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Intelligent Traffic Light System by Using Video Processing

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Abstract **–** In this paper, a novel real-time traffic control system using video processing techniques is presented. In the proposed method, a webcam is used in each stage of traffic lighting in order to take real video state of the roads. Counting the total number of vehicles in these images is realized using image processing tools in Open CV and different timing are allocated according to the count along with a green signal for vehicles to pass. In the proposed prototype, the green and red signals are represented using LED's and the decremented timer for the green signal is represented by typing in the result screen of the Raspberry Pi. Index Terms—Image processing, edge detection, traffic congestion detection, intelligent traffic control system.

Keywords – Video Processing, Image Binarization,

I. Introduction

This Traffic congestion is a severe problem in many major cities across the world. Conventional traffic light system is based on fixed time concept allotted to each side of the junction which is not changed according to traffic density in specific junctions. Because of this there is unnecessary wastage of time and fuel consumption. It leads to undesired traffic jams. The simple solution to the problem is to control traffic signals according to traffic density. The main aim of this project is to monitor the density of traffic on the road and control the traffic lights at different junctions based on the density of vehicles. There are a lot of solutions to solve this problem by using (sensors – cameras – traffic men -signals-. . . . etc.). Using an IR proximity sensor arranged at four lanes to detect presence of the vehicles is a solution. In real time, we can use laser beam with LDR (Light Dependent Resistor) sensors or arranged in front of each other at exactly opposite sides of the road such that light from laser always falls on LDR sensor. If any vehicle interrupts laser beam, the LDR sensor status changes. The advantage of laser is long range as compared with IR sensors having short detection range. The IR proximity sensor module has IR LED which acts as transmitter and photo diode which acts as receiver. The sensors are arranged side by side in the module. Whenever any object i.e. vehicle in our case comes in front of it, IR radiations get reflected back to photo diode and sensor output changes. The sensor output is given to micro-controller which processes data and control traffic signals accordingly. It is proposed an area-based technique for the detection of traffic density using camera by video processing for smart traffic light control system. This technique can better estimate the traffic density using the area occupied by the edges of vehicles. Area based traffic density estimation will be more effective for controlling traffic lights than the conventional methods for the countries, this technique will depend on the Raspberry Pi with Python code on the OPEN CV program to detect the number of vehicles.

II. LITERATURE REVIEWS

A lot of techniques are proposed to detect traffic density to control traffic signals. Authors in [1], for example, presented an approach for detecting vehicles in urban traffic scenes by means of rule-based reasoning on visual data. However, we observe in [2] a queue detection algorithm consisting of motion detection and vehicle detection operations, based on extracting edges of the scene was introduced. Meanwhile, we notice in [3] that a traffic signal control method to adjust signal split using the information of vehicular queues at a critical intersection was proposed. With regards to [4], it presented a vehicle detection algorithms which was developed using the traffic images collected from various scenes covering 100-250 m of a three-lanes freeway. On the other hand, in [5] the use of the theory of fuzzy sets in constructing a controller based on linguistic control instructions was introduced. Whereas in [6] the authors' idea was that the signal controller at a single intersection should control its traffic. As for [7], it reviews a distributed traffic control system built upon a fuzzy distributed architecture which was developed earlier, whereas we notice that [8] presented an approach to self-organizing traffic signal control based on a fully distributed system of cooperative local controllers. As for [9], it presented the development of a realtime traffic adaptive control scheme based on fuzzy logic for isolated and coordinated intersections. Likewise, the authors of [10] proposed a fuzzy traffic lights controller to be used at a complex traffic junction, meanwhile, [11] dealt mainly with signal controllers which controls a single intersection. Nevertheless, [12] described the installation of a fuzzy signal controller (FSC) at a real intersection, whereas [13] presented a fuzzy traffic controller for a set of intersections and its simulation results. In [14], a framework for a dynamic and automatic traffic light control expert system combined with a simulation model was proposed. Comparatively, a GA based intelligent traffic signal scheduling model was presented by the authors of [15]. However, a method of real time area based traffic density estimation using image processing for intelligent traffic control system is described in [16]. On the other hand, [17] adopted the multigene system approach to develop distributed unsupervised traffic responsive signal control models, whereas [18] described the process of developing a traffic signal control for isolated intersections using artificial neural networks. On the other hand, [19] explored the feasibility of using neural networks for centralized control and distributed control. Whereas it is observed that authors in [20] presented an innovative measure-of-effectiveness that evaluates the interruptions of the traffic flow caused by the traffic signal and also reflects the needs of traffic engineers. In additions, a new hybrid, synergistic approach in applying computational intelligence concepts to implement a cooperative, hierarchical, multigene system for real-time traffic signal control of a complex traffic network was developed in [21]. However how many of the important theoretical results concerning reinforcement learning in mdps extend to a generalized mdp model was shown in [22].

