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Adaptive Traffic Management System Using IoT and Machine Learning

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ABSTRACT

India is a developing country. Increase in personal vehicles comes with the development of a country parallely. This has led to rise in congestion in large cities. So, we need a better traffic management system. The purpose of this project is to create a traffic system which is adaptive to the present traffic scenario in a lane. Usually, we have fixed average waiting time for all lanes. This project suggests to change the average waiting time by monitoring the number of vehicles in a lane. The data will be sent to central system through internet, which will decide the timing for signal according to the dumped program. This project also, suggests implementing congestion lights at previous intersections, so that drivers can change lanes at the situation of congestion. The system is useful in emergencies and it also, helps in reducing pollution and traffic congestion.

Keywords: Camera Sensor, TensorFlow, Waiting Time, Traffic management, min max fairness, AIMD , PCA

I. INTRODUCTION

India is a developing and emerging country. The GDP annual growth rate of India has increased from 6.9% in 2013 to 7.3% in 2014 according to the World Bank Data. This proves that the economy of India has improved and raised the standard of living of people. Increase in personal vehicles comes with the development of a country, in parallel. This has led to rise in congestion, in large cities. So, we need a better traffic management system.

Manual control of traffic, by traffic officers or using predefined timers has been proven not an effective solution, but they are still being used in many places. One of the major issues with Indian cities is that we cannot expand the existing infrastructure more, so we have only one option available is better management of the traffic. The present traffic control system uses fixed average waiting time concept for controlling the traffic. But, in large cities it is still difficult to handle the traffic using this concept. Sometimes, we observe that though there is no vehicle in a lane and heavy traffic on other lane, still the traffic light is green for latter lane and red for other lane. This leads to traffic congestion.

Adaptive traffic management system will be better choice than the manual traffic based system. The purpose of this project is to create a traffic system which is adaptive to present traffic scenario in a lane using IoT. Internet of Things (IoT) is an environment and a platform that connects people, devices and computers by letting them share data with each other by having machine to machine or machine to human interaction.

The system can lead to zero average waiting time situation. Delay of few minutes can lead to risks of human lives and financial losses. Many times it is seen that due to heavy traffic ambulance has to wait for long time to cross the traffic signal but, by using density count we can improve this problem. This system is useful in such emergencies. Now, we will further see in detail the implementation of this project and the components used.

II. LITERATURE SURVEY

A. Traffic Management as a part of Intelligent Transportation System

"Internet of Things based Adaptive Traffic Management System as a part of Intelligent Transportation System (ITS)", is published in IEEE Conference (2018) by Ankit Dubey, Mayuri Lakhani, Shivansh Dave and Jignesh J. Patoliya [1]. This paper refers to manage the traffic by using IoT concepts and be a part of Intelligent Transportation System (ITS).

The proposed system in this paper works on the principle of IoT and related algorithms. Ultrasonic sensors and arduinos play an important part in this system.

In this system, the ultrasonic sensors will be placed on road sides, which will count the number of vehicles, as they intersect its range. This count will be sent through arduino to another arduino. Another arduino will use this count to update the traffic lights accordingly, based on real time data.

B. Traffic management using data mining

"Application of Data Mining in Traffic Management: Case of City of Isfahan", this paper is presented in IEEE conference(2010), and is published by Zahra Zamani ,Mohammad Hossein Saraee, Mahmoud Pourmand[2]. This paper aims to develop traffic signal timing plans. Case study of Isfahan was taken and by using cluster analysis time-of-day was identified. Time-of-day was analysed with the help of historical data. Data mining techniques are used like data collection, data cleaning, data classification and data transformation.

Data collection was done with the help of sensors which are installed in Isfahan at entry of road junction. They maintained different tables for five traffic signal junctions. Data cleaning was used as sensors used to go in an inactive state if vehicles were not at junction and hence, resulted in zero as a value in database. Data was classified on the basis of weekdays and weekends as traffic variation is large.

Transformation consisted of queries with the help of that graphs and pie charts are developed. The time at different days is noted and cluster are created on the basis of match in density of traffic [refer section IV].

Clementine, data analysis tool was used. Microsoft excel was used to draw charts for clusters created by Clementine.

C. Traffic corridor control using machine learning

"Integrated Traffic Corridor Control Using Machine Learning", is published in IEEE Conference (2005) by Celine Jacob and Baher Abdulhai[3]. The motive of this research is to develop self learning adaptive and independent freeway control for recurring traffic patterns.

This paper is based on artificial intelligence and machine learning algorithms. Reinforcement learning, Q learning are used in this paper for the development of self-learning independent model.

