DETECTION OF TRAFFIC CONGESTION USING SMART TRAFFIC CONTROL SYSTEM

R.Maheswari[1], RA. Preethi[2], R. Poorvaja[3], A. Mahizhini[4], P.R. Preethi[5]

[1] *Assistant Professor, Department of Electronics and Communication Engineering, Panimalar Engineering College, Tamil Nadu, India*

[2] *Student, Department of Electronics and Communication Engineering, Panimalar Engineering College, Tamil Nadu, India*

[3] *Student, Department of Electronics and Communication Engineering, Panimalar Engineering College, Tamil Nadu, India*

[4] *Student, Department of Electronics and Communication Engineering,Panimalar Engineering College, Tamil Nadu, India*

[5] *Student, Department of Electronics and Communication Engineering, Panimalar Engineering College, Tamil Nadu, India*

ABSTRACT

Since the number of vehicles is increasing day by day, traffic jams are becoming a common scenario in large cities. These frequent traffic jams at major junctions kill a lot of man hours. Thus it creates a need for an efficient traffic management system. A smart traffic control system has been implemented which is based on the measurement of traffic density using real time video processing technique. The video sequences from a camera are analysed using object detection and counting methods to obtain the most effective way. So to smoothen the flow of traffic at intersections, option available is the video processing based smart traffic control system. Such system can allow extracting information from the big traffic issues and helps us deciding to improve the traffic policy. This project aims to render automatic control system on roads and highways. The computed vehicle density is compared with other parts of the traffic in order to control the traffic signal brilliantly.

Keywords : - *Vechile Detection Procedure, Camera Placing Calculation, Vechile Detection, Vechile Counting, Video Camera, Intelligent Traffic Light Management System, Decision Making.*

1. INTRODUCTION

Today the number of vehicles on the road is creating heavy traffic that is very difficult to control and maintain safety. This problem is much more serious and uncomfortable for common people especially in large cities. Growth of traffic here is non-linear as compared to the development of infrastructures such as roads, intersections, flyovers and bridges. It is difficult for most of the time and sometimes impossible to modify or broaden them in existing cities. New construction takes its own time with all constraints. So to smoothen the flow of traffic at intersections, option available is the video processing based smart traffic control system. Such system can allow extracting information from the big traffic issues and helps us deciding to improve the traffic policy. This project aims to render automatic control system on roads and highways. Technically this system is based on computers and cameras. The cameras continuously monitor the traffic by capturing videos and images. The system will extract frames at particular time intervals. The consecutive frames are compared and based on some parameters traffic jam is determined and the traffic light signalling system is used accordingly.

2. EXISTING SYSTEM

Traffic light posts are positioned at road intersections and pedestrian crossings. Traffic light posts blink the light signals after a certain time period which is not a complete systematic system as it cannot solve the traffic problems fully. So, traffic jams take place.

Lack of trained traffic police officers and old manual traffic light control system made this problem worse in many cities. Since the traffic vehicle pressure is not same at every road at the same time, Traffic lights should be controlled by an adaptive system which will detect the traffic conditions and use traffic light signals accordingly.

3. PROPOSED SYSTEM

In our system a camera will be installed alongside the traffic light. It will capture video sequences of traffic condition on road. This technique will analyse the videos from cameras and count the number of vehicles for each direction and also import to the controller. Then the controller estimates a period of time needed by each path to turn on or off traffic light based on the number of vehicles in a fixed sequence.

It can reduce the traffic congestion and avoid the time being wasted by a green light on an empty road. This system is more reliable to detect vehicle presence because it uses actual traffic condition images.

