and post values in time (seconds) both outcome measures

Outcome measures (N= 19)	Pre Mean ± SD	Post Mean ± SD	Pre-Post Difference Mean ± SD	p value	95% Confidence Interval		Effect Size
					Interval		
					Upper	Lower	
FSBT	5.1 ± 2.59	8.52 ± 2.09	3.37 ± 2.7	0.001	2.31	4.47	1.52
TUG	13.42 ± 1.36	12.13 ± 1.1	1.29 ± 0.55	0.001	1.56	1.02	1.83

Table 2 summarizing result values of Student’s paired t-test For FSBT and TUG which suggests the significance. (P < 0.05 denotes statistically Significant difference)

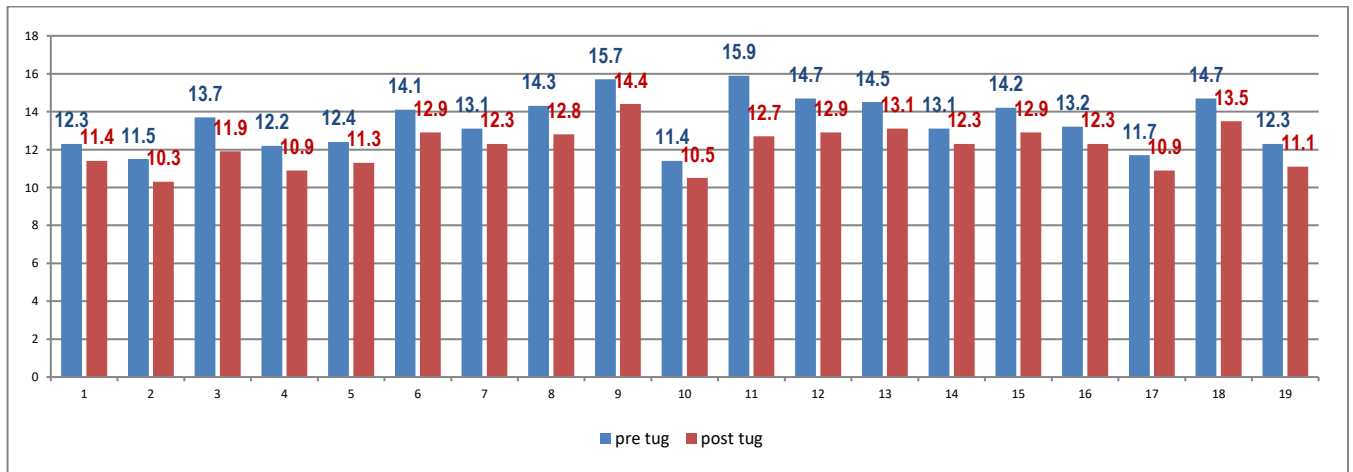


Figure 1(a) showing the data for pre Tug test and post Tug test in second (X axis represents the number of samples and y axis represents the time taken in seconds to complete the TUG test)

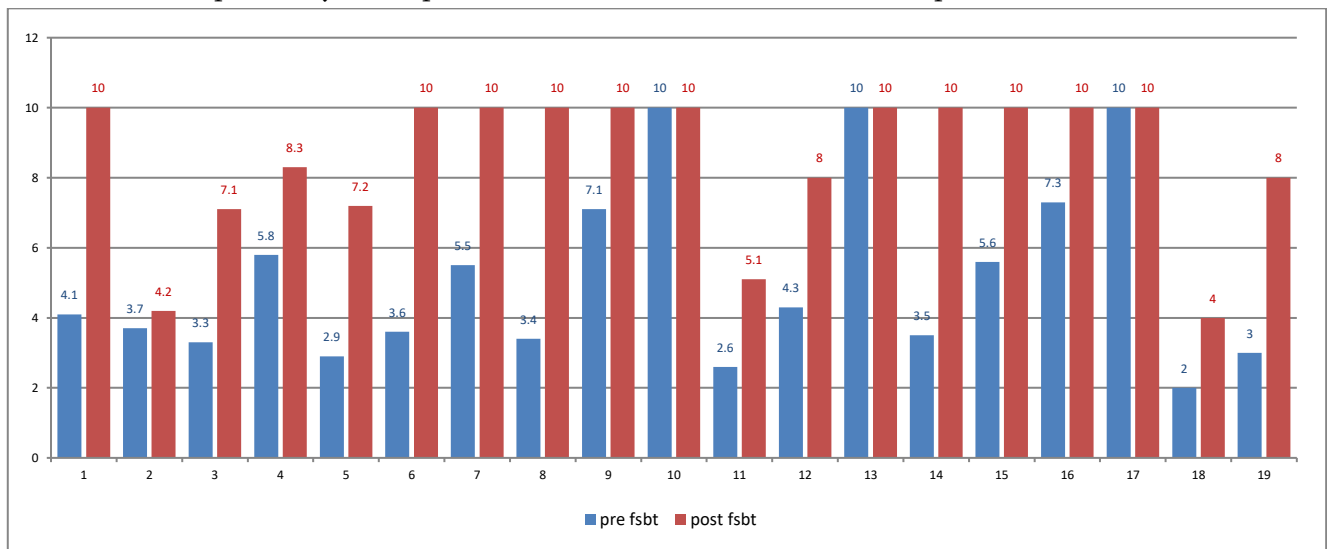


Figure 1(b) showing the data for Four step balance test pre and post values in seconds (X axis represents the number of samples and y axis represents the time taken in seconds to complete the FSBT Test)

**DISCUSSION:**

The VR system can be categorized as immersion and non-immersion. In the immersive system, the person is encapsulated in the virtual environment and all of their senses (vision, touch and auditory) are blocked from the external environment. Whereas in the non-immersive system the person senses are intact with the external world. Some of the input devices which can be used in VR are the computer mouse; a data glove and in some cases position trackers<sup>6</sup>. The output devices may be computer and/or television screens, shutter glasses or head-mounted displays. The elements of motor learning theory are integrated in VR intervention because it enables the users to gain feedback, thereby monitoring their performance, which is more likely to result in repeated practice. Cortical reorganization (brain learning), a systematic review found that more than half of the reviewed studies reported desirable results in brain plasticity and brain reorganization with the use of VR<sup>7</sup>. Active participation, receiving feedback, and repetition of movements assisted in motor learning and related cortical changes. Neural plasticity through cortical reorganization following VR intervention was also reported.

This study demonstrates the use of virtual reality training in elderly to motivate subjects during the target oriented task and therefore contributing to the augmented rehabilitation. VRT Exergames have task difficulty control and task velocity adjustment. VRT helps subjects to engage with motivation and fully cooperate with the task which may enhance the rehabilitation outcome measures and also on the other hand allow creating a virtual environment where task constraints can be modified and also supervised. This is the reason that the studies mentioned in literature review seem to be overlapping with this study but these studies are done using different modes of

exergames. For instance, one of study used balance board for exergames as controller, whereas the study used only one single exergame which was skiing where participants have to only control with lower body. Other study used a Balance rehabilitation unit (BRU) is software which is made specifically virtual games to improve balance and it is expensive for people to use commercially<sup>8</sup>. This study aims to use the commercially available exergames using kinect device which makes the body itself as a game controller, where participants can perform different activity as virtual tasks. The use of VRT in developed countries have a upper hand as they are well versed with technology and can easily understand the working of program so it can be the one of the reason for the positive outcome. Contrary to this since India is a developing country VRT and technology is not in main stream in an Indian scenario.

As discussed earlier that, there are many conventional balance training programs for the geriatric population but some limitation such as adherence , compliance and physical limitation of exercise which will hinder the effects of balance training. And thus, participants in the VRT were highly motivated by the challenge, variability and the competitive factors. VR Improved cognitive function, concentration and levels of participation during VR intervention. It provides feedback which enables the participants to improve their performance by repetition, cognitive planning, and by giving them a sense of achievement. The VR environment can allow creativity, it has been shown to have resulted in improved persistence with repetitive tasks; increased enjoyment in attaining the therapeutic objective; and it gives the participant a certain degree of control<sup>9</sup>. VRT serves as a alternative preventive measure against age related issues and disability, the existing evidence supports the use of home based VRT for improving age related impaired balance in elderly.

Feasibility and effectiveness of VR/gaming systems use by older adults at home to enable physical activity to address impairments, activity limitations and participation. Although it is clear that VR systems rely on hardware and software, their use in all rehabilitation situations requires clinicians to make decisions about the appropriateness of the intervention for the patient, implementation of treatment parameters and progression through different levels of the game or task.

**CONCLUSION**

This study concludes that the change in balance is one of the largest factors for falls in the elderly, and lack of balance and fall occurrences have a high correlation. Dynamic balance exercise in particular can reduce the fall risk factor significantly. In this regard, the effect of introducing virtual reality based interventions is positive, because they can provide immediate visual and auditory feedback concerning the exercise results, thereby increasing the exercise learning effect. This suggests the possibility of using virtual reality based games for a broad range of exercise applications.

**IV. Annexure**



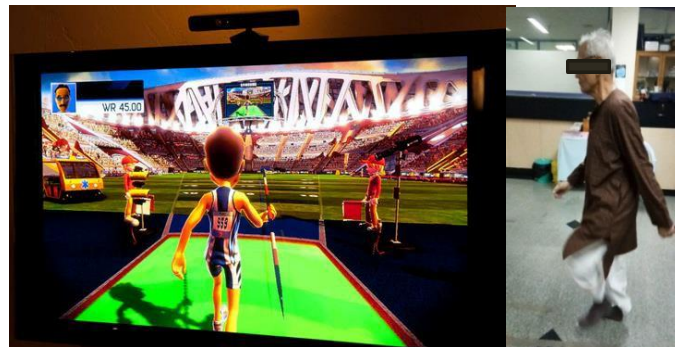
**FIG 6: WATER PLUGS**



**FIG 7: 100 METER SPRINT**



**FIG 8: DISCUS THROW**



**FIG 9: JAVELIN THROW**



**FIG 4: SPACE POP**



**FIG 5: RIVER RUSH**

**PARTICIPANT SCREENING CHECKLIST**

**Study Title:** Effects of kinect based Virtual Reality Training in Geriatric population on balance.

Patient ID No.:

Age/Gender.:

Inclusion Criteria:

- 1. Age from 65-80
- 2. TUG test score >13.5.

Exclusion Criteria:

- 1. MMSE < 24
- 2. Late Elderly (>80 years of age.)
- 3. Significant impairment due to other neurological Conditions or orthopedic conditions.

YES

NO

Patient fulfilled the inclusion criteria: Consent for participation n

study obtained

**DATA COLLECTION SHEET**

**Demographic Data:**

**Age:**

**Gender:**

**Co morbidities Medications and dosage:**

OUTCOME MEASURE	Pre intervention Data	Post intervention Data
4 stage balance test		
TUG		

Game Score Sheet.

Sl. NO	GAME	SESSION 1	2	3	4	5	6	7	8
1	Water plugs								
2	Space pop								
3	100m sprint								

4	Javelin throw								
5	River Rush								
6	Discus Throw								

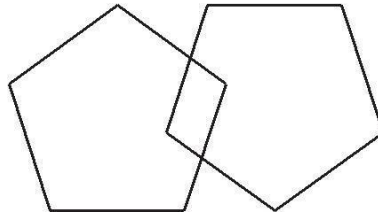
Examiner

## The Mini-Mental State Exam

Patient \_\_\_\_\_ Examiner \_\_\_\_\_  
 \_\_\_\_\_ Date \_\_\_\_\_

Maximum Score 30

Orientation



5 ( ) What is the (year) (season) (date) (day) (month)?

5 ( ) Where are we (state) (country) (town) (hospital) (floor)?

Registration

3 ( ) Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record.

Trials \_\_\_\_\_

Attention and Calculation

5 ( ) Serial 7's. 1 point for each correct answer. Stop after 5 answers.

Alternatively spell "world" backward.

Recall

3 ( ) Ask for the 3 objects repeated above. Give 1 point for each correct answer.



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10.21767/2171-6625.100033.

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# Evaluation of CFRP Composite Laminates by Drilling Using Finite Element Approach

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## ABSTRACT

Numerical modelling of material behavior & defect formation during machining was made possible by the years. Rapid expansion of the usage of carbon fiber composite materials, which are extensively employed in a variety of civilian industries, including aviation, aerospace, defense, automotive, electronic information, and high-speed machinery. Drilling is a vital final machining process for components made of composite laminates. Determining static structural, dynamic, or vibrational, and explicit dynamics is a crucial challenge in drilling CFRP.

In this work, the drilling behavior of CFRP composite laminate with five layers is analysed. Drilling behavior is examined using the finite element method while taking into account the precise geometrical considerations as well as the static, dynamic, and explicit factors involved in the operation in order to find the initial modes and corresponding natural frequency using Ansys workbench 19.2 and Catia V5 software used to modelling required 3d Geometry.

**Keywords:** Drilling, Finite Element Method, Ansys Workbench 19.2 and CFRP

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## I. INTRODUCTION

Carbon fiber reinforced plastic (CFRP) composites have become widely used as structural components in the aerospace, naval, automotive, and defense industries due to advancements in manufacturing technology. In order to create riveted and bolted joints for the assembly operation of composite laminates with other components, drilling procedures are widely used. To provide high joint strength and precision for riveted and bolted joints, damage-free and precise holes must be drilled in the components. However, the non-homogeneous, anisotropic, extremely abrasive, and

strong reinforced fibers that are a part of composite laminates by nature make them challenging to machine. Drilling significantly reduces strength against fatigue due to a number of unfavorable effects (including delamination and fiber pull-out), which lowers the durability of composite laminates [1]. When drilling Carbon Fibre-Reinforced Plastic (CFRP) materials, achieving acceptable hole quality is challenging while balancing productivity and tool wear. Numerical models are important tools for the optimization of drilling CFRP materials in terms of material removal rate and hole quality. In this research, a macro-Finite Element (FE) model was developed to

accurately predict the effect of drill tip geometry on hole entry and exit quality [2]. This study develops a 3D finite element (FE) model for drilling in CFRP composite laminate.

## II. METHOD AND METHODOLOGY

First Stage is to model each part with exact Dimensions and second stage is to assemble the different parts together and next third stage is preparing the final assembled model and converting into STP/IGES File Format using Catia V5.

Selection Of Elements and next stage is finite element modelling which includes importing the file followed by mesh generation and applying the boundary conditions and solving the problem. This procedure is called Pre-Processing. Next extracting the required results and validating the answers. This procedure is called post-Processing. Flow Chart of Methodology is shown in Figure.1

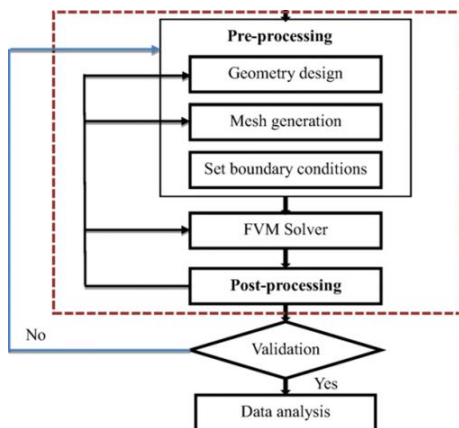


Fig.1. Flow Chart of Methodology

### 2.1. Geometrical Modelling

The FE analysis used a CFRP composite laminate with a stack sequence of [(90/-45/0/45)<sub>2</sub>]. Modeling was done for a layered CFRP plate with overall measurements of 120 mm, 15 mm, and 7.2 mm. Additionally, the flute and shank lengths are 50mm and 50mm, respectively. To discretize the intricate drill geometry, a model with a diameter of Ø7.04 mm and a point angle of 120.04° and a helix angle of 30° was

used. 5 layers are analyzed in which the first four layers are CFRP material and the last one is Aluminum 2024. Three-dimensional Geometric model which is imported in Ansys Workbench 19.2 is shown in Figure 2.

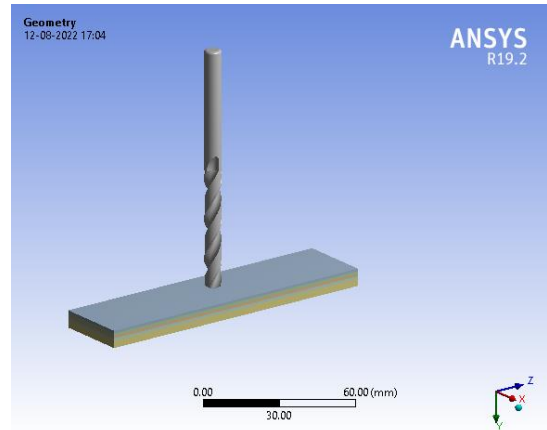


Fig 2. 3D Geometry Model Imported in Ansys Workbench 19.2

### 2.2 Meshed Model

The mesh used in the FE analysis was Hexahedral mesh. Effective meshing has been done for the Bladed Disc assembly geometry model. It is believed that the mesh, which consists of a mixture of triangular and quadrilateral pieces, is a good mesh. It efficiently absorbs the stress and strain caused by the load on the geometry model. When there are bodies that cannot be swept, choose this option. Tet and pyramid cells are mixed in the mesh, with the majority being hexagonal cells. Element count was decreased by hex dominating meshing. Number of nodes and elements was 4465 and 7557 respectively. Meshed Model for the corresponding FE setup is shown in Figure 4.

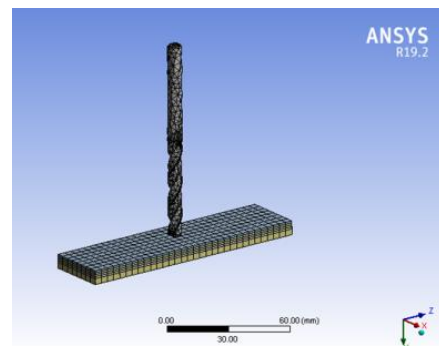


Fig.3. Meshed Model

### 2.3 Loads and boundary conditions

Displacement is constrained at X and Z co-ordinates and Y is left free. The load is in the form of compression and applied in Y-axis as in the form of steps which is varying from 1000-7000N. Displacement and Force applied is shown in Figure 4 and 5 respectively. Loads is applied in steps is shown in the Table 1.

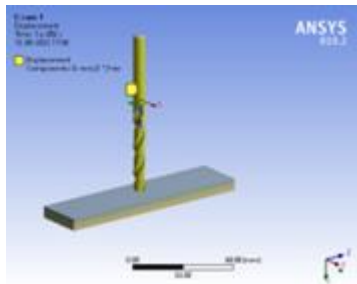


Fig.4 Displacement

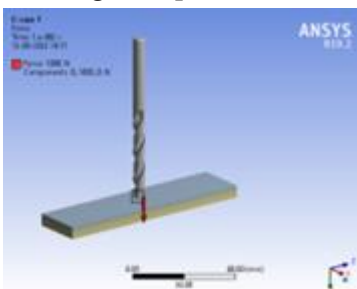


Fig.5 Force

Table.1. The Loads Applied in Steps

Tabular Data				
Steps	Time [s]	X [N]	Y [N]	Z [N]
1	0.	= 0.	= 1000.	= 0.
2	1.e-002	0.	1000.	0.
3	1.1e-002	= 0.	2000.	= 0.
4	1.2e-002	= 0.	3000.	= 0.
5	1.3e-002	= 0.	4000.	= 0.
6	1.4e-002	= 0.	5000.	= 0.
7	1.5e-002	= 0.	6000.	= 0.
8	1.6e-002	= 0.	7000.	= 0.
*				

## III. RESULTS AND DISCUSSION

### 3.1. Results of Case I-Glass Fiber Reinforced Polymer

Equivalent Von -Mises Stress for the Analysis of Drilling in GFRP obtained is 158.81 MPa Illustration of Equivalent Von-Mises Stress is shown in Figure.6

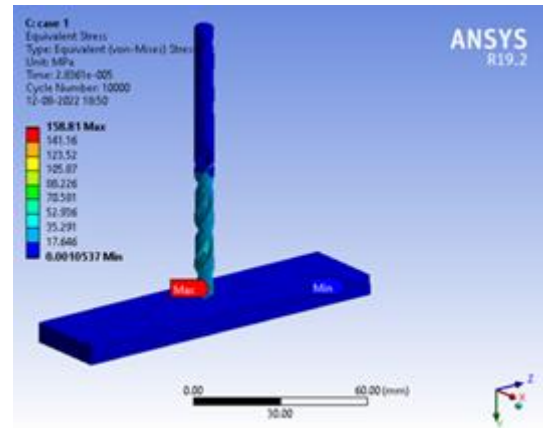


Fig.6. Equivalent Von-Mises Stress and for the Applied Load Condition of 1000 N.

### 3.2 Results of Case II-Carbon Fiber Reinforced Polymer

Equivalent Von-mises Stress for the Analysis of Drilling in CFRP obtained is 160.01 MPa. Illustration of Equivalent Von-mises Stress is shown in Figure.7

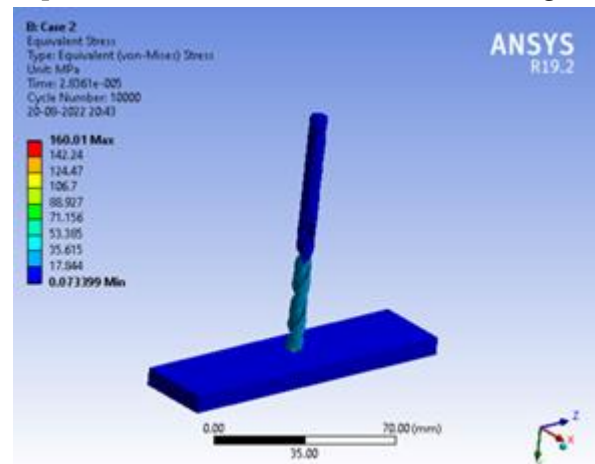


Fig.7. Equivalent Von-Mises Stress and for the Applied Load Condition of 1000 N.

### 3.3 Dynamic Analysis

Initial modes and corresponding natural frequencies are obtained in this analysis. Frequency obtained for this mode 1- 2023.2 Hz. Mode 1 Results are shown in Fig.8. Bar graph which indicates the frequency at each calculated mode is shown in Fig.9 and corresponding natural frequencies at each mode is shown in Table.2.

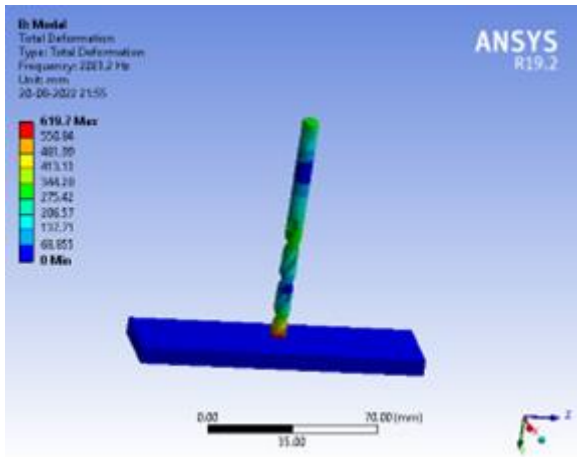


Fig.8. Initial modes and Corresponding Natural Frequency

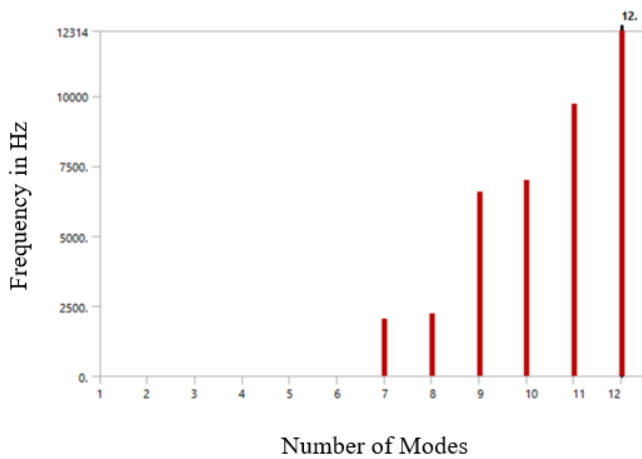


Fig. 9. Bar graph which Indicates the Frequency Calculated at Each Mode.

#### IV.CONCLUSION

This research examines the drilling behavior of a composite laminate made of five-layer CFRP. The required 3D geometry is modelled using Ansys Workbench 19.2 and Catia V5, and drilling behavior is correctly determined using the finite element approach by accounting for the static, dynamic, and explicit aspects involved in the process as well as precise geometrical considerations. On Comparing CFRP and GFRP, the Equivalent von mises stress obtained for GFRP material is 158.81 MPa whereas the Equivalent von mises stress obtained for CFRP material is 160.0 MPa. Therefore, GFRP can be chosen as the best material for the analysis of drilling.

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Table.2. Corresponding Frequencies at Each Mode

Sl. No	Mode	Frequency in Hz
1	7	2023.2
2	8	2215.4
3	9	6581.8
4	10	6990.6
5	11	9703.9
6	12	12314

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Journal URL : <https://ijsrset.com/IJSRSET2294105>

# Static, Dynamic and Fatigue Damage of Spline Coupling in Wind Turbine Rotor

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## ABSTRACT

This article evaluates the stress distribution along the spline length for partial contact length and the load distribution along the spline tooth length. Includes measurements of load distribution along the length of the spline. Torque is provided by a torque loading arm, and strain gauges are installed on the teeth to measure strain. The system is programmed to monitor tooth strain readings. Different contact lengths and load variations have been investigated in relation to the fixed contact length for the spline hub connection. The effects of varying the contact length in various torque situations have been studied. A single channel strain indicator system is used to determine the strain at the connection in the experimental setup. Using miniature strain gauges, strain at the connection is measured. On the spline teeth, strain sensors were installed to record the localised stress along the length. The spline shaft is constructed with EN19 hub material specifications. Observations indicate that in-volute spline geometry can support greater loads than rectangular and trapezoidal spline geometry.

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## I. INTRODUCTION

When it is necessary to transmit a great deal of power, using spline couplings is one of the most typical ways that two rotating shafts can be connected to one another. These components are responsible for motion transmission by utilising a predetermined number of engaging teeth. Because of the variable amplitude loadings and relative sliding, these teeth experience both fatigue and wear over time. When it comes to industrial transmissions, splines generally transmit more torque for their size than any other type of coupler or joint. However, when they operate with a relatively small shaft diameter, a common type of failure is caused by the shaft shear stresses. Because the connection is so vital to the functioning of the engine, the development process for every new engine must include testing on a full-scale rig. They are carried out to demonstrate that the shaft will be secure for the remainder of its design

life, despite the cost of such testing being incurred. Because of this, it was difficult to predict what would ultimately lead to the failure of spline couplings, especially considering the fretting fatigue failure behaviour of these couplings. As a consequence of this, numerous researchers have resorted to utilising naturally cautious design methods. The earlier experimental testing work that was carried out at the University of Nottingham to address this weakness utilised a coupling specimen that had 18 teeth on a smaller diameter. This replicated the tooth contact conditions that are found in full-size engine couplings by utilising the same spline shape along with torque, axial, and bending stresses. Following a number of fretting fatigue failures, the outcomes of laboratory-scaled spline test programming are examined in greater detail. Even if this programmer were to produce some data that was extremely helpful, it would still be very expensive to construct the lab-sized

spline specimens. As a means of resolving this issue, the concept of the representative specimen (RS) was developed as a potential solution. This solution made it possible to conduct more in-depth experimental investigations. In order to replicate the critical fretting fatigue elements of a particular spline area, a test specimen needs to be fabricated first (often on a scale lower than that of the original component). It is not possible to build an RS without first successfully matching the FE expected variables for the spline coupling and the RS. At the University of Nottingham, parallel research on the scaled spline coupling was carried out; the findings of this research are going to be presented in the following chapter. It is possible to illustrate the behaviour of splines when subjected to heavy cycle loads by employing a uni-axial representative specimen (URS), which additionally incorporates contact coordinate conventions. As a consequence of the load arms deflecting in this direction, the relative slip happens in this particular path. As a result of the interaction between heavy and light cycle loads, the spline coupling, when put to its intended use, goes through a complex multiracial state of contact slip. This state can be described as "contact slip with multiple races." Due to the URS's capability of simulating spline behaviour under major cycle loading, a multiracial representative specimen (MRS) was able to be created. This MRS is able to reproduce spline behaviour under superimposed major and minor cycle loading. The fretting is included in the MRS, and it is here that the coordinate conventions are described. The statement of the loading direction also results in the development of a multidirectional sliding condition between the fretting bridges and the specimen. In addition, testing with the cylinder on the flat helps to improve the RS approach [1-6].

## II. LITERATUR REVIEW

In gas turbine engines, the transfer of torque from one shaft to another can be accomplished with the help of spline couplings in a way that is both practical and effective. There is always a drive for improved performance because of the competition in the aerospace industry and the need to reduce fuel consumption from aircraft carriers. This need for reduced fuel consumption from aircraft carriers boosts the requirements for the coupling. Because of the minor

oscillatory relative motions that occur between the intensely stressed teeth, aeroengine spline couplings, and in particular main-shaft low pressure (LP) splines, are complicated parts that run the risk of failing for a variety of reasons due to the oscillatory relative motions. These splines are more likely to experience fretting fatigue and wear than others (FF). This study investigates the application of the representative specimen concept for predicting fretting-induced damage between spline teeth. Full-scale testing of splines is extremely expensive, which is why this concept is being investigated. [1]

This study will concentrate primarily on investigating the fretting wear of spline couplings as its principal area of inquiry. In addition, fretting wear, a specific kind of surface deterioration that can occur in combination with fretting fatigue, will be explored as a component of this study. In a combined experimental and computational representative specimen (RS) methodology, a multi-axial representative specimen (MRS) concept and a uni-axial representative specimen (URS) concept, each with varying degrees of complexity, are used to address various aspects of the spline fretting wear-fatigue problem. The MRS and URS concepts are referred to as multi-axial representative specimens (MRS) and uni-axial representative specimens (URS), respectively. Both MRS and URS are abbreviations that stand for "multi-axial representative specimen" and "uni-axial representative specimen," respectively. The configuration of the URS test includes two pairs of specimens that are in touch with one another. This arrangement simulates all of the primary torque and axial loads that occur over the entirety of the flight cycle, as well as the damage that occurs as a direct result of those loads. The MRS rig consists of a fretting bridge arrangement that simulates the combination of the same basic stresses along with high-cycle bending loads from in-flight fluctuations (gyroscopic and carcass flexing), as well as the damage that results from these interactions. In other words, the MRS rig is designed to replicate the damage that occurs as a direct result of the interactions. The URS was successfully utilised to experimentally characterise a variety of potential material combinations for aero engine transmissions and splines, including coated and uncounted combinations [2].



### III. OBJECTIVES

In this study, the stress that develops in the Spline shaft as a result of the various loading scenarios and the velocity is the primary focus. The Finite Element Method was used to review this research's findings for the static structural, dynamic analysis, and life estimation.

- Carrying out a static linear analysis on the spline connection that is found between a shaft and a sleeve. Utilizing the Ansys Workbench as the application programme.
- Figuring out the modes and the natural frequency that are between a shaft and a sleeve.
- Development of FEM model to demonstrate the spline tooth width in the axial direction for evenly distributing the load across the structure. Investigations are being conducted into a wide variety of tooth forms, sizes, and variants.
- Utilizing finite element method to derive an estimate of the spline coupling's fatigue life.

### IV. METHODOLOGY

The explanations that came before this one emphasize how important it is to understand how spline couplings fret when they get fatigued. This objective is what this paper's methodology aims to accomplish. Both experimental methods and a technique that combines both experiments and computing are given. Hyde invented the uni-axial representative specimen (URS), which has since been redesigned multiple times. This configuration results in significant cycle contact pressure (from torque and axial load), significant fatigue stress, and significant contact slip for a conventional low pressure (LP) spline connection. The multi-axial representative specimen (MRS), which additionally considers the effect of spline rotational bending loads, is described below, along with any adjustments made. According to the numerical technique, the two typical specimens are simulated using the finite element (FE) method. A global FE model is built in order to examine the critical rig parts, such as the URS and MRS. By comparing the specimens to prior scaled spline finite element modelling, the representativeness of the

samples is then assessed. Figure-1 indicates work process of flow chart.

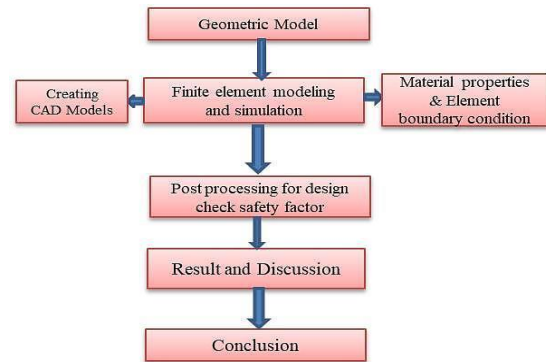


Fig-1: Flow chart

### Preliminary Design Considerations:

Gearboxes in wind turbines may not always achieve their planned design life, despite frequently meeting or exceeding the current design specifications and regulations in the gear, bearing, and wind turbine industries, as well as third-party certification standards. The National Renewable Energy Laboratory (NREL) established the Gearbox Reliability Collaborative (GRC) in 2006. Using a combination of dynamometer testing, field testing, and modelling, its primary objective is to identify the factors that contribute to early gearbox failures and improve gearbox dependability. Other objectives of the GRC include promoting an increase in the precision of existing gearbox design and modelling tools, developing these tools if necessary, and conducting research on gearbox dependability. This study, which is part of the GRC programme, examines the design of spline couplings, which are commonly used to connect the planetary and helical gear stages in modern wind turbine gearboxes. In addition to providing the driving force, articulating spline couplings promote load sharing in the planetary stage by permitting the sun to "float." Planetary gear mesh contact patterns are less affected by defects, misalignments, and non-torque stresses when the sun is in free flight. On the other hand, loads may be distributed unevenly and gearbox misalignment may occur even without the floating sun. Consequently, planet-bearing forces and edge loading on the gears increase, shortening their lifespan and increasing the probability of an early failure. The distance the sun can float depends on the flexibility of the sun shaft and the design of the spline, both of which are subject to operational forces. The AGMA 6123-B06 design guide for single articulation couplings contains the most

comprehensive instructions. Various standards address the design requirements for spline couplings in varying depths. Using a reduced-order mathematical formulation and high-fidelity finite element (FE) modelling techniques, as well as contact, bending, and shear safety factors based on fatigue and yield, the operating loads and stresses imposed on a test gearbox's spline coupling are calculated in this study. Additionally, this study offers a novel comparison to a different model [7-14].

## V. FINITE ELEMENT ANALYSIS (FEA)

Finding a numerical solution to a variety of engineering problems can be accomplished effectively by using the finite element method, which is a powerful tool. Because of the broad application of the method, it can handle any complex shape or geometry for any material under a variety of boundary and loading conditions. This is because of the breadth of the method's applicability. In today's complex engineering systems and designs, where it can be difficult to obtain closed form solutions to the governing equilibrium equations, the generality of the finite element approach satisfies the analytical requirements. This is because finite elements can be broken down into a large number of smaller elements. In addition, it is an efficient design tool that enables designers to conduct parametric design studies. These studies involve taking into account a variety of design circumstances (different shapes, materials, loads, etc.) and analysing them in order to determine the design that is the most effective. The aerospace industry was the first to develop this method as a tool for analysing the effects of stress on complex aircraft parts. It was derived from a technique known as matrix analysis that was used in the design of aeroplanes. Academics and professionals alike are resorting to the strategy more frequently at an increasing rate. According to the fundamental principle underlying the finite element method, a body or structure can be broken down into a number of smaller, "finite element"-style components that have finite dimensions. Therefore, the initial body or structure can be understood as a collection of distinct components that are linked together at a limited number of nodes [15-22].

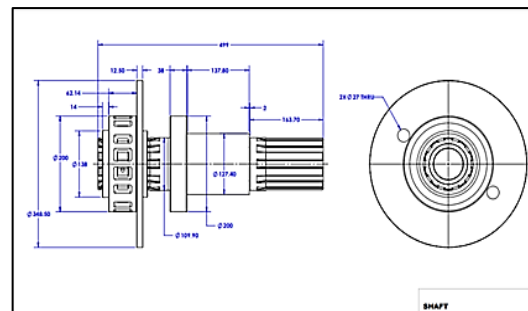
## GEOMETRIC MODELING

The study of methods and algorithms for the mathematical representation of shapes is what we mean when we talk about geometric modelling. Although it is

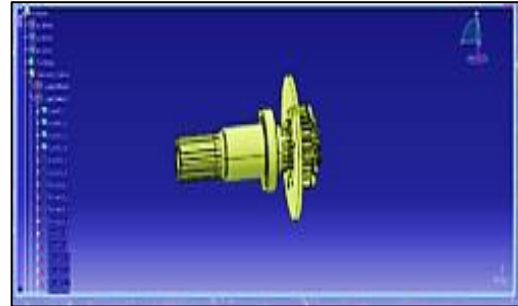
common practise in the field of geometric modelling to investigate sets of three-dimensional shapes, it is possible for sets of any finite dimension to be taken into consideration. The majority of the time, the completion of the process is accomplished through the use of computers and software that runs on computers. Technical drawing and computer-assisted typography are both based on two-dimensional issues, whereas computer-aided design (CAD/CAM) is focused on issues relating to three dimensions.

## STATIC ANALYSIS OF WIND TURBINE ROTOR

5.1, Geometry Boundary Condition Load Applied – Temperature and Rotational Velocity



**Fig-2:** Geometrical dimension of outer casing of aircraft turbo engine



**Fig-3:** Isometric view of outer casing of aircraft turbo engine

Both the geometrical dimensions of the outer casing of an aircraft turbo engine as well as an isometric view of the casing can be seen in Figures 2 and 3, respectively. The statistical analysis model of the outer casing of an aircraft turbo engine is depicted in Figure 4. The model of the casing with the mesh is shown in Figure 5. Utilizing the dominant meshing technique results in the production of a free hexa dominant mesh. This choice will be made if there are bodies that cannot be swept away by the other options. Although tetra and pyramid cells can also be found in the mesh, hexagonal cells make up the majority of the structure. In order to

decrease the total number of elements, hex-dominant meshing was utilised.

It was decided that the rotational velocity should be in the range of 2000 to 10000 RPM, the torque should be 500 N-m, and the displacement of X and Y should be equal to zero. The load is expressed as a rotational velocity measured in radians per second. The load is increased gradually, going from 0% to 50% to 100% to 121% to 100% to 50% to 0%. At full load, the rpm is 6920, which equates to 724.75 rad/s. The amount of load that was utilised is recorded in tabular form. On the Bladed Disc assembly, the load is being applied along the Z-axis. Figure 6 illustrates the final geometric model of the outer casing that was used for the analysis. The equivalent von mises stress distribution can be seen depicted in figure 7, which was obtained from a static analysis of the outer casing. The highest level of stress that was measured was found to be 57.6 MPa. The total deformation is shown in Fig. 8, which was created under fully loaded conditions. When the plots of deformation obtained under loaded conditions are examined, it can be seen that the point at which there was the greatest amount of deformation was 69.54 MPa[23-25].

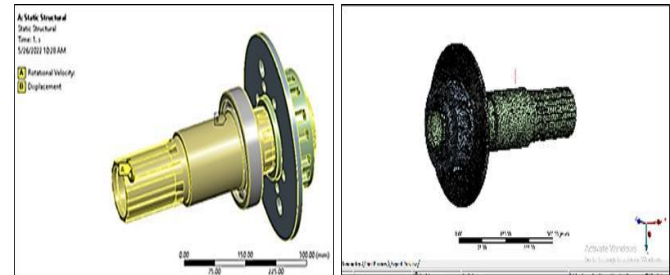


Fig-4: Static analysis Model Fig-5: Mesh model

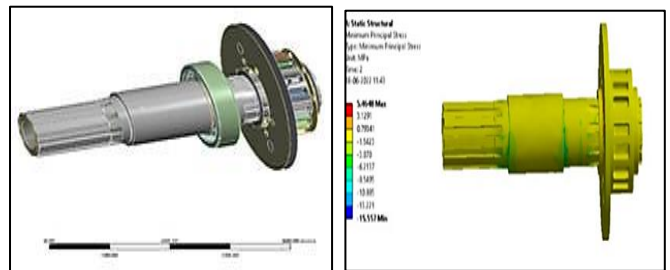


Fig-6: Geometric model Fig-7: Equivalent von –mises

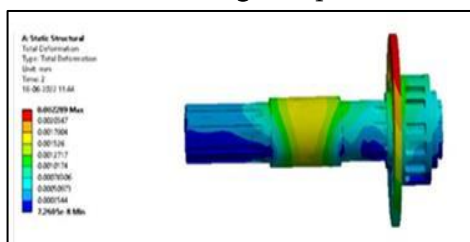


Fig-8: Total Deformation

**Dynamic analysis**

The frequency and frequency variations that were recorded in the various modes are presented in Table 1. When the number of modes is increased, there is also an accompanying increase in the frequency value. The graphical representation of the same frequency values can be found in Figure 9. The plot of the deformation for the dynamic analysis is shown in figure 10. It has been determined that the maximum amount of deformation that has been observed is 14.799.

Fig.11 shows a plot of the deformation that was performed using the second mode of dynamic analysis. The value of deformation that is considered to be the highest is 14.83.

Table:1 Frequency variation at different modes

SL	MODE	Frequency(Hz)
1	1.	494.21
2	2.	498.28
3	3.	1908.4
4	4.	2382.2
5	5.	2393.3
6	6.	2503.4

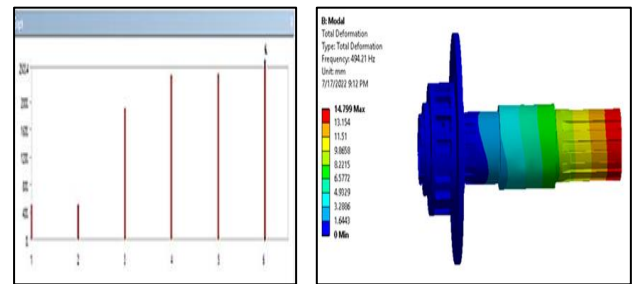


Fig-9: (Dynamic Mode Graph)  
Fig-10: Dynamic Mode-Dynamic model analysis maximum 14.799

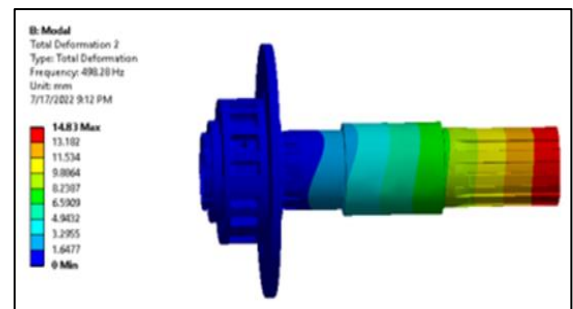
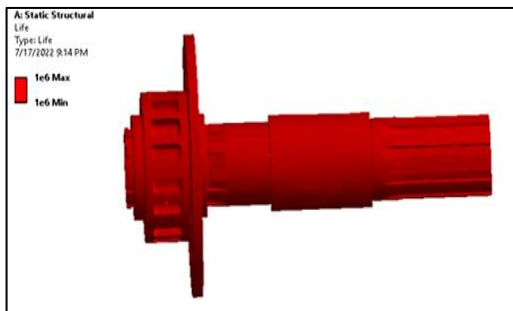


Fig-11: Dynamic Mode- Dynamic model analysis maximum 14.83

## Fatigue Life Assessment

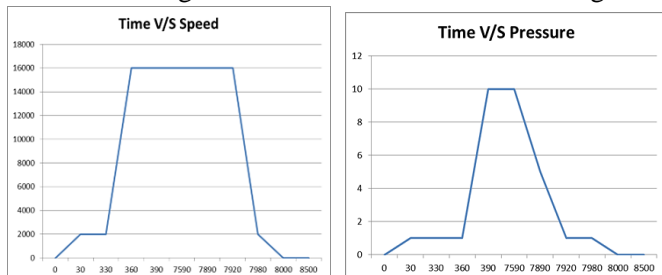
Procedures that have been developed over the course of the past century are utilised in the creation of modern building designs that include fatigue analysis. The development of strain-based methodologies to address the impacts of local plasticity has allowed for the ongoing improvement of these strategies over the course of time. It is essential to have a solid understanding of the accuracy problem before attempting to calculate the fatigue life of a component using finite element (FE) models. The vast majority of finite element analysis (FEA) based fatigue systems use the stress-life, strain-life, and crack-propagation methods when conducting their life assessment calculations. These are the three primary life assessment approaches. Fig.12 demonstrates the fatigue life evaluation model used in this investigation.



**Fig-12:** Fatigue life Model

### Analysis of transient responses:

Static analysis does not take into account how the load varies in relation to the passage of time. The output in the form of stress or displacement with regard to time can be predicted with the help of a technique called transient response analysis. Figure 13 depicts the variations in time versus speed, and Figure 14 depicts the variations in time versus pressure for the fatigue life of outer casing that was studied in this investigation.



**Fig-13:** shows Time V/S Speed variations

**Fig-14:** Time V/S Pressure variations

## VI. CONCLUSION

In addition to the calculation of spline safety factors, the analytical method that is presented in this paper

provides much of the same information as modern gearbox design tools. The analytical formulation, by virtue of its very nature, provides greater clarity than the other methods on the impact of the spline coupling design parameters on the performance of the spline and subsequent safety issues. This is because the analytical formulation takes into account all of the design parameters simultaneously. If parametric research is used in the early stage of design, it may be possible to calculate solutions two orders of magnitude more quickly than when using models of higher quality. The maximum tooth load, the load distribution along the splines, and the safety factors are all influenced by torque. It is necessary to conduct an analysis of the spline design across the entire torque range. Crowning raises both the maximum load that can be placed on a tooth and the load sharing factor. However, because it also raises the stresses that are brought into contact with the teeth, it may have an adverse effect on safety considerations.

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## Agricultural Based Drone

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### ABSTRACT

The main vision of our project is to build a drone which can do certain things that is very much impossible by standards of a human in the fields such as locomotion and aerodynamics. The demand for delivery personnel has multiplied due to the significant growth in the use of online ordering. In order to fulfil this demand, drone-based technology is being deployed. A hexacopter can fly vertically in a stable manner and be used to deliver goods or collect data in a certain area. We think delivery drones are poised to disrupt the last mile transportation industry given the development of drone technology and rising commercial usage. Drones can drastically shorten delivery times and lower the cost of delivery for both humans and drone manufacturers.. The value chain and opportunities in the market for delivery drones are examined in this paper. It also talks about adoption's difficulties. Our argument for using drones to deliver the majority of lightweight products for the final mile comes at the end. This study describes the Hexa copter (QC) as a lightweight, inexpensive, autonomous flying capable Unmanned Aerial Vehicle (UAV) for delivering packages ordered online. Its primary on-board computing unit is an android device. This QC can locate and reach its goal by using Google Maps. This experiment showcases QC's ability to deliver an online-ordered package and then return to the starting point. Future studies on the use of QC for parcel delivery are made possible by the method's encouraging results.

Keywords : Hexa copter, Unmanned Aerial Vehicle, Inertial Measuring Unit

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## I. INTRODUCTION

A drone is a type of unmanned aerial vehicle (UAV), which is an aircraft without a human pilot, crew, or passengers. Unmanned aerial vehicles (UAVs) are a part of an unmanned aircraft system (UAS), which also includes a ground-based controller and a

communications network for the UAV. UAVs can be remotely piloted by a human operator to fly as remotely-piloted aircraft (RPA), or they can fly autonomously with varying degrees of help, such as autopilot, up to fully autonomous aircraft that don't allow for human intervention. A drone, in its most basic definition, is a flying robot that can be remotely

controlled or fly on its own using software-controlled flight plans in its embedded systems in coordination with onboard sensors and a global positioning system (GPS). A multicoloured helicopter with four rotors that lifts and propels it is known as a hexacopter, also known as a hex rotor helicopter or a hex rotor. Hex copters are categorised as rotorcraft as opposed to fixed-wing aircraft since their lift is produced by a series of rotors (propellers that are positioned vertically). Typically, two identical fixed-pitch propeller pairs—two in the clockwise (CW) and two in the counter-clockwise directions—are used by hex copters (CCW). These achieve control by independently varying the speed of each rotor.

One can particularly produce a desired overall thrust by altering the speed of each rotor. Hex copters are different from traditional helicopters in that they don't have rotors that can dynamically change the pitch of their blades as they move around the rotor hub. Hex copters, sometimes known as "Hex rotors" or "helicopters," were considered early on as potential solutions to some of the enduring issues with vertical flight. Since counter-rotation frequently eliminates torque-induced control problems (as well as efficiency problems resulting from the anti-torque rotor, which creates no useful lift), the comparatively short blades are significantly simpler to build. In the 1920s and 1930s, a number of manned designs were developed. The majority of successful heavier-than-air vertical takeoff and landing (VTOL) vehicles were among these ones. However, due to weak stability augmentation and constrained control authority, early prototypes had poor performance, while subsequent versions demanded an excessive amount of pilot duty.

## II. LITERATURE SURVEY

The use of drones is rapidly expanding throughout society. More and more drones are being employed today, including hobby drones, military equipment, and delivery services. In reality, sales of drones rose by

63% between 2014 and 2015 and have since kept rising. Drones aren't perfect, though—as with all technology. Additionally, it's important to keep in mind any problems you can run into if you possess a drone. So let's examine a few typical drone issues and how to fix them.

The author of this work states, "A mathematical model used force and torque as control variables." The mobility of the hexacopter was also evaluated using a nonlinear optimum control problem, which demonstrated the challenges associated with moving the x and y axes in the absence of actuators. In this paper, position control for a hexacopter was created. In order to reject the modelling error, a second controller was added. The most typical method involves using the Failure Detection and Isolation (FDI) filter and then reconfiguring the controller, but the FDI is too complex for the hex copter, so the controller was modified to use the Modified Linear Extended State Observer (LESO), which does not use failure detection or reconfiguration. Although the flight was safe thanks to the controller, there is certainly room for improvement in terms of the flight's performance.

The author claims that it is "possible to compress a tiny volume aerosol in an unmanned octocopter. The primary rotor of the octocopter has a diameter of 3 metres and has a payload capacity of 22.7 kilos. At least a gallon of gasoline was used every 45 minutes. This study opened the way for the creation of drone aeronautical application systems, paving the way for the development of goods with higher target speeds and larger Volume Median Diameter (VMD) droplets. "An octocopter has six BLDC motors and two Lipo batteries with six cells and an 8000 mAh capacity," the author claims. Additionally, they measure the droplet size and density as well as the spray rate and fluid pressure as part of their research. With the help of their project, they were able to create a drone that can transport 5.5 litres of liquid with a 16-minute resistance.

The scientists noted that basic and inexpensive tools would be required to build an octocopter drone and its spray system. Both liquid and solid items can be sprayed using the universal spray system. They examined a number of agricultural controllers in their inquiry and came to the conclusion that the octocopter system with the Atmega644PA is the most suitable because of its effective implementation. UAV use is nothing new; the technology has been around since the turn of the 20th century. Military uses in World War I propelled the technology at first, and World War II led to its expansion. Military UAV uses are more sophisticated than civilian applications.

Due to their quick adoption in numerous applications, including border security, traffic surveillance, precision agriculture, police observations of civil unrest and crime sites, and reconnaissance for natural disaster response, the civilian uses are also evolving in the same directions. The authors use unmanned UAVs with cameras for vineyard management tailored to each individual site. To confirm the accuracy of the ADC system, the Normalized Differential Vegetation Index (NDVI) values obtained by the Tetracam ADC-lite camera placed on VetPro were compared to ground-based NDVI values taken with the Field Spec Pro spectroradiometer. The vegetation indices produced from UAV photos and those obtained with a ground-based high-resolution spectroradiometer are in perfect agreement.

The design of an autonomous unmanned helicopter system for remote sensing missions in uncharted regions was the subject of the work published in this publication. By offering flying services, the focus is on reliable autonomous capabilities in Beyond Visual Range (BVR) operations without a backup pilot. uses a technique for detecting objects known as Laser Imaging Detection and Ranging (LIDAR), which has applications in real-world development

The IMU (inertial measuring unit) is a device that uses data from accelerometers, gyros, and an implanted controller to present precise data on aircraft manoeuvring details as well as accelerations in all directions. In general, all aircraft are equipped with one. GPS offers a positional fix, which is useful for outside applications. A differential GPS or the combination of data from an IMU can be used to combat GPS drift. Vision-based navigation systems frequently select a single or stereo camera. In contrast to single-camera systems, which require extra distance sensors like ultrasound, stereo vision is well suited to determining feature distance from the cameras by observation. Drone users could notice that the flight direction is off during flight if the drone's compass is not set properly. This can also happen if the drone has a mounted flight controller and the specifications are misplaced as a result. For this reason, it's crucial to give your drone a quick checkup before each flight. The compass should normally be calibrated to address this problem, although occasionally a restart of the remote control may be necessary. Drone repair services might also be required to identify the root of those drone issues if none of those methods prove successful.

### III. SPECIFICATIONS

Industry diffusion, regulation, and economics will all contribute to the standardisation of drone-driven IoT's controls and capabilities. The adoption of comparable apps, tools, and user interfaces will naturally increase, creating a huge opportunity for drone makers. Between 2015 and 2020, the market for commercial and civilian drones is anticipated to expand at a compound annual growth rate (CAGR) of 19%. The commercialization of drones may have a significant positive impact on the following industries:

Mining: Drone-driven IoT can be utilised in the mining industry to scan and audit a variety of mining operations' elements, such as berm erosion, road



analysis, subsidence, controlling automated ground vehicles, and security.

**Construction:** Powered by drones Construction sites can be surveyed, operations and progress tracked, 3D maps provided, building materials inspected, and security checked using IoT.

**Utilities:** Power lines, turbines, towers, and dams may all be inspected using drones and IoT. IoT powered by drones can also be used for security, equipment monitoring, and property surveys.

**Delivery Services:** Once rules are established and services are made available to extend operations, drone deliveries might start.

**Film and TV:** Already, drones are being used to equip cameras and shoot aerial photos that were previously only possible using helicopters. In this area, drones have offered a less disruptive and vibration-free medium.

**Emergency Services:** Drones are frequently utilised for accident investigation and traffic surveillance. They may even be requested to transport supplies such as equipment, water, and emergency assistance kits.

**Agriculture:** It will be possible to conduct aerial or orthographic surveillance of the land to spot and eradicate potential pest or fungus infection crop risks. It may be simple to detect soil anomalies like water saturation and erosion. Aerial drones might also scan fruit for sugar content and temperature variations to look for possible issues and pinpoint locations for planting crops at the best periods.

**IV. BLOCK DIAGRAM**

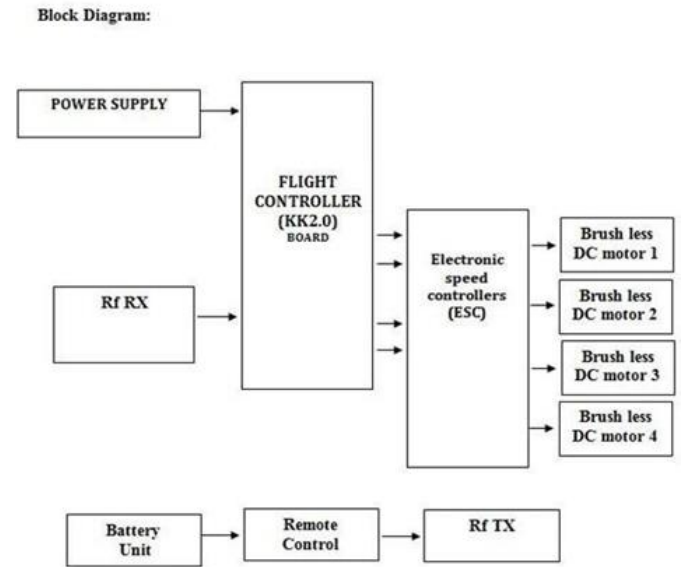


Fig 1 : Block Diagram

**V. FLOW CHART**

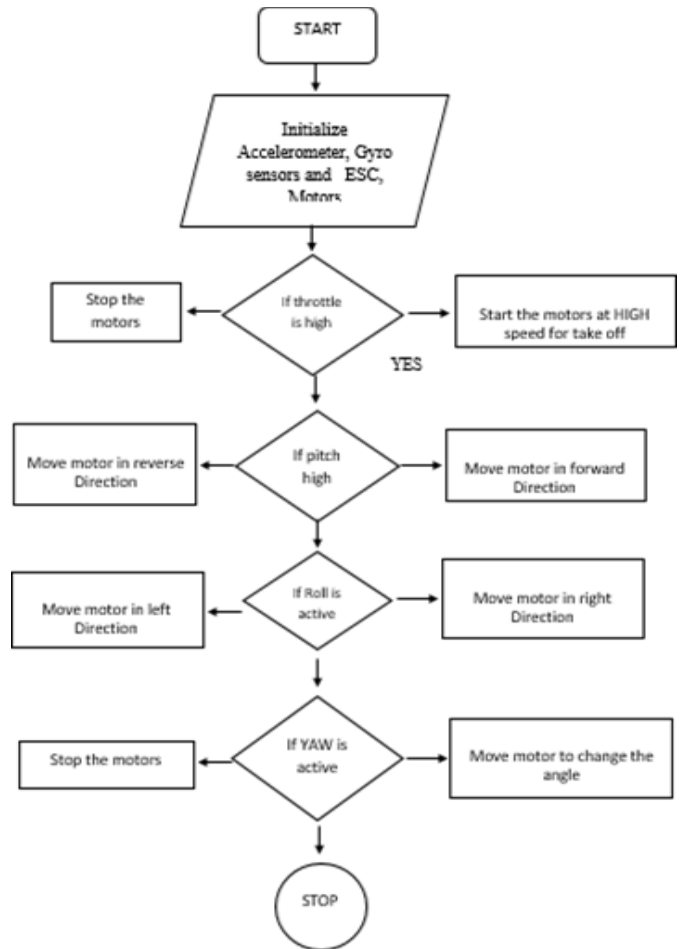


Fig 1 : Flow Chart

## VI. SCHEMATIC DIAGRAM

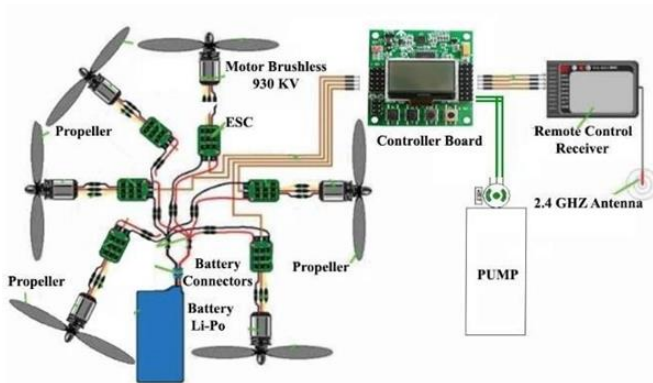


Fig 3 : Schematic Diagram of Drone

## VII. WORKING MODEL



Fig 4 : Working Model

## VIII. CONCLUSION

Our drone's key benefit will be that farmers may spray crop protection agents, insecticides, and fertilisers while only needing one person to operate it from a secure position. The prototype that is being made is unique and has never been put to the test. This may be advantageous for the development of robotics and

drones in the future, which may influence how humankind develops in various ways. This trial-and-error approach has been tried and tested numerous times to produce favourable outcomes for the demands of proper drone setting and operation. Different sections of the drone have a lot of room for improvement, and with the right research, they might undergo a stunning evolution in the field of robotics.

## IX. FUTURE SCOPE

Along with better cooperation between governments, IT leaders, and industry, drones can play a significant role in the crucial answer to this exponential rise in demand. Drones can help farmers with a variety of tasks, including research and planning, planting crops, and following field monitoring to assess crop health and growth. Drones will be crucial in precisely monitoring a farm's crucial activities as farms grow larger and more productive to satisfy this increasing demand.

Drones UAVs are uniquely sturdy in severe, unpredictably weather, and they give farmers the longest flying periods on the market because they were designed to carry out all of these farming applications.

Farmers can survey their fields accurately and consistently thanks to the drones' simplified flight planning, monitoring, and analysis. Microdrones systems are adaptable and effective in a number of applications, such as crop monitoring, where multi-spectral photography and thermal mapping are required, or field analysis, thanks to modular payloads. LiDAR mapping solutions are a focus for Micro Drones, and this technology should be helpful in fields like precision agriculture.

The biggest challenge facing the agricultural sector right now is the ineffective crop monitoring caused by industrial farming's vast scale, which is made worse by the weather's rising instability, which raises risk and

maintenance costs. In comparison to hitherto used satellite imagery, drones enable real-time surveillance at a far higher degree of accuracy and cost-effectiveness. In order to maintain crop health and determine yields, the drones are specifically made for this function, providing customers with an aerial image package that is designed to track nutrients, moisture levels, and overall crop vigour. As a result, many other factors can be taken into account in the future. Drone-based Delivery: The Future: High-Speed, Contactless, and Accurate High-Speed, Contactless, and Accurate Drone delivery has many applications and will continue to expand in the years to come. To fully achieve this potential, businesses will need to continue to engage in drone delivery initiatives and technological advancements. Drones, also referred to as unmanned aircraft systems, are becoming more and more widespread in contemporary logistics operations. Drone delivery services move prescription drugs, packages, groceries, food, and other home healthcare supplies. Given their accuracy, environmentally friendly operations, quicker delivery times, and cheaper operational costs compared to traditional delivery channels, these drone delivery operations are becoming increasingly important in last-mile delivery. The operating costs for a drone delivery service are, according to analysts, 40% to 70% lower than those for a vehicle delivery service model. Further accelerating the need for alternative, secure, and contactless delivery mechanisms is the COVID-19 pandemic. Due to this, demand for drone delivery services has increased globally.

Drones were first developed as military and law enforcement tools, primarily for surveillance and monitoring in the event of any targeted attacks. Since then, the use and application of this technology has expanded to a number of additional labor-intensive and difficult jobs in a variety of industries. Inspecting the health of crops, determining hotspots in the event of a fire, keeping an eye out for mining and

construction activity, filmmaking, and parcel delivery are a few examples of these.

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# A Procedure to Use Saline Water

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## ABSTRACT

Only 3% of the world's water supply is currently available, so I tried to combine water extraction and supply technologies to make use of the plentiful sea water for domestic and drinking purposes. One machine will extract water, while another will supply it to households. We may use this to filter the water for drinking as well as to extract water for all daily duties like washing clothes, dishes, cars, and taking baths. I made an effort to affix a purifier that would get rid of the saltiness and other impurities in seawater. I next used the Ion Electro Sorption method. I will install hydro machines, submersible pumps, and motors along the coast to make sure that every home has access to at least one sea valve. Additionally, I will build underground pipelines that span the entire circle region. This will help us a lot in finding a solution to the water crisis. I essentially had to construct a full sea plant employing hydro machines, submersible pumps and motors, and underground sea water pipes in order for every local residence to have access to one sea valve. I want to make extensive use of the equipment so that I can genuinely gain from them.

**Keywords :** Research Paper, Water, Reverse Osmosis, Electro sorption, Filter Sheet, Ion, Equipment

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## I. INTRODUCTION

I can use submersibles and other tools to get water out of the sea. Water is promptly pumped into the underground pipelines that deliver it to every dwelling within a set radius as soon as it is drawn from the sea. But before I can accomplish that, I need to install pipes all over the circle area. I'm adding water to every device in absolutely vast amounts, and the setups will be enormous. According to the theory I used, liquids quicken under force and lose their driving force in the end, were driving force changes into coercion. Electric submersible pumps, which run upright continuous period centrifugal pumps, are used to do this.

In HSP, the electric stepper machine is a pneumatic stepper rather than a galvanically stepper, with the unbolted padlock mixing the ability liquid with the formed fluid substantive surface unconnected or the padlock circle holding the power liquid unconnected formed liquid. The driving pole is automatically integrated on the drive base and connected to the fuel delimiter.

This is a crucial part of spiral course drives that are connected

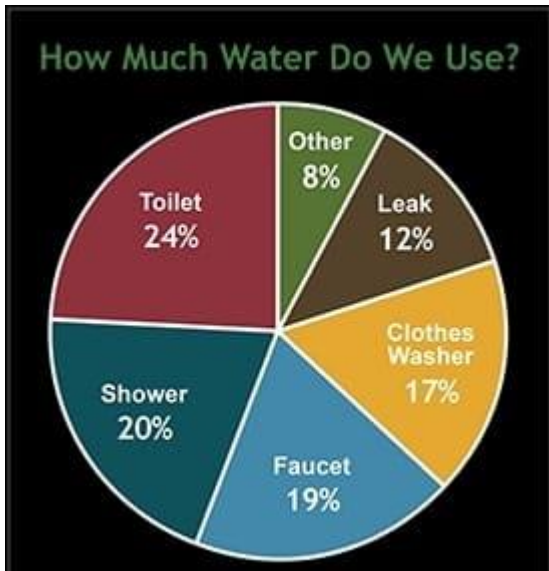


Figure 1

## II. METHOD TO BUILD

1. First of all, I need to establish a HSP which is used to get saline water from the sea or ocean.
2. The outlet of HSP will be connected to The Purification Machine which is based upon (RO principle).
3. After Purifying water, the out supply from Purification machine will be connected to Ion Electro sorption Technique.
4. Now the water will be stored in a container which has filter sheets inside them.

### IMAGE OF STEP OF CONSTRUCTIONS

After collecting water with the help of HSP, we use a RO filter on a large scale to purify the water. The reverse osmosis (RO) method of water filtration removes ions, unwanted chemicals, and larger particles from waste water using a partially permeable membrane. As a result, the dirty particles are trapped on the pressured side of the membrane while the pure water is allowed to pass to the other side.

From the other side the water now moves to the next process. In the next process I set up an Ion Electro sorption Technique. For this I used a Charged carbon electrode

Water is passed through a charged carbon electrode that adsorbs the opposite charged ions. water with low ions/salts remains.

After that I collect water in a container. In this water can purify by setting different layers of purifying sheets or paper that can be replaced manually by a normal person again and again when required as it will show the red light when they need to be changed.

The point now arises is now regarding filter sheets that what type of sheets and materials will be used? The solution to this problem is to we will use the plastic sheet of thin plastic which will have a net like apparatus like as shown in Figure 1.3

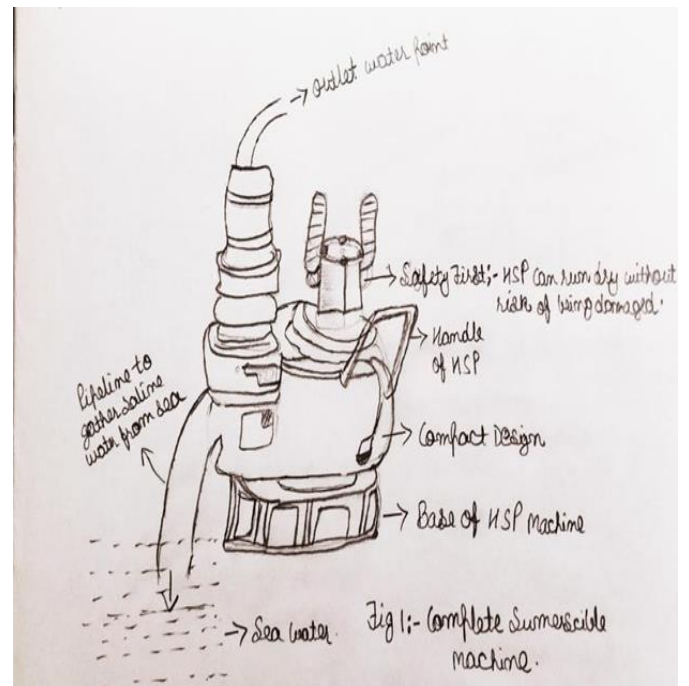


FIGURE 1.2

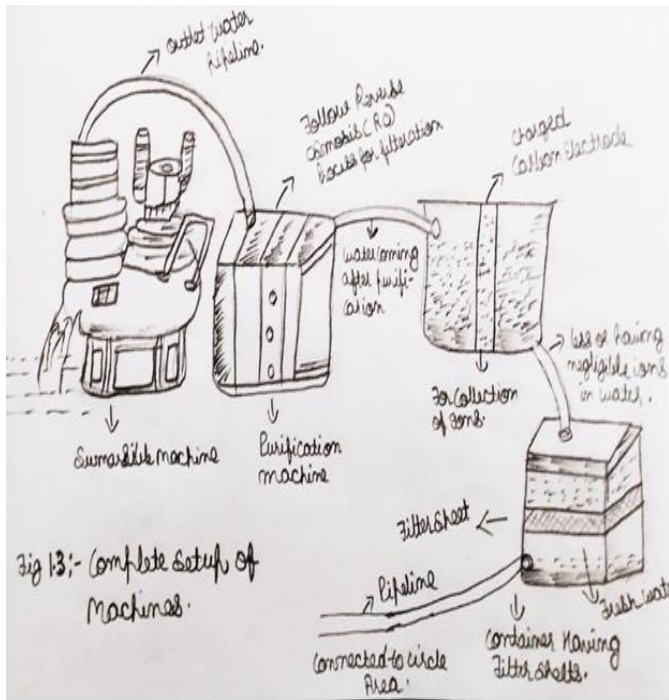


FIGURE 1.3

### III. RESULT

The equipment that the inventive technique creates can force sea water into our residence through a valve, which we can use to clean, flush the toilet, wash cars, wash clothing, and carry out any other unneeded chores that don't require drinking water. The equipment that the inventive ways build has the potential to save a lot of drinking water.

### IV. DISCUSSION

Many previous concepts were less successful than expectations because the machines were employed singly rather than in combination. But now, I integrated the two technologies to produce pure water without endangering nature or its innate rules.

### V. CONCLUSION

The optimization strategy, which also offers some unrealistic methods, seems to be a breakthrough in the use of extremely basic and simplest structures to solve complex machine structure problems. In order to

utilize sea water effectively, my goal was to design and merge two distinctive machines. I had already used reverse osmosis to remove the salinity from the water, which is necessary before transferring it to pipes.

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# Agricultural Invention and Economic Growth

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## ABSTRACT

A financial reserve is one of the key basics to this conversion. Financial resource is a very significant, if not the most significant, factor in economic growth. Farmers need economic resource to buy enhanced agricultural inputs and farm apparatus so that they can raise their output and income level and break the series of poverty. Farmer's asset in these technologies cannot be real without having in place organization and systems that are capable of effectively providing rural financial services to farmers. So, the exertion to expand agriculture could suffer in the nonappearance of a muscular financial base that aims at expanding entrée to credit for small farmers. Regrettably, the state of rural financial markets in rising countries is characterized by insufficient accessibility of financing for both farming and non-agricultural tricks. Very few of the rural populations have admittance to financial military since commercial banks believe lending to small farmers as a chancy business and because providing.

Keywords: Agricultural, Rural Development, Agricultural Invention.

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## I. INTRODUCTION

Agricultural Marketing and Rural Management Financial martial to rural citizens are careful to be more exclusive and thorny. Lending to small farmers involves high operation costs. They lack traditionalist collateral and the executive skill and do not keep records. India is characterized by a inhuman circle of poverty (low productivity, low income, low coffers and therefore low efficiency). In order to break this cycle of shortage and raise efficiency injection of capital could play a chief role. Praise is the only instrument for small farmers to attain the beloved capital goods for manufacture and to break the ferocious cycle of scarcity and raise their output and level of income. Ethiopia should forever give precedence to the peasant agriculture in its nationwide growth efforts since

growth cannot take place without generous particular considerations to the mainstream of the rural population. In a country where agriculture accounts for a major proportion of economic activities and employs a large proportion of the population improved availability of credit to the sector would lead to enlarged production and increase. Therefore, in order for cultivation to effectively meet the confront of being an train of growth credit should be made obtainable and available to farmers in particular.

## Objectives of the Paper :

- 1) To know the Agricultural finance for economic growth.
- 2) To learn the Institutional sources for agriculture.
- 3) To study the categorization of agricultural credit.



## II. RESEARCH METHODOLOGY

A close study has been carried out by Agricultural Invention and Economic growth and the methodology in commerce research comprises collection of secondary data for this research paper. The secondary data are drawn classified from the Govt. Publications of books, monthly journals on agricultural invention and economic growth, including the annual reports of agriculture finance, wherever necessary reference was also made in different issues of bulletins, agricultural finance and economic development. Internet websites and apart from this, different edition of daily newspapers, such as the Hindu, Indian Express, etc, were also used for the purpose of collection the information.

### **Importance of Agricultural Invention:**

Credit is necessary for agricultural growth and also for the growth of the economy as a whole. The agricultural finance is necessary for the following reasons: □

The scope for broad agriculture in India is imperfect. Therefore, increase in agricultural manufacture is possible only by increase and diversification of farming. Severe agriculture needs huge capital. □

Farmer's economic situation is subject to frequent ambush of flood, drought, famine etc. Therefore, either the continuation of agriculture of crops or creation improvements on the farms depends on the nature and accessibility of finance. □

In order to maintain the growth of agro-based industries, there should be a significant increase in the supply of raw resources wanted for such industries. Therefore, for the development of farm sector, a stable flow of credit is required and it would enhance overall increase of the economy.

In agriculture, flat capital is locked up in ceaseless investments like land, well, buildings, etc. also, it takes a long time to get profits from farm. Hence, farmers need finance to persist their farm process and the weaker sections of the farming community should be motivated to participate in growth programmes by

charitable financial assistance to obtain productive assets.

### **Institutional Sources for Agriculture:**

Institutional sources consist of the government and co-operative societies, profitable bank Including the Regional bank, Lead bank.

Co-Operative Societies Indian planners believe co-operation as a device for inexpensive growth of the penniless farmers, chiefly in the rural areas. They see in a village panchayat, a village helpful and village school, as the trinity of institute on which a self-reliant and just financial and social order is to be built. The supportive movement was ongoing in India mainly with a view to provide agriculturists funds for agricultural operations at low rates of attention and projects them from the control of money lenders.

### **Primary Agricultural Credit Society:**

Primary agricultural credit societies are pasturing root plane arms of the short term co-operative credit structure. PACs deal openly with farmer borrowers, grant short term and average term loans and also suppose distribution and making functions.

### **Agricultural Marketing and Rural Management:**

PACs has been growing steadily. In 1950-51, it higher loan worth Rs. 23 crores and Rs. 34,520 crores in 2000-01. The PACs have stepped up their advances to the weaker sections chiefly the small and slight farmers. The progress has been quite imposing but not sufficient considering the demand of money by farmers.

### **Central Co-Operative Banks:**

There are now 369 (2001-2002) District Central Co-operative Banks. The loan amount of 56,650 crores is circulated to the farmers so far. Their main task is to lead Primary Agricultural Credit Societies in village. Central Co-operative Banks functions as intermediaries between the State Co-operative Bank and Primary Agricultural credit society.

### **State Co-Operative Banks:**

There are now 30 State Co-operative banks in the country. These Banks are the peak banks of the Co-operative credit arrangement. It serves as a link between NABARD from which it borrows and lends to

the co-operative central bank and primary societies village.

#### **Classification of Agricultural Credit:**

Agricultural credit can be classified based on purpose, time (repayment period), and security, generation of surplus funds, creditor and number of activities for which credit is provided. □ Purpose: Based on the purpose for which loan is granted, agricultural credit is categorized into: **Growth Credit or Investment Credit:** This is provided for acquiring durable property or for improving the obtainable assets. Under this, credit is extended for:

1. Purchase of land and land retrieval.
2. Purchase of farm machineries and apparatus
3. Growth of irrigation facilities
4. Construction of farm structures
5. Development of plantation and orchards
6. Development of dairy, poultry, sheep/goat, fisheries, sericulture, etc. □

#### **Repayment Period:**

Based on the period for which the borrower requires credit, it is alienated into: □

#### **Short-Term Credit:**

It is given to farmers for periods ranging from 6 to 18 months and is primarily meant to meet agriculture Expenses viz., purchase of seed, fertilizer, pesticides and payment of wages to laborers. It serves as the working assets to operate the farm efficiently and is probable to be repaid at the time of harvesting / marketing of crops. It should be repaid in one installment. □

#### **Medium-Term Credit:**

Repayment is for the period of 2 to 5 years, it is for the purchase of pump-sets, farm machineries and apparatus, bullocks, dairy animals and to carry out minor development in the farm. It can be repaid either in half yearly or annual installments.

#### **Long-Term Credit:**

It is advanced for periods more than 5 years and extends even unto twenty five years against mortgage of permanent property for undertaking growth works viz., sinking wells, purchase of tractor, and ranking

permanent improvement in the farm. It has to be repaid in half-yearly or annual installments.

#### **Generation of Surplus Funds:**

Based on generation of excess funds, credit can be classified as self-liquidating and non-self-liquidating acclaim. □

#### **Self Liquidating Credit:**

In this case, loan amount gets absorbed in the production process-in one year or manufacture period and the further income generated is sufficient to repay the complete loan amount. □

#### **Non-Self Liquidating Credit:**

Here the income acquired with the borrowed funds is not inspired in the production process through the project period. The investment is spread over a period of numerous years. The further income generated in one year is not enough to repay the entire loan amount and hence the repayment is increase over to number of years.

#### **Agricultural Marketing and Rural Management:**

And gainful businesses of small and large farmers and companies in the cultivation sector. Innovation in finance to solve the wants of the rural sector should not be limited to financial institutions. The government can play a proactive role by promoting laws and system with new monetary instruments or even raising awareness of accessible ones to bring them to the attention of the monetary and agricultural sectors. Specialization in farming finance in the government and in the financial sectors is a significant driver to its development.