Reinforcement learning is about how an agent that senses and acts in the environment can learn to choose optimal actions to achieve its long-term goals. Whenever the agent performs an action in the environment, a trainer may provide a reward or penalty to indicate the difference between actual state and achieved state.Dynamic rerouting of traffic from the Expressway to a parallel arterial/collector is implemented in the field using a single Variable Message Sign.

D. Traffic Management for Emergency Services

"Adaptive Traffic Management for Secure and Efficient Emergency Services in Smart Cities", this paper was published in IEEE PerCom conference (2013), and is published by Soufiene Djahel, Mazeiar Salehie, Irina Tal and Pooyan Jamshidi [4]. The aim of this project is to particularly focus on traffic management for emergency services.

The proposed system in this project uses IoT and Machine Learning algorithms. Cameras, controllers and networks play an important role in this system.

In this system, the local traffic controller sends the information from CCTV cameras to traffic management controller. If images are in great clusters, a notification is sent to emergency vehicle and emergency service authority, so that they can take further actions.

E. Traffic Management using RFID

"Intelligent Traffic Management based on IoT", this paper was published in International Journal of Computer Applications (0975 – 8887) (2017) by Sonali P. Kshirsagar, Priyanka H. Mantala, Gayatri D. Parjane and Kalyani G. Teke [5]. This paper focuses on reducing traffic congestion to reduce manual interference in controlling traffic.

This paper uses IoT based appliances. This paper is based on use of RFID (Radio Frequency Identification) and Raspberry Pi.

In this proposed system, RFID tag in placed on vehicle, containing one unique number. The information from RFID tag is read by RFID reader and passed on to Raspberry Pi by router. The count is maintained and traffic signals are organized accordingly. It can be used to identify stolen vehicles also.

F. Traffic Management using Image Processing

"Smart Traffic Optimization Using Image processing", this paper was published in IEEE conference (2015), and is published by Pranav Maheshwari, Deepanshu Suneja, Praneet Singh and Yogeshwar Mutneja[6].The main aim of this paper is to determine the volume and density of the incoming traffic by using image processing technique.

Edge detection and ORB[Oriented FAST and Rotated BRIEF] algorithms are used for processing the snapped images at fixed intervals. Since the objects are not tracked in a video, the system thus has a low computational cost.

After snapping the images RGB colors are captured from the image and sent to the central server, where it is converted into grayscale image which then undergoes edge detection.After edge detection, the image is then transformed into binary image.The issues faced while using edge detection algorithm is overcomed by using Otsu's multiple thresholding over various pixel areas in the image. Distance is detected from the scanned image and after that this distance is multiplied with the width of road which gives the area covered by traffic.

The system then extracts feature points from the image using ORB algorithm,the road that is plain will not contribute towards features but the vehicles being mobile will do so. Feature matching is doing further using brute force on two simultaneous images to deduce the traffic jam.Thus, a two-fold cost saving approach is adopted i.e fuel and time cost reduction[refer section IV].

G. Traffic Management using Internet Of Things (IOT)

"Smart Traffic Management System Using Internet of Things", this paper was published in IEEE conference (2018), and is published by Sabeen Javaid, Ali Sufian, Saima Pervaiz and Mehak Tanveer[7].This paper is based on hybrid approach that is combination of centralized and decentralized approach for optimizing traffic flow on roads and also the developed system connects to nearby rescue departments with centralized server as well as extracts useful information for future road planning.

The developed system is divided into three layers a)Data Acquisition and Collection layer B)Data Processing and Decision-making layer C)Application and Actuation layer. In the first layer the data is collected with the help of surveillance cameras, ultrasonic sensors, RFIDs, smoke sensors and flame sensors. Blob detection algorithm is used at the local server for noise reduction.After detecting the traffic, a local server sends the density measured to the respective microcontroller.

In the second layer the system allocates time dynamically to each lane on the basis of traffic density. Moreover, if any emergency vehicle is detected, the system gives the highest priority to that lane to be green until that vehicle passes to that intersection.

In the third layer, the system calculates the rush interval by using Regression Tree algorithm on the data saved at local server and also updates this report to the centralized server on the daily basis. Moreover, this system is also capable of managing emergency situations like smoke or fire if detected on the road by intimating to the nearby relevant department with the help of mobile application for further actions.

H. Traffic Management using Camera Sensor

"Adaptive Traffic Signal Control System Using Camera Sensor and Embedded System", this paper was published in IEEE conference (2011), and is published by M Febrian Rachmadi, Faris Al Afif, Wisnu Jatmiko, Petrus Mursanto, Manggala E A, and M Anwar Ma'sum[8].This paper mainly focuses on implementing a system in which vehicle detection and counting is done from a video or camera sensor.

In this paper the system uses camera as input sensor which provides real-time traffic data and is implemented using BeagleBoard and AVR microcontroller.