III. METHODOLOGY

Our method for detecting traffic congestion involves the following steps:

A. *Real Time Image Processing*

1. *Image Subtraction.*
2. *Pre-processing.*
3. *Greyscale conversion.*
4. *Image Binarization.*

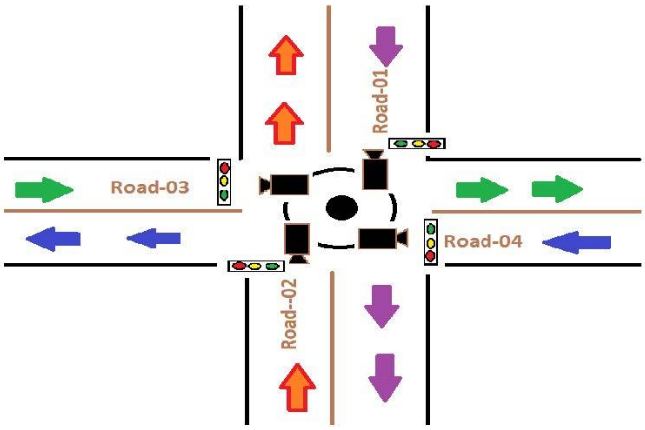

Fig. 1 Image acquisition processing.

In the figure 1. The platform design four cameras are used to observe the roads but in real time used a common camera that can control all the roads.

B. *Decision Making:*

A System having camera is installed at the intersection of lanes, where camera continuously records the traffic. It will then send the recorded video and will take one frame per second from the video and then will send it to Raspberry for processing it in Open CV software. Raspberry and camera will be connected using Data cable.

C. *Change of Timer according to the traffic density*

Timer can be changed according to the output of number of cars. This project works manly on junction. Considering two lanes, each lane is divided into two parts via the input lane and the output lane. The lane having the maximum number of vehicles in the input lane will be given the first priority, the lane with the number of vehicles lesser than the higher priority lane will be give the second priority

D. *System Stemimplementatiom*

A System having camera is installed at the intersection of lanes, where camera continuously records the traffic. It will then send the recorded video and will take one frame per second from the video and then will send it to Raspberry for processing it in Open CV software. Raspberry and camera will be connected using Data cable.

a. *Image Subtraction:*

In system we already save background image without vehicles (Initial Condition) and subtracts current image of traffic from background image.

Fig. 1 Live Image without masks.

b. *Image Acquisition:*

Image of the vehicle is captured using video camera and transferred to the image processing system in Open CV.

c. *Pre-processing:*

Acquired image is enhanced using contrast and brightness enhancement techniques.

d. *Greyscale conversion:*

It involves conversion of colour image into a gray image. The method is based on different colour transform. According to the R, G, B value in the image in fig.3, it calculates the value of gray value, and obtains the gray image at the same time.

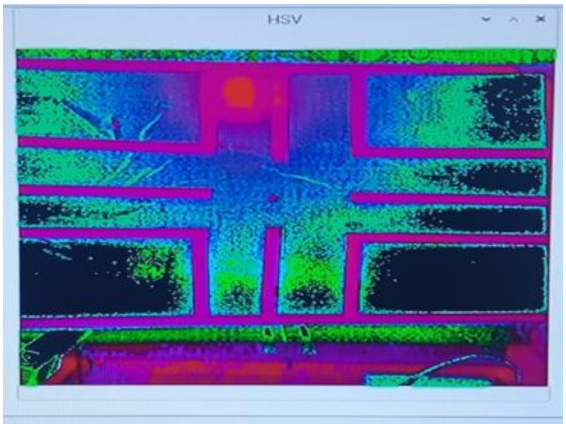

Fig. 3 Live Image with HSV mask.

Fig. 4 Live Image with thresh mask.

e. *Image Binarization:*

Greyscale image is converted into black and white image i.e. binary image using thresholding operation. Traffic Density Calculation: By applying Blob Detection analysis on the binary image number of vehicles will be count and compare with Traffic density threshold that we see in figure 4. Figure 5 shows the flow chart of whole area based traffic density estimation method control the traffic light based on the vehicles counter results so that the congested lane is passed first. A camera is fixed overlooking the intersection continuously capturing frames of approaching vehicle. Frames are processed in real time to detect the vehicles object and Using Open CV lib for object detection vehicles are detected and a count is kept for the number of cars in each lane.

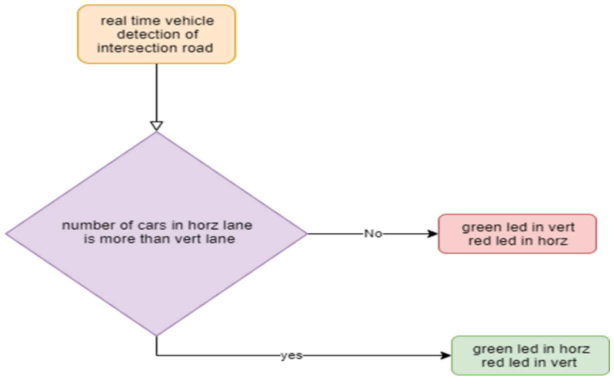

Fig. 5 Flow chart of traffic congestion estimation process

IV.CONCLUSION

We observe that there are many projects that can assess the problem of congestion at traffic lights, but all these systems are not worthy of the best solution to the problem. In this research processing video using the image processing technology received by the Raspberry Pi system we can calculate the number of cars and open light signals without human intervention and automatically and quickly What distinguishes this system is the ease of inclusion and work and application in fact this system will solve the problems of congestion and change the traditional traffic signs of smart systems that suit the communities.

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