### **III.CONCLUSION**

Access to money is a vital part of any developed cultivation sector, and drawing farmers and small entrepreneurs in developing countries into the financial system is far from talented. It is not mere accident that the countries with developed financial markets in the cultivation sector are the ones where the sector is also highly industrial. This does not

necessarily mean that only residential countries can have successful stories of cultivation finance. In fact, many of the examples cited above come from rising countries. It requires a combination of good laws, a particular financial sector.

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# Validated Stability Indicating HPTLC of Diclofenac

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## ABSTRACT

The present paper describes stability indicating high-performance thin-layer chromatography (HPTLC) assay method for Diclofenac in bulk drugs. The method employed TLC aluminium plates precoated with silica gel 60F-254 as the stationary phase. The solvent system consisted of toluene: methanol: triethylamine (6.5: 4.0: 0.1 v/v/v). The system was found to give compact spot for Aceclofenac (R<sub>f</sub> value of 0.64 ± 0.028). Densitometric analysis of Diclofenac was carried out in the absorbance mode at 243 nm. The linear regression analysis data for the calibration plots showed good linear relationship with r<sup>2</sup> = 0.999 with respect to peak area in the concentration range 30 - 120 ng/spot. The developed HPTLC method was validated with respect to accuracy, precision, recovery and robustness. Also to determine related substance and assay determination of Diclofenac that can be used to evaluate the quality of regular production samples. The developed method can also be conveniently used for the assay determination of Diclofenac. The limits of detection and quantitation were 4.062 and 12.322 ng/spot, respectively by height.

Keywords: Diclofenac, validation, HPTLC

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## I. INTRODUCTION

### Estimation of Diclofenac in Tablet by Proposed Method

- **Standard solution:** Working standard solution was prepared (10.0 µg/ml) as described under preparation of standard solution.
- **Sample solution:** Twenty tablets were weighed and average weight was calculated. Tablets were crushed to a fine powder. An accurately weighed quantity of tablet powder equivalent to about 10.0 mg of

Diclofenac was shaken with about 8.0 ml of methanol, sonicated for 15 minutes, the volume was made up to 10.0 ml with methanol, and solution was filtered through Whatman Grade I filter paper. One ml of the filtrate was diluted to 100.0 ml with methanol to get concentration of 10.0 µg/ml (on labelled claim basis). Replicate sample solutions were prepared in similar manner.

- **Procedure:** Two bands of standard solution and six bands of sample solution of equal volume (5 µl) were applied on TLC plate and the plate was

developed and scanned as per optimized chromatographic conditions.

- **Calculation:** The instrument directly gives the weight of constituent in volume of sample solution

applied by comparison with concentration of standard. This value was subsequently converted to percent of labelled claim using following formula.

Pulmoza tablet (Avg. wt.: 358.82 mg., Labelled claim: 200 mg per tablet)					
Sr. No.	Wt. of tablet powder taken (mg)	Amt. of Diclofenac estimated in applied 5 µL vol. (ng)		% of labelled claim	
		By Height	By Area	By Height*	By Area*
1.	14.50	41.07	40.96	100.66	100.26
2.	16.00	44.25	44.15	99.57	99.21
3.	18.30	50.83	50.94	99.91	100.11
4.	21.20	58.85	59.14	99.90	100.38
5.	22.50	62.99	62.79	99.86	99.44
* Each value is mean of five observations			<b>Mean</b>	<b>99.90</b>	<b>99.90</b>
			<b>±S.D.</b>	<b>0.364</b>	<b>0.497</b>
			<b>% RSD</b>	<b>0.363</b>	<b>0.495</b>

**Table:** Results of estimation of Diclofenac in tablet

## VALIDATION

### ❖ Validation of the proposed method

Validation of proposed method was ascertained on the basis of accuracy, precision, linearity & range, limit of detection, limit of quantitation, specificity, ruggedness and robustness.

- ❖ **Accuracy:** Accuracy of the proposed method was ascertained on the basis of recovery studies performed by standard addition method.

- **Standard solution:** Working standard solution was prepared (10.0 µg/ml) as described under preparation of standard solution.

- **Sample solution:** Accurately weighed quantities of pre-analyzed tablet powder equivalent to about 7.0 mg of Diclofenac were transferred to five different 10.0 ml volumetric flasks and 1.5 mg, 3.0 mg, 4.5 mg and 6.0 mg of standard Diclofenac added to 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> flask respectively (representing 70- 130% of labelled claim). This was followed by addition of methanol to make volume to about 8.0 ml in each flask, and the contents were shaken and sonicated for 15 minutes. Sufficient methanol was added to each flask to adjust the volume to 10.0 ml mark and filtered. One ml of each of the filtrate was diluted to 100.0 ml with methanol.

**Calculation:** Amount of Diclofenac (ng/5µl) obtained from instrument was converted to total Drug

Estimated by using following formula:  $T = \frac{Ew \times 1000}{V_s}$

The percent recovery was then calculated using the formula:

$$\% \text{ Recovery} = \frac{T - B}{C} \times 100$$

Where,

- T = total drug estimated (mg)  
 $E_w$  = Wt. ( $\mu\text{g}$ ) of drug calculated by instrument in  $V_s$   
 $V_s$  = Volume ( $\mu\text{l}$ ) of sample solution applied  
 B = amount of drug contributed by pre-analysed tablet powder (mg)  
 C = weight of pure drug added (mg)

Pulmoza tablet (Avg. Wt.: 359.82 mg., Labelled claim: 200 mg per tablet)					
Flask No.	Wt. of tablet powder taken (mg) + Amt of pure drug added (mg) (% of labelled claim)	Amt. of Diclofenac estimated in applied 5 $\mu\text{L}$ vol. (ng)		% Recovery	
		By Height	By Area	By Height*	By Area*
1.	12.80 + 0 (70 %)	35.7	34.8	100.49	100.86
2.	12.60 + 1.5 (85 %)	41.4	42.6	99.87	100.08
3.	12.90 + 3.0 (100 %)	50.7	50.7	100.11	99.68
4.	12.70 + 4.5 (115 %)	56.9	56.1	98.96	98.87
5.	12.50 + 6.0 (130 %)	65.2	65.3	100.54	100.93
* Each value is mean of five observations		Mean		100.00	100.07
		$\pm$ S.D.		0.632	0.872
		%RSD		0.632	0.872

Table: Results of recovery studies of Diclofenac in tablet

❖ Precision

• Repeatability

Precision of proposed method was ascertained by replicate analysis of homogeneous samples of tablet powder.

• Intermediate precision

The samples were analysed by proposed method on different days (intra-day & inter-day), and by different analysts.

Sr. No.	Observations	% of labelled claim					
		Intra-day		Inter-day		Different Analysts	
		By Height	By Area	By Height	By Area	By Height	By Area
1.	I	99.77	99.56	100.02	99.46	100.23	100.33
2.	II	99.95	99.35	99.78	99.25	99.52	99.92
3.	III	100.05	99.85	98.93	99.12	100.76	100.25
Mean*		99.92	99.70	99.58	99.28	100.18	100.16
$\pm$ S.D.		0.141	0.256	0.572	0.173	0.622	0.216
% R.S.D.		0.141	0.252	0.578	0.173	0.622	0.216

Table: Result of precision studies

\* Each value is mean of three observations

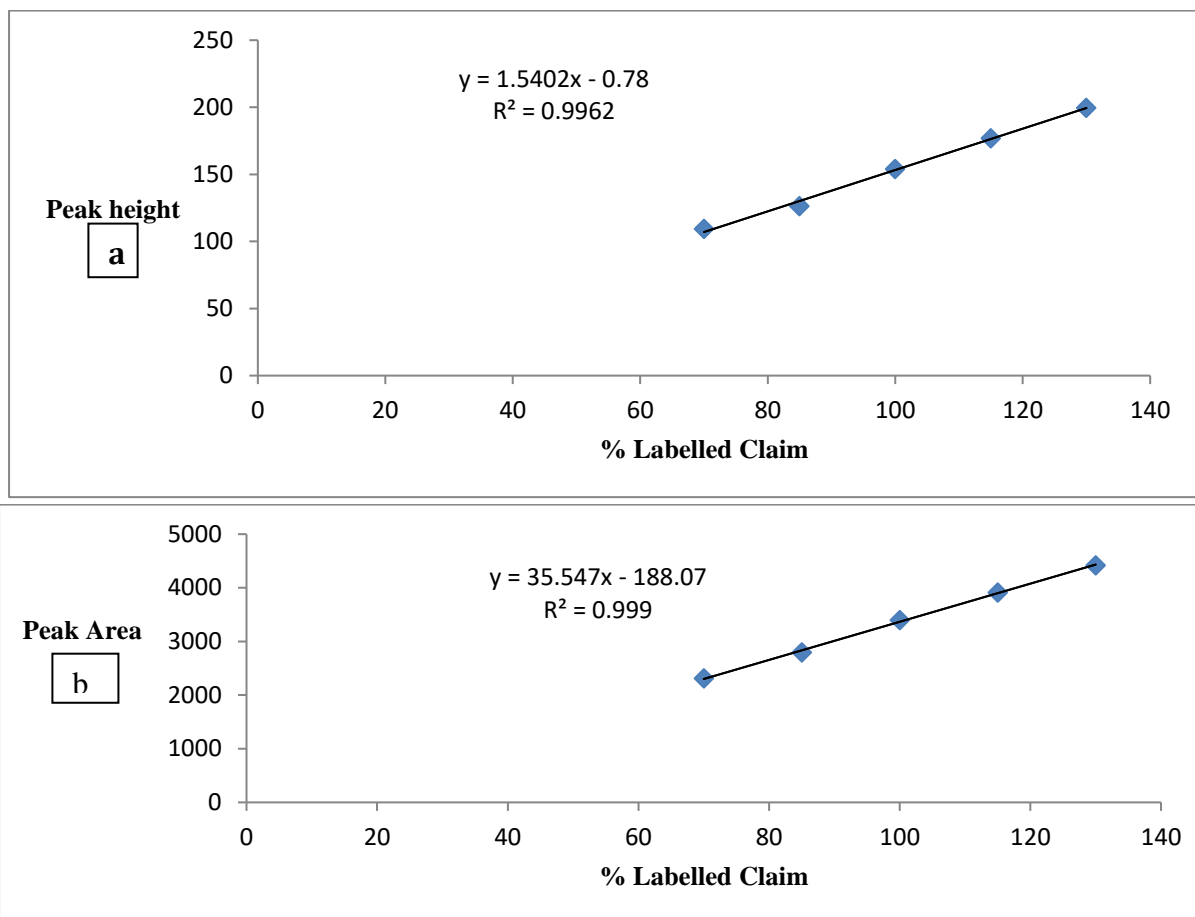
❖ Linearity and Range

- **Linearity of response**

Chromatographic response (peak height / peak area) as a function of concentration was studied.

- **Range of the method**

Sample weights of pre- analysed tablet powder were fortified by addition of standard drugs to have the range 70-130 % of labelled claim and the samples were processed as discussed under accuracy studies. The graph plotted as percent labelled claim vs. peak height or peak area.



**Figure 5:** Calibration curve of range of method (a) by height (b) by area

Concentration range	70- 130% of labelled claim	
Parameter	Height	Area
Regression equation	$Y=1.540X-0.78$	$Y=35.54-188.0$
Slope	1.540	35.34
Y-intercept	(-) 0.78	(-) 188.0
Correlation coefficient	0.996	0.999

**Table:** Results of range of method

- ❖ **Limit of Detection (LOD) and Limit of Quantitation (LOQ)**

LOD and LOQ were determined by the method based on standard deviation of the response and the slope of calibration curve as per ICH guidelines and are as follows:

$$\text{LOD} = \frac{3.3\sigma}{S} \text{ And } \text{LOQ} = \frac{10\sigma}{S}$$

Signal to noise ratio (k) = 3.3 and 10 for LOD and LOQ respectively

$\sigma$  = Standard deviation of response (Estimated by measuring the response in term of peak height or peak area of standard solution of conc. 30.0 ng/spot for five times and  $\sigma$  was calculated) = 1.455201, 48.71276 by height and area resp.

S = Slope of calibration curve (obtained from calibration curve) = 1.18, 60.86 by height and area respectively

S. No	Parameters	By Height	By Area
1.	LOD (ng/spot)	4.068	2.642
2.	LOQ (ng/spot)	12.334	8.005

**Table:** Results of LOD and LOQ studies

#### ❖ Solution State Stability and stability on plate

The chromatograms of the same standard were obtained periodically over a period of 24 h.

Time (h)	Solution state stability		Stability on plate	
	Peak height*	Peak area*	Peak height*	Peak area*
1	151.96	3498.52	151.85	3498.62
3	152.14	3498.96	151.90	3498.21
7	152.36	3491.25	151.93	3495.54
24	151.99	3496.39	152.25	3495.95
<b>Mean</b>	<b>152.11</b>	<b>3496.82</b>	<b>151.98</b>	<b>3497.08</b>
<b>± SD</b>	<b>0.183</b>	<b>3.536</b>	<b>0.181</b>	<b>1.560</b>
<b>% RSD</b>	<b>0.120</b>	<b>0.101</b>	<b>0.119</b>	<b>0.044</b>

\*mean of three observations

**Table:** Results of Solution State Stability and stability on plate

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# Fecal Carriage of Vancomycin-Resistant Enterococci among Hospitalized Patients in Khartoum Sudan

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## ABSTRACT

**Background:** Vancomycin-resistant Enterococci have emerged as important nosocomial pathogens worldwide. These organisms are often resistant to multiple antimicrobial agents limiting the number of antimicrobial treatment options.

**Aim:** This study aimed to isolate and identify the vancomycin-resistant enterococci from fecal specimens of hospitalized patients in Soba hospitals- in Khartoum, Sudan.

**Methods:** The current is a descriptive cross-sectional laboratory-based study. 100 hospitalized patients were selected randomly. A fecal specimen was collected from each participant and inoculated on Kanamycin esculin azide agar and incubated at 37°C overnight. Isolated colonies were identified using conventional microbiological methods. Antimicrobial susceptibility testing was determined by using the Kirby-Bauer disc diffusion method. Vancomycin resistance was detected by using vancomycin screening agar. Collected data were analyzed using Statistical Package for Social Science, version 22, *P. value* <0.05 was considered statistically significant

**Results:** Out of 100 fecal specimens, 89 *Enterococcus spp.* were isolated. 1 out of 89 Enterococci (1.1%) were found vancomycin resistance. Resistant to Ceftriaxone was 100%, Rifampicin was 98.9% and streptomycin was 89.9%.

**Conclusion:** There was a low prevalence of a vancomycin-resistant and wide range of other antimicrobial agents' resistance with an increase in multi-drug resistant strains of enterococci.

**Keywords:** Antimicrobial; Enterococci; Multidrug Resistant; Vancomycin

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## I. INTRODUCTION

Enterococci are opportunistic and nosocomial human pathogens that can cause urinary tract infections, burn wound and surgical site infections, bacteremia and sepsis, endocarditis, cholecystitis, peritonitis, neonatal

meningitis, and others <sup>(1)</sup>. *E. faecalis* is one of the most frequently isolated microbial flora in the human gastrointestinal tract, while *E. faecium* isolated with less frequency <sup>(2)</sup>.

Enterococci are part of the microbial flora of the gastrointestinal tract of animals and humans and can

be released into the environment through fecal materials <sup>(3)</sup>. Residues of Antimicrobials and Antimicrobials resistance genes were detected from human environments and farms and they must be considered as important pollutants <sup>(4)</sup>. Dissemination of resistant genes among microbial flora and pathogenic bacteria in sewage can play a major role in the development of MDR isolates <sup>(5)</sup>. Methods to reduce the amount of antimicrobial agents and a load of resistant bacteria in wastewater originating from hospitals and farms include the optimization of disinfection procedures and management of wastewater and manure <sup>(6)</sup>. These resistant isolates may be transmitted to humans through contaminated water, food, or vegetables <sup>(1)</sup>.

The emergence of multidrug-resistant (MDR) Enterococci has become a serious problem in healthcare settings worldwide <sup>(7)</sup>. The intrinsic resistance to various antimicrobials and dissemination of resistant genes by horizontal transfer is currently thought to play a major role in the development of MDR Enterococci <sup>(8)</sup>. These MDR isolates are associated with increased mortality and costs due to prolonged hospitalization, need for surgery, and prolonged treatment with antimicrobials <sup>(9)</sup>. A common regimen for the treatment of serious Enterococcal infections is the synergistic combination of cell wall inhibitors such as penicillin, Ampicillin, or vancomycin with Aminoglycosides such as streptomycin or Gentamicin <sup>(10)</sup>.

However, Vancomycin Resistant Enterococci (VRE) has caused significant problems for Antimicrobial therapy <sup>(10)</sup>. VRE were first isolated in the UK and France in 1986. Since that time, hospital outbreaks of VRE have been reported in the UK, Ireland, Italy, and Finland <sup>(11)</sup>. VRE carriage has also been reported among out-patients in Germany and patients that newly admitted to hospitals in France <sup>(12)</sup>. According to van der Auwera *et al.*, fecal cultures of 11 (28%) out of 40 healthy individuals who were not health care staff and who had not taken Antimicrobials in the previous year gain a heterogeneous collection of VRE <sup>(13)</sup>. In the

Netherlands, 5 to 10% of healthy people were colonized with VRE and a study in a cattle-rearing region in France revealed that 11.8% of non-hospitalized people and 37% of hospitalized patients were carriers of VRE <sup>(14)</sup>.

## II. METHODS AND MATERIAL

This descriptive cross-sectional laboratory-based study was performed in Soba hospital- in Khartoum, Sudan from September to January 2022. 100 hospitalized patients were selected randomly. Patient's data including age and gender were collected from lab records. The fecal specimen was collected from each participant

**Enterococci isolation and Identification:** Fresh collected fecal specimens were inoculated on Kanamycin Esculin Azide agar (Merck, Germany) and incubated at 37°C for 24 h. Then, the black colonies were examined to certify the gram-positive cocci through the gram staining technique. Bacterial identification was done by colonial morphology, identification was based on gram stain litmus, milk, and bile esculin hydrolysis test. Standard strains for quality control were used, *E. faecalis* ATCC 2921, *E. faecalis* ATCC 51299 <sup>(15)</sup>

**Antimicrobial susceptibility testing:** Assessment of determining susceptibility to antimicrobial was performed by Kirby-Bauer agar disk diffusion assay. The susceptibility of enterococci was determined for the following Antimicrobials; vancomycin (30 µg), streptomycin (30 µg), erythromycin (15 µg), Ampicillin (10 µg), ciprofloxacin (5 µg), and Chloramphenicol (30 µg), Rifampicin (2 mg), Gentamicin (10 mg), Cefepime (50 mg), To estimate the sensitivity of isolates to Antimicrobials, the size of inhibition zone was measured and compared against a reference standard chart of the Clinical and Laboratory Standards Institute (CLSI) <sup>(16)</sup>.

**Vancomycin detection:** After Direct colony suspension to obtain 0.5 McFarland turbidity was prepared. Using a micropipette, a 10-µL drop was

spotted on the agar surface. The plates were incubated at 35°C aerobically for 24 hours. > 1 colony = reported as Presumptive vancomycin resistance, QC strain ATCC 29212, *E. faecalis* ATCC 51299 were used (17).

### III. RESULTS AND DISCUSSION

**3.1 Enterococci carriage rate:** In this study, a total of 100 fecal specimens were collected from hospitalized patients, 89 of them were carry fecal *Enterococcus spp.*

**3.2. Age distribution:** The age range of the study group was between 20 and 78 years and the median age was 41 years and above 40 years age.

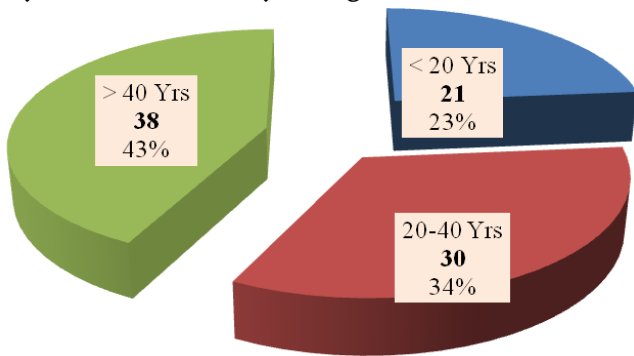


Figure 3.1. Age distribution among the study group No. 89

**3.3. Gender distribution:** About 62% of the study population were males and 38.2% were females.

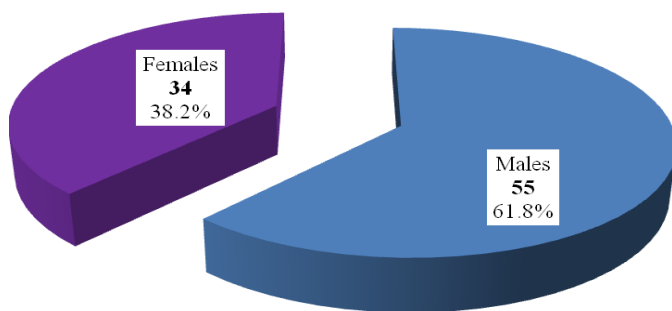


Figure 3.2. Gender distribution among the study group No. 89

**3.4 Susceptibility to Antimicrobial Agent:** The enterococci isolated were highly resistant 100% to Ceftriaxone and 98.9% to Streptomycin and

Rifampicin as in table 3.1.

**Table 3.1. Antimicrobial resistance among *Enterococcus spp.* isolates No. 89**

Antimicrobial	Resistance	
	No.	%
Gentamicin	76	85.4
Erythromycin	78	87.6
Ampicillin	66	74.2
Ciprofloxacin	60	67.4
Streptomycin	80	89.9
Rifampicin	88	98.9
Ceftriaxone	89	100.0
Chloramphenicol	03	03.4
Cefepime	89	100.0

As listed in table (4), 100% of the fecal enterococci showed multi-drug resistance to the tested antimicrobials (strain resists 4 or more antimicrobials)

**Table (3.2): Multi-drug resistance among *Enterococcus spp.* isolates No. 89**

Resistance	No. (%)
Fully sensitive	00 (00.0)
Resistant to 1 agent	00 (00.0)
Resistant to 2 agents	00 (00.0)
Resistant to 3 agents	00 (00.0)
Resistant to 4 agents	03 (03.3)
Resistant to 5 agents	04 (04.5)
Resistant to 6 agents	14 (15.8)
Resistant to 7 agents	31 (34.9)
Resistant to 8 agents	37 (41.5)
Resistant to 9 agents	00 (00.0)
<b>Total</b>	<b>89 (100)</b>

**3.5 Vancomycin screening:** Vancomycin screen agar of enterococci isolates showed that 1 (1.1%) strain was found vancomycin-resistant. This VRE was multi-drug resistant and resistant to Rifampicin, Chloramphenicol, and Streptomycin.

## Discussion

Enterococci have emerged in the last 3 decades, as well as acquired resistance to many antimicrobials such as Vancomycin, resulting in multi-drug-resistant strains, which become increasingly in the hospital setting <sup>(18)</sup>. Vancomycin has been the most reliable and available therapeutic agent against serious life-threatening infections caused by MDR Enterococci and Staphylococci as the last line drug, but unfortunately, decreases in Vancomycin susceptibility of these isolates were recently reported in many countries.

In this study out of 100 fecal specimens, Enterococci strains were isolated from 89%, this high Enterococcal fecal carriage rate agrees with Mogadam and Yassin in Khartoum-Sudan (2019) (87%) <sup>(19)</sup>, Hijazi and his colleagues in Gaza-Palestine (2009) (94%) <sup>(20)</sup>

CLSI recommends the use of 6 µg/ml vancomycin-containing agar to detect vancomycin resistance among Enterococci isolates and only one (1.1%) was VRE. This low resistant rate agrees with a study done in Kuwait that reported that 1.9% of enterococci were VRE <sup>(21)</sup>. Low vancomycin was also reported in Jordan (4%) <sup>(22)</sup> and Iran (4%) <sup>(23)</sup>. On the other hand, a high rate of VRE was reported in another study from Iran (16%) <sup>(24)</sup>, VRE are reported worldwide the epidemiology of this strain varies widely in different geographical areas and populations.

Our isolated strains showed high resistant rates to a wide range of antimicrobials, a very high resistance rate (85-100%) was reported against Gentamicin, Erythromycin, Streptomycin, Rifampicin, Ceftriaxone, and Cefepime. A high resistance rate (67 and 74 respectively) was reported against Ciprofloxacin and Ampicillin; while Chloramphenicol showed activity against most of our strains (only 3 strains were resistant).

High resistance to the most common anti-Enterococcal antimicrobials was reported in Iran <sup>(23, 24)</sup> Jordan <sup>(22)</sup>, Ethiopia <sup>(25)</sup>, and Sudan <sup>(19)</sup>. The variation in isolation rate and resistance of enterococci may be due to differences in the study area, population, and protocol of antimicrobial uses. A high antimicrobial resistance

rate can make a real challenge for the treatment of Enterococcal infections. In this study, high-level resistance to Aminoglycosides, this is one of the traditionally most useful anti-Enterococcal.

Antimicrobial-resistant results in increased human illness, cost, and length of treatment. Patients being admitted for prolonged periods should be screened for VRE owing to this organism's capability of resistant gene transfer to other susceptible species within the hospital. There is a need for implementation of stringent infection control measures like rational use of antimicrobials especially restricting the use of Vancomycin to a minimum, proper containment, and effective treatment of VRE infections. Strict hand washing practices, education of the healthcare workers and other personnel involved in the patient management. These measures are to be strictly followed to bring down the mortality and morbidity associated with these nosocomial VRE infections

## IV. CONCLUSION

There was a low-frequency rate of VRE and a wide range of other antimicrobial agents' resistance with an increase in multi-drug resistant strains of enterococci. Regular surveillance of antimicrobial susceptibilities should be done regularly and the risk factors should be determined.

## V. Acknowledgment

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# Cyber Attacks : Detection and Prevention

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## ABSTRACT

Tens of millions of cyber-attacks (Emails, online transactions, live video streaming, online games, and navigation are all examples of fraudulent Internet-based intelligence gathering.) are launched every day against Internet users throughout the world. Various defences have been developed by researchers in response to these attacks. At present, the techniques that cyber attackers use to perpetrate attacks are related to human exploitation. These attacks are more frequent than before, and they are harder to contain. In the area of information management, cybersecurity is essential. In today's world, protecting privacy has been one of the most difficult tasks. "Cyber-crimes" is the first thing that has come to me when I think about cyber security, which are on the rise at an alarming rate. Various governments and corporations are taking various actions to tackle cybercrime. Despite different initiatives, cyber security remains a major issue for many people. Traditional non-confidence counter-measures are unable to prevent violations against individuals. This paper explains the current state of cybersecurity threats, counter-measures and non-confidence tools that are relevant to day-to-day online operations. It offers a valuable cyber-attack taxonomy and classification that aids in the identification of cyber-attacks and cyber-security initiatives.

**Keywords** : Cyberattacks, Cybercrime, cyberattacks detection, Cyberattack Prevention, Malware, SQL injection, Phishing, Man in the middle attack (MiM), ObURL detection algorithm.

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## I. INTRODUCTION

Any effort to obtain unauthorized access to a device, operating system, or computer network with the intent to inflict harm is considered a cyber-attack. Cyber-attacks attempt to disable, interrupt, kill, or take control of computer networks, as well as to alter, block, erase, exploit, or steal data stored on them. Any person

or group may initiate a cyber-attack from anywhere using one or more different attack strategies. Cybercriminals are people who carry out cyber-attacks. Bad actors, threat actors, and hackers are individuals who work independently and rely on their programming abilities to design and execute malware attacks. They may also be members of a crime gang that collaborates with other threat actors to discover flaws



or bugs in computer networks, known as bugs that can be abused for financial gain.

### 1.1 Reasons for Cyber Attacks

Cyber-attacks are intended to harm people and damage their information. They can have various objectives, including the following:

#### 1.1.1 Financial gain:

The majority of cyber-attacks today, including those targeting commercial institutions, are carried out by cybercriminals for monetary benefit. They also aim to steal confidential information, such as consumer credit card numbers or personal employee information., which cyber criminals then use to access money or items under the victims' names

#### 1.1.2 Disruption and revenge:

The majority of cyber-attacks today, including those targeting commercial institutions, are carried out by cybercriminals for monetary benefit. They also aim to steal confidential information, such as consumer credit card numbers or personal employee information., which cyber criminals then use to access money or items under the victims' names

#### 1.1.3 Cyberwarfare:

Governments all over the world are engaged in cyber-attacks, with many admitting to or suspecting to planning and launching attacks against other countries as part of ongoing political, economic, and social conflicts. Cyber warfare is the term that describes these kinds of attacks.

### 1.2 Working on cyber attack

Depending on whether they're pursuing a targeted or untargeted goal, threat actors employ a range of strategies to carry out cyber-attacks. When bad actors want to hack into as many computers or networks as possible in an untargeted attack, they search for bugs that will allow them to gain entry without being detected or blocked. They could use a phishing attack, for example, sending emails to a large number of people with socially programmed messages designed to persuade recipients to click a connection that will

download malicious code. Threat actors threaten a single organization in a coordinated attack, and the tactics used differ based on the attack's goals. In a coordinated attack, hackers craft emails to particular individuals who, if they select included links, download malicious software intended to subvert the organization's infrastructure or the sensitive data it contains.

### 1.3 Types of Cyber Attacks:

Cyber-attacks most commonly and dangerous involve the following:

#### 1.3.1 Malware:

Malware is a sort of technology (framework, algorithms, integrated data, as well as other programs) that is designed to disrupt or dismiss actions, collect data that can lead to privacy or misuse, obtain unauthorized access to device resources, and engage in other abusive behavior. The word is a catch-all phrase used by programming professionals to describe a wide range of offensive, disruptive, or irritating software or programmed code.

#### 1.3.2 Phishing:

Phishing is the practice of delivering malicious emails that tend to come from a trusted source, usually through email and text messages. Phishing is such social manipulation technology that involves obtaining private data from individuals, such as user credentials and banking details. When an attacker poses as a trustworthy person to trick a victim into clicking a suspicious connection, the victim's computer may be infected with malware.

#### 1.3.3 Man-in-the-middle attack:

A cyberattack that uses a man-in-the-middle technique, in which an unauthorized third party approaches an online conversation between two users and stays unnoticed by the two parties. Individual/classified data that was only found by the two users are often tracked and updated by the

malware at the heart of the attack. An outsider within the machine is exposed to a man-in-the-middle assault, which allows the outsider to enter, read, and alter sensitive knowledge without leaving any traces of coercion.

#### 1.3.4 Denial-of-service attack:

A denial of service (DoS) assault is a sort of internet that attacks a networked model and prevents a server from providing services to its customers (DOS). Sending millions of requests to a server to slow it down, overwhelming a server with massive packets of invalid data, and sending requests with an invalid or spoofed IP address are all examples of attacks.

#### 1.3.5 SQL injection:

SQL injection is the greatest threat to web-based systems. The attackers will use SQL queries to trick the server into permitting them to enter the database. This occurs because the developers aren't completely aware of SQL Injection attacks and their origins. SQL Injection is perhaps a methodology for modifying the database besides a piece of software. It's calculated by transferring Database queries as just an input pattern to gain access to the system access permission.

#### 1.3.6 Ping of death attack:

A refusal assault known as PoD (Ping of Death) is a type of dos and ddos attack. in which an attacker uses a basic ping command to transmit malformed or oversized packets to crash, since sending a ping packet greater than 65,535 bytes is a violation of the Internet Protocol, attackers will send malformed packets in chunks. Memory overload can occur as the target device tries to reassemble the fragments and ends up with an oversized packet, which can cause a variety of issues including a crash.

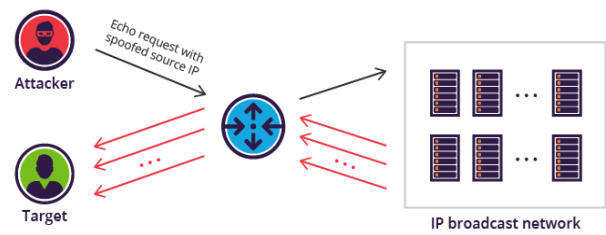


Figure 1. Ping of death attack

## II. APPLICATION AREAS

Cyber-security has a number of advantages, including

### 1.1 Backup and Data Recovery

All of your data is backed up. Are you sure you're safe? Perhaps, however, consider where the backed-up data resides. Maintaining backups is only part of the battle. A hybrid server-based backup model is recommended, in which backups are stored locally and in the cloud. When you have three sets of data manufacturing, central, and off-site, hybrid cloud backups have greater security.

### 1.2 Physical Access Controls

Controlling access to the campus, house, and data-sensitive areas is a top security priority. It's critical that only authorized individuals have actual quicker access. Picture ID cards, least-privilege approvals for badge entry, surveillance cameras, and a protocol that includes visitor check-in are also examples of physical access restrictions that your company should consider enforcing.

### 1.3 Logical Access Controls

Limiting access to full-time staff isn't enough. It's also critical to ensure that even those who require communication network and data access have access. A robust protection strategy should include controls such as least-privilege permissions for end-user network access, annual checks of access permissions, and the automatic revocation of access due to position transition or termination.

### 1.4 Email and Online Protection

A phishing email is used in at least 91 percent of hacking attempts! With this in mind, it's critical to have military-grade email filters in place that can detect and block spoofing emails from outside your jurisdiction. For browsing the web, just use Brave, Mozilla or Google Chrome - sorry, Internet Explorer. Furthermore, using a service like Cisco's Umbrella would block links to established malware pages, because that if one of your customers clicks on a potentially malicious post, the domain will be blocked.

### 1.5 Vulnerability Assessments and Security Training

When we get caught up in the implementation of operations, we can be lulled into a false sense of faith. A third-party vulnerability evaluation and compliance test can reveal security flaws that need to be addressed. The annual security training session that is a one-and-done, check-the-box exercise is no longer sufficient. End-user training, like executive training, is an integral aspect of overall security wellbeing.

## III. METHODOLOGIES

### 1.4 Malware Detection:

Malware is malware that is intended to infiltrate a computer or mobile device to damage the machine and compromise the stability, reliability, and privacy of the user. The use of machine learning to identify malicious files has expanded the use of malware detection systems that use data mining techniques. Often, malware creators do not write new code without first preparing it, but rather rewrite existing code with new elements or muddled tactics. Detection of malware there are many algorithms.

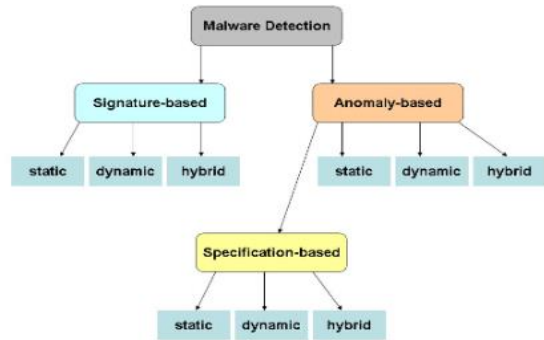


Figure 2. Malware detection algorithms

#### 1.4.1 Signature Based Malware Detection:

Signature-based security tries to predict malware's malicious behavior and uses the model to detect malware. The collection of both of these models represents the experience of signature-based recognition. The term "signature" refers to an approach of harmful behavior. In concept, a signature ought to be able to discern any malware which illustrates the intrusion attempts specified in the verification. Signatures, like all other large-scale data that needs storage, need an archive. It keeps detects malware by matching patterns to the database. The antivirus programmed provider regularly updates and refreshes a library of known code signatures so that this strategy can reliably identify known instances of malware.



Figure 3. The flow of signature-based malware detection.

#### 1.4.2 Behavior-Based Malware Detection:

Behavior-based malware identification assesses an entity based on the operation it intends to perform. The behavior of an object, or its possible behavior, is

examined for irregular activity. Attempts to execute irregular or illegal acts would mean that the target is malicious, or at the very least questionable. A broad set of possibilities suggests the probability of danger. Such examples include attempting to detect a sandbox setting, deactivating security checks, installing rootkits, and auto-start registration. The examination of malevolent activity as it occurs is referred to as dynamic characterization. Static analysis that searches for hazardous functionality in the code and layout of the object may also determine threat risk or malicious intent. While no solution is absolutely stupid, behavioral detection always leads technologies to identify new and unexpected threats in almost real-time today. Such examples of the success of conduct-based systems if signature-based systems fail are:

- Defending against heretofore unimagined malware threats.
- Detecting a single case of malware that has been aimed at a specific person or organization.
- Identifying what the virus does when files are accessed in a certain environment.
- Gaining extensive data on the malware.

### 1.5 Phishing Detection:

Phishing is a persistent trouble, as well as the loss is much larger on social networking sites like Instagram, Reddit, Twitter, and Google. Hackers will develop a website imitation and encourage you to enter your personal information, something you will then send to them by e-mail. Hackers also use these websites to target people who use them at work, at home, or in public to collect information on personal safety and protection that can influence their users or businesses (if in a workplace environment); therefore, as this happens the hacker can obtain sensitive information, including passwords, usernames, security codes, and credit card numbers, from the target user.

#### 1.5.1 Rule-Based Phishing Detection:

Like the IDS signature for a network, a rule is a template we want on a web page. By using a rule-based

approach mechanism, phishing attacks can be detected more easily, quickly, and efficiently. One of our and key objectives is to make the framework scalable clear by integrating modern and evolving phishing methods as they meet. Regulations are mostly based on numerous current pieces of literature about phishing attack identification on observations and machine learning features [2]. The section provides an overview of the many rules we evaluate to identify malicious phishing URLs:

IF conditions are met, THEN actions will be taken

- When a correlation, also widely regarded like a condition, is met, the rule's operations are triggered.

#### ❖ Search Engine-based Rules

- **Rule 1:** If the URL of a webpage does not apply in all indexes of search engines, the webpage is potentially phishing
  - Users check whether a Link exists in the search results indexes (Google, duck duck go, and Bing). Our rule generator queries search engines automatically and finds the top 30 answers. This law declares the website to be a phishing attack if the findings do not contain the URL. Once we crawled the URL, we noticed that it was presented as the very first response by all major search engines. This makes sense intuitively because we cannot check the URL ourselves, which is dependent on keywords, for appropriate URLs. But to be sure, we use the 30 best results because it has proved to have little impact, moving beyond the 30 top results.
- **Rule 2:** The web site may phish if the domain of such webpage doesn't really present in all search algorithm indexes.
  - By querying the search engines with a URL domain, rule 2 is created. If there is no domain in the top 30 results, this rule states that the web page must be complete.

❖ **Obfuscation-based Rules**

- **Rule 3:** An IP-based URL (hexadecimal, octal, or decimal) may indicate phishing.
- **Rule 4:** If a URL has most of [-, \_, 0-9, @, ", , ;] [-, The website is phishing, or it has a non-standard port.
- **Rule 5:** If a URL's portion of the host is 5 or more points or the URL's size is more than 75 characters OR the host's length is longer than 30, the website could be a phishing threat.
- **Rule 6:** Blacklisted URLs are likely to be phishing websites.
- **Rule 7:** When a URL includes a top-notch target or the domain of the URL's IP, then the website is possibly a phishing attack in statistical reports produced by PhishTank, Stop adware, etc.

❖ **Content-based Rules**

Most criteria in this classification are focused on the HTML components of phishing websites. The look and sound of the legitimate website are similar to the ingenious phishing website. Nevertheless, phishers use the same techniques to find out about our content-based laws. Regulations are created as follows by examining HTML structures of several hundred phishing web pages:

- **Rule 8:** If you have a Web site with the password AND HTML element (for the corresponding form contents, the form contents shall be transmitted in plain text without even using Transport Layer Security (TSL)/Secure Socket Layer (also with assistance of the "get" procedure) (SSL).
- **Rule 9:** An external domain that does not have TLS/SSL can be phished if it has a webpage with password input.
- **Rule 10:** META tags include a target property's URL, which might be blacklisted or in a third-party domain, and the page might be blocked
- **Rule 11:** If a webpage does not have the wrong HTML mark-up, then the webpage might be phishing. IF it includes the password entry field.

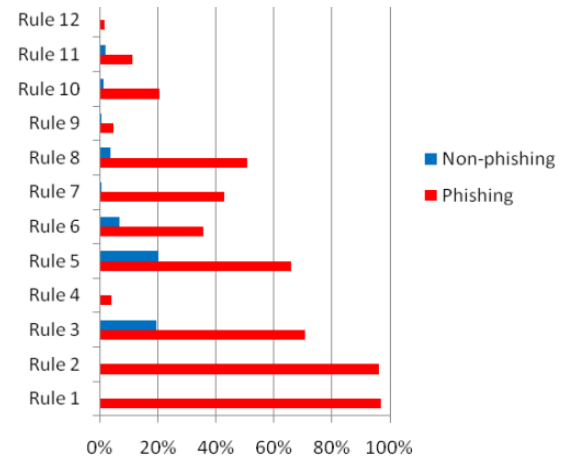


Figure 4. Histogram of Rules

Figure 4 shows the histograms of Rules 1-12

In Phishing websites, rules 1 and 2 are prominent and are high markers of whether the website phishes. These rules will detect more than 97% of the Phish web pages, thus classifying 100% of legal websites correctly.

1.5.2 Detecting Phishing Using Obfuscation URL

Detection:

The email has been used for exchanging messages since 1993 from a sender to one or more beneficiaries. This works on the Internet or other network of computers. Before this, all senders and email recipients require the email system to be simultaneously online. Fraud mail is a threat to the SMTP system's purpose of exchanging messages. Mail containing spam or junk mail is unwanted. Spoofing is perhaps a term that describes unsolicited message sent to multicast. Spam mail has a link to phishing pages or malware. Often, money and confidential information can also be obtained indirectly through phishing, such as usernames and passwords.

➤ ObURL Detection :

- The way to spot spam emails is by combining fingerprint technology with large data analysis. Almost every fingerprint is stored in an inbox and

directory through using hash functions used to create a footprint for the World Summit on Innovation Systems and Management.

- In phishing assaults, ObURL monitoring is used to recognize the URL. ObURL Algorithm for Detection of URL is the Obfuscated algorithm for URL Detection. The ObURL target acquisition technique provides multilayered defence. Due to the continuously growing usage of internet services, phishing attacks are also on the rise. How do we give users the phishing website and spoofed e-mail? The algorithm for the identification of ObURL would then protect the data from phishing attacks across the Internet. As we all understand exactly, the attacker hides the Address in a variety of ways. As a result, detecting each of these threats is challenging, but even then the ObURL detection method will recognise the maximum URL obfuscation number. As a result, detecting any of these attacks is difficult, nonetheless, the ObURL detection algorithm is capable of detecting the largest volume of URL obfuscation phishing as it examines phishing site addresses using the following test cases:

1. Domain Name System Test
2. Verify your IP address
3. Test to encrypt the URLs
4. Test for shortening URLs
5. White List Test
6. Black List Test
7. Pattern Matching Test

#### IV. Algorithms / Techniques

##### ❖ Detection Algorithms / Techniques

➤ ObURL Detection Algorithm:-

**Step 1.** Load: Content

**Step 2.** Output: Discourage users if URLs appears to be a forgery

**Step 3.** Alert notification to the User: Phishing is attainable.

**Step 4.** Safe User: There will be no phishing.

**Step 5.** DB: Database

**Step 6.** Within the email content **If** there is an Input form **then**

The user will receive an alert; **End**

**For each** iframe inside of an e-mail which is illustrated **does**

// Retrieve the iframe's content

**For each** iframe's origin during an e-mail text **do**

**If** There was an input form **then** Notify User;

**End**

**For each**, source of the iframe in the E-mail's content contains a hyperlink **do**

// For every one of the six assessments, follow the directions carefully.

**End**

**For each** Iframe source URL and e-mail content contain hyperlinks **do**

**Step 7.**

**Test 1:** DNS Test

If text\_of\_hyperlinks! = text\_of\_anchor

**Then**

The user will receive an alert;

**Step 8.**

**Test 2:** Verification of IP address

**If** the IP address set up in the text of the hyperlink

**Then**

**If** an IP address is discovered in the White list database

**then**

User is Safe: There is no Phishing;

**Else** The user will receive an alert;

// an IP address is discovered in the Blacklist DB

**Step 9.**

**Test 3:** Encryption of URL Test

**IF** the text of the hyperlink is constructed using ciphered

**Then**

Decipher hyperlink;  
Inform the User;

**Step 10.**

**Test 4:** shortening the URL Test,

**IF** is the size of the URL is lessened

**Then**

Notify alert to the user;

**Step 11.**

**Test 5:** hyperlink white list and blacklist test

**IF** URL found in safelist (Whitelist) Database

**Then**

User is safe: There is no phishing;

**Else**

The user will receive an alert;  
// URL discovered in Blacklist Database

**Step 12.**

**Test 6:** Pattern Matching Test

**IF** the pattern of hypertext and anchor text matches

**Then**

Notify Alert to the User;

1.5.3 Prevention Techniques

1.5.3.1 Malware Prevention Techniques:

The quick solution to blocking extortion security breaches is to regulate the activity. Educating your workers about what to do to identify and protect their personal computers and smartphones from malware attacks is a good place to start when it comes to preventing malware attacks in the company. The below are some of the best tactics that we can use to take a constructive way to prevent malware:

- Make doubly sure you already have most of the essential defense security patches applied. – To guard against ransomware and other security threats, Releases and security fixes should be installed as soon as feasible. This is especially

important for a program like Java, Adobe, and QuickTime, which are common and commonly used. Where practicable, allow automatic app updates.

- Avoid suspicious links and emails – Avoid clicking on any unsolicited or suspicious-looking attachment or text. These are often phishing emails that claim to be genuine to deceive users into uploading malware or disclosing confidential details. Remember that a company would seldom request your credentials or other private details through email, which is usually a sign of a phishing scam.
- Review software carefully before downloading – Look at the application and its ratings before downloading something for the first time on a machine or smart device, even app versions that are free or trial.
- Make use of strong, one-of-a-kind passwords – The passwords that so many Users opt select the most appropriate passwords that are easy to deduce or should be the same for hundreds of accounts. For every one of your identities, you must create secure and unique credentials.
- Firewalls and security protocols should be turned on– Make absolutely sure that firewall is enabled well and controlled properly all of the time as these rules determine what information can reach your computer.
- Install an anti-virus/anti-malware software – Advanced anti-virus software that monitors the environment will shield you from common ransomware and other security threats. Many infiltrations can be blocked and prevented by using trustworthy anti-virus applications. Anti-virus tools won't catch any bit of malware out there, so it's a good starting point for defending against well-known malware threats.
- Limit application privileges –Since malware also requires complete access to your computer to function properly, account controls can be used to

restrict what a program can do without your permission. Then, when you're alerted to apps or programs that are attempting to alter your device, you should pay heed to the alerts and seek assistance in preventing ransomware from being installed.

#### 1.5.3.2 Phishing Prevention Techniques:

Nobody wants to be a victim of a phishing scheme. However, there is an explanation why those scams will continue to exist: They are lucrative enough for black hat hackers to make a lot of money handsomely from them. Phishing scams have existed almost since the dawn of the Internet, and they aren't going anywhere anytime soon. There are, interestingly, things you can still do to avoid being a victim of a crime. Here are 10 basic safety standards to follow:

- **Keep Informed About Phishing Techniques –** Phishing scams are constantly being created. You could fall victim to one of these modern phishing tactics if you don't keep up with them. Keep an eye out for updates on the latest phishing scams. You would have a much smaller chance of being snared by one if you learn about them as soon as possible. Continuous threat awareness training and simulated phishing for all users are strongly recommended for IT managers to maintain security top of mind in the organization.
- **Think Before You Click! –** When you're on a reputable website, it's fine to click on links. Clicking on links in random emails and text messages, on the other hand, isn't such a good idea. Before clicking on any links that you're not sure about, hover over them. A phishing email may appear to be from a reputable organization, and when you click the link to the website, it may appear to be identical to the actual one. If you get a phishing email that begins with "Dear Customer," be cautious. When in doubt, rather than visiting a potentially dangerous website, head straight to the source.
- **Install an Anti-Phishing Toolbar –** For some of the most modern web browsers, anti-phishing extensions are easily accessible. Using these toolbars, you can quickly verify a website's legitimacy via a rapid test and link it to established phishing websites. You will be notified if you visit a potentially harmful website when using the toolbar. Phishing scams can now be avoided thanks to a secure additional line of defence.
- **Verify a Site's Security –** It's understandable to be wary of disclosing confidential financial information over the internet. However, as long as you're on a safe website, you shouldn't have any problems... Often look for the site's protection certificate. Do not access a website if you receive a warning that it can contain malicious material. Even search engines can display such links that lead to a phishing website that advertises low-cost goods. If a customer makes a payment on such a website, credit card information is collected.
- **Check Your Online Accounts Regularly –** Someone might be having a field day with your online account if you don't log in for a bit. Regularly, make sure almost all of your internet accounts is up to date. To stop bank phishing and credit card phishing scams, you should directly check your accounts regularly. Obtain monthly financial account statements and a close review of entry to ensure that unauthorized transactions have occurred without your knowledge.
- **Be Wary of Pop-Ups –** Pop-up windows are often mistaken for genuine website elements. The vast majority of the time, though, they are phishing frauds. Pop-ups can be blocked in several popular browsers, or you can authorize them on a case-by-case basis. If you do happen to slip between the cracks, don't press the "cancel" button; these buttons often lead to phishing pages. Instead, press the little "x" in the window's upper corner.
- **Never Give Out Personal Information –** You can never exchange personal or financial information



over the Internet as a general rule. This law dates back to the early days of America Online when users were continuously warned about phishing scams due to their popularity. Where in doubt, go to the company's main webpage, get their phone number, and send them a message. The majority of phishing emails will guide you to a website where you must enter financial or personal details. A account holder of the Internet should never enter top secret information via email attachments. Never give someone personal information via email.

## V. TOOLS & TECHNOLOGIES

Cyber-attacks integrate a variety of tools, which are classed as follows:

### 1.6 Operating System:

#### ❖ Kali Linux:

Offensive Confidentiality also keeps up and funds a fully accessible platform called Kali Linux. It's criminal investigations and detection process software designed exclusively for computer forensics.

### 1.7 Attacks Tools:

#### ❖ Ophcrack:

This tool is primarily used to crack hashes that are created by the same Windows files. It offers an user - friendly interface that is durable and can set up on a variety of platforms.

#### ❖ EnCase:

An investigator will use this program to photograph and analyze data from hard drives and removable disks.

#### ❖ SafeBack:

SafeBack is primarily used to visualize the storage media of Intel-based operating systems and restore those images to other hard discs.

#### ❖ KeyLoggers:

The process of having to log (or storing) the keys pressed on a keyboard, Keystroke logging, also known as recordkeeping or keyboard capture, is a method of recording keystrokes in a non-obtrusive manner so that the person using the keyboard is blissfully ignorant that their activities are being recorded.

#### ❖ Spyware:

Spyware is malware that collects information about an individual or organization without their permission and sends it to another party without their approval, or that, without any of the user's awareness, takes ownership or control of the device.

#### ❖ X-Ways Forensics:

This collection is one of the most extensive forensic suites accessible for Windows-based programs. It is supported by nearly every version of Windows, resulting in it being one of the most user-friendly on the marketplace, permitting you to work with versions supporting both 32-bit and 64-bit. One of its most appealing features is the fact that it is entirely compact, allowing it to be run from a memory card and transferred from one machine to another.

#### ❖ SurfaceBrowser:

SurfaceBrowser™ is the ideal tool for identifying a company's entire online infrastructure and extracting useful intelligence information from DNS records, DNS servers and their past and present Registry information, exposed subdomains, Digital certificate files, and more are all available.

## VI. CURRENT/LATEST NR&D WORKS IN THE FIELD

Here some of the trends that affect cyber security are listed below.

### 1.8 Web Servers:

Cybercriminals spread their malicious code over their hacked legal web servers. However, data robberies, many of which are media-focused, are also a major threat. Such cybercriminals may steal data on web servers in particular. Therefore, a safer browser must always be used in order not to fall victim to such crimes, particularly during important transactions.

### 1.9 Cloud computing and its services:

All small, medium-sized, and big businesses now gradually become cloud service providers. This means that the planet progresses steadily to the clouds. This latest development poses a major challenge to cyber safety because traffic can be rounded by conventional checkpoints. In addition, with the increase in the number of cloud applications, policy controls would need to change for web applications and cloud services to ensure that sensitive information is not lost.

### 1.10 Encryption of the code

Encryption is the encoding (or information) method in such a way that nobody can read it. The message or data is encrypted with an encryption algorithm in an encryption scheme to turn it into an unreadable chip document. This is normally achieved using an encryption key, indicating how to encode the message. Encryption preserves the privacy of data and their confidentiality at an early stage.

### 1.11 IPv6: New internet protocol

IPv6 is the latest IPv4 (old version) Internet Protocol, which was a backbone to our networks and the Internet as a whole. It is not just a matter of porting IPv4 capacity that we protect IPv6. Though IPv6 is a wholesale substitute in providing more IP addresses,

some key improvements to the protocol need to be taken into account in security policies.

## VII. CONCLUSION

Overall, several security measures can be enforced to safeguard computers and networks against these types of attacks. The majority of security tools targeted at consumers are designed to protect computers from malware, adware, spam, and different forms of viruses. Despite the fact that many businesses offer these services, cybercriminals are constantly searching for new ways to get around firewalls and anti-virus software, and they are often successful. Since there are so many hackers and spammers all over the world, new ways to get around these obstacles are constantly being built, making it difficult to catch them. Users who take the necessary precautions, such as installing firewalls and anti-malware/virus software, are less likely to fall victim to cybercriminals. Though not all people are victims of cybercrimes, they are still at risk. Computer-assisted crimes are diverse, and they do not all take place in front of a computer, but they are always carried out by one. The hacker's age ranges from 12 years old to 67 years old. The hacker may be on the other side of the world from the victim, and they would have no idea they were being hacked. Computer-assisted crimes are a concern in the twenty-first century. Criminals no longer need to rob banks or be outside to commit any crime, thanks to advancements in technology. On their laps, they have everything they require. Their arms are no longer guns; instead, they use mouse cursors and passwords to strike.

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# The Influence of COVID-19 and Other Determinants on Bogor City's Local Revenue

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## ABSTRACT

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One manifestation of the successful implementation of regional autonomy is marked by the existence of regional independence in generating funds obtained from the maximum utilization of regional potential which is called Local Revenue (PAD). The high realization of PAD reflects the large capacity of the region to finance government and development. This study aims to analyze the growth of PAD annually, the level of income contribution of PAD compilers, effectiveness, and influence of COVID-19 and other determinants on PAD. The method used is descriptive analysis, contribution, effectiveness, and multiple linear regression with dummy variable. The object under study is Bogor City, using annual and monthly time series data for the January-December 2018-2021 period. The results of this study indicate that PAD is influenced negatively by Population (JP), PAD is influenced positively by the Local Tax (PD), Inflation (IN), and Other Legitimate Local Revenue (LLPADS). While PAD is not influenced by the Regional Retribution (RD), Results of Separated Regional Wealth Management (HPKDD), Entertainment Tax (PHi), Number of Hotel Business Units (JHo), and COVID-19.

**Keywords:** Bogor City, COVID-19, Dummy Variable, Local Revenue, Multiple Linear Regression.

## I. INTRODUCTION

The success of state development is determined based on the success of each region in it, especially those that have been given the authority to carry out regional autonomy, which means the transfer of government authority by the central government to autonomous regions, to regulate and manage government affairs in the system of the Unitary State of the Republic of

Indonesia [1]. It is because the central government gives authority to local governments to regulate their respective territories.

The fiscal decentralization policy expects the dependence of local governments on the central government to decrease so that they can achieve regional independence as the goal of regional autonomy itself [2]. Regional autonomy aims to improve public services, public welfare, and regional

competitiveness. The way to achieve this goal is to regulate all regional affairs, especially financial affairs. It is important because the relationship between central and regional finance greatly determines regional independence. It is crucial, and its availability needs to be increased because as a source of financing, the increase will accelerate the activities to achieve development goals [3]. If funds from the region itself can finance the development of a region, it can be said to be an ideal regional development [4].

This finance has been regulated based on [5], regional revenues is the amount of funds that enter the regional treasury is in the form of regional income and financing receipts. With the high realization of regional income, it is hoped that the government system will run well. Regional income in Bogor City is dominated by the contribution of regional income from three sources of income, including Local Revenue (PAD), Balancing Funds, and Other Regional Original Income.

Local Revenue (PAD) is the revenue obtained by a region from various types of income in it and at the same time becomes a source of regional original economy that is cultivated by its region. According to [6], PAD growth must be rise quickly and precisely because its growth will always increase following the lifestyle of the local population. Data shows that from 2018-2021 PAD has a relatively significant contribution to regional income, with an average of 39.17% in the last four years [7]. With the setting of targets, it is hoped that the realization can achieve these targets.

TABLE 1. Regional Income and Local Revenue of Bogor City in 2018- 2021

Year	Regional Income (Trillion Rupiah)	Target of Local Revenue (Billion Rupiah)	Realizationof Local Revenue (Billion Rupiah)
2018	2.32	887.39	912.19
2019	2.49	972.60	1015.86
2020	2.42	741.53	872.01
2021	2.65	914.55	1083.59

The development of PAD in Bogor City always reaches the target annually. It is accompanied by an increase except in 2020, where the target and realization of PAD have decreased compared to the previous year. It is directly proportional to the amount of regional income earned and also reduced. The contribution of PAD this year is the lowest compared to the other three years, which is only 35.9%. However, there was a rapid increase in 2021, and even the realization achieved was higher than in 2019.

The correlation between the amount of PAD and the income of Bogor City is directly proportional, indicating that the role of PAD is quite influential. With the authority to regulate their regions, each city/district can have different targets and achievements related to the realization obtained in PAD. Thus, the higher the PAD, the higher the ability of local governments to finance their own needs [8]. The increase in PAD is influenced by four types of income, namely local taxes, regional retribution, results of separated regional wealth management, and other legitimate local revenues [9].

Figure 1 shows that the four types of income in Bogor City's PAD experienced a fairly good increase in realization from 2018 to 2019 and from 2020 to 2021, in line with the increase in PAD. However, in the following year, when PAD decreased by 14.1% (decreased by Rp 143,850,789,060 in 2020), it was also followed by a decrease in local taxes of Rp 180,456,435,538 and regional retribution of Rp 16,351,777,933 while HPKDD increased by Rp 3,685,448,881 and LLPADS increased by Rp 51,383,990,311 [10]. Bogor City can further revive its economy, marked by an increase of 24.2 % in 2021, and this increase is greater than in 2018 to 2019, which was only 11.3%.

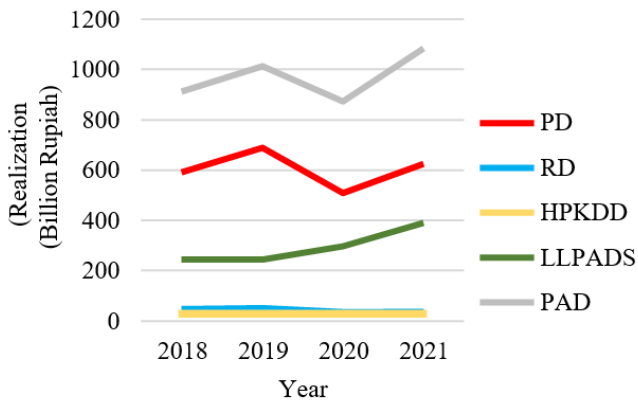


Figure 1. Realization of Bogor City's Local Revenue and the four types of income in it in 2018-2021

The high amount of PAD obtained can reflect the success of a region in financing governance and development. But on the other hand, if the realization is not as expected, this can be a considerable risk, especially considering that in 2020 and 2021, the world is being hit by the COVID-19 outbreak. This extraordinary event that has been experienced since the end of 2019 started with a virus in Wuhan, the capital of Hubei Province, China, which spread massively so that the pandemic continues to this day and has attacked all countries in the world, including Indonesia since early 2020. As a result of this pandemic, Bogor City enforced the PSBB (Large-Scale Social Restrictions) policy which aims to break the chain of the spread of the COVID-19 virus.

One of the sectors affected by this pandemic is the economic's sector, which has temporarily closed entertainment centers, hotels, and restaurants. Likewise, the number of fatalities due to infectious diseases is swift and is also marked by inflation which affects the prices of goods and the income of entrepreneurs. The influence of the economic sector, both in terms of human resources as an economic driver and other indicators, will harm economic movement, which is hampered.

In a pandemic condition and with various government policies, Bogor City still has to maximize PAD which

is very dependent on the four types of income in it and also other determinants that affect it, because if PAD is not increased by utilizing the existing regional potential by the local revenue, then COVID-19 will affect the situation[11]. Based on the basic formulation of the problem above, this research aims to:

1. Explain the comparison of Bogor City's PAD in conditions before and during COVID-19.
2. Analyze the effectiveness of PAD and the four types of income in it, as well as the amount of contribution to PAD of Bogor City in conditions before and during COVID-19.
3. Analyzing the influence of COVID-19 and other determinants of PAD of Bogor City.

## II. METHODS AND MATERIAL

### A. MATERIAL

This study uses secondary time series data in the form of annual data and also monthly data from January to December 2018-2021, which is a total of 48 periods with the consideration that this year is the condition before and during the COVID-19 pandemic in Indonesia, and the object being analyzed is Bogor City.

There is one dependent variable (PAD), eight independent variables (PD, RD, HPKDD, LLPADS, Inflation, Population, PHi, JHo), and one categorical variable, namely a dummy variable which is divided into two conditions (before and during the COVID-19 pandemic). This data was obtained through the Bogor City Revenue Realization Report, the Recap on the Development of the Number of Bogor City Taxpayers, the Bogor City Population and Civil Registration Office, and Central Statistics Agency (BPS) of Bogor City.

**B. METHOD**

In this study, four methods were used, namely descriptive analysis, effectiveness analysis, contribution analysis, and multiple linear regression analysis (with dummy variable). In all types of analysis, all data processing uses Microsoft Excel software, and for multiple linear regression analysis (with dummy variable) using STATA 2022 software. Descriptive analysis is a simple method of searching for related information and collecting data presented in sentences, graphs, tables, and images so that the reader can easily understand the information obtained. In this study, descriptive analysis was used to compare the Local Revenue of Bogor City before and during the COVID-19 pandemic, namely by calculating the decrease, increase, and growth of various types of income.

Effectiveness is the relationship between output and goals. It describes the extent to which the expected results are compared with the planned results. When a realization matches the target, it can be said to be effective. In this study, the intended target and realization is local revenue and four types of income in it, namely local taxes (PD), regional retribution (RD), results of separated regional wealth management (HPKDD), and other legitimate local revenue (LLPADS). The effectiveness is meant by looking at the relationship between the realization of the five variables to the revenue target on an annual basis and seeing whether the amount does not reach the target or can exceed the predetermined target. The following formula can calculate this effectiveness:

$$\text{Effectiveness} = \frac{\text{Actual Revenue}}{\text{Target Revenue}} \times 100\%$$

The formula produces several answers regarding the amount of tax effectiveness, and these results also have five criteria [12] as follows:

**TABLE 2. EFFECTIVENESS MEASUREMENT INDICATORS**

Percentage (%)	Criteria
<60%	Ineffective
60%-80%	Less Effective
80%-90%	Quite Effective
90%-100%	Effective
>100%	Highly Effective

Contribution analysis is used to determine the magnitude of the involvement of four types of income in Local Revenue using monthly and annual data with the following formula with K as the contribution calculated by dividing P, namely the realization of I (various types of income in local revenue, namely PD, RD, HPKDD, and LLPADS), to the realization of local revenue whose results are multiplied by 100% with n is the period (monthly and yearly). The formula that can be used is as follows:

$$KI_n = \frac{P_{In}}{PAD_n} \times 100\%$$

The formula produces several answers regarding the amount of contribution, and these results also have six criteria [13] as follows:

**TABLE 3. CONTRIBUTION CRITERIA CLASSIFICATION**

Percentage (%)	Criteria
0.00%-10%	Very less
10.10%-20%	Not enough
20.10%-30%	Currently
30.10%-40%	Pretty good
40.10%-50%	Well
>50%	Very good

Multiple linear regression analysis is an analysis that can only be used on an interval and ratio scale, which is presented in the form of an equation model. The regression equation consists of one dependent variable and many independent variables [14]. This analysis aims to determine the effect of several independent variables on one dependent variable. To find out the relationship between variables can be presented in the following mathematical equation:

$$\begin{aligned} \ln \text{PAD} = & \beta_0 + \beta_1 \ln \text{PD} + \beta_2 \ln \text{RD} + \beta_3 \ln \text{HPKDD} \\ & + \beta_4 \ln \text{LLPADS} + \beta_5 \ln \text{JP} + \beta_6 \text{IN} \\ & + \beta_7 \ln \text{Phi} + \beta_8 \ln \text{JHo} + \beta_9 \text{D1} + \varepsilon \end{aligned}$$

Information:

PAD : Local Revenue

(Rp)PD : Local Tax (Rp)

RD : Regional Retribution (Rp)

HPKDD : Results of Separated Regional Wealth Management (Rp)

LLPADS: Other Legitimate Local Revenue (Rp)JP : Total Population (Individual)

IN : Inflation (%)

Phi : Entertainment Tax (Rp)

JHo : Number of hotel business units (Units)

$\beta$  : Coefficient/intercept

D1 : Dummy; 0=Before COVID-19; 1=During COVID-19

$\varepsilon_{it}$  : Error term

This regressed model uses a natural logarithmic variable, both the dependent variable and the independent variable, except for inflation because it is in percent (%). In this regression equation model, exact test results are needed in the estimation, with unbiased and consistent results. But before, some tests are required, namely the Hypothesis Testing and Classical Linear Regression Model Assumption Test.

The hypothesis test consists of three types, namely the coefficient of determination, the F statistical test, and the T statistical test.

The coefficient of determination ( $R^2$ ) was carried out by looking at the value of  $R^2$  to find out how much the ability of all independent variables to explain the variance of the dependent variable. The result is obtained by dividing RSS (Regression Sum Square) by TSS (Total Sum of Square). The final results provide a range of  $R^2$  values ranging from 0-1 (100%) or other calculations obtained from the results of  $R^2$  contained in the multiple linear regression analysis in the ANOVA (Analysis of Variance) table.

The F statistical test is a model feasibility test (goodness of fit) conducted to determine whether the independent variables simultaneously influence the dependent variable or not. The steps taken are by formulating the following hypothesis:

$$H_0: \beta_1 = \beta_2 = \dots = \beta_n$$

$$H_1: \text{at least one value } \beta \neq 0$$

Based on two hypotheses, it can be considered with the results of the F statistical test, which can be seen based on the F-Table or compared with the probability of F statistic with (significant level) 5%.

While the t-test is also known as the partial correlation test, which aims to determine whether each independent variable influence the dependent variable or not. The steps taken are by formulating the following hypothesis:  $H_0: \beta = \beta_0$  (the independent variable ( $x_i$ ) has no significant effect on the dependent variable ( $y$ ))

$$H_1: \beta \neq \beta_0 \text{ (the independent variable } (x_i) \text{ has a significant effect on the dependent variable } (y))$$

These two hypotheses can be considered with the results of the T statistical test, which can be seen from the T-Table where the t value in df n-k and the whole level for the one-tailed test and /2 for the two-tailed test, or it can also be analyzed based on the results of



the partial correlation of the significance value obtained are significant (value less than 5% significance level) or insignificant (value greater than 5% significance level).

The next step is to test the assumptions of the classical linear regression model with the aim that the prediction model produced is in accordance with the Gauss-Markov conditions, namely:

1.  $E\{\varepsilon_i\} = 0, i = 1, \dots, N$  zero mean
2.  $V\{\varepsilon_i\} = \sigma^2, i = 1, \dots, N$  homoscedasticity
3.  $Cov\{\varepsilon_i, \varepsilon_j\} = 0, i = 1, \dots, N \text{ for } i \neq j$  no autocorrelation

An additional condition does not include the Gauss-Markov assumption, there is no perfect correlation between independent variables (no perfect multicollinearity). Multicollinearity is not calculated by testing the hypothesis related to the error component but by the rule of thumb, which only detects a linear relationship between independent variables, which usually uses linear correlation.

The existence of multicollinearity between independent variables does not make the regression model violate the OLS (Ordinary Least Square) assumption, meaning that the obtained model remains BLUE (Best Linear Unbiased Estimation). However, it can still complicate regression modeling because if there is multicollinearity, there will be a change in the sign of the regression coefficient so that it becomes more difficult to interpret and tends to be insignificant because it will result in the standard deviation of the coefficients increasing so that the t value will decrease and tend to be difficult to reject  $H_0$ . The thing that should not happen is perfect multicollinearity where the linear correlation is between -1 and 1, then the estimation of the regression model is not possible.

Thus, the solution that can be done is to exclude one of the independent variables that are perfectly correlated in the model or by remove the independent variable, which has a large VIF (Variance Inflation

Factor) value that exceeds the rule of thumb. If a variable has a VIF value  $> 5$ , it indicates a multicollinearity problem in the model [15].

Heteroscedasticity is a condition where the error variance is not the same for each observation. The way to detect it is to look at the graph/plot and White Test hypothesis. The graph/plot shows the relationship between the squared residuals and the estimated y. If the results show that the data distribution is relatively wide and has the same width from left to right, then there is no indication of heteroscedasticity and vice versa. This conclusion should be accompanied by a heteroscedasticity assumption test, namely the White Test. Two hypotheses, namely  $H_0$  and  $H_1$ , are analyzed based on the p-value obtained if it is greater than (significant level) 5%, then do not reject  $H_0$  where the number is insignificant, so there is no indication of heteroscedasticity, and vice versa. If the results indicate heteroscedasticity, the next step is needed to overcome this problem, namely by transforming the variable into log form.

One of the assumptions of regression modeling using the OLS method, which is a Gauss-Markov condition, is that there is no autocorrelation between the residuals. In time-series data, it can detect the correlation of data between time (before and after). It can be seen from the pattern formed on the graph/plot between the residual and the lag of the residual because the data used is time-series data. Other tests can also be done using the Durbin Watson Test, which will produce statistical values between 0-4, which will later be compared with the critical value from the Durbin Watson table.

The results obtained can be grouped into five regions. It can be said whether the model contains positive autocorrelation (between 0 to dL), free from autocorrelation (between dL to dU, dU to 4-dU, and 4-dU to 4-dL, or negative autocorrelation (between 4-dL to 4) with dU and dL values obtained from the Durbin

Watson table. However, the weakness of the Durbin Watson test is that it cannot use the lag variable on the model, so the Breusch-Godfrey test can be used. The results are that if the p-value is more than 5%, it does not reject  $H_0$ , so there is no indication of autocorrelation and vice versa.

### III. RESULTS AND DISCUSSION

#### A. Comparison of Bogor City's Original Regional Income in the Period Before and During the COVID-19 Pandemic.

The realization of the four types of income in PAD experiences fluctuating numbers annually, but the realization always increases both in 2018-2019 (before the COVID-19 pandemic) also in 2020-2021 (during the COVID-19 pandemic). All types of income are progressing which is improving annually. Table 4 shows the realization of PAD in 2018 of Rp 912,197,971,288 successfully reaching the predetermined target of Rp 887,396,041,682. In the following year, namely in 2019, the realization of PAD in Bogor City of Rp 1,013,756,016,431 also succeeded in exceeding the predetermined target of Rp 914,550,650,320 [16]. The increase that occurred in 2019 was caused by the rise in all types of local taxes (except groundwater taxes), general service fees, business service fees, returns on equity participation in PDAMs and BPRs, demand deposits receipts, income for work execution fines, tax penalties, income BLUD, and JKN capitation income.

TABLE 4  
REALIZATION OF FOUR TYPES INCOME IN THE LOCAL REVENUE OF BOGOR CITY IN 2018-2021

Year	PD (Billion Rupiah)	RD (Billion Rupiah)	HPKDD (Billion Rupiah)	LLPADS (Billion Rupiah)
2018	592.97	48.41	26.77	244.02
2019	689.49	51.36	28.24	244.65
2020	509.03	35.01	31.92	296.04
2021	624.78	36.03	32.42	380.35

At the beginning of the COVID-19 outbreak, HPKDD increased by Rp 3,685,448,881 and LLPADS increased by Rp 51,383,990,311 while PD decreased drastically by Rp 180,456,435,538 and RD by Rp 16,351,777,933 in 2020 so that the realization of PAD also decreased compared to the previous year, which was a decrease of Rp 141,738,774,279. It happened due to the COVID-19 pandemic, which caused a lot of economic adjustments, including lowering targets and taking into account local capacity adjustments in terms of the realization of various types of income, because during the pandemic, the government implements the PSBB policy (Large-Scale Social Restrictions) so that economic activities are disrupted and resulting in the closure of various shopping centers as a source of the economy. At the same time, various business units that are the driving force of the economy, as well as people who have lost their jobs, their income is reduced, as a result, tax contributions and other mandatory contributions are diverted to meet the necessities of life first.

The decline that occurred in 2020 was due to a decrease in the realization of restaurant taxes (56.2 billion rupiahs), hotel taxes (45.6 billion rupiahs), BPHTB (24 billion rupiahs), entertainment taxes (22 billion rupiahs), PBB (19 billion rupiahs), parking tax (7.9 billion rupiahs), advertisement tax (2.8 billion rupiahs), street lighting tax (2 billion rupiahs), groundwater tax (1.6 billion rupiahs), certain licensing fees (-7 billion rupiahs), business service fees (-5 billion rupiahs), and general service fees (-4.2 billion rupiahs). While HPKDD, all incomes in it have increased, as well as LLPADS which increased because the revenue in them increased except for current account receipts, tax penalty income, results from the use of regional wealth, JKN capitation fund income, and the contributions from Bogor Botanical Gardens.

To strengthen the community's economy, incentives/stimulus are provided by reducing or eliminating local taxes and

regional retribution for business actors, including MSME to avoid a decline in production and mass layoffs [17]. This business operation in Bogor City causes restaurant, hotel, entertainment, and parking tax revenues decrease drastically. The stimulus provided by the government caused the realization of local taxes and regional retribution decrease in 2020 (Table 4).

There are various levels of PPKM, namely levels 1, 2, and 3 for the Java and Bali regions. Bogor City is included in the PPKM level 1, which meets the requirements of the World Health Organization (WHO) indicators so that Bogor City can implement new adjustments [18]. In 2021, the pandemic still occurred, and there were many economic adjustments, but there was a drastic increase in the following year with the PAD target increasing to Rp 914,550,650,320 with a realization of Rp 1,083,597,832,664. This increase in PAD became the largest realization in the last four periods. It is caused by four types of income in PAD that has increased, mainly PD and LLPADS, which dominate the amount of PAD. In 2021 the spread of COVID-19 had begun to decrease. It was not as severe as when it first appeared, so the economic sector started moving positively. Various business units have begun to reopen so that workers also have income that can be allocated for their daily needs and pay other mandatory dues.

Figure 2 shows that in 2019, all types of income experienced positive growth, with the largest percentage obtained by PD (16.28%), followed by the next order, namely RD (6.08%), HPKDD (0.26%), and LLPADS (0.26%), so that PAD experienced growth positively (11.13%). The growth of HPKDD and LLPADS in the following year experienced a rapid increase, with the largest number being LLPADS (21%) and second place being HPKDD (13.05%).

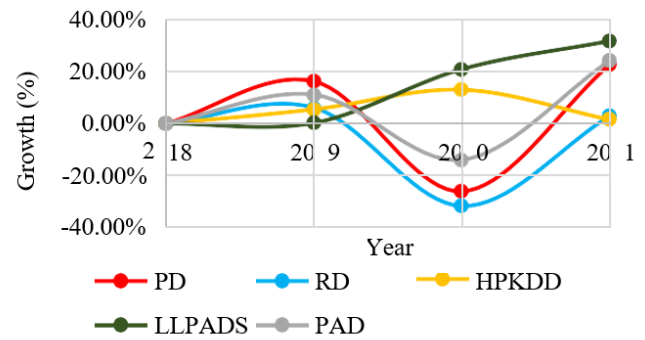


Figure 2. The growth of Bogor City's Local Revenue and four types of income in it in 2018-2021

The COVID-19 pandemic in early March 2020 in Indonesia resulted in PAD changes marked by negative growth in PD (-26.17%) and RD, which decreased dramatically (-31.84%), which resulted in PAD also experiencing negative growth (-13.98%) because these two incomes dominate the amount of PAD in 2020. Good developments can be seen in the following year (2021). Although there is still a pandemic, there is positive growth in all types of income, with the largest order being LLPADS (31.86%), PD (22.74%), RD (2.92%), and HPKDD (1.54%). This achievement indicates that even though there is a pandemic, the performance of Bogor City is still good, even experiencing an increase which is marked by the growth of PAD during the pandemic (24.26%), which was greater than before the pandemic (11.13%), even becoming the largest growth in the period the last four years.

B. Analysis of the Effectiveness of Bogor City's Local Revenue and the Four Types of Income in it in the Period Before and During the COVID-19 Pandemic Effectiveness is an analysis used to explain the extent to which the expected results are with the planned results. The greater the output contributed, the greater the effectiveness. When the realization of the income obtained contributes greatly to the predetermined target, the level of effectiveness is also large. In this study, the effectiveness level of the following five variables was calculated using annual data, namely the

Local Revenue (PAD), Local Taxes (PD), Regional Retribution (RD), Results of Separated Regional Wealth Management (HPKDD), and Other Legitimate Local Revenue (LLPADS) [16].

The amount of local tax realization is obtained from the accumulation of nine types of taxes, namely Hotel Tax, Restaurant Tax, Entertainment Tax, Advertising Tax, Street Lighting Tax, Parking Tax, Groundwater Tax, Rural & Urban Land and Building Tax (PBB-P2), and Land and Building Rights Acquisition Fee (BPHTB). Every year, the realization of local taxes always reaches the target even though the target set has decreased. In 2019, the government raised the local tax target (11.38%), increase around Rp 65,846,554,586. Compared to the realization, which experienced positive and larger growth, (16.28%), increase around Rp 96.517,157,422. This is due to an increase in the target of nine types of local taxes from 2018, as well as the realization which has increased except for the groundwater tax.