Video from camera is processed using (PCA) Principal Component Analysis.PCA is used for analyzing and classifying the object on video frame for detecting vehicles. Distributed Constraint Satisfaction Problem (DCSP) method is then used for determining the duration of each traffic signal,which is based on the vehicle count from each lane.The result of DCSP is sent to traffic signal that is integrated with traffic engine which gives signal accordingly.

I. Vehicle Counting using Video Image Processing

"Vehicle counting using Image Processing" is published in conference IJCAT (2014) by Megha C. Narhe,Dr.M.S.Nagmode.The Project proposes vehicle classification and counting implementation scheme using Scale Invariant Feature transform (SIFT) algorithm.to improve the efficiency and reliability of the vehicle counting and classification[9].

The methodology used in this system is as follow 1.The video clip is read by one function ,then it is divided into number of frames. 2.The background subtraction is done by the second function. 3.Segmentation is performed in next step 4.Feature extraction is done using SIFT. 5.Features are matched to classify vehicles according to class 6.Finally number of vehicles are counted.

The classes of vehicles are defined and by using the algorithm features matching is done and count is increased. Thus, SIFT provides image features that works over image rotation, scaling, translation ,camera viewpoint giving the accurate results.

J. Improving Traffic monitoring system using (IoT)

"Improvement of Traffic Monitoring System by Density and Flow Control for Indian Road System Using IoT",this paper was published in IJARIIE conference(2016) by Karan A Shah, Jasmine Jha.This paper tends to improve current traffic management system IoT based concepts[10].

The project is implemented in the following way. First the ultrasonic sensors are fixed on each lanes .They have used three types of sensors :High, Medium, Low .High is send on 1st priority Medium on 2nd and Low on 3rd priority respectively.Data is collected from sensors and sent to the system.Traffic density is measured and average waiting time is calculated.

The prototype model was built and comparison between time taken by existing system and the proposed system was done .Thus, waiting time was decreased efficiently.

III. METHODOLOGY

Adaptive traffic management system is a smarter way of controlling traffic in countries like India, where traffic congestion is a big issue. The current traffic system has problems of waiting time, pollution and many accident related issues. After installing adaptive traffic management system we can overcome all such issues.We can use IoT and machine learning techniques to improve the current system.

1. Algorithms

1.1 Min Max Fairness Algorithm

Min Max Fairness algorithm is more widely used in TCP congestion. It helps to improve the transfer of data packets. When the data packets come in a burst or a heavy traffic is found in network this algorithm is best situated to be used. The same can be done in traffic congestion control over roads and highways.
Min Max Fairness algorithm uses scheduling methods which are similar to round robin, to achieve fair scheduling. The algorithm first checks whether the data can be allocated or not. If one packet is allocated it results in decrease of other.

When all the lanes are having equal traffic then we can use round robin allocation in min max fairness algorithm.

Fair queuing is used in case , when lanes are not having same number of vehicles. In fair queuing the First In First Out and priority is given more importance.

Min Max Fairness algorithm is useful in the proposed project as in real time traffic we can have different situations and only density count cannot work efficiently. There are different scheduling techniques also but round robin, priority and fair queuing are much better.

If we use first come first served(FCFS) in that situation the LED lights will be ON (green) according to the lane where the vehicle came first ignoring the lane having heavy traffic. The another technique is shortest job first which cannot be used in traffic management as the technique is used for allocation of jobs which require less time for execution but we cannot determine which vehicle take less time for crossing signal.

1.2 ADDITIVE INCREASE MULTIPLICATIVE DECREASE (AIMD) ALGORITHM

Additive Increase Multiplicative Decrease algorithm is widely used in TCP implementations for rate control and congestion avoidance in a sending device. AIMD exhibits a slow increasing transmit bit rate until network saturation occurs, at which point the rate will fall dramatically before increasing again.

When the acknowledgement is received for every sent packet at the beginning, congestion window is increased by 1 and is in slow start state which is an additive increase. Whereas if there is a timeout or the acknowledgement is not received in that case the congestion window size is reduced to half which is an multiplicative decrease.

When the congestion window is greater then the slow start threshold the state is congestion avoidance and if then timeout occurs slow start state is again reached.Since the receiver responds every time as the packet arrives,this implies that the sender gets duplicate ack 's and upon receiving three duplicate ack 's TCP sender retransmits the lost packet again which is the fast recovery state.

Additive Increase Multiplicative Decrease algorithm comes into picture in the proposed project when the data of multiple lanes collected and counted at one controller is sent to another controller for further decision of giving priority to a particular lane to be green for a certain time period.Hence in this scenario AIMD will handle congestion avoidance by fast retransmit and fast recovery.

1.3 PRINCIPAL COMPONENT ANALYSIS

PCA is used for analysis of the data in order to identify patterns to reduce the dimensions of the dataset with minimum loss of information.In this project, PCA is used for image processing, the dimensions of images are reduced so that less space is required for storage. Principal component analysis is a mathematical method which uses orthogonal transformation for conversion of related variables into unrelated variables known as principal components.

