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INTELLEGENT TRAFFIC SIGNAL MANAGEMENT USING RASPBERRY PI AND OPEN CV

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Abstract –
Traffic management is becoming one of the most important issues now a day due to the rapidly growing of urban population due to these; the number of vehicles on the road is increasing rapidly. Due to these the need of controlling streets, highways and roads become the major issue. Due to this problem of proper traffic management, there is a need for advanced technology and equipment to improve the state-ofthe-art of traffic control. Today's traffic management systems are not based on the live scenario, which leads insufficient traffic management. There is a need for developing selfadaptive system helps for better traffic management and helps to reduce the problem. The proposed project represents the method that can be implemented by using Raspberry Pi and its aim to prevent heavy traffic congestion. A web camera is placed in a traffic lane that will capture the images on the road these reference image and capture real-time images are compared. Images are effectively processed to know the traffic density; According to the processed data from Raspberry Pi and OpenCV, the controller will send a command to the timer show the particular time on the signal to manage traffic. Using this information obtained the development of Android application will be done; User can get the information of traffic density of particular location. The emergency vehicle detection such as ambulance, so that it can be detected easily and that lane can be given higher priority.

1.INTRODUCTION

Fast transportation system and rapid transit system are important for economic development of any nation. Mismanagement and traffic congestion results in wastage of time, loss of fuel and money, there is a need for fast, efficient and economical traffic management system. The monitoring and controlling traffic becomes a major problem nowadays. The numbers of users are increasing day by days due to this proper management is being required and there is a need for smart traffic control system. To have proper traffic management there are several techniques are available. But no technique is perfect itself as the real-time situation is continuously changing and the no system is suitable to adopt the change continuously. There is two standard traffic control system such as

1) manual controlling: It requires manpower to control the traffic. Traffic police are allocated to that particular area and he will carry the signboard, sign light, Whistle.

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2) automatic controlling: Controlled by the timers and electronic sensors. The sensor detects the availability of the vehicle and according to that the timers are adjusted. But it has too many drawbacks not adaptable and not an efficient system.

We proposed a system for controlling density based smart traffic light control system in these is aims are to achieve goals:

 Distinguish presence and absence of vehicles in

 capture road image. Signal traffic light goes red when the road is empty.

 Signal the traffic light go green accordingly to the density of the vehicle and the duration of green light adjusted based on calculation.

 Provide Proiority to emergecy vehicles

This proposed system can be done by using Raspberry Pi and aim to have proper traffic management. The camera is installed in the particular area where all the lanes are visible just above the traffic light. The film comes in the form of consecutive frames and each frame is compared with the first frame from which the density of car specified, further, the number of vehicles are displayed on the screen. According to that traffic control algorithm is used to display the allocation time. Accordingly, the green light adjusted. Then the use of emergency vehicle detection is made which helps to detect the ambulance and the emergency vehicle accordingly the lane is given higher priority. These are passed on the hardware which is consists of Raspberry Pi SoC for processing and controlling traffic lights. According to that, the traffic signal is being controlled. Using the information of traffic density is passed on the android application user can select the location as per his choice. It gives various locations along with the traffic status. This status provided information can use to choose the particular location to the destination. This application is easy and no extra cost is required. In these use of canny edge detection made because

1) Have a proper detection, a strong response even at low contours.

2) a good location guarantee ensures .

3) for a contour there will be only one edge detection avoid the effects of rebounds.

As per stated in [7], Here these shows the comparison between different edge detection technique such as zero crossing, Prewitt, LOG, Robert, canny and Sobel. The Canny edge detector is better than other techniques due to its higher accuracy in detection of an object with higher entropy, PSNR (Peak Signal to Noise Ratio), MSE (Mean Square Error) and better execution time. It's having better overall performance as compared to other techniques.

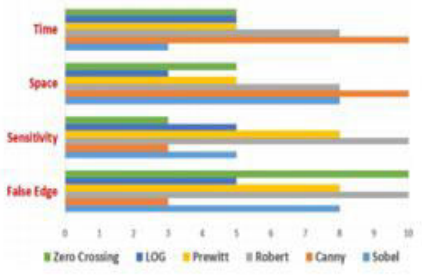

Fig -1: Comparative analysis of distinct edge detection technique

2.PROPOSED SYSTEM METHODOLOGY

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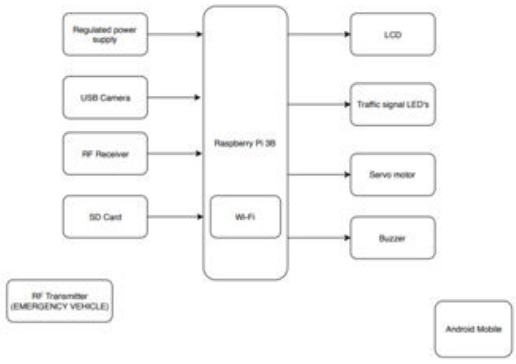

