Traffic Light Signal Control using Image Processing

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Abstract-*Traffic congestion has become a major problem in every large city of the world. To ensure a reliable transportation system it is important to have an intelligent traffic control system. Different techniques have been proposed to acquire traffic information. Most of the work detects edge of the vehicles and counts the number of traffic on the road. However the disadvantage of the method is that counting the number of vehicles may give faulty results when spaces between the vehicles on the road are very small (i.e. two cars very close to each other may be counted as one vehicle). We propose a method that finds out total amount of pixels in an image which corresponds to the amount of area of occupied by vehicles on the road rather than finding number of vehicles. The greater the amount of area occupied by vehicles on the road the greater the amount of traffic congestion. This way every kind of vehicles can be accounted for traffic density. Using this traffic data we propose a model for traffic signal control depending on the amount of traffic on the road. Time allocated for each road is made variable by weighing its time allocation depending on the traffic density.*

Keywords- Edge detection, Background Subtraction, Greyscale, Image enhancement, Morphological operations.

I. INTRODUCTION

As the population of the modern cities is increasing use of vehicles is also increasing which is leading to traffic congestion problem. Traffic congestion has been a critical problem and challenge in the metro cities. The increased traffic has leads to problems such as wastage of time and fuel also people lose time, miss opportunities, and get frustrated. Traffic load is highly dependent on parameters such as time, day, season, weather and unpredictable situations such as accidents, special events or constructional activities, these parameters contribute to a great extent and create delays. To solve congestion problem new roads are constructed. The disadvantage of making new roads is that it consumes more space. So for that reason there is a need to change the system rather than making infrastructure twice. Image processing techniques has been very valuable topic to deal with traffic issues because it is easy to maintain and is more smart system [2].

Different techniques [2]–[3] have been proposed to acquire traffic information. Most of the work detects edge of the vehicles and counts the number of traffic on the road. However the disadvantage of the method is that counting the number of vehicles may give faulty results when space between the vehicles on the road is very small (i.e. two cars very close to each other may be counted as one vehicle). Moreover most of the methods treat only cars as traffic but in many parts of the world rickshaws, auto rickshaws, bikes are major part of everyday traffic such as in south Asian countries.

In this paper we propose a method that finds out total amount of pixels in a video frame which corresponds to the amount of area of occupied by vehicles on the road rather than finding number of vehicles. The greater the amount of area occupied by vehicles on the road the greater the amount of traffic congestion. This way every kind of vehicles can be accounted for traffic density. Using this traffic data we propose a model for traffic signal control depending on the amount of traffic on the road. Time allocated for each road is made variable by weighing its time allocation depending on the traffic density.

II. LITERATURE REVIEW

The paper presented by Ms. Pallavi Choudekar and team says that image processing is a better technique to control the state change of the traffic light. It shows that it can reduce the traffic congestion and avoids the time being wasted by a green light on an empty road. Use of actual traffic images helps in detecting vehicles more consistently. It visualizes the reality so it functions much better than those systems that rely on the detection of the vehicles' metal content. [3].

But her technique is based on detecting edges and counting number of vehicles. This technique may causes error since it uses number of vehicles as a factor while this paper suggests a technique which uses density of road as a factor to assign time to traffic signal.

A review paper presented by Massimo Piccardi shows how we can subtract background from a particular image. This paper says Background subtraction is an approach for detecting moving objects in videos from cameras placed in

fixed location. The rationale in the approach is that of detecting the moving objects from the difference between the current frame and a reference frame, often called "background image". As a baric, the background image must be a representation of the scene with no moving objects and must be kept regularly updated so as to adapt to the varying luminaire conditions and geometry settings. More complex models have extended the concept of "background subtraction" beyond its literal meaning [4].

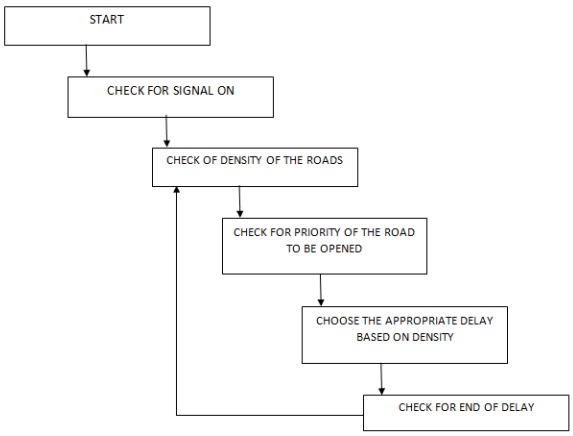
There are many subtraction methods available and presented in M. Piccardi's paper. We will use MATLAB since it has many inbuilt functions which do this work of Background subtraction easily [5]. Complete analysis of performance of various methods is show in M. Piccardi's paper, accordingly we will use them [4].

