“AI-Based Traffic Management System”

A MINI PROJECT REPORT

18CSC305J - ARTIFICIAL INTELLIGENCE

Submitted by

Shashwat Chaturvedi
[RA2011003010151.]
Devansh Pareek
[RA2011003010184.]
Rudransh Singh
[RA2011003010196.]

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Rajalakshmi M.

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(Under Section 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

Certified that Mini project report titled "AI-Based Traffic Management System"is the bona fide work of who(Rudransh Singh(RA2011003010196), Shashwat Chaturvedi(RA2011003010151), Devansh Pareek(RA2011003010184) carried out the minor project under my supervision.

Certified further, that to the best of my knowledge, the work reported herein does not form any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE

Rajalakshmi
Assistant Professor
Department of Computing Technologies

SIGNATURE

Dr. M. Pushpalatha
HEAD OF THE DEPARTMENT
Professor & Head
Department of Computing Technologies

ACKNOWLEDGEMENT

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We deeply express our sincere thanks to our Head of Department for encouraging and allowing us to present the project on the topic "AI-Based Traffic Management System" at our department premises for the partial fulfillment of the requirements.

We take this opportunity to thank all our lecturers who have directly or indirectly helped our project. We pay our respects and love to our parents and all other family members and friends for their love and encouragement throughout our career. Last but not the least we express our thanks to our friends for their cooperation and support.

YouTube video link for the project -
https://www.youtube.com/watch?v=z9QHu1p4TMQ

ABSTRACT

Dynamic Traffic Management Systems **(DTMS)** are intended to operate within Traffic Management Centers (TMC) to provide pro-active route guidance and traffic control support. The integration of multiple **DTMS** software systems requires the modification of the structure and design of the TMCs where they will be integrated. An open, scalable and parallel system architecture that allows the integration of multiple **DTMS** servers at minimum development cost is presented in the current research. The core of the architecture provides: a generic distribution mechanism that extends the Common Object Request Broker Architecture (CORBA); a generic creation mechanism based on the Abstract Factory pattern that permits an anonymous use of any **DTMS** within TMCs; and a generic naming mechanism (Registry) that allows the TMC to locate the **DTMS** servers in remote hosts without using any vendor specific mechanism. Finally, the architecture implements a Publisher/Subscriber pattern to provide parallel programming on top of the CORBA's basic synchronous communication paradigm.

This system architecture is used to propose TMC application designs. The system architecture was validated in a case study that showed the integration of DynaMIT, a prediction-based real-time route guidance system with MITSIMLab, a laboratory for the evaluation of Dynamic Traffic Management Systems. MITSIMLab includes a Traffic Management Simulator (TMS) that emulates the TMC operations. DynaMIT was integrated within TMS using the proposed system architecture.

The core of the system architecture was distributed under CORBA using IONA Technologies Orbix 2.0 Object Request Broker, and it was implemented in **C++** using the object-oriented paradigm.

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LIST OF FIGURES

ABBREVIATIONS:

AI:
Artificial intelligence

ML:
Machine learning

GPS:
Global positioning system

ITS:
Intelligent traffic system

KNN:
K-nearest neighbor

CNN:
Convolutional neural network

LSTM:
Long short-term memory

CO_2:
Carbon dioxide

COPD:
Chronic obstructive pulmonary disease

CCTV:
Closed-circuit television

IoV:
Internet of vehicles

V2I:
Vehicle to infrastructure

V2V:
Vehicle to vehicle

DSRC:
Dedicated short-range communication

VANET:
Vehicular ad hoc network

ReLU:
Rectified linear unit layer

FC:
Fully connected layer

FPS:
Frame per second

mAP:

Mean average precision

UDP:

User datagram protocol

AUC:

Area under the curve

ROI:

Return of investment

RCNN:

Recurrent convolutional neural network

YOLO:

You only look once—real-time object detection algorithm

IOU:

Intersection over union

GRU:

Gated recurrent units

OLS:

Ordinary least squares

SAE:

Social adaptive ensemble

RF:

Random forest

ANN:

Artificial neural network

CHAPTER-1(INTRODUCTION)

As the population of the modern cities is increasing day by day due to which vehicular travel is increasing which lead to congestion problem. We used video processing technique caused by using this we can easily calculated density of traffic present on road. The system will detect vehicles through images instead of using electronic sensors embedded in the pavement. A camera will be installed alongside the traffic light. It will capture image sequences. Image processing is a better technique to control the state change of the traffic light.