4. BLOCK DIAGRAM

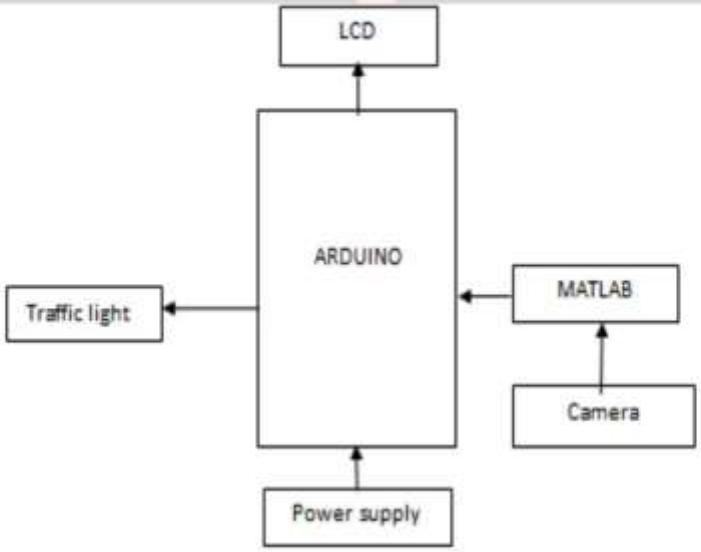

Fig- 1 Overall block diagram

5. MODULE DESCRIPTION

Manual traffic control system uses man power to control traffic. Though the system is effective, it is time consuming. Automatic traffic control system has been implemented in this project. It includes analysing video from the camera and counting the number of vehicles which provides more accurate information for signal decision making. our system is flexible, reliable and cost effective.

5.1 Vechile Detection Procedure

Vehicle Detection is the primary step for the Proposed System. Installed camera will send the output to the main server computer that will analysis that video and give its after analysing result to the microcontroller. The vehicles are detected with the help of OC and camera. Video processing will be done by using MATLAB.

For successfully detecting car with more efficiency, two things are very important in this part of the system. These two are:

1. Camera placing calculation
2. Vehicles Detection Algorithm

5.2 Camera Placing Calculation

Camera placement is very important for better vehicle detection and accuracy. According to proposed project, a camera in the Light post is set up. The height has to be in a certain range so that the software could detect car and detect as many car as possible in a road.

After Taking samples from various heights, calculated shows that when the camera's height is in range between 19 feet to 25 it gives us the best result. In Fig- 3 the position of the camera is illustrated. So camera's height should not exceed 25 feet otherwise there will be problem to detect car for the software.

Camera should be placed in such a place where street light posts are near so that vehicles of the roads can be easily visible at night. Infrared Camera or Thermal camera can be placed for those streets where there is not much street light post, but detection procedure will be different in that case and efficiency can be decreased up to 50%.

5.3 Vechile Detection Algorithm

Here first the vehicles are detected by some car models in xml file. Then background has been subtracted and the shadow by Background Subtraction (BS) with the help of BGS library. Another technique that used here is Blob detection for better detection. Video frames are filtered by area, circularity, convexity and inertia.

Fig-2 Vehicles Detection Process

5.4 Vechile Counting Procedure

The number of vehicles are counted. Vehicle counting is very important for the system, Efficiency of the total System depend on the proper and correct car counting. Without proper vehicle counting, intelligent system will not be able to take correct decision for traffic light control management.

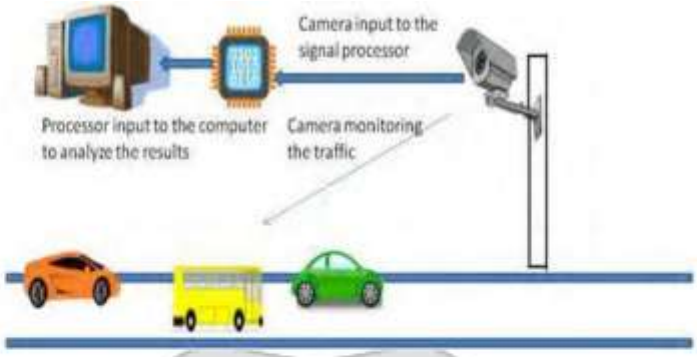

Fig-3 Vehicular flow monitoring system using

5.5 Intelligent Traffic Light Management System

Intelligent system will make the decision after analysing the data it will send command to the traffic light post and traffic light will be controlled according to it. Threshold value is the limiting value of the system. After detecting and measuring vehicles, it will compare the result with threshold value. This System will take further decision based on threshold value. This Threshold value will be set manually up on the basis of cities traffic situation on the road.

Traffic congestion is not same all time it can vary time to time, so this intelligent System will also changes its decision making process on the basis of time. The threshold value for the car detection will be changed according to time.

5.6 Decision Making

Intelligent system follows the instructions and takes the decision by considering time. Using the threshold value, duration of light On/Off can be changed according to traffic condition. In this system will take the output from the camera twice for checking the traffic condition which is described here as camera check 1 and camera check 2.

By considering each road in a four way intersection road in each road traffic is checked twice. By which we can cover almost 50 cars (48.2 cars to be exact) with our camera for a specific road which means if our video processor could detect 48 cars then the OC will send a specific char in our com port of Arduino when it gets car.size>=48 (car.size is the total no. of car, output from the vehicle detection algorithm) or else it will send a random char.