PCA is a methodology which can reduces dimensions by calculating correlation matrix eigenvector and eigenvalue among data set and give the easier way to gain required information from group of data.

PCA generally consists of four steps: (1) normalization of image data (2) calculation of covariance matrix from the image data (3) apply Single Value Decomposition (SVD) (4) finding the projection of image data to the new basis with reduced features.

2. WORKING

In this proposed system, aim is to achieve low average waiting time or low traffic congestion. The priority will be given depending on the present situation. This will be implemented for two lanes.

Camera sensors and two controller boards (arduino) will play major roles. The camera sensor will capture the details from the lane with live streaming and pass it on to first controller board. This board will differentiate all the vehicles from obtained data by using TensorFlow and maintain the count of vehicles in a particular lane. This count will be passed on to another controller board.

This board will use this count to adjust the traffic signals and congestion lights accordingly. If there is a great difference between the counts of two lanes, then using the Min-Max Fairness algorithm, the priority will be given to low average waiting time. If the difference is not much, then using the Round Robin algorithm, the priority will be given to low traffic congestion.

IV. RESULTS

After having reference to different conference papers and books we have found the following results:

1. Internet of Things based Adaptive Traffic Management System as a part of Intelligent Transportation System (ITS)

Sr. No.	No. of Vehicles detected	Actual no. of vehicles	Status	Priority
1.	Lane 1:- 5 Lane 2:- 1	Lane 1:- 5 Lane 2:- 1	Lane 2 Green 3s ; Lane 1 Green 8s Congestion message on Lane 1 displayed	Low Average Waiting Time
2.	Lane 1:- 6 Lane 2:- 5	Lane 1:- 6 Lane 2:- 5	Lane 1 Green 8s ; Lane 2 Green 8s Congestion message on Lane 1 and Lane 2 displayed	Low Traffic Congestion
3.	Lane 1:- 0 Lane 2:- 0	Lane 1:- 0 Lane 2:- 1	Lane 1 Green 3s (4 times and then priority shifts) Lane 1 Green 3s (4 times and then priority shifts)	Changing priority to not miss any vehicle if same logic repeats itself more than 4 times

Figure 1

The above figure gives the result of implemented system. In this system, the results are displayed by experimenting with number of vehicles. With unequal number of vehicles between lanes, priority is given to low average waiting time. With almost equal number of vehicles, priority is given to low traffic congestion [1].

2. Application of Data Mining in Traffic Management: Case of City of Isfahan

This paper has used data mining technique for developing a self learning and decision making system for controlling traffic. The results were taken according to timing hours. Decision vary as timing hours change. Another, way of representing result in the paper is using the graph. Graph compares traffic on different weekdays[2].

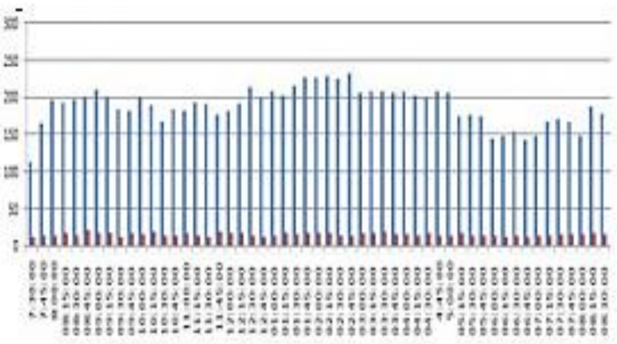


Figure 2. The clusters for business day

The above figure shows the results of traffic on business days (i.e. Wednesday to Saturday). Cluster analysis is used with which our cluster were made using data mining tool.

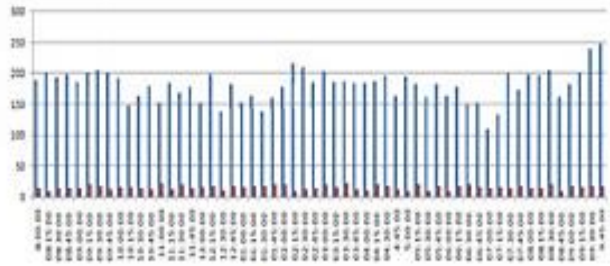


Figure 3. The diagram for Thursdays.

This figure shows the data collected for weekends separately on Thursdays. The four clusters are shown below using pie chart representation. Two junctions are considered in case study and data is collected.