In 2020, as the initial period of the pandemic, the local tax target decreased due to the adjustment to COVID-19 conditions so that it experienced negative growth (-22.21%), decreased around Rp 125,600,000,000. It is comparable to the realization which also experienced negative growth but with a higher rate (-26.17%) decreased around Rp 180,456,435,538. This realization occupies the lowest position in the last four years. This is due to the decrease in the target and realization of all types of local taxes in it.

After one year of the pandemic, the government raised the local tax target again in 2021 (28.55%), increase around Rp 125,600,000,000 and has the same nominal as in 2019. It is comparable to the realization which also experienced positive growth but with a lower rate (only 22.74%) increased around Rp 115,745,417,399 compared to the previous year. But this realization has not succeeded in exceeding the local tax realization figure before COVID-19. This is due to the fact that

there are still many adjustments to economic conditions and the implementation of new policies due to the pandemic. The increase in targets was caused by all types of local taxes except parking water taxes and street lighting taxes, as well as the realization which increased except parking taxes and entertainment taxes.

TABLE 5. TARGET, REALIZATION, AND EFFECTIVENESS OF BOGOR CITY'S LOCAL TAX IN 2018-2021

Year	Target (Billion Rupiah)	Realization (Billion Rupiah)	Effectiveness (%)
2018	578.70	592.97	102.46
2019	565.60	689.49	121.90
2020	440.00	509.03	115.69
2021	565.60	624.78	110.46

Table 5 shows that the effectiveness of local tax variables in Bogor City in 2018-2021 is included in the "very effective" category because it is at a value greater than 100% and the calculation results of the effectiveness of local taxes are obtained with the highest order of 115.7 % in 2020, 110.5% in 2021, 106.9% in 2019, and 102.5% in 2018.

The amount of regional retribution realization is obtained from the accumulation of three types of income, namely general services, business services, and certain permits. The realization of the regional retribution exceeded the target but only happened twice, in 2018 and 2021. In 2019, the target increased (20.24%) around Rp 8,997,195,400 and comparable to the realization, which increased around Rp 2,944,082,877 but with a lower growth rate (only 6.08%). This is due to the increase in the target and realization of all types of regional retribution.

In 2020, as the initial period of the pandemic, the target for regional retributions decreased due to the adjustment to COVID-19 conditions so that they

experienced negative growth (-31.35%) around Rp 16,755,762,000. It is comparable to the realization which also experienced a negative growth (-31.84%) which fell around Rp 16,351,777,933 where this figure became the lowest realization in the last four years. This is due to the decrease in the target and realization of all types of regional retribution in it.

After one year of the pandemic, the government has lowered the target for regional retribution in 2021 (-13.85%), decreased around Rp 5,081,593,905. The realization in 2021 also experienced a positive growth (2.92%), increased around Rp 1,022,635,280. This is influenced by the declining target of public service retribution. Meanwhile, all realizations have increased, except for general service retribution.

TABLE 6. TARGET, REALIZATION, AND EFFECTIVENESS OF BOGOR CITY'S REGIONAL RETRIBUTION IN 2018-2021

Year	Target (Billion Rupiah)	Realization (Billion Rupiah)	Effectiveness (%)
2018	44.44	48.41	108.92
2019	53.44	51.36	96.09
2020	36.69	35.01	95.41
2021	31.60	36.03	113.99

Table 6 shows that the effectiveness of the regional retribution variable in Bogor City in 2018-2021 is included in two categories, namely "effective" because it is ranging between 90%-100% and "very effective" because the value is more than 100%, with the lowest score was 95.4% in 2020, 96.1% in 2019, 108.9% in 2018, and the largest number in 2021 was 114%.

The amount of HPKDD realization is obtained from the accumulation of profit shares (dividends) on Equity Participation in Regional Owned Companies/BUKMD, namely in three fields: drinking water (PDAM), financial institutions

(Bank BJB and BPR), and various businesses (PD. Pasar Pakuan Jaya). The HPKDD target experienced an increase (0.41%) around Rp 114.112.981 in 2019, comparable to its realization, which increased with a larger number, around Rp 1,469.417.5055 (5.49%). This was due to an increase in the profit target in the drinking water sector, and all realizations increased except for the profit in the financial institution sector.

In 2020, despite being the initial period of COVID-19, there was an increase in the HPKDD target (19.36%) around Rp 5,437,197,809 in 2020, in line with its realization, which increased by a larger figure of Rp 3,685,448,881 (13.05%). This is due to the increase in targets for all types of HPKDD, and all of their realizations have increased.

In 2021, Bogor City will still be affected by the pandemic, so that the HPKDD target decreased (-3.28%) in 2021, around Rp 1,100,353,420. It caused by the consideration of the realization of HPKDD in 2020, which did not reach the target. However, this year's realization was not comparable to the decrease in the target because it increased around Rp 493,258,358, which experienced positive growth (1.54%) and became the largest nominal in the last four years. It caused by a decrease in profit targets in the drinking water sector and various businesses and an increase the realization of profits in financial institutions and various businesses.

TABLE 7. TARGET, REALIZATION, AND EFFECTIVENESS OF BOGOR CITY'S RESULT OF SEPARATED REGIONAL WEALTH MANAGEMENT IN 2018-2021

Year	Target (Billion Rupiah)	Realization (Billion Rupiah)	Effectiveness (%)
2018	27.96	26.77	95.71
2019	28.08	28.24	100.56
2020	33.52	31.92	95.24
2021	32.42	32.42	100

Table 7 shows that although the realization of HPKDD in 2018 and 2020 did not reach the target, and in 2021 it has the same target number as the realization rate, the level of effectiveness for that year is still in the "effective" category because it is between 90%-100%. which is 100% in 2021, 95.7% in 2018, 95.2% in 2020. So that the highest level of effectiveness is in 2019 (100.6%), included in the "very effective" category because the value is more than 100%.

The amount of LLPADS realization is obtained from various types of income, namely current account receipts, regional compensation claims (TGR), fines for late work implementation, local tax fines, regional retribution fines, income from returns, results of utilization of regional assets, BLUD revenues, JKN capitation funds, contributions from the Bogor Botanical Gardens, forwarding of loan interest to PDAM Tirta Pakuan, rental of rusunawa, proceeds from the sale of regional assets that are not separated, income from fines for violations of regional regulations, other legitimate PAD, contributions from companies/business entities, results from the use of BMD that are not separated, income from fines for terminating the lease BMD, the proceeds from the sale of BMD which are not separated, the proceeds from the sale of equipment and machinery, as well as receipts of commissions, discounts, or other forms. In 2019, the LLPADS target increased around Rp 10,253,384,329, which grew 4.34% and was comparable to the realization, which increased around Rp 627,387,339 but grew at a lower rate (only 0.26%). The increase influences this in targets for all types of income except for fines and demands for regional compensation (TGR), which do not have a certain amount. Likewise, all realizations that have increased are receipts services giro, income fines for delays in work implementation, fines of local taxes, JKN capitation fines, forwarding of loan interest to PDAM Tirta Pakuan, and rental of flats.

In 2020 there was a decrease in the target (-6.17%), around Rp 15,211,047,000 with the initial consideration of the pandemic and the realization in 2019, which did not reach the target. However, this year's realization is not comparable to the decrease in the target because it experienced positive growth (20%), increased around Rp 51,383,990,311. This is influenced by the decrease in all targets except the contribution of botanical gardens, rental flats, and contributions from companies/business entities. Meanwhile, the increase in realization was influenced by all types of increased income except tax penalty income, results from the use of regional wealth, income from JKN capitation funds, contributions from Bogor Botanical Gardens, forwarding of loan interest to PDAM Tirta Pakuan, and proceeds from the sale of regional assets that are not separated.

In 2021 there will be an increase in the target around Rp 53,601,474,444, which is a positive growth (23.17%). Compared with the realization, which experienced positive growth with a larger number (31.86%), around Rp 94,319,279,475. The realization figure in 2021 is the largest nominal in the last four years. This is due to the increase in targets for all types of income except for fines and demands for regional compensation (TGR), which do not have a certain amount. Likewise, the realization of all types of income increased except for the receipt of demand deposits and income from returns.

The realization of LLPADS not reaching the target only occurred in 2019 with an effectiveness of 99.24% but still entered the "effective" category and was followed by the highest class, namely "very effective" because the value is more than 100%, which was obtained in the order of the largest percentage in 2021 by 137%, in 2020 by 128%, and in 2018 by 103.3% (Table 8).

TABLE 8. TARGET, REALIZATION, AND EFFECTIVENESS OF BOGOR CITY'S OTHER LEGITIMATE LOCAL REVENUE IN 2018-2021

Year	Target (Billion Rupiah)	Realization (Billion Rupiah)	Effectiveness (%)
2018	236.27	244.02	103.28
2019	246.53	244.65	99.23
2020	231.31	296.04	127.97
2021	284.92	380.35	137

The determination of the Bogor City's PAD target is quite volatile from 2018-2021. It is based on consideration of the conditions being experienced, namely before and during the COVID-19 pandemic. The target for 2019 has increased around Rp 27,154,608,638 (3.06%). It is comparable to the good achievement results because the realization of PAD in Bogor City managed to exceed the predetermined target, and there was a growth in PAD in Bogor City in 2019 with a figure of a percentage that is larger than the target growth (11.13%) increased around Rp 101,558,045,143.

At the beginning of the pandemic (2020), there was a decrease in the PAD target (-18.92%) around Rp 173,019,527,119. It is comparable to the decreased of realization around Rp 141,738,774,279 (-13.98%). It is due to various considerations, and adjustments, along with the results of the calculation of the economic potential due to presence of COVID-19. The following year, the government raised the PAD target around Rp 173,019.527,119 (23.33%) with the same nominal in 2019. It is based on consideration of conditions that are still experiencing the COVID-19 disaster, but the

realization of PAD obtained is far greater than the previous three years. The realization of PAD in 2021 experienced a greater growth (24.26%), increased around Rp 211,580,590,512 where this figure is the largest growth from the last four years.

TABLE 9. TARGET, REALIZATION, AND EFFECTIVENESS OF BOGOR CITY'S LOCAL REVENUE IN 2018-2021

Year	Target (Billion Rupiah)	Realization (Billion Rupiah)	Effectiveness (%)
2018	887.39	912.19	102.79
2019	914.55	1013.75	110.84
2020	741.53	872.01	117.59
2021	914.55	1083.59	118.48

It can be concluded that despite the COVID-19 pandemic, Bogor City's PAD has improved from year to year, although initially, there was an adjustment to the target first. Still, it turns out that Bogor City can show its superiority which is marked by PAD which always reaches the target every year with a high percentage. Continued to increase around 102.8% in 2018, 110.8% in 2019, 117.6% in 2020, and 118.5% in 2021, so Bogor City's PAD is included in the "very effective" category in the last four periods because the value is more than 100% (Table 9).

C. Analysis of the Contribution of Four Types of Income in Bogor City's Local Revenue in the Period Before and During the COVID-19 Pandemic Broadly speaking, when viewed based on the annual period, the contribution of the four types of income in Bogor City's PAD is dominated by local taxes annually.

The average percentage is 62.26%, which is 65% in 2018, 68.01% in 2019, 58, 37% in 2020, and 57.66% in 2021 (Figure 3). Every year, local tax contributions are included in the "very good" category because the value is always more than

50%. The second position with an average percentage of 30.21% is LLPADS which is divided into two categories where the initial two years are included in the "medium" category because they are between 20.10%-30%, which is 26.75% in 2018 and 24.13% in 2019 and then rose to the category of "good enough" in the next two years because it was between 30.10%-40%, namely 33.95% in 2020 and 36.02% in 2021 [16].

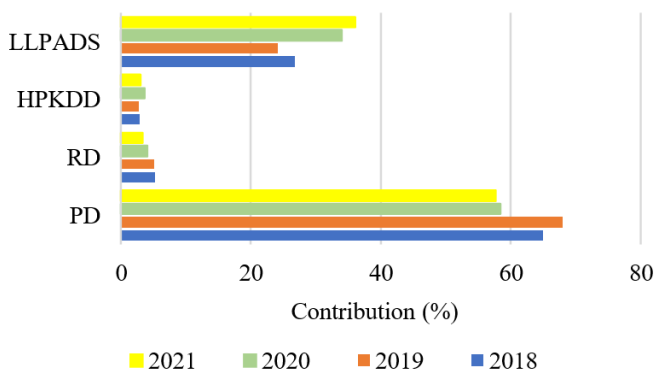


Figure 3. Contribution of four types of income to Bogor City's Local Revenue in 2018-2021

Regional retribution and HPKDD have a very small average contribution (4.42% and 3.09%). Both are included in the category of "very low" contribution because in the 2018-2021 period, the contribution rate obtained is only in the range of 0.00%-10% annually. The value for the regional retribution was 5.31% in 2018, 5.07

% in 2019, then decreased to 4.01% in 2020 and 3.33% in 2021. While HPKDD had the smallest contribution compared to other types of income with fluctuating numbers (2.93% in 2018, decreased to 2.79% in 2019, then increased to 3.66% in 2020, and again reduced to 2.99% in 2021).

Based on monthly data, PD is the largest contribution compared to other types of income and are dominated by the "very effective"

category, with contributions ranging between 22.21%-93.87%. The second position is the LLPADS variable, with contribution figures that fall into various categories between 0.24%-74.65%. RD is in the third position with contributions ranging from 1.94%- 17.01% and dominated by the "very poor" category. HPKDD variable with the lowest position with the acquisition of a contribution between 0.00%-74.65% so that the "very poor" category dominates it. There is also a 0% contribution to the HPKDD variable that occurs because there are no funds obtained from BUMD deposits, there is no rule states that BUMD must deposit their share of profits in a certain period.

#### D. Analysis the Influence of COVID-19 and Other Determinants on Bogor City's Local Revenue

Multiple regression analysis with dummy variable was used to determine the influence of the eight independent variables, namely Local Tax (PD), Regional Retribution (RD), Results of Separated Regional Wealth Management (HPKDD), Other Legitimate Local Revenue (LLPADS), Number of Population (JP), Inflation (IN), Entertainment Tax (PHi), and Number of Hotel Business Units (JHo) on one dependent variable, namely Local Revenue (PAD) of Bogor City with additional qualitative variables namely conditions before and during the COVID-19 pandemic. Before the model is regressed, several types of tests are carried out, including hypothesis testing, multicollinearity, heteroscedasticity, and autocorrelation, to get the best model.



**TABLE 10. MULTICOLLINEARITY TEST**

<b>lpad</b>	<b>VIF</b>
lpd	1.84
lrd	1.78
lhp added	1.56
llp added	1.58
IN	1.56
ljp	2.76
lphi	3.02
ljho	2.44

The results of this study indicate that the Variance Inflation Factor (VIF) value obtained by each independent variable is very small and the value ranging between 1-5 according to the rule of thumb, so there is no indication of multicollinearity problems (Table 10).

**TABLE 11 WHITE TEST**

<i>source</i>	<i>chi2</i>	<i>p-value</i>
<i>heteroskedasticity</i>	33.00	0.418
<i>skewness</i>	12.14	0.206
<i>kurtosis</i>	0.13	0.722
<i>total</i>	45.27	0.337

Heteroscedasticity test using the White Test, the results provide information based on the chi2 statistic obtained a p-value greater than 5%, so it does not reject H0 or insignificant, so there is no indication of heteroscedasticity (Table 11).

**TABLE 12 DURBIN WATSON TEST**

Number of gaps in sample	= 6
Durbin-Watson d-statistic (9, 33)	= 1.262

The results of the autocorrelation test using the Durbin Watson test counted as many as 33 observations due to the 15 periods of HPKDD's realization is 0 rupiahs. The statistical results are 1.262 (Table 12) which close to number two, so there may be no autocorrelation problem. When compared with the critical value from the Durbin Watson table, this number also enters an area that is free from autocorrelation.

**TABLE 13 BREUSCH-GODFREY TEST**

<i>lags</i>	<i>chi2</i>	<i>df</i>	<i>Prob&gt;chi2</i>
1	1.318	1	0.251

After being strengthened using the Breusch-Godfrey Test, the results show that with the hypothesis H0: there is no autocorrelation, the value of the p-value is more than 5%, which is 0.251 (Table 13), which means it does not reject H0 so there is no indication of autocorrelation. After performing various Classical Linear Regression Model Assumption Tests, the best model obtained is that there are eight independent variables and one dependent variable, which is converted into its natural logarithm, except for the inflation variable, which is already in percent (%) and one qualitative variable is used, namely the dummy variable with consideration of two conditions (condition 0 before COVID-19 and condition 1 during COVID-19).

The estimation results in the ANOVA (Analysis of Variance) table show that the R2 = 0.897 value is obtained, which means that 89.7% of the diversity of the dependent variable can be explained by the independent variable, while the other 10.29% is explained by other variables outside the model. There is an F-statistic value of 0.000 and it is smaller than  $\alpha=5\%$  or significant. This value means that there is at least one independent variable that has a significant effect on the dependent variable, meaning that the eight independent variables simultaneously have a significant effect on the dependent variable (PAD).

Table 14 shows that from eight independent variables, four variables are significant at the 5% level of significance, namely local taxes, LLPADS, inflation, and population. The coefficient with a positive sign means that the independent variable has a positive relationship or is in the same

direction as the dependent variable. There is only one independent variable, population, who have a negative relationship with Bogor City's Local Revenue.

TABLE 14. RESULTS OF MULTIPLE LINEAR REGRESSION ANALYSIS WITH DUMMY VARIABLE

lpad	Coef	P >   t
lpd	0.777	0.000
lrd	0.186	0.139
lhpkdd	0.024	0.156
lllpads	0.164	0.000
in	0.304	0.044
ljp	-5.329	0.042
lphi	0.005	0.894
Ljho	1.942	0.290
covid during	0.072	0.685
Cons	47.409	0.079

#### COVID-19

PAD of Bogor City is not influenced by COVID-19; it begins with adjustments to a pandemic where the local government implements many policies that limit people's movement, especially in the economic sector, namely PSBB (Large-Scale Social Restrictions). When the PSBB period ended, Bogor City's Government decided to start the pre-Adaptation to New Habits or New Normal phase, with the PSBB rules still being implemented. When Bogor City entered the 1'st level of PPKM (Implementation of Restrictions on Community Activities), economic activity has revived and could operate again even though it is under applicable regulations. Although COVID-19 is an extraordinary disaster, Bogor City is quite adaptive to the conditions that occur and has managed to improve

conditions. With the high productivity of the community, the income also earned increases, resulting in the acquisition of various types of regional income increasing, marked by the growth of all kinds of local revenue in 2021.

#### Local Tax (PD)

PAD of Bogor City is influenced positively by the local tax variable. This result is in line with the initial hypothesis and previous research, which states that the local tax variable with a significant level of 0.000 is below a significance of 0.05 (5%), so it has a significant effect on PAD [19]. The increase in the realization of local taxes will affect the realization of PAD because with the increasing number of taxpayers, both from the hotel, restaurant, entertainment, billboards, street lighting, parking, groundwater, PBB-P2, and BPHTB tax categories, the nominal of local taxes will also be greater. Since local tax is one type of income in PAD, it will directly affect the amount of PAD in Bogor City also supported by looking at the results of the contribution analysis, which shows that local taxes are included in the "very good" category because the contribution's value more than 50% annually from 2018-2021.

#### Regional Retribution (RD)

PAD of Bogor City is not influenced by regional retribution. This result is in line with the initial hypothesis and previous research, which states that the significance value of regional retribution is 0.681, which means that the regional retribution variable has no significant effect on PAD in North Luwu Regency [20]. The increase in the realization of regional retribution will affect the realization of PAD because with the increasing number of mandatory retributions from public services, business services, and certain permits, the nominal regional retribution paid will also increase, so that when regional retribution increase, it will be directly proportional to the increase in PAD. Although regional retribution is one type of income in PAD, it will also affect the amount of PAD

in Bogor City. In reality, regional retribution doesn't affect Bogor City's PAD, supported by looking at the results of the contribution analysis, which shows that regional retribution is included in the "very poor" category because the contribution's value ranging between 0.00%-10% annually from 2018-2021.

#### Results of Separated Regional Wealth Management (HPKDD)

PAD of Bogor City is not influenced by the results of separated regional wealth management (HPKDD). This result is in line with the initial hypothesis and previous research [21], with the results of the Result of Separated Regional Wealth Management (HPKYD) variable having no significant effect on PAD because it has a significant value of 0.452. The increase in the realization of HPKDD will affect the realization of PAD because with the increasing share of profits distributed to local governments on BUMD capital participation from financial institutions, various businesses, and drinking water companies, the nominal HPKDD obtained will also increase, so that when HPKDD increases, will be directly proportional to the rise in PAD. Since HPKDD is one type of income in PAD, it will also affect the amount of PAD in Bogor City. In reality, HPKDD doesn't affect Bogor City's PAD, supported by looking at the results of the contribution analysis, which shows that HPKDD is included in the "very poor" category because the contribution's value ranging between 0.00%-10% annually from 2018-2021.

#### Other Legitimate Local Revenue (LLPADS)

PAD of Bogor City is influenced positively by other legitimate local revenue (LLPADS). These results are in line with the initial hypothesis and also previous research, which states that based on the results of the t-test, other variables of legitimate income have a significance value of  $0.01 < 0.05$ , so that partially, this variable has a significant effect on PAD Bandung Regency [22]. LLPADS consists of several sources of income, namely the proceeds from the sale of Regional

Property (BMD) which are not separated, the proceeds from the sale of equipment and machinery, the proceeds from the utilization of BMD that are not separated, demand deposits, receipts for claims for regional financial compensation, receipts of commissions, discounts, or other forms of income, other fine income for delays in the implementation of work, local tax fines, regional retribution fines, income from returns, Regional Public Service Agency (BLUD) revenues, fines for termination of BMD goods, fines for terminating BMD leases, and fines for violations local regulation.

The increase in the realization of LLPADS will affect the realization of PAD because LLPADS is one type of income in PAD; it will directly affect the amount of PAD in Bogor City. It is also supported by looking at the results of the contribution analysis, which shows that LLPADS is included in two categories, namely "good enough" because it is in the contribution value between 30.10% - 40% in 2020-2021 and the "currently" category because the contribution's value ranging between 20.10% -30% from 2018-2019.

#### Population (JP)

PAD of Bogor City is influenced negatively by the population. These results are in line with previous research, which states that the t-test results say that the population variable (X2) had a negative and significant effect on Denpasar City's Local Revenue (PAD) from 1997-2011 [23]. However, this is not the same as the initial hypothesis, which assumed that the population positively affected PAD in Bogor City. Based on [24], the population in Bogor City (2018-2021) has consistently increased. Still, in 2020 the COVID-19 pandemic caused the number of unemployed to increase due to many workers who were temporarily laid off and even laid off (PHK/Termination of Employment Relations). High unemployment rates characterize workers who are unemployed or affected by layoffs. The influence of the increasing unemployment rate is that the

community does not have a fixed income anymore, and some others experience salary cuts so that public consumption will be low on goods and services that are the object of local taxes and regional retribution. This decrease can cause PAD to decrease. So, although the population is high, it does not make PAD also increased because of the economic influence felt due to the pandemic that occurred, also caused by a lack of public awareness in paying taxes/other mandatory contributions, or even people prefer to buy goods that are primary so that taxes payment has been postponed.

#### Inflation (IN)

PAD of Bogor City is influenced positively by inflation. This result is in line with the initial hypothesis and previous research, which states that the inflation variable has a positive and significant impact on the level of Local Revenue by using  $\alpha = 5\%$  with a coefficient value of 0.048 [25]. When the money supply increases, the price of goods, in general, will increase. In this case, the beneficiary parties are producers with businesses that will earn higher incomes than the increase in production costs caused by inflation. Thus, producers will tend to increase production in the hope that more revenue will be obtained, especially the production of basic needs, which are the primary needs of each individual so that they will continue to buy them even though prices increase, people's purchasing power does not decrease, when the income of entrepreneurs increases, their ability to pay taxes is also high so that the PAD of Bogor City will increase. Another factor is also caused by the inflation rate of Bogor City, which is included in the light category.

Based on monthly inflation data in Bogor City for 2018- 2021, when calculated using the y-o-y (year on year) method, the results obtained are that the inflation rate for Bogor City from 2018- 2021 is always less than 10% annually [26]. The relationship with high inflation will cause significant obstacles to the acquisition of regional income; besides that, it will

affect the level of economic productivity in the community, but low inflation will have a positive influence on PAD [27].

#### Entertainment Tax (PHi)

PAD of Bogor City is not influenced by the entertainment tax. This result is in line with the initial hypothesis and previous research, namely the p-value of 0.517, so the entertainment tax does not affect the Local Revenue of Regency/City Governments in East Java in 2011-2018 [28]. The entertainment tax is one type of local tax, so the realization of the entertainment tax will also affect PAD. But in reality, the entertainment tax in Bogor City has a tiny contribution to Bogor City's PAD with a very low number ranging between 0.00%-10%, which 3.37% in 2018, 3.25% in 2019, 1.25% in 2020, and 0.56% in 2021.

So that it is included in the "very poor" category and its realization continues to decrease from 2018-2021. Hence, the entertainment tax does not influence Bogor City's Local Revenue.

#### Number of Hotel Business Units (JHo)

The number of hotel business units is lodging/resting service provider facilities, including other related services for which a fee is charged. The increase in the number of hotel business units will affect the hotel tax earned annually. Hotel tax, which is one component of local taxes, when increases, will also affect the amount of local taxes, which are one type of income in PAD. Based on [29], the number of hotels in Bogor City has increased annually, (2,816 units in 2018, 2,893 in 2019, 2,947 units in 2020, and 2,992 units in 2021. But in reality, the number of hotel business units that continues to increase does not make hotel taxes also increase. The hotel tax in Bogor City has a tiny contribution to Bogor City's PAD with a very low number, ranging between 0.00%-10% with 9.63% in 2018, 9.39% in 2019, 5.69% in 2020, and 6.2% in 2021

so that it is included in the "very poor" category and its realization continues to decrease from 2018-2021. Hence, PAD of Bogor City is not influenced by the number of hotel business units. This result is in line with the initial hypothesis as well as previous research which states that the number of hotels variable has a probability value of 0.2209 so it is not proven to have a significant effect on PAD in the tourism sector [30].

#### IV. CONCLUSION AND SUGGESTION

PAD of Bogor City is not influenced by COVID-19, which is indicated by the insignificant p-value of the estimated results obtained. Comparison of targets and realizations before and during COVID-19 has increased, but COVID-19 and the policies for providing incentives/stimulus have resulted in adjustments to the targets and realization of Bogor City's PAD in 2020 which decreased, but Bogor City's PAD during COVID-19 in 2021 managed to become the largest realization in the 2018-2021 period.

The effectiveness of PAD and the four types of income in it in conditions before and during COVID-19 are not much different because they are included in the "very effective" and "effective" categories. The biggest average contribution is Local Taxes in the "very good" category, Other Legitimate Local Revenue which are Legitimate with the "currently" and "good enough" categories, Regional Retribution and Results of Separated Regional Wealth Management with the "very poor" category.

PAD of Bogor City is influenced negatively by Population (JP) variable, and influenced positively by the Local Tax (PD), Inflation (IN), and Other Legitimate Local Revenue (LLPADS) variables. While PAD is not influenced by the Regional Retribution (RD), Results of Separated Regional Wealth Management (HPKDD), Entertainment Tax (PHi), Number of Hotel Business Units (JHo), and COVID-19.

The suggestion that can be submitted is the Bogor City's Government is expected to be able to maintain and increase Bogor City's PAD so that it grows positively in the next period both from the target and its realization, namely by utilizing the regional potential from various incomes in PAD which will have an influence on the amount of regional revenue, so that it can be used as a reference by other regional governments in exploiting the potential of their respective regions.

As a manifestation of the implementation of regional autonomy, the Bogor City's Government is expected to implement various interventions to increase the realization of PAD, namely by reinforcing rules/policies that require the community to pay dues, conducting socialization on the importance of paying taxes and other mandatory contributions so that awareness increases, also accompanied by improve the quality of public services to facilitate the payment of the mandatory fee transactions. In this study, the influence of PAD in Bogor City can only be seen from eight independent variables, so it is hoped that future research can use other relevant additional variables in analyzing its influence on PAD.

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# Understanding the Predictors of Actual Use Behavior of Medical Devices among Kenyans post-COVID-19. The Moderating Effects of Technology Anxiety and Resistance to Change

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## ABSTRACT

COVID-19 has provided a solid basis for the diversification of healthcare delivery by incorporating medical technologies into healthcare, especially in developing countries. However, knowledge on the predictors of actual use behavior of medical technologies post-COVID-19 remains scarce. This study, therefore, seeks to provide an overview of the determinants of actual use behavior (AUB) of medical devices among Kenyans post-COVID-19 by using the extended Unified Theory of Acceptance and Use of Technology (UTAUT2) model. Data were collected from the people of Kenya using structured questionnaires. Two hundred and twelve (212) responses were used for the analysis by applying the Partial Least Squares based on Structural Equation Modeling. The results showed a significant positive relationship between FC and AUB ( $p < 0.000$ ). Other predictors such as social influence, effort expectancy, and resistance to change were also found to significantly impact the actual use behavior of medical devices among Kenyans post-COVID-19. Although the relationship between technology anxiety and actual use behavior was not significant in this study, it had a negative impact, influencing the actual use behavior of medical devices. Based on the findings of this study, stakeholders need to create the necessary conditions to facilitate the adoption and use of medical devices, as this will boost the adoption and utilization of medical devices, which will help improve the quality of life among Kenyans post-COVID-19.

**Keywords** : Medical devices, Actual use behaviour, Extended UTAUT, Post-COVID-19, Kenya

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## I. INTRODUCTION

With recent technological advancements and the COVID-19 pandemic crisis, new healthcare innovations, such as medical devices (MEDs), have generated a surge of enthusiasm among healthcare technology users [1]. Users are looking for technology and devices that can facilitate and meet their demands to instantly and precisely depict their health condition [2]. Medical devices (MEDs) have significantly improved over time, and COVID-19 has partly accounted for that. Medical devices play an integral role in delivering healthcare services, and as a result, it is becoming increasingly critical for providing efficient healthcare delivery services post-COVID-19. According to World Health Organization (WHO) [3], having access to suitable medical devices and proper care is of utmost importance. However, the COVID-19 pandemic situation compels the public and health professionals to adopt and use medical devices. In addition, the use of medical devices increased public awareness of the "Digital Health" movement [4].

In 2019, Kenya was named one of the fastest-growing economies in Sub-Saharan Africa, with an annual growth of 5.7% [5] and proceeding with new technology in the IT sector [6], the use of health technology is not at the experts' expected rate [7]. Hence, a low-resource country such as Kenya, with a critical healthcare workforce shortage, can be equipped with medical devices [8], which can help deliver fast and efficient healthcare post-COVID-19. Moreover, going out has become a health-related problem due to the contagious nature of COVID-19, such as consulting with a physician, medical devices can be adopted and utilized by individuals to provide a proper solution from a distance. Although innovative strategies for healthcare delivery, such as the utilization of medical devices, is not a new concept, it has taken on a whole new meaning that healthcare providers are becoming more dependent on medical devices post the pandemic. On the other hand, the public is becoming conscious about

their health in this pandemic because the likelihood is very high of being affected by COVID-19 if going out of home is regular and careless. This can change the behavior of the public regarding receiving healthcare at healthcare facilities. They can access healthcare in the comfort of their homes using technology instead of going out if the necessity for going out is health-related.

It is believed that a better understanding of how individual adoption choices are formed will significantly affect the actual use behavior of medical devices post-COVID-19. Therefore, this study aims to provide an overview of the determinants of actual use behaviors of medical devices among Kenyans post-COVID-19 by applying the extended UTAUT model.

## II. Theoretical Basis and Conceptual Framework

### A. Extended UTAUT Model

The Extended unified theory of acceptance and use of technology (UTAUT) serves as this study's theoretical cornerstone and framework. In contrast to the UTAUT model, which describes user intents to utilize an information system and subsequent use behavior, numerous additional research has used the expanded UTAUT model to explain their hypotheses on various modes and mediums of technological adoption [9-11]. For example, some of these studies have extended the model to assess the influence of online social support on network information technology usage [12], to evaluate individual adoption of social networks in organizations [13], and to study the determinants of acceptance of mobile learning in other jurisdictions [14-17]. The extended UTAUT is made up of four traditional UTAUT antecedents: effort expectancy, performance expectancy, facilitating condition, and social influence. These antecedents determine both actual use behavior and behavioral intention to adopt technology, such as medical devices [9]. To comprehend the study question, each dimension of the extended UTAUT model was examined in this study.

*Performance Expectancy (PE)*: According to the model's proponents, the performance expectancy construct helps assess how individuals believe that using a particular system will help them attain the desired goals in their job performance [17-19]. Using this construct as part of the tools to determine the actual use behavior will be very beneficial, as COVID-19 has made individuals avoid social contact and hence avoid visiting hospitals until an emergency. Therefore, individuals would have to believe that using medical devices will improve their health without necessarily visiting the hospital. Thus, we posit that;

**Hypothesis 1 (H1)**. PE positively impacts behavioral intention to use medical devices post-Covid-19.

*Effort Expectancy (EE)*: An important concept in determining users' intentions, effort expectancy is "the degree of ease associated with the usage of the system." It is derived from the TAM component known as perceived ease of use (PEOU) [18-20]. For any system to be used effectively to meet the needs of its users, the degree of perceived difficulty associated with using such a system is critical. Thus, it is imperative to determine how users perceive the degree of difficulty related to the use of medical devices. Due to the infectious nature of COVID-19, it's best to stay indoors, which motivates one to learn how to operate medical devices and how useful they can be during such a time. **Hypothesis 2 (H2)**. EE positively impacts behavioral intention to use medical devices post-Covid-19.

*Social Influence (SI)*: Another essential construct in the extended UTAUT model is the social influence (SI) construct. According to Venkatesh et al., 2003, SI measures how strongly system end users think their friends, family, and society believe they should utilize the system. [18, 21]. In highly collective countries where a sense of community is embedded into the socialization process of citizens, the opinions and advice of family members, friends, and society are considered relevant and play a significant role. These opinions ultimately influence the decision-making process of whether or not to adopt medical devices.

Previous studies have shown that the behavior of others in a user's social and work circles significantly impacts that end user's use of technology [22-24]. This has changed during the post-COVID-19 era since there has been a need to stay indoors and avoid social contact. Therefore, it's critical to assess if SI will still affect actual usage behavior post-COVID. As a result, this study suggests that:

**Hypothesis 3 (H3)**. SI positively impacts behavioral intention to use medical devices post-Covid-19.

*Facilitating Conditions (FC)*: People's perceptions of institutional and technological facilities that support system usage create facilitating conditions in the extended UTAUT [18, 25]. This construct comprises project communication, shared system belief, and training and support. According to research, enabling factors influencing actual technology usage behavior include a person's intellectual and cognitive aptitude and the perceived cost of learning new technologies. [7, 9, 26]. Due to the contagious nature of COVID-19, it is almost impossible to attend gatherings (training sessions) or seek help from health professionals on how to operate medical devices. The impact of enabling circumstances on behavioral intention and actual usage of medical devices post-Covid-19 is thus examined in this study in four essential areas. This design will also aid in evaluating whether individuals will have access to the needed information, resources, and experience required to allow them to utilize medical devices post-Covid-19 and the compatibility of such devices with other technologies they use.

**Hypothesis 4 (H4)**. FC positively impacts behavioral intention to use medical devices post-Covid-19.

**Hypothesis 5 (H5)**. FC positively impacts the actual use behavior of medical devices post-Covid-19.

*Technology Anxiety (TA) and Resistance to Change (RC)*: Technology anxiety, which individuals feel due to using technology, is an adverse affective, emotional reaction, or fear of discomfort [9, 27]. Therefore, it is crucial to examine how this anxiety affects adoption decisions. Furthermore, it has been discovered that

resistance to change reduces the desire to use technology [9, 28]. The anxiety that comes with being infected with Covid will compel the use of medical devices if it will improve their health and aid them in not contracting the disease. The study, therefore, proposes the following hypotheses:

**Hypothesis 6 (H6).** RC has a negative impact on the actual use behavior of medical devices post-Covid-19.

**Hypothesis 7 (H7).** TA has a negative impact on the actual use behavior of medical devices post-Covid-19.

*Behavioral Intention (BI):* In several disciplines, there is evidence linking behavioral intention (BI) and actual use behavior (AUB), proving that BI is a reliable predictor of AUB [29-31]. Empirically, the behavioral intention construct has been tested and found to explain the user's actual use behavior of technology [18]. According to research by Han et al. on physicians' behavioral intentions about the use of mobile technology, actual use behavior (AUB) impacts physicians' behavioral intentions to utilize mobile health technology [32]. There is a need now to avoid frequent hospital visits due to COVID-19, which has created the intention that one can use medical devices at home to monitor their health. Adopting this design will make it easier to understand how it affects medical device users' actual usage behavior post-Covid-19. This research suggests that:

**Hypothesis 8 (H8).** BI positively impacts the actual use behavior of medical devices post-Covid-19.

*Moderating Effect:* TA and RC were used as moderating constructs to test their significance on the actual use behavior post-Covid-19 as posited below:

**Hypothesis 9 (H9).** RC will negatively moderate the effect of BI on the AUB of medical devices post-Covid-19.

**Hypothesis 10 (H10).** TA will negatively moderate the effect of BI on the AUB of medical devices post-Covid-19.

1. *Conceptual Framework:* A conceptual framework was developed based on an extant literature review and posited hypothesis, as shown in Figure 1.

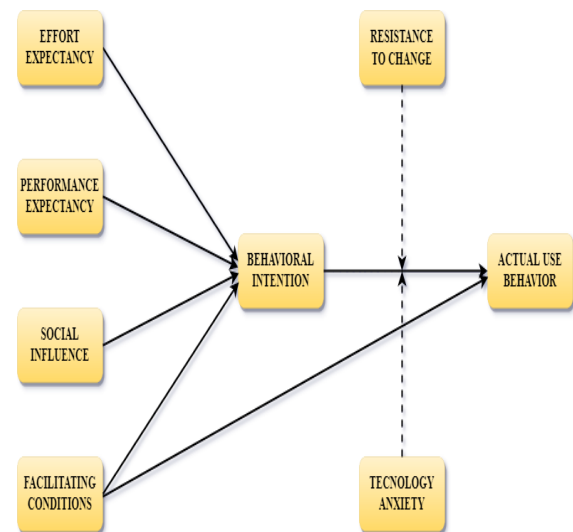


Figure 1. Conceptual framework

### III. METHODOLOGY

#### A. Questionnaire Design and Data Collection.

A structured questionnaire was developed in English using Google Forms, an online portal for creating surveys. English was chosen because the research participants (Kenyan) were from English-speaking sub-Saharan African countries. The criteria used to select research participants were: being a citizen of Kenya and their availability and willingness to take the survey. Respondents were informed that participating in the study had no risks and that their answers would remain entirely anonymous. To prevent difficulties with bias in the replies, the questions asked were closed-ended. The survey's purpose, the requirements to be a respondent, and an internet link to the survey were all included in the introduction of the questionnaires that were sent to participants via social media platforms and emails. Additionally, the researchers' contact information was included so that respondents may get in touch with them if they had any additional inquiries about the study.

The questionnaire was divided into two parts, with the first part containing demographic information; age, gender, educational level, marital status, monthly income, and medical device use. A 5-point Likert scale

with responses ranging from (1) "strongly disagree" to (5) "strongly agree" was used in the second portion of the questionnaire to gauge respondents' opinions on the various extended UTAUT model components that were provided in the research model. Missing values, outliers, and normality were assessed to ensure the data quality for further analysis. Received responses were 236, out of which 24 were excluded due to missing values, leaving 212 for further analysis. For statistical analysis such as structural equation modeling (SEM), a sample size of 200 is considered fair and 300 as good [33]. Hence, the sample size of 212 meets these requirements and is significant enough to obtain robust results after analysis. Questionnaire compositions were adapted from literature sources are indicated in Table 1.

Table 1. Measurement Instruments

Users' (Kenyans) Perception	Number of Questions	Notations	Literature Sources
Behavioral intention (BI)	3	BI1-BI3	[31, 32]
Effort expectancy (EE)	3	EE1-EE3	[17, 34]
Facilitating conditions (FC)	4	FC1-FC4	[17]
Performance expectancy (PE)	3	PE1-PE3	[29, 34, 35]

Resistance to Change (RC)	3	RC1-RC3	[17, 34]
Social influence (SI)	3	SI1-SI3	[17, 29, 34]
Technology Anxiety (TA)	3	TA1-TA3	[12]
Actual use behavior (AUB)	3	AUB1-AUB3	[30]

*B. Data Analysis.*

Data from the questionnaire were exported from the online database of Google Forms into Microsoft Excel for statistical analysis. The data analysis consisted of both exploratory and confirmatory analyses to validate the reflective measurement model [36]. The exploratory/descriptive analysis was performed on the data using Statistical Package for the Social Sciences (SPSS) software. This is to ensure the data meet the initial requirement for it to be used for SEM. The partial least squares (PLS) method, a statistical analysis technique based on the SEM, was used to test and validate the proposed model and the relationships between the hypothesized constructs due to its robustness of estimations and statistical power [27]. SmartPLS4 software was used to analyze the data [28] due to its ability to provide results for all variables, regardless of whether they have metric, quasi-metric, ordinal, or categorical scales (e.g., binary coded) [37].

**IV.RESULTS**

*A. Descriptive statistics.*

Frequencies and percentages were calculated for the demographic variables: age (years), gender, marital status, level of education, monthly income, and usage of medical devices, as presented in Table 2.

Table 2 : Sample demographic characteristics

Variables	Frequency (n=212)	Percentage (100%)
<b>Gender</b>		
Male	121	57.08

Female	91	42.92
<b>Age range</b>		
<18	1	0.47
19 to 29	85	40.09
30 to 39	81	38.21
40 to 49	31	14.62
50+	14	6.60
<b>Educational Level</b>		
Pre-primary education	0	0.00
Primary education	0	0.00
Junior secondary education	2	0.94
Secondary secondary education	32	15.09
College/pre-university/university education	119	56.13
Post-graduate education	59	27.83
<b>Marital Status</b>		
Never married	107	50.47
Married	92	43.40
Divorced/Separated	6	2.83
Widow/Widower	7	3.30
<b>Monthly Income</b>		
Less than KES12,000 (\$100)	39	18.40
KES12,001-KES60,000 (\$100-\$500)	70	33.02
KES60,001-KES120,000 (\$501-\$1,000)	37	17.45
KES120,001-KES180,000 (\$1,001-\$1,500)	33	15.57
KES180,001-KES240,000 (\$1,501-\$2,000)	25	11.79
Above KES240,000 (\$2,000)	8	3.77
<b>Medical Device Usage</b>		
Yes	146	68.87
No	66	31.13

### B. Evaluation of Measurement Model.

The measurement model's outer loadings, internal consistency reliability, convergent validity, and discriminant validity were examined <sup>[38, 39]</sup>, as presented in Table3. The outer loadings for all constructs showed values greater

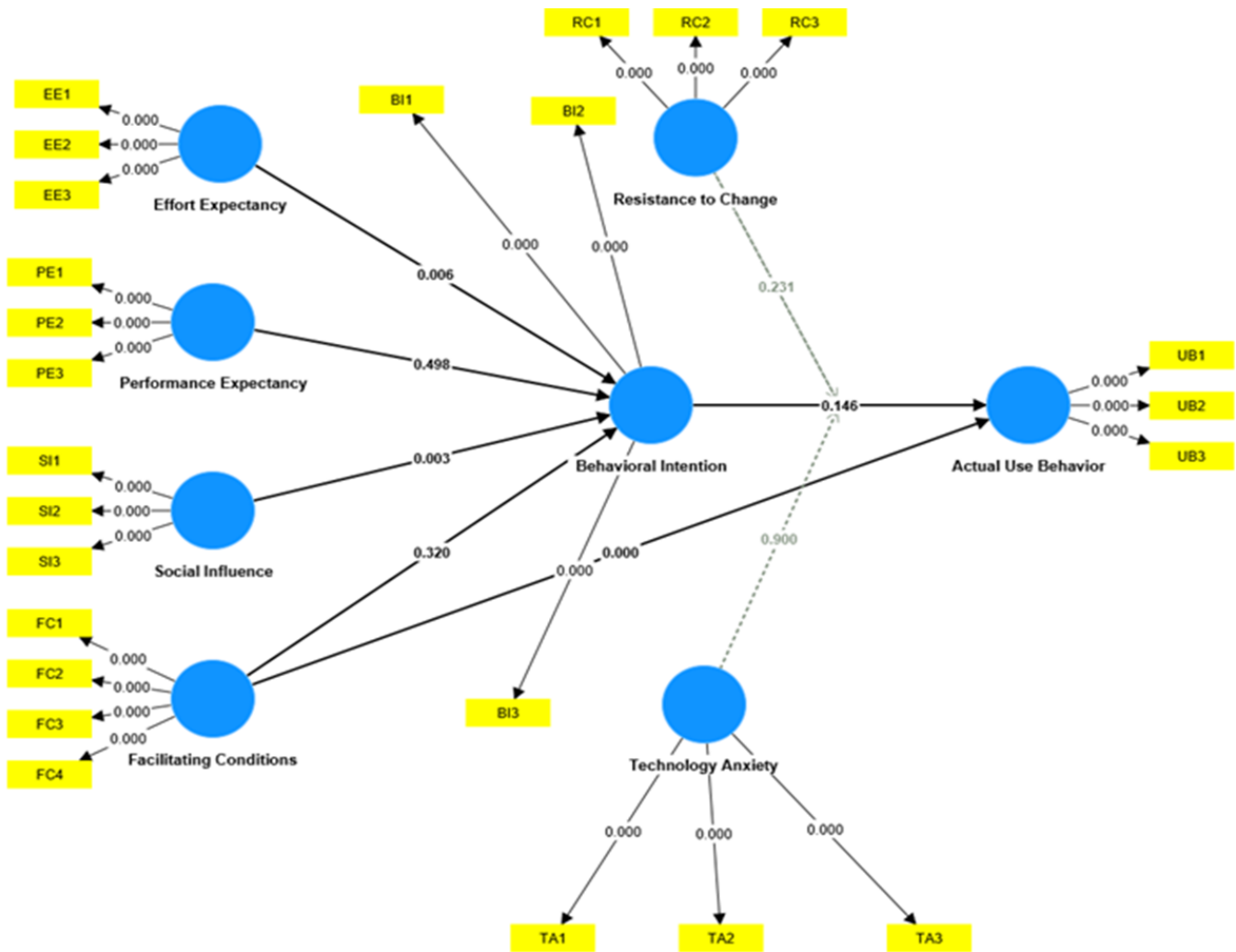
than the acceptable threshold of 0.70. Composite reliability and Cronbach alpha ( $\alpha$ ) values for all the constructs were greater than 0.70, suggesting strong internal consistency reliability [40]. Finally, the convergent validity was assessed by an average variance extracted (AVE) and the factor loadings of the constructs. AVE values were all above the recommended level of 0.50 [39], as shown in Table3.

Table 3: Measurement model

Constructs	Notation	Convergent Validity		Internal Consistency	
		Outer Loading	AVE	$\alpha$	CR
Behavioral Intention	BI1	0.909	0.838	0.903	0.903
	BI2	0.934			
	BI3	0.903			
Effort Expectancy	EE1	0.894	0.792	0.869	0.878
	EE2	0.915			
	EE3	0.861			
Facilitating Conditions	FC1	0.860	0.701	0.857	0.868
	FC2	0.874			
	FC3	0.753			
	FC4	0.857			
Performance Expectancy	PE1	0.874	0.806	0.879	0.884
	PE2	0.925			
	PE3	0.894			
Resistance to Change	RC1	0.905	0.862	0.920	0.959
	RC2	0.957			
	RC3	0.810			
Social Influence	SI1	0.863	0.740	0.824	0.834
	SI3	0.904			
	SI4	0.810			
Technology Anxiety	TA1	0.856	0.783	0.870	0.962
	TA2	0.895			
	TA3	0.904			
Actual Use	AUB1	0.852	0.661	0.742	0.742
	AUB2	0.811			
	AUB3	0.773			

Figure 2: shows the various constructs with their respective loadings.

Table 4: Structural model.



C. Evaluation of Structural Model.

The collinearity assessment (variance inflated factor (VIF)), path coefficient ( $\beta$ ), t-statistics, coefficients of determination ( $R^2$  values), and effect size ( $\eta^2$  values) were used to evaluate the structural model. VIF shows all the latent variables have a VIF less than 5; therefore, the model has no collinearity problem [41]. The hypothesized relationship between constructs was assessed using the path coefficient ( $\beta$ ). All the constructs had a strong positive relationship. The p-values of some of the relationships between the various constructs were significant at  $p < 0.001$  or  $p < 0.05$ , except for PE  $\rightarrow$  BI, FC  $\rightarrow$  BI, TA  $\rightarrow$  AUB, BI  $\rightarrow$  AUB, RC x BI  $\rightarrow$  AUB, and TA x BI  $\rightarrow$  AUB which had  $p = 0.25$ , as reported in Table above.

D. Hypotheses Testing.

Results from Table 4 showed EE $\rightarrow$ BI (t-statistics = 2.749, b = 0.296,  $p < 0.006$ ), FC $\rightarrow$ AUB (t-statistics = 6.668, b = 0.559,  $p < 0.000$ ), RC  $\rightarrow$  AUB (t-statistics = 2.749, b = -0.194,  $p < 0.006$ ), SI  $\rightarrow$  BI (t statistics = 2.959, b = 0.406,  $p < 0.003$ ), were significant. Thus, Hypotheses 2, 3, 5, and 6 were supported. However, BI  $\rightarrow$  AUB (t statistics = 1.454, b = 0.158,  $p < 0.146$ ), FC  $\rightarrow$  BI (t statistics = 0.995, b = 0.104,  $p < 0.320$ ), PE $\rightarrow$  BI (t statistics = 0.677, b = 0.077,  $p < 0.498$ ), TA  $\rightarrow$  AUB, RC x BI  $\rightarrow$  AUB (t statistics = 1.197, b = 0.102,  $p < 0.231$ ), and TA x BI  $\rightarrow$  AUB (t statistics = 0.126, b = -0.010,  $p < 0.900$ ) were insignificant, thus not supporting Hypothesis 1, 4, 7, 8, 9, and 10.

## V. DISCUSSION

This study applied the constructs of the extended UTAUT model: performance expectancy (PE), effort expectancy (EE), social influence (SI), technology anxiety (TA), facilitating conditions (FC), and resistance to change (RC) to determine the actual use behavior of medical devices among the people of Kenya post-Covid-19.

The results of this study supported the posited hypotheses concerning effort expectancy (EE), social influence (SI), facilitating conditions (FC), and resistance to change (RC). A previous study found a significant relationship between social influence and behavior intention to adopt wearable devices [9]. Furthermore, a study by Hoque and Sorwar, 2017 on the adoption of mHealth in Bangladesh also observed that social influence (SI) has a significant influence on the adoption and usage of mHealth [7]. These findings are consistent with our current study results. In a highly collective country such as Kenya, where a sense of community is embedded into the socialization process of families, the opinions and advice of other members of society and family are considered relevant and play a significant role in the decision-making process of whether or not to use medical devices [42]. For instance, the three questions posed to determine to what extent individuals perceived that society influences their decision to use or recommend medical devices post-Covid-19 in this study revealed that, though COVID-19 has made family and social gatherings almost impossible, most respondents still agreed that society plays a part in their decision-making process.

The findings confirmed the hypothesis that facilitating conditions (FC) positively influenced the AUB of medical devices post-COVID-19 by demonstrating that FC was one of the factors that explained the most significant amount of variation (t-statistics = 10.351). This finding is consistent with previous studies, which suggested that facilitating conditions, such as an individual's intellectual abilities and perceived cost of

learning new technologies, affect the adoption of technology [26, 43-46]. The ratio of device costs to disposable income, device capabilities, and technical proficiency on the side of individuals may all impact facilitating conditions in the actual use behavior of medical devices. COVID-19 brought about a halt in many jobs that required physical presence to be completed and also caused the lockdown of many cities; hence individuals had to spend their savings without generating new income. In addition, most individuals in developing economies are either living below the acceptable minimum wage or barely making enough income to dispose of excess to procure medical devices for personal use. Hence, stakeholders need to consider investments in strategies that will facilitate the use of medical devices post-COVID-19. In addition, healthcare costs should be remodeled to reduce costs and increase access to these devices.

Despite the positive receptiveness of individuals to medical device adoption, some studies have recorded evidence of negative attitudes toward medical device adoption. For example, a study by Van den Heuvel et al. [47] observed that individuals feel reluctant to accept and use new technology. This position is consistent with our current study, where resistance to change (RC) was significant and had a negative influence on the actual use behavior of medical devices post-COVID-19, as posited. This finding is similar to the position expressed by most researchers that people have a high degree of resistance to change [48]. In addition, studies have revealed that individuals may decline the use of technology due to concerns about the unsuitability of technologies [49, 50]. Due to unrealistic expectations and a need for fulfillment over what they believe medical devices should and can achieve for them, people may exhibit a negative attitude toward the actual usage of medical devices [51]. Health campaigns must be intensified to manage these expectations, and people must be made aware of the advantages of utilizing medical devices more regularly post-COVID-19. Institutions, such as the Kenyan



Ministry of Health (KMOH) and the Kenya Medical Supplies Authority (KEMSA), need to implement and strengthen frameworks that will focus on eliminating exaggerated advertising claims about what medical devices should and can do.

This study further observed that technology anxiety was not significant but negatively impacted the actual use behavior of medical devices post-COVID-19. Though technology anxiety was not significant in this study, attention needs to be given to the role it could play in increasing the use of medical devices post-COVID-19, which explains the inverse relationship from the result; the less anxious one gets, the more likely the person is to use medical devices. Due to the burden associated with using technology, such as frustration, confusion, discomfort, embarrassment, or anxiety [52, 53], most individuals may not be interested in using or recommending medical devices as they get more anxious about it. To increase the actual use behavior of medical devices post-COVID-19, healthcare stakeholders must address the perception that using technology causes discomfort [47, 49] and the fear of becoming unduly dependent on it [54].

Privacy and confidentiality concerns and autonomy concerns are frequently considered to significantly impact the decision to use or not utilize healthcare technology [55]. Therefore, it is crucial to maintain patients' autonomy because losing one's sense of independence might result in infantilization [56], especially during post-COVID-19.

The study had a few limitations as it focused on the adoption and utilization of medical devices post-COVID-19 by individuals and not medical institutions or health professionals who could be abreast with the use and importance of medical device adoption. Future research might thus look at factors that affect how medical devices are adopted and used in the hospital context and by healthcare personnel. Additionally, even though the focus of the current study was not on the particular medical devices Kenyans chose post-COVID-19, future research on this topic will be

valuable. This will then guide future discussions and stakeholders in the healthcare sector in their effort to increase adoption and improve healthcare interventions for the people of Kenya post-COVID-19.

## VI. CONCLUSION

Based on these findings, this study concludes that the actual use behavior of medical devices post-COVID-19 primarily depends on the facilitating conditions faced by the end user. Therefore, stakeholders should develop pricing strategies and technical know-how to boost the adoption and utilization of medical devices post-COVID-19. Furthermore, as social influence impacts behavior intention to use medical devices post-COVID-19, views of persons of influence must be incorporated into the design considerations, ultimately increasing their readiness to recommend these devices. Policymakers and manufacturers must also ensure they create the necessary conditions to facilitate the use of these devices post-COVID-19, for example, making less conspicuous devices, as this has shown to significantly reduce individuals' anxiety about technology use. In addition, they must create more awareness of measures being implemented to safeguard individuals' data and reduce risks associated with using these medical devices post-COVID-19. Furthermore, there is a need for manufacturers (external stakeholders) also to provide reliable and sustainable technical support to users to smoothen their use of these medical devices to allay their fears concerning hacking and data theft without physical contact during post-COVID-19.

**Conflict of interest:** The authors declare that they have no conflict of interest.

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# A Geographical Study on the Effect of Climate on the Concentration of Rice Crop in Bhandara District

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## ABSTRACT

The present study is geospatial modeling in the assessment of environmental resources for sustainable water resource management in a Bhandara district, India, using by geographical information system (GIS) and remote sensing (RS) techniques. The study will be based on secondary data. Secondary data was collected during the time period between are 1971 to 2013. The major crop of Bhandara district is rice, to study its crop concentration the total cultivated area, area under rice crop and index of concentration in each taluk of the district are given in the following table. To illustrate the changes over time, rice concentration figures from 1991 to 2011 are grouped by index and shown in a map. The average concentration of rice in the district in 1991 is moderate with values of 0.86. High concentration of rice crop is found in three taluks namely Mohadi, Tumsar and Sakoli in the district. The values of centralization in this taluka are more than 1.00 and are 1.10, 1.18 and 1.11 respectively. Whereas three talukas namely Bhandara, Pavani and Lakhandur have moderate concentration of rice cultivation. This concentration falls in the range of 0.80 to 1.00. The value of centralization in these taluks is 0.88, 0.85 and 0.94 respectively. In the year 2011, the average high concentration of rice is found in the district and its values are 1.02. Four taluks namely Mohadi, Tumsar, Sakoli and Lakhani have high concentration of rice with values of 1.08, 1.18, 1.08 and 1.12 respectively. Whereas in three taluks namely Bhandara, Pavani and Lakhandur medium concentration of rice is found and its values are 0.91, 0.86 and 0.90 respectively. The data can be used for area management, utilized in restoration and conservation of natural resources studies in the future.

**Keywords :-** Agriculture, Environmental Resources, Sustainable Water Resource Management

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## I. INTRODUCTION

Agriculture is the oldest occupation of human civilization. The most basic human needs like food, clothing, fuel and fodder for animals are met through

agriculture. Agriculture as a profession has developed multifaceted and many practical dimensions have become apparent

[1,2,3,4,5]. Agriculture is one of the most ancient occupations of man. Agriculture means tilling the land

and sowing seeds in it and taking care of the sown seeds and their seedlings to get grain from them [6,7,8,9]. In intensive rice-growing areas of the world, temperatures are high throughout the year and annual rainfall exceeds 200 cm. Rice is cultivated three times a year due to favorable geographical conditions. This method of paddy cultivation is known as 'Savah' farming. Monsoon Asian countries produce about 90% of the world's rice [10,11,12,13,14]. The main rice producing countries are China (30%), India (21%), Indonesia (8.5%), Bangladesh (5.6%), Thailand (3.8%), Vietnam (3.7%), Myanmar (2.5%) and Japan (2.5%). ) are is 2.3%) [15,16,17,18].

In all the above countries, rice is grown in deltaic areas, flood plains, terraces and lowlands. Ganga, Brahmaputra, Irrawaddy Mimang, Sikyang, Yangtiseikyang, lowland and deltaic areas are the main rice producing areas [19,20,21,22,23]. Since it is basic agriculture, it is very important to bring maximum land under irrigation in order to get maximum production from agriculture, irrigation facilities are being developed on a large scale in Bhandara district. Choosing the right irrigation method is very important. The particular method chosen for a farm should be determined by the water retention capacity of the soil. There is no problem in understanding the important stage of management.

## II. STUDY AREA

Geographically, Bhandara district (**Figure 1**) is located in the central part of India, in the eastern part of Maharashtra state, in the interior of the continent away from the ocean and in the central part of the Wainganga river basin [24, 25, 26, 27, 28]. The latitudinal extent of Bhandara region is 20039' North to 21036' North and the longitudinal extent is 79027' East to 80007' East. The north-south length of this region is 103 km. And the east-west length is about 45 km. Bhandara district has a total area of 3779.25 square km. The area is occupied. Bhandara may be a corruption of the word 'Bhanara'. Because in the excavations at Ratanpur AD. In an inscription found in

1100, the term 'Bhanara' is found. A.D. From 1818 to 1890, the region was ruled by royal families. At this time the district headquarters was at 'Lanji'. A.D. During 1827, the headquarters of 'Lanji' was changed to 'Bhandara'. A.D. In 1767 Balaghat district of Madhya Pradesh was created by cutting off a part of Bhandara district. The headquarters of Sangadi taluka in Bhandara district was changed to the headquarters of Sakoli. On 1 May 1999, the newly created Gondia district came into existence by bifurcating the district. Bhandara district is the eastern part of the Deccan Plateau and is isolated by the mining activities of the Wainganga, Kanhan, Maru rivers. In the north of this region are the Ambagad hills, Chandpur hills and Gaikhuri hills in the Satapuda range, in the north-west the Ramtek uplift region, in the west the border of Nagpur district, in the south the Pavani hills and the borders of Gadchiroli and Chandrapur district and in the east the border of Gondia district. Bhandara district includes 7 taluks.

## III. OBJECTIVE

- 1) To observe the effect of rainfall and temperature on paddy crop in Bhandara district.
- 2) To see centralization of paddy crop in Bhandara district.
- 3) To observe the effect of irrigation on various factors affecting the yield of paddy crops.

## IV. DATABASE & METHODOLOGY

These studies are mainly based on secondary materials. For Secondary Information District Gazetteer, District Census Handbook, Social and Economic Review Report, Census District and Regional Statistics Department, Regional Meteorological Center Nagpur, Agriculture Department, Land Survey Department, G.P., Research Papers of Geography Experts, Newspapers, Google Application as well as published by Govt. And unpublished information has been used. Bhatia's (1965) method has been used to derive the index of production concentration. Also, the information obtained has been displayed through maps

and diagrams at appropriate places through scientific methods [29, 30, 31, 32 ].

## V. RESULT

### a) Rationale for study selection:-

Geologically Bhandara district is mainly covered by Archaean rocks. It mainly consists of metamorphic igneous and metamorphic rocks. It includes silt, phyllite, neisses and granite etc. Includes rocks. Alluvial region (**Figure 2**) is found in the areas along the banks of rivers in Lakhandur and Pavani talukas. It is called "Chairas Patta". Bhandara district is known as the district of ponds because the district is irrigated through wells, ponds, large and medium irrigation projects. Wainganga river (**Figure 3**) and its tributaries Bawanthadi, Sur, Chulband, Vagh apart from Ambagad Bodalaksa, Gadhvi, Maru etc. have been used for irrigation since ancient times. Rainfall, temperature and soil are factors that are useful for rice cultivation. The district has suitable temperature and rainfall for the paddy crop and under the crop conservation campaign, seeds are distributed to the farmers of the district under the rice development programme.

### b) Bhandara District : Climate

Climate has a direct effect on geomorphic processes, natural vegetation, cropping systems, human occupations, types of housing, living conditions, etc. Hot and dry summers, cold and dry winters, and extensive rainfall in monsoons are the salient features of the climate of Bhandara and its adjoining region. Winter is from December to February, summer is from March to mid-June, monsoon is from June to September and post-monsoon is from October to November.

The temperature soil (**Figure 4**) rises rapidly from March to May. The monthly average maximum temperature (**Table 1**) rises to 47.50 Celsius in the month of May. In summer, the nights are cool compared to the scorching heat of the day. Afternoon heat is pleasant due to occasional gusts of wind. The climate is very hot and dry as there is no rain during

this period. Also the relative humidity of the air is also low. The average maximum and minimum temperature in May is 47.50 Celsius and 21.60 Celsius respectively. The average daily temperature is around 25.90 Celsius. The monsoon season begins after mid-June and ends by the end of September due to the southwest monsoon. Bhandara region received an average monthly rainfall of 280 mm during this period. It's raining. Due to this, the humidity in the atmosphere increases and the temperature decreases. After June till July the maximum monthly temperature decreases by 100 Celsius. After that, the decrease in maximum temperature decreases in the months of August and September. But the average monthly minimum temperature remains constant throughout the monsoon season.

The weather in Bhandara region is very pleasant as the monthly average maximum (31.80 Celsius) and minimum (9.70 Celsius) temperatures decrease during the winter season from November to February. December is the coldest month. When a cold wave comes from North India, the temperature drops considerably. At that time the minimum temperature drops to 7.40 Celsius.

### Rainfall:-

Rainfall is a very important factor in terms of irrigation. The average annual rainfall (**Table 2**) in Bhandara is 1246 mm. While the median value is 1250 mm. That's it. This shows that it is not significantly different from the average [33, 34]. The table shows the total average of rainfall in 5 years from 2011 to 2015. Bhandara district receives more rainfall than other districts of Maharashtra. The main crop here is paddy (rice). And 70% of agriculture is rain dependent. Total average rainfall for five years in seven districts of Bhandara district was recorded. Considering the total average rainfall in 5 years, Lakhandur taluka has the highest rainfall while Tumsar taluka has the lowest rainfall. Overall, all the seven talukas have recorded more rainfall than the average.

**C) Form of rice cultivation:-**

Rice is a hot and humid subtropical crop. Water and warm temperature are essential for this crop. Growing crops usually: Temperature of 24°C. Rainfall above 1400mm and 1500 to 2000mm Rainfall is required. In addition to this irrigation makes it more beneficial. Soil is an important factor and generally alluvial soil to a depth of two to three feet from the surface and chicken soil below it is excellent for paddy cultivation.

## VI. INDEX OF CONCENTRATION OF RICE PRODUCTION IN BANDARA DISTRICT

Bhatia in 1965 has used the following formula to break down agricultural divisions on the basis of crop density. In this study, the crop concentration of rice crops in Bhandara district has been calculated using the above formula of 'Bhatia'. The major crop of Bhandara district is rice, to study its crop concentration the total cultivated area, area under rice crop and index of concentration in each taluk of the district are given in the following table. To illustrate the changes over time, rice concentration figures from 1991 to 2011 (**Figure 5**) are grouped by index and shown in a map [35, 36, 37, 38, 39]. The average concentration (**Table 3**) of rice in the district in 1991 is moderate with values of 0.86. High concentration of rice crop is found in three taluks namely Mohadi, Tumsar and Sakoli in the district. The values of centralization in this taluka are more than 1.00 and are 1.10, 1.18 and 1.11 respectively. Whereas three talukas namely Bhandara, Pavani and Lakhandur have moderate concentration of rice cultivation. This concentration falls in the range of 0.80 to 1.00. The value of centralization in these taluks is 0.88, 0.85 and 0.94 respectively. In the year 2011, the average high concentration of rice is found in the district and its values are 1.02. Four taluks namely Mohadi, Tumsar, Sakoli and Lakhani have high concentration of rice with values of 1.08, 1.18, 1.08 and 1.12 respectively. Whereas in three taluks namely Bhandara, Pavani and Lakhandur medium concentration of rice is found and its values are 0.91, 0.86 and 0.90 respectively. From 1991 to 2011, the centralization of rice cultivation has

gradually increased and agriculture here is moving towards specialization [40, 41, 42, 43, 44, 45, 46]. As the net cultivated area in Bhandara district has increased over the past 30 years, there has also been a large increase in the irrigated area. As irrigation allows for more than one cropping, there is a greater difference between net and gross cultivated area. The percentage of irrigated area out of net area under crop in Bhandara district taluka wise is shown in the following table. The taluk-wise change in irrigation during the 30-year period from 1981 to 2011 means that in 1981 almost all taluks had less than 50% irrigation. By 2011, the ratio has increased from 50% to 70%. In 1981, the irrigation ratio was less than 50% in most parts of the district. In 1991, there was an increase in the irrigated area of Mohadi Taluka. While some other talukas have increased and decreased (**Figure 6**). During the thirty year period from 1981 to 2011, there has been a progressive increase in the irrigated area, which has definitely had an impact on agricultural productivity.

**d) Impact of Irrigation Project:-**

In the year 2010-11, there are 4 major projects and 4 medium projects in the irrigation sources in the district and their irrigation capacity is 33,659 respectively. and 13,071. That's it. Apart from this, there are 32 projects at the state level and 220 projects at the local level under minor projects and their irrigation capacity is 16425 respectively. And 17835. That's it. Also, there are 19 sub-irrigation projects in the district through which 57962 ha. It has the potential to bring the area under irrigation. Also the total number of K.P. Dams 310 (Kolhapuri style) and thereby 9897. The area has potential to come under irrigation.

**VII. CONCLUSION**

Bhandara district has 589 irrigation projects and its irrigation capacity is 148849. is Only 89759 of them. The area is actually under irrigation. That means 60.30%



area has been brought under irrigation and another 39.70% area is about to come under irrigation.

1) It can be seen that geographical factors soil temperature and rainfall are affected in paddy production in Bhandara district.

2) The average concentration of rice in the district in 1991 is moderate with values of 0.86. In the year 2011, the average high concentration of rice is found in the district and its values are 1.02.

3) During the period 1991 to 2011, the concentration of rice crop has gradually increased and the agriculture here is moving towards specialization.

4) Bhandara district includes talukas with concentration of paddy in the irrigated area.

5) During the 30 year period from 1981 to 2011 in Bhandara district, there has been a progressive increase in irrigated area and its impact on agricultural productivity is evident.

In terms of paddy crops in Bhandara district the following remedial schemes have been given. Adoption of hybrid planting technology and disease management etc. to increase the productivity is orderly. The yield and quality of paddy can be increased by using improved methods using important cultivation formulas.

Table 1: Annual Maximum and Minimum Temperature – 2011 (Temperature in 0C)

Sr.No.	Months	Maximum Temperature	Minimum Temperature	Average Temperature
1	January	31.7	10.9	21.3
2	February	32.7	11.8	22.25
3	March	38.9	13.4	26.15
4	April	43.1	18.2	30.65
5	May	47.5	21.6	34.50
6	June	46.1	21.6	33.85
7	July	36.1	21.8	29.35
8	August	34.8	21.8	28.3
9	September	34.2	21.4	27.8
10	October	35.5	17.4	26.55
11.	November	32.6	8.5	20.55
12	December	30.5	7.4	18.95
	Annual average	37.04	16.33	26.69

Table 2: Average Rainfall - 2011-2015 (Rainfall cm)

Sr. No	Taluke	2011	2012	2013	2014	2015	Average Rainfall
1	Tumsar	948.80	985.60	1499.50	1260.80	1002.70	919
2	Mohadi	955.30	1043.40	1488.80	1260.80	803.70	1110
3	Bhandara	974.90	1216.90	1773.60	1260.80	955.30	1236
4	Sakoli	1186.50	1385.90	1921.80	1399.10	1050.30	1389
5	Lakhani	1027.80	1270.30	2014.00	1451.30	945.80	1342
6	Pawani	1195.70	1304.70	1824.30	1227.40	822.40	1275
7	Lakhandur	1416.60	1553.40	1912.80	1451.30	784.30	1424
	Total	1086.80	1251.50	1809.80	1330.20	909.20	12420

Table 3: Taluka Wise Net Area Under Crop and Total Irrigated Area: 1981-2011

Sr. No.	Taluke	1981			1991			2001			2011		
		pica empty area	Total Irrigated Area	%	pica empty area	Total Irrigated Area	%	pica empty area	Total Irrigated Area	%	pica empty area	Total Irrigated Area	%
1	2	3	4	5	9	10	11	15	16	17	15	16	17
1	Bhandara	32600	9104	27.93	32818	7718	23.52	32715	17186	52.53	33633	23873	70.98
2	Mohadi	32400	10550	32.56	25247	16642	65.92	34399	30745	89.38	39168	26147	66.76
3	Tumasar	29800	14438	48.45	31238	12947	41.45	31198	27127	86.95	29160	19927	68.34
4	Sakoli	31400	16748	53.34	32418	17047	52.58	21827	15305	70.12	19969	14265	71.44
5	Lakhani	-	-	-	-	-	-	-	-	-	24458	12529	-s
6	Pawani	36700	6922	18.86	35461	8097	22.83	33464	14892	44.50	33519	14689	43.82
7	Lakhandur	29500	8247	27.96	30495	7387	24.22	27681	18414	66.52	28461	16735	58.80
Total		192400	66009	34.31	34.31	69838	37.21	181284	123669	68.22	208368	128165	61.51

Table 4: Irrigation potential of projects and area under irrigation : 2010-11 (Area in. Hectars)

Sr. No.	Type of Project	No. of Projects	Irrigation Potential (Area)	Area under Crop
1	Major Projects	4	33659	33659
2	Medium Project	4	13071	13071
3	Small Reservoirs (State Level)	32	16425	13512
4	Small Watersheds (Local Level)	220	17835	16863
5	Upsa Irrigation Scheme (State Level and Local Level)	19	57962	4339
6	Ko. W. Dams (State Level)	1	400	400
7	7 Ko. W. Dams (Local Level)	309	9497	7915
Total		589	148849	89759

### Study Area

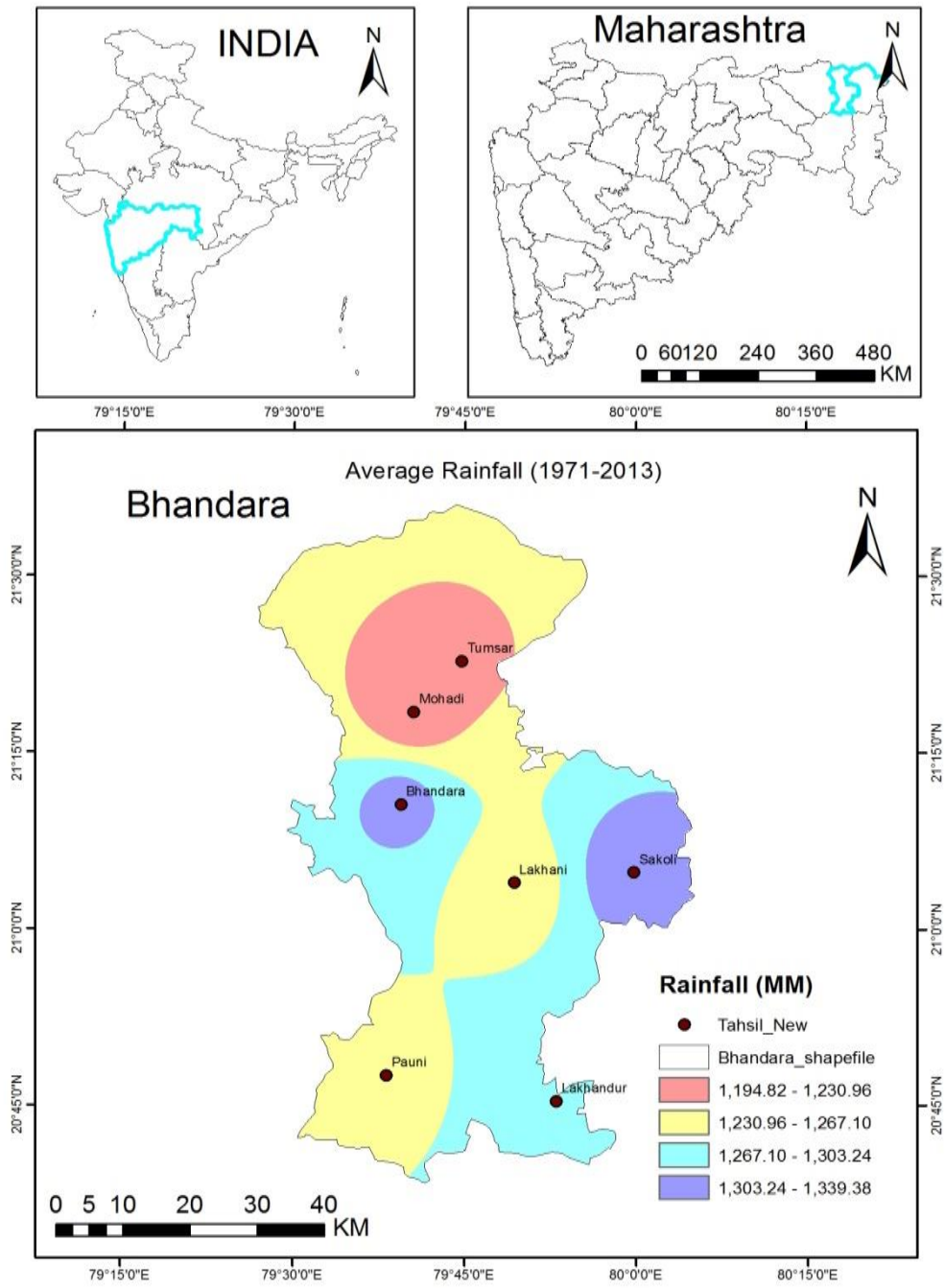


Figure 1: Study area

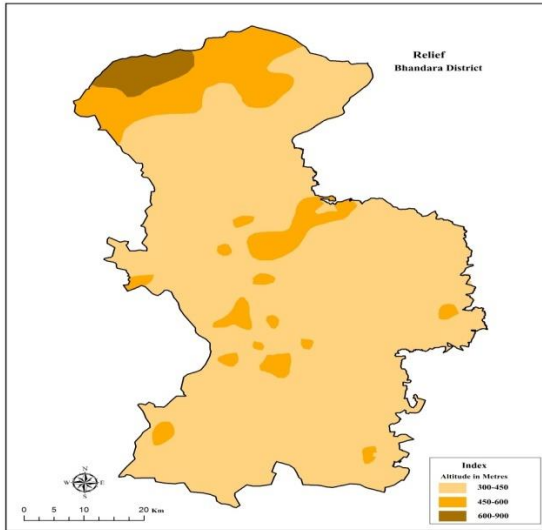


Figure 2: Relief

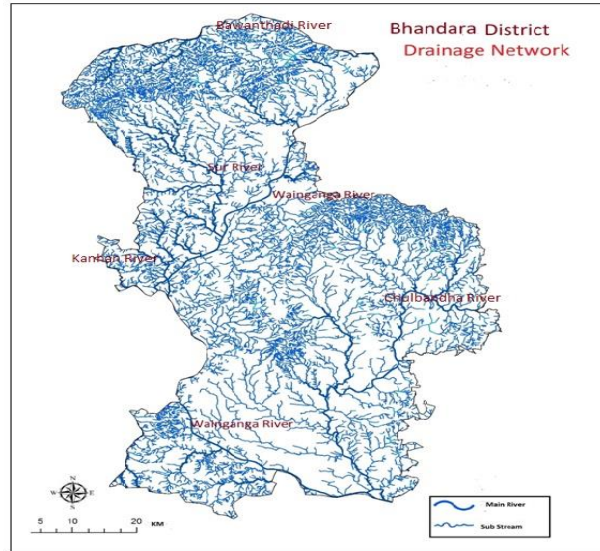


Figure 3: Drainage

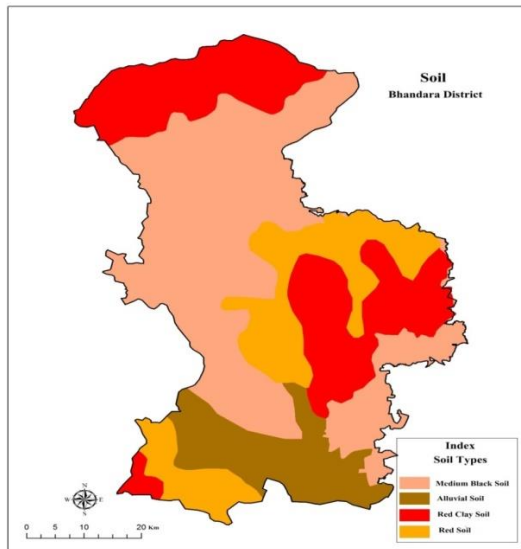


Figure 4: Soil

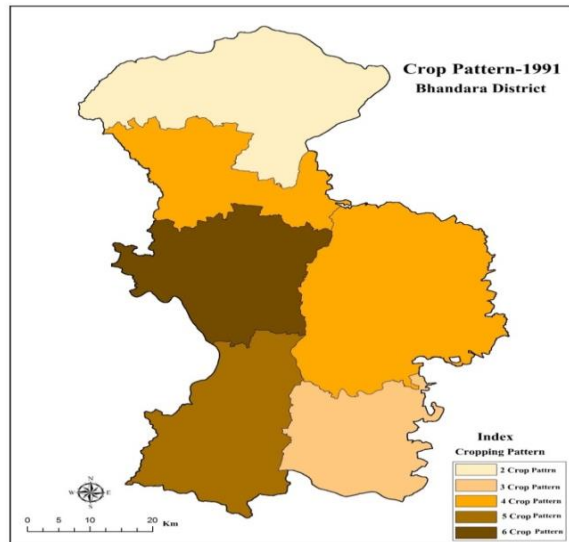


Figure 5: Crop Pattern-1991

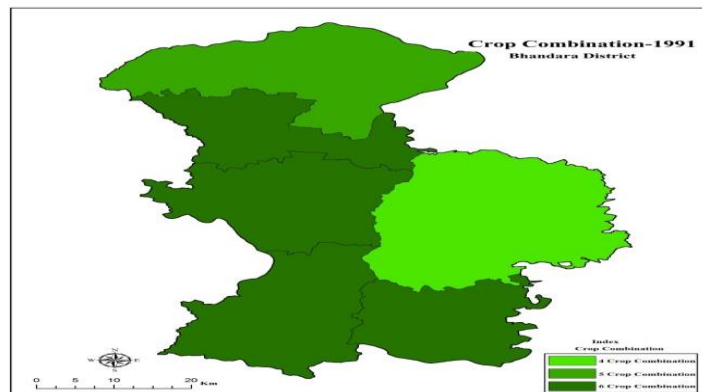


Figure 6: Crop Combination

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# Optimization of Ink Density for the Widest Color Gamut in a Lithographic Printing Process

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## ABSTRACT

In this study, the color gamut of a commercial offset printing system was investigated at different ink densities. The color gamut increases with increasing ink densities. However, there are optimal densities at which the maximum colorfulness of the primary inks and the overprint colors are obtained. The color targets and color gamut agree with ISO 12647-2:2013 standard.