After establishing serial communication, microcontroller will keep checking if there is the assigned char which is in this case ‘s’ in the com port or not, this leads to two situations. If Arduino could detect the char in its com port it will consider the road is crowded and it turns on green light. If Arduino could not detect the char in its com port then the road is not so crowded.

The light will be turned on for 60 seconds. After passing the Assigned 60 second the OC will check again for the traffic. This leads to 2 situations,

1. Greater than threshold value
2. Less than threshold value

6. RESULT

The development of current traffic controlling situation and make things happen smoothly without any blunders. Video detection technology became a new frontier in case of vehicle tracking because of its dependability. This type of traffic signalling is more structured however. Vehicle is detected, counted and smart traffic management system is implemented. The results are shown below.

6.1 Video detection

The figure 4 shows the image from original video that is to be processed for vehicle detection and Figure 5 shows number of frames in the video

Fig- 4 Original image

Fig- 5 Number of frames in the video

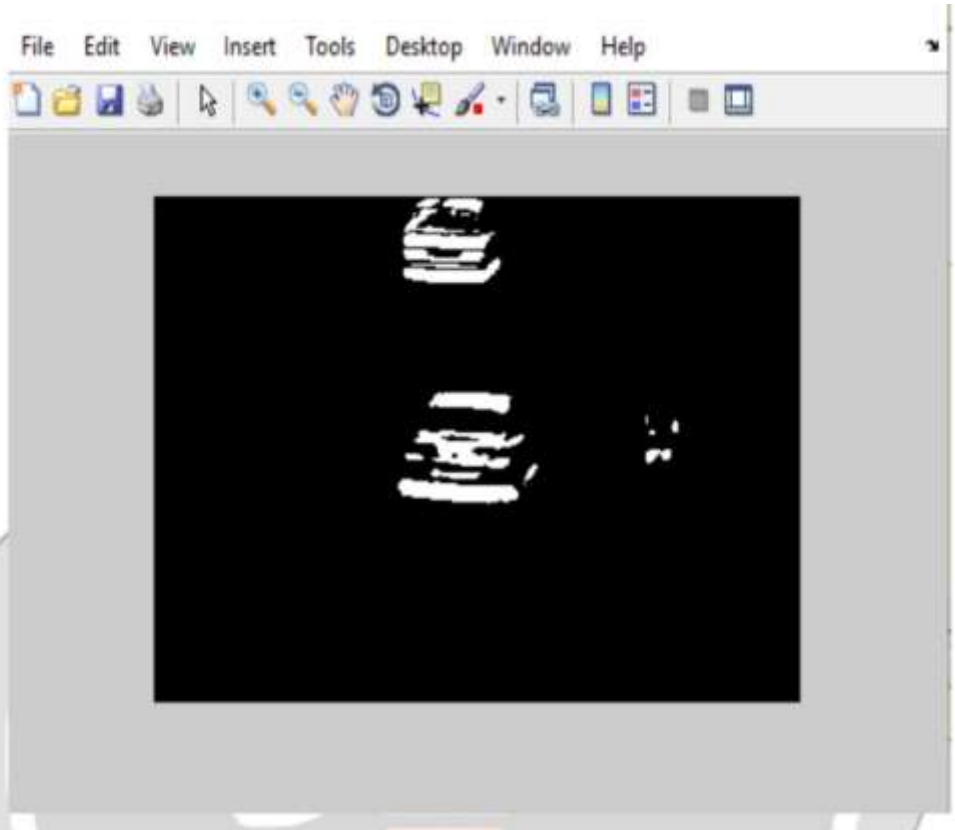

Fig- 6 Output obtained after background subtraction

The figure 6 shows the output obtained after background subtraction. The video is divided into frames. The number of frames is displayed in the command window.

The input image is processed for obtaining the background subtracted image. The current frame and the background image are read and both are converted from colour image to gray scale image (RGB to gray scale conversion). Now the background subtraction is performed using frame differencing technique.

$$B(x,y,t) = I(x,y,t-1)$$
$$|I(x,y,t) - I(x,y,t-1)| = \text{Background subtracted image}$$

B(x,y,t) - Background image at time 't'
I(x,y,t) - Image at time 't'

The background subtracted image is converted to binary image. The boundaries in the binary image are traced.

