Real Time Traffic Light Control using Image Processing

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Abstract— As the number of vehicles on the road increases to control and manage this heavy traffic it becomes extremely difficult. So the proposed system uses a webcam mounted to observe the traffic on the road. On each captured image, we are using different image processing techniques and based on the result, the duration of traffic light on each lane the priority is set. On the basis of the priority is allocated. Then a lane which is having heavy traffic, green light signal is turned on for a long time. Also we are using MATLAB programming in simulating and developing the system.

Key words: Image processing, traffic light control, real time image capture, vehicle counting, blob detection technique

I. INTRODUCTION

Many developing countries faces traffic congestion problem due to ineffective traffic light control Initially fixed timing signals were used but they are not desirable as they do not work for the actual road conditions thereby traffic jam problems occurs. These signals The introduces delays which adversely affects the quality of life as well as environment. In addition,the economic crises also takes place as traffic problem causes severe loss on companies production of many countries.To overcome these problems is to construct new roadways, flyovers;intercity train should be introduced so as to enhance public transport. But the availability of free space will demand new infrastructure thus imposes a serious problem and also various environmental conditions are severly damaged.Hence to overcome the above limitation there is a need to improve the existing traffic light system such that it is able to manage the traffic flow in smooth and efficient manner. Thus traffic control system can be developed which can be adaptive and reliable,used to monitor traffic conditions and sets the timing of traffic lights according to the actual road conditions[1].

II. BLOCK DIAGRAM

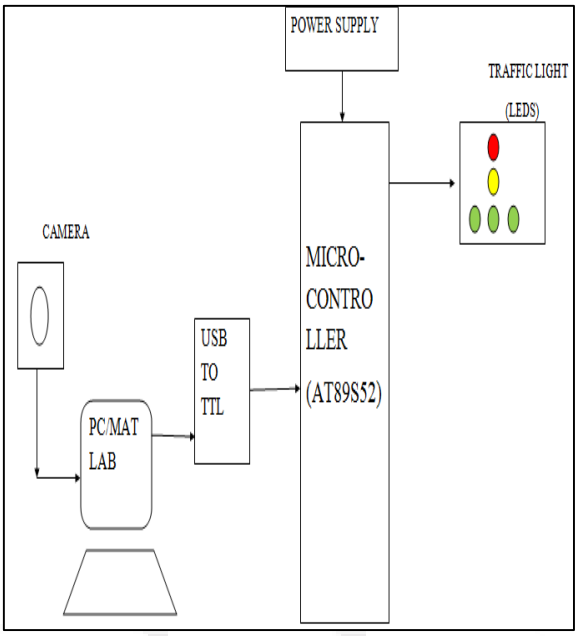

Fig. 1:

III. FLOWCHART

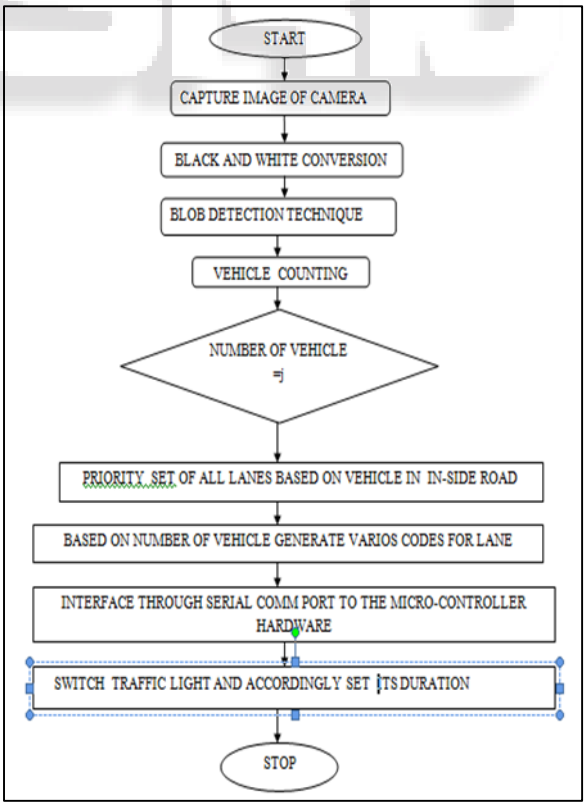

Fig. 2:

A. Image Analysis:

An image is captured from the webcam and is processed to calculate the total area covered by vehicles on the road.The more the number of vehicles on the road , the more will be the area covered by the vehicles and also more time will be assigned to that road.