The aim of proposed system is to introduce a system which is cost effective and compatible with the existing system to solve the problems of the present system. Understanding the problems that we face today and the various approaches adopted by different works, we propose a system as shown in Fig. 1. Block diagram of the proposed system manily consists of the image capturing device (camera), Raspberry Pi SoC, Radio frequecy transmitter,receiver and the traffic signal controlling algorithm.

A. Image Capture

The sensor which is used to monitor vehicles is an image capturing unit, camera. The frames of images can be effectively analyzed. For this we use the cameras already installed in the traffic islands by the Motor Vehicle Department (MVD) to capture the videos of the traffic.

B.Image Processing

In this section, image obtained from camera are processed to get the count of the vehicles. Here we use Raspberry-pi and OpenCV- Python platform to process the video captured. The steps involved are:

- Filtering the image: Here we use a Gaussian filter to filter out the errors such as illumination and intensity variations, poor contrast etc. Filtering helps us to extract the required part of the image by suppressing unwanted variations.
- Conversion of RGB to HSV since the colour information is usually is much noisier than the HSV information, also the effect of shadow is minimized.
- Background Subtraction: Here from the subject image• the background image (the empty road image) is subtracted. Subtraction operation is taking bitwise XOR of the two images [13]. The resultant image consists only the difference elements of the two images.
- Conversion of HSV image to GRAY: The difference image which is in HSV form is converted to GRAY for thresholding.
- Thresholding: The GRAY image is thresholded to get the binary difference image, which contain only the difference elements.
- Area estimation: Now the region occupied by the vehicles is calculated by the area covered by it. Based on this value approximate time is allotted to each lane.

C.Object Detection

The object here i.e. the vehicle is isolated during image processing step is counted based on the area occupied by it in the image. In area estimation we get an area value corresponding to the number of pixels occupied by the vehicle. Based on what percentage of the road is occupied we assign time based algorithm.

D.Traffic Control Algorithm

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With the area count as the input data we developed an algorithm to control the traffic lights connected to the GPIO pins of the Raspberry pi.

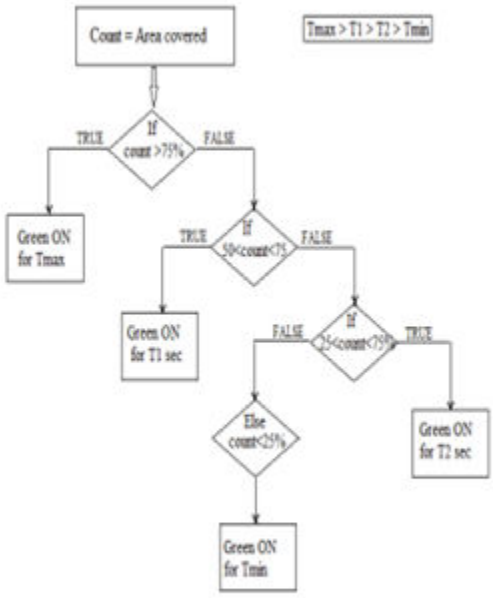

Fig. 2. Flow Chart of the Traffic Control

The flow chart shown in Fig. 2 the area covered is taken as 'count' value, and based on it four time delays are assigned. The algorithm is based on what percentage of the total area is occupied by the vehicle. If the traffic is greater than 75% of the total area a maximum time Tmax is allotted to that lane, similarly if the count is between 50%-75% a lesser time T1 is allotted, 25%-50% T2 is allotted and finally if density is less than 25% a minimum value of time i.e. Tmin is allotted to that lane. The value of Tmax, T1, T2 and Tmin (Tmax > T1 > T2 > Tmin) depend on the region, vehicular speed, road condition, road type etc.

E. Emergency Signallig

The proposed system cosists of Radio frequecy trance receivers to idetify emergecy vehicles and provides gree signal on corresponding lane.