6.2 Vehicle counting procedure

The figure 7 displays the output obtained for vehicle counting. A line structuring element is created. Properties of the binary image such as area, centroid, bounding box are calculated. The Centroid is used to determine the location of object in pixels. Bounding box is merely the coordinates of rectangular border that fully encloses the digital image. Whenever the area is greater than the threshold value assigned and when the enclosed image crosses the line the count is incremented. The vehicle count is displayed in the command window as shown in Figure 8. Thus, the vehicle count is calculated.

Fig- 7 Output obtained for vehicle counting

Fig- 8 Command window displaying vehicle count

6.3 Intelligent traffic management

This result explains how traffic signals are optimized automatically. For decision making a threshold value which denotes the maximum number of allowed vehicles in a particular lane is determined. The number of vehicles will be counted for each lane and compared with the threshold value. When the vehicle count approaches a value nearer to the threshold value yellow light turns ON and when the vehicle count becomes greater than the threshold value green light turns ON.

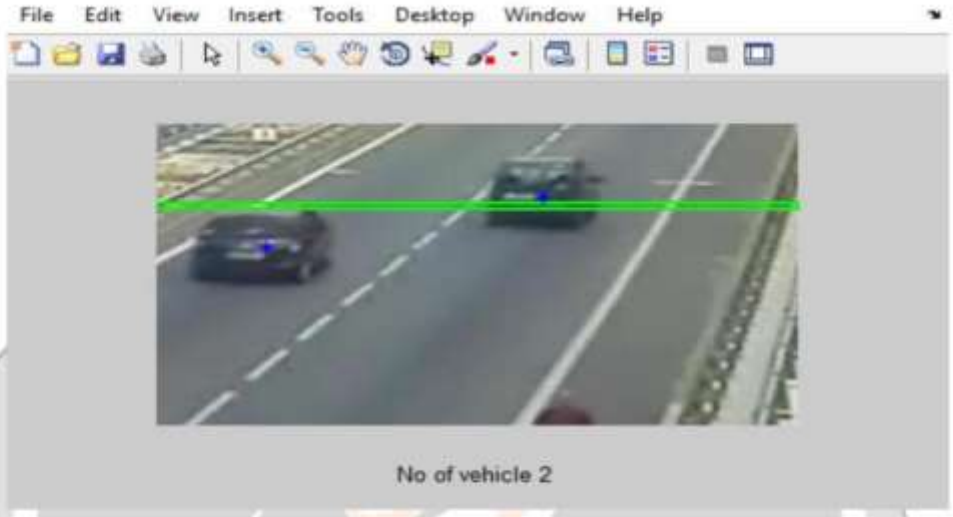

Fig- 11 Output obtained when vehicle count is less than threshold

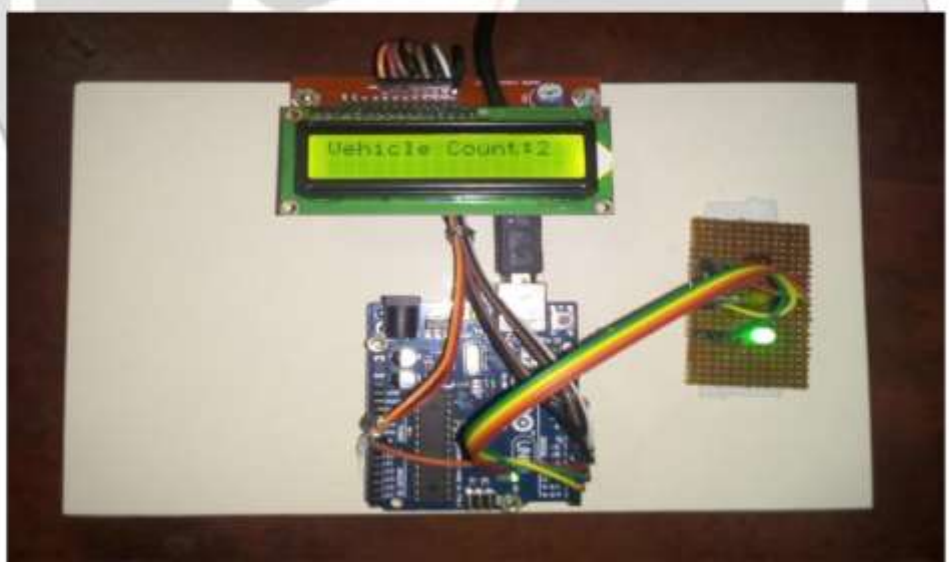

Fig- 12 Green light glows when the count is less than threshold

The figures 11 and 12 show that when the number of vehicles is less than the threshold value in road 1 , the green light is turned ON in road 2.