In our proposed system there we will be four cameras in one intersection for a four way road. A CPU will be connected with these cameras which will be responsible for video processing. This processing unit take picture from camera and compare all picture and take count the vehicle present on the road. After comparison allocated time first on that road where vehicle count in more, this process happened again and again and reduced the traffic conjunction.

Literature Survey-

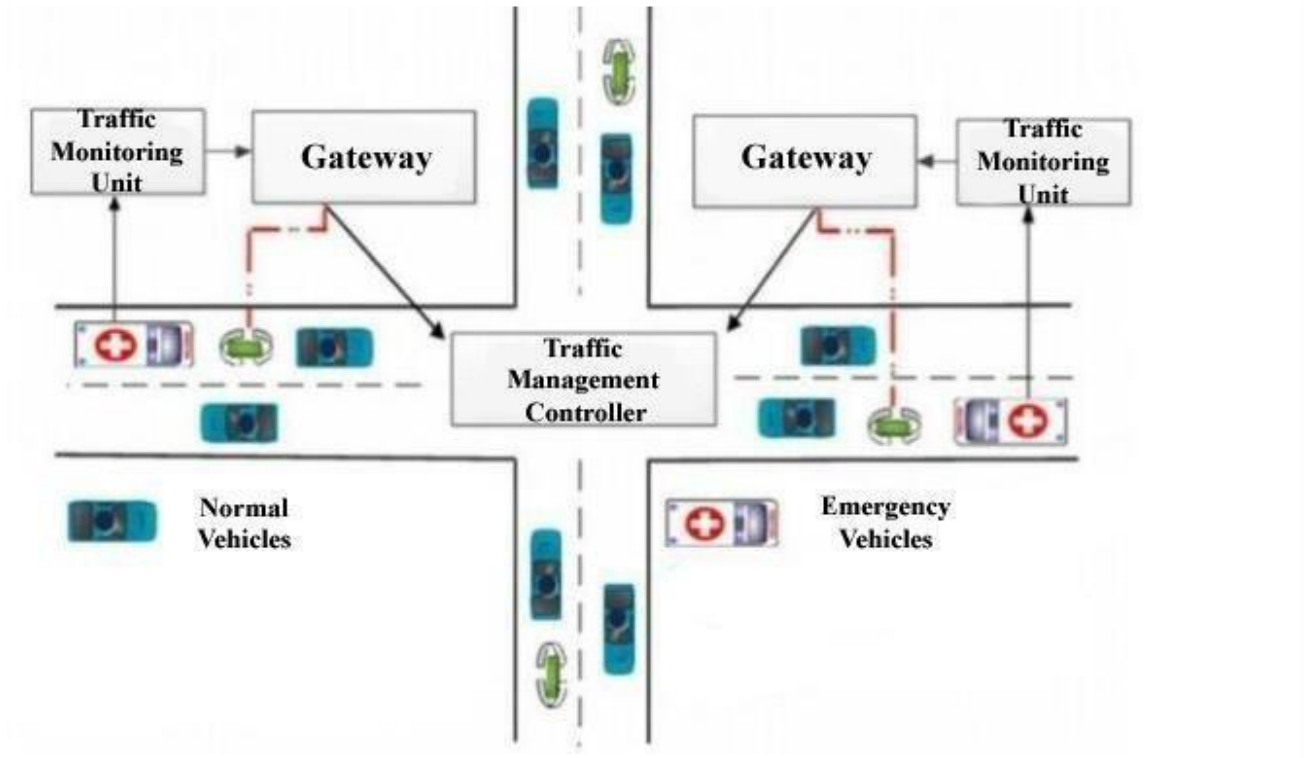
Traffic is a critical issue of transportation system in most of all the cities of Countries. This is especially true for countries where population is increasing at higher rate. There is phenomenal growth in vehicle population in recent years. As a result, many of the arterial roads and intersections are operating over the capacity and average journey speeds on some of the key roads in the central areas are lower than 10 Km/h at the peak hour. In some of the main challenges are management of more than 36,00,000 vehicles, annual growth of 7–10% in traffic, roads operating at higher capacity ranging from 1 to 4, travel speed less than 10 Km/h at some central areas in peak hours. It involves a manual analysis of data by the traffic management team to determine the traffic light duration in each of the junction. It will communicate the same to the local police officers for the necessary actions.[1]