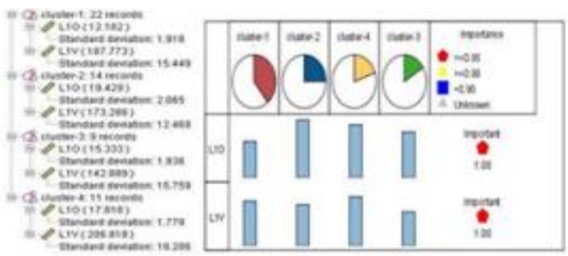


Figure 4. The clusters for Thursdays.

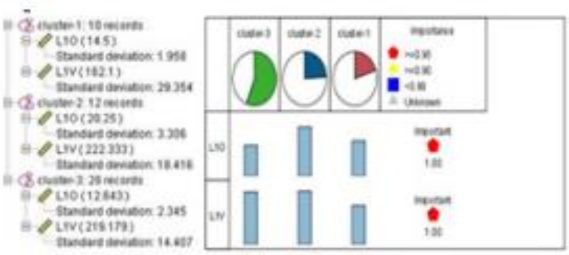


Figure 6. The clusters for holidays.

Holidays are divided into three clusters using data mining tool.

TABLE I. TOD INTERVALS FOR WEEKEND.

Cluster#	TOD Classification	TOD intervals
1	Off peak	22:00-08:00
2	AM , Evening	08:00-10:00 , 19:30-20:30
3	Post AM , PM	10:00-12:30 , 15:30-18:00
4	Mid day , Post PM	12:30-13:30 , 18:00-19:15
5	Pre-Off peak	14:00-15:30 , 21:00-21:45

The above table shows intervals of weekends. It clearly shows that traffic is more on weekends as compared to all other tables.

TABLE II. TOD INTERVALS FOR HOLIDAYS.

Cluster#	TOD Classification	TOD intervals
1	Off peak	22:00-09:30
2	Post AM , Evening	09:30-10:30 , 18:30-21:30
3	Mid day	12:00-14:30
4	Post PM	14:30-18:30

The above table shows intervals at which traffic was high. Cluster are four here. Off peak and mid day was having less traffic and vehicles counted using sensors were less. But, during the evening, PostPM and postAM it was observed that number of vehicles were more.

TABLE III. TOD INTERVALS FOR BUSINESS DAYS.

Cluster#	TOD Classification	TOD intervals
1	Off peak	21:00-07:30
2	AM , PM	07:30-09:00 , 15:30-17:30
3	Post AM , Evening	09:00-12:30 , 19:00-21:00
4	Mid day	12:30-15:30
5	Post PM	17:30-19:00

This table shows TOD data for business days. Off peak had less traffic. AM, PM had same amount of traffic. The traffic was more at AM, PM, PostPM, PostAM and evening.

3. Integrated Traffic Corridor Control Using Machine Learning

The paper uses machine learning and artificial algorithms[3].

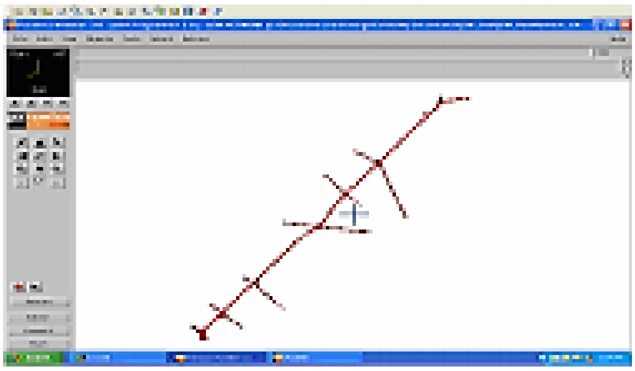
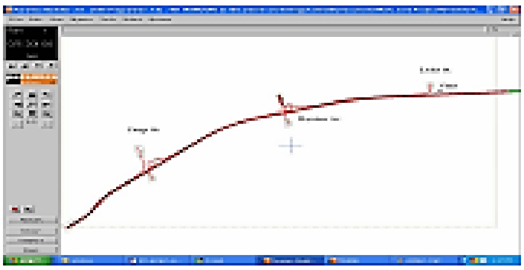


Figure 7

In this graph, the intelligent system receives the percentage occupancy on the detector downstream of the ramp and the current metering rate in order to represent the state of the network. Here,means of four variables represent the state of the network.

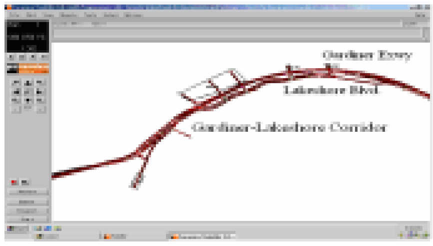
1. Occupancy on the main line upstream of the ramp
2. Occupancy on the ramp at the entrance to the main line.
3. Occupancy on the mainline at the end of the stretch for that particular ramp.
4. Current metering rate at the ramp.