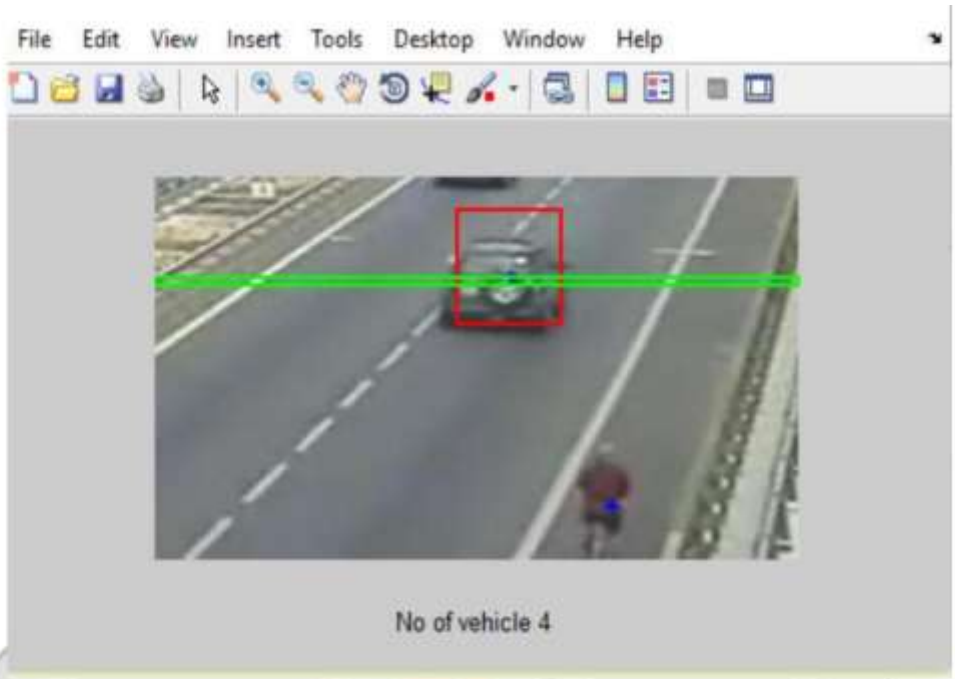

Fig- 13 Output obtained when vehicle count approaches the threshold value

Fig- 14 Yellow light glows when the count approaches threshold value

The figures 13 and 14 show that when the number of vehicles are close to the threshold value in road 1 , the yellow light is turned ON in road 2.