Keywords : Color Gamut, Ink Density, Lithographic Printing, CIE Lab

## I. INTRODUCTION

Density is defined as the ability of a material to absorb light. The reflection density is calculated in densitometers (ANSI/ CGATS.4-1993) by

$$\text{Density}_R = \log_{10} (1/R)$$

Where  $R$  = Reflectance

Density values indicate to the press operator whether the amount of ink should be increased or decreased. This solid ink density directly affects dot gain, print contrast, and apparent trap [1, 2].

Color gamut is the entire range of colors and tones achievable by an imaging system. The color gamut of a printing device is determined by the hue, saturation, and lightness of its cyan, magenta, yellow, and black inks, the brightness, and other characteristics of the substrate on which they are printed [3]. Generally, the color gamut is specified in the hue-saturation plane, as a system can usually produce colors over a wide intensity range within its color gamut. The full-tone of

process inks (cyan, magenta and yellow) and their two color overprints (red, green, and blue) mark the six endpoints of a device gamut, as shown in Fig. 1 [4].

The density impacts the color gamut directly. As the ink amount increases, the color of the ink becomes more vivid and colorful, i.e. the magnitude of the chroma is increased. Once it reaches its full tone, the hue slice becomes less saturated as it darkens. High density is expected to expand the color gamut. However, this case could also cause a shift of color hue and different print defects (drying and such) [4, 5]. In this matter, no rule is applied for every printing process with the ink-substrate-press combination.

The question arises here, how can we optimize the color gamut of a printing process? This study investigated the print density effect to get the widest color gamut for a commercial offset printer.



## II. EXPERIMENTAL

### A. Materials

The investigation was carried out in the CTP workflow. The test form (Fig. 1) was output using AM technology with a resolution of 175lpi. Heidelberg SM 74- printing machine, as shown in Fig. 2.

Offset printing Nippon speed (Cyan - C, Magenta - M, Yellow - Y) inks and Coated paper 100 g/m<sup>2</sup> were used. The printing process was carried out with the ink sequence Black - Cyan - Magenta - Yellow and a speed of 10.000 sph. The variation in the average and range solid ink density values (CMYK) of the printed sheets during the printing process was less than 0.1.

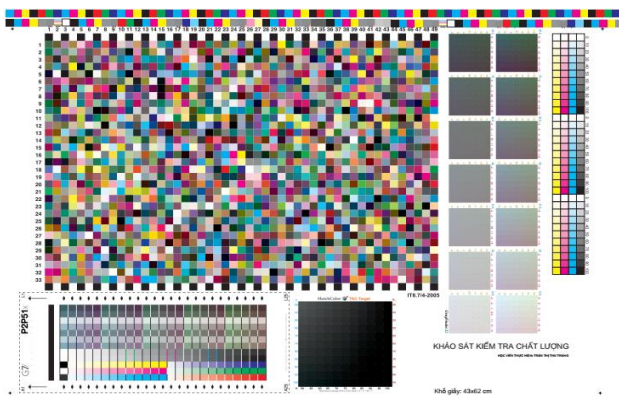


Figure 1: The CMYK test target



Figure 2: Offset printing machine SM74 - 2012

### B. Density and CIE Lab value measurement

The dry densities are measured by an X-Rite SpectroDensitometer 504, Inc. Grandville, MI

The color values were quantified numerically by the CIELAB color model. The CIE Lab values were calculated by an X\_Rite SpectroDensitometer 504, Inc. Grandville, MI. The colour characteristics were calculated in the CIELAB color model by following equations [6].

$$\text{Hue } H^* = \text{artg}\left(\frac{b^*}{a^*}\right)$$

$$\text{Chroma } C^* = \sqrt{a^{*2} + b^{*2}}$$

$$\text{Color difference } \Delta E_{ab} = \sqrt{\Delta L^2 + \Delta a^2 + \Delta b^2}$$

### C. ISO12647-2:2013 standard

The ISO12647-2 standard data sets for PS1 paper [7] were recalculate by SCCA (Substrate Corrected Color Aim) Calculator based on the CIE L\*a\*b\* values of the investigated substrate. The procedure utilizes the tristimulus correction methodology defined in ISO 13655 Annex A for correcting measurements based on two backing materials.

TABLE I

CIE L\*a\*b\* values of ISO 12647-2 substrate corrected

	GRACoL2013 CRPC6 IT8.7-4			Substrate Corrected Results		
	L*	a*	b*	L*	a*	b*
Substrate	95.00	1.00	-4.00	83.43	-2.85	11.18
Cyan	56.00	-37.00	-50.00	48.72	-34.67	-31.37
Magenta	48.00	75.00	-4.00	41.65	63.79	4.78
Yellow	89.00	-4.00	93.00	78.08	-7.05	88.43
Black	16.00	0.00	0.00	14.13	-0.33	2.68
Red	47.00	68.00	48.00	40.76	57.65	44.78
Green	50.00	-66.00	26.00	43.41	-59.36	28.85
Blue	25.00	20.00	-46.00	21.62	15.98	-31.64
CMY	23.00	0.00	0.00	19.92	-0.79	4.03
CMYK	9.05	0.20	0.39	8.74	0.41	1.34
CMY HR	57.46	0.38	-2.03	50.01	-2.02	7.68
K HR	60.40	0.46	-2.59	52.62	-2.07	7.64

### III. RESULTS AND DISCUSSION

#### A. Effect of ink density values on color gamut

In this series of experiments, 6 samples were printed with the ink densities (CMYK) decreasing in the range of typical ink densities,  $D_c = 1.45$ ,  $D_m = 1.40$ ,  $D_y = 1.0$ ,  $D_k = 1.7$  with  $\Delta D = 0.1$ . The experimental data are given in Table 2. The changing color values  $L^*a^*b^*$  at different densities are reported for solid colors CMYKRGB (Table 1). The color characteristics of Lightness, Hue and Chroma, are presented in Table 3. The relationship between lightness and chroma for a particular hue is built by  $L^*C^*$  plots of cyan, magenta and yellow primaries (Fig. 3). Note that the hue slice begins at the top left, and that's where the paper white is located and goes to the darkest black (lower left corner).

TABLE II

CIE  $L^*a^*b^*$  values of solid colors at different ink densities

Sample		1	2	3	4	5	6
	Dc	1.40	1.42	1.46	1.49	1.50	1.52
	Dm	1.32	1.35	1.38	1.40	1.46	1.49
	Dy	1.01	1.04	1.09	1.10	1.13	1.18
C	L*	47.68	47.34	47.30	46.20	46.08	44.58
	a*	-36.29	36.26	35.59	36.07	36.09	35.75
	b*	-27.74	28.87	29.23	29.97	29.74	29.60
M	L*	43.13	42.55	42.28	41.32	40.88	40.12
	a*	59.95	61.11	59.71	61.46	62.82	60.65
	b*	-2.82	-0.35	-0.09	-0.08	-0.62	0.40
Y	L*	79.20	78.56	78.13	78.25	77.71	75.94
	a*	-6.51	-6.12	-6.23	-5.83	-7.31	-7.40
	b*	73.05	74.39	75.33	76.21	80.23	77.56
K	L*	17.06	14.68	14.36	13.96	13.92	13.81
	a*	-0.40	-0.35	0.59	1.28	2.39	0.07
	b*	9.79	9.71	7.47	5.89	1.41	8.08
R	L*	39.04	40.71	41.43	42.33	42.83	43.77
	a*	50.70	52.57	51.62	50.07	51.28	50.23
	b*	36.47	37.17	35.58	35.17	34.59	32.65
G	L*	41.42	43.81	44.23	45.21	45.50	46.20
	a*	-50.88	51.45	52.21	51.26	52.35	52.18
	b*	30.77	32.21	29.85	29.68	29.30	29.04

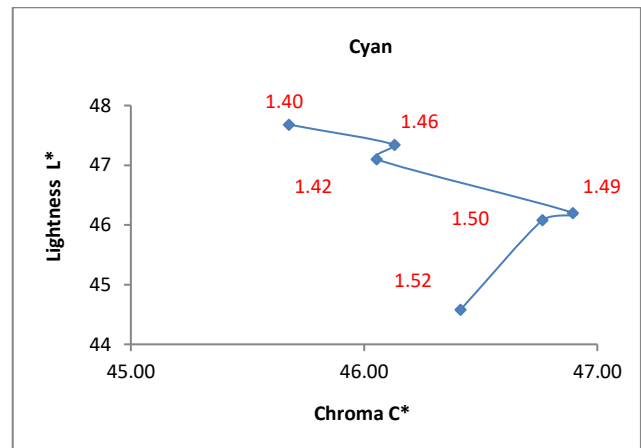
B	L*	39.04	40.71	41.43	42.33	42.83	43.77
	a*	50.70	52.57	51.62	50.07	51.28	50.23
	b*	36.47	37.17	35.58	35.17	34.59	32.65

TABLE III

Characteristics of solid colors at different ink densities

Sample		1	2	3	4	5	6
C	L*	47.68	47.34	47.30	46.20	46.08	44.58
	H*	217.39	218.58	219.40	219.72	219.49	219.62
	C*	45.68	46.13	46.05	46.90	46.76	46.41
M	L*	43.13	42.55	42.28	41.32	40.88	40.12
	H*	357.3	359.7	359.9	359.9	359.4	360.4
	C*	60.02	61.11	61.23	61.46	62.82	60.65
Y	L*	79.20	78.56	78.13	78.25	77.71	75.94
	H*	95.09	94.70	94.73	94.37	94.39	95.45
	C*	73.34	74.64	75.59	76.43	82.47	77.91

As observed in Fig.3, for all the inks, the magnitude of the  $C^*$  moves to the right when the ink amount increases. However, it reaches its full tone at sample 5, and the hue slice becomes less saturated as it darkens (sample 6). Therefore, the color gamut seems to get the widest size in this sample 5 (Fig. 4). The corresponding ink densities are  $D_c = 1.50$ ,  $D_m = 1.46$ , and  $D_y = 1.13$ . At this sample, Black ink also get a good neutral color,  $D_k = 1.75$ ,  $a^* = 2.39$ ,  $b^* = 1.41$



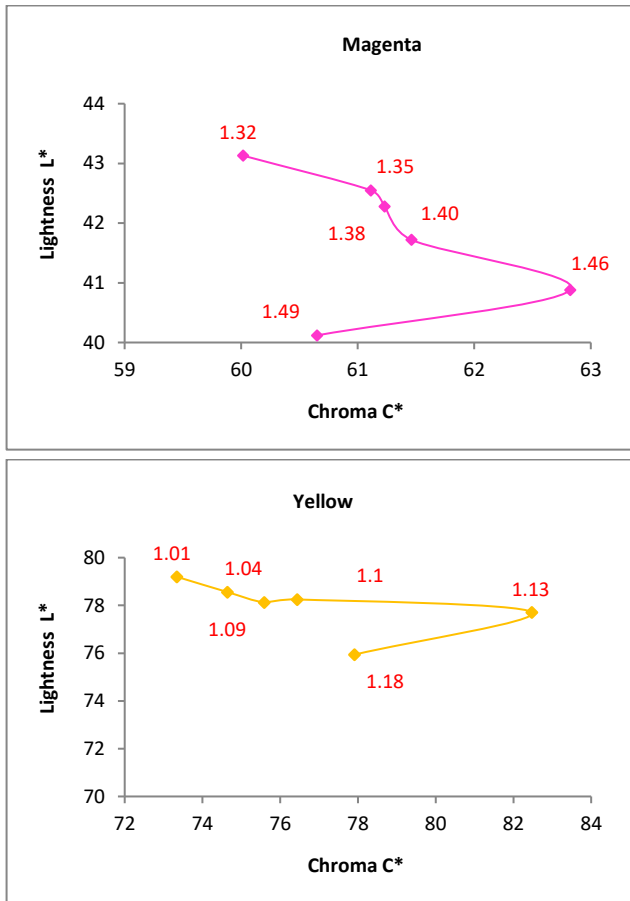


Figure 3: L\*C\* gamut plots of cyan, magenta and yellow hue

The CIE L\*a\*b\* of solid colors and overprints of the printed image (sample 5) are compared to ISO 12647-2 standard (Table 4). The color difference  $\Delta E_{ab} < 5$  for all the solid colors. This result indicates that the printing process adapted to the international standard. Fig. 5 illustrates that the ISO 12647-2 gamut is slightly larger than the obtained gamut at two-color overprints (R, G, B). However, as mentioned in ISO 12647-2, the secondary colours red, green and blue depend on conditions that include the printing sequence, the rheological and transparency properties of the inks, mechanics of the press and the surface characteristics of the print substrate. Thus, it is not possible to state tolerance windows for both solids and overprints [7]

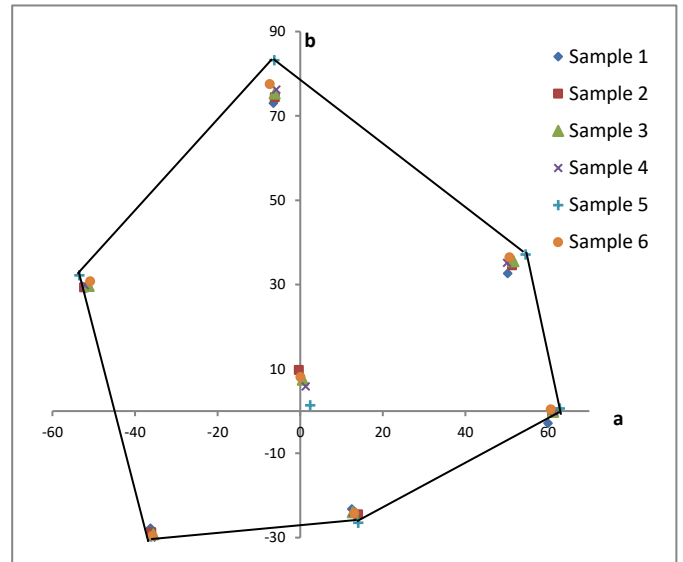


Figure 4: Color gamut at different ink densities

TABLE IV

CIE L\*a\*b\* of printed image compared to the standard

Color	L	a	b	$\Delta E_{ab}$	ISO $\Delta E_{ab}$
C	46.08	-36.09	-29.74	3.13	5
M	40.88	62.82	0.62	4.34	5
Y	77.71	-6.31	83.23	4.49	5
K	13.92	2.39	1.41	2.92	5

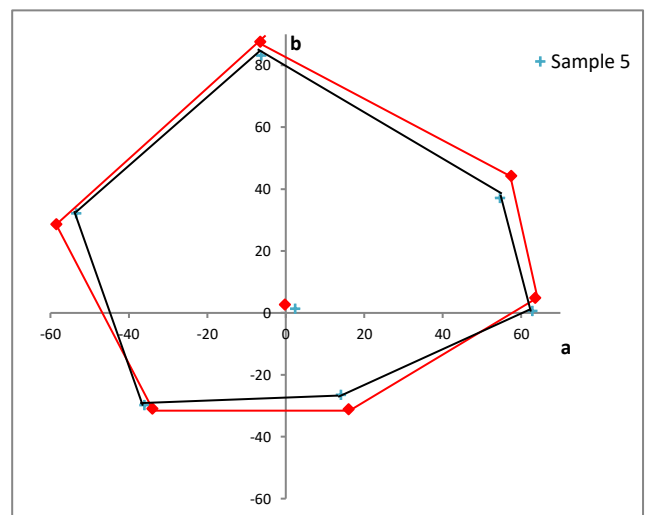


Figure 4: Obtained color gamut compared to the standard

All the results optimize ink densities that induce a color gamut that exhibits maximum colorfulness of the primary inks, the overprint colors and a very dark neutral shadow. The optimum densities also allow archiving color targets and color gamut accepted by ISO 12647-2 for the investigated substrate.

#### IV. CONCLUSION

The printing system was optimized in ink densities to get the widest color gamut. The color values of solid colors and overprints are suitable with ISO 12647-2:2013 for the investigated paper. The results contribute to controlling and improving printing quality and cost savings.

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# Effect of Feed rate on Material Removal Rate, Surface Roughness and Machining Time of Aluminum Alloy 6063 in CNC Turning

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## ABSTRACT

The main objective of today's manufacturing industries is to produce low cost and high quality product in short time. Turning is a very important machining process in which a single-point cutting tool removes material from the surface of a rotating cylindrical work-piece. In general, CNC lathe machine is operated with several controllable factors such as spindle speed, depth of cut, feed rate etc. This present work focuses on CNC turning of aluminum alloy 6063 using carbide tool for varying feed rate. The results revealed that the feed rate is the most important parameter that affects the material removal rate, surface finish and machine time in CNC turning process.

Keywords: Feed Rate, Material Removal Rate, Surface Roughness, Machining Time, Aluminum.

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## I. INTRODUCTION

Turning is the removal of metal from the outer diameter of a rotating cylindrical work piece. Turning is used to reduce the diameter of the work piece, usually to a specified dimension, and to produce a smooth finish on the metal. It is done with a single point cutting tool. The three primary factors in any basic turning operation are cutting speed, feed, and depth of cut. Other factors which further influences the machining are type of material, size of work, tool geometry, lubricant etc. The accuracy, surface finish, precision which is achieved through CNC cannot be done or achieved through conventional process. Nowadays, more and more CNC

machines are being used in every kind of manufacturing processes.

Aluminum alloys have been widely used in industrial applications due to its low cost, corrosion resistance, light weight and other attractive mechanical and thermal properties. The classes of cutting tool materials currently in use for machining operation are high speed tool steel, cobalt-base alloys, cemented carbides, ceramic, polycrystalline cubic boron nitride and polycrystalline diamond. Different machining applications require different cutting tool materials. In industry today, carbide tools have replaced high-speed steels in most applications. Carbide steel has more high cutting speed and is 4- 7 times higher than high – speed steel. Carbide is much harder, so it has a longer tool life

and faster cutting data than conventional high speed steel. Cemented carbide is a powder metal product consisting of fine carbide particles cemented together with a binder of cobalt. The major categories of hard carbide include tungsten carbide, titanium carbide, tantalum carbide, and niobium carbide. The cutting fluid is any liquid or gas that is applied to the chip and/or cutting tool to improve cutting performance. A very few cutting operations are performed dry, i.e., without the application of cutting fluids. Generally, it is essential that cutting fluids be applied to all machining operations. The main purpose of using cutting fluid is to decrease cutting temperature, reduce friction between tool and work piece, extend tool life, and improve machining efficiency and surface quality. Metal removal rate and surface roughness are important for describing the quality of the product. Metal removal rate directly affects the cost of the product and time of manufacturing. Surface roughness is an important measure of product quality since it greatly influences the performance of mechanical parts as well as production cost. Surface roughness has an impact on the mechanical properties like fatigue behavior, corrosion resistance, creep life, etc. It also affects other functional attributes of parts like friction, wear, light reflection, heat transmission, lubrication, electrical conductivity, etc.

## II. LITERATURE REVIEW

Deepak D et al [1] investigated the effect of operating parameters such as feed rate, cutting speed and depth of cut on the material removal rate. Also, the effect of using coolant on material removal rate while turning is also determined. The result show that the material removal rate increases with increase in feed rate. Machining of the work piece by the supply of coolant is found to produce higher material rate compared to machining without using coolant.

C.John Joshua et al [2] investigated the effect of cutting speed, depth of cut and feed rate on material removal rate, machine time and surface roughness for turning

of aluminium alloy 6063A. Selected machining parameters are the cutting speed of 500, 1000 and 1500 rpm, feed rate of 0.1, 0.15 and 0.2 mm/rev. From the experimental results they observed that machining time in CNC turning is greatly influenced by feed rate.

M. Sree Praveen Chowdary et al [3] have studied material removal rate and surface roughness on turning operation using CNC lathe. The process parameters used in the experiment were spindle speed, feed rate, and depth of cut. The results showed that feed rate, depth of cut and spindle speed are the most important parameter influencing the material removal rate and surface roughness. The surface roughness was found at cutting speed of 150 m/min, depth of cut of 0.6 mm and feed of 0.4 mm/rev. Whereas, at cutting speed of 630 m/min, depth of cut 0.7mm and feed of 0.6 mm/rev, the maximum material removal rate was obtained.

Maske K.V et al [4] worked on the effect of insert nose radius and machining parameters including cutting speed, feed rate and depth of cut on surface roughness and material removal rate in a turning operation are investigated by using Taguchi Grey Relational Analysis. For this work they used three spindle speed range from 225 to 715rpm, three feed range from 0.1 to 0.2 mm/rev, three depth of cut range from 0.1 to 0.3mm and three nose radius range from 0.4 to 1.2 mm. The results revealed that the feed rate and nose radius are the most important parameters that affect the surface finish and material removal rate (MRR) in CNC turning process is greatly influenced by depth of cut followed by cutting speed.

Palash Biswas et al [5] investigated the effect of cutting speed, feed rate and depth of cut on surface roughness during turning of aluminium alloy. From this investigation they concluded that an increase in depth of cut surface roughness value also increase when the other two variables are fixed. Likely with an increase

in feed rate surface roughness value also increases when the other two variables are fixed.

Mahendra Korat et al [6] have conducted an experimental investigation on turning of En24 alloy steel. Five parameters were chosen as process variables: speed, feed, depth of cut, nose radius, cutting environment (wet and dry). It is predicted that nose radius, depth of cut, feed rate, cutting speed and coolant condition affects the material removal rate and surface roughness.

T. S. Pawar et al [7] investigated the effect of spindle speed (800, 900, and 1000), feed rate (80, 100, and 120) and depth of Cut (0.5, 0.8, and 1.0) on surface roughness in CNC turning operation. The experiments were performed on 2024-T3 Aluminium material using Taguchi method. The result shows that optimum level for surface roughness is obtained as 800 m/min of spindle speed, 80 mm/min of feed and 0.8mm of depth of cut.

T. Nithyanandhan et al [8] have investigated the influence of process parameters on surface finish and material removal rate. In this work, stainless steel work pieces are turned on conventional lathe by using tungsten carbide tool. The results showed that the feed and nose radius is the most significant process parameters on work piece surface roughness. However, the depth of cut and feed are the significant factors on material removal rate.

M.V.R.D Prasad et al [9] has analyzed turning parameter of cylindrical parts. The machining parameter are selected in this work are cutting speed, feed and depth of cut. The results predicted that the surface roughness increased with increase of speed and depth of cut is not influencing much on roughness but the roughness value increasing non linearly with increasing feed.

### III. METHODS AND MATERIAL

The material and tool selected was aluminum 6063 and carbide tool respectively. The specimen is prepared with the dimensions of 80mm length and 25mm diameter for turning. This alloy is part of the 6000 series of alloys. It is a medium strength alloy, which is used for applications such as railing, window frames, door frames, roofs, sign frames, shop fittings, irrigation tubing, building products, electrical, marine, piping, recreation equipment, storage tanks, truck frames & trailers. The chemical composition of aluminium alloy 6063 is depicted in table-1.

**Table-1:** Chemical composition of aluminium alloy 6063

Chemical composition	
Element	Content (%)
Silicon	0.20-0.60
Iron	0.35 max
Copper	0.1 max
Manganese	0.10 max
Magnesium	0.45-0.90
Chromium	0.1 max
Zinc	0.1 max
Titanium	0.1 max
Other elements	0.15 max
Aluminum	Bal

The experiments were conducted on a high precision CNC Turning centre. The work piece was mounted on

a chuck and the CNC program for machining is entered according to the selected parameters.

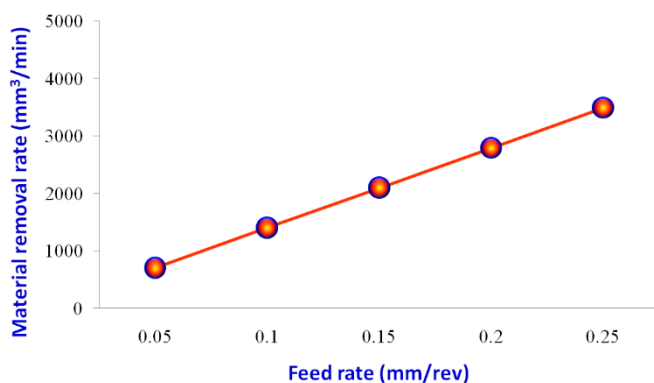
#### IV. RESULTS AND DISCUSSION

The results of the machining experiment for material removal rate, surface roughness and machining time were as tabulated in Table-2.

**Table-2 :** Cutting parameters and the experimentation results.

S. No	Spindle speed (rpm)	Depth of cut (mm)	Feed (mm/rev)	Material removal rate (mm <sup>3</sup> /min)	Surface roughness (μm)	Machining time (min)
1	600	0.3	0.05	697.6	0.419	1.368
2	600	0.3	0.10	1395.3	0.871	0.684
3	600	0.3	0.15	2092.6	1.638	0.456
4	600	0.3	0.20	2790.1	3.276	0.342
5	600	0.3	0.25	3486.9	3.582	0.273

**Material Removal Rate**

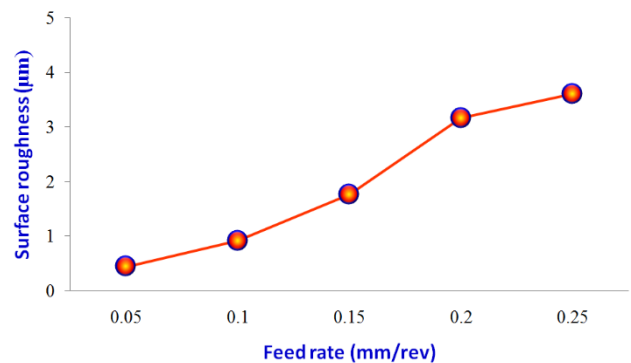


**Figure-1:** Effect of feed rate on material removal rate

The analysis diagram for the material removal rate during machining of the CNC turning of aluminium

alloy is displayed in figure -1. It can be observed from the results that material removal rate increases with the increase in feed rate. The material removal rate required is maximum for maximum production rate so the optimum value of material removal rate is 3486.9mm<sup>3</sup>/min which is obtained at feed rate of 0.25mm/rev. The influence of cutting fluids on the material removal rate and surface roughness during turning of aluminium alloy was investigated by Swaraj Samanta et al [10]. They used water, coconut oil and mustard oil as cutting fluids. Results concluded that the cutting fluid has a influence on the material removal rate. Yakala Mani Ratnam et al [11] has experimentally investigated the effects of machining parameters such as cutting speed, feed, depth of cut on the surface roughness and material removal rate of EN8 steel. The result show that the material removal rate increases with increased feed rate.

**Surface roughness**



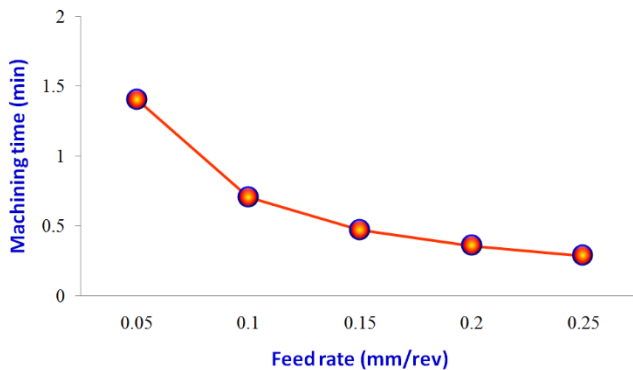
**Figure-2:** Effect of feed rate on surface roughness

The analysis graph for surface roughness during machining of the CNC turning of aluminium alloy 6063 is shown in figure-2. The depth of cut was kept at 0.3mm throughout, but feed rate was varied from 0.05mm/rev to 0.25mm/rev in steps of 0.05mm/rev. Increase in feed rate results in an upsurge in values of roughness. The surface roughness is influenced by the most important factors such as: cutting parameters, tool geometry, build-up edge, process time, work piece and tool material, tool wear, machine condition appliance of cutting fluids. N. Satheesh kumar et al [12]



investigated the effect of process parameters in turning of carbon alloy steels in a CNC lathe. The parameters namely the spindle speed and feed rate are varied to study their effect on surface roughness. The five different carbon alloy steels used for turning are SAE8620, EN8, EN19, EN24 and EN47. Based on this study they concluded that the surface roughness increases with increased feed rate. J. Kouam et al [13] have conducted an experimental investigation on turning of aluminum alloy 6061-T6 material. For this work they use three cutting speed range and three feed range (0.0508-0.2845 mm/rev) with constant depth of cut. The result shows that the surface roughness increases as feed rate increases.

### Machining time



**Figure-3:** Effect of feed rate on machining time

The effects of feed rate on the machining time as shown in figure-3. It was increased from 0.05mm/rev to 0.25mm/rev in steps of 0.05mm/rev, by keeping the depth of cut constant at 0.3mm throughout. It is seen from these figures that the machining time decreases with increase in the feed rate. M. Dhanenthiran et al [14] investigated the effect of various cutting parameters on the surface roughness, material removal rate and machining time of Al 6063 aluminium alloy. They selected speed 800, 1200, 1600 rpm. Feed (mm/rev) 0.1, 0.2, 0.3 and depth of cut (mm) as 0.04, 0.06, 0.08. From this investigation they concluded that machining time decreases as feed rate increases. Alagarsamy.S.V et al [15] has analyzed the effect of cutting parameters on the material removal rate and

machining time of aluminum alloy 7075. The machining parameters selected in this work are cutting speed, feed, depth of cut. The results predicted that the machining time decreased with an increase of feed rate.

## V. CONCLUSION

Following conclusions are drawn from the present experimental work

- It is observed that the feed rate is most influential process parameters that influence material removal rate, surface roughness and machining time.
- Material removal rate and surface roughness are found to increase with increase in feed rate.
- The machining time in turning decreases with increase in feed rate.

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# Modification Structure and their Effects on Physical Properties of Tin Based Lead Free Solder Alloys for Industrial Applications

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## ABSTRACT

Soldering properties such as melting temperature and wettability of tin-zinc alloy improved after adding different alloying elements such as indium, aluminum, cadmium and bismuth. Decreasing zinc content ( $\text{Sn}_{91}\text{Zn}_9$ ) up to 4% ( $\text{Sn}_{96}\text{Zn}_4$  alloy) increased corrosion resistance from -0.847 to -0.530 and decreased corrosion rate from 51.84 to 7.705 mpy. Microstructure of tin-zinc alloy changed with increasing hardness value of it after adding alloying elements. Tin-zinc alloys have lower melting temperature compared to  $\text{Sn}_{95}\text{Sb}_5$ ,  $\text{Sn}_{96.5}\text{Ag}_{3.5}$  and  $\text{Sn}_{99.3}\text{Cu}_{0.7}$  alloys. The  $\text{Sn}_{90}\text{Zn}_4\text{Bi}_6$  alloy has best solder properties for electronic industrial applications.

**Keywords:** Tin-Zinc Alloy, Wettability, Melting Temperature, Hardness

## I. INTRODUCTION

Soldering is a low temperature metallurgical joining process. In electronics applications low temperature and reversibility are especially important because of the materials involved and the necessity for reworking and making engineering changes. Tin-zinc eutectic alloy is a lead free solder which used in different industrial applications. The aim of this research was to improve physical and soldering properties of tin-zinc eutectic alloy by adding different alloying elements (Al or In or Al-In or In-Bi). Many studies have been made on various alloy system solders based on Sn such as  $\text{SnZn}_9$ ,  $\text{SnAg}_{3.5}$ ,  $\text{SnAg}_3\text{Cu}_{0.5}$ , etc. as possible replacements [1, 2]. Tin-zinc eutectic alloy has been considered as a candidate for lead free solder materials because of its low melting point, excellent mechanical properties and low cost [3- 5].

Microstructure, corrosion behavior and soldering properties of tin based or tin-zinc or tin based with adding alloying element or effect of adding titanium oxide on all properties have been studied [6-10]. The results show, corrosion behavior, soldering properties and microstructure of tin based alloy changed after adding alloying elements and titanium oxide.

## II. EXPERIMENTAL WORK

The alloys  $\text{Sn}_{91}\text{Zn}_9$ ,  $\text{Sn}_{96}\text{Zn}_4$ ,  $\text{SnZn}_9\text{In}_{1.5}$ ,  $\text{SnZn}_9\text{Al}_{1.5}$ ,  $\text{Sn}_{90}\text{Zn}_4\text{Bi}_6$ ,  $\text{Sn}_{95}\text{Sb}_5$ ,  $\text{Sn}_{96.5}\text{Ag}_{3.5}$  and  $\text{Sn}_{99.3}\text{Cu}_{0.7}$  which used tin, zinc, indium, copper, aluminum, antimony, cadmium and bismuth elements with a high purity, more than 99.95%, were molten in the muffle furnace. The resulting ingots were turned and re-melted several times to increase the homogeneity of the ingots. From these ingots, long ribbons of about 3-5 mm width and ~ 100  $\mu\text{m}$  thickness were prepared as the test samples

by directing a stream of molten alloy onto the outer surface of rapidly revolving copper roller with surface velocity 31 m/s giving a cooling rate of  $3.7 \times 10^5$  K/s. The samples then cut into convenient shape for the measurements using double knife cutter. Structure of used alloys was performed using an Shimadzu x-ray diffractometer (Dx-30, Japan) of Cu-K $\alpha$  radiation with  $\lambda=1.54056$  Å at 45 kV and 35 mA and Ni-filter in the angular range  $2\theta$  ranging from 20 to 100° in continuous mode with a scan speed 5 deg/min. **Scanning electron microscope JEOL JSM-6510LV, Japan was used to study microstructure of used samples.** The melting endotherms of used alloys were obtained using a SDT Q600 V20.9 Build 20 instrument. A digital Vickers micro-hardness tester, (Model-FM-7- Japan), was used to measure Vickers hardness values of used alloys.

### III. RESULTS AND DISCUSSION

#### 3.1 Microstructure

X-ray diffraction patterns, Figure (1), for Sn<sub>91-x</sub>Zn<sub>9</sub>X<sub>x</sub>(X=0 or In or Al, x=0 or 1.5 wt. %) rapidly solidified alloys show sharp lines of body centered tetragonal Sn and hexagonal Zn phase. From x-ray analysis, it obvious that adding In or Al content to SnZn<sub>9</sub> alloy caused a change in its matrix microstructure (as lattice parameters, unit cell volume and crystal size) and the shape of formed phases (such as peak intensity, peak broadness and peak position). That is because indium or aluminum atoms dissolved in SnZn<sub>9</sub> matrix formed a solid solution\or and some In or Al atoms formed a traces of undetected phases (In or Al or In or intermetallic phases).

Scanning electron micrographs, SEM, of Sn<sub>91</sub>Zn<sub>9</sub>, Sn<sub>96</sub>Zn<sub>4</sub>, SnZn<sub>9</sub>In<sub>1.5</sub>, SnZn<sub>9</sub>Al<sub>1.5</sub>, Sn<sub>95</sub>Sb<sub>5</sub>, Sn<sub>96.5</sub>Ag<sub>3.5</sub> and Sn<sub>99.3</sub>Cu<sub>0.7</sub> alloys show heterogeneous structure (different features) as seen in Figure (2) which agreed with x-ray analysis.

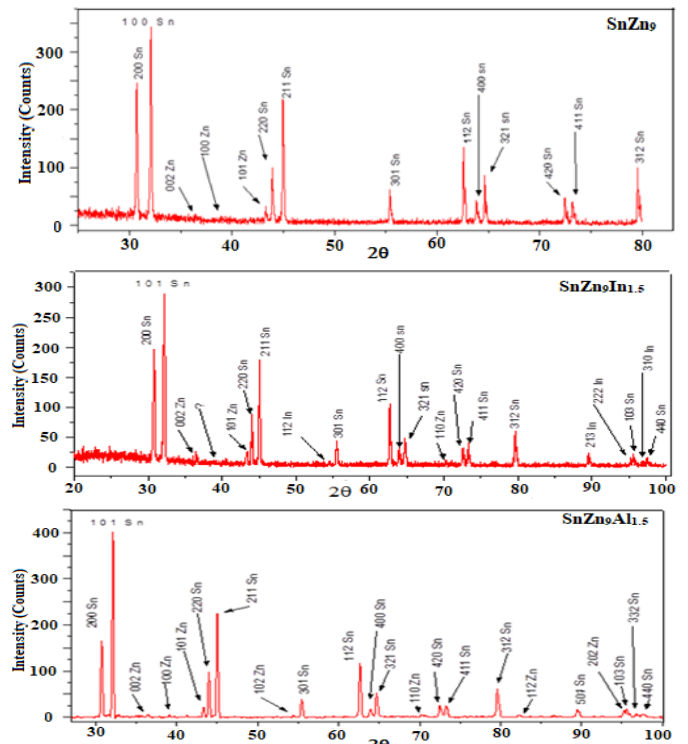


Figure 1: x-ray diffraction patterns of Sn<sub>91-x</sub>Zn<sub>9</sub>X<sub>x</sub>(X=0 or In or Al, x=0 or 1.5 wt. %) alloys

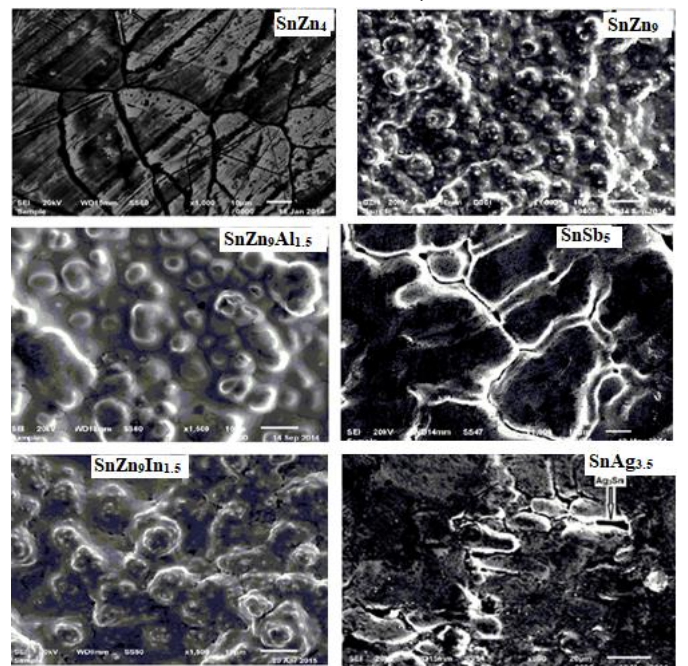


Figure 2: scanning electron micrographs of tin based alloys

#### 3.2 Soldering properties

##### Wettability

Wettability is quantitatively evaluated by the contact angle formed at the solder substrate's flux triple point.

The contact angles of Sn<sub>91</sub>Zn<sub>9</sub>, Sn<sub>96</sub>Zn<sub>4</sub>, SnZn<sub>9</sub>In<sub>1.5</sub>, SnZn<sub>9</sub>Al<sub>1.5</sub>, SnZn<sub>9</sub>Cd<sub>1.5</sub>, Sn<sub>90</sub>Zn<sub>4</sub>Bi<sub>6</sub>, Sn<sub>95</sub>Sb<sub>5</sub>, Sn<sub>96.5</sub>Ag<sub>3.5</sub> and Sn<sub>99.3</sub>Cu<sub>0.7</sub> alloys on Cu substrate in air presented in Table (1) show that the contact angle for Sn<sub>91</sub>Zn<sub>9</sub> alloy decreased after adding alloying elements.

**Thermal parameters**

The amounts of thermal properties depend on the nature of solid phase and on its temperature. The melting point for Sn<sub>91</sub>Zn<sub>9</sub>, Sn<sub>96</sub>Zn<sub>4</sub>, SnZn<sub>9</sub>In<sub>1.5</sub>, SnZn<sub>9</sub>Al<sub>1.5</sub>, SnZn<sub>9</sub>Cd<sub>1.5</sub>, Sn<sub>90</sub>Zn<sub>4</sub>Bi<sub>6</sub>, Sn<sub>95</sub>Sb<sub>5</sub>, Sn<sub>96.5</sub>Ag<sub>3.5</sub> and Sn<sub>99.3</sub>Cu<sub>0.7</sub> alloys listed in Table (1), show that the melting temperature of Sn<sub>91</sub>Zn<sub>9</sub> alloy decreased after adding alloying elements.

Table 1: contact angle and melting temperature of tin based alloys

Alloys	Contact angle°	M. P °C
SnZn <sub>9</sub>	36±75.15	198.28
Sn <sub>96</sub> Zn <sub>4</sub>	24.5±1.2	216.42
SnZn <sub>9</sub> In <sub>1.5</sub>	21.25±1.3	194.98
SnZn <sub>9</sub> Al <sub>1.5</sub>	20.25±1.2	196.68
SnZn <sub>9</sub> Cd <sub>1.5</sub>	28.25±1.23	195.38
Sn <sub>90</sub> Zn <sub>4</sub> Bi <sub>6</sub>	27.5±2	190.75

Alloys	Contact angle°	M. P °C
Sn <sub>95</sub> Sb <sub>5</sub>	27±2	242.06
Sn <sub>96.5</sub> Ag <sub>3.5</sub>	26±2	223.81
Sn <sub>99.3</sub> Cu <sub>0.7</sub>	37.5±3.15	231.55

**3.3 Vickers microhardness**

The greater of material hardness is the greatest of the resistance to deformation. Table (2) shows Vickers hardness value for Sn<sub>91</sub>Zn<sub>9</sub>, Sn<sub>96</sub>Zn<sub>4</sub>, SnZn<sub>9</sub>In<sub>1.5</sub>, SnZn<sub>9</sub>Al<sub>1.5</sub>, SnZn<sub>9</sub>Cd<sub>1.5</sub>, Sn<sub>90</sub>Zn<sub>4</sub>Bi<sub>6</sub>, Sn<sub>95</sub>Sb<sub>5</sub>, Sn<sub>96.5</sub>Ag<sub>3.5</sub> and Sn<sub>99.3</sub>Cu<sub>0.7</sub> alloys at 10 gram force for 5 sec. Vickers hardness value of Sn<sub>91</sub>Zn<sub>9</sub> alloy increased by adding alloying elements.

Table 2: Vickers hardness value of tin based alloys

Alloys	H <sub>v</sub> kg/mm <sup>2</sup>
SnZn <sub>9</sub>	22.75±1.1
Sn <sub>96</sub> Zn <sub>4</sub>	30.75±0.4
SnZn <sub>9</sub> In <sub>1.5</sub>	23.53±1
SnZn <sub>9</sub> Al <sub>1.5</sub>	32.2±2.1
Sn <sub>90</sub> Zn <sub>4</sub> Bi <sub>6</sub>	27.53±1.54

Alloys	H <sub>v</sub> kg/mm <sup>2</sup>
Sn <sub>95</sub> Sb <sub>5</sub>	20.05±1.8
Sn <sub>96.5</sub> Ag <sub>3.5</sub>	23.067
Sn <sub>99.3</sub> Cu <sub>0.7</sub>	12.025

**IV.CONCLUSION**

Adding alloying elements improved soldering properties of SnZn<sub>9</sub> alloy with increasing its hardness value. Tin-zinc based solder alloys have the best properties compared other tin based alloys.

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# Deepfakes Technology Using A.I

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## ABSTRACT

In spite of the fact that controls of visual and hear-able media are just about as old as media themselves, the new entry of deepfakes has denoted a defining moment in the formation of phony substance. Fuelled by the most recent mechanical advances in man-made reasoning and AI, deepfakes offer computerized methods to make counterfeit substance that is increasingly hard for human spectators to recognize. The prospects to hoodwink are unending including controlled pictures, recordings, and sound and associations should be ready as this will without a doubt have a huge cultural effect. In this article, I will cover working meaning of deepfakes along with an outline of its fundamental innovation. We order distinctive deepfake types and distinguish dangers and freedoms to assist associations with pondering the eventual fate of deepfakes. At last, I trust that our general public can be more ready to counter deepfakes as we appreciate deepfakes.

**Keywords :** Deepfake, A.I, Neural Network.

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## I. INTRODUCTION

In late years, counterfeit news has turned into an issue that is a danger to public talk, human culture, and majority rules system. Counterfeit news alludes to invented news style content that is manufactured to mislead the general population. Bogus data spreads rapidly through online media, where it can affect a great many clients. one out of five Web clients get their news by means of YouTube, second just to Facebook. This ascent in prominence of video features the requirement for instruments to affirm media and news content legitimacy, as clever advances permit persuading control regarding video. Given the

straightforwardness in acquiring and spreading deception through web-based media stages, it is progressively difficult to tell what to trust, which brings about destructive ramifications for informed navigation, in addition to other things. Without a doubt, today we live in what some have called a "post-truth" period, which is described by computerized disinformation and data fighting drove by pernicious entertainers running bogus data missions to control general assessment.

Recent innovative headways have made it simple to make what are currently called "deepfakes", hyper-sensible recordings utilizing face trades that leave little

hint of control. Deepfakes are the result of man-made reasoning (computer-based intelligence) applications that union, join, supplant, and superimpose pictures and video clasps to make counterfeit recordings that seem true. Deepfake innovation can produce, for instance, a hilarious, obscene, or political video of an individual saying anything, without the assent of the individual whose picture and voice is involved. The game-changing variable of deepfakes is the extension, scale, and refinement of the innovation in question, as nearly anybody with a PC can manufacture counterfeit recordings that are basically vague from real media. While early instances of deepfakes zeroed in on political pioneers, entertainers, humourists, and performers having their appearances meshed into pornography recordings, deepfakes later on will probably be increasingly more utilized for vengeance pornography, tormenting, counterfeit video proof in courts, political harm, fear monger purposeful publicity, extortion, market control, and phony news. While spreading bogus data is simple, remedying the record and battling deepfakes are more diligently. To battle against deepfakes, we really want to comprehend deepfakes, the purposes behind their reality, and the innovation behind them. Nonetheless, insightful examination has as of late tended to advanced disinformation in online media. As deepfakes just surfaced on the Web in 2017, insightful writing on the theme is scanty. Henceforth, this review expects to talk about what deepfakes are and who produces them, what the advantages and dangers of deepfake innovation are, a few instances of current deepfakes, and how to battle them. In this manner, the review dissects various news stories on deepfakes drawn from news media sites. The review adds to the early written works of phony news and deepfakes both by giving a far-reaching survey of deepfakes, just as establishing the arising point into a scholastic discussion that likewise recognizes choices for lawmakers, columnists, business visionaries, and others to battle deepfakes.

The article is coordinated as follows. After the presentation, the review clarifies information assortment and news story examination. The concentrate then, at that point, advances four segments that audit deepfakes, what the expected advantages of deepfake innovation are, who the entertainers associated with delivering deepfakes are, and the dangers of deepfakes to our social orders, political frameworks, and organizations. From there on, two segments give instances of deepfakes and examine four possible systems to battle deepfakes. At long last, the review finishes up with suggestions, restrictions, and ideas for future exploration.

## II. WHAT ARE DEEPFAKES

A mix of "deep learning" and "fake content", deepfakes are hyper-practical recordings carefully controlled to portray individuals saying and doing things that never really occurred. Deepfakes depend on neural organizations that investigate huge arrangements of information tests to figure out how to copy an individual's looks, quirks, voice, and affectations. The interaction includes taking care of film of two individuals into a profound learning calculation to prepare it to trade faces. At the end of the day, deepfakes utilize facial planning innovation and man-made intelligence that trades the essence of an individual on a video into the substance of someone else. Deepfakes surfaced to exposure in 2017 when a Reddit client posted recordings showing big names in compromising sexual circumstances. Deepfakes are hard to recognize, as they utilize genuine film, can have legitimate sounding sound, and are enhanced to spread via online media rapidly. Hence, numerous watchers accept that the video they are checking out is certified.

Deepfakes target online media stages, where tricks, reports, and falsehood spread effectively, as clients will generally go with the group. Simultaneously, a progressing 'infopocalypse' pushes individuals to figure



they can't confide in any data except if it comes from their interpersonal organizations, including relatives, dear companions or family members, and supports the sentiments they as of now hold. Truth be told, many individuals are available to whatever affirms their current perspectives regardless of whether they presume it very well might be phony. Modest fakes, that is, inferior quality recordings with somewhat doctored genuine substance, are as of now wherever in light of the fact that low-estimated equipment, for example, effective graphical handling units are broadly accessible. Programming for making superior grade, practical deepfakes for disinformation is progressively accessible as open source. This empowers clients with minimal specialized abilities and with next to no imaginative mastery to approach impeccably alter recordings, trade faces, change appearances, and combine discourse.



Fig 1: Image altered using deepfake

As for innovation, deepfakes are the result of Generative Adversarial Network, to be specific two fake neural organizations cooperating to make genuine looking media. These two organizations called 'the generator' and 'the discriminator' are prepared on the equivalent dataset of pictures, recordings, or sounds. The primary then, at that point, attempts to make new examples that are adequate to deceive the subsequent organization, which attempts to decide if the new media it sees is genuine. That way, they drive each other to improve. A GAN can check out a huge number of photographs of an individual, and produce another picture that approximates those photographs without

being a precise of any of them. Sooner rather than later, GANs will be prepared on less data and have the option to trade heads, entire bodies, and voices. In spite of the fact that deepfakes generally require countless pictures to make a sensible fraud, specialists have effectively fostered a method to create a phony video by taking care of it only one photograph, for example, a selfie.

### III. HOW DEEPFAKES ARE CREATED

The fundamental fixing in deepfakes is AI, which has made it conceivable to create deepfakes a lot quicker at a lower cost. To make a deepfake video of somebody, a maker would initially prepare a neural organization on numerous long stretches of genuine video film of the individual to give it a reasonable "understanding" of what the person resembles from many points and under various lighting. Then, at that point, they'd join the prepared organization with PC illustrations methods to superimpose a duplicate of the individual onto an alternate entertainer.

While the expansion of computer-based intelligence makes the cycle quicker than it at any point would have been, it actually sets aside effort for this interaction to yield an acceptable composite that puts an individual into a totally anecdotal circumstance. The maker should likewise physically change large numbers of the prepared program's boundaries to stay away from obvious blips and relics in the picture. The interaction is not really direct.

Many individuals expect that a class of profound learning calculations called generative ill-disposed organizations (GANs) will be the primary motor of deepfakes improvement later on. GAN-produced faces are close difficult to tell from genuine countenances. The primary review of the deepfake scene gave a whole area to GANs, recommending they will make it feasible for anybody to make modern deepfakes.

GANs are difficult to work with and require a gigantic measure of preparing information. It takes the models longer to create the pictures than it would with different strategies. Also, generally significant—GAN models are useful for orchestrating pictures, yet not so much for making recordings. They struggle protecting worldly consistency, or keeping a similar picture adjusted starting with one edge then onto the next.

The most popular sound "deepfakes" likewise don't utilize GANs. At the point when Canadian simulated intelligence organization Dossa (presently claimed by Square) utilized the moderator Joe Rogan's voice to absolute sentences he never said, GANs were not involved. Indeed, the vast majority of the present deepfakes are made utilizing a star grouping of computer-based intelligence and non-man-made intelligence calculations.

#### IV. METHODOLOGY

Our examination was parted into two significant parts, a hypothetical and a viable part. The hypothetical one depended on a pilot concentrate on where we went through the significant security concerns and significant data with respect to Deepfake and Profound neural organization just as finding proper venture scope supporting the objective of the undertaking. The reasonable part is to really get to know the advancement devices and conditions (e.g., Autoencoder, DNN) and dive profound into the Profound figuring out how to find out more about deepfake to see how Deepfakes function just as it's Recognition Strategies

#### V. TOOLS AND TECHNOLOGY

##### *Deep Neural Network*

the super innovative fixing in making deepfakes is Profound Neural Organization which is a ML procedure from artificial intelligence that can be

utilized to prepare DNNs suggestive of neurons in the cerebrum. DNNs comprise of an enormous arrangement of interconnected fake neurons, regularly alluded to as units. Similar as neurons in the cerebrum, every unit itself plays out a somewhat straightforward calculation, and all units together can perform complex nonlinear tasks, for example, perceiving a particular individual from seeing pixels on a screen

In the cerebrum, data stream is controlled by the strength of the associations among neurons. To improve at a given undertaking, the cerebrum's learning systems work on these associations, reinforcing or debilitating them as needed to further develop our errand execution over the long run. Similarly, the calculations of DNNs are directed by the strength of the association of their separate units. These associations, too, need to possibly be prepared. Undeveloped DNNs have arbitrary associations among units, which will prompt irregular data course through the organization and subsequently irregular result. For an undeveloped DNN working on pictures of faces, all looks are in this way self-assertive and aimless, and effectively distinguishing a look would just occur by some coincidence. A prepared DNN, then again, will have further developed the association strength of the units and took in the basic attributes of a face.

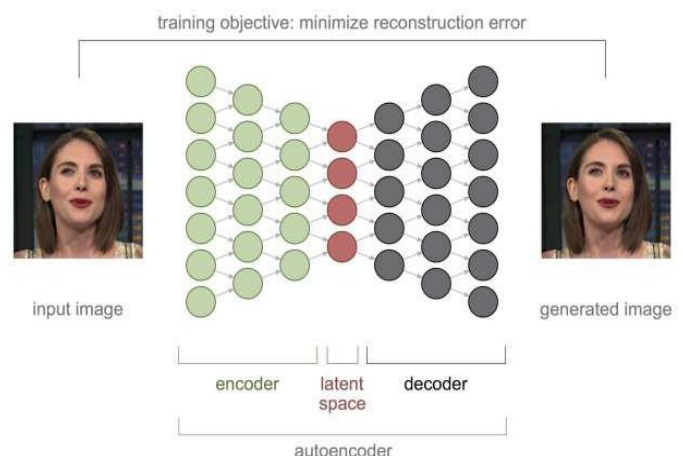


Fig 2: Image generating using autoencoder

The objective of profound learning is to refresh the association qualities or loads in DNN phrasing to enhance the data stream and result. This logically drives the organization result to limit mistakes by characterizing how the organization ought to in a perfect world react in an assortment of known conditions. For instance, when shown realized information pictures, DNNs can be prepared to change their loads to lessen recognition blunders so they can ultimately distinguish and appropriately identify objects in reality, gauge three-dimensional profundity from 2-D pictures, and perceive digits and letters on bank checks, tags, tax documents, letters, etc. While the preparation cycle can prompt remarkable errand execution, it is information hungry. The present profound learning requires a huge number of association loads to be realized, which thusly requires enormous arrangements of preparing information. That is the reason predominantly superstars are focused on by deepfakes: on the grounds that a broad library of pictures and recordings as of now exists to prepare the organizations.

### ***Generative adversarial Network***

Generative adversarial network, or GANs for short, are a way to deal with generative demonstrating utilizing profound learning techniques, for example, convolutional neural organizations. Generative displaying is a solo learning task in AI that includes consequently finding and learning the normalities or examples in input information so that the model can be utilized to produce or result new models that conceivably might have been drawn from the first dataset.

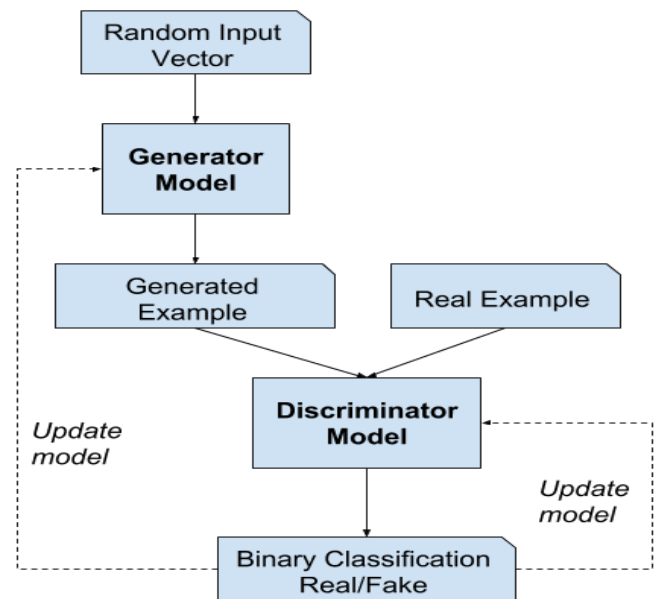


Fig 3: GANs Work Model

GANs are an astute method of preparing a generative model by outlining the issue as an administered learning issue with two sub-models: the generator model that we train to produce new models, and the discriminator model that attempts to order models as one or the other genuine (from the area) or phony (created). The two models are prepared together in a lose-lose situation, ill-disposed, until the discriminator model is tricked about a fraction of the time, which means the generator model is producing conceivable models.

GANs are an intriguing and quickly evolving field, following through on the guarantee of generative models in their capacity to create reasonable models across a scope of issue spaces, most strikingly in picture to-picture interpretation undertakings, for example, making an interpretation of photographs of summer to winter or day to night, and in producing photorealistic photographs of items, scenes, and individuals that even people can't tell are phony.

## VI. APPLICATION AREA

### *Education*

Deepfake innovation works with various potential outcomes in the instruction space. Schools and instructors have been utilizing media, sound, video in the homeroom for a long while. Deepfakes can assist a teacher with conveying imaginative examples that are undeniably more captivating than customary visual and media designs.

AI-Produced engineered media can resurrect authentic figures for a seriously captivating and intuitive study hall. A manufactured video of re-establishments or voice and video of a chronicled figure might have more effect, commitment, and will be a superior learning apparatus. For instance, JFK's goal to end the virus was discourse, which was rarely conveyed, was reproduced utilizing engineered voice with his voice and talking style will obviously get understudies to find out with regards to the issue innovatively.

Synthetic human life systems, modern apparatus, and complex modern undertakings can be displayed and mimicked in a blended reality world to instruct understudies and work together utilizing Microsoft HoloLens. Inventive utilization of manufactured voice and video can expand generally speaking achievement and learning results with scale and restricted expense.

### *Art*

For numerous many years, Hollywood has utilized very good quality CGI, VFX, and SFX advancements to make fake yet acceptable universes for convincing narrating. In the 1994's film, *Woods Gump*, the hero meets JFK and other authentic figures. The making of the situation and impact was cultivated utilizing CGI and various methods with a great many dollars. These days modern CGI and VFX innovations are utilized in films to produce manufactured media for recounting a charming story.

Deepfakes can democratize the expensive VFX innovation as an integral asset for autonomous narrators for a portion of the expense.

Cultural and amusement organizations can utilize deepfakes for imaginative purposes. Dalí Gallery in St. Petersburg, Florida, made a presentation called *Dalí lives*, resurrecting him utilizing deepfakes for guests to collaborate and take a selfie with surrealist painter Salvador Dalí. Additionally, Samsung's computer based intelligence lab in Moscow rejuvenated *Mona Lisa* by utilizing Deepfake innovation.

In the video gaming industry, artificial intelligence produced designs and symbolism can speed up the speed of game creation. Nvidia demoed a mixture gaming climate made by deepfakes and is chipping away at offering it for sale to the public soon.

Audio narrating and book portrayal is another great use instance of engineered voice. The writer's manufactured voice text style can be utilized to make the writer's book's sound organization. Organizations can utilize manufactured voice-overs of similar entertainer in various dialects to widen the range of their substance. The innovative voice innovation to execute the above situations should be utilized morally and responsibly with a vigorous assent system as it straightforwardly affects the work and office of a voice craftsman.

### *Autonomy and Expression*

Synthetic media can help common freedoms activists and columnists to stay mysterious in domineering and severe systems. Utilizing innovation to report out barbarities on conventional or online media can be very engaging for resident columnists and activists. Deepfake can be utilized to anonymize voice and faces to ensure their protection.

Deepfakes might be utilized to make symbol encounters for people online for self-articulation.

Individual advanced symbol gives independence and can assist people with broadening their motivation, thoughts, and conviction and empower self-articulation, which in any case might be hard for a few. People experiencing specific physical or mental handicaps could utilize manufactured symbols of themselves for online self-articulation.

Deepfakes can give people new apparatuses for self-articulation and joining in the web-based world.

Deep Compassion, a UNICEF and MIT project, uses profound figuring out how to get familiar with the qualities of Syrian areas impacted by struggle. It then, at that point, recreates how urban communities all throughout the planet would look in the midst of a comparable clash. The undertaking made engineered war-torn pictures of Boston, London and other key urban areas all throughout the planet to assist with expanding sympathy for casualties of a fiasco district.

There are voice innovation new businesses that will make engineered voice as another sort of deprivation treatment or assist individuals with recalling the perished and associate with them.

### ***Public Safety and Digital reconstruction***

Reconstructing the crime location is a criminological science and craftsmanship, utilizing inductive and insightful thinking and proof. Artificial intelligence Created engineered media can assist with remaking the scene with the interrelationship of spatial and transient curios. In 2018, a group of common specialists utilized phone recordings, post-mortem examination reports, and reconnaissance film to recreate a virtual crime location.

### ***Innovation***

Data and artificial intelligence are helping in advanced change and robotization in numerous ventures. Deepfake or computer-based intelligence Created Engineered media is turning into an establishment to

draw in clients and offer customized benefit. Reuters showed a completely computer-based intelligence Created deepfake moderator drove sports news rundown framework to assist with customizing news at scale. In the design retail business, deepfakes can assist with transforming clients into models by practically evaluating the most recent clothing and accessories.

An invigorating application will catch clients' faces, bodies, and surprisingly miniature peculiarities to create a deepfake and evaluate the most stylish trend patterns. Information Lattice, a Japanese man-made brainpower organization, made a man-made reasoning motor that naturally creates virtual models for promoting and style. The deepfake approach gives the capacity for brands to have a virtual preliminary space for clients to encounter items prior to getting them. Retail brands can likewise draw in clients at home by making a computer-based intelligence produced blended reality world to attempt, outfit, and beautify their space.

## **VII. CONCLUSION**

Deepfakes can be used in certain and negative ways to control content for media, redirection, publicizing and tutoring. Continuously our lives are being gotten through online media and this substance can be used to get ready DNNs, with or without our assent. Deepfakes are not wizardry, yet rather are conveyed using strategies from mimicked insight that can create fake substance that is significantly

According to our survey, deepfakes are a huge risk to society, the political system and associations since they put pressure on writers fighting to channel real from fake news, sabotage public wellbeing by dispersing proclamation that interferes in races, hamper inhabitant trust toward information by subject matter experts, and raise online security issues for people and affiliations and nuances these risks through examples

of existing and likely vocations of deepfakes. On the other hand, there are positive points and uses which are very important and obliging to the overall population and many fields.

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# Predicting Stock Market Using Machine Learning Algorithms

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## ABSTRACT

Predicting how the stock market will move could be useful as a way for short-term investors to get early advice and as a way for long-term shareholders to get early warning of financial trouble. The most crucial consideration when choosing a forecasting approach is predicting accuracy. Since the past ten years, more research has been done to increase the forecasting models' accuracy. It can be very challenging to choose the right stocks that are ideal for investment. The primary objective of any investor should be to maximise returns. The goal of stock market forecasting is to estimate how stock prices on a given exchange will fluctuate in the future. If it were possible to accurately forecast the direction of stock prices, investors would be able to earn more. This research uses machine learning to greatly reduce the uncertainty of future trend predictions. We will improve the accuracy of stock market predictions by using the boosting models found in machine learning algorithms.

Keywords : Stock Market, Machine Learning Algorithm

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## I. INTRODUCTION

Predicting the performance of a stock market has historically been a difficult problem for statisticians and financial analysts. This forecast is based on the idea that investors should put their money into stocks that are expected to rise in value and liquidate those that are expected to decrease in value. There are typically two methods for forecasting the stock market. One such method is fundamental analysis, which looks at the strategy and basic data of a company, such as its market position, expenses, and annual growth rates. The second is called "technical analysis," and it uses data from past stock prices and values to predict future

stock prices. In order to forecast the market, this study looks at past charts and patterns. In the past, financial experts could reliably foresee the direction of stock markets.

Stocks, also known as equity, are a type of security that represents a claim to a piece of a business. Accordingly, the stockholder is entitled to a portion of the company's assets and profits equal to the number of shares of stock owned by the stockholder. The plural of "shares" is "shares."

Forecasting the stock market is fraught with difficulty, and data scientists often run into roadblocks when attempting to create a predictive model. The correlation between investor psychology and market

behaviour, as well as the volatility of the stock market, pose two major challenges: complexity and nonlinearity.

## II. MOTIVATION

Since it could be worth billions, the world's largest financial institutions are investing heavily in studying stock market price prediction. It is a serious issue since there is no apparent solution, despite the fact that approximations can be made using a variety of machine learning approaches. A vast data set can be collected and analysed as part of the project, and a number of different methodologies can be used to train the programme and forecast possible results.

## III. LITERATURE SURVEY

Due to its impact on financial difficulties and its ability to be predicted, the stock market is currently the subject of study in a wide range of disciplines. The ICECA 2017 Stock Market Forecasting International Conference on Electronics, Communication, and Aerospace Technology By employing Linear Regression, Reference: Dinesh Bhuriya et al. Our study's ultimate goal is to offer stock brokers and investors a hand up as they put their money to work in the stock market. Stock market business is a very complex and challenging process due to the dynamic nature of the stock market, so prediction plays a very important role in this business. Consistent with the aforementioned literature, our system makes accurate stock price predictions using a variety of regression techniques, including linear regression. After looking at the results of each method and comparing them based on the confidence values they gave, they decided that linear regression gave the best results.

Maqsood, H., et al. [2] Market fluctuations are affected not only by the nonlinearity of data and economic rules but also by public opinion and the state of the economy and government. They used linear regression,

support vector regression, and deep learning to effectively predict stock prices based on Twitter data for events that happened between 2012 and 2016. The findings indicate that not all major events have a consequential effect on stock market forecasting. However, the effectiveness of prediction algorithms can be impacted by more significant local events. Some global events have been noted to affect stock markets in other countries as well. Predictions of the stock market now also incorporate data from news reports. The state of the country typically has a significant impact on the stock market, and the news can be a good place to learn about these developments. Machine learning methods can be used to anticipate trends in the news, which can then be applied to the stock market. One potential area of development is the application of such a massive Twitter dataset to the problem of predicting interest and exchange rates. Foreign exchange and interest rates are sensitive to market sentiment and can quickly change.

The idea of an improved AdaBoost algorithm model to pick outperforming stocks was proposed by Sun Yutong et al. [3]. This model analyses stocks in depth to select those with a return that is greater than the market average. These findings demonstrate the superior effectiveness and precision of the AdaBoost algorithm when choosing stocks. It has higher than average output reliability and return. When using this model, you won't have to worry about overriding or waiting around for hours while it trains. In reality, we typically only invest in high-performing stocks, so there is a wide range in the error costs associated with various categories. Therefore, in this paper, we give different kinds of errors different amounts of weight to improve precision and effectiveness. A dissatisfactory accuracy rate of 54.5% on the testing dataset led them to the conclusion that the sophisticated AdaBoost algorithm falls short. Also, they discovered that there is a significant influence of factors and that simple weak learner perform poorly towards a single factor, resulting in a slow decline in error rate. Although the



factors are calculated in this model, they are not independent, which leads to fluctuating results and poor boosted classifier performance. In future projects, we will use methods like fundamental analysis and industry analysis to find stocks that look good.

According to J. B. Duarte et al [5], efficiency as a metric for judging the impact of investors' mentality on a simulated stock market. The goal of this research was to construct a scenario, grounded in the principles of behavioural finance that would allow for the representation of the behaviour of a market with multiple stock agents and the effect of the investor on the efficiency of that market. Changing the market's dispositions and the number of each type of agent can reduce the financial series' persistence level in the mixed cellular automaton model. It is possible to create a mixed learning cellular automaton model by instituting a system of punishments and incentives when the position taken by the behavioural agents is in response to the economic behaviour at the  $t+1$  instance.

According to Mehar Vijh et al. [6], two main strategies have been proposed to forecast a company's stock price. When predicting the future price of a stock, technical analysis relies on information about the stock's past performance, such as its closing and opening price, volume traded, adjacent close values, etc. Qualitative analysis, on the other hand, is conducted by economic analysts based on external factors such as company profiles, market conditions, political and economic factors, and textual information in the form of financial news articles, social media, and even blogs. These days, stock price forecasts are made using cutting-edge artificial intelligence methods based on technical or fundamental analysis. In the case of stock market analysis in particular, the data size is enormous and the data structure is non-linear. A model that is both efficient and capable of discovering previously unnoticed patterns and intricate interrelationships in this massive dataset is required for processing data of

this type. When compared to conventional methods, recent applications of machine learning in this field have been shown to increase productivity by an impressive 60–86%.

#### IV. Proposed Methodology

In the proposed system we have collected the dataset from the Tesla Stock Exchange from October 19, 2015 to October 16, 2020. The stock data obtained from Tesla contains the following parameters:

- Date: It has the date of the stock trading
- Open: The first price at which a security is traded during a business day is known as its "opening price."
- High: The period's highest closing price for a given stock
- Low: The period's lowest closing price for a given stock
- Close: The closing price is the last price at which an asset was traded on a given business day, as indicated by the word "close."
- Adj Close: When corporate actions are taken into consideration, the closing price of a stock is "adjusted" to reflect its true value
- Volume: The volume of a security is the number of shares that were bought and sold in a certain amount of time.

The data set is split into a training part, which has 90% of the data, and a testing part, which has 10% of the data.

#### Data Preprocessing

Data pre-processing is done by various methods in those we are using MinMaxScaler and it is imported from the scikit learn.

MinMaxScaler: Transform features by scaling each feature to a given range. This estimator scales and translates each feature individually such that it is in the given range on the training set, e.g. between zero and one.



Figure 1: Visualisation of whole stock close data

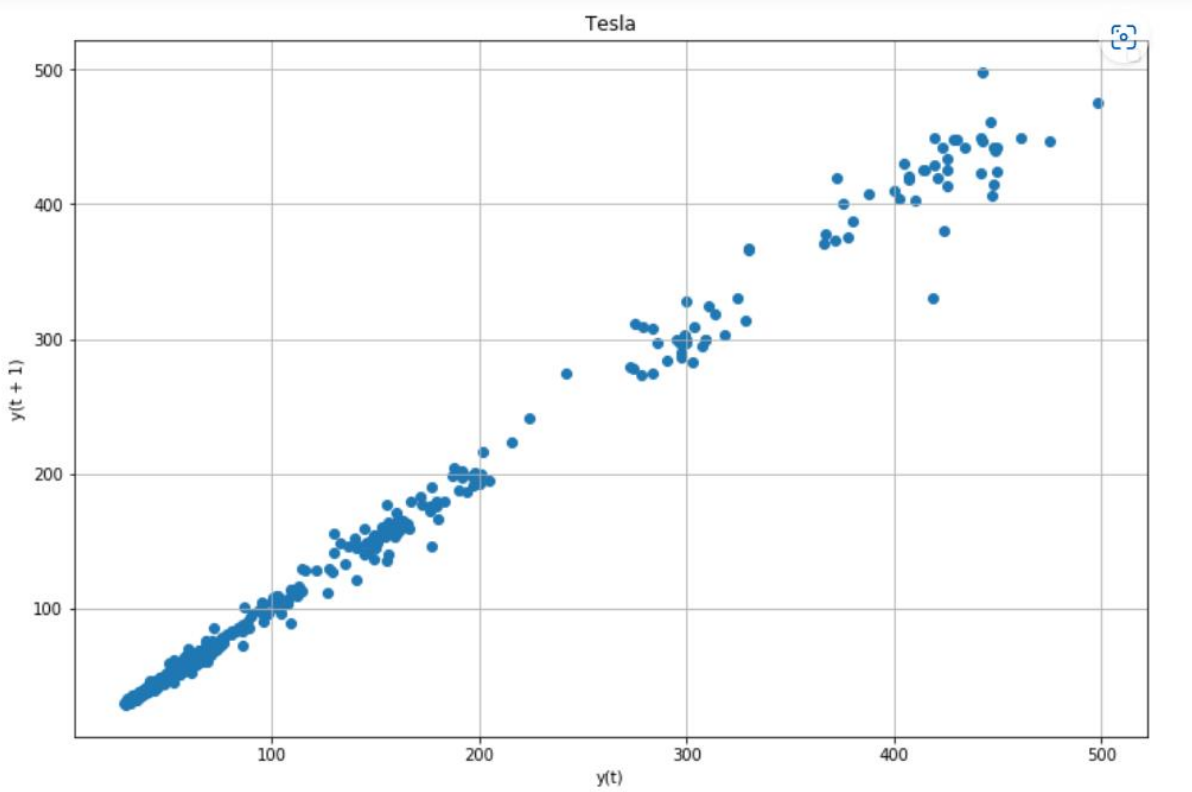


Figure 2: correlation of close coloumn in a Data Frame.

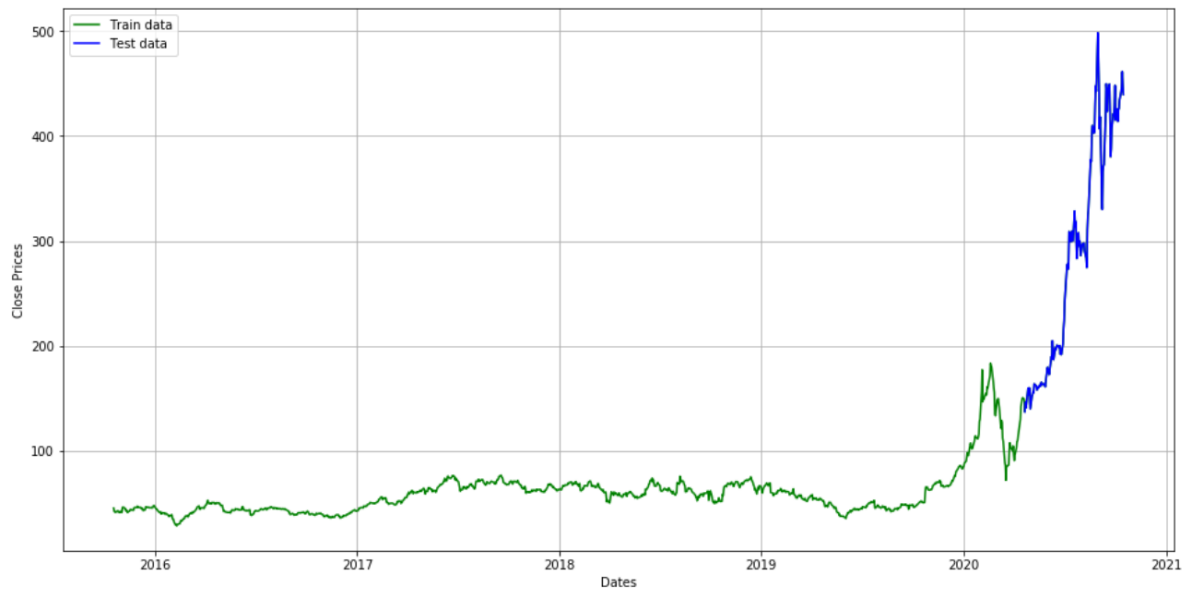


Figure 3: Visualization of training and testing data

## V. PREDICTION MODELS

Some of the machine learning techniques that are used here are Linear Regression, Ridge Regression, AdaBoost, CatBoost, LightBoost, and XgBoost.