Reinforcement learning for traffic light control has first been studied by Thorpe He used a traffic light-based value function, and we used a car based one. Thorpe used a neural network for the traffic-light based value function which predicts the waiting time for all cars standing at the junction. Furthermore, Thorpe used a somewhat other form of RL, SARSA (State-Action, Reward-State Action) with eligibility traces [2]. Roozemond describes an intelligent agent architecture for traffic light control intelligent traffic signaling agents (ITSAs) and Road Segment Agents (RSAs) try to perform their own tasks, and try to achieve local optimality. One or more Authority Agents can communicate with groups of ITSAs and RSAs for global performance. All agents act upon beliefs, desires, and capabilities. No results were presented [3].

In G. Sathya, et al[3]achieved with the help of "AARS using GPRS 3G TECHNOLOGY". Through this, we can provide a smooth flow for the ambulance by controlling the traffic light according to the ambulance location to reach the hospital. The location of the ambulance can be easily identified with the help of the GPS unit installed in it.[4] Then comes the Traffic light system using image processing. The system will detect vehicles through images instead of using electronic sensors embedded in the pavement. A camera will be installed alongside the traffic light. It will capture image sequences. [5].

CHAPTER -3

SYSTEM ARCHITECTURE AND DESIGN



COMPONENTS REQUIRED

System Antiquation

Hardware:

PC & Cameras: A PC is used as a central device for various image processing operations and Cameras to capture the video to execute the project.

Software:

MATLAB: It is used in the entire processing for signal as well as image processing.

CHAPTER -4

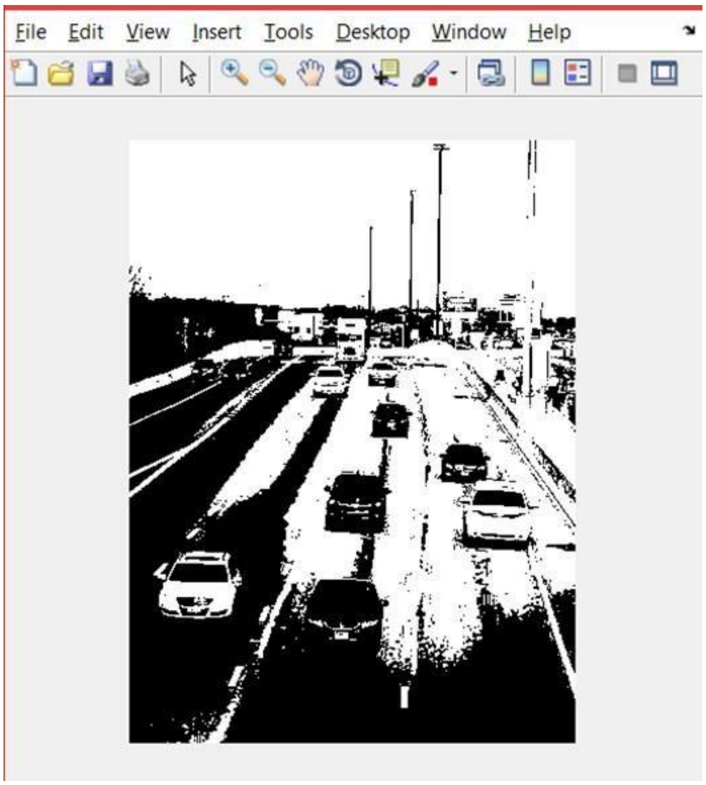
Methodology

Implementation of Smart Traffic system mainly consists of 2 parts. 1st part is image processing part and second is signal controlling part. Front end of the system is Matlab. Matlab will process all the video processing work and lest controlling of the signal will be carried out by controller or arduino.