Steps of the image processing described below :

1) Region Of Interest (ROI) Selection:

It is a method used for selecting a region of interest (ROI) which is used to filter out undesired information present on roads. Since the image is a matrix, so some desired rows and columns are considered and remaining are deleted from these images and these are then image is saved as region of interest area. The portion of the original image which is selected is known as cropping of image.

2) Conversion To Grayscale:

The captured image of actual road is converted into grayscale image.

3) Conversion To Binary:

The grayscale image is then converted to binary image with some threshold value.

4) Applying ROI:

The converted binary image is ended on image as pixel by pixel basis to remove the undesired area.

5) Blob Detection Technique:

Blob detection technique is used at detecting regions in a digital image which is differ in properties compared to surrounding regions.Blob is a region of an image in which some properties of pixels are constant.

6) Thresholding: :

If the pixel value in an image is less than the predefined threshold value(T) , it will results in black pixel and if the pixel value in an image is greater than the predefined threshold value(T) , it will results in white pixel.

7) Road Time Calculation:

Based on number vehicle detected the time is allocated to signals of all roads at intersection. More vehicle high priority and less vehicle least priority.

IV. RELATED WORK

In the following discussion, some of the state of the art work done for controlling traffic is presented. In this paper description of solution for the older system of hard coded lights which cause unwanted delays thereby leading to traffic congestions on road. Reducing congestion and the number of accidents will be reduced as waiting time will lessen and also introduces fuel consumption which in turn will help in controlling the air pollution.

Algorithm or method used: 1) hard-coded. 2) Dynamic. The difference in the above two methods lies in the aspect of waiting time.Considering factors of Shadows and Weather conditions like Rain, the system is affected. System can be further improved by using background detection techniques.[2] For vehicle tracking: lane masking algorithm for edge detection :Laplace ,sobel, and prewitt this method include such benefits as: sensors are not required,it has low cost and setup is easy and also has relatively good speed and accuracy. This method is extremely sensitive to light by using specific filters during image processing.[3]. The microcontroller already has the software embedded in it and the entire circuitry of the system control the traffic light. The real time data is obtained by using image processing methods and also by using background detection technique. Thereby efficiency of traffic control system can be improved by employing traffic light system that operate on real time data other than fixed data and to employ affordable and power efficient traffic-lights control system operated by microcontroller Required proper circuit connection.

Monitoring of the complete system. Checking connection problem.[4]. Prewitt edge detection method is used and according to the result obtained the duration of traffic lights can be controlled. Image processing is a advanced technique used to control the state of change of the traffic lights. It avoids the time being wasted by a green light on an empty road.the accuracy of this method is very high for the vehicles presence detection as it uses actual traffic images. A camera has to be installed,captures image sequences and is connected alongside of traffic lights.A reference image of empty road is initially set, then the sequentially captured images are matched using image matching. Still improvements are needed in the system to achieve a better results. [5].In this paper pre-emptive scheduling algorithm is used. The algorithm uses Countdown-style timer and has a strong real-time control capability and relatively low hardware requirement..The algorithm used in this paper takes into account both fairness and traffic efficiency. The hardware will cost more than that of two algorithms, in the paper, more improvement can be made in the decision algorithm to make proper decisions for switching process. [6].

A. Advantage:

- The main advantage of this system is the adaptation of the cycle period to the entire region's traffic profile.
- Its network configuration which is based on a point-to-point architecture, thus avoiding the higher complexity and cost..
- It avoids the time being wasted by a green light on an empty road.
- Flexible as it adjusts the timing of traffic lights according to the actual road conditions.