Pezhman Niksaz [6] proposed a system that estimates the size of traffic on roads by using image processing and as a result a message is shown to update the system with the number of cars on roads. This project has been implemented by using the MATLAB software and it aims to prevent heavy traffic in highways. Moreover, for implementing this project following steps must be considered: Image acquisition, RGB to grayscale transformation, Image enhancement and morphological operations. At first, image of road is captured by a camera has been installed in road. Then, the image comes in the form of consecutive frames and each image is compared with the first image. After that, the number of cars in the road is calculated. Depending on number of cars on the road message is shown and time is allotted to the signal accordingly.

In this particular research paper they have used live video footage. Camera is capturing live video and the video is then converted to consecutive images by taking snapshots. This approach is difficult to implement as we have nothing to do with live video footage. So we avoided this method and decided to use a simple web-camera only.

III. PROPOSED SYSTEM

Our proposed system used to calculate density of Traffic. We will start with capturing the image of vehicles. We will capture image using a camera fixed at traffic signal. After this we will put the image in the MATLAB software and image pre-processing will be performed after that. This process will improve the quality of image. Following this we will perform segmentation which will focus on a particular part which we want to analyses. Next is feature extraction in which we will extract the focused part. We will store this image for the future comparison.



A. Input Images:

First image empty road i.e. Background Image is captured. Then this image is transferred in MATLAB software as a reference image and it will be used for further processing. Then Foreground image is captured frequently on real time based and then compared with background image.

B. Image pre-processing(Background image):

After transferring image into software then it requires pre-processing. In this step, image is converted into greyscale (background image).This image is used as a reference image.

C. Image (Foreground image):

In this step, foreground image is converted into greyscale. Then this image is subtracted from Background image. After this we need to do some noise removal to remove the noise introduced by subtraction. We choose wiener filter because of its ability remove the additive noise and invert the blurring simultaneously. After that we perform flood fill operation to fill the holes in the objects with closed contours and we get image with solid foreground objects. Now we obtain a binary image after flood fill.

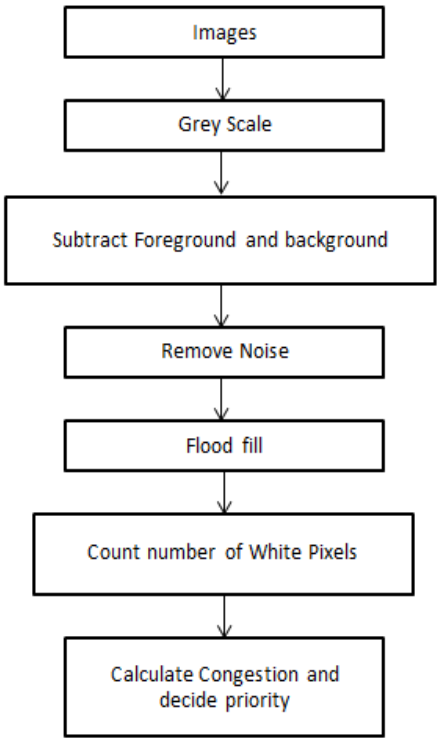
D. Calculating Density:

In this step, image obtained after processing of foreground image is used for calculating density of road occupied by vehicles. This is done by calculating white pixels present in the image.

E. Traffic control Algorithm:

We formulate a simple traffic algorithm to implement in the traffic system. We take the traffic densities of different roads at any certain time as input. We find the road with high density and give more time to that lane (high density means more traffic and high number of vehicles). If density is same then equal time is allocated to both the lanes.

The following image describes the flow diagram of the system



IV. CONCLUSION

In this paper, we have determined the traffic density by measuring total area occupied by vehicles on the road and used it as traffic density. We have set variable traffic cycle depending on the total traffic density of all the roads at the junction. Depending on the traffic density a weight is determined for each road and total traffic cycle is weighted for the roads. This way an automated traffic control system may be designed. This model could be extended to incorporate a large number of interconnected traffic junctions and using their traffic density to adjust adjacent junction's time allocation.

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