### Regression model

For regression to work, a dataset must already have target values defined. Plus, the final product can be improved upon by including additional data. Regression can establish a pattern in the relationship between predictor and outcome values. Applying this pattern to other datasets where the desired values are unknown will yield similar results. For regression, you'll need two sets of information: training data and test data. Here, we conduct an analysis using linear regression. As a first step, we split the data into a training set and a test set. After that, we use the training phase to initiate analysis and establish the model's parameters. The data was split into a 90% training set and a 10% test set.

### Linear Regression

The supervised learning technique known as linear regression has been implemented in machine learning. It's tasked with carrying out a regression analysis,

which it does. Using independent variables, a target prediction value is modelled in a regression analysis. Most commonly, it is employed to investigate the connection between observables and future predictions.

### Ridge Regression

Multiple regression Data with multi-collinearity can be analysed with a technique called ridge regression. It works best when there are more predictor variables than observations in the data set. As a result, the second-best case scenario is multi-collinearity in a set.

### ADA Boost

The boosting method is a process that takes a group of weak learners and turns them into strong ones. To improve upon the predictions of every individual learning strategy, AdaBoost employs a specialised form of boosting known as an ensemble model. Boosting's main purpose is to teach less capable learners how to improve their accuracy by revisiting their old forecasts in a step-by-step process. This model is a meta-predictor, which means that it fits a model to the primary dataset and then uses that model to fit additional copies of itself to the primary dataset. By adjusting sample weights in response to the actual forecasting error, the training process helps the model zero in on the most challenging data points.

**XG Boost**

The decision tree-based ensemble model XG Boost is relatively new. The principles of boost for slow students are used here. The XG Boost model was introduced to outperform and outrun its tree-based counterparts in terms of performance and speed. The XG Boost method has many advantages over other similar approaches, including regularisation to prevent over-fitting, built-in cross-validation capability, expert handling of missing data, catch awareness, parallelized tree building, and tree pruning.

**Light GBM**

The model's efficiency is improved and memory consumption is decreased with Light GBM, a gradient boosting framework that uses decision trees. A One-Sided Sampling Method Using Gradients for Light-Weighted GBM The importance of various data instances in calculating information gain varies.

**Cat Boost**

Gradient-boosted decision trees are the foundation of Cat Boost. When trained, a series of decision trees are constructed in order. Loss is minimised with each new tree constructed. The initial settings determine how many trees will be created.

**VI. EXPERIMENTAL RESULTS AND DISCUSSIONS**

This section visualizes the performance of the model and communicates the report of the accuracy of the machine learning models.

The experiment were performed using Jupyter notebook. These experiments were supported on a system that is equipped with intel i5 10<sup>th</sup> Generation processor having 8GB RAM and running on 64-bit Windows 10 operating system.

**Dataset Description**

In the proposed system we have collected the dataset from the Tesla Stock Exchange from October 19, 2015 to October 16, 2020. The total rows in the dataset has 1259. The stock data obtained from Tesla contains the following parameters:

- Date: It has the date of the stock trading
- Open: The opening price is the price from the first transaction of a business day
- High: The highest price at which a stock has traded during the time period
- Low: The highest price at which a stock has traded during the time period
- Close: The closing price is the price from the end transaction of a business day
- Adj Close: The adjusted closing price amends a stock's closing price to reflect that stock's value after accounting for any corporate actions
- Volume: Volume is the number of shares of a security traded during a given period of time

The dataset is splitted in the form of training and testing, training consists of 90% and testing as 10%.

**Table 1.** Results of machine learning models

Methods	Accuracy	R Square
Linear Regression	98%	98%
Ridge Regression	89%	86%
AdaBoost	97%	97%
Xg Boost	99%	99%
Light Boost	84%	64%
Cat Boost	84%	86%

The XG boost Classifier technique has outperformed the other techniques and achieved a prediction accuracy of 99%.

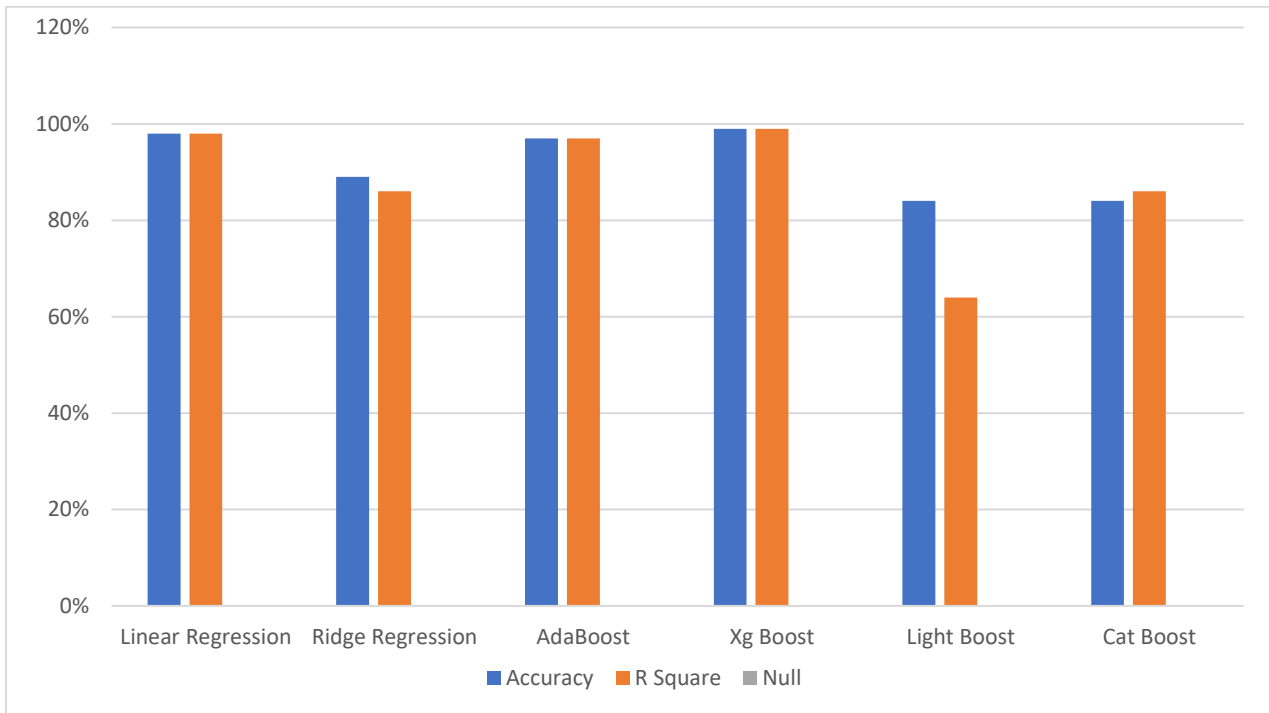


Figure 4: Accuracy and R squared chart visualization.

Table 2. Comparative analysis

Author and year	Title	Techniques	Accuracy
Dinesh Bhuriya, Girish Kaushal, Ashish Sharma and Upendra Singh,2017 [1]	Stock Market Predication Using a Linear Regression	Linear regression	97%
		Polynomial	46%
		RBF	56%
Sun Yutong, Hanqing Zhao, 2015 [3]	Stock Selection Model Based on Advanced AdaBoost Algorithm	AdaBoost	54%
<b>Proposed work</b>	Predicting Stock Market Using Machine Learning Algorithms	Linear Regression	<b>98%</b>
		AdaBoost	<b>97%</b>
		Ridge Regression	89%
		Xg Boost	99%
		Light Boost	84%
		Cat Boost	84%

From the above existing papers by comparative analysis the Linear regression and AdaBoost algorithms are got better accuracy.

Dinesh Bhuriya et al. in [1] calculated the level of confidence in linear regression as 97%. Confidence defines the probability of the single input occurred in the form of a event. If a class has high probability then it has high confidence. In proposed methodology accuracy of Linear regression is predicted rather than the confidence and got better accuracy than existing once. Sun Yutong et al. in [3] used advanced adaptive boost algorithm. Factors calculated in this model are not independent which makes result unstable and boosted classifier perform badly. In proposed methodology adaboost algorithm used to predict and R square is calculated and achieved better results.

## VII. CONCLUSION AND FUTURE SCOPE

To predict stock moment several machine learning methods are employed like Linear Regression, Ridge Regression, Ada boost, XG Boost, Cat Boost and Light Boost. Results show that boosting Classifier technique has outperformed the other techniques and achieved a prediction accuracy of 99%. This work can be extended by implementing some other Machine Learning models to data you may improve the findings and accuracy.

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# Impact of single-use plastic on local communities in India

## Mapping the lives and livelihoods of local fishing communities

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### ABSTRACT

Single-use plastics are the kind of plastics that are utilised once prior to being disposed of or recycled. Plastic bags, straws, coffee stirrers, soda and water bottles, and the majority of food packaging are examples of such materials. This plastic is then often disposed of in rivers and larger water bodies. Plastic pollution will have a disastrous impact on marine ecosystems and wildlife for many generations to follow. One of the coastal local communities that largely relies on the sea and the coast is the fishing community. Single-use plastic has extremely detrimental effects on the environment, including harm to marine life, a reduction in the quality of seawater, a decline in the livelihood of fishermen, and unfriendly consequences for their possibilities of survival. Henceforth, the need of the hour is to address the issue of the impact of single-use plastic on the local communities. Likewise, the paper intends to break down the issue exhaustively and set forth suggestions to handle the issue at hand.' This paper intends to investigate the manufacture, use, and disposal of single-use plastics, as well as the stakeholders involved in this industry. Further, the paper likewise expects to analyse how these concerns are tackled in different countries, especially those with socioeconomic and geographic similarities to India. Lastly, this research paper suggests certain actionable recommendations that are deemed necessary to help resolve the plastic problem in India.

**Keywords :** Plastic Bags, Straws, Coffee Stirrers, Soda, Paper Intend

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## I. INTRODUCTION

### 1.1 What is Single-Use Plastic?

Single-use plastics are plastic goods that are meant to be disposed of right after use. The term single-use

plastic in India is often interchangeably called disposable plastic.

Though the legislation in India does not provide any definition, the Plastic Waste Management Amendment Rules, 2021 classifies the following as SUP: thin carry bags (less than 50 microns); non-woven

carry bags and covers (less than 80 gsm and 320 microns); small wrapping/ packing films; straws/ stirrers; cutlery such as foam cups, bowls; earbuds with plastic sticks; cigarette filters; small plastic bottles; plastic banners; among other products.<sup>1</sup>

In the absence of an official definition, the following definition provided by the European Union might be more useful: *a single-use plastic product is a product that is made wholly or partly from plastic and that is not conceived, designed, or placed on the market to accomplish, within its life span, multiple trips or rotations by being returned to the producer for a refill or reused for the same purpose for which it was conceived*<sup>2</sup>.

## 1.2 Production of Single-Use Plastic

The process of plastic production begins with the extraction of raw materials (largely crude oil and natural gas, but also coal).<sup>3</sup> The raw materials like crude oil are refined into numerous petroleum products. The products are converted to form many useful chemicals including monomers (a molecule that is the basic building block of polymers). These monomers are then chemically combined to form chain-like structures called polymers which are converted to a molten state where several additives are blended to achieve the desired characteristics. The molten state cools off to form plastic.

The production of plastic is largely reliant on fossil hydrocarbons, which are non-renewable resources. If the current pace of development in plastic production

continues, the plastic industry might account for 20% of global oil use by 2050.<sup>4</sup>

## 1.3 Usage of SUP

The impact single-use plastic creates is significant to the global extent of its use which has spiked up in the past few years: The world is producing 538 billion plastic bottles per year from the earlier number of 438 billion in just five years. As consumers, we have reached the alarming number of using 5 trillion plastic bags per year which is 160,000 plastic bags every second<sup>5</sup>.

With a focus on America, we learn that half a million plastic straws are used by residents. The use of single-use plastics has tripled in the past two years (Since the start of the pandemic) owing to various factors including an increase in takeout orders.<sup>6</sup>

Coming closer home to India, 5.58 million tonnes<sup>7</sup> (MT) of single-use plastic is used annually. Furthermore, the country ranks as the third-largest producer of plastic in the world<sup>8</sup>.

Looking at the financial year of 2019, we see the total demand for major plastics across India was approximately 16 million metric tons, of which polyethylene had the highest demand with around 5.3 million metric tons. Polythene was followed by polypropylene, which had a demand of over five million metric tons. The total demand of the Indian market made up less than six per cent of the global demand. Out of the total plastic waste produced only

<sup>1</sup> Ministry of Environment, Forest and Climate Change, Plastic Waste Management Amendment Rule, August 13 2022, <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1745433>

<sup>2</sup> European Commission, Single Use Plastics, 2 July 2019 [https://environment.ec.europa.eu/topics/plastics/single-use-plastics\\_en](https://environment.ec.europa.eu/topics/plastics/single-use-plastics_en)

<sup>3</sup> Dr Payal Baheti, British Plastic Federation <https://www.bpf.co.uk/plastipedia/how-is-plastic-made.aspx>

<sup>4</sup> World Economic Forum, 2016

<sup>5</sup> Hannah Ritchie and Max Roser, Our World in Data, April 2022

<https://ourworldindata.org/plastic-pollution>

<sup>6</sup> Hannah Ritchie and Max Roser, Our World in Data, April 2022

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<sup>7</sup> Ian Tiseo, Leading plastic consumption in India in financial year 2019

<https://www.statista.com/statistics/1154447/common-plastic-consumed-india-by-type>

<sup>8</sup> India Today, May 2021

<https://www.indiatoday.in/science/story/plastic-waste-india-reliance-mukesh-ambani-1804331-2021-05-19>



60% is being recycled. Households are generating maximum plastic waste, with water and soft drink bottles forming a large number. In the country, around 43% of manufactured plastics are used for packaging purposes and most are single-use. Multi-Layered Plastics also make up a large part of the single-use plastic waste and are categorised under either recyclable, energy recoverable, or having some other alternate use, but their recycling is an expensive process<sup>9</sup>.

#### 1.4 Social, Economic and Environmental Impacts of SUP

##### Social

Oil extraction fields, and chemical and plastic industries are usually located near predominantly minority populations. The people living in these areas are exposed to high levels of toxic pollution and are known to have a high risk for cancer, heart disease, and other respiratory problems. For example, Cancer alley, in the state of Louisiana, serves as an industrial hub with nearly 150 chemicals and plastic plants - where the risk of cancer is 50 times the national average.<sup>10</sup>

Another common impact of usage of SUP is on the marginalised sections of society, such as waste-pickers. Most consumers discard waste with little thought of pre-processing or understanding of what is recyclable. This places a great burden on the recycling facilities and waste pickers to sort wastes and determine which items have recycling value. Waste pickers play a pivotal role in our global recycling process. They work under hazardous conditions for long hours with low

wages resulting in many indirect health effects like respiratory illness and infection.

##### Environmental

Polyethene, the most discarded form of plastic, is the highest emitter of methane, a powerful greenhouse gas, and ethylene, which reacts with the gas Hydroxide in the atmosphere, increasing the concentrations of carbon monoxide<sup>11</sup>. Currently, the global plastic industry emits 850 million<sup>12</sup> tons of greenhouse gases per year which include the production and incineration of plastics and the degradation of plastics due to sunlight exposure. The transportation of plastics also contributes to climate change. Incineration, a common method of plastic disposal results in the disruption of the plastic's original structure releasing toxic compounds increasing the risk of premature mortality related to respiratory issues.

Marine animals also bear the burden of this influx of garbage into their habitats. Plastic waste is ingested or entangled by marine creatures, resulting in serious injury and death. Seabirds, whales, fish, and turtles mistake plastic debris for food, and the majority of them starve to death as their bellies fill with plastic<sup>13</sup>.

Pollution originates in different stages of the plastic life cycle and harms fishing activities as well. Hazardous chemicals such as bisphenols are released by microplastics entering marine food chains and bioaccumulating through trophic levels. The runoff from plastic recycling and incineration systems threatens to pollute waters used for fishing and other agricultural activities.

9 The Energy and Resources Institute, Fact Sheet on Plastic Waste in India, 2018

<https://www.teriin.org/sites/default/files/files/factsheet.pdf>

<sup>10</sup>United Nations, UN News, 2 March 2021, <https://news.un.org/en/story/2021/03/1086172>

<sup>11</sup>Williams M and others, 'No Time to Waste: Tackling the Plastic Pollution Crisis Before It's Too Late' (Tearfund 2019)

<sup>12</sup>World Wide Forum, April 2022

[https://wwf.panda.org/wwf\\_news/?5406441/climate-plastic-treaty](https://wwf.panda.org/wwf_news/?5406441/climate-plastic-treaty)

<sup>13</sup>International Union for Conservation of Nature, November 2021

<https://www.iucn.org/resources/issues-briefs/marine-plastic-pollution#:~:text=Marine%20wildlife%20such%20as%20seabirds,to%20swim%2C%20and%20internal%20injuries.>

## Economic

Post-consumer single-use plastics have a poor economic value. The economic case for recovering and recycling these materials is weak. They are unable to be recycled and end up as non-biodegradable garbage polluting seas and oceans and posing a big threat to all marine life.

The pollution of the seas and oceans does not only affect marine life but also those who depend on it for their livelihood. According to Valuing Plastic, a UNEP-sponsored report created by the Plastic Disclosure Project (PDP) and Trucost, the annual natural capital cost of using plastic in the consumer goods industry is US \$75 billion<sup>14</sup>. This cost includes the financial costs associated with problems like marine environment pollution and air pollution brought on by burning plastic.

Plastic pollution also affects local businesses. Beaches trashed with marine litter are less likely to be visited by tourists, reducing income for beach communities by millions of dollars annually. In addition to driving away customers, beach clean-up efforts require high costs further impacting coastal communities in middle to low-income countries.

### 1.5 Stakeholders Involved

Several stakeholders are involved in both the production as well as the usage of Single-Use Plastics. Additionally, stakeholders are also involved in the import, stocking, distribution and sale of the same. Bottled-water manufacturing companies, Plastic bag

producing companies, and petrochemical companies are a few examples.

There is a need for regulation in the rules regarding the usage of Single-Use Plastics. The rules can be framed along the lines: a significant increase in the cost of production which would in turn require them (the stakeholders) to switch to a more sustainable material for their product.

### 1.6 The Legal and Regulatory Framework for the regulation of Single-Use Plastic in India

India's current legal and regulatory framework for regulating single-use plastic, as a nation, includes The Plastic Waste Management Rules, 2016<sup>15</sup> (amended in 2018<sup>16</sup> and 2021<sup>17</sup>); there also exist particular state laws that are currently in force to deal with plastic waste in those particular states.

The Plastic Waste Management Rules, 2016, amended the 2011 Rules and aimed to reduce the amount of plastic waste by taking several measures that include:

- a) Increasing the minimum thickness of plastic carry bags from 40 to 50 microns to facilitate collection and recycling, promoting its use for road construction, energy recovery and so on.
- b) Prohibition of the manufacture, import, stocking, distribution, sale and use of the enlisted single-use plastic, including polystyrene and expanded polystyrene:
  - i. earbuds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [thermocool] for decoration;

<sup>14</sup> UNEP Press Article, 23 June 2014

<https://www.unep.org/news-and-stories/press-release/plastic-waste-causes-financial-damage-us13-billion-marine-ecosystems#:~:text=It%20finds%20that%20the%20overall,pollution%20caused%20by%20incinerating%20plastic.>

<sup>15</sup> Ministry of Environment, Forest and Climate Change India, Notification, March 18, 2016. <http://www.mppcb.nic.in/proc/Plastic%20Waste%20Management%20Rules,%202016%20English.pdf>

<sup>16</sup> Ministry of Environment, Forest and Climate Change India, Plastic Waste Management (Amendment) Rules, March 27, 2018.

<https://cpcb.nic.in/displaypdf.php?id=cGxhc3RpY3dhc3RIL1BXTV9HYXpldHRILnBkZg==>

<sup>17</sup> Ministry of Environment, Forest and Climate Change India, Plastic Waste Management Amendment Rules, August 13, 2021. <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1745433>

- ii. plates, cups, glasses, cutlery such as forks, spoons, knives, straws, trays, stirrers, wrapping or packaging films around sweet boxes, invitation cards, cigarette packets, plastic or PVC banners of less than 100 microns, and stirrers.
- c) Establishing an efficient waste management system.

A significant addition in 2016 was the legal mandate on plastic manufacturers and retail establishments that utilise plastic as a major constituent, to act in accordance with the system of re-collecting the plastic waste: Extended Producer Responsibility.

Furthermore, a few past state initiatives are elaborated upon below. Additionally, these states have individually planned to take into account and implemented the guidelines of the 2021 amendment, which will come into effect from July 2022:

### **Maharashtra**

In 2018<sup>18</sup>, the Government of Maharashtra issued a notification banning the manufacturing, usage, sale, distribution, and storage of plastic materials that included one-time usage (single-use plastic), a penalty between Rs. 5000 and Rs. 25,000 was imposed for a violation of these rules. However, this ban did not sustain due to the low level of awareness, strong lobbying by the industry and a significant lack of alternatives to the material.

### **Uttar Pradesh**

In 2018<sup>19</sup>, the Uttar Pradesh Government imposed a ban on polythene bags as well as other single-use

plastic items, alongside a ban on non-biodegradable polythene. The ban was rolled out in phases, to make the state plastic-free. First-time offenders would be fined Rs 1,000 and could be imprisoned for up to one month, according to the rules. Second-time offenders will face a six-month prison sentence and a fine ranging from Rs 5,000 to Rs 20,000. Those discovered making, storing or carrying illegal plastic bags for the first time face up to six months in prison and a fine ranging from Rs 10,000 to Rs 50,000. If you violate the ordinance for the second time, you might face a year in prison or a fine of up to Rs 1 lakh.

### **Goa**

Banning the supply of plastic raw material, stopping the manufacturing, sale, and use of banned SUP items, and promoting alternatives to SUP are all examples of supply-side interventions in Goa. To ensure that the phase-out is completed, the state government runs random inspections of plastic waste providers to ensure that the materials are not being given to banned single-use plastic companies. The state government also intends to create an app-based system to monitor the manufacturing, stockpiling, distribution, sale, and usage of prohibited single-use plastic goods.<sup>20</sup>

## **II. Impact of Single-Use plastic on local Indian communities**

### **3.1 Impact of Single-Use plastic on the Local Fishing Communities**

According to conservative estimates, eight million metric tons of plastic enter the world's oceans yearly<sup>21</sup>. That is the equivalent of two Empire State Buildings

<sup>18</sup>Singh, Dipti . "Maharashtra Pollution Control Board Issues Public Notice on Banning Single-Use Plastic." Maharashtra Pollution control board issues public notice on banning single-use plastic. The Free Press Journal. March 11, 2022. <https://www.freepressjournal.in/mumbai/maharashtra-pollution-control-board-issues-public-notice-on-banning-single-use-plastic>.

<sup>19</sup> Srivastava, Kanchan. "A Year On, Plastic Waste Returns to Uttar Pradesh Despite Ban." The Wire. July 17, 2019. <https://thewire.in/environment/uttar-pradesh-plastic-waste-return-ban>.

<sup>20</sup>Goa Creates 3-Part Action Plan Ahead of Plastic Ban from July 1 | Goa News - Times of India." *The Times of India*, [timesofindia.indiatimes.com](https://timesofindia.indiatimes.com), <https://timesofindia.indiatimes.com/city/goa/state-creates-3-part-action-plan-ahead-of-plastic-ban-from-july-1/articleshow/91242436.cms>. Accessed 13 June 2022.

<sup>21</sup>Britta Denise Hardesty,CSIRO and Chris Wilcox, CSIRO, Eight million tonnes of plastic go into the ocean every year

worth of plastic entering the water every month.<sup>22</sup> For generations to come, plastic pollution will have devastating effects on marine species and ecosystems. Plastic pollution from land to sea is one of the most prevalent environmental issues faced by the planet today.<sup>23</sup> Marine and coastal ecosystems are the main pillars that support the lives of local coastal communities. The fishing community is one of the coastal local communities that make the sea and the coast their main source of livelihood. Therefore, the degradation of the quality of marine and coastal ecosystems is a threat to fishermen's life.

In general, the garbage that pollutes coastal areas is split into two categories: organic and non-organic waste. Pieces of wood, tree roots, and bamboo are among the organic trash that can be found. Organic waste is simple to degrade, and its presence does not constitute a significant threat to coastal ecosystems and populations. Non-organic waste is the most significant pollutant of the water and coastal regions. The most common types of marine and coastal plastic litter are single-use disposable food containers, packaging, and plastic bags<sup>24</sup>.

Pollution of plastic litter, both those that are still in the sea and those that have piled up on the surface of the water bodies, presents a problem of its own to coastal communities, including fishermen. When fishing nets are dragged or hauled ashore after being left in the water for several hours, they include not just fish but

also plastic garbage. Sorting fish and plastic garbage has become a routine trend among fishermen. The garbage is then left to pile up on the seashore once the fish and plastic have been separated. This process makes the fishermen's work duration longer than it should be. Indeed, fishermen have attempted to clean up the trash and dispose of it at the nearest landfill, but because the amount of waste continues to grow and the local government's control of coastal waste management is inadequate, fishermen have chosen to leave the plastic waste heaped on the water bodies.<sup>25</sup> Since fishermen rely on marine and coastal habitats as their major source of food, plastic and garbage pollution have a direct impact on their livelihoods. As the state of the oceans and rivers has worsened due to marine debris and rubbish, the catch of fishermen's sea fish has plummeted. Polluted seawater and, as a result, a smaller fishing zone have made it more difficult for fishermen to catch fish. This condition has a direct impact on the economic status of fishermen.

A drop in the catch has a proportional impact on the well-being of fishermen's households. Most traditional fishermen and labour fishermen, who make up the fishing community's largest socioeconomic group, suffer from poverty and poor levels of social welfare.<sup>26</sup> When primary livelihood from fishing gets impacted, fishermen are forced to rely on secondary or other sources of income which may not always be efficient for them. As a result, fishermen's wives frequently

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[Eight million tonnes of plastic go into the ocean every year – Tribune International \(Australia\) \(tribune-intl.com\)](#)

dsa

<sup>22</sup>Dillon Hanson-Ahumada, The Devastating Impact of Plastic Pollution on Our Oceans and Marine Life, [The Devastating Impact of Plastic Pollution on Our Oceans and Marine Life | NRDC](#)

<sup>23</sup>Hanson, A.M., (2019). Women's Environmental Health Activism Around Waste and Plastic Pollution in the Coastal Wetlands of Yucatan. Topics in Gender and Water, Sanitation and Hygiene.

<sup>24</sup>[Minister for Green Skills, Circular Economy and Biodiversity](#), Single-use food containers and other single-use items: call for evidence,

[Single-use food containers and other single-use items: call for evidence - gov.scot \(www.gov.scot\)](#)

<sup>25</sup>Maanvi Singh, How India's Fishermen Turn Ocean Plastic Into Roads, [How India's Fishermen Turn Ocean Plastic Pollution Into Roads \(nationalgeographic.com\)](#)

<sup>26</sup>Aarti Kelkar-Khambete, Traditional fisherfolk of Kerala - An article about their socio-economic organisation and the special relationship they share with the sea and the environment, [Traditional fisherfolk of Kerala - An article about their socio-economic organisation and the special relationship they share with the sea and the environment | India Water Portal](#)

assist the family's economic situation by trading or opening small stores to meet basic needs.<sup>27</sup>

To summarise, single-use plastic has extremely negative effects on the environment, including a decrease in the quality of seawater, and severe damage to marine inhabitants while subsequently leading to a sharp decline in fishermen's livelihood, and the detrimental consequences on their survival chances.

### III. Comparative Analysis - assessing the impact of policies in other countries

Along with India, many other countries are making efforts to reduce the production and consumption of Single-Use plastics. Here are the examples of such countries and their policies towards it:

#### *Indonesia*

Indonesia has banned single-use plastic.<sup>28</sup> It has decided to use multiple policies and ideas to reduce its consumption of single-use plastic. Firstly, manufacturers should be encouraged to utilise collected and recyclable packaging and to decrease the usage of single-use plastic. Second, regulations supporting radical efficiency methods for plastic reuse and repurposing are being developed. Thirdly, they are working towards innovation regarding the reduction of plastic.<sup>19</sup> In rivers such as the 'Citarum,' waste collection dams are being installed to clean up this river. This floating dam is built from local materials and catches all of the waste floating in the first 60 centimetres of the water.<sup>29</sup> This can be used in India in

<sup>27</sup>Wilda Fesanrey and Samsia Umasugi, The Role of Fishermen's Wife in Increasing Family Income, (PDF) [The Role of Fishermen's Wife in Increasing Family Income \(researchgate.net\)](https://www.researchgate.net)

<sup>28</sup>Lucentezza Napitupulu, Hidayah Hamzah and Sakinah Ummu Haniy, 3 Key Interventions to Support the Ban on Single-Use Plastic, [3 Key Interventions to Support the Ban on Single-Use Plastic | WRI Indonesia \(wri-indonesia.org\)](https://www.wri-indonesia.org)

<sup>29</sup><https://www.dw.com/en/a-floating-dam-against-plastic-trash/av-53352072>

order to collect the excess plastic waste floating in water bodies.

#### *Brazil*

Brazil, the world's fourth-largest producer of plastic waste, recycles only 1.28 per cent of the 11.4 million tonnes of garbage it generates each year<sup>30</sup>. As a result, approximately 7.7 million tonnes of plastic garbage from Brazil find its way to the landfills<sup>31</sup>. Recently, Guanabara Bay in Brazil faced a paucity of fish supply due to the amount of plastic waste in its waters. An Italian enterprise in Brazil has begun a program consisting of 25 fishermen families. These fishermen are determined to clean the bay. The project aims to help local fishermen with minimum wages for work while aiming to collect 100 tonnes of trash within the next 12 months.<sup>32</sup> This can be used in India as an incentive for fishermen to collect the waste gain some money out of it. Companies can use this waste as plastic credits and also get the incentive to recycle more.

#### *Thailand*

When looking at the Plastic waste management system in Thailand it is extremely similar to the issues faced by India's Plastic waste management system. Like India, Thailand also needs to address the challenge of designing a system which bans single-use plastic products while at the same time providing alternate reusable products and also improving waste collection coverage to ensure that all collected waste is sent to appropriate treatment facilities.

Thailand has used many collaboration approaches which include a Memorandum of Understanding

<sup>30</sup>Wion News on Twitter <https://twitter.com/wionews/status/1534516844220100615?s=24&t=hCUOAKEtSFrvQDSyBkQRJw>

<sup>31</sup>Wion News on Twitter <https://twitter.com/wionews/status/1534516844220100615?s=24&t=hCUOAKEtSFrvQDSyBkQRJw>

<sup>32</sup>Wion News on Twitter <https://twitter.com/wionews/status/1534516844220100615?s=24&t=hCUOAKEtSFrvQDSyBkQRJw>

(MoU) with food delivery platforms, to lessen the use of single-use plastics. The MoU is a voluntary agreement between the Pollution Control Department and food delivery platforms and restaurants to collaborate on activities to reduce the problem of plastic waste by reducing single-use plastic products in food delivery operations.

Apart from that Thailand has also introduced many programmes which promote public education and awareness about plastics. They include recycling programmes in communities and education programmes promoting the use of single-use plastic products as well as campaigns related to the reduction of plastic bags in fresh markets and supermarkets.<sup>33</sup>

### **Rwanda**

Rwanda had initially developed a policy in 2004 on plastic shopping bags. Then in 2008, regulations related to the prohibition of manufacturing, importing, use and sale of polythene bags were introduced and extended to all packaging plastics. Then in 2019, a new law came that covered other plastic materials as well which contribute to plastic pollution.

Rwanda conducted wide-reaching and ongoing awareness-raising and sensitization programmes reaching all levels of the population and carried it out through different media channels like TV, radios, etc. Apart from this Rwanda has made sure that illegal transportation of plastic does not take place by ensuring regular inspections to control compliance and control of the entrance of plastics at all country borders and this has also contributed to better success of the policy.<sup>34</sup>

Recently Rwanda has banned all non-degradable plastic bags, however, recent reports have suggested

that while the ban looks impressive on paper it has created major issues for people who rely heavily on them considering Rwanda does not have enough alternatives<sup>35</sup>. This is a major learning for India as well. Directly banning plastic without having the infrastructure to face the repercussions would only invite more issues.

The countries above all have policies that address the plastic problem. Some are successful and some have failed. This, in fact, can be seen as learning for India which can adapt the successful policies to the existing system and be careful not to repeat the same mistakes as the countries that have failed.

## **IV. Actionable recommendations and solutions**

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Keeping in mind the adverse impacts of SUPs and their impact on local and marginalised communities following are the actionable recommendations and solutions India can take to bring down the current levels of production, distribution, and consumption of plastics and single-use plastics in the country:

### **Community-Based approach**

- *Community-based approach:* Since the impact of SUPs is largely felt by local communities, as seen above, it may be prudent to take a community-based approach in shaping solutions to the problem. India can try to engage local, marginalised, and small communities at first. Organisations such as non-profits, and profit organisations working for climate justice, can reach out to local communities like rag pickers and fishing communities and engage them to help collect waste while giving them some sort of incentive. This would work

<sup>33</sup>UN Environment Programme, Addressing Single-use plastic products pollution using a life cycle approach, Pg 38.

<sup>34</sup>UN Environment Programme, Addressing Single-use plastic products pollution using a life cycle approach, Pg 34,

<sup>35</sup>Kinder, Plastic-free is not problem-free: Rwanda struggles despite ban, <https://kinder.world/articles/problems/plastic-free-is-not-problem-free-rwanda-struggles-despite-ban-17698>

especially well with fishing communities since plastics affect their ecosystem directly. Companies should also measure the quantities and types of plastic that the communities collect and use the plastic collected either to create new products or use the plastic to create energy.. CSR funding can act as an incentive for companies to engage in such activities since this can become a part of their annual CSR target.

- *Co-processing*: Co-processing is a waste management system in which waste materials are converted into alternative fuels and/or raw materials.<sup>36</sup> Co-processing will allow the trapping of energy and also utilise the leftover ash. This is an effective option companies can consider after having collected the waste by the engagement of local communities.
- *Awareness campaigns for single-use plastic*: Environmental awareness campaigns should be held across communities to acquaint them with the problems associated with Single-Use Plastics so that they can be conscious of their usage of the same. These campaigns should not target only a particular group but all income groups and communities. To ensure that these programs can reach all levels of the population, different types of media such as television, radios, newspapers, and so on should be employed. These programs should also be targeted toward fishing communities and be designed according to their needs.
- *Regular beach clean-ups*: Beach clean-ups with the help of volunteers should be carried out to spread awareness amongst the youth about preventing plastic from going into water bodies. The VeryNile initiative, for instance, in Egypt brings together a diverse group of volunteers and partners to work on

finding long-term solutions for cleaning up the Nile, recycling solid trash collected from the river, and reducing the use of single-use plastics.<sup>37</sup>

### Government Sanctioned

- *Effective Waste management*: Even today, India has ragpickers on the streets working without any sanitary equipment such as gloves or masks. Inhaling microplastics for a longer duration of time is extremely dangerous. Thus, the government should ensure that the municipalities, local government bodies, etc. help such ragpickers and provide them with hygiene equipment such as gloves, masks, sanitisers, etc. so that they are able to collect this waste without harming themselves in the process.
- *Bio- Plastics*: Due to the lack of alternatives, the production and use of plastics keep on increasing. Here, bioplastics present themselves as a viable alternative. Bioplastics are fully or partially produced from natural resources (sugarcane and corn) rather than fossil fuels yet they possess properties identical to their conventional version. Since they are made from renewable resources, bioplastics are sustainable, largely biodegradable and biocompatible. However, bioplastics have some problems also. Firstly, not all bioplastics are biodegradable and the land required for bioplastics competes with food production because the crops that produce bioplastics can also be used to feed people. Bioplastics are also relatively expensive.
- *Segregation of waste at the source*: Wastes like plastics, organic, metals and paper should all be segregated at the source. In Bangalore, individuals and businesses must separate trash before it is collected by municipal staff. This is a practice that

<sup>36</sup> <https://tontoton.com/co-processing-what-more-do-we-need-to-know-about-it/>

<sup>37</sup>“Feature: Egypt’s Nile Cleanup Initiative Raises Environmental Awareness, Creates Jobs - Xinhua | English.News.Cn.” *Feature: Egypt’s Nile Cleanup Initiative Raises Environmental Awareness,*

*Creates Jobs - Xinhua | English.News.Cn*, www.xinhuanet.com, 9 June 2021, [http://www.xinhuanet.com/english/africa/2021-06/09/c\\_139997092.htm](http://www.xinhuanet.com/english/africa/2021-06/09/c_139997092.htm).

should be implemented across all states at municipal levels. Landfilling and dumping should be avoided by investing more funds in storage facilities due to landfills being a major source of methane- a greenhouse gas, whose surplus causes the Earth's atmosphere to trap more heat which results in the increase of temperatures above normal. Recycling companies can then pick up the segregated wastes from these storage units and recycle them. Most importantly, landfills should be properly managed so that they do not become a source of greenhouse gases and toxins. This process should be done in a phase-wised organised manner so that waste can be collected and reused again.<sup>38</sup>

- India should add compostable single-use plastic products to the list of single-use plastics banned as when we look at the real-life practical scenario, the country does not have the mechanism to compost the waste.
- Another solution can be to develop the required mechanism: increase the number and efficiency of industrial composting units. Industries can be incentivized by keeping certain eco-friendly materials tax-free. The government should allow them enough time to transition as well and offer them tax rebates for being eco-friendly. Since food delivery companies create a lot of SUP waste the government can come up with programs and schemes in collaboration with companies like Zomato and Swiggy to change their packaging to more eco-friendly and biodegradable products by providing them with incentives like tax rebates and subsidies.

*Taking suggestions from states:* Establishment of plastic crusher machines, similar to the ones at The Golden Temple, Amritsar, Punjab; incentivize the

recycling of used plastic by providing money whenever an individual does so. Inspiration should also be taken from Sikkim which is a 100% organic and plastic-free state. Kerala's *Suchitwa* mission should be taken as an example of a great initiative by the government for a cleaner and healthier environment, the mission focuses on zero plastic and phasing out single-use plastics. But it was shut down due to a lack of funds, the government should have a special focus on redirecting funds for such projects. Plastic Waste Management laws are constantly changed and amended by legislators which makes it difficult to measure their impact. Any law the government passes in the future should be in effect for a longer period to increase its impact as well as to enable the calculation of the positive change (if any) brought by it.

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Journal URL : <https://ijsrset.com/IJSRSET229534>

<sup>38</sup>“Waste Management Crisis in India - Recycling Magazine.” *RECYCLING Magazine*, www.recycling-magazine.com, 6 May 2020, <https://www.recycling-magazine.com/2020/05/06/waste->

[management-crisis-in-india/#:~:text=Urban%20India%20generates%2062%20million,just%2011.9%20million%20is%20treated.](https://www.recycling-magazine.com/2020/05/06/waste-management-crisis-in-india/#:~:text=Urban%20India%20generates%2062%20million,just%2011.9%20million%20is%20treated.)



# Solutions to minimize the impacts of climate change on bridge abutments in the Vam Co river downstream, Long An province, Vietnam

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## ABSTRACT

Long An province, Vietnam, is one of the provinces in the Mekong Delta region, with the geographical location and natural conditions of dense rivers and canals, so it is easily affected by extreme weather phenomena, leading to impact on socio-economic issues in general and the field of traffic construction in particular. Especially, bridge works in the downstream area, in which the abutment and pier system is among the hardest impacted categories. This article uses the expert method by consulting experts and road managers in Long An province to identify the influencing factors. Then, the authors use SPSS20 software to build an econometric problem of regression analysis, assessing the influence of this factor on the management and exploitation of bridge abutments in the increasing conditions of climate change in Long An. After that, this study proposes solutions to minimize the impact of climate change on the bridge abutments in the Vam Co lower river, Long An province, Vietnam.

**Keywords :** Climate Change, Bridge Abutment, Solutions, Downstream, Impacts.

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## I. INTRODUCTION

Climate change is causing more frequent and severe floods, droughts, storms and heat waves as average global temperatures rise to new record levels. Scientists have warned that an increase in greenhouse gas emissions globally could lead to extreme weather conditions and higher risks from natural disasters [1]. Vietnam is one of the countries most heavily affected by climate change, in terms of politics, socio-economic, national defense and security. Therefore, proactively responding to climate change is an important and urgent issue [2].

Extreme weather events that occur abnormally, in which temperature increases, heavy rains, high tides, sea level rise, saline intrusion, etc., with increasing frequency and intensity, are specific examples of climate change, causing serious impacts on the system of road traffic works in Vietnam.

The morphologies of climate change affecting abutments and piers include 1) deformation of the river bed; 2) shoreline change in the downstream area; 3) downstream area and 4) sea level rise and saline intrusion to the downstream.

Management and exploitation of bridge abutments and piers in the context of climate change are activities of management, preparation, use and storage of records

related to works in general, abutment and pier systems in particular; operating the system, checking, monitoring and updating changes; immediately dealing with damage and protecting the abutment and pier systems during the exploitation phase, especially in climate change conditions in order to reduce the impact on the abutment and pier systems by extreme weather phenomena such as rain, storm, flood, temperature rise, sea level rise, saltwater intrusion, etc. causing damage and destruction to abutments and piers. This work is carried out regularly and continuously to maintain the technical state, ensure the role and function of the abutment and pier systems in the overall operation of the bridge, promote its functions, save maintenance costs and improve exploitation efficiency.

Climate change and the impact of natural disasters is the change in characteristic values of the natural environment affecting bridge works in general, bridge abutments and piers in particular. If the design works is according to environmental conditions, it will not be safe enough for future responsiveness, potential risks and impacts will be very serious if no timely countermeasures are taken.

Therefore, the study identifies the effect of climate change factors on bridge abutments and piers including [3]:

- The increase in temperature rapidly destroys the protective layer of reinforced concrete structures, abutments, and causing cracks in the abutments.
- Reinforced concrete and bridge piers after a period of use often appear cracks, surface pits, abraded concrete flow, appearance of emulsions, or damage in the connecting parts between the piers. There are many causes of cracking and damage such as shrinkage, creep, strength of concrete or poor construction quality, resulting in the appearance of seepage, rust through the structure, reducing the capacity of the building and affecting the safety and the exploitation.
- Corrosion due to weathering: The surface is worn with rock or gravel only. The abutment material loses

its original strength, resulting in cracking of the outer parts. If it is a reinforced concrete structure, the protective concrete part is broken, causing exposure and rusting of the reinforcement, the section is reduced.

- Types of cracks appearing on the abutments, cylinder body: Cracks appear on the surface - these cracks are usually horizontal cracks along the construction joints, at the adjoining positions of the pedestal and pier body, cylinder body, the millstones, and the helm beams. Longitudinal and deep cracks caused by the action of loads. These cracks usually originate from the position of the supporting stone growing deep below the cylinder body, possibly through the thickness of the cylinder body.

- Landslides caused by collisions of boats: Due to weathered concrete, when there are heavy rain or high tides, sea level rise, the river level rises, narrowing the clearance, causing accidents and collisions of boats to the piers. Those without supporting structures, have poor bearing capacity, easily causing bridge collapse.

- Landslide in the fourth part of the cone: Occurs due to the impact of rain and flood or the construction work does not meet the technical requirements.

- Damage to the foundation: Including local erosion; broken piles; submersible well wall cracking, partly erosion by floods, load development, appearance of slip arcs, and failure of foundations.

- Damage due to displacement: Too deep erosion at the abutment foundation; insufficient bearing capacity of the ground; horizontal pressure of the soil increases; deep sliding phenomenon; damage due to displacement of the movable bearing, expansion or contraction of the gap between the top of the span structure and the abutment to develop excessive displacements. If detected and suspected, detailed measurements should be carried out; damage the connection between the bridge and the road. If the slope of the abutment cone is too steep, landslides, sleeper settlement, rail settlement, deformation and stress in the rails can increase to dangerous levels.

Regarding the bridge construction system in Long An province, at present, the Department of Transport manages a total of 360 road and bridge works, with a total length of more than 23.5 km, including many types of structures such as reinforced concrete and pre-stressed; iron seamless and surface; iron seamless wooden surface; iron surface suspension bridge; wooden suspension bridge [4].

The Department of Transport of Long An province manages a total of 360 bridges, mainly pre-stressed reinforced concrete bridges (accounting for 91.67%), iron bridges (accounting for 6.94%) and a number of iron bridges, iron suspended bridges - wooden surface bridges temporarily built by localities in remote and isolated areas to meet people's needs [4].

Regarding the bridge system in the downstream area of Vam Co river, there is My Loi bridge located on the National Highway 50 connecting Phuoc Dong commune, Can Duoc district, Long An province with Binh Dong commune, Go Cong town, Tien Giang province. My Loi Bridge has a total length of about 2,691m, the main bridge is 1,422m long, the starting point is at Km33+650, the ending point is at Km36+543 on National Highway 50. Design load of HL93, design speed of 80 km/h. The cross section is 12m wide, ensuring the circulation of 2 lanes of motor vehicles and 2 lanes of rudimentary vehicles. Total investment is VND1,438 billion and 952 million [4].

Bridges on Vam Co Tay River route include: Tuyen Nhon Bridge (on National Highway N2): across Vam Co Tay River on National Highway N2, Thanh Hoa Town, Thanh Hoa, Long An; Ho Chi Minh City - Trung Luong Expressway Bridge; Tan An Bridge 1; Tan An Bridge 2;

Bridges on Vam Co Dong River route include: Duc Hue Bridge (connecting Hiep Hoa town, Duc Hoa district with Dong Thanh town, Duc Hue district - Long An); Duc Hoa Bridge (on National Highway N2); Ho Chi Minh City - Trung Luong Expressway Bridge; Ben Luc Bridge (Long An).

## I. CURRENT STATUS OF IMPACTS OF CLIMATE CHANGE ON BRIDGE ABUTMENTS ON VAM CO RIVER, LONG AN PROVINCE

In recent years, climate change has affected many areas of Long An province, in which the transport sector is directly and comprehensively affected.

In particular, the situation of saline intrusion is complicated and tends to increase, causing negative impacts on agricultural production in Long An province. Especially the transportation industry is significantly affected, causing damage to agricultural production. destroying transportation infrastructure in general, bridge abutment and piers in particular, especially steel and reinforced concrete structures, causing traffic unsafety, incurring maintenance costs, etc.

In Long An, this study summarizes a number of incidents and damage to abutments due to impacts of climate change, especially in the lower Vam Co river, including erosion, damaged concrete abutment of Ben Luc bridge. Sea level rise has changed the navigability of the Duc bridge - Tan An; damage to bridge abutment and retaining wall of Tong Uan bridge - DT.833; change the water flow and damage the abutment, causing the collapse of Vinh Binh bridge; collapse of Tan Duc bridge - Tan Tru.

In addition to affecting the system of abutments and piers, climate change also affects many other items of transport works such as damage to the roof of Hau Thanh Tay bridge - provincial road No. 837; the main reinforced concrete girder of Kenh Ngang bridge - provincial road No. 837B bridge was damaged due to environmental impacts; Kenh 1 bridge - Thu Thua was damaged.

### A. Impacts of climate change on the system of bridge abutments and piers in the downstream area of Vam Co river

Through the failures of the abutment and pier systems, it can be seen that climate change has a comprehensive impact on the bridge construction, not only the

abutment and pier systems. On that basis, this study identifies the impacts of climate change factors on road and bridge works in Long An province as follows [4]:

- The sea level rise factor: sea level rise leads to more complicated saline intrusion, affecting seriously to bridge structures such as rusting of steel abutment structures, bridge piers, cracking of concrete structures, rapid degradation of reinforced concrete, broken protective layer.

- Temperature factor: for asphalt concrete structures of bridge decks and abutments, temperature increase will be a factor causing concrete cracking, rutting of the wheel tracks of asphalt concrete deck, reducing service life and increasing costs for maintenance work;

- Rain factor: according to climate change scenarios, the annual rainfall will increase, especially the maximum 1-month rainfall and the 5-day maximum rainfall may increase by over 10%, sometimes up to 70%, causing many risks and damages such as:

+ Bridge works are facing the risk of flooding and erosion because of the significant increase in the peak flow, flood water level, and flow velocity in the basins where the works are located.

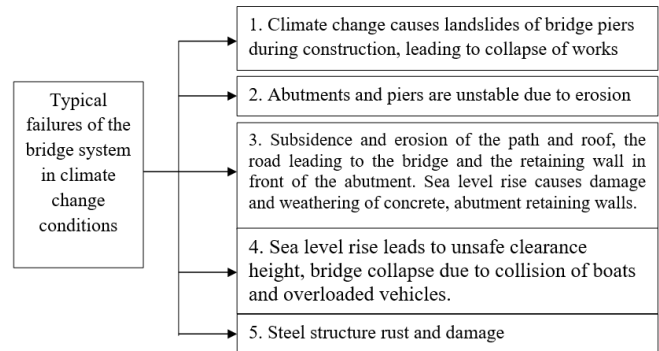
+ Some existing bridges will be in danger of no longer being able to meet the traffic clearance, when the water level is high in floods, due to heavy rains.

In summary, the frequency and intensity of extreme weather events are increasing, not only causing delays to the traffic system, reducing service time, but also negatively impacting the bridge pier system, which is dangerous, creating chances of being hit by a ship or boat when there is heavy rain, storm, strong current, etc.

**B. Identify the main causes that accelerate the failure rate of abutments in the context of climate change**

Climate change causes a change in the characteristic values of the natural environment affecting the abutments. The potential risk of causing a very serious incident if timely action are not taken.

Causes of abutment damage in climate change conditions can be classified into the following basic groups (Figure 1) [5] [6] [7].



**Figure 1.** Typical failures of bridge system under climate change conditions

**II. FORECASTING FACTORS AFFECTING THE MANAGEMENT OF THE BRIDGE ABUTMENT DUE TO CLIMATE CHANGE IN VAM CO RIVER LOWER AREA**

**A. Research process**

In order to predict the factors affecting the exploitation and management of the bridge abutment in the increasing conditions of climate change in the lower Vam Co river, the authors evaluate the influence of these factors through two main stages [7] [8] [9]:

- Qualitative research to build questionnaires, organize interviews, collect opinions of experts and experienced managers working at road management agencies in Long An province.

- Quantitative research to complete questionnaires, collect official data, analyze data and test research models [10].

The research process is shown in Figure 2.

**B. Research model and research hypothesis**

Based on the results from expert consultation with an initial draft of 35 questions, after receiving comments from experts, the authors adjusted the terms and meanings of the questions, thereby preliminary determining 25 basic factors affecting the exploitation management of abutments in the increasing conditions

of climate change in the lower Vam Co river area, classified into 06 groups as follows:

- Group of factors on the mechanism and policy of exploitation management of road and bridge works
- Group of factors on the management, organization and exploitation of the investors
- Group of factors related to maintenance contractors
- Group of factors on maintenance budget
- Group of factors related to consulting contractors
- Group of negative factors from climate change.

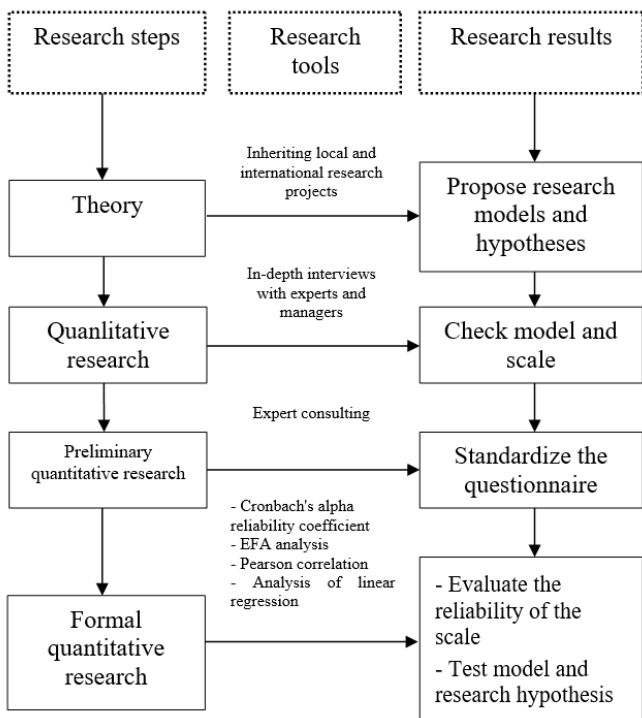


Figure 2. Research process

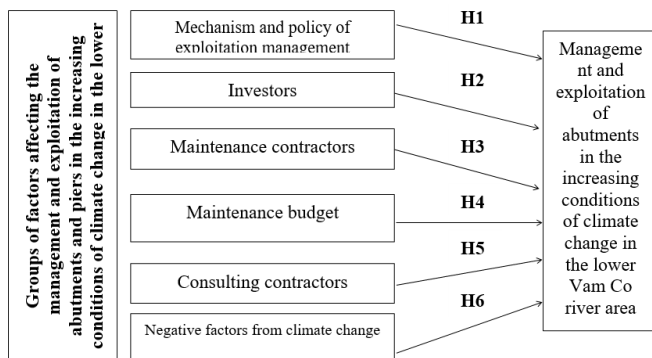


Figure 3. Research model

In order to determine the influencing factors, the question that needs to be answered is "The degree of influence of these factors on the exploitation management of the bridge abutment in the increasing

conditions of climate change in the lower Vam Co river". Among them, the research hypotheses are as follows:

Hypothesis 1: Group of factors on mechanisms and policies that have an impact on the exploitation management of bridge abutments in the increasing conditions of climate change in the lower Vam Co river area.

Hypothesis 2: Group of factors on investors that have an impact on the exploitation management of bridge abutments in the increasing conditions of climate change in the lower Vam Co river area.

Hypothesis 3: Group of factors on maintenance contractors that have an impact on the exploitation management of bridge abutments in the increasing conditions of climate change in the lower Vam Co river area.

Hypothesis 4: Group of factors on maintenance budget that has an impact on the exploitation management of bridge abutments in the increasing conditions of climate change in the lower Vam Co river area.

Hypothesis 5: Group of factors on consulting contractors that have an impact on the exploitation management of bridge abutments in the increasing conditions of climate change in the lower Vam Co river area.

Hypothesis 6: Group of negative factors from climate change that have an impact on the exploitation management of bridge abutments in the increasing conditions of climate change in the lower Vam Co river area.

**C. Scales**

The scale of factors affecting the exploitation management of abutments in the increasing conditions of climate change in the lower Vam Co river area was adjusted and supplemented after getting expert consultation and measured by 6 following groups of factors.

- The group of factors about the investors (CĐT) is measured by 5 observed variables, with codes from CĐT1 to CĐT5.

- The group of factors about maintenance contractors (NT) is measured by 4 observed variables, with codes from NT1 to NT4.
- Group of factors of consulting contractors (TV) is measured by 3 observed variables, with codes from TV1 to TV3.
- The group of factors caused by climate change (KH) is measured by 4 observed variables, with codes from KH1 to KH4.
- The group of factors on maintenance budget (NV) is measured by 4 observed variables, with codes from NV1 to NV4.

- The group of factors on mechanisms and policies for exploitation management is measured by 5 observed variables, with codes from CC1 to CC5.
- The scale of factors affecting the exploitation management of the bridge abutments in the increasing conditions of climate change in the lower Vam Co river area is the Likert scale (Rensis Likert 1932) with 5 rankings from 1 to 5. In which: (1) Not affected; (2) Very little influence; (3) Medium influence; (4) Great influence; (5) Huge influence.

TABLE I. TABLE OF SYMBOL OF OBSERVED VARIABLES

No.	Symbol	Factors
Group 1	<b>CĐT</b>	<b><i>Group of factors on the management, organization and exploitation of the investors</i></b>
1.1	CĐT1	The investors' model of exploitation management is not appropriate
1.2	CĐT2	The investors have not yet developed a process for management, exploitation and maintenance of abutments and piers in climate change conditions.
1.3	CĐT3	The professional capacity and experience of the investor staff is still weak. They do not have a deep understanding of climate change, and there is no full-time staff.
1.4	CĐT4	The work of patrolling, inspecting and detecting damage to bridge works of the investors is still procedural in nature, and testing equipment is outdated.
1.5	CĐT5	The investors have not yet boldly applied IT in the management and exploitation of bridge works.
Group 2	<b>NT</b>	<b><i>The group of factors about maintenance contractors</i></b>
2.1	NT1	Inappropriate maintenance plan, outdated construction technology, not yet applied new technologies, new materials in maintenance, repair of bridge abutments, piers.
2.2	NT2	The organization and assurance of traffic safety during maintenance and repair is not efficient.
2.3	NT3	The contractors' construction capacity is weak, the contractors' underwater construction equipment is still lacking in quantity, size and type.
2.4	NT4	Experience and professional ethics of technicians are weak
Group 3	<b>TV</b>	<b><i>Group of factors related to consulting contractors</i></b>
3.1	TV1	The survey and design work has not taken into account the impact of climate change
3.2	TV2	The supervision consultants lacks expertise, experience and awareness about the harmful effects of climate change to warn contractors.
3.3	TV3	Consultants do not fulfill their responsibilities, and there are interest groups.
Group 4	<b>KH</b>	<b><i>The group of negative factors caused by climate change</i></b>
4.1	KH1	The increase of temperature causes rapid destruction of the protective layer of reinforced concrete structures, abutments, piers, railings, pedestrian curbs, bridge bearings, ...
4.2	KH2	The increase in frequency and intensity of rain and storm surge causes local erosion and landslides of abutments.

No.	Symbol	Factors
4.3	KH3	The frequency and intensity of rain increase, the sea level rises, leading to the rise of river water level, narrowing the space for navigation, and easily causing accidents and collisions between boats and piers.
4.4	KH4	Saltwater intrusion causes rust and corrosion of steel structures and reinforced concrete abutments.
Group 5	NV	<b>Group of factors on maintenance budget</b>
5.1	NV1	Maintenance budget does not meet actual requirements
5.2	NV2	Capital allocation is slow
5.3	NV3	Prolonged payment and settlement procedures, slow administrative reform
5.4	NV4	Corrupted staff in charge of payment and settlement work
Group 6	CC	<b>The group of factors on mechanisms and policies for exploitation management</b>
6.1	CC1	Investment policy is too general, lacking key objectives
6.2	CC2	The system of legal documents regulating the exploitation management and maintenance of road bridges has not been completed yet
6.3	CC3	The mechanism and method of bidding in road bridge maintenance are still inadequate
6.4	CC4	The weak coordination between departments, agencies and sectors in exploitation management and maintenance of bridge works
6.5	CC5	The unit price applied to new materials, new technologies in maintenance, repair of road bridges are not practical.

**D. Data collection**

Within the scope of the research topic, the authors selected 125 votes to be distributed to experts and managers to create a database to include in the analytical model.

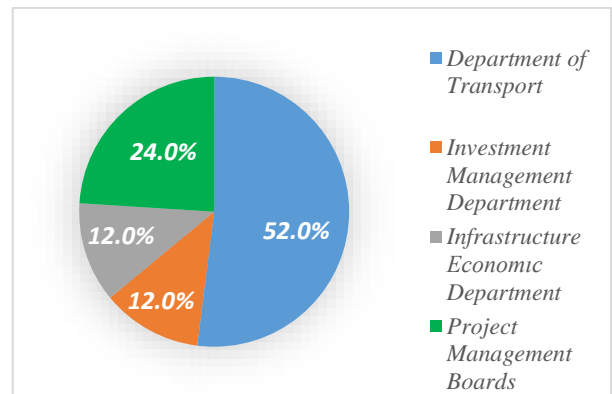
**E. Data Analysis Methods**

Quantitative data collected through the questionnaire survey will be considered, eliminating the responses that do not meet the requirements for the study. Satisfactory responses will be coded, entered and cleaned using SPSS20 software. This software also provides data analysis utilities for descriptive statistics, Cronbach Alpha scale testing, EFA factor analysis and regression correlation analysis.

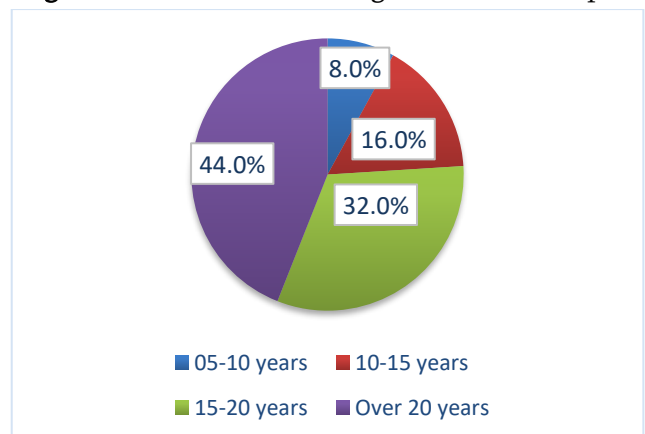
The statistical features of the samples can be shown in Figures 4-7.

Descriptive statistics of the scale are summarized in Table II.

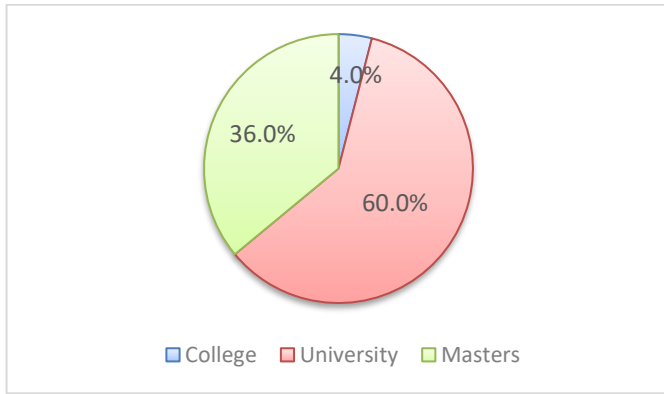
The results of Cronbach's Alpha test are shown in Table III.



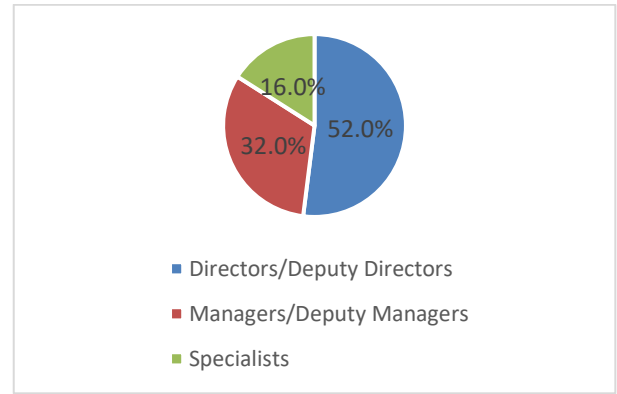
**Figure 4.** Statistics of working units of the samples



**Figure 5.** Statistics of sample's work experience



**Figure 6.** Qualification statistics



**Figure 7.** Positions of samples

**TABLE II. DESCRIPTIVE STATISTICS OF THE SCALE**

Observed variables	Number of samples	Smallest	Largest	Medium	Standard deviation
TV1	125	2	5	3.23	0.844
TV2	125	1	5	3.22	1.023
TV3	125	1	5	3.38	0.973
GDT1	125	2	5	3.37	0.946
GDT2	125	2	5	3.50	1.005
GDT3	125	2	5	3.38	0.973
GDT4	125	2	5	3.20	0.898
GDT5	125	1	5	3.10	0.923
KH1	125	2	5	3.65	0.986
KH2	125	2	5	3.47	0.921
KH3	125	1	5	3.18	1.017
KH4	125	1	5	3.38	1.149
NV1	125	2	5	3.25	0.790
NV2	125	1	5	3.26	0.881
NV3	125	2	5	3.05	0.831
NV4	125	2	5	2.84	0.756
CC1	125	1	5	3.53	0.938
CC2	125	1	5	3.83	0.859
CC3	125	1	5	3.62	0.840
CC4	125	1	5	3.37	0.946
CC5	125	1	5	3.45	0.954
NT1	125	1	5	3.13	0.992
NT2	125	1	5	2.82	0.916
NT3	125	2	5	3.41	0.890
NT4	125	1	5	3.14	0.846

**TABLE III. SUMMARY OF CRONBACH ALPHA COEFFICIENTS OF THE SCALES**

Observed variables	Scale average if eliminating variables	Scale variance if eliminating variables	Total variable correlation	Cronbach's Alpha if eliminating variables
1. Group of factors on the management, organization and exploitation of the investors (GDT), Cronbach's alpha = 0.847				
GDT1	13.18	8.872	0.749	0.790
GDT2	13.05	9.111	0.638	0.821
GDT3	13.17	9.109	0.671	0.812



CĐT4	13.34	9.550	0.655	0.816
CĐT5	13.44	9.845	0.569	0.838
2. Group of factors related to maintenance contractors (NT), Cronbach's alpha = 0.8				
NT1	9.37	4.605	0.645	0.736
NT2	9.67	4.948	0.624	0.745
NT3	9.09	5.113	0.603	0.755
NT4	9.36	5.329	0.586	0.764
3. Group of factors related to consulting contractors (TV), Cronbach's alpha = 0.836				
TV1	6.60	3.339	0.667	0.806
TV2	6.61	2.595	0.749	0.722
TV3	6.46	2.879	0.692	0.779
4. The group of negative factors of climate change (KH), Cronbach's alpha = 0.778				
KH1	10.03	6.063	0.613	0.708
KH2	10.12	6.263	0.629	0.704
KH3	10.50	6.204	0.548	0.741
KH4	10.30	5.662	0.554	0.744
5. Group of factors on maintenance budget (NV), Cronbach's alpha = 0.785				
NV1	9.15	3.920	0.615	0.720
NV2	9.14	3.731	0.576	0.742
NV3	9.35	3.746	0.631	0.711
NV4	9.56	4.200	0.548	0.753
6. Group of factors on mechanisms and policies on management and exploitation of road and bridge works Cronbach's alpha = 0.855				
CC1	14.26	8.793	0.613	0.840
CC2	13.96	8.894	0.674	0.825
CC3	14.18	8.953	0.681	0.823
CC4	14.42	8.520	0.664	0.827
CC5	14.34	8.227	0.721	0.812

Evaluation results: All scales have Cronbach coefficient  $\alpha > 0.7$ , total variable correlation coefficient  $> 0.3$ , so the observed variables have enough reliability needed to conduct factor analysis.

The results of the EFA exploratory factor analysis are summarized in Table IV. KMO and Bartlett's Test.  $0.5 \leq KMO = 0.723 \leq 1$ , factor analysis is accepted with the research data.

Sig Barlett's Test = 0.000 < 0.05, factor analysis is appropriate.

TABLE IV. KMO VALUE AND BARLLET'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.723
Bartlett's Test of Sphericity	Approx. Chi-Square	1545.772
	df	300
	Sig.	0.000

TABLE V. TOTAL VARIANCE EXTRACTION

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.639	22.558	22.558	5.639	22.558	22.558	3.445	13.781	13.781
2	3.607	14.428	36.986	3.607	14.428	36.986	3.317	13.268	27.049
3	2.195	8.781	45.767	2.195	8.781	45.767	2.638	10.554	37.602
4	1.951	7.803	53.571	1.951	7.803	53.571	2.523	10.091	47.693
5	1.825	7.300	60.870	1.825	7.300	60.870	2.415	9.660	57.353
6	1.457	5.829	66.699	1.457	5.829	66.699	2.336	9.346	66.699

7	.976	3.906	70.605						
8	.944	3.776	74.381						
9	.732	2.928	77.309						
10	.672	2.689	79.998						
11	.632	2.527	82.525						
12	.544	2.177	84.702						
13	.475	1.899	86.601						
14	.458	1.831	88.431						
15	.417	1.668	90.099						
16	.394	1.577	91.676						
17	.375	1.500	93.176						
18	.320	1.281	94.456						
19	.280	1.121	95.578						
20	.251	1.006	96.584						
21	.240	.962	97.546						
22	.141	.564	99.436						
23	.141	.564	100.000						

Extraction Method: Principal Component Analysis

- Eigenvalue = 1.457  $\geq$  1 and extracted 6 factors that have the best information summary meaning.
- Total variance extracted = 66,699  $\geq$  50% shows that the EFA model is suitable. Thus, 6 factors were extracted to summarize 66.19% of the variation of observed variables.

TABLE VI. ROTATION MATRIX OF FACTORS

	Factors					
	1	2	3	4	5	6
CC_3	.814					
CC_5	.809					
CC_2	.808					
CC_4	.754					
CC_1	.715					
CĐT1		.810				
CĐT4		.754				
CĐT2		.736				

CĐT5	.726					
CĐT3	.706					
NT_2		.800				
NT_1		.793				
NT_4		.732				
NT_3		.720				
NV_1			.822			
NV_3			.779			
NV_2			.758			
NV_4			.679			
KH1					.877	
KH2					.862	
KH4					.557	
KH3					.549	
TV3						.841
TV2						.813
TV1						.794

The results of the rotation matrix show that 25 observed variables are classified into 6 factor groups,

all observed variables have Factor Loading coefficients greater than 0.5 (Table VII).

TABLE VII. CORRELATION MATRIX BETWEEN EXTRACTED FACTORS

		Y	CC	CĐT	NT	NV	KH	TV
Pearson Correlation	Y	1.000	.165	.370	.297	.272	.487	.282
	CC	.165	1.000	.000	.000	.000	.000	.000
	CĐT	.370	.000	1.000	.000	.000	.000	.000
	NT	.297	.000	.000	1.000	.000	.000	.000
	NV	.272	.000	.000	.000	1.000	.000	.000
	KH	.487	.000	.000	.000	.000	1.000	.000
	TV	.282	.000	.000	.000	.000	.000	1.000

Sig. (1-tailed)	Y	.	.033	.000	.000	.001	.000	.001
	CC	.033	.	.500	.500	.500	.500	.500
	CĐT	.000	.500	.	.500	.500	.500	.500
	NT	.000	.500	.500	.	.500	.500	.500
	NV	.001	.500	.500	.500	.	.500	.500
	KH	.000	.500	.500	.500	.500	.	.500
	TV	.001	.500	.500	.500	.500	.500	.
N	Y	125	125	125	125	125	125	125
	CC	125	125	125	125	125	125	125
	CĐT	125	125	125	125	125	125	125
	NT	125	125	125	125	125	125	125
	NV	125	125	125	125	125	125	125
	KH	125	125	125	125	125	125	125
	TV	125	125	125	125	125	125	125

Results of the correlation matrix between the extracted factors showed that no factors were excluded due to sig < 0.05 Testing the research model - the results of the regression analysis are summarized in Table VIII.

TABLE VIII. RESULTS OF REGRESSION ANALYSIS

Model	The coefficient is not yet normalized		Normalization coefficient (β)	t value	Sig.	Multicollinearity		
	b	Standard error				Tolerance coefficient	VIF coefficient	
1	Constant	3.000	.035		86.349	.000		
	CC	.105	.035	.165	2.997	.006	1.000	1.000
	CĐT	.235	.035	.370	6.743	.000	1.000	1.000
	NT	.189	.035	.297	5.410	.000	1.000	1.000
	NV	.173	.035	.272	4.957	.005	1.000	1.000
	KH	.310	.035	.487	8.873	.000	1.000	1.000
	TV	.179	.035	.282	5.134	.000	1.000	1.000

The results of the regression analysis showed that Sig. of the normalized regression coefficients (β) of the variables CC and NV in the model ≥ 0.05, which means that the known CC and NV are not eligible to exist in the model. The remaining variables include CĐT, NT, KH, TV with Sig. of the regression coefficient > 0.05, which means that there is not enough evidence to reject these

independent variables in the model. In other words, these independent variables have statistical significance at 5% significance level. The variance exaggeration factor (VIF) of all the independent variables are < 10, so the phenomenon of multicollinearity, i.e. the phenomenon that the independent variables in the model are linearly correlated with each other, is not serious.

TABLE IX. FISHER TEST - FULL MODEL TEST

Model	Sum of squares	df	Average of squares	F	Sig.	
1	Regression	32.196	6	5.366	35.564	0.000 <sup>b</sup>
	Residual	17.804	118	0.151		
	Total	50.000	124			

Analysis of variance for the whole model gives results Sig.=0.00 < 0.05, so there is not enough evidence to reject the model. In other words, the model has statistical significance at 5%.

TABLE X. MODEL FIT ASSESSMENT

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.802 <sup>a</sup>	.644	.626	.388

Evaluation of the fit of the model shows that the regression model has adjusted R2 = 0.644 > 0.5, so the regression model can be used.

Thus, the multivariable regression analysis shows that the model is built in accordance with the research data and the obtained results are the management and exploitation of abutments in the increasing conditions of climate change in the downstream area of Vam Co river depends on 4 groups of factors. The results of testing and evaluating the model show that there is not enough proof to reject this model. So, the equation of multiple regression is as follows:

Unnormalized regression equation:

$$QLKT = 3.000 + 0.235 * CDT + 0.189 * NT + 0.310 * KH + 0.179 * TV \tag{1}$$

Normalized regression equation:

$$QLKT = 0.487 * KH + 0.370 * CDT + 0.297 * NT + 0.282 * TV \tag{2}$$

In which:

CDT: Investors

NT: Maintenance contractors

TV: Consulting contractors

KH: Climate change

The multiple regression equation has confirmed the authors' hypotheses, specifically as follows:

- Confirming hypothesis 2: Coefficient  $\beta_2 = 0.370 > 0$ , so the group of factors about the investors has an impact on the exploitation management of the bridge abutment in the increasing conditions of climate change in the lower Vam Co river area;
- Confirming hypothesis 3: Coefficient  $\beta_3 = 0.297 > 0$ , so the group of factors about maintenance contractors

have an impact on the exploitation management of the bridge abutment in the increasing conditions of climate change in the lower Vam Co river area;

- Confirming hypothesis 5: Coefficient  $\beta_4 = 0.282 > 0$ , so the group of factors about consulting contractors have an impact on the exploitation management of the bridge abutment in the increasing conditions of climate change in the lower Vam Co river area;
- Confirming hypothesis 6: Coefficient  $\beta_1 = 0.487 > 0$ , so the group of negative factors of climate change has an impact on the exploitation management of the bridge abutment in the increasing conditions of climate change in the lower Vam Co river area;

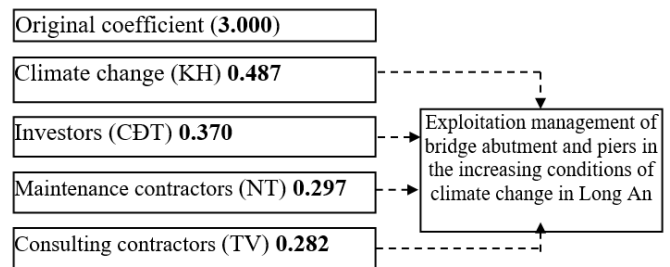


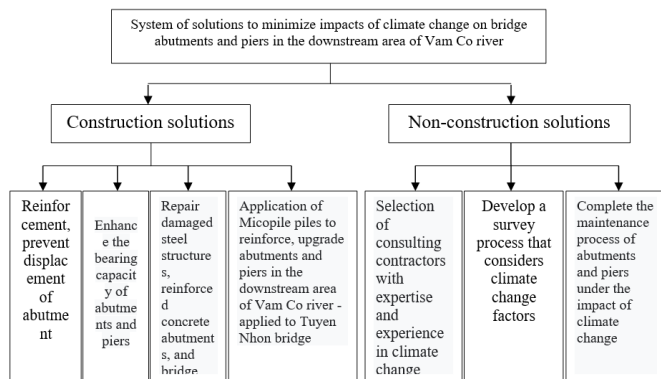
Figure 8. Regression model

In which:

- The factor of climate change (KH) has a coefficient of 0.487, indicating that when this factor increases by 1 unit, the exploitation management of abutments in the lower Vam Co river area will increase to 0.487 units.
- Factor of the investors (CDT) has a coefficient of 0.370, indicating that when this factor increases by 1 unit, the exploitation management of abutments in the lower Vam Co river area will increase to 0.370 units.
- The construction contractor factor (NT) has a coefficient of 0.297, indicating that when this factor increases to 1 unit, the exploitation management of abutments in the lower Vam Co river area will increase to 0.297 units.
- The consulting contractor factor (TV) has a coefficient of 0.282, indicating that when this factor increases by 1 unit, the exploitation management of abutments in the lower Vam Co river area will increase to 0.282 units.