B. Limitations:

- Project cannot work same if one of the lanes is having slope (Flyovers, bridge etc.)
- On rainy days the accuracy is reduced when the camera less contains raindrops, when there are very heavy vehicles, such as trucks or tankers or lorries, in the view, and when there is very low light around dusk or dawn.

V. EXPERIMENTAL RESULTS

1) Take a black cardboard paper. Draw 4 lanes and each lane divided into a 2 part, one is IN and other is as an OUT.
2) Place a camera such a way that it can capture the entire top view of the cardboard.
3) Place vehicle on that cardboard in the form of stickers.
4) We are using 4 traffic signal set to clear the priority.
5) Camera automatically will capture the entire image of the 4 lane i.e. the image of the cardboard.
6) MATLAB is used which identify the number of vehicle present in the each lane IN and OUT part.

7) The count of the vehicle will get display on the command window of the MATLAB.
8) MATLAB will send specific characters for each lane IN and OUT, that depends on the number of vehicles. The specific characters for each IN and OUT vehicle count fixed by MATLAB programmer.
9) The specific characters will get send from USB to TTL to Uc in binary form.
10) Uc programming helps to identify which characters will get received and according to that it gives priority to that lane in which traffic density will be maximum.
11) In such a way that traffic priority will get cleared. Clear all four lane traffic and then again camera will get ready to click next image.
12) Each lane IN is used to decide the priority and OUT is used to decide the duration. For how much duration LED need to be on that decided by number of vehicles presented in OUT.

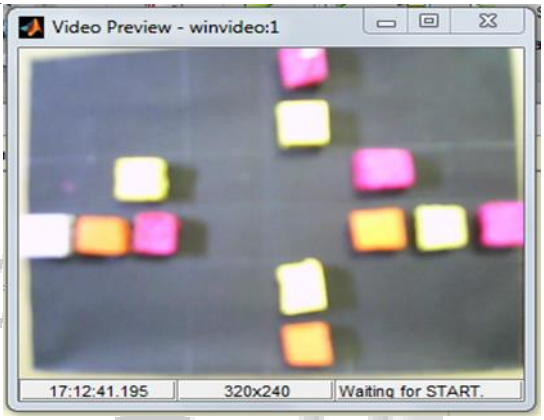

Fig. 3: real-time image captured

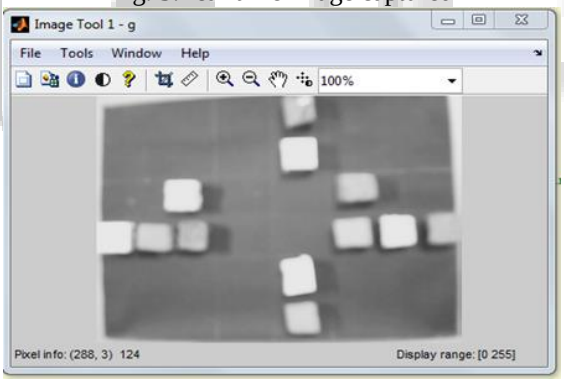

Fig. 4: grey-scale conversion.