3.RESULT ANALYSYS

Based on the above methodology analysis were conducted different sample images. The programs were done Python 2.7 supported by image processing software OpenCV and its associated libraries. The image is read from the video and is converted to hue saturation and value (HSV) form. The background is subtracted from it to get the subject image i.e. the vehicle. The image is converted to binary and the area of the subject is calculated. The results obtained for a sample as per the above discussed methodology are shown in Figures below. The shell result involves the pixel occupied by the subject (vehicle), and the traffic calculation based on it. Fig. 3 shows a case where there is six cars detected and result indicating 50%-75% traffic. Fig. 4 shows the case with four cars detected indicating 25-50% traffic

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Fig. 3. Figure showing result of six cars detected and output showing 50=75% traffic

Fig. 4.

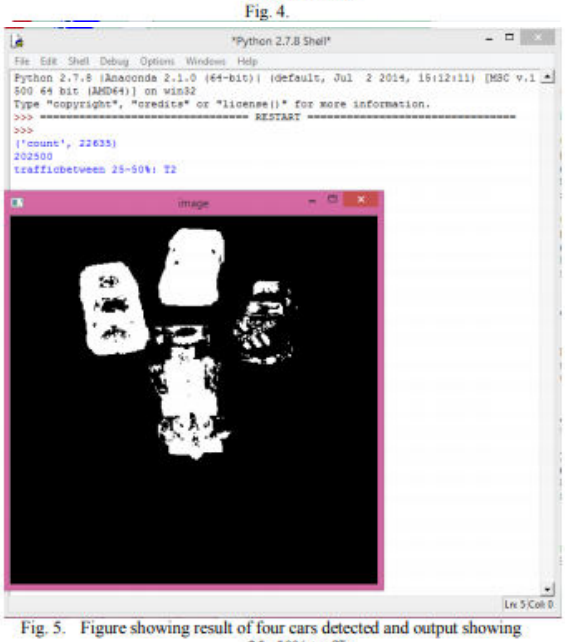
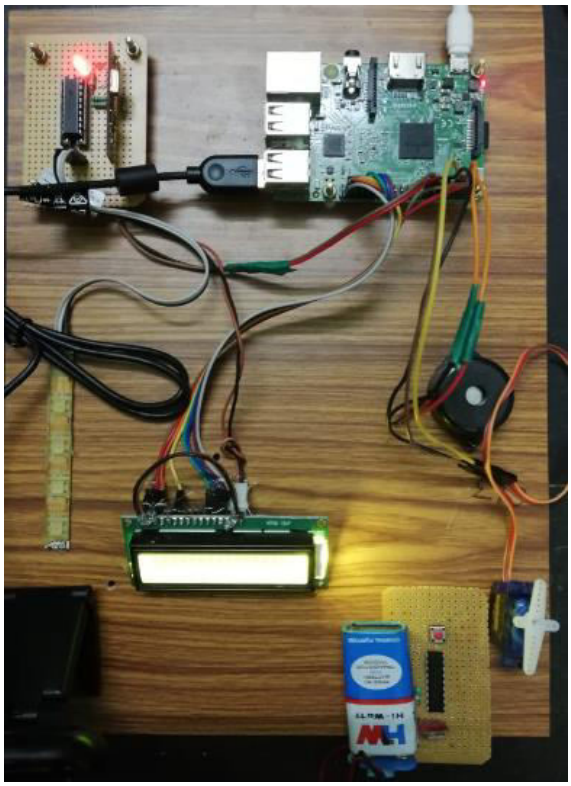


Fig. 5. Figure showing result of four cars detected and output showing 25=50% traffic



4. CONCLUSION AND FUTURE SCOPE

In the proposed project we discuss a method for estimating the traffic density on the different lane based on image processing, we can use it to count the number of dynamic vehicles that are passing on the highway and to control the traffic. These are advantageous technique over such as the use of Ariel imagery, complex sensor-based system and using any additional devices, such as RFIDs. The image is acquired by the camera and it's being placed at a particular height. Traffic information extraction is done by combining the two techniques such as gradient magnitude and frame subtraction method. The vehicle count is found out by using bounding box property, further according to the traffic control algorithm we

can allocate the time limit to the particular lane according to the traffic density. The use of emergency vehicle detection algorithm helps to detect the vehicle such as ambulance, fire vehicles etc. Helps to give the priority to those emergency vehicles. The controlling of traffic light takes place through the raspberry Pi GPIO pis. the traffic light control based on the priority assigned. The use of the Android-based application to detect the traffic status to the user and accordingly decided the path to the destination. It helps to save the time and also to control the traffic.The present system uses a single camera for monitoring traffic at an intersection. By using a separate camera for each road at an intersection can improve the system efficiency further. The vehicle objects can also be categorized into various classes depending upon the geometrical shape of vehicle for blocking the passage of large vehicles e.g. trucks during day time.

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