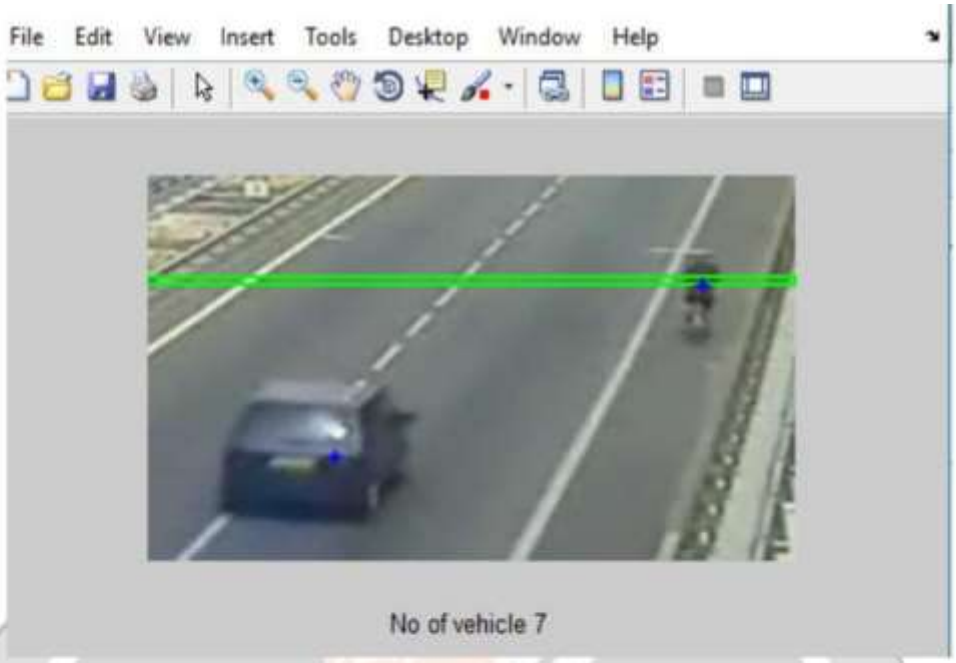

Fig- 15 Output obtained when vehicle count is greater than the threshold value

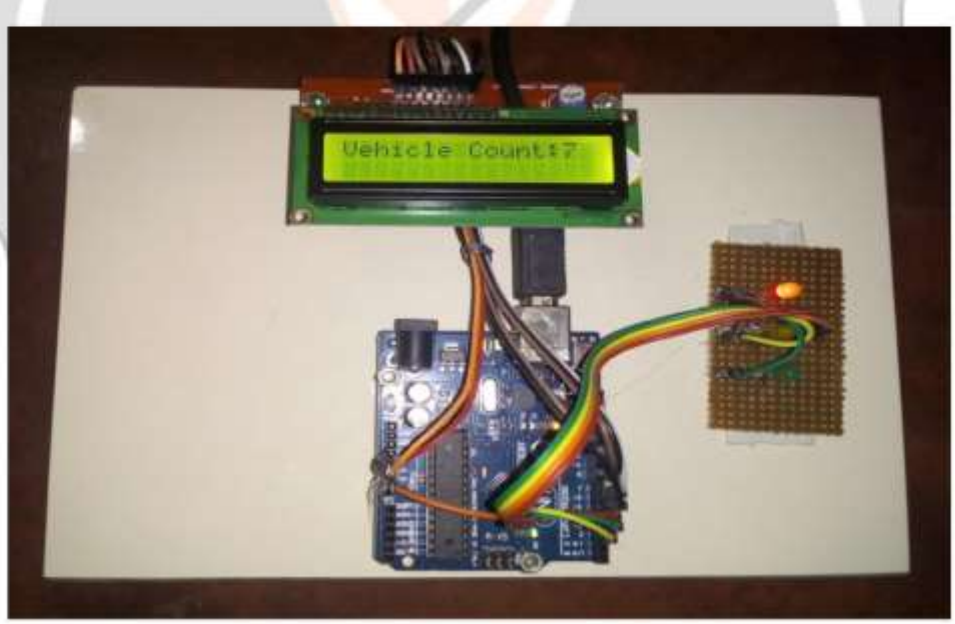

Fig- 16 Red light glows when the count becomes greater than the threshold value

The figures 15 and 16 show that when the number of vehicles are greater than the threshold value in road 1, the red light is turned ON in road 2 and green light is turned ON in road 1 which has high traffic density.The road with more number of vehicles will be allowed to move forward after receiving the green signal. The other will be receiving the red signal at this condition. By this way, we can eliminate the time being wasted by a green light on an empty road.

7. CONCLUSION

Traffic congestion has become a significant issue especially in modern cities. The most common reason of traffic congestion is an inefficient traffic signal controlling system which affects the traffic flow severely. Frequent traffic jams at major junctions always create a need for an efficient traffic management system. In this project, an efficient algorithm for a real time video processing based traffic controller for detecting traffic congestion is implemented. Implementation of our project will exclude the need of traffic personnel at various junctions for regulating the traffic.

8. REFERENCES

[1]. Mahmud Hassan Talukdar – "Framework for Traffic Congestion Management", Economia. Seria Management, Volume.16 , Issue 1, 54-64, 2015.

[2]. Rajesh Dhakad, Manish Jain- "GPS Based Road Traffic Congestion Reporting System", Computational Intelligence and Computing Research (ICCIC), IEEE International Conference, December 2016.

[3]. Natasha Petrovska, Aleksandar Stevanovic- "Traffic Congestion Analysis Visualisation Tool", Intelligent Transportation Systems (ITSC), IEEE 18th International Conference, September 2015.

[4]. Mohammad Samin Yasar and Md. Tahmid Rashid- "Implementation of Dynamic Traffic Light Controllers Using Artificial Neural Networks to Diminish Traffic Ordeals", European Modelling Symposium, October 2015

[5]. Ihtisham Ali, Arsalan Malik, Waqas Ahmed, Sheraz Ali Khan- "Real-Time Vehicle Recognition and Improved Traffic Congestion Resolution", Frontiers of Information Technology (FIT), December 2015, 13th International Conference.