### III. SOLUTIONS TO MINIMIZE THE IMPACTS OF CLIMATE CHANGE ON THE SYSTEM OF ABUTMENTS AND BRIDGES IN THE LOWER VAM CO RIVER AREA, LONG AN PROVINCE

#### A. Solutions to minimize the impact of climate change on the system of bridge abutments and piers in the downstream area of Vam Co river, Long An province

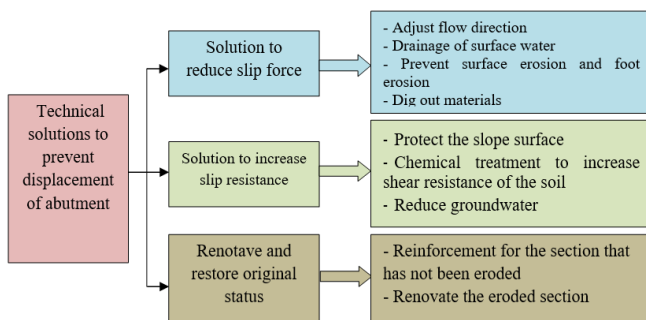


**Figure 9.** System of solutions to minimize impacts of climate change on abutments and piers in downstream area of Vam Co river

#### B. Construction solutions

##### 1. Reinforcement, prevent displacement of abutment

The abutment displacement due to the impact of rain and storm can cause changes in flow, leading to abutment slippage. From practical experience and technical principles of anti-displacement abutment, some solutions are suggested as Figure 10 [11] [12].



**Figure 10.** Technical solutions to prevent displacement of abutment

- Solution to reduce sliding force: According to the Southern Federation of Water Resources Planning and Investigation, the downstream area of Vam Co river has a characteristic that the flow is very complex. As a

result, it is easy to wash away the riverbed sediment, riverbanks and around abutments, piers, causing local erosion in the area of bridge abutments and piers. Therefore, adjusting the flow direction to prevent local erosion leading to displacement of the abutment system can be considered if the actual site conditions can be implemented.

- Solution to increase slip resistance:

+ Protect the slope surface: in order to prevent the development of landslides, methods to protect the slope surface can be considered such as using gabion mats, tangled rock, melaleuca poles, bamboo, etc.

+ Underground drainage: it is possible to arrange more horizontal drainage pipes to increase the shear resistance and reduce the horizontal pressure acting on the retaining wall.

+ Chemical treatment to increase the shear resistance of the soil: it is possible to apply new materials for treatment to increase the shear resistance of the soil in the slip arc.

- Renovate and restore the current status: conduct surveys and assess the current status of the downstream area of Vam Co river to have information to propose solutions for reinforcement on the following principles:

+ For the section that has not been eroded, it is possible to consider keeping the current status and reinforce it in combination with the implementation of displacement monitoring.

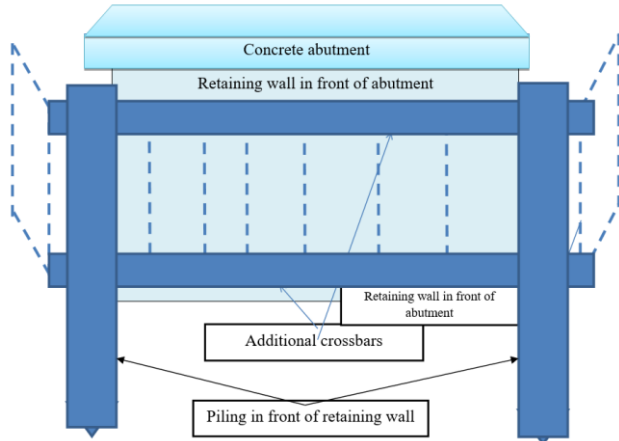
+ For the part that has been eroded: consider restoring the current state or renovating the work.

Besides, in order to avoid the situation that the retaining wall in front of the abutment is missed or displaced, leading to the risk of collapse of the entire structure, the study proposes measures to strengthen the retaining wall in front of the abutment to ensure the stability of the system as follows [13]:

- Adding rows of piles to form cross-linked reinforced concrete in front of the abutment retaining wall.

- Add more fixed reinforced concrete piles to the reinforced concrete panels to keep the retaining wall

in front of the abutment stable. It is noted that the reinforced concrete pile tip needs to be plugged into the good soil layer and the driving depth needs to be carefully calculated to ensure it can withstand lateral load from earth pressure behind retaining wall.

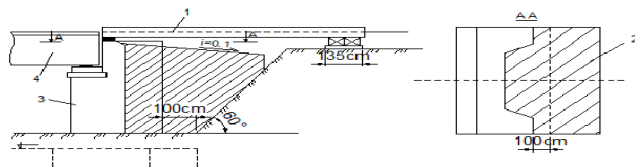


**Figure 11.** Simulation of abutment and retaining wall in front of abutment, avoiding abutment displacement

**2. Enhance the bearing capacity of abutments and piers**

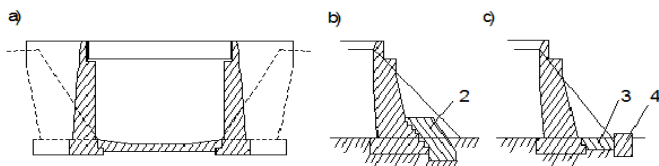
*a) Increase the bearing capacity of the abutment*

Strengthen the abutment by placing rocks behind the abutment instead of the old soil [11] [12].



**Figure 12.** Strengthen the bearing capacity of abutment. 1) Temporary girder span structure for vehicles to pass through during repair; 2) New stone blocks are placed behind the abutment to reduce horizontal pushing pressure; 3) Walls in front of the abutment; 4) Span texture.

Strengthen the abutment by adding struts (a) adding a barrier in front of the abutment (b), (c).



**Figure 13.** Strengthening the bearing capacity of abutment. 1) The strut between the foundations of two abutments; 2) Forts; 3) Struts; 4) Forts.

*b) Increase the bearing capacity of the pier*

Concrete wrapping method: This method is to create a layer of reinforced concrete with a thickness of 10-15 cm around the old cylinder body throughout the height of the cylinder body to increase the bearing area for the cylinder body.

Method of using high-strength FRP material: This method uses high-strength FRP material to wrap around the cylinder body vertically and horizontally to increase the bearing capacity of the cylinder body and inhibit hip expansion of concrete and increase the bearing capacity of the concrete body.

The method of using a steel cover: Increase the bearing capacity of the cylinder body by wrapping the steel shell around the cylinder body [11] [12].

*c) Increase bearing capacity of pile foundation structure*

Common types of damage to pile foundation structures include:

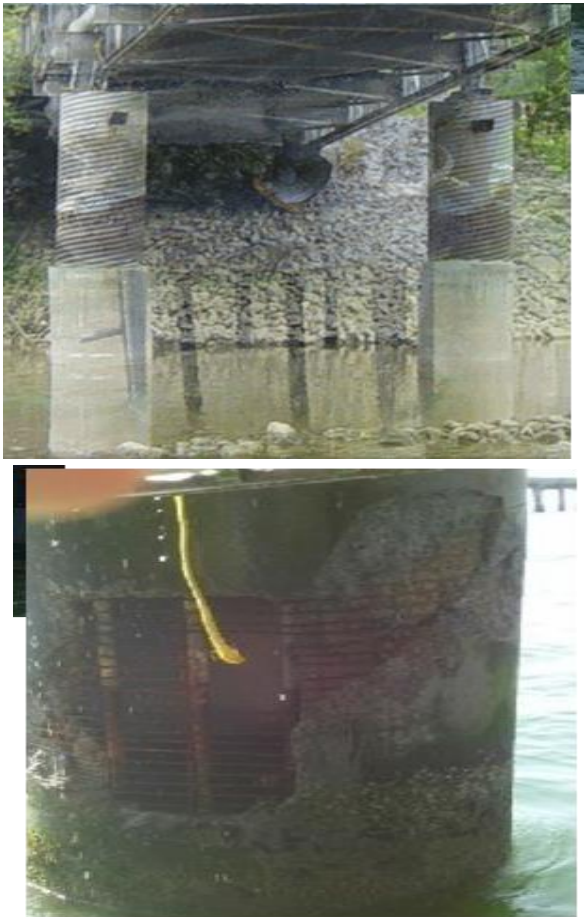


**Figure 14.** Strengthening the bearing capacity of the pile foundation structure

Concrete pile: Corrosion leads to damage to the protective concrete, reducing the bearing capacity of the pile.

Steel pile: Corrosion reduces the bearing cross-sectional area of the pile, reducing the bearing capacity of the pile.

- Method of covering concrete: creating a layer of reinforced concrete of 10-15 cm thick around the old pile body throughout the pile height to increase the bearing area for the pile. Augmented results in reality as shown in Figure 15.



**Figure 15.** Strengthening the bearing capacity of pile and column foundation

- Method of using prefabricated FRP sheet: using prefabricated FRP sheet as formwork, then pour epoxy-based concrete to fill the gap between the FRP sheet and the existing concrete of the pile. The bearing capacity of the pile is significantly increased due to the use of high-strength materials in the casing and the increase in the compressive capacity of the concrete by inhibiting the expansion of the concrete.

- Method of using prefabricated FRP sheet:



**Figure 16.** Using prefabricated FRP sheet  
(a). Prepare the FRP sheet; (b) Construction of FRP sheets; (c) Fixing and finishing the FRP sheet; (d) High strength grout pump, (e) After finishing



**Figure 17.** Actual results of using enhanced prefabricated FRP panels

- The method of adding piles applies to the case that the abutment foundation of the bridge is not capable of bearing the additional piles:

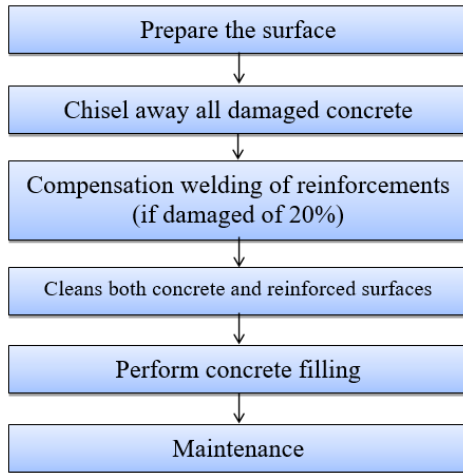


**Figure 18.** Addition of piles applies to the case that the abutment foundation of the bridge in the downstream area of Vam Co river is not able to bear the load and additional piles are needed.

*d) Concrete is peeling, cracking, reinforcing steel is exposed and corroded*

The general method to repair this phenomenon is: chisel away all damaged concrete, compensate reinforcement if necessary, clean the surface of both concrete and reinforcement then pour polymer mortar, polymer concrete or normal concrete. Based on the method as well as the material to decide whether to

stop the vehicles or still allow the vehicles to circulate at a limited speed during the construction period.

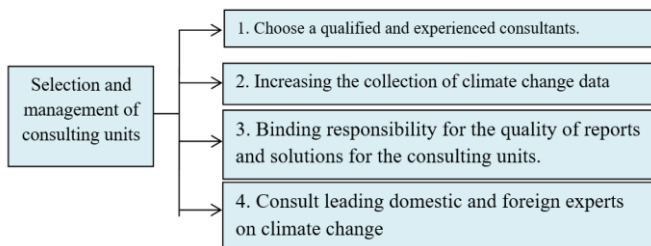


**Figure 19.** Steps to repair peeling and cracking of concrete

**C. Non-construction solutions**

**1. Selection of consulting contractors with expertise and experience in climate**

The authors recommend the following contents as Figure 20.



**Figure 20.** Selection and management of survey and design consultants [14]

**2. Developing a survey process in the context of increasing climate change**

The process of survey and maintenance in the exploitation phase is carried out similar to the normal survey. However, in order to further consider the impact of climate change on the abutment of the bridge during the exploitation phase, the authors propose to add the following tasks:

- The alignment needs to avoid landslides, floods, large flows, etc.

- The plan of bypass, temporary bridge to ensure traffic during construction or operation of works when there is an incident.

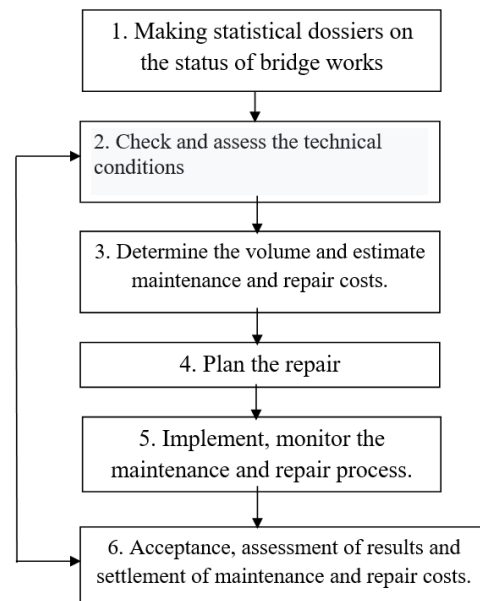
- Survey consultants must be responsible for the results of experiments and surveys.

- Solutions suitable for reinforcement for critical locations.

- Survey similar constructions nearby to prevent the impact factors from floods, landslides, etc.

**3. Complete the maintenance process of abutments and piers under the impact of climate change**

In order to maintain the abutment and pier systems in a timely manner under the impact of climate change, and at the same time to meet the objectives of effective management and exploitation activities, this study proposes a process as shown in Figure 21.



**Figure 21.** Process of management and repair of abutments and piers due to climate change impacts [15] [16]

**IV. CONCLUSIONS AND RECOMMENDATIONS**

**A. Conclusions**

This study analyzed and evaluated the obtained results and drew the following conclusions:

1. Abnormally occurring extreme weather events, in which temperature increases, heavy rains, high tides, sea level rise, saltwater intrusion, etc., with increasing



frequency and intensity, have caused great influence on the abutment system during the exploitation phase.

2. This study has built an econometric model showing the influence of factors on the management of abutment exploitation in the context of increasing climate change in the lower Vam Co river with 6 groups of factors. The main influencing factors are mechanisms, policies, investors, maintenance contractors, maintenance capital sources, consulting contractors and negative impacts of climate change. Conduct a survey to evaluate their effects, obtain the standardized regression equation as:

$$(Exploitation\ management)\ QLKT = 0.487 * KH + 0.370 * CDT + 0.297 * NT + 0.282 * TV$$

From the above equation, it can be seen that the variable KH (climate) has the greatest influence, followed by the variable CDT (investors), NT (maintenance contractors) and TV (consulting contractors).

This helps the exploitation management units, the maintenance contractors and the consultants to re-evaluate their own capacity and experience, oriented to improve their capacity and experience in exploitation management in climate change conditions. Strongly apply management technology, advanced exploitation technology to the management and exploitation of abutments in order to improve the efficiency and quality of bridge construction management and exploitation in the downstream area of Vam Co river in Long An province.

3. On that basis, the authors have proposed structural and non-structural solutions to cope with and minimize damage to abutments caused by climate change impacts.

### B. Recommendations

- Increase investment in construction, supplement and complete solutions to ensure smooth operation and traffic order and safety in the current climate change situation.

- Develop regulations on coordination between traffic management and operation agencies and the authorities of Long An province.

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# A Cross-National Analysis of Intrinsic and Extrinsic Cues' Preferences of Premium Denim Products : A Case of Levi's and other Premium / Luxury Denim Brands

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## ABSTRACT

This study has been conducted to investigate the Premium Denim brands' intrinsic and extrinsic product cues which are significant for consumers when they want to shop for their favourite denim brands. The brands which are included in this study are Levi's, Calvin Klein, Diesel, Armani and Gap. This research is a cross-national study and data are collected from India and European countries like Italy, Malta, UK, Poland, Sweden, Serbia etc. For intrinsic cues study we have taken products' quality, fabric, color, fitting and uniqueness whereas for extrinsic cues we have taken pricing cues preferences, distribution channel preferences and promotional tools influences on Indian and European consumers.

## Design/Methodology/ Approach

Online questionnaires link were shared through emails, whatsapp and linkedin and paper questionnaires were distributed to friends, universities students and to other people in India to collect responses from them. Students of "University of Ca'foscari, Venice, Italy" were met several times during lunch break and informed about research questionnaire. The google forms of questionnaire were sent to the university students and other respondents of European countries through emails and linked in.

Hypotheses for intrinsic and extrinsic cues were developed and data analysis was conducted by SPSS statistical analyses.

## Originality/Value

There are very few research papers written on both intrinsic and extrinsic cues and with an in- depth empirical research. Some scholars have written research papers on intrinsic cues and extrinsic cues separately. This study is an in-depth and comprehensive investigation of cross-national research on premium denim products' intrinsic and extrinsic cues and its statistically significant preferences

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and influence differences between India and European countries' consumers.

**Keywords** :Product Cues, India, Denim Products, Premium Denims, Cross-National Study, Intrinsic Cues, And Extrinsic Cues.

## Findings

This research analysis indicates that there is a statistically significant difference between Indian and European consumers' preferences for "Fabric" and "Fit" of denim product cue. Uniqueness and Color are the most rated product cues among all intrinsic cues by both Indian and European consumers but their differences between these two groups are not significant. Quality was the fifth in preference by both Indian and European consumers and the differences in preference are not statistically significant.

For Pricing cues, both group consumers rated "Payment Terms" (like EMI) the first preference while Premium pricing got the second rating, discounted price received third and Offers got fourth preference. All the options of pricing cues preferences were not statistically significant different between Indian and European consumers.

In case of distribution channel preferences, European consumers rated retail chain/ super market channel as most preferred channel for shopping premium brands while Indian preferred online shopping as their most preferred channel. Exclusive stores ranked second by European consumers while Indians ranked it third preference. There were statistically significant differences between Indian and European consumers' preferences.

## I. INTRODUCTION

### Indian Clothing Market & Denims

Government favorable policies and focus is leading to growth in the textile and clothing industry. In the financial year 2015, foreign direct investment (FDI) in

the textile sector increased to US\$1587.8 million in comparison to US\$1424.9 million in the FY 2014. Through Technology Up gradation Fund Scheme (TUFS), government is encouraging investment in the textile sector. Free Trade agreement with ASEAN countries and proposed agreement with European Union will also boost exports.

Textile plays a major role in Indian economy and contributes 14% to Industrial production and 4% to GDP. Textile industry accounts for nearly 13% of total exports. In 2015, ready garments were the largest contributor to the total textile and apparel exports from India.

Cotton and man-made textiles were also major contributors with shares of 31% and 16%, respectively.

### Denim & its History

India is the second largest producer of Cotton in the World after China and Textile is the oldest sector in India. Currently Cotton market is valued at US\$ 102 billion and accounts for 14% of India's total exports as in 2018.

Textile industry also includes Indian Denim industry which is growing significantly over the years.

### Denim & its Types

Denim is made from strong Cotton fabric using Twill weave and this twill weave creates a subtle diagonal ribbing pattern. This cotton twill weave fabric has warp faced in which the weft passes under two or more warp threads. The warp threads are more prominent on the right side. The diagonal ribbing distinguishes Denim from cotton duck.

The Denim predecessor known as Dungaree produced in India for hundreds of years and Denim itself was

first produced in French city of Nimes and thus named as “Serge de Nimes” meaning Serge from Nimes. The word Denim is an English expression of De Nimes.

The Denims are often indigo dyed in which warp thread is dyed and weft thread is left white. As a result of the warp faced twill weaving, one side of the textile is dominated by blue warp threads and other side is dominated by the white weft thread. This is the reason blue jeans to be white on the inside.

Earlier Denim cloths were used by ranch hands and farmers and later used by California (USA) gold miners. During World War II Denim jeans were declared as “essential commodities” due to its durability.

In 1853, a Bavarian immigrant “Levi Strauss” and Nevada tailor “Jacob Davis” created the first pair of Jeans which is used as a tough miner’s cloth and Levi’s Strauss & Co. was founded. Earlier Levi used a brown tent cloth for making trousers with no belt loops and back pockets. Later Strauss switched to Denims (twill made in Southern France) and dyed it in uniform indigo. By 1860, this blue Denim pants were regular wear for miners, farmers and cattlemen throughout the western countries. By 1873, Levi Strauss name got patented and by riveting the critical seams the Denim pants made stronger.

These Denim pants nicknamed “jeans” after the city Genoa of Italy.

During 1940s Denims became fashionable items and icon for youth culture. By 1950s, due to television programs & films Jeans became the symbol of teenage rebellion.

Based on Price, product quality, Brand image and Country of origin there are 4 distinct segments in Denim industry;

**Economy:** These include private labels, unbranded denim items that are priced at lower end and usually sold through departmental stores and mixed retailers.

**Standard:** These included branded products targeted for the mass market. Labels under this category can differ from market to market for instance Lee, Levi’s,

Gap, and Wrangler may be considered Standard in the USA, the EU but may be in premium segment in low income country.

**Premium:** Better product quality, brand name, higher price and positioning in the premium range enable brands to be classified as Premium Denim. However the classification is variable according to per capita income of the country and position of brands in that market. G-star Raw, DIESEL are generally considered Premium brand Denim. A price of US\$ 75 got tagged with the Premium Denims.

**Luxury/ Super Premium:** These are fashion and status symbol. These are sold under designer labels at high end boutiques to maintain its exclusivity. The brands include in this lists are Giorgio Armani, 7 For All Mankind, J brand, True religion, Acne Studios. Any fashion Jeans beyond US\$ 250 come under Super premium as written by Dr. P.R. Roy (Dr P R Roy is a PhD in textiles from the University of Manchester, United Kingdom and a former Group Chief Executive (Textiles) of Arvind Mills Ltd., based in Ahmedabad, India).

DIESEL Jeans was a global leader in the segment of Super Premium Jeans in the beginning of 1990s. Till 2007 Premium Jeans continued its growth but during global recession in 2008 the US Denim hit hard and Western European countries showed its strong strength and showed its appreciable growth year to year.

In 2013, US Denim export of Super premium Jeans adversely affected as the EU imposed additional import duty on US made Jeans, in spite of that LA,USA made Tag remain popular and continued interest in EU Denim fans for True Religion, J Brand, & 7 For All Mankind like bestsellers.

In the beginning of the millennium, Cone Mills, USA which was a leading Denim fabric manufacturer and original supplier of Levi’s 501 Jeans, was under a higher pressure for survival now bounced back through sustainability and brought age old Selvedge Denim as a Super Premium Denim.

Besides established Super Premium Denim brands some more like Denim Lounge, D-bar, Destination Denim, Swedish Cult “Nudie Jeans”, MiH (Made in Heaven) have shown their presence felt in this category.

Super Premium Japanese Denim brands “Benzak” .now being produced in Europe .is meeting expectations of European buyers.

### Product Cues and Literature Review

When a product is to be judged, it can be done through various aspects of product’s features or dimensions. Product attributes include both tangible and intangible characteristics. Tangible characteristics are colour, size, weight, design etc. whereas intangible characteristics include properties like quality, price, and aesthetics.

When we talk about apparel, the attributes like fit, fabric, quality, colour, design, weight of the fabric, uniqueness represent apparel’s intrinsic cue. The attributes which is not the part of product itself like price, distribution, packaging, brand, promotion, represent product’s extrinsic cue. Olson and Jacoby (1972) stated that Product has various characteristics or collection of attributes which are called as “Cues” and are used to create an impression about the specific product by the consumers.

Ahmed *et al.* (2004) mentioned that product cues are described as catalysts that play informational role before product consumption.

Aqueveque (2006) that when consumers develop evaluation of product quality they use both intrinsic cue and extrinsic cue.

In case of denim products, the intrinsic cue and extrinsic cue of products are as follows:

#### Intrinsic Cues

Olsen 1977, Olsen & Jacoby, 1972 stated that intrinsic quality cues are those characteristics of a product which cannot be changed without changing the product itself. These intrinsic quality cues are physiological characteristics and related to technical specifications.

The intrinsic cues of clothing are inherent characteristics like Quality, fabric; colour, fit, design, uniqueness etc. and these properties cannot be experienced without physical verification of the product.

Intrinsic cues are inherent characteristics to the physical composition of the product and it is concrete characteristics such as fabric, fit, color and style. Any alterations of these cues will change the physical appearance of a product (Hines and Swinker, 2001; Olson and Jacoby, 1972)

Lennon and Fairhurst (1994) and Rahman et al. (2010) stated that intrinsic cues are supposed to be more important than extrinsic cues as they are generally considered authentic indicators of quality.

In 1999, Forsythe et al. stated that there is enough evidence that for assessing the quality of product, consumers usually use intrinsic cues.

#### Design

Design plays an important role to link technological factor and market innovation. Many luxury and premium products have created huge market due to its unique designs and style.

In denim industries many Italian brands like Giorgio Armani, DIESEL, Versace, Dolce and Gabbana, Gucci, Dsquared2 and American brands like True Religion, Calvin Klein, Levi’s have established themselves due to their unique design and style.

Choice of design varies from country to country. Yamini and kanchisa (1955) did a research to find out differences in consumer preferences related to basic characteristics which define product design. They found out that Japanese and Korean people have similar tastes, the preferences between United States citizens and French people are also same.

The companies concern is to introduce a product which must meet local needs and technological requirements and does not involve higher development costs.

#### Color

The interpretation of color is a complex thing; consumers of different countries interpret colors

differently.

Keegan, W.J. & Green, M.C. (2008) in *Global Marketing* states that in many countries, White color is associated with symbol of purity but in many Asian countries its color of death and bad luck, in Ivory Coast, color Dark Red symbolizes death and witchcraft.

Color Grey, signals a low cost product for Chinese and Korean people but Purple signals an expensive product. For American these two colors symbolize complete opposite meaning.

Yellow flowers signals death or disrespect for Mexican people. (Cateora & Graham, 1998).

In 1991, Jacobs, Keown, Worthley and Ghymn did a in-depth research on this topic and pointed out that during positioning of a product it is necessary to carefully analyze the symbolic content of the color.

Most of the denim products like Jeans, Shirts, Jackets are blue colored. Some more colors are also used to dye denim. Levi's jeans are made in Blue, Indigo and in black shades. Sometimes Levi's also launches White Jeans. Diesel brands produce its jeans in Black/Dark grey, Dark blue, Light blue, Medium blue and in White. Calvin Klein jeans and other denim products are available in Blue, black and white shades. Armani Jeans are available in Blue, Indigo Blue, Silver Denim, Black, Gray, White and Beige Colours. Gap denims are made in Black, Blue, Grey, Green, White and Beige colours.

In 2015, Osmud Rahman did a qualitative research on denim Jeans, its product cues, body type and appropriate use and found out that dark colored denim jeans is associated with being formal, classy, elegant and sophisticated. It also stated that for many consumers color and style is supposed to be important to create a desirable public image for a specific social situation.

### Quality

Quality is an intrinsic cue of products which has an important connection with marketing strategy conceptualization, developing a product or service, planning distribution, pricing and communications.

It may be possible that a product which is considered a high quality product in one country may be considered an average quality or low quality product in other country which has same consumer behaviour. It depends on the positioning of product.

Quality is a relatively more significant clothing evaluative cue for Chinese consumers than for Canadian consumers (Osmud Rahman et al., 2017).

Kawabata and Rabolt conducted a research in 1991 among American and Japanese consumers and found that the clothing interest is deeply impacted by the quality aspects of the clothes.

Cook (2010) and Ruban (2002) stated that creation of customers' interest depends on how they perceive the quality of the products.

### Fabric

Fabric is the most important intrinsic cue in clothing. Denim products quality depends on the fabric, weight of product and type of other threads which are mixed in denim to make it more comfortable, stretchable and durable.

Weight of denim is measured in Ounce per square yard and higher the ounces mean the fabric is heavier. The weight of denim denotes the durability of fabric and how it feels when one wears it.

Denim products' quality also depends on its stitching quality, fabric treatment like wash, raw denim, pre shrunk denim etc.

Kadolfet *et al.* in 1993 found that Fabric is an important evaluation criterion for aesthetic appearance, tactile qualities and overall appeal but when compared with "Comfort" it plays relatively less important role.

Fabric is the most important compositional feature in judging quality of socks, construction for shirts and men's suits and appearance for sweaters (Kathryn L. Hatch and Jeanne A. Roberts, 1985)

### Fit

Fit is a most important intrinsic cue which plays an important role during selection of denim products. Premium and luxury brands make denim jeans in various fits and consumers have option to choose among the various fits, in unorganized sectors Jeans

and other denim products are made as per the fashion running at that time.

Workman and Lentz (2000) defined Fit as the way a garment conforms to the human body.

Osmud Rahman, Benjamin C.M. Fung and Zhimin Chen (2017) found in their research that for Chinese and Canadian consumers, “Fit” is relatively more significant clothing evaluative role than many other product cues.

Metje et al.(2008) and Rahman (2011) state that Fit , Fabric and Comfort are closely related. Rahman in 2009 and 2011 pointed out that these 3 cues are positively correlated.



Levi's Mens Fit

### Uniqueness

Kumar et al. in 2009 stated that people who want to present themselves different from others always use clothing products to show their social image and unique selves.

Lynn and Harris (1997) stated that people who have higher desire for dissimilarity from others also have higher need for uniqueness.

Workman and Kidd in 2000 stated that clothing selection is a uniqueness-seeking behavior.

Cham, T.H., Ng., C.K.Y., Lim Y.M. and Cheng B.L.(2018) conducted a study in Malaysia on generation Y consumers and found that among these generation Y consumers need for uniqueness and self concept have a significant positive influence on clothing interest.

### Extrinsic Cues

Extrinsic cues are those properties that are not part of the product itself instead they are related to the product like Price, packaging, distribution, promotion, brand etc.

Extrinsic cues are plays an important role when consumers want to make decision about purchasing of products without having any information and experiencing intrinsic cues. Most of the intrinsic cues can be experienced only when consumers are at stores and can feel it.

Hines and Swinker (2001) stated that extrinsic cues are those attributes which can be changed without any change in product's appearance or physical structure like price, brand name and country of origin. Aayed Qasem ,RohaizatBaharun& Ammar Yassin (2016) found out that in case of high- involvement products , for brand quality indicators consumers use 3 way extrinsic cues-interaction such as country of origin, brand name and price rather than individual cue to enhance the behavioral intention.

### Price

Alpert, Wilson & Elliott in 1993 stated Price as a quality indicator and Price signaling factor was pushed up as an important factor in price. The price of a product should indicate the quality and consumers' perceived value.

When companies enter in the international market they set their product pricing policy as per their need. If companies target is to get the maximum sales volumes in short period they go for penetration price and product cost set low to generate the maximum sales.

Premium and luxury brands always go for “Skimming Pricing” and set its product price high enough.

Most of the premium denim brands like DIESEL, Armani, Calvin Klein, True Religion, Levi's (Premium range) have set its prices higher and positioned itself premium and luxury.





Calvin Klein discount sale

Osmud Rahman, Benjamin C. M. Fung, and Zhimin Chen (2017) found in their study that consumers are concerned about the product price when they shop for clothing regardless of economic inequality between nations (study done between China and Canadian consumers).

Zeithamal (1988) states that when consumers do not have enough information about intrinsic cues, Price is considered as an important extrinsic cue, also in the absence of any other cue except Price, consumers consider Price as an important cue.

There is believe that consumers think that the quality products are expensive while lower quality products are less expensive on the basis of price consumers tend to categorize products (Acebro`n and Dopica,2000; Kardes, Cronley, Kellaris, and Posavac,2004).

#### Place (Distribution)

Products which are specialty products adopt Selective distribution channel and sold through selective company owned outlets.



Levi's Concept Stores at Campo San Luca Venice, Italy

For premium and luxury products, companies opt for Exclusive distribution system and very few limited companies owned outlets are opened to maintain products exclusivity and image. All designers and luxury brands adapt the exclusive distribution strategy.

Denim brands like Levi's , GAP have adapted Selective distribution strategy while designers and luxury brands like Armani, DIESEL, Calvin Klein have gone for exclusive distribution with limited number of company owned showrooms.

#### Promotion

Promotion attracts consumers and helps them, also entice and compel them to buy the products.

Companies apply various communications techniques to reach, inform and attract consumers.

The integrated marketing communications (IMC) includes advertising, public relations, sales promotion, personal selling, direct selling etc. Integration of these elements makes promotional mix.

Through promotion companies create a medium to start conversation with target consumers. The function of promotion is to grab customer's attention and convey them information about the products so that they can get motivated to purchase the products. Promotion aims to increase sales by raising awareness about the products by using different communication mediums and also to stimulate brand loyalty among customers.



Discount sale at Levi's Stores Venice

### Brand Name

Brand is a name, image, design, symbol, term or combination of two or all which can differentiate the companies' product or service from others. It helps to differentiate a product or service from its competitors. Brand signals a product or service quality standard.

In denim industries, DIESEL, Armani, True Religion, Versace, Calvin Klein are the brands which have successfully established themselves as luxurious brands and customers who buy these brands are loyal and do not care about the pricing of the products. Levi's has positioned itself as a premium brand and enjoys largest brand share of the jeans market. In Levi Strauss total sales, Levi's brand contribution was 87% in 2019.

Cham, T.H., Ng., C.K.Y., Lim Y.M. and Cheng B.L.(2018) found in their research that Brand name is a significant predictors of clothing interest of the generation Y consumers of Malaysia.



Excerpted from designyourway.net

Besnik FETAI\*, Nora SADIKU-DUSHI, Raman ISMAILI (2017) researched the impact of extrinsic cues on purchase decision for food product and found that the Brand name has significantly positive impact on consumers purchase decision.

Rowley(2004) mentioned that Brand name provides consumers much information about the product like the product is 'durable', 'comfortable', 'reliable' and 'fashionable'.

Erdem and Swait (1998) stated that brand name acts as a signal of quality and reduces consumers' confusion.

### Country of Origin

Country of Origin is also an extrinsic cue which affects the consumers purchasing decision process.

The definition of "Luxury" also involves the condition that the products should be produced in its head quarter, where the company is born. Giorgio Armani's products are made in Italy where as its other brands like Armani Exchange's products are being sourced from different countries. DIESEL Jeans' designer and luxury segments are produced in Italy. Levi's premium range "Made & Crafted", Levi's X Super Mario 501, Levi's X JUSTIN Timber Lake range are produced in its head quarter the USA.

In 1995 'Samli' and in 2001 'Keegan and Schlegelmilch' established a connection between particular countries and specific product types for which those product types are seen as typical or ethnical. Like in case of denim Italy is seen as "Birth place" as Genoa city of Italy is origin of denims and the USA is considered as a birth place of Jeans in fashion. Levi's is popular as an originator of Jeans and that is why people relate Jeans to the USA but Genoa(Italy) is a birth place of denims and most of designer and luxury brands are from Italy like Diesel, Giorgio Armani . People do not relate jeans to Germany instead "Automobiles" are seen as typical and ethnical to Germany.

Earlier research (Heisey, 1990; Rahman *et al.*, 2010) shows that country of origin does not play important

role and influence the consumers' perception towards apparel products.

As per Cordell (1991); Cui *et al.* (2004) for evaluating high-end or luxury goods and durable goods, country of origin is supposed to be an important or frequently chosen cue.

Besnik FETAI\*, Nora SADIKU-DUSHI, Raman ISMAILI (2017) researched the impact of extrinsic cues on purchase decision for food product and found that the Country of Origin is deemed as most important extrinsic cue when multiple cues are presented to the customers.

### **Objective of the Study**

The various objectives of this study were:

- (1) Which intrinsic cues influence most at first to buy customers their favorite denims/Jeans?
- (2) To examine the difference of product evaluative cue choices between Indian and European consumers when they buy their premium denims.
- (3) To investigate the extrinsic cues which influence both Indian and European consumers to buy their favorite denims?
- (4) Which communication channels influence Indian and European consumers to buy their favorite premium denims?

### **Hypotheses**

#### **Intrinsic Cues**

The following hypotheses for intrinsic cues preference were developed:

- H1. Fabric is the relatively most important clothing - evaluative product cue than many other cues for both Indian and European customers.
- H2. Uniqueness plays an important product cue role for European consumers than for Indian consumers.
- H 3: Fabric cue is more important for European consumers than for Indian consumers.
- H 4: Color is more important for Indian consumers than Europeans.
- H 5: Fit is more important cue for Indian consumers than European consumers.

H6. Fabric and quality are strongly co related in both India and European country.

H7. Quality is the most important product cue than color for both Indian and European consumers.

#### **Extrinsic Cues**

The following hypotheses for extrinsic cues preference were developed:

#### **Pricing Cues Preference**

H8. Price (discounted) is more important extrinsic product cue for Indians than European consumers.

H9. Consumers of both India and European countries prefer to buy their denim products when there is a Price offer going on.

H10. Consumers prefer to buy less products when there is a premium pricing.

H11. Consumers from both geography prefer to opt for "Payment Terms" like EMI for shopping their premium and luxury denims.

#### **Distribution Channel Preference**

H12. European consumers prefer to buy more from Retail chain/supermarket than Indian consumers.

H13. Consumers from both India and European countries choose to buy from Exclusive stores.

H14. Online shopping is preferred by Indian consumers more than the European consumers.

#### **Promotional Tools Impact**

H15. Indian consumers are more influenced by Film actors/ celebrity endorsement of brand which entice them to buy their premium denims than European consumers.

H16. European consumers are more influenced by TV/ Internet advertisements than Indian consumers when they make decision to buy their premium denims.

H17. Newspaper/ magazines advertisements play more important role to influence more than any other promotional tool for both Indian and European consumers.

H18. Indian consumers are more influenced by Friends opinion while shopping for Premium Denims than European consumers.

#### **Research Methodology**

Quantitative research method will be used for Hypothesis testing and quantitative research method is best suited for finding the relationship between independent and dependent variables (Hopkins, 2008).

### Data Collection

To collect responses from all age group and from different demography, paper survey and online survey were conducted; questionnaires were distributed through LinkedIn, Whatsapp, Face Book and emails. Data were collected primarily through convenience sampling and total 350 questionnaires were distributed in India, out of which 245 were received and 10 responses were eliminated due to outliers. The response rate in India was 67%.

In Europe, most of the respondents were from "Ca'Foscari University Of Venice", Italy. The students were asked to provide their emails and they were briefed during lunch hours about the questionnaires. Other participants were contacted personally or through LinkedIn and whatsapp. Total 300 questionnaires were distributed out of which 230 were received and 215 were sorted out by eliminating responses which had outliers. The response rate in European countries was 77%.

To understand the differences of products attributes, store ambience and display arrangements, short visits of many stores of Premium brands were planned and visited exclusive stores of Levi's, Diesel, Calvin Klein, Armani and Gap in metro cities Delhi, Mumbai, Chandigarh, Raipur of India and exclusive store of all premium denim brands in Venice, Italy and in Malta.

### Questionnaire Survey

A 5 point Likert Scale type questionnaire (most preferred to least preferred and from most significant to least significant factor) is developed to collect consumers responses for their preferences and significant factors.

There are 4 sections in the questionnaire. The first part covers the questions of Products' Intrinsic cues and ask consumers to rate their most significant to least significant attributes (Cues) which they inspect or search while purchasing the premium and luxury

denim products. The 5 attributes are Quality, Fabric, Color, Fit and Uniqueness. Consumers of both Indian and European countries were asked to rate the 5 attributes.

The second, third and fourth parts collect information from consumers about preferences of Extrinsic cues of denim products, they choose while shopping for premium and luxury denim brands.

The second part is about Pricing cues where consumers have been asked to rate their preferences for Premium, discounted, Offers and payment terms pricing cues. Here payment terms mean EMI or any relaxation on full payment of products.

Third part of questionnaire is about distribution channel preferences people choose to buy their premium products from. Consumers have been asked to rate their preferences from first preferred to least preferred options. There are 4 options Exclusive Stores, Multi Brand Stores, Online Shopping and Retail Chain/Super Market. Consumers need to rate from first to least preferred options.

The fourth and last part represents Promotional/advertising tools which influence consumers most. The options include TV/ Internet Advertisement, Newspaper/Magazine Ad, Films/Celebrities endorsements and Word of mouth.

### Analysis

Through Descriptive & inferential statistics, SPSS statistical analyses were used for descriptive and inferential statistics.

Independent Samples T Test was used to determine statistically significant differences between Indian and European consumers' preferences for Denims' intrinsic and extrinsic cues Measurement model is adapted from "Osmud Rahman (2017) and "Benjamin C.M. Fung"(2017)'s research paper "A cross-national study of apparel consumer preferences and the role of product-evaluative cues".

**Pilot Study** A pilot study was done to test the reliability and suitability of questionnaires with 30 respondents' data. The Cronbach's Alpha was .866

which is a good enough reliability level (Konting et al, 2009)

## Descriptive Analysis: Participants' Demographic Profile

Table I

<b>INDIA</b>		<b>%</b>	<b>EUROPE</b>		<b>%</b>
Frequency (n=235)			Frequency (n=215)		
<b>Gender</b>					
Male	184		78.3	86	40.0
Female	51		21.7	129	60.0
<b>Age</b>					
Less than 25	36		15.3	144	67.0
26-35	69		29.4	63	29.3
36-45	67		28.5	6	2.8
46-55	56		23.8	2	0.9
Above 55	07		03.0	-	-
<b>Education</b>					
HSSC	04		8.1	1	0.5
Graduate Student	19		1.7	79	36.7
Graduate	80		34.0	76	35.3
Post Graduate	121		51.5	56	26.0
PhD	11		4.7	3	1.4
<b>Occupation</b>					
Student	40		17.0	152	70.7
Intern	-		-	13	6.0
Research Scholars	-		-	3	1.4
IT Specialist	18		7.6	2	0.9
Engineer	29		12.3	1	0.5
Professionals	64		27.2	26	12.1
Marketing Executive	-		-	4	1.9
Managers	-		-	1	.5
Doctors	4		1.7	4	1.9
Professors/Teachers	13		5.5	4	1.9
Secretary	1		0.5	-	-
Businessmen	43		18.3	2	0.9
Actor	1		0.4	-	-
Govt. Service	21		8.9	-	-
Home Maker	2		0.9	-	-
Unemployed	-		-	2	0.9
<b>Marital Status</b>					
Single	91		38.7	156	72.6
Married	144		61.3	16	7.4
In a relationship	-		-	43	20.0

### Favourite Denim Brand

<b>LEVI'S</b>	<b>174</b>	<b>74.0</b>	<b>154</b>	71.6
CALVIN KLEIN	23	9.8	21	9.8
DIESEL	12	5.1	25	11.6
ARMANI	05	2.1	12	5.6
GAP	21	8.9	03	1.4

### Income

Country					
India			Europe		
Income Range (INR)		%	Income Range Average (Euro 27,000)		%
15,000-25,000	28	11.9	Average	30	14.0
26,000 -35,000	36	15.3	Above Average	62	28.8
36,000-45,000	37	15.7	Below Average	69	32.1
46,000-55,000	33	14.0	Affluent	02	0.9
55,000 and Above	94	40.0	Prefer not to mention	28	13.0
Student	03	1.3	Not applicable	24	11.2
Unemployed	04	1.7			

### Findings

We asked consumers about their favourite brand among 5 denim brands, Levi's, DIESEL, Calvin Klein, Armani and GAP. 71.6% consumers chose Levi's while DIESEL brand was chosen by 11.6% consumers. Calvin Klein stood in 3<sup>rd</sup> preferred brand with 9.8% consumers. Armani consumers were 5.6% in total sample and GAP was chosen by 1.4% consumers.

The consumers demographic profile are as follows:

The Indian respondents are predominantly male (78.3%) while female respondents are 21.7% whereas in European countries female respondents predominate (60%) and male respondents' share is 40%. The majority of Indian respondents (58%) are in the age group of 26-45 while 23.8 % are above 55 years of age and 15.3 % are below 25 years old while 2.9% respondents are above 55. 67% European respondents are below 25 years of age as most of the respondents are students. 29.3% European respondents are in between 26 to 35 years of age and 3.7% are in between 36 to 55 years old.

51.5% Indian respondents are post graduate, 34% are graduated and 4.7% are PhD, rest 9.8 % have completed their higher secondary and are graduate students now.

Majority of European students (36.7%) are graduate students at present, 35.3 % have graduated and 26% have got post graduation degree. 1.4% European respondents are PhD while 0.5% is only HSSC passed.

In Indian respondents group 47.1% are Engineers, IT Specialist and professionals like marketing managers, Sales executives, lawyers, consultants, Chartered accountants etc., 18.3 % are businessmen while 17% are students. 17.6% Indian respondents are Professors/teachers, doctors, in government job, secretary and actor and home maker.

Majority of European respondents are students and they share 70.7% of total respondents, 14.5% are professionals like marketing managers; accountants etc., 1.5% are engineers and IT Specialist. Doctors and professors share 3.8% of total respondents, research scholars and intern shares 7.7% while 0.9% is businessmen and 0.9% is unemployed.

61.3% Indian respondents are married while 38.7% are unmarried. As most of the European respondents are students, 72.6% respondents are single, 20% are in relationship and 7.4% are married.

Average income in India is around INR 1,00,000 per year , 40% of Indian respondents are earning INR 55,000 and above per month which much high above average income, 29.7% are earning in between INR 36,000-55,000 per month while 15.3% are earning in between INR 26,000 -35,000 and 11.9% are in between INR 15,000-25,000. 3% Indian respondents are students and unemployed.

Average income in European countries is Euro 27,000 per year and 28.8% of respondents are earning above average, 32.1% are below average while 14% respondents earn average salary, 0.9% is affluent while 13% respondents did not share their income level. 11.2% European respondents are either studying or not earning. As most of the respondents are students, they are earning through part time jobs and have mentioned the salary they were getting at that time.

**Inferential Analysis: SPSS Analyses**

**Product Intrinsic Cues Analy**

**Table II**

	INDIA			EUROPE			Mean Difference		t	df	Sig. - 2 tailed
	M	SD	N	M	SD	N					
<b>QUALITY</b>	2.01	1.054	235	1.93	1.039	215	-.121,	.268	0.745	448	.457
<b>FABRIC</b>	2.76	1.108	235	3.36	1.044	215	-.801,	-.401	-5.905	448	.000
<b>COLOR</b>	3.70	1.197	235	3.56	1.113	215	-.075,	.354	1.276	448	.203
<b>FIT</b>	2.48	1.199	235	2.03	1.156	215	.235,	.671	4.078	448	.000
<b>UNIQUE</b>	4.05	1.391	235	4.12	1.231	215	-.314,	.175	-0.559	448	.576

**-NESS**

## Findings

An independent sample T test is conducted to compare the “Quality” attribute significance level between the Indian and European consumers. There are differences ( $t(448)=.745, p=.457$ ) in the scores with mean score for India ( $M=2.01, SD=1.054$ ) is higher than Europe ( $M=1.93, SD=1.039$ ).

As the p value is greater than .05 ( $p=.457$ ) hence the difference is insignificant and Null hypothesis is accepted. Therefore there are not any Statistically significant “Quality preference” differences between European and Indian consumers.

Regarding the “Color” cue, result shows that the Indian consumers ( $M=3.70, SD=1.197$ ) give more importance to the Color than European consumers ( $M=3.56, SD=1.113$ ). According to the result of t-test ( $t= 1.276, df =448, p=.203$ ) analysis, no Statistically significant “Color” cue preference differences are found between European and Indian consumers, hence null hypothesis is accepted **and H4 is not supported.**

According to the result of t-test analysis, no statistically significant “Quality preference” differences between European and Indian consumers are found and “Color cue” differences are also not Statistically significant different between European and Indian consumers therefore the alternate **hypothesis H 7** “Quality is the most important product cue than color for both Indian and European consumers” is **not supported.**

Based on the t-test result, it is observed that there are statistically **significant** mean differences in “Fabric” product cue between the Indian and European respondents ( $t = 5.905, df =448, p = .000$ ). The European consumers ( $M=3.36, SD = 1.044$ ) are relatively more concerned with “Fabric” cue than Indian consumers ( $M= 2.76, SD = 1.108$ ) hence null hypothesis is rejected **and H3 is supported.**

The result also shows that Fabric is the relatively most important Statistically significant Denim-evaluative product cue than many other intrinsic cues for both Indian and European customers hence **H 1 is supported**

The result of the t-test analysis also indicates that there are statistically significant differences in “Fit” product cue preferences between the Indian and European consumers ( $t=4.078, df =448, p= .000$ ). Indian consumers are more concerned with Fit ( $M= 2.48, SD = 1.199$ ) than European consumers ( $M= 2.03, SD = 1.156$ ) hence null hypothesis is rejected and alternate hypothesis **H 5 is supported.**

Result shows that though the “Uniqueness” cue is the most important among all intrinsic cues for both Indian ( $M=4.05, SD =1.391$ ) and European ( $M= 4.12, SD=1.231$ ) consumers. The result of t-test ( $t=0.559, df =448, p= 0.576$ ) analysis shows that there are no Statistically significant “Uniqueness cue” preference differences between Indian and European consumers hence null hypothesis is accepted **and**



**H 2 is not supported.**

**Correlation Tests for Fabric and Quality**

**Table III**

Country	Fabric	Quality	N
Europe	Fabric	1	215
	Quality	r= .155*, p = .023	
		1	

Note:  $p < .05$  = Significant

Correlation coefficient for Fabric and Quality cues based on 95% Statistical significance

**Table IV**

Country	Fabric	Quality	N
India	Fabric	1	235
	Quality	r=.009, p = .890	
		1	

Note:  $p > .05$  = Not Significant

Correlation coefficient for Fabric and Quality cues based on 95% Statistical significance

Table III and IV show the Correlation tests for Fabric and Quality between the European and Indian consumers’ samples. For the European consumers (TableIII) Fabric is Significantly positively related to Quality ( $r = .155^*$ ,  $p = .023$ ) whereas in case of Indian consumers (TableIV) correlation coefficient is not significant between Fabric and Quality ( $r = .009$ ,  $p = .0890$ ) therefore **H 6 is partially supported.**

**Conclusion of Intrinsic Cues Analysis**

From the t-test result we can say that both European and Indian consumers are not concerned with the Quality cue when they go for Premium and luxury denims purchase as the brand value and brand trust are high enough to get influenced.

Color is also not a significant cue for both the European and Indian consumers, reason behind this may be due to the fact that the product is Denim jeans and mostly it comes in Blue and Black shades and as we know the Blue Jeans is a second name for Denim pants and other denim products.

For both the European and Indian consumers, Uniqueness is not a significant cue and they are satisfied with the Fits they are getting from their favourite premium brands.

Fabric is positively and significantly correlated with Quality so the European consumers who rate Fabric as a significant cue also know that they get good quality fabric from their favourite premium denim brands. Indian consumers are more influenced with the brand name and they trust that if the brand is premium the Fabric and Quality have to be premium. Color is the second most preferred cue after Uniqueness for both the European and Indian consumers but both cues are not statistically significant.

## Product Extrinsic Cues Analysis

### Pricing Preference Analysis

Table V

	INDIA			EUROPE			Mean Difference	t	df	Sig.(2-tailed)	
	M	SD	N	M	SD	N					
<b>PREMIUM</b>	2.76	1.217	235	2.83	1.076	215	-.283	.142	-.655	448	.513
<b>DISCOUNT</b>	1.83	.771	235	1.75	.814	215	-.071	.223	1.021	448	.308
<b>OFFERS</b>	1.95	.810	235	1.87	.750	215	-.066	.224	1.073	448	.284
<b>PAYMENT TERMS</b>	3.46	.735	235	3.54	.688	215	.217	.048	-1.258	448	.209

The Price evaluative analysis is done by t-test and it is found that the “Premium Pricing ” cue is the second most important cue for the both the European(M= 2.83 ,SD = 1.076) and Indian (M= 2.76, SD = 1.217) consumers . The result of t-test (t= .655, df=448. P= 0.513) analysis indicates that no Statistically significant “Premium price “ differences are there between European and Indian consumers preferences when it comes to premium pricing. Hence **H 10** is not supported

As shown in **table** , both European (M= 1.75, SD = .814) and Indian (M= 1.83, SD = .771) consumers rated “Discount” as the least important cue among all Price evaluating cues. According to the result of t-test analysis (t=1.021, df= 448, p =0.308), no Statistically significant “Discount” cue differences between European and Indian consumers are found hence null hypothesis is accepted and **H8** is not supported.

As result indicates “Offers” cue is the second least preferred cue by both Indian (M=1.95, SD= 1.87) and European (M=1,87, SD= .750) consumers. The t-test (t=1.073.df =448, p= 0.284) result shows that there is no statically significant “Offers” cue preference differences between European and Indian consumers. Hence **H 9** is not supported.

“Payment Terms” like EMI on products’ price, is most rated Price evaluative cue by both Indian (M=3.46, SD =.735) and European (M=3.54, SD = .688) consumers. The t-test (t=1.258, df=448, p= 0.209) analysis found that no Statistically significant “Payment Terms” cue preference differences between European and Indian consumers are there. Hence **H 11** is not supported.

**Conclusion** : The above analysis and results signals that for Premium and luxury denims Price is not a statistically significant factor and consumers do not concern more about discount, offers and payment terms.

## Stores (Distribution) Preference Analysis

Table VI

	INDIA		EUROPE			Mean Difference	t	df	Sig.(2-tailed)	
	M	SD	N	M	SD					N
<b>Exclusive Stores</b>	1.89	1.028	235	2.07	1.003	215	-.364 , .013	-1.833	448	.047
<b>Multi Brand Stores</b>	1.90	.820	235	1.83	.799	215	-.081 , .221	.913	448	.362
<b>Online Shopping</b>	3.21	.970	235	2.47	.970	215	.568 , .929	8.167	448	.000
<b>Retail Chain /SuperMarket</b>	3.00	.926	235	3.64	.695	215	-.789 , -.486	-8.280	448	.000

Stores preference analysis is conducted through t-test and it is found that the “Exclusive Stores” is the third preference for both Indian (M= 1.89, SD =1.028) and European consumers (M= 2.07, SD = 1.003). Based on the t-test result, there are statistically significant mean differences in “Exclusive Stores” evaluative cue between the Indian and European consumers (t=1.833, df =448, p= .047). European consumers (M= 2.07, SD = 1.003) give more preference to Exclusive stores than Indian consumers (M= 1.89, SD =1.028). **Therefore H13 is supported.**

T-test result shows Indian consumers (M= 1.90, SD = .820) give higher rating/preference to the Multi Brand Stores than European consumers (M=1.83, SD = .799). According to the result of t-test analysis (t= .913, df = 448, p =0.362) no Statistically significant “Multi brand Stores” preference differences between Indian and European consumers are found.

Online Shopping is the first most preferred distribution cue by Indian consumers (M=3.21, SD =.970) and it is the second most preferred cue by European consumers (M = 2.47, SD =.970). The t-test analysis (t = 8.167, df = 448, p= .000) observed that there is Statistically significant “Online Shopping” cue preference differences between Indian and European consumers therefore null hypothesis is rejected and **H 14 is supported.**

The result of the t-test analysis also indicates that there are statistically significant differences in “Retail Chain/Super Market” distribution cue preference between the Indian and European consumers (t = 8.280, df =448, p= .000). European consumers (M= 3.64, SD =.695) prefer shopping through retail chain more than the Indian consumers (M = 3.00, SD =.926). The difference is Statistically significant so the null hypothesis is rejected and **H 12 is supported.**

**Conclusion:** European consumers prefer to shop in Exclusive stores and through retail chain/Super Market more than the Indian consumers. Indian consumers’ first preference is online shopping as the E-commerce site amazon , Myntra, ,Ajo, luxury.tatacliq and brand owned sites are very popular in India. Retail chain like The Collective, The White Crow, Shoppers Stop which sell Premium and luxury Denim brands are established only in metro politian cities and states capitals so they are not accessible for people living in other cities. These research data are collected during Covid-19 period (2020 -2022) so the online shopping may be rated more by the Indian consumers.

**Promotion Preferences Analysis**

**Table VII**

	INDIA			EUROPE			Mean Difference	t	df	Sig.(2-tailed)
	M	SD	N	M	SD	N				
<b>TV/Internet Advertisement</b>	2.07	.951	235	2.20	1.079	215	-.321, .057	-1.375	448	.170
<b>News Paper/ Magazine Ad</b>	2.66	.916	235	2.96	.893	215	-.462 , -.126	-3.445	448	<b>.001</b>
<b>Films/Celebrity Endorsement</b>	2.54	1.122	235	2.65	1.154	215	-.321 , .100	-1.032	448	.303
<b>Friends Influence me</b>	2.79	1.309	235	2.19	1.154	215	.373 , .829	5.173	448	<b>.000</b>

An Independent sample t-test analysis was conducted to measure the differences between European and Indian consumers’ “Promotion preferences” for their favourite premium and luxury denim brands. **Table VII** shows that the European consumers (M =2.20, SD =1.079) are influenced by advertisement on Television and internet more than the Indian consumers (M = 2.07, SD = .951). According to the result of t-test analysis (t =1.375, df =448, p =.170, no Statistically significant “TV/Internet Advertisement” preference differences between European and Indian consumers are found. Thus **H 16** is not supported.

The t-test result analysis also indicates that the European consumers (M = 2.96, SD = .893) are more influenced by Newspaper/ Magazine Ad than the Indian consumers (.M= 2.66, SD = .916). The t-test analysis (t= 3.445, df= 448, p=.001) suggests that there are Statistically significant “Newspaper/ Magazine Ad influence” differences between European and Indian consumers hence null hypothesis is rejected. European consumers has given the highest rating to Newspapers/Magazine Ad than any other promotional tools while Indian consumers has chosen this as the second highest medium of promotion hence **H 17 is partially** supported.

The result shows that the European consumers (M=2.65, SD =1.154) are more influenced by Celebrities and Film stars endorsements than Indian consumers (M=2.54, SD = 1.122). According to

the t-test analysis ( $t = 1.032$ ,  $df = 448$ ,  $p = .303$ ), no Statistically significant differences are found between Indian and European consumers. **H15 is not supported.**

Based on the t-test result, it is observed that there are statistically **significant** mean differences between the Indian and European respondents ( $t = 5.173$ ,  $df = 448$ ,  $p = .000$ ) in “Friends Influence me” option of promotional tool. The Indian consumers ( $M = 2.79$   $SD = 1.309$ ) are more influenced by “Friends” opinion while buying Premium Denim brands than European consumers ( $M = 2.19$ .  $SD = 1.154$ ) and as it is Statistically significant hence null hypothesis is rejected and **H 18** is supported

**Conclusion**

Print media (Newspaper/magazine advertisement) has got major influence on European consumers and it has got the second most influence on Indian consumers. Indians are more influenced by Friends’ opinion on Brand preference than European consumers. Advertisement on Television and Internet influences European and Indian consumers both but there are not significantly differences in the impact of these promotional tools on these two group , same is the case when we analyze Celebrity/ Films stars endorsement’s impact on brands. No significantly differences found between these two groups on impact of Celebrity/ Films stars endorsement.

**Hypothesis Testing Summary(Intrinsic & Extrinsic cues)**

**Table VIII**

<b>Hypothesis</b>	<b>Result</b>
<b>H1.</b> Fabric is the relatively most important clothing-evaluative product cue other than many other cues for both Indian and European customers.	<b>Supported</b>
<b>H2.</b> Uniqueness plays an important product cue role for European consumers than for Indian consumers.	<b>Not Supported</b>
<b>H3.</b> Fabric cue is more important for European consumers than for Indian consumers.	<b>Supported</b>
<b>H 4.</b> Color is more important for Indian consumers than Europeans.	<b>Not Supported</b>
<b>H 5.</b> Fit is more important cue for Indian consumers than European consumers.	<b>Supported</b>
<b>H6.</b> Fabric and quality are strongly co related in both India and European countries.	<b>Partially Supported</b>
<b>H 7.</b> Quality is the most important product cue than color for both Indian and European consumers.	<b>Not Supported</b>
<b>H8.</b> Price (discounted) is more important extrinsic product cue for Indians than European consumers.	<b>Not Supported</b>
<b>H9.</b> Consumers of both India and European countries prefer to buy their denim products when there is a Price offer going on.	<b>Not Supported</b>
<b>H10.</b> Consumers prefer to buy less products when there is a premium pricing.	<b>Not Supported</b>

<b>H11.</b> Consumers from both countries prefer to opt for ‘Payment Terms’ like EMI for shopping their premium and luxury denims.	<b>Not Supported</b>
<b>H12.</b> European consumers prefer to buy more from Retail chain / supermarket than Indian consumers.	<b>Supported</b>
<b>H13.</b> Consumers from both India and European countries choose to buy from exclusive stores.	<b>Supported</b>
<b>H14.</b> Online shopping is preferred by Indian consumers more than the European consumers.	<b>Supported</b>
<b>H15.</b> Indian consumer are more influenced by Film actors/ celebrity endorsement of brand which entice them to buy their premium denims than European consumers.	<b>Not Supported</b>
<b>H16.</b> European consumers are more influenced by TV/ Internet advertisements than Indian consumers when they make decision to buy their premium denims.	<b>Not Supported</b>
<b>H17.</b> Newspaper/ magazines advertisements play more important role to influence more than any other promotional tool for both Indian and European consumers.	<b>Partially Supported</b>
<b>H18.</b> Indian consumers are more influenced by Friends opinion while Shopping for Premium Denims than European consumers.	<b>Supported</b>

### Limitation and Future Research

As other studies have limitation this study has too some limitations. The majority of European respondents (67%) were below 25 years of age and were students (70.7%) or intern/research scholars (7.4%). They were dependent on parents or doing part time jobs or receiving scholarships. On the other hand 81.7% Indian respondents were in the age group of 26-55 years and 86 % of Indian respondents were employed or businessmen. More research among different countries should be conducted to increase the reliability. The research was conducted during Covid-19 pandemic so the data from different demography could not be easily collected.

Notwithstanding this study is an in-depth and comprehensive research on denims’ intrinsic and extrinsic cues preferences and the research contribute to the existing literature by its empirical analysis and findings.

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# Keyword Search and Dual-Server Public-Key Encryption for Secure Cloud Storage

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## ABSTRACT

A growing number of people are interested in searchable encryption to safeguard the privacy of their data in secure searchable cloud storage. In this research, we examine the security of public key encryption with keyword search (PEKS), a widely used cryptographic fundamental with several applications in cloud storage. Unfortunately, it has been established that the conventional PEKS architecture has a flaw known as an inside keyword guessing attack (KGA) that is perpetrated by a rogue server. We suggest the dual-server PEKS framework as a new PEKS framework to remedy this security flaw (DS-PEKS). One further significant addition is the definition of a new type of smooth projective hash function (SPHF) called a linear and homomorphic SPHF (LH-SPHF). Then, using LH-SPHF, we demonstrate a generic construction of secure DS-PEKS. We propose an effective instantiation of the general framework from a Decision Diffie-Hellman-based LH-SPHF and demonstrate that it can accomplish the strong security inside the KGA to demonstrate the viability of our new framework.

Indexed Terms : Location-Based Social Network, Text Mining, Travel Route Recommendation

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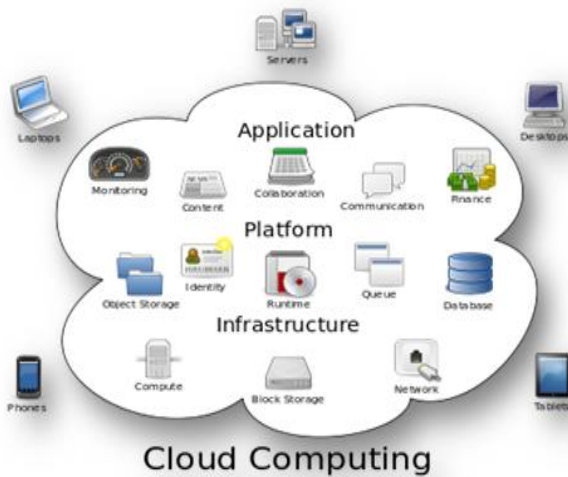
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## I. INTRODUCTION

Cloud computing (equipment and software) is used and shared remotely over a network in what is known as "the cloud" (usually the Internet). In structure graphs, a cloud-shaped picture is commonly used to represent the complex information it contains, hence the name. Through distributed processing, a client's information, code, and estimation can be shared amongst multiple, geographically dispersed

organizations. System hardware and software for appropriate processing are available online from supervised pariah groups. Modern programming languages and server PC networks are made possible by these establishments.





Structure of cloud computing

### Explaining the Workings of Cloud Computing.

Traditional supercomputing, or peak execution handling power, is typically reserved for use by the military and assessment agencies. The purpose of distributed registration is to put this type of processing power to use in client-centric applications, such as financial portfolios, the transmission of updated information, the provision of data limits, and the management of massive, visually impressive PC games. Distributed processing makes use of networks of very large groups of servers, which typically run low-cost client PC development and have some connection to dispersing data-handling tasks. Common IT architectures feature massive aggregations of interconnected systems. Virtualization methods are commonly used to increase the efficiency of distributed computing. Characteristics and Service Types: With the NIST's definitions in mind, here are some of the most remarkable aspects of widely disseminated numbers:

- Self-organization on demand: customer can set their limits for things like server time and association storage as needed, without needing to coordinate with each specialist facility individually.

- Capabilities are accessible over the network and can be used by a variety of client types thanks to standardized frameworks (e.g., cells, PCs, and PDAs).
- Resource pooling: In a multi-tenant model, the provider shares its enlisting resources among its many clients, allocating and reallocating its physical and digital assets to each client by their needs. Since the client generally has no control or data over the specific region of the provided resources at this point, there is a sense of region opportunity and the client may have the option to decide region at a higher level of reflection (e.g., country, state, or server ranch). Resource situations consist of constraints, management, memory, data transmission over networks, and virtual machines.
- Rapid adaptability: Capabilities can be provisioned quickly and skillfully, occasionally normally, to rapidly scale out, and immediately conveyed to rapidly scale in. Often, the client has the impression that they can purchase an unlimited amount of provisioning at any time.
- A metering limit appropriate to the type of business is typically used by cloud architectures to manage and expand resource utilization (e.g., limit, dealing with, information transmission, and dynamic client accounts). Both the user and the resource provider can benefit from due, controlled, and definitive resource use.



Characteristics of cloud computing

## II. RELATED WORK

### 1) A new generic framework with a keyword search for safe public key encryption

**R. Chen, Y. Mu, G. Yang, F. Guo, and X. Wang are the authors.**

Users can search encrypted files on an untrusted server using Public Key Encryption with Keyword Search (PEKS), a technology developed by Boneh et al. in Eurocrypt'04. The cryptography research community has paid a lot of attention to this idea because it has many practical uses. All of the current PEKS schemes, however, have the drawback of being unable to withstand the Keyword Guessing Attack (KGA) initiated by a hostile server. In this research, we present Dual-Server Public Key Encryption with Keyword Search as a new PEKS architecture (DS-PEKS). As long as the two untrusted servers do not cooperate, this new structure can withstand every assault, including the KGA. Then, using a fresh iteration of the Smooth Projective Hash Functions (SPHFs), we propose a general construction of DS-PEKS that is also of interest.

### 2) Improved definitions and effective structures for searchable symmetric encryption

**R. Curtmola, J. Garay, S. Kamara, and R. Ostrovsky are the authors.**

A party can delegate the private storage of his data to a third party while still having the option to conduct limited searches on it thanks to searchable symmetric encryption (SSE). Research on this issue has been ongoing, and several security definitions and constructions have been put out. In this essay, we first examine current security concepts before putting forth new, more robust security definitions. Then, we provide two constructions that, according to our new definitions, are secure. Interestingly, our buildings are more effective than any preceding constructions and also satisfy better security assurances.

Additionally, earlier research on SSE only took into account the scenario in which only the owner of the data can submit search queries. We take into account

the logical extension where search queries can be submitted by any arbitrary group of parties aside from the owner. In this multi-user environment, we explicitly define SSE and propose an effective construction.

### 3) K-Resilient IBE-based Public Key Encryption with Keyword Search

**TITLE: D. Khader**

**Abstract.** Bob sends Alice an email that has been encrypted. For some reason, a gateway needs to see if a specific keyword is present in an email or not (e.g. routing). However, Alice does not want anybody else, not even the gateway, to be able to decode the email. This situation calls for the use of public key encryption with keyword search (PEKS). In this study, we develop the KResilient Public Key Encryption with Keyword Search (KR-PEKS), a novel technique. Without the random oracle, the new technique is secure against a chosen keyword attack. The

The KR-PEKS was created using the capability of creating a Public Key Encryption with Keyword Search from an Identity Based Encryption. By demonstrating that the used IBE had a notion of key privacy, the security of the proposed system was demonstrated. The system was then changed in two distinct ways to achieve each of the following: the first change enabled multiple keyword searches, and the second change did away with the requirement for secure channels.

### 4) Generic secure-channel encryption that is open to search and has adaptive security

**K. Emura, A. Miyaji, M. S. Rahman, and K. Omote are the authors.**

A public key encryption system with keyword search (PEKS) and its variant secure-channel free PEKS (SCF-PEKS) have been proposed for keyword searches against encrypted material. In this research, we expand the security of SCF-PEKS and provide adaptive SCF-PEKS, where an adversary is allowed to issue test queries adaptively (modeled as a "malicious but legitimate" receiver). We demonstrate that only anonymous identity-based encryption is capable of

generically constructing adaptive SCF-PEKS. In contrast to the PEKS construction by Abdalla et al. (2008), SCF-PEKS can be created without the need for any additional cryptographic primitives, even though adaptive SCF-PEKS necessitates additional capabilities.

We also provide an alternative adaptive SCF-PEKS structure that is more effective than the previous one while not being entirely generic. In comparison to the (non-adaptive secure) SCF-PEKS scheme by Fang et al., we finally instantiate an adaptive SCF-PEKS scheme (using our second construction) that achieves a similar degree of efficiency for the costs of the test procedure and encryption (CANS2009). 2014 John Wiley & Sons, Ltd. Copyright 5) Cooperative data possession for multi-cloud storage integrity verification

**5) Offline keyword guessing attacks using keyword search techniques on modern public key encryption**  
**W.-C. Yau, S.-H. Heng, and B.-M. Goi is the author.**

Boneh et al. introduced the Public Key Encryption with Keyword Search Scheme (PEKS) for the first time in 2004. The issue of searching through material that has been encrypted with a public key setting is resolved by this scheme. The Secure Channel Free Public Key Encryption with Keyword Search (SCF-PEKS) technique, which eliminates the secure channel for sending trapdoors, was recently suggested by Baek et al. Later on, they put out the PKE/PEKS system, an upgraded PEKS method that incorporates a PKE scheme. We discuss offline keyword guessing attacks against SCF-PEKS and PKE/PEKS methods in this work. We show that offline keyword guessing attacks allow external adversaries who intercept trapdoors sent over a public channel to decrypt encrypted keywords. While internal enemies can carry out assaults regardless of whether trapdoors are supplied over a secure or public channel.

### III. SYSTEM ANALYSIS

#### Existing System

- In a PEKS system, the sender encrypts some keywords (called PEKS ciphertexts) with the receiver's public key and appends them to the encrypted data. The receiver then communicates with the server with the backdoor of a search term. The server can determine if the keyword used by the receiver in the PEKS ciphertext is the same as the one used in the trapdoor by comparing the two. If it does, the server will give the recipient the appropriate encrypted information. A new PEKS strategy, called a secure channel-free PEKS, was proposed by Baek et al., which eliminates the need for a secure channel (SCF-PEKS).
- Security for SCF-PEKS was improved by Rhee et al. after it was discovered that an attacker may learn about the connection between the non-challenge ciphertexts and the trapdoor.
- Since users typically employ well-known terms when looking for documents, Byun et al. introduced the offline keyword guessing attack against PEKS.

#### CONS: The current system has many drawbacks.

- Despite not requiring the dissemination of secret keys, PEKS methods are not completely secure due to a vulnerability in the trapdoor keyword privacy, more specifically the Keyword Guessing Attack (KGA). Security is compromised because anyone with knowledge of the receiver's public key can produce the PEKS ciphertext of any random keyword.
- To be more precise, an adversarial server equipped with a trapdoor can select a guessing term from the keyword space and use it to produce a PEKS ciphertext. When a guess is made, the server can see if it matches the secret keyword. Repeating

this process of guessing and testing until the right keyword is identified is possible.

- One problem is that the server does not have a hard time determining which small set the underlying keyword is a part of, even if it cannot guess the keyword itself. This means that the keyword's privacy is not properly safeguarded from the server. However, their plan is infeasible since the recipient must independently locate the correct ciphertext by utilizing the exact trapdoor to eliminate all but the one correct answer from the set supplied by the server.

**THE SUGGESTED SYSTEM:**

This study makes four major contributions.

- To fix this security hole in PEKS, we create a new framework we call Dual-Server Public Key Encryption with Keyword Search (DS-PEKS).
- For a more general DS-PEKS design, we present a linear and homomorphic form of the Smooth Projective Hash Function (SPHF) called linear SPHF.
- Using the proposed Lin-Hom SPHF, we demonstrate a generic construction of DS-PEKS.
- In this study, we describe a practical implementation of our SPHF based on the Diffie-Hellman language to demonstrate the viability of our novel framework.

**PROPOSED SYSTEM BENEFITS**

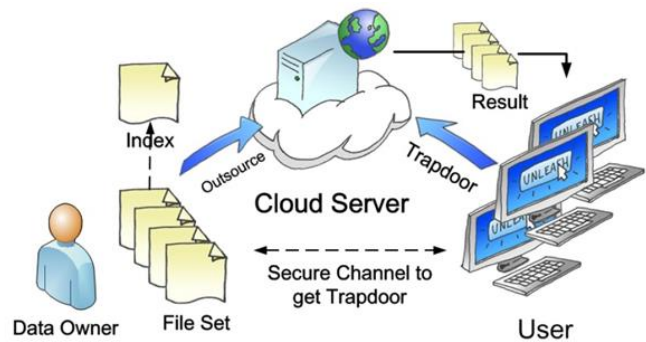
- Since our technique does not require any pairing computation, it is more efficient than existing systems that do require pairing computation during the production of PEKS ciphertext and testing.
- It has been determined that our method achieves the highest PEKS computation efficiency. The reason is, our plan leaves out the computation of pairs deliberately. In particular, the current technology has the highest calculation cost

because each generation of PEKS requires 2 pairing computations.

- We do not need to perform any pairing computation, and the server takes care of all the searching, so our scheme has a lower computation cost than any existing scheme, despite requiring an additional step for the testing.

**IV. SYSTEM DESIGN**

**4.1 SYSTEM ARCHITECTURE:**



**MODULES:**

- Module for Building Systems
- Security against Selective Keyword Semantics
- Server at the Front
- Back Server

**CONTENTS OF MODULES:**

**Module for Building Systems**

Our first module focuses on building the foundation of our system by creating the necessary data structures and entities. 1) Cloud User: the person or business who initially placed data in the cloud and is now using that data. 2) CSP: cloud service provider, the company in charge of running CSS and selling access to their network's cloud storage space to customers. We introduce the formal concept and security models of the new framework we propose, called DS-PEKS. Later, a new type of smooth projective hash function is defined by us (SPHF). Formal correctness analysis and security proofs are presented to demonstrate a general construction of DS-PEKS from LH-SPHF. In

conclusion, we show that SPHF can be used to efficiently implement DS-PEKS.

#### Security against Selective Keyword Semantics

To ensure that an attacker cannot tell one keyword apart from another when presented with a PEKS ciphertext, we implement semantic security against a chosen keyword attack in this section. In other words, an opponent cannot deduce the underlying keyword from the PEKS ciphertext.

#### Server at the Front

When the front server receives a query from the receiver, it uses its private key to pre-process the trapdoor and all the PEKS ciphertexts. It then provides the rear server with a set of testing states that conceal the relevant trapdoor and PEKS ciphertexts.

#### Back Server

Using its private key and the obtained internal testing states from the front server, the back server can then decide which documents are queried by the receiver in this section.

### III. CONCLUSION

In this research, we propose a novel framework called Dual-Server Public Key Encryption with Keyword Search (DS-PEKS) to address a flaw in the standard PEKS architecture: the possibility of an inside keyword guessing attack. In addition, we developed a new Smooth Projective Hash Function (SPHF) and applied it to the creation of a generalized DS-PEKS protocol. The research also presents a practical implementation of the new SPHF based on the Diffie-Hellman issue, which yields a practical DS-PEKS method without pairings.

### IV. FUTURE WORK

In the Future, Long-Term Impact: In MessageLocked Encryption (MLE), a new cryptographic primitive, the key used to encrypt and decode the message is itself obtained from the message. Numerous cloud-storage companies aim to provide secure deduplication (space-

efficient secure outsourced storage), and MLE gives the means to do so. It defines confidentiality as well as a type of integrity known as tag consistency.

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# Cold-Start Product Recommendation Using Microblogging Information: Linking Social Media To E-Commerce

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## ABSTRACT

The lines between online shopping and social networking have blurred in recent years. Social login allows users to access their favourite e-commerce sites by logging in with credentials from their existing account on a third-party social network like Facebook or Twitter. Additionally, customers can promote their recent purchases on microblogs by including links to the item pages on the merchant's website. To recommend products from e-commerce websites to users on social networking sites in "cold-start" situations, this paper proposes a novel approach to the under-explored problem of cross-site cold-start product recommendation. The challenge of figuring out how to use knowledge extracted from social networking sites is a major one in implementing cross-site cold-start product recommendations. To facilitate the mapping of social networking features to another feature representation for a product recommendation, we propose using users who have accounts on both social networking sites and e-commerce sites as a bridge. To be more specific, we propose using recurrent neural networks to learn feature representations for users and products (termed user embedding's and product embedding's, respectively) from data collected from e-commerce websites, and then employing a modified gradient boosting trees method to transform users' social networking features into user embedding's. After acquiring user embedding's, we develop a feature-based matrix factorization approach to cold-start product recommendations. Experimental results on a large dataset constructed from SINA WEIBO, the largest Chinese microblogging service, and JINGDONG, the largest Chinese B2C e-commerce website, confirmed the efficacy of our proposed framework.

**Keywords :** Online Store , Online Business I, Jingdong, Sina Weibo

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## I. INTRODUCTION

The lines between online shopping and social networking have blurred in recent years. Social

network features, such as instantaneous updates and interactions between users, can be found on e-commerce sites like eBay. Social login is a feature

offered by some online stores that enable new customers to register with their existing credentials from a social media platform like Facebook, Twitter, or Google+. A "buy" button, accessible via advertisements or other posts, was introduced on both Facebook and Twitter in the past year, allowing users to make purchases without leaving the sites. Strategically investing in SINA WEIBO1 allows e-commerce giant ALIBABA to reach Chinese internet users with product advertisements. Data extracted from social sites is crucial especially in light of the growing popularity of using these platforms for e-commerce.