. Work zone network built in Paramics

Figure 8

The above figure is construction site on the westbound collector of Highway.Due to construction collector is reduced to one lane near site,that has great effect on collector capacity. Collector to the Express transfer well upstream of the congested location, which will allow us to divert traffic from the Collector to the Express via VMS, based on the downstream traffic situation.



Gardiner/Lakeshore with single VMS and ramp

Figure 9

The above figure shows the small network used in the case study of paper. This part of the network has one variable message sign (VMS) upstream of the Gardiner-Lakeshore bifurcation. One metered on-ramp downstream of the bifurcation.

4. Adaptive Traffic Management for Secure and Efficient Emergency Services in Smart Cities

Figure 10

Above diagram gives an idea about the proposed system. The road network authority will transfer the data to traffic management controller. TMC passes the details to emergency service authority and emergency vehicle. Thus the emergencies are handled [4].

5. Intelligent Traffic Management based on IoT

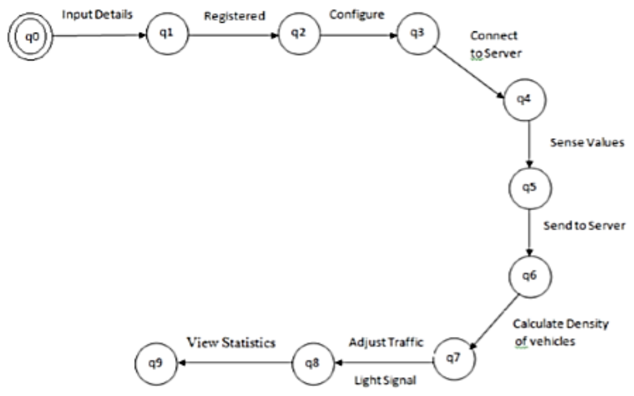


Figure 11

The above figure represents the mathematical model of the proposed system. It shows the flow of data and the application. The input from lanes is registered, configured and sent to server. Then the density is calculated and traffic signal is adjusted accordingly [5].

6. Smart Traffic Optimization Using Image processing

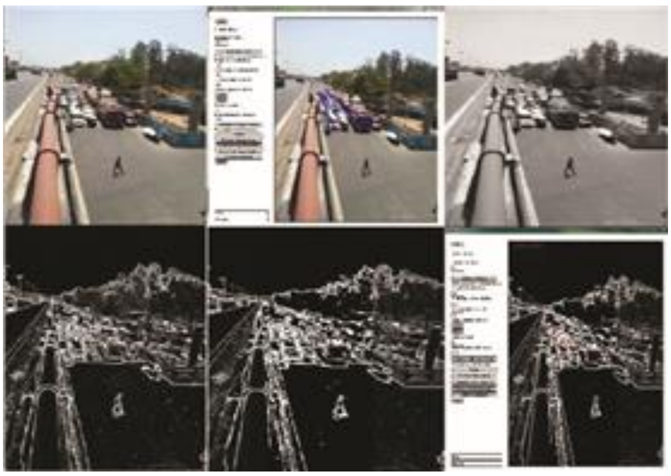


Figure 12. Day Time Analysis

Figure 13. Night Time Analysis

The above figures show the images that are processed and analysed at day and night time.The system after extracting feature points from the image uses ORB algorithm and feature matching using brute force is then applied on two concurrent images and if more than 90% of the features match ,it then deduces that the road is jammed[6].

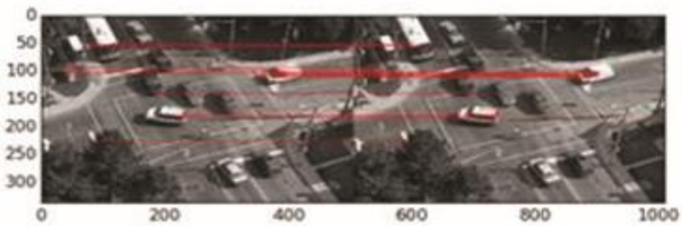


Figure 14. ORB Algorithm

7. Smart Traffic Management System Using Internet of Things

Traffic density is monitored and calculated by vehicle detection as shown in the following figure.

Figure 15. Vehicle Detection

A web interface is developed for the authorities for showing the statistics of traffic on the roads and for making real-time and future decisions. Following figure shows the statistical traffic data that is number of vehicles passed in a particular time span at a particular road.