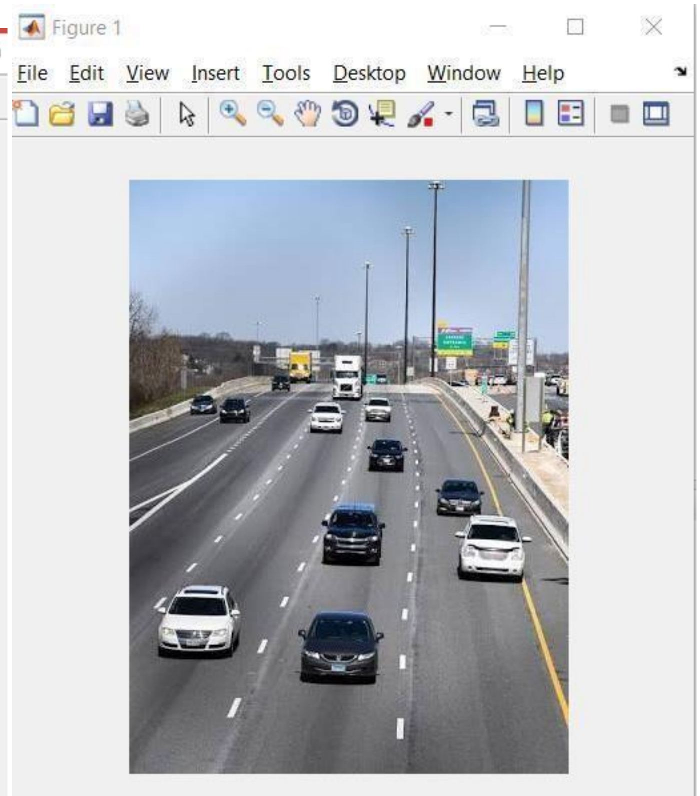
3.1 Video Processing Using Matlab :- Step 1 - Get Video and Initialize Foreground Detector

Rather than immediately processing the entire video, the example starts by obtaining an initial video frame in which the moving objects are segmented from the background. This helps to gradually introduce the steps used to process the video. The foreground detector requires a certain number of video frames in order to initialize the Gaussian mixture model. After the training, the detector begins to output more reliable segmentation results. The two figures below show one of the video frames and the foreground mask computed by the detector. **Fig -1:** Original Image

Fig -



Foreground Image



Original Image

Step 2 - Detect Cars in an Initial Video Frame

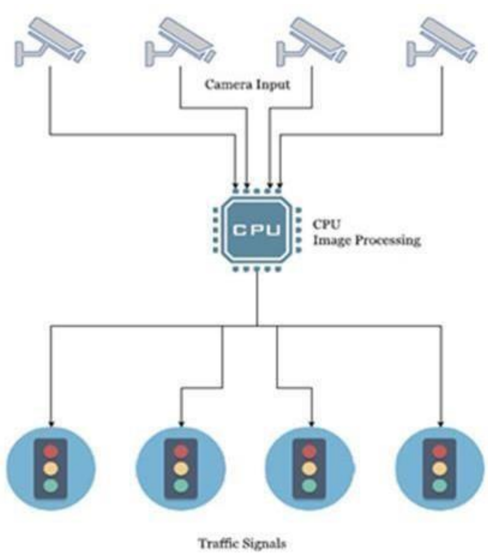
The foreground segmentation process is not perfect and often includes undesirable noise. The example uses morphological opening to remove the noise and to fill gaps in the detected objects. Noise Removed Image

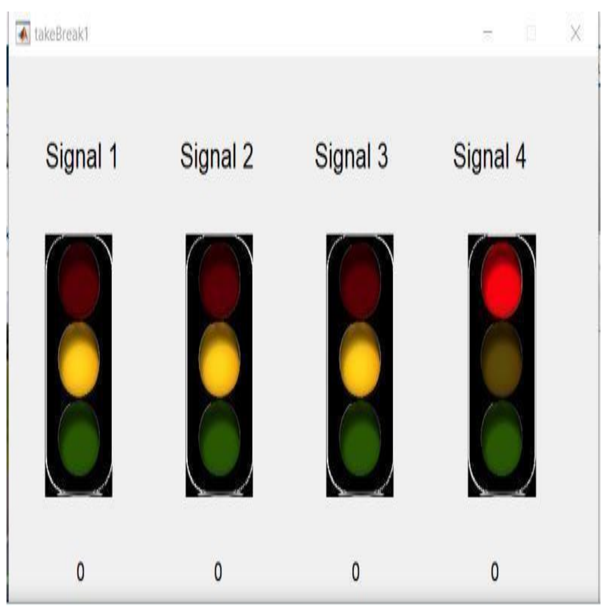
Next, we find bounding boxes of each connected component corresponding to a moving car by using vision. Blob Analysis object. To highlight the detected cars, we draw green boxes around them.
The number of bounding boxes corresponds to the number of cars found in the video frame.