In this paper, we investigate the intriguing challenge of making product recommendations from e-commerce sites to social networking site users in "cold-start" situations, where no previous purchase data exists.

We referred to this issue as "cold start" product recommendations across multiple sites. Even though online product recommendation has been studied extensively, most studies only concentrate on building solutions within specific e-commerce websites and primarily use users' historical transaction records. Cross-site cold-start product recommendation appears to be an underexplored area. Because of the nature of the problem we're trying to solve, we're limited to using the users' social networking information to make recommendations.

To overcome this difficulty, we propose connecting users' social networking features to latent features for product recommendation through the shared users between social networking sites and e-commerce websites. To be more precise, we propose using recurrent neural networks to learn feature representations (called user embedding's and product embedding's, respectively). After learning user embedding's, we create a feature-based matrix factorization method to use for cold-start product recommendations.

## II. RELATED WORK

Possibility-based framework for advising on online purchases: Just the right product, at just the right time:

The primary goal of most current e-commerce recommender systems is to match a user with a product they are more than likely to buy and enjoy. However, the timing of a recommendation can have a significant impact on its success. Take the brand-new laptop owner as an example.

If the laptop's original battery tends to stop holding a charge around the two-year mark, she may buy a replacement battery at that time and then a new laptop at the end of the four-year mark. In this case, it would be inappropriate to suggest that the user buy a new laptop or a replacement battery so soon after making the initial purchase. Getting the right product recommendation at the wrong time can lower the user's opinion of the recommender system.

While it's important for a system to recommend the most applicable item, we argue that it's also important for it to recommend at the optimal time.

The paper investigates the contemporary issue of making timely product suggestions. Here, we apply the proportional hazards modelling strategy from survival analysis to the study of recommendations and propose a new opportunity model for including time in an online store's individualized product recommendations.

## III. SYSTEM ANALYSIS

### 3.1 EXISTING SYSTEM:

- Studies typically only look at specific e-commerce sites, and even then, they only look at solutions built with users' past transaction data. Cross-site cold-start product recommendation appears to be an underexplored area.
- The cold-start recommendation problem is also the subject of a substantial body of literature.
- In order to predict ratings for new users, Seroussi et al. proposed incorporating data from users' public profiles..
- The ensemble learning algorithm proposed by Zhang et al.
- Schein suggested a technique that would incorporate content and collaborative data into a unified probabilistic model.
- Using social data, Lin et al. solved the "cold-start" problem for app recommendations.



### 3.1.1 Disadvantages of the Current System

- Our cross-site cold-start product recommendation task is different from theirs in that they only consider the brand or category-level purchase preference based on a trained classifier.
- In contrast to the wide variety of features we investigated, they only consider gender, age, and Facebook likes.
- In order to solve the cross-site cold-start recommendation problem, they neglect to think about how to convert the varied data collected on social media platforms into a format suitable for use in online stores.

### 3.2 PROPOSED SYSTEM

- In this paper, we investigate the intriguing issue of making product recommendations from e-commerce sites to social networking site users in "cold-start" situations, where no previous purchase data exists. We referred to this issue as "cold start" product recommendations across multiple sites.
- Because of the nature of the problem we're trying to solve, we're limited to using the users' social networking information to make recommendations. To overcome this difficulty, we propose connecting users' social networking features to latent features for product recommendation using the shared user base of social media and online stores (users who have social networking accounts and have made purchases on e-commerce websites).
- We specifically propose using recurrent neural networks to learn feature representations for users and products (termed user embedding's and product embedding's, respectively) from data collected from e-commerce websites, and then using a modified gradient boosting trees method to transform users' social networking features into user embedding's.
- Next, we use the user embedding's we've learned to power cold-start product recommendations using a matrix factorization method based on feature engineering.

### 3.2.1 BENEFITS OF THE SUGGESTED SYSTEM:

- The cross-site cold-start product recommendation problem can be solved using our proposed framework.
- We expect our study to have far-reaching consequences for academic and commercial settings alike.

## IV. SYSTEM DESIGN

### 4.1 SYSTEM ARCHITECTURE

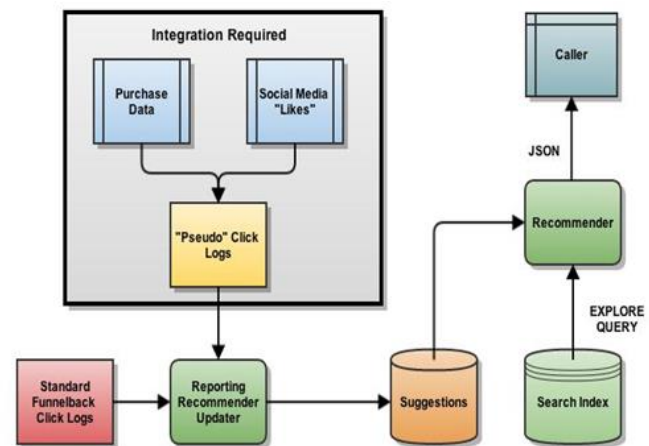


Fig: 4.1 system architecture

## V. RESULT

The study states that social media and e-commerce are interconnected by each other. By using embedded system and microblogging system we can provide the user of both social media and e-commerce facilities in the same application. Also it helps the sellers to improve their business by recommending the required product for the user by data mining techniques. It collects user's data at the time of login and based on the data it provides recommendation of the required product and also which increase the business we use peer to peer network for this particular paper. So but the limitation is we can only add the products and can review the product. Almost customers purchase the product based on the previous reviews. So here we can provide the reviews as well.

We are certain that our view point towards the issue can be an impactful change in how consumers use

recommendations to shop online. We hope that this can reform how people use their social media to look for products that fit their requirements and also help e-commerce websites to reach their target audience with the right recommendation. This outlook is only a basic proposed solution; furthermore many effective-advance methods such as Convolutional Neural Network<sup>13</sup> can be implied for feature learning.

## VI. CONCLUSION

In this project, we investigate a new challenge: how to recommend products from e-commerce sites to microblogging users who don't have any purchase history. Our central thesis is that, through feature learning using recurrent neural networks, e-commerce website users and products can share a common latent feature space. Users who have accounts on both e-commerce and social networking sites can be used as a bridge to learning feature mapping functions by employing a modified gradient boosting trees approach. This approach maps users' attributes extracted from social networking sites onto feature representations learned from e-commerce sites.

Incorporating the mapped user features into a feature-based matrix factorization approach for cold-start product recommendation is a powerful strategy. Using WEIBO and JINGDONG, we have assembled a sizable dataset. Our findings validate the efficacy of our proposed framework in solving the cross-site cold-start product recommendation issue. We anticipate significant repercussions from our study for academia and business alike. To learn user and product embedding's, traditional methods have only used a basic neutral network architecture. We can look into more cutting-edge deep learning models for feature learning in the future, like Convolutional Neural Networks<sup>13</sup>. In addition, we'll think about how to enhance the current feature mapping technique by transferring learning ideas.

## VII. FUTURE WORK

Additional deep learning models, such as Convolutional Neural Networks<sup>13</sup>, can be investigated for feature learning in the future. We will also think about how to enhance the current feature mapping method using concepts from transfer learning. Learned user and product embedding's have previously only been implemented using a basic neutral network architecture. It is possible to improve the solution by attempting to identify more qualified traits from the client's online networking about the client, which will aid in the appropriate evaluation of the client's interest. Existing solutions may be integrated with it, such as linked product recommendation, which suggests complementary items to those already in a customer's inventory.

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# Identity-Based Proxy-Oriented Data Uploading and Remote Data Integrity Checking in Public Cloud

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## ABSTRACT

A steadily expanding number of clients should store their data in public cloud servers (PCSs) close to the fast improvement of circulated processing. New security issues ought to be settled to help more clients with taking care of their data straightforwardly cloud. Right when the client is restricted to get to PCS, he will assign its delegate to deal with his data and move them. On the other hand, distant data genuineness checking is moreover a critical security issue without trying to hide conveyed capacity. It makes the clients check whether their reexamined data are kept intact without downloading the whole data. From the security issues, we propose a unique go-between arranged data moving and far away data reliability checking model in character-based public-key cryptography: character-based mediator arranged data moving and far off data uprightness truly investigating straightforwardly cloud (ID-PUIC). We give the legitimate definition, structure model, and security model. Then, a significant ID-PUIC show is arranged using the bilinear pairings. The proposed ID-PUIC show is provably secure considering the hardness of the computational Diffie-Hellman issue. Our ID-PUIC show is in a like manner useful and versatile. Considering the primary client's endorsement, the proposed ID-PUIC show can comprehend private far away data uprightness checking, named far away data trustworthiness checking, and public far off data decency checking.

**Keywords :** Cloud Computing, Identity-Based Cryptography, Proxy Public Key Cryptography, Remote Data Integrity Checking.

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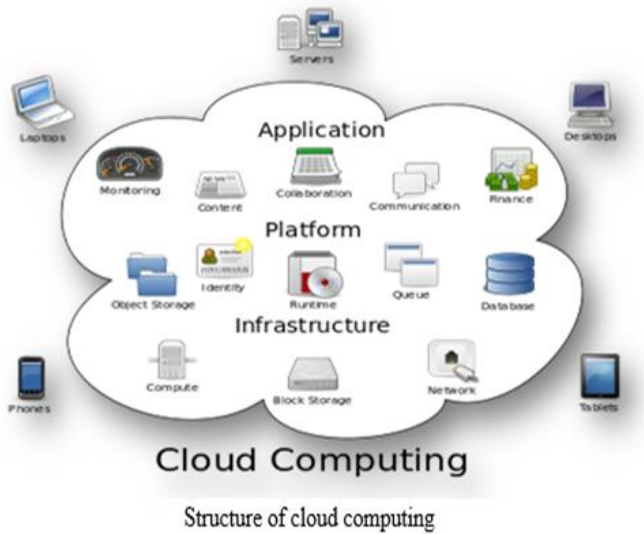
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## I. INTRODUCTION

Cloud computing (equipment and software) is used and shared remotely over a network in what is known as "the cloud" (usually the Internet). In structure graphs, a cloud-shaped picture is commonly used to represent

the complex information it contains, hence the name. Through distributed processing, a client's information, code, and estimation can be shared amongst multiple, geographically dispersed organizations. System hardware and software for appropriate processing are available online from supervised pariah groups.

Modern programming languages and server PC networks are made possible by these establishments.



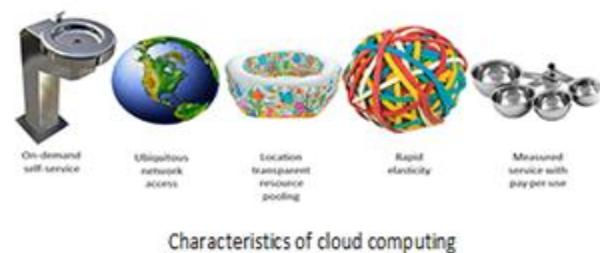
**Explaining the Workings of Cloud Computing.**

Traditional supercomputing, or peak execution handling power, is typically reserved for use by the military and assessment agencies. The purpose of distributed registration is to put this type of processing power to use in client-centric applications, such as financial portfolios, the transmission of updated information, the provision of data limits, and the management of massive, visually impressive PC games. Distributed processing makes use of networks of very large groups of servers, which typically run low-cost client PC development and have some connection to dispersing data-handling tasks. Common IT architectures feature massive aggregations of interconnected systems. Virtualization methods are commonly used to increase the efficiency of distributed computing. Characteristics and Service Types: With the NIST's definitions in mind, here are some of the most remarkable aspects of widely disseminated numbers:

- Self-organization on demand: customer can set their limits for things like server time and association storage as needed, without needing to

coordinate with each specialist facility individually.

- Capabilities are accessible over the network and can be used by a variety of client types thanks to standardized frameworks (e.g., cells, PCs, and PDAs).
- Resource pooling: In a multi-tenant model, the provider shares its enlisting resources among its many clients, allocating and reallocating its physical and digital assets to each client by their needs. Since the client generally has no control or data over the specific region of the provided resources at this point, there is a sense of region opportunity and the client may have the option to decide region at a higher level of reflection (e.g., country, state, or server ranch). Resource situations consist of constraints, management, memory, data transmission over networks, and virtual machines.
- Rapid adaptability: Capabilities can be provisioned quickly and skillfully, occasionally normally, to rapidly scale out, and immediately conveyed to rapidly scale in. Often, the client has the impression that they can purchase an unlimited amount of provisioning at any time.
- A metering limit appropriate to the type of business is typically used by cloud architectures to manage and expand resource utilization (e.g., limit, dealing with, information transmission, and dynamic client accounts). Both the user and the resource provider can benefit from due, controlled, and definitive resource use.



## II. RELATED WORK

There exist many different security problems in the cloud computing [1], [2]. This paper is based on the research results of proxy cryptography, identity-based public key cryptography and remote data integrity checking in public cloud. In some cases, the cryptographic operation will be delegated to the third party, for example proxy. Thus, we have to use the proxy cryptography. Proxy cryptography is a very important cryptography primitive. In 1996, Mambo et al. proposed the notion of the proxy cryptosystem [3]. When the bilinear pairings are brought into the identity-based cryptography, identity-based cryptography becomes efficient and practical. Since identity based cryptography becomes more efficient because it avoids of the certificate management, more and more experts are apt to study identity-based proxy cryptography. In 2013, Yoon et al. proposed an ID-based proxy signature scheme with message recovery [4]. Chen et al. proposed a proxy signature scheme and a threshold proxy signature scheme from the Weil pairing [5]. By combining the proxy cryptography with encryption technique, some proxy re-encryption schemes are proposed. Liu et al. formalize and construct the attributebased proxy signature [6]. Guo et al. presented a noninteractive CPA(chosen-plaintext attack)-secure proxy reencryption scheme, which is resistant to collusion attacks in forging re-encryption keys [7]. Many other concrete proxy re-encryption schemes and their applications are also proposed [8]–[10]. In public cloud, remote data integrity checking is an important security problem. Since the clients' massive data is outside of their control, the clients' data may be corrupted by the malicious cloud server regardless of intentionally or unintentionally. In order to address the novel security problem, some efficient models are presented. In 2007, Ateniese et al. proposed provable data possession (PDP) paradigm [11]. In PDP model, the checker can check the remote data integrity without retrieving or downloading the whole data. PDP is a probabilistic proof of remote data

integrity checking by sampling random set of blocks from the public cloud server, which drastically reduces I/O costs. The checker can perform the remote data integrity checking by maintaining small metadata. After that, some dynamic PDP model and protocols are designed [2]–[6]. Following Ateniese et al.'s pioneering work, many remote data integrity checking models and protocols have been proposed [7]–[9]. The end devices may be mobile and limited in computation and storage. Thus, efficient and secure IDPUIC protocol is more suitable for cloud clients equipped with mobile end devices. From the role of the remote data integrity checker, all the remote data integrity checking protocols are classified into two categories: private remote data integrity checking and public remote data integrity checking. In the response checking phase of private remote data integrity checking, some private information is indispensable. On the contrary, private information is not required in the response checking of public remote data integrity checking. Specially, when the private information is delegated to the third party, the third party can also perform the remote data integrity checking. In this case, it is also called delegated checking.

## III. SYSTEM ANALYSIS

**Existing System** Straightforwardly cloud environment, most clients move their data to PCS and truly check out their far-off data's dependability on the Internet. Right when the client is a solitary chairman, a couple of logical issues will happen. Accepting the boss is related to being involved in business coercion, he will be taken out by the police. During the hour of assessment, the boss will be restricted to get to the association to plan for arrangements. In any case, the manager's genuine business will occur during the hour of assessment. When an immense of data is made, who can help him with taking care of this data? In case these data can't be taken care of totally dry on time, the chief will face a lack of monetary interest. To prevent the case from happening, the boss ought to assign a mediator to deal

with its data, for example, his secretary. However, the head won't believe others can play out the far-away data genuineness checking.

1. Chen et al. proposed a middle-person signature contrive and an edge mediator signature plot from the Weil coordinating.
2. By joining the go-between cryptography with an encryption system, some middle-person re-encryption plans are proposed. Liu et al. formalize and foster the property-based mediator signature.
3. Guo et al. presented a non-natural CPA (picked plaintext attack)- secure delegate re-encryption contrive, which is impenetrable to plot attacks in assembling re-encryption keys.

**DISADVANTAGES OF THE EXISTING SYSTEM:**

1. Public checking will achieve some gamble of delivering security.
2. Less Efficiency.
3. The security level is low

**III. PROPOSED SYSTEM**

1. This paper relies upon the assessment of eventual outcomes of go-between cryptography, character-based public-key cryptography, and far-off data genuineness investigating transparently cloud.
2. In the public cloud, this paper revolves around character-based delegate arranged data moving and distant data uprightness checking.
3. By using character-based public key cryptology, our proposed ID-PUIC show is successful since the validation the board abstained from. ID-PUIC is a smart go-between arranged data moving and distant data genuineness truly seeing model out in the open cloud. We give the traditional structure model and security model for the ID-PUIC show. Then, considering the bilinear pairings, we arranged the significant ID-PUIC show.
4. In the erratic prophet model, our arranged ID-PUIC show is provably secure. Considering the principal

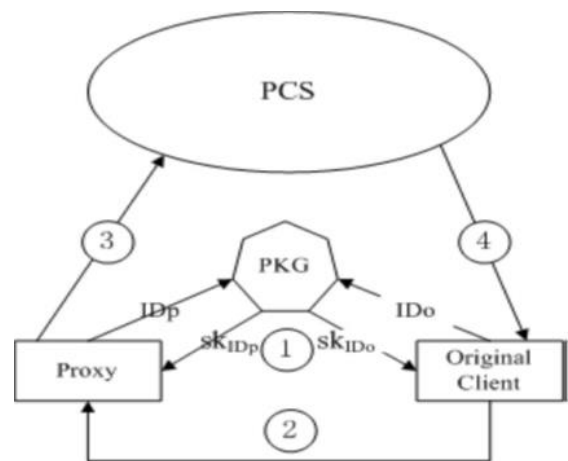
client's endorsement, our show can figure out private checking, relegated checking, and public checking.

5. We propose a successful ID-PUIC show for secure data moving and amassing organization without any attempt at being subtle fogs.
6. Bilinear pairings technique makes character-based cryptography even-minded. Our show depends on the bilinear pairings. We first review the bilinear pairings.

**ADVANTAGES OF THE PROPOSED SYSTEM:**

1. High Efficiency.
2. Improved Security.
3. The significant ID-PUIC show is provably secure and capable of using legitimate security affirmation and efficiency examination.
4. On the other hand, the proposed ID-PUIC show can in like manner recognize private far-off data decency checking, designated distant data uprightness checking, and public far away data dependability truly investigating perspective on the primary client's endorsement.

**IV. SYSTEM DESIGN**



**MODULES:**

1. Original Client
2. Public Cloud Server
3. Proxy
4. KGC

**MODULE DESCRIPTIONS:**

Stand-out CLIENT:

A surprising Client is an Entity, that will go likely trade an immense information into the public cloud server (PCS) by the doled-out center individual, and the fundamental thing is the validity checking of gigantic information will be through the controller. For the Data moving and Downloading client should follow the going with Process steps:

1. Client can see the cloud chronicles and make the downloading.
2. Client necessities to move the chronicle for specific referred-to credits with the encryption key.
3. Then the client needs to make the mention to the TPA and PROXY to perceive the download endlessly interest for the mystery key which will be given by the TPA.
4. After getting the mystery key client can make the downloading chronicle.
5. Client is an Entity, that will go most likely trade a huge information into the public cloud server (PCS).

**PUBLIC CLOUD SERVER:** PCS is a part that is remained mindful of by the cloud master affiliation. Laptops are the immense scattered additional room and assessment assets for staying mindful of the client's tremendous information.

Workstations can see the client's all's subtleties and move some records which are valuable for the client and make the cutoff concerning the client moved chronicles.

**Go-between: Proxy** is a substance, which is upheld to manage the Original Client's information and move them, is picked, and embraced by the Original Client. Precisely when the Proxy fulfills the warrant which is checked and given by the Original Client, it can process and move the essential client's information; if not, it can't do the framework.

Essentially say derives: without the Knowledge of the Proxy's assertion and check and insistence of agent-client can't download the record which is moved by the Client.

## V. CONCLUSION

Taking into account the requirements of the applications, this paper suggests the ID-PUIC cloud as the primary form of security. In this paper, we formally present the security model and framework model for ID-PUIC. Next, the bilinear pairings structure is used to arrange the vital ID-PUIC performance. Using the right level of security insistence and proficiency assessment, the essential ID-PUIC demonstration can be demonstrated to be safe and effective. With the help of their essential client, the proposed ID-PUIC display can also detect private distant information validity checking, distributed distant information dependability checking, and public distant information tolerability genuinely researching perspective.

## VI. FUTURE WORK

Furthermore, we could attempt to bargain odd circumstances managing associations like glass-breaking parts over high secure cloud framework with the objective that we could deal with the sporadic loss of keys at the information owner's end. This glass-breaking part especially helps in serving the distant clients most genuinely with no assistance breakage regardless of how there is a mix-up occurred at the information proprietor's end because their first-class information related amounted to key difficulty.

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# Providing Cloud Storage Auditing Through Verifiable Key Update Outsourcing

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## ABSTRACT

In many security applications, key-exposure resistance has long been a pressing concern for a comprehensive cyber defence strategy. How to address this critical exposure issue in the context of cloud storage auditing has been proposed and investigated as of late. Existing solutions to the problem necessitate that the client updates his secret keys at regular intervals, which can be a significant burden for clients with limited computational resources, like mobile phones. To provide maximum client transparency during key updates, we propose a novel paradigm in this paper: cloud storage auditing combined with the verifiable outsourcing of key updates. In this model, the client doesn't have to worry about keeping track of key updates because they can be safely delegated to a trusted third party. In particular, we adapt the role of the third-party auditor (TPA) from numerous existing public auditing designs, giving it responsibility for both the auditing of the storage and the security updates of keys in order to prevent key exposure. Our scheme requires TPA to keep only an encrypted copy of the client's secret key while performing these otherwise onerous tasks on the client's behalf. When transferring data to the cloud, the client only needs to get the encrypted secret key from the TPA. Further, our architecture provides the client with the means to confirm the authenticity of the TPA's supplied encrypted secret keys. The whole auditing process with key exposure resistance is made as clear to the client as possible by the inclusion of these prominent features. The definition and underlying security model of this paradigm are formally outlined. Our rigorously tested and simulated implementations of the detailed designs have proven to be safe and effective in practice.

**Keywords :** Cloud Storage, Outsourcing Computing, Cloud Storage Auditing, Key Update, Verifiability.

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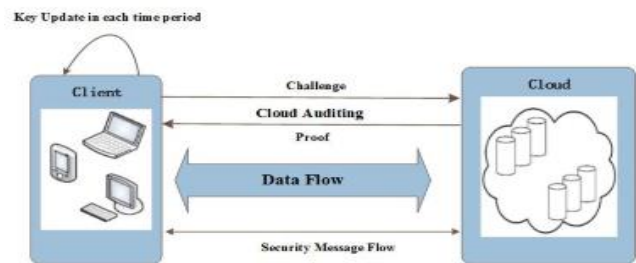
## I. INTRODUCTION

One of the most crucial safety measures in cloud storage is auditing, which is implemented to ensure the authenticity of information kept in the cloud. Recent years have seen extensive studies into the topic of auditing protocols for cloud storage. One of the primary concerns of these protocols is how to achieve high bandwidth and computation efficiency, which is relevant to the auditing process as a whole. Therefore, the Homomorphism Linear Authenticator (HLA) technique is investigated, as it allows the auditor to verify the integrity of the data in the cloud without retrieving the whole data, thus reducing the computational and communication overheads of auditing protocols.

Many auditing protocols for cloud storage like have been proposed using this method. Auditing of cloud storage services should also take privacy measures seriously. A third-party auditor (TPA) is introduced to assist the client in performing periodic checks of the cloud's data integrity, thereby reducing the client's computational burden. After the TPA has executed the auditing protocol multiple times, it may be able to obtain the client's data. Client data in the cloud is kept private using auditing protocols. What's more, the auditing of cloud storage has addressed the question of how to facilitate data-dynamic operations.

In this project, we introduce the concept of an auditing protocol with key-exposure resilience and conduct the first research into its implementation for a storage auditing system. In such a protocol, even if the cloud acquires the client's current secret key for cloud storage auditing, any dishonest behavior, such as deleting or modifying some clients' data stored in the cloud in previous periods, can be detected. Existing designs for auditing protocols do not account for this crucial shortcoming. For safe cloud-based data storage, we formalize the definition and security model of auditing protocols with key-exposure resilience.

For the first time, we create a practical auditing protocol for cloud storage that includes built-in resistance to key exposure. The binary tree structure, used in a variety of earlier works on various cryptographic designs, is put to use here to accomplish our goal of keeping the client's secret keys secure and up to date. One could think of this binary tree structure as a subset of the tree structure employed by the HIBE scheme. Additionally, a binary tree's nodes are linked to their respective periods using the preorder traversal method. To implement the binary tree preorder traversal in our detailed protocol, we make use of the stack data structure.



1. System model of our cloud storage auditing

Using the system described below, we investigate the possibility of outsourcing numerical and logical computations. If a customer needs calculations performed but their internal resources (computer power, appropriate software, or programming skills) are insufficient, they may turn to an external operator for help. These days, we see this in a wide variety of everyday contexts, from fiscal to oil administrations. If the outsourcing is handled so that neither the original data nor the final calculation results are revealed to the third party, then it is considered a safe practice. The basic idea is that the client should perform some carefully planned local preprocessing (masking) of the problem or potentially information before sending it to the operator and that the client should also perform some carefully planned local postprocessing of the appropriate response come back to extract the true reply. As little effort as possible should be put into the camouflage process regarding the size of the information and the response. Numerical properties of

computational performance may be altered by the camouflage preprocessing that the client performs locally to "conceal" the real calculation. Here, we present a structure for hiding logical computations and discuss their prices, numerical properties, and degrees of security. These covert operations can be set up in a normal state, a user-friendly framework (critical thinking condition), which conceals their complexity. We provide protocols for the secure and private outsourcing of direct polynomial math computations, allowing a client to safely outsource expensive logarithmic computations (such as the expansion of large-scale systems) to two remote servers while ensuring that neither server can learn anything about the client's private information or the result of the computation. The customer's local computations are efficient in the scope of their information and don't necessitate any time-consuming or money-sucking encryptions of the customer's input. The computational burden on the servers is proportional to the time unpredictability of the currently practically used calculations for addressing the arithmetic problem (e.g., relative to  $n^3$  for increasing two  $n \times n$  networks). Even if the servers were to collude against the client, they could only learn where the client gets their information, but they couldn't change the correct response without the client knowing.

## II. SYSTEM ANALYSIS

### EXISTING SYSTEM

One of the most valued aspects of cloud computing is cloud storage. However, while cloud storage solves many problems for its users, it also introduces new security issues. How to efficiently verify the authenticity of cloud-based data is a pressing issue in information security. Many auditing protocols for cloud storage have been proposed to address this issue in recent years. Another critical issue with auditing cloud storage is the 'key exposure problem.'

### **Problems with the Current System:**

1. Ineffectiveness of data integrity checks
2. If the cloud gains access to the client's secret key for storage auditing, it can easily cover up any data loss incidents, protect its reputation, and get rid of the client's infrequently used data to free up space.

### PROPOSED SYSTEM

A new paradigm is proposed, one that combines the auditing of cloud storage with the verifiable outsourcing of key updates. In the new model, the client no longer performs key-update operations but rather is an authorized third party. An authorized third party keeps the client's encrypted secret key and updates it each period for use in auditing cloud storage. If and when the client needs to upload new files to the cloud, he will need to download the encrypted secret key from the authorized party and decrypt it. The client also can validate the authenticity of the encrypted secret key. In this work, we develop the first auditing protocol for cloud storage that allows for the dependable delegation of key updates. Our architecture positions the TPA as the official custodian of all necessary revisions. Another crucial duty of the TPA is to verify the authenticity of the client's cloud-based data, much like the traditional public auditing protocols. Since the TPA only has an encrypted copy of the client's secret key, it cannot perform an audit of the client's cloud storage without access to the client's private key. To protect the TPA's private keys, we employ an encryption algorithm based on the blinding technique, which uses the homomorphic property. It improves the safety of our protocol and the speed of the decryption procedure. The TPA, meanwhile, can finish up any necessary key updates while in an encrypted state. After receiving the encrypted secret key from the TPA, the client can check its authenticity.

**The Benefits of the Suggested Method:**

1. The client is not aware of the TPA's handling of key updates in this protocol.
2. The TPA is only privy to the encrypted client secret key, and the client can double-check the TPA's encryption after it has downloaded the keys.

**III. SYSTEM DESIGN**

**4.1 SYSTEM ARCHITECTURE:**

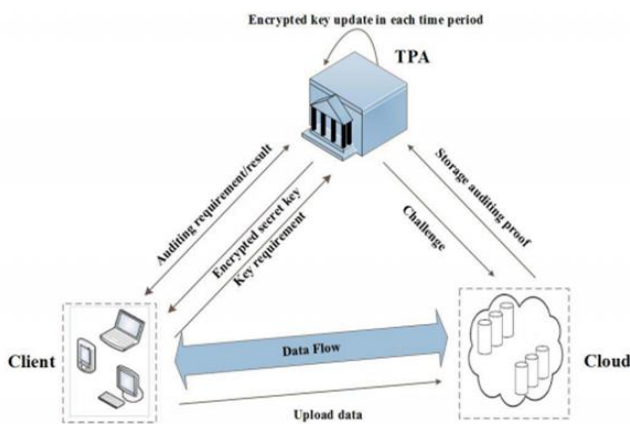


Fig. 1. System model of our cloud storage auditing.

**MODULES**

We have 3 main modules in this project;

1. Client Module
2. Cloud Module
3. Third Party Auditor (TPA)

Client:

The client retains all legal rights to any data stored in the cloud. Rather than having a set total size, the client can upload the expanding files to the cloud at any time.

Cloud:

The cloud serves as a repository for the client's data and a download hub.

TPA:

The TPA's primary function is to conduct an audit of the client's cloud-based data files, and its secondary

function is to periodically update the client's encrypted secret keys.

**IV. CONCLUSION**

To better protect our clients, we investigate the most vulnerable areas of their cloud storage accounts. An auditing protocol with key-exposure resilience is the new paradigm we propose. In such a protocol, even if the client's current secret key for cloud storage auditing is compromised, the data's integrity can still be verified for data that was previously stored in the cloud. We propose the first operational solution after formally defining and modelling the security of an auditing protocol that is resistant to key exposure. The proposed protocol is demonstrated to be safe and effective through proof of security and an analysis of its asymptotic performance.

**V. FUTURE WORK**

The generation of the time period key is not something we suggest should be based on operations but on logging instead. It's inefficient to generate new keys all the time, so long periods of time between them are recommended instead. Automatically, based on a predetermined time period, a new key should be generated.

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# Wireless Sensor Networks with Efficient Clone Detection in Terms of Energy and Memory

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## ABSTRACT

We propose an energy-efficient location-aware clone detection protocol for densely deployed WSNs to ensure successful clone attack detection and satisfactory network lifetime. Using the sensors' geolocation data, we randomly select witnesses within a ring area to attest to the sensors' legitimacy and report any clone attacks they may have uncovered. The witnesses and the sink along the path can receive data with minimal power consumption thanks to the ring topology. For the first time, we theoretically show that the proposed protocol can achieve a clone detection probability of one hundred percent with trustworthy witnesses. In this expanded work, we examine clone detection performance with untrustful witnesses and find that, even with 10% of witnesses being compromised, the clone detection probability is still very close to 99%. The proposed protocol also requires buffer storage of sensors that depends not on the number of sensors,  $n$ , but on the network's radius,  $h$ , i.e.  $Oh$ , whereas the required buffer storage of sensors is typically dependent on the node density in existing clone detection protocols with random witness selection scheme. Extensive simulations show that our proposed protocol can ensure a long network lifetime by evenly distributing the traffic load across the network.

**Keywords** : Wireless Sensor Networks, Clone Detection Protocol, Energy Efficiency, And Network Lifetime

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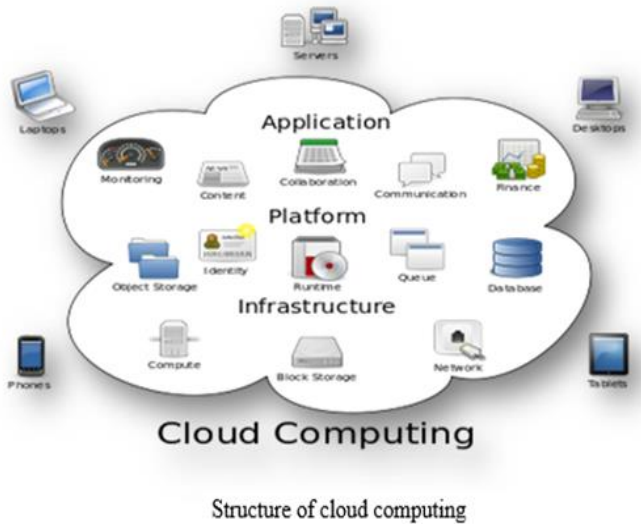
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## I. INTRODUCTION

Cloud computing (equipment and software) is used and shared remotely over a network in what is known as "the cloud" (usually the Internet). In structure graphs, a cloud-shaped picture is commonly used to represent the complex information it contains, hence the name. Through distributed processing, a client's information,

code, and estimation can be shared amongst multiple, geographically dispersed organizations. System hardware and software for appropriate processing are available online from supervised pariah groups. Modern programming languages and server PC networks are made possible by these establishments.



### Explaining the Workings of Cloud Computing

Traditional supercomputing, or peak execution handling power, is typically reserved for use by the military and assessment agencies. The purpose of distributed registration is to put this type of processing power to use in client-centric applications, such as financial portfolios, the transmission of updated information, the provision of data limits, and the management of massive, visually impressive PC games. Distributed processing makes use of networks of very large groups of servers, which typically run low-cost client PC development and have some connection to dispersing data-handling tasks. Common IT architectures feature massive aggregations of interconnected systems. Virtualization methods are commonly used to increase the efficiency of distributed computing. Characteristics and Service Types: With the NIST's definitions in mind, here are some of the most remarkable aspects of widely disseminated numbers:

- Self-organization on demand: customer can set their limits for things like server time and association storage as needed, without needing to coordinate with each specialist facility individually.

- Capabilities are accessible over the network and can be used by a variety of client types thanks to standardized frameworks (e.g., cells, PCs, and PDAs).
- Resource pooling: In a multi-tenant model, the provider shares its enlisting resources among its many clients, allocating and reallocating its physical and digital assets to each client by their needs. Since the client generally has no control or data over the specific region of the provided resources at this point, there is a sense of region opportunity and the client may have the option to decide region at a higher level of reflection (e.g., country, state, or server ranch). Resource situations consist of constraints, management, memory, data transmission over networks, and virtual machines.
- Rapid adaptability: Capabilities can be provisioned quickly and skillfully, occasionally normally, to rapidly scale out, and immediately conveyed to rapidly scale in. Often, the client has the impression that they can purchase an unlimited amount of provisioning at any time.
- A metering limit appropriate to the type of business is typically used by cloud architectures to manage and expand resource utilization (e.g., limit, dealing with, information transmission, and dynamic client accounts). Both the user and the resource provider can benefit from due, controlled, and definitive resource use.



Characteristics of cloud computing

## II. RELATED WORK

### 2.1 Protocol for detecting clones in wireless sensor networks that uses minimal power (ERCD)



**Z. Zheng, A. Liu, L. X. Cai, Z. Chen, and X. Shen are the authors here.**

As their capabilities continue to improve, wireless sensor networks (WSNs) are finding use in a growing number of fields, from the study of dangerous environments to the delivery of medical care remotely. However, due to hardware and cost limitations, sensors are vulnerable to clone attacks, which presents significant obstacles to developing and deploying an energy-efficient WSN. In this paper, we propose a location-aware clone detection protocol that can reliably identify clone attacks while minimizing their impact on the longevity of the network. To confirm sensor privacy and identify clone attacks, we utilize sensor location data and randomly select witness nodes in a ring area. Traffic load is spread out across the network, increasing network lifetime, and the ring structure allows for energy-efficient data forwarding along the path to the witnesses and the sink. Analyses and simulations show that the proposed protocol can nearly achieve a perfect clone detection probability with reliable witnesses. We further extend the work by investigating the performance of clone detection with untrustworthy witnesses, and we find that even when 10% of witnesses are compromised, the clone detection probability is still close to 98%. Moreover, in comparison to the current method, our proposed protocol can greatly increase the network's lifetime.

**2. Sustainability, dependability, and safety in the next generation of M2M communications are the focus of Section 2.2 GRS.**

**R. Lu, X. Li, X. Liang, X. Shen, and X. Lin are the authors.**

Communication between machines is characterized by a large number of autonomous machines exchanging data and reaching collective conclusions without the involvement of a human hand. M2M communications have become a game-changer for many real-time monitoring applications like remote e-healthcare, smart homes, environmental monitoring, and industrial automation because of their potential to

support a large number of ubiquitous characteristics and achieve better cost efficiency. Nonetheless, the success of M2M communications depends on overcoming the current obstacles of green energy consumption, unreliable connections, and insecure data (GRS). No serious adoption of M2M communications as a promising communication paradigm can occur without GRS guarantees. This article's goal is to promote an energy-efficient, reliable, and secure M2M communications environment by examining the emerging field from the perspective of potential GRS issues. To be more precise, we first formally define GRS requirements by incorporating three domains into the M2M communications architecture: the M2M domain, the network domain, and the application domain. We then investigate activity scheduling, redundancy utilization, and cooperative security mechanisms as several GRS enabling techniques. These methods show potential for speeding up the creation and rollout of M2M communications software.

**3 A review of wireless sensor networks**

**W. Su, Y. Sankarasubramaniam, E. Cayirci, and I. F. Akyildiz are the authors.**

Applications such as remote environmental monitoring and target tracking are crucial uses for a wireless sensor network (WSN). This has been made possible by the development in recent years of increasingly affordable miniaturized and computationally capable sensors. These sensors can form a network by talking to one another through their built-in wireless interfaces. Environment, application design goals, cost, hardware, and system constraints are just some of the factors that must be taken into account when planning a WSN's architecture.

We divide the issues into three groups:

- (1) The core infrastructure and OS,
- (2) The communication protocol stack, and
- (3) The network infrastructure and its deployment

And maintenance. We summarise the most significant progress made in these three areas and describe forthcoming difficulties.

#### **4. Cost-function-based energy-aware routing algorithms for wireless sensor networks: design principles and enhancements**

**PUBLISHER(S): A. Liu, J. Ren, X. Li, Z. Chen, and X. Shen**

To increase the network's efficiency with energy and to lengthen its lifespan, cost-function-based problem's complexity means that the current approaches all have their drawbacks. This paper examines the fundamentals, design principles, and evaluation techniques of cost-function-based routing algorithms. This paper proposes two cost-based routing algorithms that are also energy-aware: the Exponential and Sine Cost Function based Route (CFR) and the Double Cost Function based Route (DCFR). ESCFR's cost function can translate incremental shifts in nodal remaining energy to sizable shifts in overall function value. DCFR's cost function considers both the total energy used and the amount of energy left in each node, leading to a more efficient and equitable distribution of power. Analysis of the effectiveness of the cost function architecture is performed. Extensive simulations show the proposed algorithms outperform their rivals by a wide margin.

#### **5 Using dispersed random paths for secure data collection in wireless sensor networks**

**T. Shu, M. Krunz, and S. Liu are the authors.**

Key attacks in wireless sensor networks include compromised nodes and denial of service (WSNs). In this paper, we explore data delivery mechanisms that have a good chance of avoiding the black holes created by these attacks.

As a result of their deterministic nature, multipath routing approaches are susceptible to such attacks. Therefore, all data transmitted over these routes are open to attack once the adversary obtains the routing algorithm and can compute the same routes as the

source. In this paper, we create a system to generate multipath routes at random. When implemented, our plans call for different packet "shares" to take different paths at different times. Therefore, the adversary cannot determine the paths taken by each packet even if the routing algorithm is compromised. The routes generated are not only completely random but also highly dispersed and energy efficient, making them more than capable of avoiding black holes. We perform an analytical study on the safety and efficiency of the proposed schemes. In addition, we formulate an optimization problem to reduce overall power usage while maintaining specified levels of safety. In-depth simulations are run to ensure the accuracy of our mechanisms.

### **III. SYSTEM ANALYSIS**

#### **3.1 Existing System**

A group of nodes (witnesses) is typically chosen to attest to the network's nodes' authenticity in order to facilitate efficient clone detection. During the witness selection phase, the source node's identity and location are revealed to the witnesses. If a network node fails a certification check, the witnesses will report an attack. For clone detection to be successful, two criteria should be met in the selection and verification of witnesses:

- 1) It's necessary to choose witnesses at random;
- 2) At least one of the witnesses can receive the verification message(s) for detecting clones.
- 3) Threatening the efficient operation of WSNs are issues such as the uneven energy consumption of protocols like Randomized Efficient and Distributed (RED) and Line-Select Multicast (LSM), and the possibility of network partition brought on by dead sensors. Threatening the efficient operation of WSNs are issues such as the uneven energy consumption of protocols like Randomized Efficient and Distributed (RED) and Line-Select Multicast (LSM), and the

possibility of network partition brought on by dead sensors.

### 3.2 THE FLAWS IN THE CURRENT SYSTEM:

- Existing infrastructure does not guarantee that at least one witness can verify sensor node identities in the event of a clone attack; our goal, therefore, is to make it hard for malicious users to eavesdrop on the communication between the current source node and its witnesses.
- These requirements are critical but challenging to meet in clone detection protocol design, as they do not guarantee a high clone detection probability (the likelihood that clone attacks will be detected).
- When designing clone detection protocols for sensor networks, it is important to consider the energy and memory efficiency of sensors as well as to establish criteria that will lead to high performance in terms of clone detection probability.
- When a sensor's battery life starts to get low, it's important to make sure that sensors across the network are using their power efficiently and cooperatively.

### 3.3 PROPOSED SYSTEM

- For WSNs, we consider energy efficiency and memory needs alongside the clone detection probability as we design a distributed clone detection protocol with a random witness selection scheme.
- Our protocol can be used in networks with many nodes, such as multi-hop WSNs, and in which sensor nodes may be compromised or cloned by attackers.
- To further our analytic model, we evaluate the data buffer needs of the ERCD protocol and supplement our theoretical analysis with experimental results. The Powerful Method for Identifying Clone Rings.

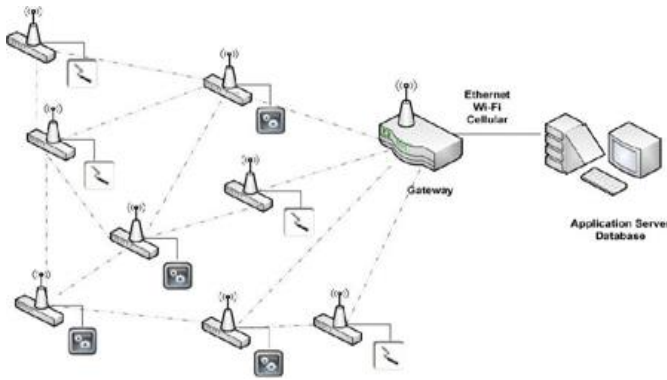
- We find that the ERCD protocol can balance the energy consumption of sensors in different locations by spreading the witnesses across WSNs, with the exception of the non-witness rings, i.e. the adjacent rings around the sink, which should not have witnesses.
- Then, we use the energy budget to find the sweet spot for the number of rings that don't count as witnesses.
- Finally, we demonstrate the scalability of our proposed protocol by demonstrating that the required buffer size depends only on the size of the ring, an expression we derive using the ERCD protocol.

### 3.4 BENEFITS OF THE INTENDED SYSTEM:

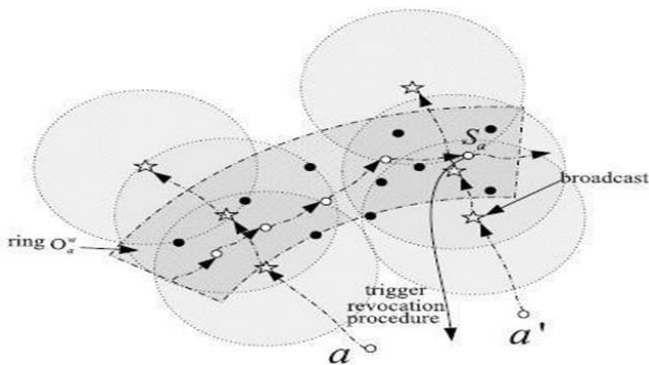
- The efficiency of the ERCD protocol is evaluated by examining its ability to detect clones, energy consumption, network lifetime, and buffer capacity.
- Our proposed ERCD protocol outperforms state-of-the-art solutions in terms of clone detection probability and network lifetime while keeping data throughput under control, as shown by extensive simulation results. This study demonstrates that even with unreliable witnesses, the probability of detecting a clone can approach 100%.
- The ERCD protocol reduces traffic of witness selection and legitimacy verification for sensors close to the sink, which helps to even out the energy consumption of data collection.

## IV. SYSTEM DESIGN

### 4.1 SYSTEM ARCHITECTURE



**BLOCK DIAGRAM**



**MODULES**

- Module for System Construction
- Protocol for Early Reproductive and Child Determination
- Clone Detection Likelihood
- Concerns about longevity and energy use in networks
- Module for Building Systems
- To test and implement our proposed system, we create the "System Construction Module" in the first phase of development. We take into account a network environment with a single base station (BS) and a huge number of wireless sensor nodes.
- The sink node acts as the coordinator's starting point. The network area is virtually divided into contiguous rings based on the location of the BS, with the width of each ring equal to the range of transmission of sensor nodes. The network is a densely deployed WSN in the sense that there are sensor nodes in each of the rings adjacent to each node, and ii) there are sufficient sensor nodes in each ring to build a routing path along the ring.

- The network model can be easily extended to accommodate scenarios with more than one BS, each of which would communicate with its corresponding sensor nodes using orthogonal frequency-division multiple-access (OFDMA). Each sensor needs to be able to collect data and identify duplicates. Every time a sensor completes a data cycle, it sends its findings to the "sink node" via a series of intermediate nodes.
- To allow any node to be chosen as a witness, the buffer space must be large enough to store the secret data of all source nodes. As new data arrives at the sensor node, the oldest data will be discarded until space is available in the buffer.

**The ERCD Protocol**

- In this section, we present our ERCD protocol, a distributed clone detection method that requires few buffers and has a low impact on the lifetime of the network.
- There are two phases to the ERCD protocol: choosing witnesses and checking their credentials. Each source node uses a random mapping function to choose its witnesses at random during the witness selection process. During legitimacy verification, the source node sends out a verification request to its witnesses that includes the source node's sensitive data. Once witnesses have received the verification messages, they will forward them to the witness header for legitimacy verification. The witness header is the node responsible for determining whether or not the source node is legitimate by comparing the collected messages from all witnesses. The witness header will notify the sink of a clone attack and initiate a revocation process if the received messages do not match the existing record or have expired.

**Clone Detection Probability**

- In this lesson, we'll look at how to design a distributed clone detection protocol with random witness selection by balancing the likelihood of finding a clone, the expected lifespan of the network, and the capacity

of any data buffers. At first, only a handful of nodes are taken over by bad actors. Using the clone detection protocol, we seek to maximize the clone detection probability or the likelihood that a cloned node will be discovered; simultaneously, sufficient energy and buffer storage capacity for data collection and operating the clone detection protocol should be guaranteed, which means that the network lifetime, or the time from when the network is first activated until the first outage occurs, should not be irrationally short.

- The clone detection probability in a randomly selected set of witnesses for a distributed clone detection protocol is dependent on the likelihood that those witnesses will actually receive the verification message from the source node. Therefore, ERCD's clone detection probability protocol refers to the likelihood that the verification message will be delivered successfully from the source node to its witnesses.

- In order to ensure the safety of the network, the ERCD protocol broadcasts the verification message whenever it is in close proximity to the witness ring.

#### Power Use and Longevity of a Network

- Since wireless sensor nodes in WSNs are typically powered by batteries, it is crucial to assess the energy requirements of sensor nodes and guarantee that normal network operations will not be disrupted in the event of a node failure. For the purpose of measuring the efficacy of the ERCD protocol, we define the network lifetime as the time span between the first moment of network operation and the occurrence of any node outage.

- With reception accounting for such a small share of overall power usage, we focus solely on transmission power consumption. Due to the ring-based nature of the generation of witness sets in our ERCD protocol, sensor nodes within the same ring perform similar functions. The analysis is simplified by assuming that all sensor nodes within the same ring experience the same volume of traffic.

- Our work here is generic in that it can be applied to a wide range of energy models, and this is one of its main selling points. Nodes in rings with indices less than or equal to  $k$  are considered to be inside the ring, while nodes in rings with indices greater than or equal to  $k$  are considered to be outside the ring. In order to calculate energy consumption and network lifetime, we first examine the traffic load of each sensor node. Using the ERCD protocol, the typical data collection, witness selection, and authenticity verification tasks are distributed evenly across all sensor nodes.

## IV. CONCLUSION

In this paper, we propose a distributed, low-energy protocol for detecting clones by randomly selecting witnesses. We have proposed the ERCD protocol, which involves the steps of selecting witnesses and verifying their credibility. Since each sensor node's witnesses are dispersed in a ring structure, detecting a clone attack is straightforward via verification message, as shown by our theoretical analysis and simulation results. In addition, with a sufficient amount of data buffer, our protocol can extend the life of the network and reduce the total amount of energy used. This is because we make use of the location data to disperse the traffic load across WSNs, relieving the burden on the sensor nodes near the sink node's energy consumption and memory storage while simultaneously increasing the network's lifespan. As we move forward, we plan to take into account a wide range of mobility trends across numerous network configurations.

## V. FUTURE WORK

In the future, we will take into account varied mobility patterns across a range of network conditions in our upcoming work. The ability to encrypt packets as they are being transferred to the destination can also be

added, enhancing security and reducing the risk of internal attacks brought on by network sensor nodes.

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# Quality Evaluation of Image Mosaicing for Aerial Photographs Based on Statistical Measures

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## ABSTRACT

Aerial and space images of a scene are usually of a large size, and therefore you need image mosaic techniques (algorithms) to form a larger (resulting) image of the same scene and create three-dimensional images such as: data from satellites, computer vision, medical imaging, and automatic target recognition. This needs to link or assemble two images or multiple images that are effective and rich in information, and to perform the process or process the image mosaic, it requires a number of algorithms, each of which has its own way of combining images, and its advantages. This corner produces a mosaic image. This paper discusses and evaluates the quality of mosaic images captured for aerial views.

**Keywords :** Satellite and Aerial images, Image Mosaic, Digital Image Quality, Statistical Processes, Image Enhancement.

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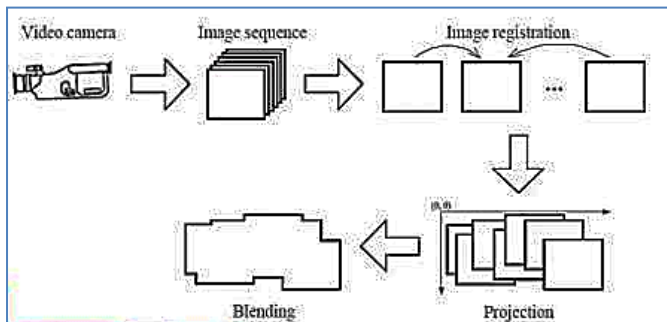
## I. INTRODUCTION

Image mosaic technology is most widely used in the fields of image processing, multimedia, vision and computer graphics. As well as It is frequently used in daily life to represent the complete with the highest clarity by connecting expansive pictures (panoramic). It may be used, for instance, to create virtual settings for video games, travel virtually on the Internet, and edit private images [1]. In Image Mosaicing, it is first broken into rectangular pieces (often of equal size), and then another image that closely resembles the target image is added in each section's place. Individual pixels seem as a raw picture when seen at low magnification, but closer inspection reveals that the image is really composed of hundreds or thousands of smaller images [2].

Two or more photos are taken, and then these pictures are stitched together to make one big picture. The final mosaic picture is this merged single image. Feature extraction is done as the initial stage in image mosaicing. Both of the input photos' features are found during feature extraction. The geometric alignment of a collection of photographs is referred to as image registration [3]. Two or more digital photographs from the same scene obtained by various sensors at various times or from other angles may be included in multiple data sets. Geometric correspondences between pictures are built in image logging so that they may be manipulated, contrasted, and evaluated in a single frame of reference [4]. In several fields, including remote sensing, computer vision, and medical imaging, this is practically significant. The following categories can be used to broadly classify recording techniques: Algorithms that directly utilize picture pixel values,

such correlation methods, and algorithms that employ frequency domain, like Fast Fourier Transform-based techniques (FFT). Algorithms that employ high-level characteristics like distinct portions of picture objects and connections between image features, for example, graph theoretical approaches, as well as algorithms that use low-level features like edges and corners, for example, feature-based methods [5]. After registration, the next phase is picture distortion, which involves fixing deformed images and may also be creatively exploited. Using registry modifications, images are placed correctly on the wider canvas to acquire the output mosaic image. The distributed image quality and time efficiency of the algorithm used is given utmost importance in image mosaic.

Different processes involved in obtaining a mosaiced image are: Image registration Image wrapping Image compositing. Figure (1) shows the main steps of image mosaic [6].



**Figure (1) main steps of image mosaic**

Image Mosaicing are two main algorithms [7]:

- 1) Direct method (Bi-directional Scanning).
- 2) Feature based method (Unidirectional Scanning).

## 2. Aerial and Satellite Images

It is one of the types of remote sensing science or remote sensing that searches for means of obtaining information and making measurements of symptoms and phenomena without touching or accessing them. Cloudless, and for a specific period of time after sunrise or two hours before sunset, and aerial photography has

developed a lot nowadays, as satellites ranging from information processing programs to cosmic sensors work with several successful contributions in many space projects, most notably the re-launch of the capsule The MERCA space agency of the German Space Agency, the development of the eastern observation satellite known as (CHAMP), and the launch of the famous American project (Grace), which aims to study the gravitational field of the Earth, as well as the manufacture of space probes to monitor and determine the locations of the rotation of satellites launched by international agencies for various purposes [8].

As for satellite images, they are called satellite imagery as the images taken by satellites of the Earth or of other planets, and these images are one of the data related to remote sensing technology, which aims to observe and study the Earth and its dynamics from space. Satellite images are captured by satellites in black and white, but through the processing of satellite images using a computer, the image can be displayed in three color bands; They are: red, green, and blue, and when the three bands are combined simultaneously, a composite and color space image is obtained. Characteristics of satellite images Satellite images are distinguished by a number of characteristics, including the following: High resolution. Stereoscopic mapping is possible due to its reliance on the technology of double binoculars for a single image. Provide valuable information about the Earth's surface. The possibility of capturing them at any time, whether day or night. Automatic processing of satellite images: The automatic processing of satellite images is based on the use of a computer to interpret these images by applying a series of mathematical algorithms to them. The most important of these processors is Enhancement meant to improve the spectral, radiometric, and optical properties of the image. Enhancement operations include a wide range of tools [9].

When interpreting aerial and space images, some conditions must be met in the aerial image interpreter



so that he can complete the process of visual interpretation of images efficiently and accurately.

What are these conditions? These conditions are:

To have a good scientific background on aerial photography techniques, for example and as mentioned above that the colors of the infrared aerial photographs are completely different from the colors of the normal aerial photographs (whether colored or black and white) as shown in the attached figures on the blackboard.

To have a scientific background and a good understanding of the basics of earth sciences, such as agriculture (types of crops), soil (types of soil) and geology (types of rocks) [10].

- To have good training in the use of appropriate devices such as a stethoscope, which helps him in the process of interpreting images.

- To have good information about the depicted area through the topographic and geological maps of this area.

### 3. Image Quality

Evaluating the perceived quality of image distortion is a challenging work in image processing. Reliable image quality evaluation criteria can be used to monitor service conditions from network video, assign bit rate parameters in compression algorithms, image acquisition process calibrations, and processing systems. The most accurate assessment of image quality is reading by the human eye. However, the self-assessment method is not able to carry out extensive operations due to the expensive operation of the budget [11].

This term refers to the degree of clarity of seeing the image, and it can be expressed by the analytics of the image or the ability to analyze it, which can be defined as the ability of the optical system to separate and distinguish converging objects, or it is the amount of the smallest angular separation between two objects, as each remains separate from the other in the optical system and can be The image quality is defined as the

amount of sharpness and contrast in the details of the image, and there are several factors that affect the quality of the image [12].

Measuring digital image quality is important for many image processing applications.

At the same time, the traditional signal error statistics, such as PSNR, MSE, etc., the evaluation results of PSNR and MSE are not very good at matching the subjective feelings of the human eye. Therefore, in order to further promote the development of image processing technology, it is necessary to study the method for assessing the quality of image perception based on the visual perception of the human eye. The Human Visual System (HVS) envisioned properties used in the traditional electronic evaluation model in the field of image quality evaluation, explores the design of local distortion measurements and distortion properties in geometric frameworks, and proposes a new algorithm for engineering evaluation based on content information [13].

### 4. Image Quality Statistical Measures [14, 15]

#### - Signal –to-Noise Ratio (SNR)

It is defined as a measure of the relative power of the desired and unwanted portion of the signal or signal noise. The SNR in Signal Processing is usually expressed in decibel (dB) as the ratio of Signal Power to Noise Power. It is expressed by the following equation:

$$SNR = 10 * \log_{10} \frac{\sum_{i=1}^M \sum_{j=1}^N [x(i,j)]^2}{\sum_{i=1}^M \sum_{j=1}^N [x(i,j) - y(i,j)]^2} \dots (1)$$

#### - Mean Squared Error (MSE)

The simplest measure of digital image quality, defined as a statistical measure that compares one pixel to another on the basis of the Luminance pattern between the original image and the enhanced image. The image is about Poor Quality. It is calculated from the following equation:

$$MSE = \frac{1}{MN} \sum_{i=1}^N \sum_{j=1}^M [x(i, j) - y(i, j)]^2 \dots (2)$$

Where  $x(i,j)$  represents the original (reference) image element in position.  $y(i,j)$  represents the optimized image element whose MSE is to be calculated)) in position (( $i,j$ . and  $M, N$ : the number of elements for which the square error rate is to be calculated. Or represent the size of the image as a whole or the size of a part of the image.

**- Peak Signal –to- Noise Ratio (PSNR)**

It is a statistical measure that represents the ratio between the maximum possible power of the signal and the power of distorted noise entered by pressure, meaning that it measures the accuracy of the image. (PSNR) is measured in (decibel) unit and is symbolized by the symbol ((dB), as the ideal values for it range between (30-50dB) and the largest value of (PSNR) indicates that the image has Better Quality. PSNR is calculated from the following equation:

$$PSNR = 10 * \log \left( \frac{(L-1)^2}{MSE} \right) \dots (3)$$

$L$  is the number of gray levels and ranges between (255-0).

**- Normalized Cross – Correlation (NK)**

is calculated by:

$$NK = \frac{\sum_{i=1}^M \sum_{j=1}^N [x(i,j) - \bar{x}] [y(i,j) - \bar{y}]}{\sqrt{\sum_{i=1}^M \sum_{j=1}^N [x(i,j) - \bar{x}]^2 \sum_{i=1}^M \sum_{j=1}^N [y(i,j) - \bar{y}]^2}} \dots (4)$$

**- Visual Signal-to-Noise Ratio (VSNR):** An effective measure for measuring or determining the optical resolution of natural images based on the near-threshold and supra-threshold properties of human vision. VSNR values range from ( $\infty$ -0). VSNR is calculated by:

$$VSNR = 10 * \log_{10} \left[ \frac{C^2(x)}{VD^2} \right] \dots (5)$$

**- Feature Similarity Index By Using Riesz Transforms (RFSIM)**

$M(x,y)$ : represents the property mask at the location ( $i,j$ ).  $c$ : Constant This scale is based on Novel Feature based on Image Quality Assessment (IQA) model is Riesz Transforms based on Similarity characteristic scale which suggested on the grounds that the human vision system (HVS) perceives the image mainly according to

its low level characteristics. The (RFSIM) is calculated by:

$$RFSIM = \prod_{i=1}^5 \frac{\sum \sum \frac{2x(i,j).y(i,j)+c}{x^2(i,j)+y^2(i,j)+c} .M(x,y)}{\sum \sum M(x,y)} \dots (6)$$

$M(x,y)$ : represents the property mask at the location ( $i,j$ ).  $c$  : is a constant whose value is small.

**- Universal Quality Index (UQI):** This scale differs from the traditional measures for calculating the image error rate, as Wang and Bovik found that the processed image model is a combination of three factors: correlation loss, lighting distortion, and contrast distortion. This scale is defined according to the following equation:

$$UQI = \frac{4\bar{x}\bar{y}\sigma_{xy}}{(\bar{x}^2+\bar{y}^2)(\sigma_x^2+\sigma_y^2)} \dots (7)$$

$\bar{x}$  ,  $\bar{y}$  : It represents the rate of the original and processed image, respectively, which is the standard deviation of the original and processed image, respectively, and represents the variance.

**- Average Difference (AD):** Represents the rate of difference between the original image and the enhanced image. It is defined according to the following equation:

$$AD = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N [(x(i,j) - y(i,j))] \dots (8)$$

The largest value of the index of difference (AD) indicates that the image has poor quality.

**- The Structural Similarity Index (SSIM):** The MSE and PSNR are the most common scales in full reference image quality, but large difference errors in these scales do not always lead to large compositional distortions. Zhou Wang and Alan Bovik suggested a complete reference for assessing image quality using SSIM, and based on error difference, to overcome this problem in measurements. The SSIM scale is based on the assessment of three different scales: luminance, contrast, and structure. SSIM can be expressed by the equation:

$$SSIM(x,y) = l(x,y).c(x,y).s(x,y) \dots (9)$$

**- Feature Similarity Index (FSIM):** This scale is based on the theory that the Human Vision System (HVS) interprets an image based on low-level features such as edges. The FSIM scale uses the Fourier transform

property of the original and enhanced image to evaluate the quality. The FSIM scale is calculated to evaluate the quality of the enhanced image relative to the original image using two features (Phase Congruency (PC) and Gradient Magnitude (GM). FSIM is calculated from the following equation:

$$FSIM = \frac{\sum_{i=1}^M \sum_{j=1}^N (Similarity Image)}{\sum_{i=1}^M \sum_{j=1}^N (PC_m)} \dots (10)$$

- **Visual Information Fidelity (VIF<sub>p</sub>):** Optical quality measurement is of fundamental importance in many image and video processing applications, so this metric was proposed to measure the accuracy of image information, which determines the amount of information in the original image and also determines the amount of reference information that can be extracted from the distorted image. It is calculated as follows:

$$VIF_p = \frac{\sum_{j \in \text{subbands}} I(\bar{C}^{N,j}; \bar{F}^{N,j} | \bar{S}^{N,j})}{\sum_{j \in \text{subbands}} I(\bar{C}^{N,j}; \bar{E}^{N,j} | \bar{S}^{N,j})} \dots (11)$$

**5. Evaluation methodology**

The rating for the resulting mosaic images is usually obtained by stats results for the final images. This requires the adoption of statistics metrics, such as error


statistics. However, this approach has at least four major drawbacks:

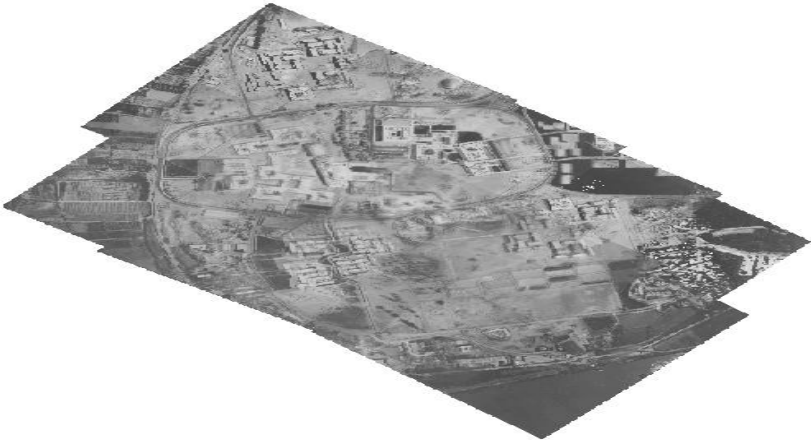



- To the best of the researcher's knowledge, it is not possible to compare the different studies if the same set of control points are not identified.
- It is not possible to study the results (the resulting mosaic image) depending only on the output, but the work steps must be available to calculate the error. The value of the error statistic may be high even if the output of the good is due to the noise values.

Instead, the proposed quantitative evaluation methodology is based on calculating the error statistics obtained by comparing the mosaic generated by the algorithm under evaluation on a reference data set (that is, a series of images that are grouped together (with the corresponding truth mosaic). by compiling the reference images with the precision of the data set). To our knowledge, there is no work that suggests a quantitative evaluation methodology for mosaic algorithms based on comparison with baseline fact information.

The practical side includes mosaic images used in the study as shown in Table (1) and according to previous studies from which aerial images were obtained.

**Table (1) :**includes mosaic images used in the study

Ref. #	Aerial Image Mosaicing
16	

17	
18	
19	
20	

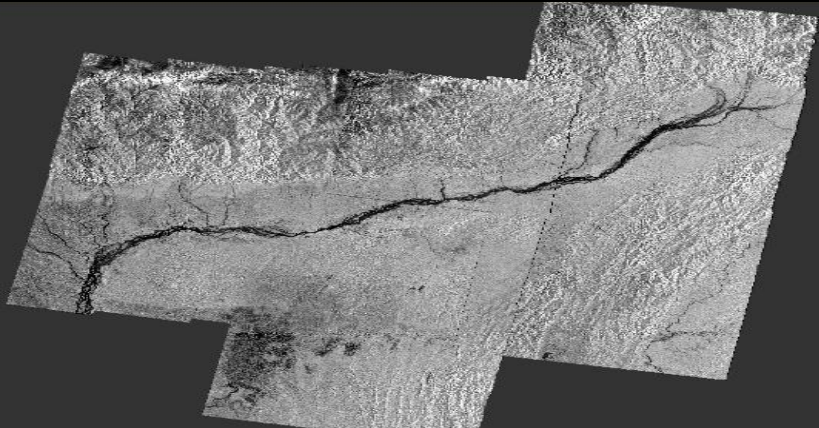
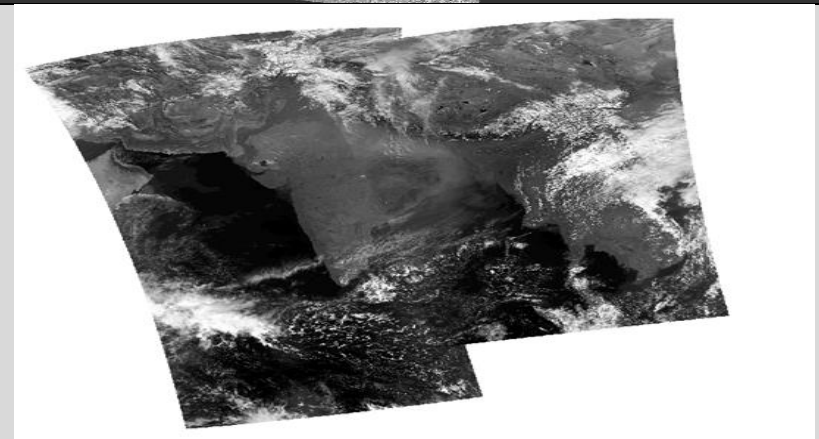
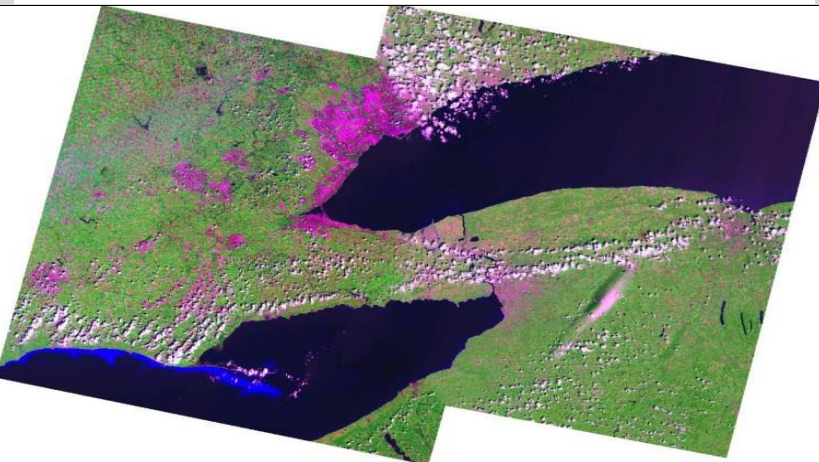

21	
22	
23	
24	



Figure 2 shows the scheme of the proposed algorithm in the study. Figure 3 shows the Remove background of images in table (1). Figure 4 shows the Remove background uniformity

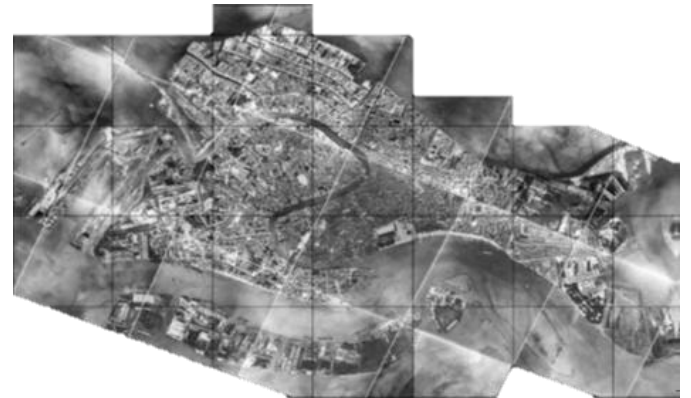
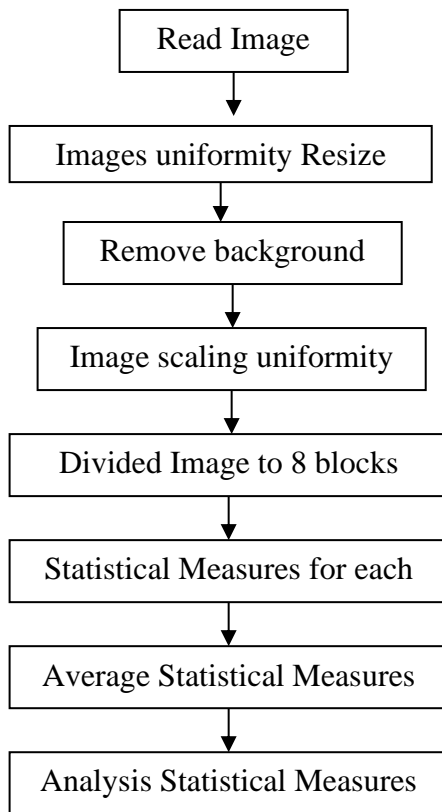


Figure 2. The scheme of the proposed algorithm in the study

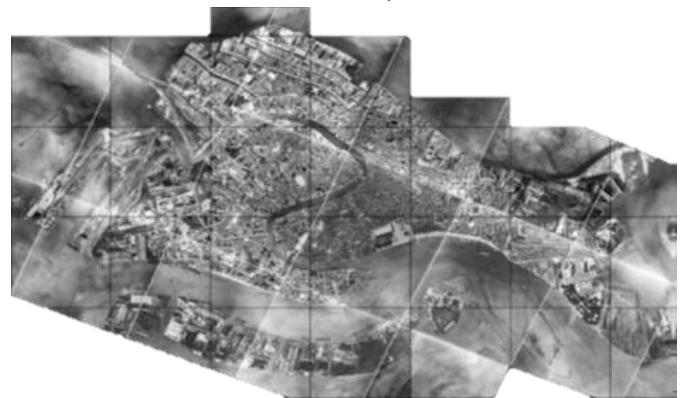


Figure 3. The Remove background of images



Figure 4. Divided each Image to 8 blocks

## The Results

Table (2) shows the results of The Statistical Measures (S.M.) for the mosaic images in Table (1), if each image includes 8 blocks.

**Table (2)** The Statistical Measures (S.M.) for the mosaic Images in table 1 (sample Blocks#1)

S.M.	#mosaic images (table 1)									
	1	2	3	4	5	6	7	8	9	10
SNR	13.58	14.55	13.58	16.71	13.58	12.88	16.94	16.66	15.29	14.85
MSE	36.43	33.44	36.43	37.51	39.33	38.33	33.78	36.97	35.44	35.90
PSNR	18.35	17.55	18.55	16.41	19.34	18.41	18.55	14.71	15.21	15.44
RMSE	34.22	35.13	34.90	32.01	31.40	37.21	36.26	30.10	37.81	36.94
NK	0.752	0.774	0.787	0.751	0.752	0.842	0.771	0.752	0.736	0.794
VSNR	14.15	15.32	14.15	13.74	16.21	14.39	14.90	14.78	13.98	14.34
RFSIM	0.549	0.612	0.743	0.746	0.549	0.549	0.549	0.549	0.549	0.549
UQI	0.934	0.964	0.904	0.931	0.911	0.847	0.944	0.964	0.914	0.864
AD	30.21	29.25	30.73	32.11	34.44	31.00	31.94	34.37	36.31	29.41
SSIM	0.915	0.917	0.911	0.915	0.974	0.961	0.973	0.943	0.930	0.914
FSIM	0.932	0.947	0.937	0.972	0.902	0.941	0.894	0.887	0.901	0.941
VIFp	0.847	0.883	0.843	0.796	0.863	0.901	0.876	0.873	0.902	0.912

## II. CONCLUSION

The Statistical Measures values calculated in Table (2), as well as for the rest of the blocks of image, indicate that the statistics values indicate the quality of the image collection process (Image Mosaic) in the studies presented in Table (1). Average values range of SNR, PSNR, and VSNR are 14.12, 17.24 and 14.34 respectively. Average values range of NK, RFSIM, UQI, SSIM, FSIM, and VIFp are 0.901, 0.911 0.899, 0.940, 0.913 and 0.932 respectively

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## Smart Helmet Based on Internet of Things to Ensure the Safety of Mining Workers

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### ABSTRACT

The mining industry now has access to a protective cap that uses artificial intelligence to warn workers when danger is present. We have taken into account air quality, head protector evacuation, and crash hazards in the development of protective caps (excavators are struck by a question). The concentration of potentially harmful gases such as carbon monoxide, sulfur dioxide, nitrogen oxide, and particles is the first problem. An excavator was used to check for fires in the mines, which led to the second dangerous occurrence. The fire was then effectively investigated with the help of a fire sensor. The third precarious occurrence is when excavators are hit by a protest against the head with power exceeding a 1000 HIC estimation (Head Injury Criteria).

**Keywords :** IoT (Internet of Things) module, Arduino UNO

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## I. INTRODUCTION

In these days solid affiliation business centers, the affiliations face creating necessities to additionally foster way efficiencies, investigate ordinary recommendation, and meet corporate monetary targets. Given the making period of different present-day frameworks and the extraordinary business-producing business center, reasonable and unimportant expense business robotization structures are depended upon to work on the capability and execution of such structures[2], [3]. all around, business computerization structures are perceived through spurring out exchanges. in any case, the wired computerization structures require outrageous verbal trade interfaces with be mounted and much of the time remained mindful of, and in this manner, they are not

regularly done in business plants by their huge expense [4]. as such, there's a true necessity for savvy distant robotization structures that award huge cash related hold saves and reduce air-poison floods through upgrading the association of current plans. WSNs, the conviction of insignificant cost implanted business robotization structures have become practical [5]. In the one's turns of events, distant little sensor community focuses are related on endeavor gear and reveal the cutoff points basic for each gadget'sefficiency fundamentally settled on several appraisals like vibration, temperature, strain, and power quality. this information is then to some degree transported off a sink community that evaluations the information from every sensor. Any end loads are told to the plant workers as a perplexed warning framework. This awards plant staff to fix or abrogate

contraptions, sooner than their sufficiency drops or they flop. Consequently, miserable device screw-ups and the related fix and substitution expenses might be stayed away from, simultaneously as consenting to genuine natural guidelines. The accommodating considered IWSNs brings two or three benefits over customary disturbed out the business following and control structures, which unite self-affiliation, quick blueprint, flexibility, and intrinsic wily dealing with limit. In such a manner, WSN plays a basic breaking point in making an unequivocally dependable and self-recuperating present-day gadget that quickly reacts to consistent occasions with genuine activities. In any case, to comprehend the imagined current applications and, therefore, take the upsides of the support benefits of WSN, productive dispatch shows, which can manage the right disagreeable conditions presented through such frameworks, are required. The imaginative improvement inside the worldwide has during that time-shifted direction and measures to show sports associations are being made to allow let free to encounters and guide for giving clients [6]. This is a delayed consequence of the staggering name for assets reasonable in helping industrialists with achieving put forward targets and foster applications for the supporting of time transportation of materials and set out a chance for expanded data [7]. The significance of introducing a pleasantly unprecedented model wi-fi Sensor social class (WSN) in business take a stab at programming can't be over-featured; as needs are, this experience tends to the great master in intersection the distance among the accessibility of OK after information offering all due appreciation to cultivate the current turns of events and the standard methodology for endeavors. WSN is a progression wherein basically confined focuses help each other in sending loads of information through the local vehicle to the spot for moving unendingly. The WSN joins focuses that can send and get messages in a cross fragment plan and a middle that can fill in as a switch and can also hand-off messages for its neighbour. through thusly, Wi-Fi group encounters will notice

their course to the predetermined occasion spot, using transitory focuses with reliable correspondence procedures. WSN programming sways from one locale to another. different fields including fire, equipped power establishments, contamination, machine success, and regular parts following fuse gifted creating insubordination inside the execution of this time in checking sports incorporate them. In many preposterous areas, clear controlling is utilized because in reality the area, at the indistinct time as new flooding-based thoroughly time, offers the open door and advantages, especially in gigantic affiliations.