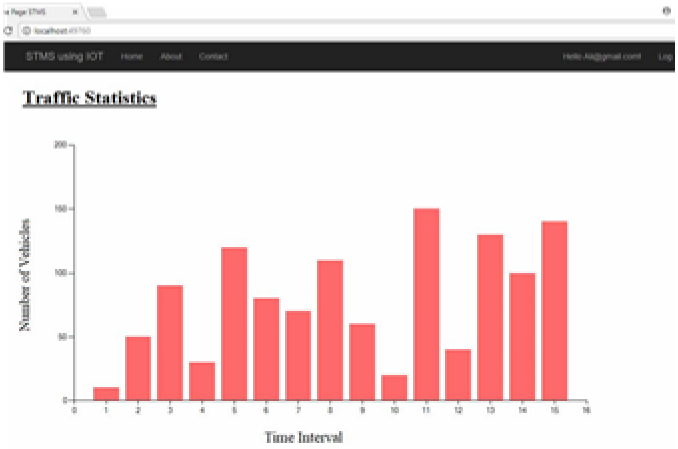


Figure 16. Statistical data on traffic

The bar graph represents the real-time traffic data. Various bar graphs based on historical and real-time data are being drawn in this application which is helpful for traffic department for managing traffic congestions on roads[7].

8. Adaptive Traffic Signal Control System Using Camera Sensor and Embedded System

Following is the screenshot of the running program with the experiment results in table below it.

Figure 17. Screenshot of the running program.

RESULTS OF VEHICLE COUNTING BY USING OUR ALGORITHM UNDER DIFFERENT CONDITIONS

Weather and Traffic Condition	Number of Vehicle (by Manual)	Number of Vehicle (by Our Algorithm)	% Accuracy
At Sunny Day in Heavy Traffic (vs0.avi)	87	115	67.82
At Rainy Day in Normal Traffic (vs1.avi)	58	56	96.55
At Night, Side view (a.avi)	207	82	39.61
At Night, Front view (z.avi)	50	18	36.00
At Sunny Day, Front view (b.avi)	125	71	56.80
At Sunny Day, Side view (d.avi)	80	20	25.00
At Sunny Day, Side view (vs2.avi)	60	1	1.67
At Sunny Day, Zoom view (vs3.avi)	46	9	19.57

Table 4

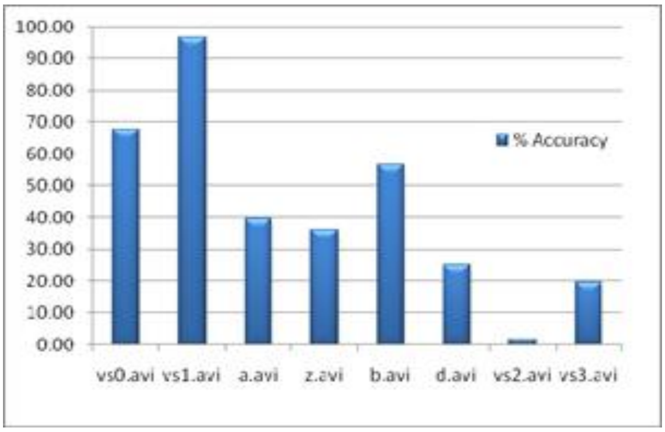


Figure 18. Graph of Vehicle Counting Accuracy

The experimental results show that vehicle detection depends on the weather conditions and camera viewpoints. From the 8 variations of existing video, PCA gives accuracy level above 50% and has good performance on vs0.avi,vs1.avi, and b.avi.Whereas due to weather conditions and camera viewpoints that are inappropriate 5 other videos thus give a low level of accuracy.

Figure 19. Captured video frame of vs0.avi,vs1.avi, and a.avi

Figure 20. Captured video frame of z.avi, b.avi and d.avi.

Video a.avi and z.avi are captured at night(in dark weather), so that PCA is more difficult to detect the vehicle,as compared to the level of light on the video.Vedio d.avi, vs2.avi, and vs3.avi are taken from the side (not from the front), with camera viewpoint,so that PCA is more difficult to detect the vehicle,related to the form of the vehicle on the video compared to trained vehicle data of the program[8].

9. Improvement of Traffic Monitoring System by Density and Flow Control for Indian Road System Using IoT

Outcomes of the current system and system were compared which are as follows[10]:

Table 5. Input for low traffic.

	Low Traffic	Actual Time of Existing System
Red (in seconds)	2.4	3.4
Yellow (in seconds)	0.4	1.4
Green (in seconds)	2.6	3.6

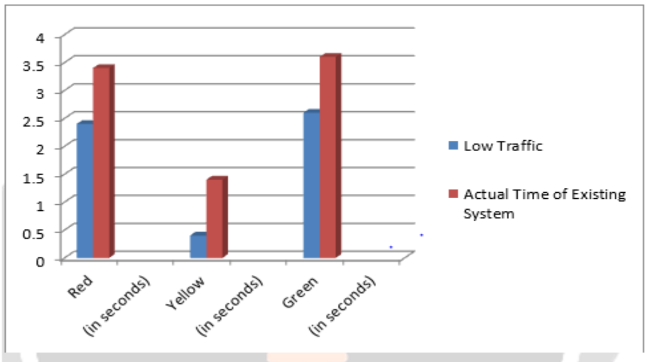


Figure 21

Table 6. Input for medium traffic

	Medium Traffic	Actual Time of Existing System
Red (in seconds)	2.8	4.8
Yellow (in seconds)	0.5	2.5
Green (in seconds)	3.0	5.0