Clean Foreground Detected Cars

Step 3 - Process the Rest of Video Frames and send count to controller.

In this step we will process the rest of the video and send the car count to the controller. In matlab we make above GUI for project. In that we make four windows of four different cameras video input. There detect the every vehicle on road and increased the number of count of vehicles. After some interval time it will arranged in descending order and allocated signal for that road on which more number of cars are present. This process happened again and again and we reduced the traffic.





System Architecture

Signal allocated on different road

CHAPTER -5

Coding and Testing: Code for Car Detection

```
import cv2

cap = cv2.VideoCapture('vb.mp4')
car_cascade = cv2.CascadeClassifier('cars.xml')

while True:
   ret, frames = cap.read()
   gray = cv2.cvtColor(frames, cv2.COLOR_BGR2GRAY)
   cars = car_cascade.detectMultiScale(gray, 1.1, 9) # if
   str(np.array(cars).shape[0]) == '1':
   #    i += 1
   #    continue
   for (x,y,w,h) in cars:
      plate = frames[y:y + h, x:x + w]
      cv2.rectangle(frames,(x,y),(x +w, y +h) ,(51 ,51,255),2)
      cv2.rectangle(frames, (x, y - 40), (x + w, y), (51,51,255), -2)
      cv2.putText(frames, 'Car', (x, y - 10), cv2.FONT_HERSHEY_SIMPLEX, 0.7, (255,
255, 255), 2) cv2.imshow('car',plate)

   # lab1 = "Car Count: " + str(i)
   # cv2.putText(frames, lab1, (40, 50), cv2.FONT_HERSHEY_SIMPLEX, 1, (147, 20,
255), 3) frames = cv2.resize(frames,(600,400))
   cv2.imshow('Car Detection System', frames)
   # cv2.resizeWindow('Car Detection System', 600, 600)
   k = cv2.waitKey(30) & 0xff if k == 27:
      break cv2.destroyAllWindows()
```

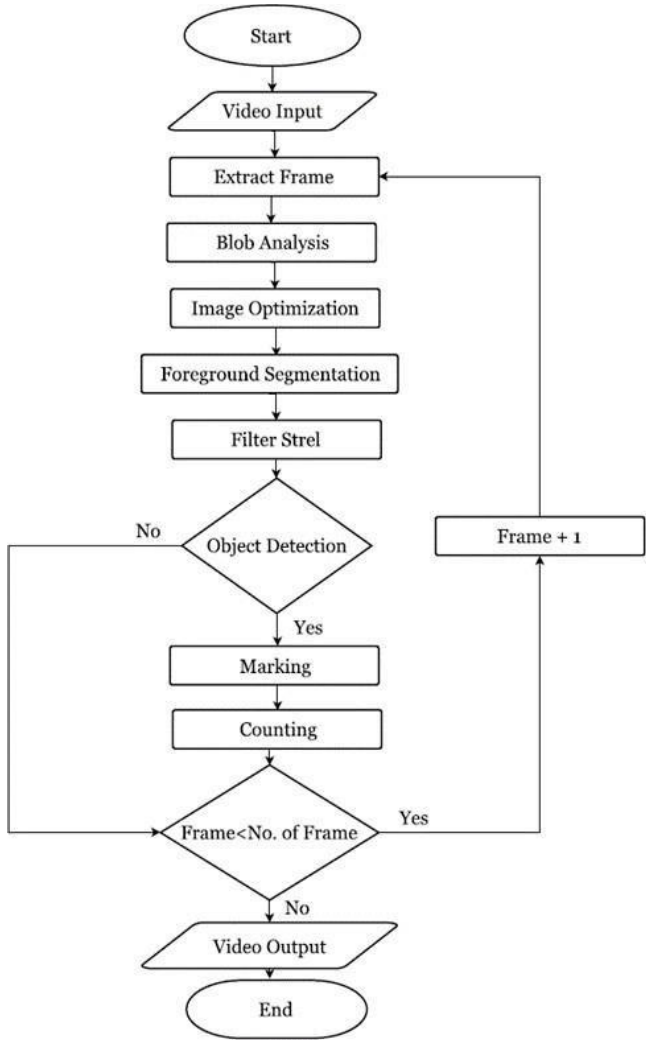
Algorithm:

Gaussian mixture model is a probabilistic model for representing the presence of sub-populations within an overall population, without requiring that an observed data set should identify the sub-population to which an individual observation belongs.