## II. LITERATURE REVIEW

In 2017, Nike Patil and Brijesh Iyer proposed wearables that would monitor soldiers' fitness and location using the Internet of Things. Since Arduino is connection focused (it has a USB port), they have not described how the conversation is established between the client and server sides.

To track and record vital signs like a patient's temperature, heart rate, and electrocardiogram in real time, R. Shaikh et al. [2012] proposed using an ARM processor. Using wireless technologies like ZigBee and GSM, we can update doctors in real-time so they can take swift action when necessary. ZigBee-based wireless body area sensor networks (WBASNs) continuously monitor patient status and location.

To compile statistics about soldiers on the battlefield, G. Raj et al. [2014] proposed an RF-based totally module.

To ease and authenticate the information processing, V. Ashok [2016] has proposed an OTP-based system.

Integrating the wireless sensor community and cloud computing has been proposed by Jassas et al. [2015] to facilitate rapid and timely data analysis.

To monitor the whereabouts of the troops, S. Dixit and A. Joshi [2014] proposed a wholly Google Maps-based approach. But most of these systems are stymied due to factors like high costs of implementation, delays in responses, and cumbersome design.

The LM35 temperature sensor, Pulse fee sensor, and oxygen degree detector sensor proposed by S. Rajeswari and R. Kalaiselvi [2017] can be used to monitor service members' health status in real-time. Positioning and navigation in real-time via GPS. A wrist multi-sensor device for continuous monitoring of health status and alert, integrating biomedical sensors for heart rate, 1-lead ECG, blood pressure, oxygen blood saturation, and skin temperature measurement, is processed and accumulated using Arduino (ATmega328P). The use of GSM and GPS in a monitoring device can help keep teachers and parents up-to-date on a child's whereabouts via a short message service.

A variety of sensors that can be worn or carried around easily and that weigh in at a reasonable amount for their size and weight have been developed for use in tracking human physiological parameters, and their authors have discussed these developments. Health monitoring on the go is possible with the help of the many biomedical and physiological sensors included in the frame Sensor network (BSN), such as a blood pressure sensor, electrocardiogram (ECG) sensor, and electrodermal interest (EDA) sensor. In this paper, we advocate for the use of a machine capable of real-time health monitoring of soldiers, which makes use of interconnected BSNs. In their final draught, the authors included a device that could monitor the whereabouts of the infantrymen in real-time. If the infantrymen have accurate GPS coordinates, they should be able to send a distress signal to the command post. It could potentially provide real-time delivery of soldiers' sensed and processed parameters. The military can use body sensor networks to manipulate units and display fitness parameters, such as heart rate, temperature, and so on, for individual service members. Using GSM, the parameters of the troops have been transmitted wirelessly.

To ensure the safety of infantrymen, the authors proposed the use of sensors to reveal information about the soldiers' fitness status and the ammunition they were carrying. To aid in providing infantrymen health

status and location records to the control unit, a GPS module has been used for location monitoring and an RF module has been used for high-speed, short-range data transmission, allowing for wireless communications between soldiers.

The authors analyzed how especially ill patients were treated. The focus of this paper is on keeping track of patients' health after they have been released from a hospital or clinic located far away. From the comfort of their offices, doctors can now remotely monitor vital signs like temperature, heart rate, and electrocardiogram (ECG) from their patients. The ZigBee transceiver continuously monitors the patient's vitals and sends the data about their health to a central server. A "Soldier fitness and function monitoring device" using a Barometric stress sensor, GPS, GSM, and WBASNs has been proposed (heartbeat sensor, temperature sensor). The ATmega328p microcontroller was used to create the prototype. The soldier's health status has been learned using only pure conditional statements, with no machine learning or human education involved. GSM has been used as the primary means of communication despite its obvious disadvantages in high-altitude areas, where establishing network connectivity may be a difficult task. After normal time intervals, GSM transmits a message with the soldier's health status. In their paper titled "IoT-based health monitoring via LoRaWAN," the authors propose sending data from medical sensors to an evaluation module via low-cost, low-strength, and comfortable communication via a LoRaWAN (extended variety, big location network) network. In rural areas, where cellular community coverage is both lacking and not allowing records of transmission, blood pressure, glucose, and temperature have been measured. When the LoRaWAN Gateway is installed outside at a height of 12 meters, the expected coverage area is 33 square kilometers. The power requirements of this monitoring device are said to be at least ten times lower than those of various lengthy-range cell solutions, such as GPRS/3G/4G.

### III. METHODS AND MATERIAL

#### 3.1 AIM

The goal of this project is to design a high-tech helmet that will keep miners safe.

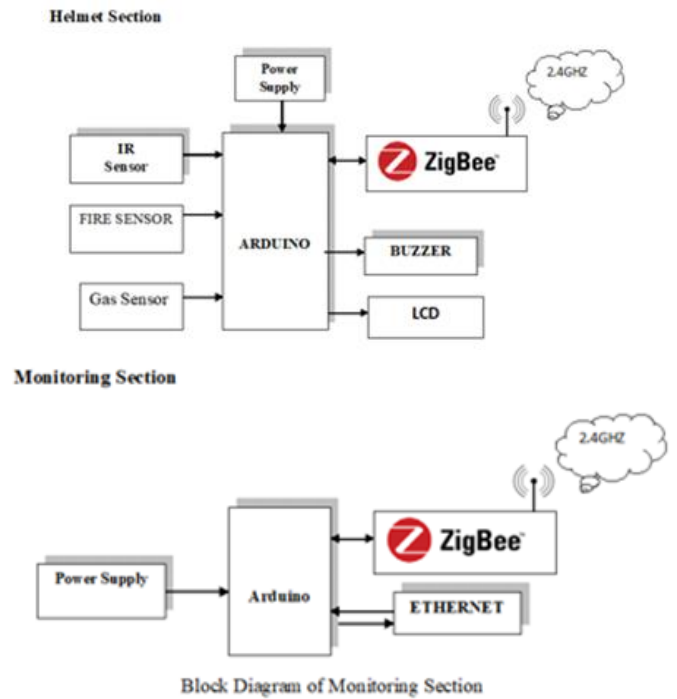
#### 3.2 Existing framework:

In the end, safety caps worn by miners only serve to protect the wearer's head from accidental blows. There is no technology built into the security protective caps that may alert other miners to a colleague's perilous situation. More recently, gathering technology has played an increasingly important role in the field of mining applications. Information regarding mine technology can be found online, albeit in a very tiny volume.

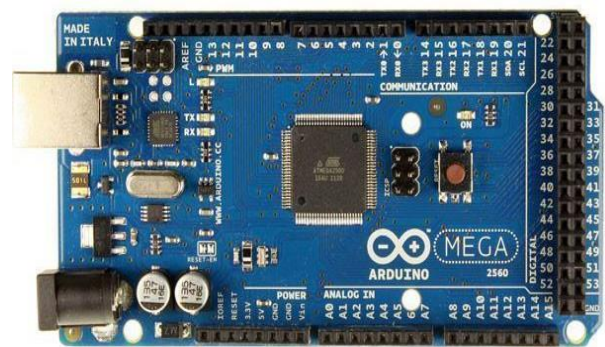
#### 3.3 Proposed framework:

To make the entire structure more understandable, it has been broken down into three sections. It is possible to detect whether or not objects have been dropped on top of the digger by using an accelerometer-based impact sensor. To tell the difference between air pollution from coal mines and other sources, scientists use sensors to measure air quality. Particulate matter and gas emissions, such as methane (CH<sub>4</sub>) and carbon monoxide, are mostly to blame (CO). The Coal Mine Fire Detection Sensor is designed to detect fires in coal mines. The data processor is a mini-controller that collects data from the device's main sensor and decides whether or not to send a signal to the device's remote location or the user's body. The information gathered by the handling unit is sent to a remote transmission and warning unit for dissemination. Ethernet is used to complete the task.

#### Block Diagram



### IV. ARDUINO



#### 1) Overview:

Arduino Uno is a microcontroller board subject to the ATmega328P (datasheet). It has 14 pushed data/yield pins (of which 6 can be used as PWM yields), 6 crucial data sources, a 16 MHz finished resonator (CSTCE16M0V53-R0), a USB affiliation, a power jack, an ICSP header, and a reset button. It contains all that normal to help the microcontroller; on a fundamental level interface it to a PC with a USB affiliation or power it with an AC-to-DC connector or battery to start. You can meddle with your Uno without anguishing significantly overachieving something incorrectly, most fundamental result

conceivable you can exchange the chip for a couple of dollars and start again.

"Uno" recommends one in Italian and was picked to stamp the presence of Arduino Software (IDE) 1.0. The Uno board and structure 1.0 of Arduino Software (IDE) were the reference types of Arduino, direct made to ceaselessly current releases. The Uno board is the first in the advancement of USB Arduino sheets and the reference model for the Arduino stage; for an expansive once-over of current, past, or old sheets see the Arduino report of sheets.

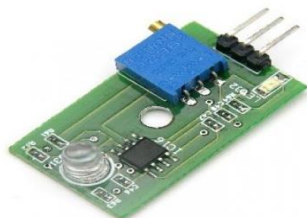
### NodeMCU

NodeMCU is an unimportant expense open-source IoT stage. It at first included firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems and stuff that depended upon the ESP-12 module. Sometime later, support for the ESP32 32-cycle MCU was added. NodeMCU joins "center" and "MCU" (small scale controller unit). The articulation "NodeMCU" thoroughly talking suggests the firmware rather than the connected progression packs.



Fig : NODEMCU Module

### FIRE SENSOR



There are several types of flame detector. The optical flame detector is a detector that uses optical sensors to detect flames. There are

also ionization flame detectors, which use current flow in the flame to detect flame presence, and thermocouple flame detectors.

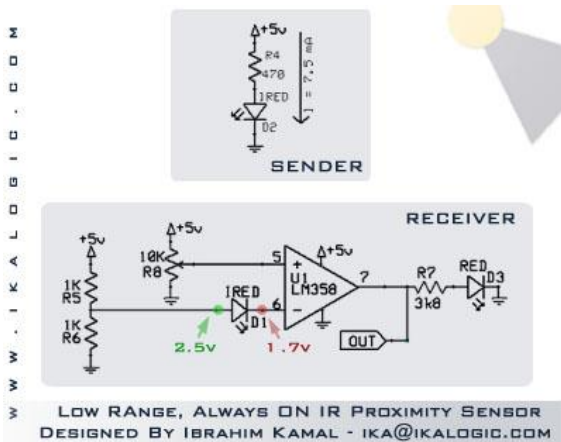
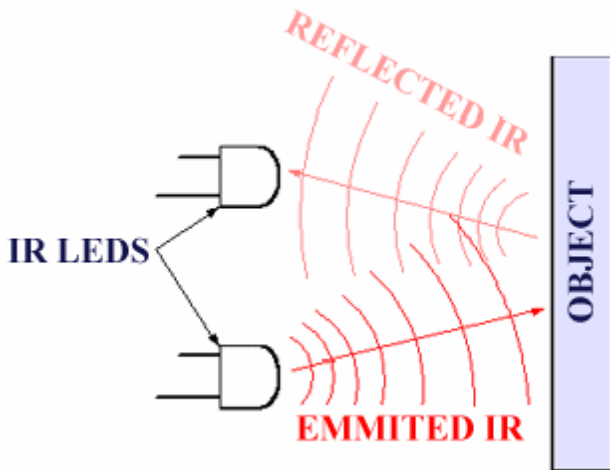
### 2) Infrared Flame Detector

Infrared (IR) flame detectors work within the infrared spectral band. Hot gases emit a specific spectral pattern in the infrared region, which can be sensed with a thermal imaging camera (TIC) a type of thermographic. False alarms can be caused by other hot surfaces and background thermal radiation in the area as well as blinding from water and solar energy. A typical frequency where single frequency IR flame detector is sensitive is in the 4.4 micrometer range. Typical response time is 3-5 seconds.

### IR SENSOR

All infrared proximity sensors operate on the same basic idea. To put it simply, IR-LEDs are used to emit infrared light, which is reflected by whatever is in the path of the sensor.

Then, the reflected IR light can be easily detected. We're going to employ a novel approach to detect the reflected IR light: an additional IR-LED will be used to pick up on the IR light originally emitted by the first IR-LED. Light Emitting Diodes (LEDs) have this electrical feature, which manifests as a potential difference across the diode's leads when illuminated. Similar to a photocell but with significantly less current output. In other words, the voltage produced by the LEDs is so low that it cannot be used to create electricity. Consequently, as you can see in the diagram, we'll be employing an Op-Amp (operational Amplifier) to precisely detect extremely low voltage fluctuations.



An infrared LED (D2) and a 470 Ohm resistor are connected in series to create the transmitter's forward current of 7.5mA. The receiver circuit is more sophisticated; R5 and R6 provide a voltage divider that supplies 2.5V to the IR LED's anode (here, this led will be used as a sensor). When infrared (IR) light shines on the LED (D1), the cathode's voltage drops, potentially as low as 1.4V or higher. An Op-Amp is able to detect this voltage drop (operational Amplifier LM358).

To get a voltage of around 1.6 volts at the Op-positive Amp's input (pin 5), you'll need to tweak the POTentiometer (R8). If you're familiar with how Op-Amps work, you'll know that when the voltage at D1's cathode falls below 1.6 volts, the output becomes High. When infrared light is detected, the receiver's output goes high.

If the voltage on the +ve input is greater than the voltage on the -ve input, the output will be High (5v, assuming the supply voltage in the schematic is 12v) (0V). If there is even a 0.0001-volt difference between the +ve and -ve inputs, the output will switch to either 0v or 5v.

## V. Zigbee Technology

When it comes to wirelessly link sensors, instruments, and control systems, ZigBee is the gold standard. It has been speculated that ZigBee, a specification for communication in a WPAN, is the "Internet of things." In theory, if both your coffee maker and toaster are ZigBee-enabled, they will be able to exchange information with one another. ZigBee is an easy-to-implement framework for establishing low-power, secure wireless networks worldwide. ZigBee and IEEE 802.15.4 are low-rate wireless networking technologies that can replace the expensive and easily-damaged cable traditionally used in industrial control systems. Equipment used to regulate flow or process can be located anywhere in a facility while still maintaining two-way communication with other nodes. And because the network doesn't mind where a sensor, pump, or valve is physically located, it can be relocated if necessary. By offering a straightforward networking layer and standardized application profiles, the ZigBee RF4CE standard paves the way for the development of multi-vendor, interoperable solutions in the realm of consumer electronics.

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Figure 1: ZigBee Applications

Low-power, low-duty-cycle, low-data-rate devices are ZigBee's intended audience. The ZigBee network example is depicted in the following figure.

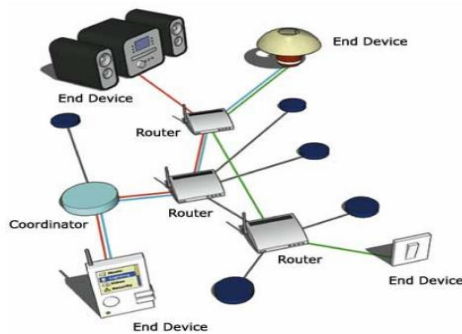


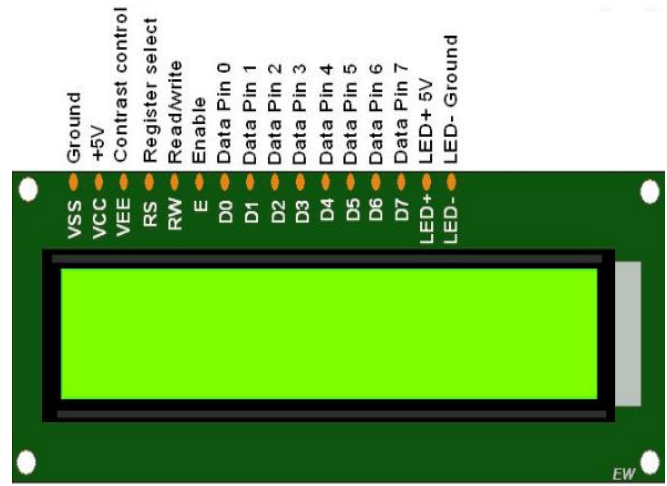
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LCD

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As LCDs have replaced progressively organized hotshot drives, LCDs have begun being removed by new introduction enhancements, for instance, OLEDs.



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The typical augmentations of the Arduino IDE utility are

1. Much less steeply-regarded
2. The clean smooth programming regular parts
3. Extensible programming program application utility and equipment

## VII. CONCLUSION

In this research project, we created a high-tech helmet to protect mining workers from potential dangers. Developing and deploying a system that can ensure the safety of construction sites and miner personnel and take corrective action as needed is essential. Both security and mining purposes can be served by the proposed strategy. As a result, the system is solid and lightweight thanks to its use of readily available uncomplicated components. An intelligent mine safety helmet prototype is created, one that can identify numerous potential dangers encountered in the mining like carbon monoxide gas buildup. The technology employs an infrared detector to alert a falling object against the top of his skull. To foster more interpersonal interaction and increase the signal's reach and intensity, it is possible to install extra antennas. To facilitate quicker sensor processing speed, data processing, and system enhancement. Modifications can be made so that the infrared detector functions inside the protective gear by avoiding conflict and considering things within.

There are ways to improve the system:

Expanding the tools used to gauge an employee's performance

Adding the pulse and blood pressure monitoring system in future enhancements.

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## Internet of Things-Based Wireless Sensor Network for Soldier Safety

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### ABSTRACT

Soldiers are a vital cog in the safety machine of any nation. Many service members are lost or injured during war and rescue operations. Because they will ultimately save us, the health and fitness of our armed forces personnel are of paramount importance. Who defends us from foreign invasion, terrorist attacks, and other threats to our safety and the security of our nation and its citizens, including many potentially dangerous sports? With this mission, we can keep tabs on our troops' whereabouts and health in real-time, which is especially helpful when they get separated or hurt in combat. It aids in reducing the army control unit's time spent searching for and rescuing people. Using an Internet of Things (IoT) module and wireless body area sensor networks (WBASNs), such as a temperature sensor, heart rate sensor, etc., this gadget connects to a military base station to monitor a soldier's location and reveal his or her health. Using a ZigBee module, sensor data can be transmitted wirelessly. Moreover, a service member can get help from the managed area and communicate with other service members in the area who have Wi-Fi transmission and reception capabilities.

**Keywords :** Arduino, IOT, Border Security System, Temperature Sensor.

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## I. INTRODUCTION

In these days solid affiliation business centers, the affiliations face creating necessities to additionally foster way efficiencies, investigate ordinary recommendation, and meet corporate monetary targets. Given the making period of different present-day frameworks and the extraordinary business-producing business center, reasonable and unimportant expense business robotization structures are depended upon to work on the capability and execution of such structures[2], [3]. all around,

business computerization structures are perceived through spurring out exchanges. in any case, the wired computerization structures require outrageous verbal trade interfaces with be mounted and much of the time remained mindful of, and in this manner, they are not regularly done in business plants by their huge expense [4]. as such, there's a true necessity for savvy distant robotization structures that award huge cash related hold saves and reduce air-poison floods through upgrading the association of current plans. WSNs, the conviction of insignificant cost implanted business robotization structures have become practical [5]. In

the one's turns of events, distant little sensor community focuses are related on endeavor gear and reveal the cutoff points basic for each gadget's efficiency fundamentally settled on several appraisals like vibration, temperature, strain, and power quality. this information is then to some degree transported off a sink community that evaluations the information from every sensor. Any end loads are told to the plant workers as a perplexed warning framework. This awards plant staff to fix or abrogate contraptions, sooner than their sufficiency drops or they flop. Consequently, miserable device screw-ups and the related fix and substitution expenses might be stayed away from, simultaneously as consenting to genuine natural guidelines. The accommodating considered IWSNs brings two or three benefits over customary disturbed out the business following and control structures, which unite self-affiliation, quick blueprint, flexibility, and intrinsic wily dealing with limit. In such a manner, WSN plays a basic breaking point in making an unequivocally dependable and self-recuperating present-day gadget that quickly reacts to consistent occasions with genuine activities. in any case, to comprehend the imagined current applications and, therefore, take the upsides of the support benefits of WSN, productive dispatch shows, which can manage the right disagreeable conditions presented through such frameworks, are required. The imaginative improvement inside the worldwide has during that time-shifted direction and measures to show sports associations are being made to allow let free to encounters and guide for giving clients [6]. this is a delayed consequence of the staggering name for assets reasonable in helping industrialists with achieving put forward targets and foster applications for the supporting of time transportation of materials and set out a chance for expanded data [7]. The significance of introducing a pleasantly unprecedented model wi-fi Sensor social class (WSN) in business take a stab at programming can't be over-featured; as needs are, this experience tends to the great master in intersection the distance among the accessibility of OK

after information offering all due appreciation to cultivate the current turns of events and the standard methodology for endeavors. WSN is a progression wherein basically confined focuses help each other in sending loads of information through the local vehicle to the spot for moving unendingly. The WSN joins focuses that can send and get messages in a cross fragment plan and a middle that can fill in as a switch and can also hand-off messages for its neighbour. through thusly, Wi-Fi group encounters will notice their course to the predetermined occasion spot, using transitory focuses with reliable correspondence procedures. WSN programming sways from one locale to another. different fields including fire, equipped power establishments, contamination, machine success, and regular parts following fuse gifted creating insubordination inside the execution of this time in checking sports incorporate them. In many preposterous areas, clear controlling is utilized because in reality the area, at the indistinct time as new flooding-based thoroughly time, offers the open door and advantages, especially in gigantic affiliations.

## II. LITERATURE REVIEW

In 2017, Nike Patil and Brijesh Iyer proposed wearables that would monitor soldiers' fitness and location using the Internet of Things. Since Arduino is connection focused (it has a USB port), they have not described how the conversation is established between the client and server sides.

To track and record vital signs like a patient's temperature, heart rate, and electrocardiogram in real time, R. Shaikh et al. [2012] proposed using an ARM processor. Using wireless technologies like ZigBee and GSM, we can update doctors in real-time so they can take swift action when necessary. ZigBee-based wireless body area sensor networks (WBASNs) continuously monitor patient status and location.

The LM35 temperature sensor, Pulse fee sensor, and oxygen degree detector sensor proposed by S. Rajeswari and R. Kalaiselvi [2017] can be used to

monitor service members' health status in real-time. Positioning and navigation in real-time via GPS. A wrist multi-sensor device for continuous monitoring of health status and alert, integrating biomedical sensors for heart rate, 1-lead ECG, blood pressure, oxygen blood saturation, and skin temperature measurement, is processed and accumulated using Arduino (ATmega328P). The use of GSM and GPS in a monitoring device can help keep teachers and parents up-to-date on a child's whereabouts via a short message service.

The ZigBee transceiver continuously monitors the patient's vitals and sends the data about their health to a central server. A "Soldier fitness and function monitoring device" using a Barometric stress sensor, GPS, GSM, and WBASNs has been proposed (heartbeat sensor, temperature sensor). The ATmega328p microcontroller was used to create the prototype. The soldier's health status has been learned using only pure conditional statements, with no machine learning or human education involved. GSM has been used as the primary means of communication despite its obvious disadvantages in high-altitude areas, where establishing network connectivity may be a difficult task. After normal time intervals, GSM transmits a message with the soldier's health status. In their paper titled "IoT-based health monitoring via LoRaWAN," the authors propose sending data from medical sensors to an evaluation module via low-cost, low-strength, and comfortable communication via a LoRaWAN (extended variety, big location network) network. In rural areas, where cellular community coverage is both lacking and not allowing records of transmission, blood pressure, glucose, and temperature have been measured. When the LoRaWAN Gateway is installed outside at a height of 12 meters, the expected coverage area is 33 square kilometers. The power requirements of this monitoring device are said to be at least ten times lower than those of various lengthy-range cell solutions, such as GPRS/3G/4G.

Prototype hardware for the authors' proposed "Soldier tracking and fitness Indication system" includes a Global Positioning System (GPS) receiver, a heart rate sensor, a temperature sensor, a vibration sensor, a bomb detector, and a PIC16F877A microcontroller. To monitor your heart rate, we'll be employing a polar heart rate transmitter and an RMC01 receiver. The piezo disc vibration sensor with a piezo-electrically powered plate is proposed in this paper. The piezoelectric film offers a lightweight, flexible, reliable, cellular, and low-cost alternative to expensive sensors. Hypothermia and Hyperthermia can be detected with the temperature sensor by using standard, everyday conditional statements. Paper sensors, also known as IED bomb detectors, are what used (Improvised Explosive gadgets) are. You can tell what kind of IED it is just by looking around you and picking up on the chemical signatures, and it can also detect the shape of the device without any additional structures. The goal of this paper is to incorporate the low-power and long-range characteristics of LoRaWAN and ZigBee. We can send and display health data and real-time location data sensed by far-flung squad members to the squad chief via ZigBee and onto the bottom station via a LoRaWAN module. Factors like cell connectivity at higher altitudes, weather and environmental conditions throughout the soldier's unit, and lengthy variable signal strength make GSM (a global device for mobile communique) and RF (Radio Frequency) unfavorable for communication skills.

### III. METHODS AND MATERIAL

#### 3.1 AIM

Primary to this mission is the development of an IoT-based system for monitoring and managing the physical well-being of the infantrymen.

#### 3.2 IMPLEMENTATION

The Arduino Uno, NodeMcu, and sophisticated domestically available regulators for commercial applications all contributed to the realization of this mission.

### 3.3 DESCRIPTION:

The military is a crucial component of any functional kingdom's security system. Soldiers sustain wounds and lose countenance in the course of battle and search and rescue missions. As such, the well-being of our armed forces is crucial, as they are the ones who defend us from foreign invasion, terrorist acts, and any number of other threats to our safety and the safety of our country. As a result of this mission, infantrymen who become disoriented or injured on the battlefield can have their status updated in real-time, and the surrounding area can be listened to and viewed in musical detail. The time and energy spent on search and rescue operations by army management units are reduced. Using an Internet of Things (IoT) module and wireless frame location sensor networks (WBASNs), such as a temperature sensor, coronary heartbeat sensor, etc., the military base station can track the location of infantrymen and reveal their health status. Utilizing a ZigBee module, records from sensors can be sent wirelessly. To top it all off, a service member within the wireless transmission and reception range can talk to other service members and even ask for help from the command center.

#### Block Diagram

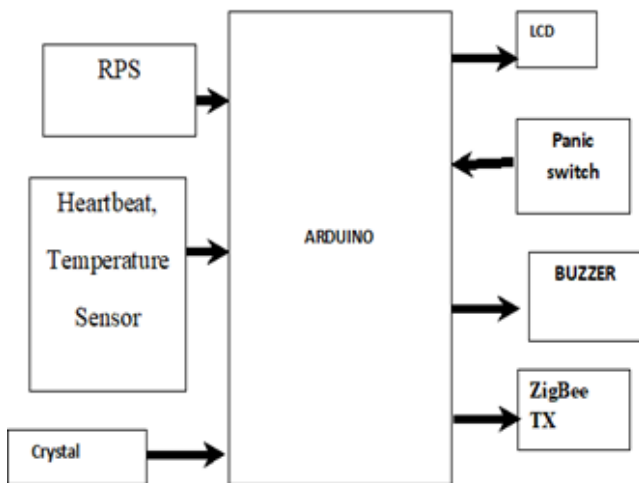


Fig 3.0. Block Diagram

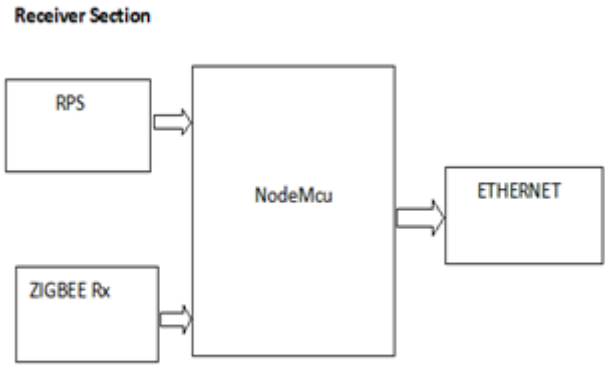
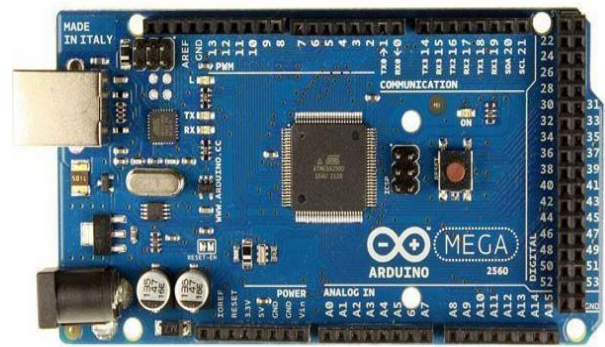


Fig 3.1. Receiving Section

## IV. ARDUINO



### Overview

Arduino Uno is a microcontroller board subject to the ATmega328P (datasheet). It has 14 pushed data/yield pins (of which 6 can be used as PWM yields), 6 crucial data sources, a 16 MHz finished resonator (CSTCE16M0V53-R0), a USB affiliation, a power jack, an ICSP header, and a reset button. It contains all that normal to help the microcontroller; on a fundamental level interface it to a PC with a USB affiliation or power it with an AC-to-DC connector or battery to start. You can meddle with your Uno without anguishing significantly overachieving something incorrectly, most fundamental result conceivable you can exchange the chip for a couple of dollars and start again.

"Uno" recommends one in Italian and was picked to stamp the presence of Arduino Software (IDE) 1.0. The Uno board and structure 1.0 of Arduino Software (IDE) were the reference types of Arduino, direct made to ceaselessly current releases. The Uno board is the first

in the advancement of USB Arduino sheets and the reference model for the Arduino stage; for an expansive once-over of current, past, or old sheets see the Arduino report of sheets.

### NodeMCU

NodeMCU is an unimportant expense open-source IoT stage. It at first included firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems and stuff that depended upon the ESP-12 module. Sometime later, support for the ESP32 32-cycle MCU was added. NodeMCU joins "center" and "MCU" (small scale controller unit). The articulation "NodeMCU" thoroughly talking suggests the firmware rather than the connected progression packs.



Fig : NODEMCU Module

### LM35 TEMPERATURE SENSOR

**LM35** is a precision IC **temperature sensor** with its output proportional to the temperature (in °C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With **LM35**, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air.

The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every °C rise/fall in ambient temperature, i.e., its scale factor is 0.01V/°C.

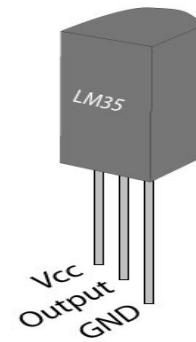


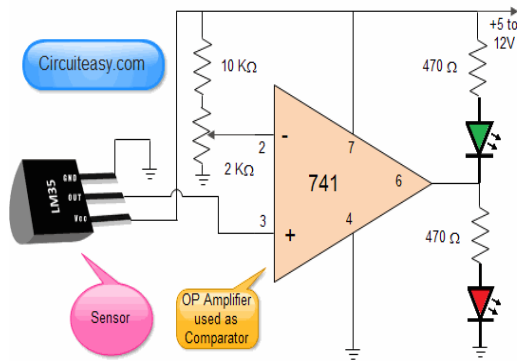
FIG: Temperature Sensor LM35

### TEMPERATURE SENSOR

This project uses IC LM35 as a sensor for detecting accurate centigrade temperature. Linearity defines how well over a range of temperature a sensor's output consistently changes. Unlike thermistor, Linearity of a precision IC Sensors are very good of 0.5°C accuracy and has wide temperature range. its output voltage is linearly proportional to the Celsius (Centigrade) temperature.

The LM35 is rated to operate over a -55° to +150°C temperature range. It draws only 60 μA from its supply, it has very low self-heating, less than 0.1°C in still air. LM35 Operates from 4 to 30 volts.

Output of IC is 10mv/degree centigrade for eg if the output of sensor is 280 mV then temperature is 28 degree C. so by using a Digital multimeter we can easily calculate the degree temperature. For trigger point you should set the voltage of pin 2 of IC 741 by using preset or potentiometer. Our aim of this project is not to construct a thermometer but to activate or deactivate a device at a particular margin temperature. For simplicity we have used 2 LED for indication of both low (Green) and high (Red) temperature.



Circuit Diagram of temperature sensor

**Working:** The output of IC2 increases in proportion to the temperature by 10 mV per degree. This varying voltage is feed to a comparator IC 741 (OP Amplifier). OP Amplifier are among the most widely used electronic devices today. The op-amp is one type of differential amplifier. It has two input inverting (-) and non-inverting (+) and one output pin. We have used IC741 as non-inverting amplifier which means pin 3 is the input and the output is not reversed. This circuit amplifies the difference between its input terminals. As a comparator, Bistable output of an op amplifier is as follows :-

$$V_{out} = \begin{cases} V_{S+} & \text{if } V_1 > V_2, \\ V_{S-} & \text{if } V_1 < V_2, \\ 0 & \text{if } V_1 = V_2, \end{cases}$$

**Part list:**

- IC LM35, IC LM741
  - Resistance: 10K Ohms, 470 Ohms X 2Pcs
  - Preset or P.O.T of 2K Ohms
  - LED 2pcs (Red and Green)
  - 9V Battery with Snap
  - Switch, wire
- \*By making this Temperature Sensor Project, student will be capable of making many similar project i.e Automatic room heater controller, determine hotness of Tea or Coffee to avoid burning your tongue, Automatic Fan Controller etc.

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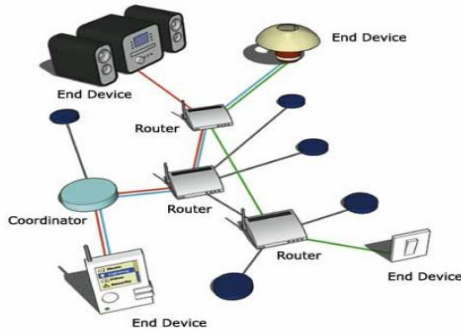


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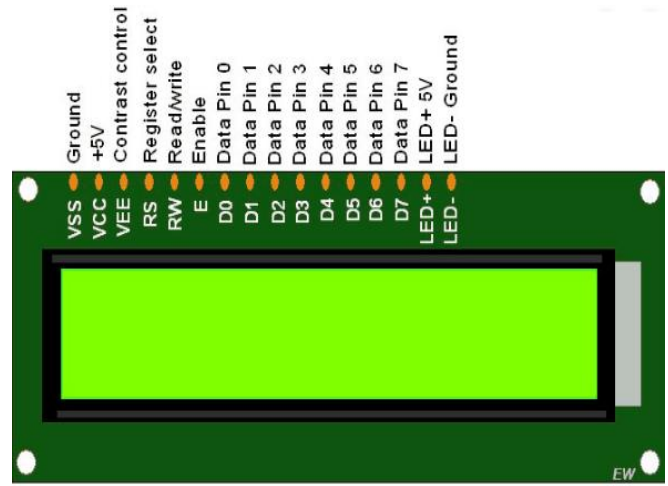
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### Introduction

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3. Extensible programming program application utility and equipment

## VII. CONCLUSION

One of the major drawbacks of military operations is that troops are unable to communicate with the control room and other authorities. Troops have a vital role to play in ensuring national safety. The situation with the soldiers is then monitored. In the same vein as its rivals, the paper details an Internet of Things-based architecture for health monitoring. Here, an Arduino board is being used. In a similar vein, biomedical sensors can report vital signs like body temperature and heart rate to the command center. This development will be helpful in providing the specific area of the missing authority in basic condition and assessing the damage to the authority's historical record. The monitoring system can also help with improving official-to-hero communication in times of crisis and providing a more direct line to the control room. It follows that the military personnel of any country in the world will benefit greatly from this design. Eventually, a more compact handheld sensor gizmo with additional perceiving decisions may be developed to aid the rivals in the game.

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**Dr. G. RAVI KUMAR, Professor**, Dept. of ECE from Shadan College of Engineering and Technology, Peerancheru, Telangana.

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## Fall Detection for Elderly People Using Machine Learning

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<sup>2</sup> Professor, Department of Computer Science Engineering, Shadan Women's College of Engineering & Technology, Hyderabad, Telangana, India

### ABSTRACT

The state of one's health is a major source of concern, and this unavoidable uncertainty only grows with age. As a result, caring for our aging population is a duty of great importance. To improve people's quality of life, technology is being used in this way. 'Fall' is one of the leading causes of health decline and death among the elderly. In light of the aforementioned problem, a novel system has been proposed to detect falls in the elderly using machine learning. While other methods, such as recording and processing webcam images, have proven useful for detecting falls, this study is the first to use a data set that includes information from sensors actually used by the elderly. It is possible to implant the sensor in an item like a belt or watches, and then use the data recorded from the sensor's activities and changes. Further, we have attempted to construct, using the flask framework, a prediction system that can determine whether or not the recorded sensor activity represents a fall, thereby allowing caregivers to take the necessary precautions. It has been found that support vector machines (SVM) and decision trees can be used for prediction, with the latter providing a high level of accuracy compared to other algorithms.

Keywords: Elderly People, Machine Learning, Fall Detection

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## I. INTRODUCTION

As children and grandchildren leave home for college and the workforce, today's elderly are increasingly likely to live alone. Homebound seniors still face a significant risk of falling, whether from an accident or because of a preexisting health condition; failure to act within the required time frame could have fatal consequences. According to the World Health Organization, falls in the home are the leading cause of accidental death and serious injury. They are more

likely to injure themselves or wander off when they are home alone, whether as a result of forgetfulness or a predisposition to wandering. Until they return home, the family may not realize that the elderly member has fallen or is unconscious. Those in their golden years would be unable to advocate for themselves, get medical attention, or communicate their condition to others. If the information about the fall could be communicated to the worried family members or caregivers, they could take immediate measures to mitigate the negative effects of the fall for a variety of

reasons. People with Parkinson's disease, whose nervous systems are already compromised, and the elderly, who are often trying to care for themselves independently, both have common causes for falls. A fall can be caused by a variety of physical factors, including an unsteady gait, blurred vision from age, distracted thinking, and so on. Hip fractures and other serious injuries are common results of these falls, further diminishing the quality of life for the elderly.

## II. PROBLEM STATEMENT

As children and grandchildren leave home for college and the workforce, today's elderly are increasingly likely to live alone. Homebound seniors still face a significant risk of falling, whether from an accident or because of a preexisting health condition; failure to act within the required time frame could have fatal consequences. According to the World Health Organization, falls in the home are the leading cause of accidental death and serious injury. They are more likely to injure themselves or wander off when they are home alone, whether as a result of forgetfulness or a predisposition to wandering. Until they return home, the family may not realize that the elderly member has fallen or is unconscious. Those in their golden years would be unable to advocate for themselves, get medical attention, or communicate their condition to others. If the information about the fall could be communicated to the worried family members or caregivers, they could take immediate measures to mitigate the negative effects of the fall for a variety of reasons. People with Parkinson's disease, whose nervous systems are already compromised, and the elderly, who are often trying to care for themselves independently, both have common causes for falls. Asymmetries in gait, impaired vision due to age, distracted attention, and other similar factors can all contribute to the onset of a fall. The elderly suffer serious injuries, such as hip fractures, from these falls, further diminishing their quality of life. Consequently, the goal of this project was to propose a new method

for identifying falls among the elderly by employing machine learning methods. Several machine learning algorithms can be trained on the fall dataset to find the one that works best in a given situation. Accelerometers, gyroscopes, etc. are examples of sensors that can be used to get real-time input from the elderly. An issue with fault detection systems is that they can give off false alarms. Therefore, it is essential that we construct a system with a low rate of false positives. Good accuracy can be obtained using SVM and decision trees, it has been found. When compared to the others, decision trees have the highest rate of accuracy.

## III. EXISTING SYSTEM

Most hip fractures and other injuries occur as a result of falls. As the elderly person's health declines and deteriorates, death is a real possibility if emergency care is not given to treat these injuries and fractures. Having a reliable fall detection system in place is crucial for geriatric patients to receive the care they need. False alarms, or alerting fall when there is fall-like activity but not exactly a fall, are a significant challenge to developing accurate fall detection systems. Studies have mostly concentrated on finding ways to enhance the fall detection system's accuracy and decrease false alarms.

### Disadvantages:

- Mistaken alarms
- Possesses a high propensity for making mistakes

### Model of Proposed System:

We propose to create a machine-learning strategy for detecting and analyzing the fall. We also propose rolling out a web app that, given enough data from sensors, can foretell when a patient will fall. The user would be able to upload his sensor parameters and view the machine learning model, as well as receive predictions, on the web. With this project, we hope to develop an automated prediction system that can reliably categorize whether or not an elderly person

has fallen. Here is a breakdown of the system's structure:

#### Advantages:

- Computerized process
- Greater precision

#### Machine Learning

There are four types of machine learning. They all differ in their approach, the data type they take as input and give output.

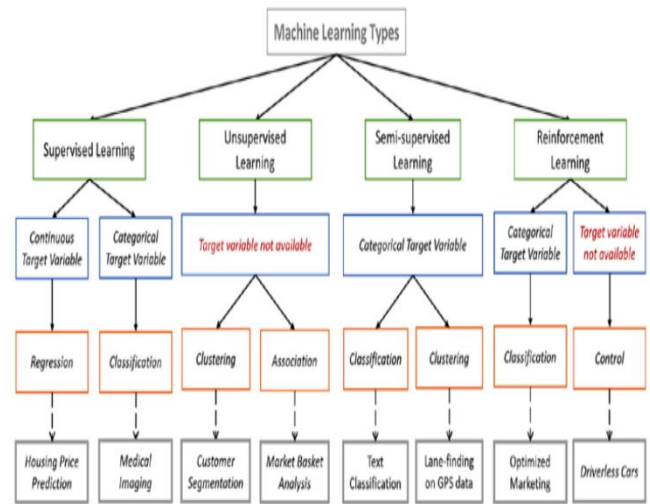
The four types are:

1. *Supervised Learning*: it is a learning in which we train the models using the data which is well labelled that we already know the answers. Basically, it is a task of learning a function that represents an input to an output based on example input output pairs. It infers a function from labeled training data comprising of a set of training examples.

2. *Unsupervised Learning*: it is used on some data in which we don't know the output allowing the algorithm to act on that data without any guidance. It basically groups the data based on the similarities and pattern without any prior knowledge of data. Unlike Supervised Learning, no training will be given to the machine. Therefore, machine is limited to find the hidden structure in an unlabeled data by itself.

3. *Semi-Supervised Learning*: in the learning, it is assumed that the data is the combination of both labeled as well as unlabeled. Its major aim to extract the data from the unlabeled data that could enable learning a discriminative model with better execution.

4. *Reinforcement Learning*: it basically means improving the performance of the machine using trial and error experience. There is unkind teacher is given, where if a machine predicts wrong then penalty is given and if machine predicts correct then some reward is given.



#### PYTHON:

The Python 3.8 programming language is being used to create the project's applications. If you're looking for a powerful programming language that doesn't require you to memorize a bunch of syntaxes, look no further than Python. Python is an easy programming language to learn because its syntax is so similar to regular English. It can run sophisticated mathematical computations, incorporate machine learning algorithms, and support object-oriented programming. Its dynamic typing and data structures allow for swift application development. Python is widely regarded as a readable programming language because it uses a larger percentage of English words than any other language. The exponential growth of available data. Since Python's interpreter performs syntax analysis at runtime, the language doesn't need a compiler to fix syntax errors and compile programs. It can run on any OS and comes with a tonne of prebuilt libraries and packages for a wide range of tasks. It's a simple language that's straightforward to study, use, keep up with, and improve. You can access the vast majority of popular databases on the market today with just a few lines of Python code. Using GI programming can help you create applications for both Windows and the web. This language is unique in that it allows developers to choose between functional, structural, and object-oriented programming. Python code is easily portable

to other languages, and it even has garbage collection built in!

#### **FLASK:**

Flask is a framework for creating small, fast, and simple web apps. It does this by making available Python's library system. The WSGI Development Environment Flask is a web application framework based on the Andy jinja 2 template engine. Flask is a microframework due to its lightweight nature. The Web Server Gateway Interface (WSGI) toolkit is a standardized protocol and interfaces for implementing common web objects like requests, responses, and helper functions. Python now uses this standard as its baseline for building web applications. It is the universally accepted interface specification for establishing communication between a web server and a web application. Jinja 2 is a popular Python templating engine. Using this method, templates can be linked to various data sources to generate dynamic web content. Flask's architecture makes it easy to create basic web applications. Unfortunately, it lacks basic features like database support and built-in form validation abstraction layers. However, the flask allows for the incorporation of all these features. This flask is a lightweight web framework that can be easily customized.

#### **MYSQL:**

Our project makes use of MySQL, an open-source RDBMS, to establish database connections and store information. To store, retrieve, and modify information in a database, My SQL relies heavily on structured query language. There are rows and columns in the tables that hold the data in the database. To facilitate a client-server architecture, MYSQL was developed. The user, or client, connects to the MYSQL client to perform tasks on the database, such as creating tables, modifying data, and retrieving records. The MYSQL client initiates an operation, which is sent to the server, and the server either completes the operation successfully or returns an error message.

#### **Elderly fall detection system**

According to data compiled by the World Health Organization, falls rank among the leading causes of accidental death. The effects of these accidents on people over the age of 65 are visible in the data. Diseases of the brain and nervous system, such as Parkinson's, and the natural deterioration of human bodies are to blame. This article presents a novel method for detecting falls in the elderly in real-time. The following elements make up this system:

1. A gadget that can be worn
2. A mobile phone.

The device's communicative capacities would allow it to automatically text an alarm to a user's phone. within a hundred feet of it. When a fall is detected, the mobile device notifies predetermined emergency contacts, such as family members. One benefit of this setup is that the elderly person's cell phone is not required to be carried at all times. In the event of an emergency, a panic button is integrated into the system. After pressing the button, the designated people would be immediately notified.

#### **"Internet of Things and Big Data-based Fall Detection for the Elderly"**

For the elderly, falls are a leading cause of serious injuries and health problems. If a senior citizen falls and isn't helped right away, he could die or require life-changing surgery that leaves him less mobile and reduces his overall quality of life. In this article, we discuss a novel method for identifying elderly indoor fall victims. This method relies heavily on low-power wireless sensor networks, smart devices with built-in communication capabilities, large amounts of data, and cloud computing. A 3D access accelerometer is a sensor that can be integrated into any wearable device. In this way, an IoT gateway can process the collected sensor data and interpret the results. In the first place, the gateway would receive regular updates from the sensors, and if a fall were detected, alerts would be sent to the appropriate contacts and groups responsible for the elderly. The aforementioned method has been implemented with the aid of cloud systems because all

this technology cannot be maintained in a local environment. The system's ability to detect falls quickly and accurately has been demonstrated.

#### IV. PROPOSED MODULAR IMPLEMENTATION

The project's proposed modular implementation is detailed below. It has two separate parts:

1. Admin
2. User

##### Admin Module

The system administrator is in charge of doing things like:

1. Dataset uploading
2. Analyzing the data in the dataset
3. Dividing the data into a test and a training set
4. Modelling instruction for SVM and Random Forest algorithms
5. Evaluate how well the algorithms work with the provided data.
6. Take a look at profile info and forecasts for a user

##### User Module:

The machine learning services provided by the system include:

1. Entering one's login information
2. It's important to remember to record the settings for your sensors in your system's database.
3. Get your autumn forecast.

##### Architecture diagram:

An architecture diagram is a visual representation of a system's concepts, principles, elements, and components. It is an abstract representation of the system's structure and behaviour. It's possible to define different levels of abstraction, such as a purely conceptual one, in which only the ideas behind the system are shown. Logical abstractions provide further insight into the workings of the concepts by illustrating their underlying principles and constituent parts. A system's design can be seen at the physical abstraction level, the lowest level of abstraction. Any

of the aforementioned three abstraction levels may be shown in the Architecture diagram as appropriate.

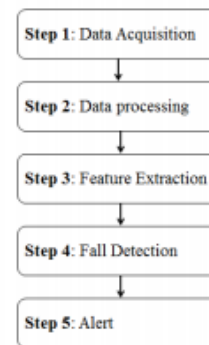


Figure 1 System flow

#### V. Conclusion and Future Work

##### Conclusion

This project describes a system that uses a portable sensor to detect when an individual has fallen. The target demographic here is the senior population. It is proposed to use a machine learning algorithm to identify potential slips and falls from a person's routines. Most people would rather use the threshold approach than the Machine Learning strategy. This is because of a pattern known as pre-trained Gait, which results in fewer false positives. The decision tree's ability to define and categorize each attribute to a class allows it to provide greater accuracy than SVM. When compared to SVM, which slows down the system, a decision tree can make predictions more quickly. A model's performance can be measured with tools like sensitivity, specificity, accuracy, and confusion matrix. The best accuracy for detecting falls that can be achieved with a decision tree algorithm is 96%. Training the models on a large dataset and determining the best features to use can boost accuracy. In addition, we propose deploying the model to a web application and making it available to the students, parents, and faculty to reduce attrition and assist students in their areas of need.

##### Future Work:

As part of future enhancement, we are planning to improve the ground plane segmentation to reduce the false detections. The public data set is restricted with only one person per video. As part of enhancing the

current work, we are investigating the possibility to detect the falls from videos where multiple people are present under various conditions and multiple falls within a single video.

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Journal URL : <https://ijsrset.com/IJSRSET229543>



## Predictive Analysis for Big Mart Sales Using ML Algorithms

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<sup>2</sup> Professor, Department of Computer Science Engineering, Shadan Women's College of Engineering & Technology, Telangana, India

### ABSTRACT

Big Marts, which are distribution centers for supermarket chains, now keep tabs on sales volume and revenue numbers for each product to anticipate domestic consumption and adjust inventory control. Examining the data warehouse's server database often reveals inconsistencies and overarching patterns. Companies like Big Mart can use the data with a variety of machine learning techniques to predict future product sales. Many different machine learning algorithms, including Linear Regression, Ridge Regression, Lasso Regression, Decision Tree Regression, Random Forest Regression, Support Vector Regressor, Adaboost Regressor, and XGBoost Regression, have been employed in this project to forecast Big Mart product sales. We find that XGBoost Regression performs the best in predicting sales volume among the listed algorithms. To this end, we have developed a model with XGBoost Regression and optimized it for maximum precision. This model is available through a flask application; users simply log in, specify the product's parameters, and receive sales forecasts.

**Keywords:** Linear Regression, Polynomial Regression, Ridge Regression, Xgboost Regression

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## I. INTRODUCTION

The fierce and increasingly aggressive competition between specialty shops and megastores is largely attributable to the rise of foreign retailers and online shopping. The company's management of inventory, shipping, and operational activities must be able to attract a large number of customers in a short amount of time and predict the amount of revenue for every product. To triumph over less expensive methods of prediction, the modern machine learning approach provides methods for estimating rather than

forecasting sales trends for any kind of business. An ever-improving business plan, which is aided by more precise forecasting, is also of great value.

There has been a lot of work done up to this point that was legitimately meant for the field of transaction forecasting. The extensive research conducted on supermarket alliances is briefly summarised in this section. Regression, the Auto-Regressive Integrated Moving-Average (ARIMA), and the Auto-Regressive Moving-Average (ARMA) are just a few of the additional Measurable techniques that have been used to develop some deal prediction standards. As an

antidote to the stress of daily food deal anticipation, A. S. Weigend et al. suggested a hybrid approach involving the Auto-Regressive Integrated Moving Average (ARIMA) and the occasional quantum relapse strategy. Predicting future transactions is a challenging problem, affected by both internal and external factors.

## II. PROBLEM STATEMENT

In recent years, people's ability to spend money has risen dramatically, both in traditional retail settings and online. Throughout the year, supermarkets frequently release a slew of deals to celebrate holidays like the New Year, Christmas, and others. Since it's a given that business will be brisk, top brass must make accurate projections about product demand and keep stock levels under control. Supermarkets typically stock up on products and sell them all before the end of the period. If it doesn't, the market risks incurring enormous losses because its predictions were off. Current methods cannot reliably extrapolate future product sales from historical data. Managers are solely responsible for doing this by carefully analyzing historical data and making best-guess projections of future sales activity in light of a variety of factors. This task can only be completed manually, as no automated system is currently capable of doing it.

## III. OBJECTIVE

This study's primary objective is to foretell the sales volume of products carried by a supermarket. To do this, we have been using the Big Mart sales data set from Kaggle. The R2 score is compared after the dataset has been processed, analyzed, and fed to multiple regression algorithms. Stock booking and inventory upkeep are not part of this project's remit.

## IV. Existing system:

Sales are guaranteed to skyrocket around holidays like New Year's and Christmas, so it's crucial that

management accurately predicts these spikes in demand so that they can keep inventory levels stable. Supermarkets typically stock up on products and sell them all before the end of the period. If it doesn't, the market risks incurring enormous losses because its predictions were off. Current methods cannot reliably extrapolate future product sales from historical data. Managers are the only ones responsible for doing so, and their efforts are needed to meticulously examine historical data, factor in multiple events, and estimate sales volume.

### Problems with the Current System

- May be inaccurate, increasing the risk of financial setbacks.
- This requires human intervention.

## V. A PROPOSED SYSTEM

It is proposed that multiple machine learning algorithms, such as Linear Regression, Ridge Regression, Lasso Regression, Decision Tree Regression, Random Forest Regression, Support Vector Regressor, Adaboost Regression, and XGBoost Regression, be used to forecast Big Mart product sales, with the best-performing algorithm being used to build a model to forecast sales volume. Ideally, this model would be hosted on a flask application, where users could log in, input product details, and view sales projections in real-time.

### Advantages of Proposed System

- Computerized process
- Accurate
- Simple in design and implementation.

### Machine Learning

There are four types of machine learning. They all differ in their approach, the data type they take as input and give output.

The four types are:

1. Supervised Learning: it is a learning in which we train the models using the data which is well labelled that we already know the answers. Basically, it is a task of learning a function that represents an input to an output based on example input output pairs. It infers a function from labeled training data comprising of a set of training examples.

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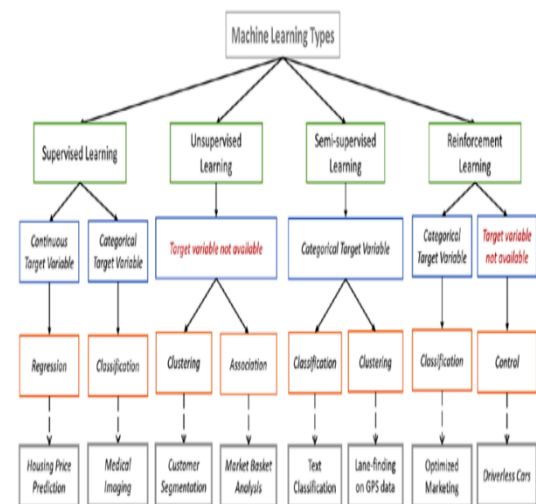
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**FLASK:**

Flask is a framework for creating small, fast, and simple web apps. It does this by making available Python's library system. The WSGI Development Environment Flask is a web application framework based on the Andy jinja 2 template engine. Flask is a microframework due to its lightweight nature. The Web Server Gateway Interface (WSGI) toolkit is a standardized protocol and interfaces for implementing common web objects like requests, responses, and helper functions. Python now uses this standard as its baseline for building web applications. It is the universally accepted interface specification for establishing communication between a web server and



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a web application. Jinja 2 is a popular Python templating engine. Using this method, templates can be linked to various data sources to generate dynamic web content. Flask's architecture makes it easy to create basic web applications. Unfortunately, it lacks basic features like database support and built-in form validation abstraction layers. However, the flask allows for the incorporation of all these features. This flask is a lightweight web framework that can be easily customized.

#### **MYSQL:**

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#### **Regression Algorithm**

BigMart's data scientists have compiled sales information from 10 stores in different cities for 1559 products in 2013. The method was developed by Barun Waldron and Sanjeev trivedi[1]. Finding out if certain characteristics of products and/or stores significantly affect sales is the primary goal. To accomplish this, they developed a predictive model to ascertain the sales of each product in a specific store, thereby enabling BigMart to increase sales through the discovery of optimal product organization within stores. The method they used was called Linear Regression. While this makes the methods they use more refined and easier to analyze, it comes at the cost of some accuracy.

For businesses in the retail, logistics, manufacturing, marketing, and wholesale sectors, accurate sales forecasting is crucial. This paves the way for better resource management in the future of businesses. The authors Conley, T G, and Gleason, D W[2] estimated sales revenue to help better plan for the company's future expansion. In their paper, they present a two-tiered method for predicting product sales at a store that outperforms the most common single-model predictive learning algorithms. In this method, 2013 sales data from Big Mart is used as the basis for analysis. Correct predictions rely heavily on data exploration, data transformation, and feature engineering. The outcome proved that a two-level statistical approach outperformed a single model approach due to the latter's lack of information and the former's ability to better predict outcomes. Decision trees and linear regression were the methods used. It has the benefit of being extremely trustworthy. On the downside, it's less precise.

It can be challenging to analyze large datasets and derive useful insights from them. Consequently, a robust and efficient data mining tool is required for mining complex data sets to extract the information and make better decisions in the future. For this purpose, the potent and efficient xgboost is employed. The efficiency gained from using the decision tree regressor's built-in packages (ggplot2, VIM, etc.) is considerable. An essential part of statistics is the process of transforming raw data into knowledge and understanding it, and Alishahi et al.[3] used the open-source data analysis environment and programming language R to accomplish this. It enables users to perform several crucial operations for the efficient processing and analysis of big data. R includes many pre-built statistical modeling and machine learning algorithms that can be used to develop data products and conduct reproducible research. They implemented the R linear regression, RF, DT, and R algorithms. Handle such a large dataset with missing values and regularities. But the precision is better now than it was before.

## Classifiers Algorithms

The Big Mart Company uses Sales Prediction to forecast sales of their various products across their many retail locations and cities. The number of goods was a topic covered in a paper by Aghion et al.[4]. The proliferation of retail locations is making accurate manual forecasting difficult. Sellers' ability to anticipate the correct level of product demand is crucial in terms of physical location, time, and money. Depending on storage costs and availability, sellers may need to move their products quickly. Xgboost's - Linear Regression was used in this approach. When compared to alternative methods, their accuracy is very high. Some people may have a skewed perception of the drawback. Many authors have researched sales forecasting and sales forecasting analysis, which can be summarised as follows: This paper also investigates and describes in detail the automated process of knowledge acquisition using computational and statistical methods. Machine learning is the process by which a machine acquires knowledge from its experiences, based on data, using statistical or computational methods. In [6], we are introduced to several machine learning methods, each with a specific industry in mind. The most popular data mining strategy was identified by Pat Langley and Herbert A. Everyone today relies heavily on data analysis to improve their decision-making, and this is especially true in the modern era. Tackling big data analysis and gleaning useful insights from it is a challenge. So, a robust and efficient data mining tool is required for the mining of complex datasets to extract the information and make better decisions in the future. In this case, we will use R, a powerful and free data mining tool developed by the community. R comes with a plethora of pre-installed packages. That efficiency comes from sources like Fikes, Richard E et al.[7ggplot2, ]'s VIM, etc. R is a free and open-source software framework and programming language for statistical computing and analysis. Data analysis, an essential part of statistics, is the transformation of raw data into useful information.

It enables users to perform several crucial operations for the efficient processing and analysis of big data. R includes many pre-built statistical modeling and machine learning algorithms that can be used to develop data products and conduct reproducible research. Linear Regression, Decision Trees, K-Means, and Naive Bayes can all be used with this approach. Various algorithms, such as random forest and eclat', are available to us, and we plan to use them in our future projects. We also use means to cluster the dataset into categories, and we use a naive Bayes classifier to determine the fat content of individual items. The primary goal of this paper is to demonstrate strategies for dealing with a massive dataset that frequently contains missing values. In the realm of business, the Rule Induction

When compared to other data mining methods, the RI method is superior. While in [8] we learn how to forecast sales for a pharmaceutical distributor. This paper is concerned with two additional issues: (i) the stock state should not experience out-of-stock, and (ii) it avoids customer dissatisfaction by predicting the sales that manage the stock level of medicines. In [3], the authors discuss methods for dealing with sales fluctuations in the footwear industry over time. Also discussed in this paper is the use of neural networks to predict weekly retail sales, which can help reduce the amount of guesswork involved in making near-term sales projections. There is a proposal for a sales forecasting model in retail that makes use of both linear and non-linear [1] analysis. The fashion industry sales forecast was done by Beheshti-Kashi and Samaneh. Forecasting sales at the mega mart is done using a two-tiered statistical approach [7]. In their proposal, Xia and Wong distinguished between classical (based on mathematical and statistical models) and modern heuristic approaches, among which they included exponential smoothing, regression, Auto Regressive Integrated Moving Average (ARIMA), and Generalized Auto-Regressive Conditionally Heteroskedastic (GARCH) methods. In most cases, the

asymmetrical nature of real-world sales data is too complex for the linear models commonly used. Several obstacles make accurate forecasting difficult, including a lack of historical data, consumer-oriented markets that face uncertain demands, and short life cycles of prediction methods. According to the author's interpretation [9], the question of "what is data analysis, and how we can do it efficiently?" is answered. This paper suggests using R for data analysis due to its many advantages, including its extensive built-in packages, its ease of use concerning implementing various machine learning algorithms, etc. Given that R is both a statistical language and a programming language, it can be used to create more accurate models for making predictions and to improve visualization. The survey's authors concluded, then, that data analysis with R is more productive. Assesses the strengths and weaknesses of three widely used data mining tools (Rapid Miner, Weka, and R) through a detailed comparison and analysis.

This paper provides an explanation of how to use R, Weka, and Rapidminer for time series analysis and structural health monitoring.

The author provides a concise explanation of data analysis and provides tips for getting the most out of the process. The author of this paper suggests using Random Forest for data analysis due to its many useful features, including its robust data exploration capabilities, its built-in packages, and its ease of implementation of several machine learning algorithms. Because of its dual nature as a programming language and a statistical language, R facilitates accurate model prediction and enhanced visualization. Researchers concluded that the boost significantly improved the efficiency of data analysis after conducting their survey. Examines the capabilities of three well-known data mining mechanisms (Rapid Miner, Weka, and R) and how they can be applied to the problem of monitoring the condition of structures. This paper explains how to use R, Weka, and Rapid miner for time series analysis for structural health monitoring, including how to

visualize data, apply filters and statistical models, and more. The authors of this paper provide an in-depth analysis of the research done to date on the subject of estimating product sales and profits. The implementation of the proposed system is described in the following chapter. In this paper, we take a look at the challenge of trying to predict traffic on an online store. To solve this problem, we proposed a stacked generalization strategy that uses regressors at multiple levels. Separately from the overall model, we have also evaluated the performance of individual classifiers. Experiments have shown that our method is at least as effective at predicting demand as individual classifiers, and often performs even better while requiring significantly less data for training (only 20 percent of the dataset). We believe that by using more data, our method will be able to make much more accurate predictions. Because the proposed model is statistically indistinguishable from the random forest, it can be used to predict demand with a minimum of information. The results of this effort will be incorporated into a later effort to solve the problem of optimal pricing. It was suggested that long-term annual growth factors could be used to predict the demand for electricity in the future. Based on the weather data, a forecasting method using multiple linear regressions for bicycle rental demand were proposed.

## VI. PROPOSED MODULAR IMPLEMENTATION

An outline of the project's proposed modular structure is provided below.

It has two separate parts:

1. Admin
2. User

### **Admin Module:**

Activities such as these fall under the purview of the system administrator.

Step 1: Transferring the Dataset

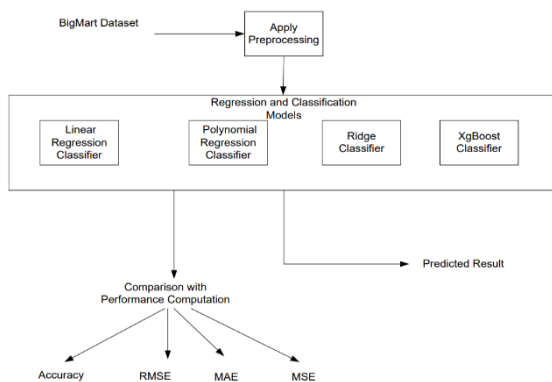
Step 2: Analysis of the data set

Step 3: Pre-processing of Data

Step 4: Dividing the data into a test and a training set  
 Step 5: Teaching the model to use a number of different regression technique.  
 Step 6: Analyze how well the algorithms work with the provided data set.  
 Step 7: The XGBoost regressor algorithm is used to build the model in step seven.

#### Architecture diagram:

An architecture diagram is a visual representation of a system's concepts, principles, elements, and components. It is an abstract representation of the system's structure and behaviour. It's possible to define different levels of abstraction, such as a purely conceptual one, in which only the ideas behind the system are shown. Logical abstractions provide further insight into the workings of the concepts by illustrating their underlying principles and constituent parts. A system's design can be seen at the physical abstraction level, the lowest level of abstraction. Any of the aforementioned three abstraction levels may be shown in the Architecture diagram as appropriate.



## VII. Conclusion and Future Work

### Conclusion:

We built and deployed a machine learning model to predict sales of different products in a superstore as part of this project. To that end, we've decided to use the publically available Big Mart sales data set from kaggle.com. We have prepared the data for analysis by performing standard data preparation steps such as sorting it into training and test sets and then feeding it to a variety of regression algorithms, including Linear regression, support vector regression, ridge regression,

lasso regression, decision trees regression, random forest regression, AdaBoost regression, and xgboost regression. We've seen that conversation and can attest that it's spot-on. Since then, we've adjusted the xG boost regressor so that it's approximately 98% accurate. To date, we have not found a machine-learning model that can compete with this one on this dataset. We hope to incorporate ARIMA time series analysis into this project down the road.

### Future Work:

As part of future enhancement, we can combined with effective data mining methods and properties, the traditional means could be seen to make a higher and positive effect on the overall development of corporation's tasks on the whole. One of the main highlights is more expressive regression outputs, which are more understandable bounded with some of accuracy. Moreover, the flexibility of the proposed approach can be increased with variants at a very appropriate stage of regression model-building. There is a further need of experiments for proper measurements of both accuracy and resource efficiency to assess and optimize correctly.

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# Role of Carbon Nano Tubes on the Emission Characteristics of Diesel Engine - An Overview

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## ABSTRACT

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The present study focuses on the overview of multiwalled carbon nanotubes (MWCNTs) and exhaust gas recirculation (EGR) of a diesel engine fuelled with the Nano Al, Mg, Zr, Ti, Ni, CuO, CuCl<sub>2</sub>, CoCl<sub>2</sub>, FeCl<sub>3</sub> and CuSO<sub>4</sub> can be used as a catalyst for Diesel engine. This study reveals that the addition of carbon nanotubes to petroleum driven fuel had minimal influence on CO and HC emissions. The data were also showed that there was an average increment in Specific Fuel Consumption (SFC) and decrease in brake thermal efficiency (BTE) in case of blends with MWCNTs and the power was slightly increased on an average of 0.60%-0.80% while operating on blends with MWCNTs.

**Keywords :** MWCNT, Catalyst, Diesel Engine, Emissions, Exhaust Gas

## I. INTRODUCTION

The diesel engine, like other internal combustion engines, converts the chemical energy in the fuel into mechanical power. Diesel fuel, in an ideal combustion process, is a hydrocarbon mixture that produces just carbon dioxide (CO<sub>2</sub>) and water vapour (H<sub>2</sub>O). The majority of diesel exhaust gases are made up of CO<sub>2</sub>, H<sub>2</sub>O, and unutilized engine charge air. Diesel emissions include chemicals that are potentially hazardous to one's health and/or the environment. Non-ideal combustion processes, such as incomplete fuel combustion, reactions between mixture components at high temperatures and pressures, combustion of engine lubricating oil and oil additives, and combustion of non-hydrocarbon components of diesel fuel, such as sulphur compounds and fuel

additives, are responsible for the majority of these pollutants. Unburned hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), and particulate matter are examples of common contaminants. The total concentration of contaminants in diesel exhaust gases is generally in the tenths of one percent range. Modern diesel engines fitted with emission after treatment equipment such as NO<sub>x</sub> reduction catalysts and particle filters emit much reduced, "near-zero" amounts of pollutants.

In automobiles, a catalytic converter serves as an exhaust emission controller. It catalyses a reduction reaction by digesting hazardous pollutants and gases from the internal combustion engine and transforming them into less-toxic pollutants. Catalytic converters are often referred to as "cats" or "cat-cons." The device's

function is to minimize air pollution by producing and converting it to steam. A catalyst is a chemical that speeds up a chemical reaction without affecting its characteristics. As a catalyst, a Nobel metal such as platinum, palladium, or rhodium is utilised. Because it requires around 800 degrees Fahrenheit (426 degrees Celsius) to work, the product is put closer to the engine. Another significant element that influences conversion efficiency is the position of the catalytic converter.

### **Emissions Characteristics and Control Strategies**

The exhaust mostly comprises three basic pollutants: unburned or partially burnt hydrocarbons (HCs), carbon monoxide (CO), and nitrogen oxides (NO<sub>x</sub>), largely NO, as well as other components such as water, hydrogen, nitrogen, oxygen, and so on. In general, emissions are affected by the air-to-fuel (A/F) ratio. The largest power production is obtained by tuning the engine to rich feed, but at the penalty of excessive fuel consumption. Lower combustion temperatures result in lower NO<sub>x</sub> emissions under lean conditions; nevertheless, at extremely high A/F engine misfire occurs, resulting in significant HC emissions.

The light-off temperature of automotive three-way catalysts (TWCs) is roughly 250-350°C. This implies that within 90-120 seconds, an under-floor catalyst is heated above the light-off temperature. For future automotive applications, an exceptionally efficient and durable catalyst is required which should have the following characteristics.

- i. High activity and selectivity (conversions more than 98%), up to 99% for Californians.
- ii. Fast light-off (10-20 s), indicating considerable activity at low temperatures.

Typically, cumulative tailpipe emissions exceed such tight limits within 3-15 seconds of the engine starting! This means that the catalyst must be active a few seconds before the limit is reached and convert almost

100% of the time left in the test process. There are two approaches for lowering diesel engine exhaust gas emissions. The first technique is to use exhaust gas treatment equipment such as a catalytic converter and a diesel particle filter to minimise emissions. However, the usage of these devices has an impact on the performance of the Diesel engine.

The use of a fuel additive is the second way for reducing emissions and improving the performance of a CI engine. The main pollutants produced by diesel engines are nitrogen oxides (NO<sub>x</sub>) and particulate matter (PM). However, controlling NO<sub>x</sub> and PM at the same time is challenging.

### **II. Exhaust Emission Characteristics**

The influence of nano additions on NO<sub>x</sub> is made up of nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>), both of which are produced during the combustion process. As a result, different metal additives such as nanometal oxide of manganese oxide (MnO) and copper oxide (CuO) have been selected and doped with diesel to achieve more complete fuel combustion and reduce the amount of exhaust gases. NO<sub>x</sub> emission values are relatively higher with the biodiesel of Mn additives compared to biodiesel with Ni additives. This higher NO<sub>x</sub> value is probably because of the Mn additives having more catalyst effect on combustion causing increase in the maximum temperature (Keskin et al. (2011), Keskin et al. (2007), Guru et al. (2002), Zhu et al. (2012)).

The Hydrocarbon emissions are caused by incomplete fuel combustion. The majority of researches observed that the inclusion of nano gasoline additives reduced hydrocarbon emissions. The exhaust gas from the engine increased in HC by 4% and 9% with nano aluminium (n-Al) and nano silicon (n-Si) in water-diesel emulsion, respectively (Mehta et al. 2014). The influence of nano particles on HC emissions are caused

by incomplete fuel combustion. The majority of researches observed that the inclusion of nano gasoline additives reduced hydrocarbon emissions. The exhaust gas from the engine increased in HC by 4% and 9% with nano aluminium (n-Al) and nano silicon (n-Si) in water-diesel emulsion, respectively.

### III. Nano additives for Diesel Engine

This section discusses the usage of nano particles as a fuel additive in diesel engines by researchers and scientists. Nano Al, Mg, Zr, Ti, Ni, CuO, CuCl<sub>2</sub>, CoCl<sub>2</sub>, FeCl<sub>3</sub> and CuSO<sub>4</sub> can be used as a catalyst for Diesel engine. Nanosized silicon granules and nanoporous silicon wafers have recently been investigated for energy uses. Basha et al. (2011) created samples of alumina nanofluid in 15% water with concentrations of 25, 50, and 100 ppm and utilised jatropha biodiesel emulsion fuel as a base fuel in a diesel engine. Fangsuwannarak et al. (2013) investigated 0.20% nano TiO<sub>2</sub> in diesel fuel and 5% palm oil and 95% diesel as base fuel. Sajith (2020) investigated cerium oxide nanoparticles with dosing level varied from 20 to 80 ppm in a base fuel as a jatropha biodiesel on a single cylinder, WC, 4-stroke Diesel engine. Sarvestany et al. (2010) investigated the compression ignition engine's response to magnetic nanofluid fuel (Fe<sub>3</sub>O<sub>4</sub>) in diesel at concentrations of 0.4 and 0.8% by volume.

### IV. Performance and Emission Parameters of a Carbon Nanotube Fueled CI Engine

Carbon nanotubes are one of the nanomaterials that researchers are interested in because of its unique qualities such as aspect ratio (length-to-diameter ratio), mechanical strength, and excellent thermal and electrical conductivity. Carbon nanotubes tend to congregate due to their hydrophobic surface. Their surface is modified with various functional groups to improve dispersion in solution. Carbon Nanotubes (CNTs) were blended with B5 and B10 fuel mixes as an

additive to assess the performance and emissions of a CI single-cylinder engine. For each fuel combination, CNTs with concentrations of 30, 60, and 90 ppm were employed. Power, brake thermal efficiency (BTE), specific fuel consumption (SFC), exhaust gas temperature (EGT), and emissions of CO, CO<sub>2</sub>, unburned hydrocarbons (UHC), NO<sub>x</sub>, and soot were all tested for full load engines at 1800, 2300, and 2800 rpm. CNTs added to gasoline mixes were shown to significantly improve power (3.67%), BTE (8.12%), and EGT (5.57%) at all engine speeds (Seyyed et al., 2017).

Mohammad et al., (2020) studied the diesel-biodiesel fuel had 5% biodiesel and 95% diesel combined with MWCNTs-OH at 30, 60, and 90ppm concentrations at E4 and E8 concentrations. Engine speeds of 1800, 2100, and 2400 rpm, as well as full load, were used to measure performance and emissions. The addition of the additive to diesel+biodiesel+ethanol blends (B5+E4 and B5+E8) enhanced torque and power without decreasing BSFC. UHC and CO emissions dropped, whereas NO<sub>x</sub> emissions increased. Seyyed et al. (2017) discovered that CNTs added to gasoline mixes significantly improve power (3.67%), BTE (8.12%), and EGT (5.57%) at all engine speeds. The results also revealed a considerable reduction in SFC as a result of the additional CNTs in the diesel-biodiesel combination. CO, UHC, and soot exhaust emissions reduced, whereas NO<sub>x</sub> emissions increased, according to the findings of emissions characteristics. There was a statistically significant negative relationship between CO and CO<sub>2</sub> emissions. Furthermore, increasing EGT has a significant impact on NO<sub>x</sub> emissions.

Tariq et al. (2021) investigated the performance and exhaust emissions of CI engines using B10 and B15 biodiesel blends generated from cottonseed oil and diesel with Multi-Walled Carbon Nanotubes (MWCNTs) as an additive. Carbon Nanotubes were employed in the fuel mixes at levels of 100 and 150

ppm. Brake power, brake thermal efficiency (BTE), specific fuel consumption (SFC), and exhaust gas analysis such as hydrocarbons (HC), CO<sub>2</sub>, CO, and smoke were all tested attributes. In the case of blends including MWCNTs, the results revealed an average increase in SFC of 7.69% and a drop in BTE of 5.50%. When using MWCNT mixes, the power was marginally boosted on average by 0.60%. It was also discovered that the amount of CO, HC, and smoke in exhaust gases was reduced by an average of 6.25%, 11.32%, and 7.31%, respectively, when CNTs were added to plain diesel fuel.

Anchupogu Praveen et al., (2017) showed that brake thermal efficiency increases by 7.6% with the addition of MWCNTs to the B20 fuel, decreases by 2.42% with the EGR to the B20 fuel, and increases by 2.26% with the addition of MWCNTs and EGR to the B20 fuel compared to the B20 fuel. The maximum cylinder pressure and heat release rate was occurred as 67.35 bar and 74.80 kJ/m<sup>3</sup> deg for the B20MWCNT40 fuel at full load condition. The CO and HC emissions for the B20MWCNT40+20%EGR fuel sample were lower compared to the B20 fuel. The Smoke emissions were reduced for B20MWCNT40 fuel compared to the B20 fuel. The NO<sub>x</sub> emissions were reduced by 25.6%, 29.7% for B20+20%EGR, B20MWCNT40+20%EGR fuel samples compared to the B20 fuel.

## V. CONCLUSIONS

Overall, the experimental findings demonstrate that adding carbon nanotubes to petroleum diesel fuel is an efficient way of enhancing the emission performance of transportation diesel engines. The inclusion of CNTs had the largest impact on smoke opacity. Under normal running circumstances, increasing the quantity of CNT added in petroleum DF from 0 to 500 mg/L resulted in a reduction in exhaust smoke. The addition of carbon nanotubes to petroleum DF had minimal influence on CO and HC emissions; there was a modest

tendency toward a decrease in CO emission, but the change in HC emission of the examined diesel engine was negligible.

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