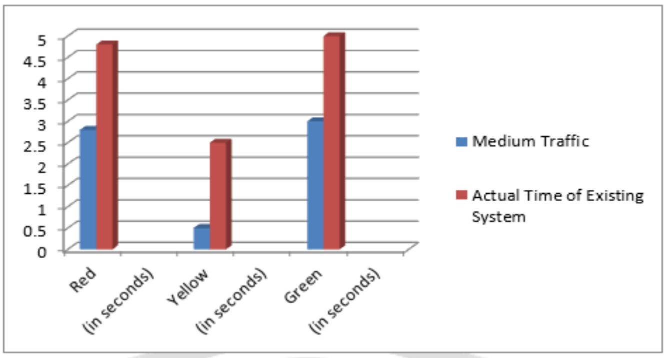


Figure 22. Results for medium traffic

	High Traffic	Actual Time of Existing System
Red (in seconds)	4.0	7.0
Yellow (in seconds)	0.6	3.6
Green (in seconds)	4.0	7.0

Table 7. Input for high traffic

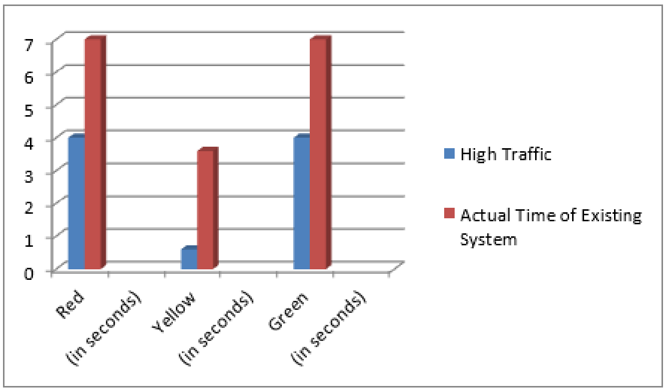
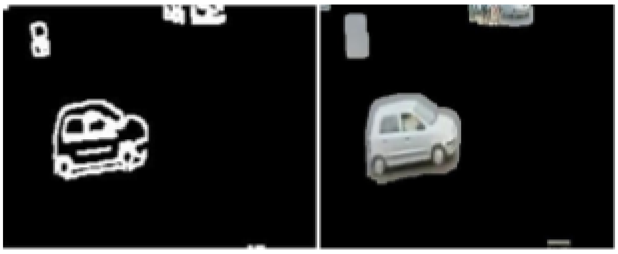


Figure 23. Results for high traffic

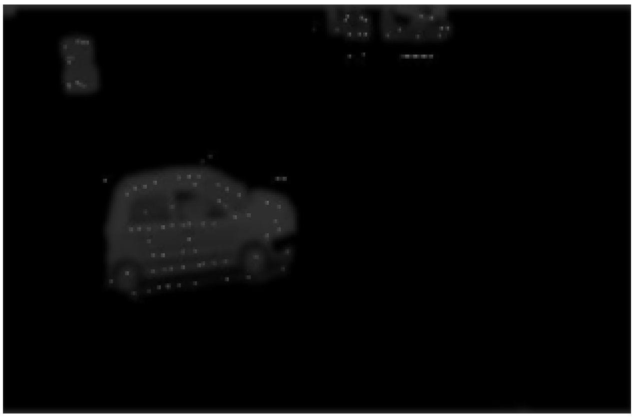
10.Vehicle Counting using Video Image Processing

As in figure below (a), (b), (c), (d) and (e) Original Frame, Edge detected Frame, Dilated Frame and Segmented Frame are shown respectively [9] .The result of the segmentation is shown in fig (f),classification and counting of vehicle is shown in fig (g),(h).

a b



c d



e

f

g

h

Figure 24

V. CONCLUSION

In this study, we have analysed different domains and how they are used for developing adaptive traffic management. We have compared them, identified the advantages and disadvantages in them. The cost analysis and technology analysis is performed in this study. The proposed system will provide better traffic management which will decrease the average waiting time, low congestion, low pollution and will help in giving priority to emergency vehicles.

VI. FUTURE SCOPE

The future scope for the project is identifying the road accidents using camera sensor and video processing. We can have a software system which can identify the overlapping images in real time video streaming and conditions of accident can be decided with overlap of images. Overlap occurs then we can use SMTP to send mail directly to the government hospitals.

VII. REFERENCES

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