A Gaussian mixture model is a distribution assembled from weighted multivariate Gaussian* distributions. Weighting factors assign each distribution different levels of importance. The resulting model is a super-position (i.e. an overlapping) of bell-shaped curves.

$$f_{\alpha,\mu,\sigma^2}(X) = \sum_{j=1}^{m} \alpha_j \frac{1}{\sqrt{2\pi\sigma_j}} e^{-\frac{(x-\mu_j)^2}{2\sigma_j^2}},$$

Gaussian mixture models are semi-parametric. Parametric implies that the model comes from a known distribution (which is in this case, a set of normal distributions). It's semi-parametric because more components, possibly from unknown distributions, can be added to the model.


Start
Video Input
Extract Frame
Blob Analysis
Image Optimization
Foreground Segmentation
Filter Strel
No
Object Detection
Yes
Marking
Counting
Frame<No. of Frame
Yes
No
Video Output
End
Frame + 1

CHAPTER -6

SCREENSHOTS AND RESULT

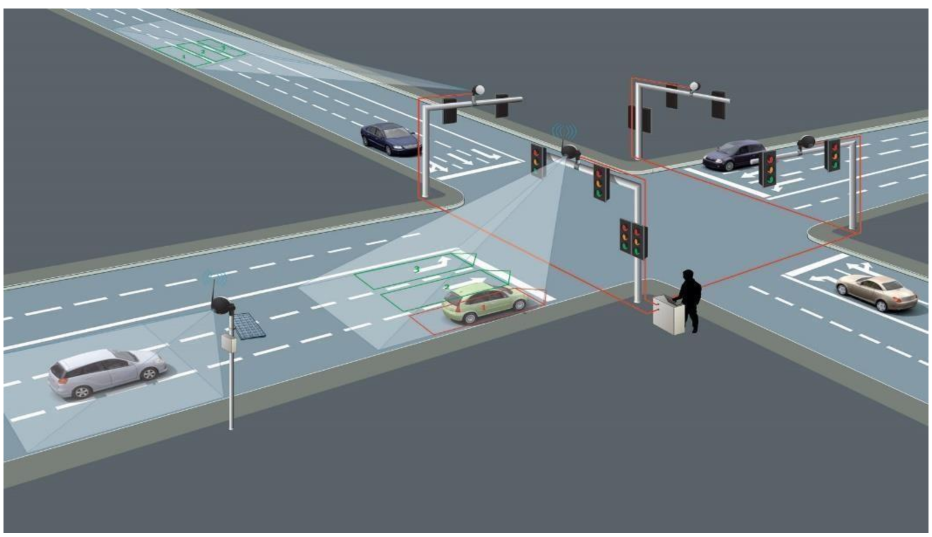
ADVANTAGES

1. Heavy traffic jam reduced.
2. Decreased the pollution.
3. save human time which waste in traffic.
4. Save fuel and money

. DISADVANTAGES

1. We can provide when to go and when to stop, but if the people are unwilling to cooperate, we wouldn't be able to help.
2. A lot of people still don't follow traffic signals.

APLLICATIONS



This type of AI based- Traffic Management System can be used on the national highways and state highways where the city rush isn't involved leading to a more strengthened test for the ai.

RESULT:

The AI based Traffic Management System was Implemented.

CHAPTER -7
CONCLUSION

Video detection technology became a new frontier in case of vehicle tracking because of its dependability. Each area needs to be exclusively programmed and the RFID equipping and maintenance is somewhat costly. Unlike any other system, our system confirms high accuracy and we are confident about its success and feasibility. However, further research and development in this management system could bring that extra edge. So far we've made this system to ease the traffic law enforcement agencies. Knowing about the traffic pressure of the adjacent node would make the system more artificially intelligent. We hope these methods will be adopted as soon as possible so that the limitations we are experiencing with present method can be overcome.

FUTURE ENHANCEMENTS:

Accident detection and diversion routing would be provided so as to reduce traffic and improve travel time

REFERENCES

[1] Rajeshwari Sundar, Santhoshs Hebbar, and Varaprasad Golla "Implementing Intelligent Traffic Control System" Sensor Journal, IEEE(Volume:15, Issue :2)

[2] Ms. Sarika B. Kale and Prof. Gajanan P. Dhok "Design of intelligent traffic light controller using embedded system" Second International Conference on