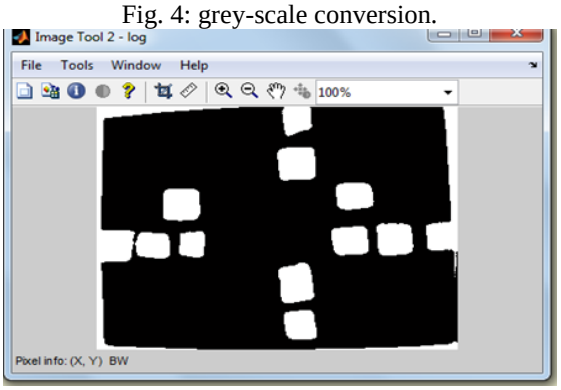

Fig. 5: threshold image

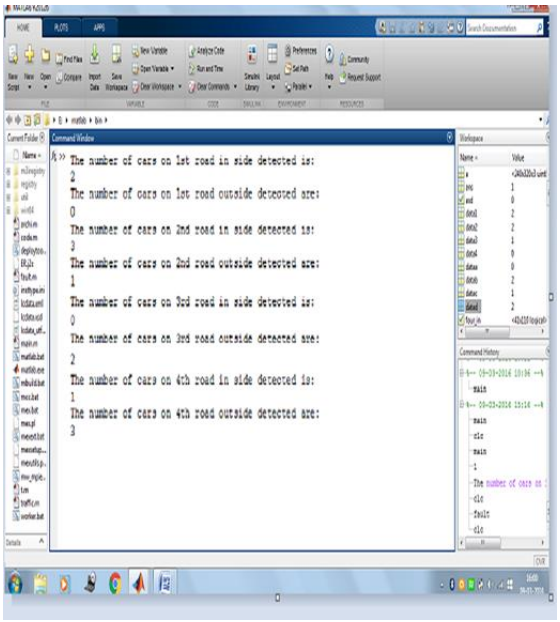

Fig. 6:

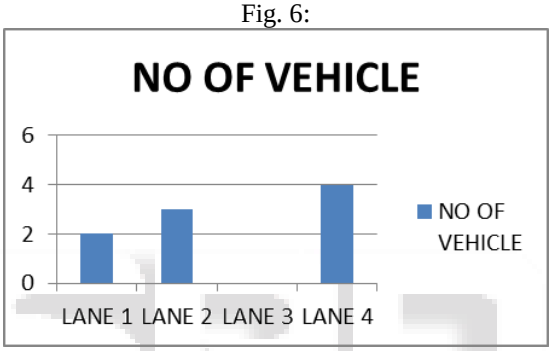

Fig. 7:

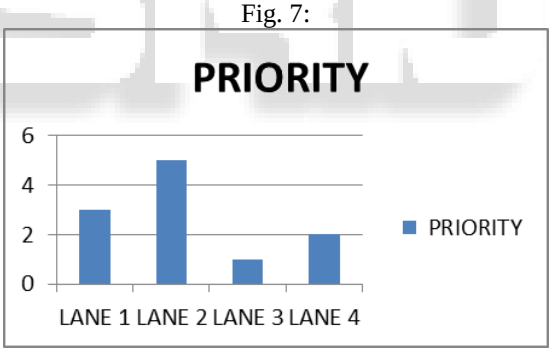

Fig. 8:

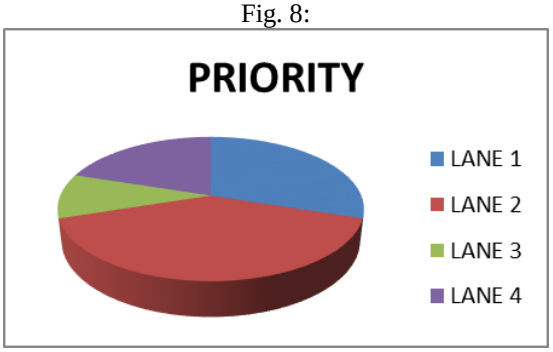

Fig. 9:

VI. FUTURE SCOPE

The present system uses a camera for monitoring traffic at an intersection. By using a separate camera for each road at an intersection will allow the system to do video processing which can improve the system efficiency further. The vehicle

objects categorized into different categories depending on the geometrical shape of the vehicle ,for the passage of heavy vehicles e.g., trucks is blocked during day times. The emergency mode can be refined further by installing a GPS receiver in ambulance so that the base station will keep track of the ambulance location on a continuous basis and clear the road whenever will be required.

VII. CONCLUSION

In this project, the traffic is estimated using image processing. This is done by using webcam which captured images from the road. Each image is processed separately and the number of each cars is being counted individually. If the number of cars exceeds a specific threshold, warning of heavy traffic will be shown automatically. In this new method many advantages are included which benefits as use of image processing over sensors, low cost, easy setup and relatively good accuracy and speed.Production costs are low while achieving high speed and accuracy because we are implementing this method using Image Processing and Matlab software.

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