Intelligent Traffic Light Control Using Image Processing

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Abstract- *In India, with the growing number of vehicles, traffic congestion at junctions has become a serious issue. The density of vehicles is increasing day by day and there is an urgent need of adaptive traffic signals which can do real time monitoring of traffic density. This paper describes a system which uses image processing for regulating the traffic in an effective manner by taking images of traffic at a junction. A step by step approach of image acquisition, image processing and implementation of algorithm to change the traffic light duration as per the density of vehicles on different roads at a traffic signal is followed. The number of objects in a given image is counted and priority is given to the densest road.*

Keywords- MATLAB, Camera, Image Processing, Traffic Congestion, Traffic Monitoring, Priority

I. INTRODUCTION

Traffic lights play a very significant role in traffic control and regulation on a daily basis. The traffic lights that are used nowadays comprise of three lights: Red for stop, Yellow for wait and Green for go. Users are made to wait for the signal to change from red to yellow and then from yellow to green. The time that a commuter has to wait for is decided by the traffic signals. The traffic lights used nowadays are hardwired at the time of installation. They are pre-programmed to wait for a fixed duration of time after every change in signal. It is independent of the traffic on the roads and remains constant during its operation. Sometimes there is a situation where one particular road is very crowded as compared to others. A simple way of decongesting the road is by allocating more time for the vehicles on the densest road to pass as compared to other less dense roads. The system should be intelligent enough to decide the priority on a daily basis.

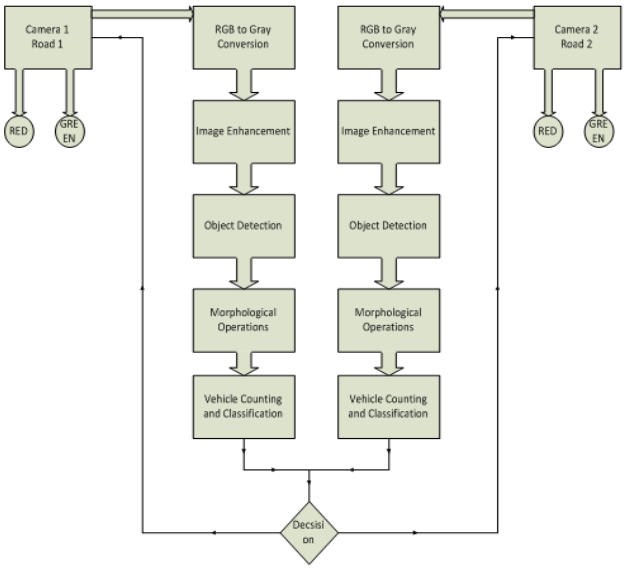
In this system, basically, the waiting time for the motorists on road with higher density is reduced. In doing so, the images for each lane are taken and processed simulataneously and a decision is passed as to which lane should be given how much amount of time and which should be the highest priority.

A camera is used to take pictures of the roads that connect in a traffic junction. The pictures taken are then processed to determine the density of vehicles on each road at that instant. A list of priority is assigned to each road in one cycle and the waiting time for that road is made to vary according to its density. A denser road is given more time to pass all its vehicles and reduce the traffic at the junction. This system is subjected to less hardware failure as it consists of a camera mounted on top of the signal which captures images and sends the images for image processing. Using MATLAB the density of the roads is determined and the microcontroller changes the duration of green light given for each road as per the output after image processing.

II. EXISTING TRAFFIC LIGHT SYSTEMS

It's The traffic lights used in India are basically pre-timed wherein the time of each lane to have a green signal is fixed. In a four lane traffic signal one lane is given a green signal at a time. Thus, the traffic light allows the vehicles of all lanes to pass in a sequence. So, the traffic can advance in either straight direction or turn by 90 degrees as shown in Fig.1.

So even if the traffic density in a particular lane is the least, it has to wait unnecessarily for a long time and when it gets the green signal it unnecessarily makes other lanes wait for even longer durations.



III. METHODOLOGY

A. Image acquisition

The image is captured by a webcam. It is then transferred to the computer via a USB cable. The image acquisition and further processing is done by using MATLAB.

B. This Image processing

The image is captured by using a webcam placed at the road junction. It has the capability of taking images of all the roads meeting at the junction. The webcam is mounted on the DC motor. The motor is responsible for capturing images from all directions in steps of fixed time interval. The speed of rotation of the camera is designed to be such that it is greater than the click-to-capture time of the camera. The acquired image is converted to grey scale image for further processing. The grey scale image is then converted to a binary image that contains only two colours, black and white. This image is known as the threshold image. The main purpose of thresholding the image is a radical reduction of information in order to simplify further processing. The thresholded image is then complemented for further image processing.

1) Image cropping

The desired portion of the image is retained and the rest is cropped. Only the lane at which there is an incoming traffic at the junction is to be processed. Hence the image is cropped to select that section of the lane

2) Image Enhancement

In this process the images are adjusted in such a way that the results are more suitable for further processing. In this, the obtained image is converted into a greyscale image.

3) Thresholding

Thresholding is transforming the greyscale image into black and white image (binary: white=1, black=0). The main purpose of thresholding is a radical reduction of information in order to simplify further processing. White colour is assigned to all the pixels that have luminosity greater than the threshold level and the others as black.

4) Edge detection

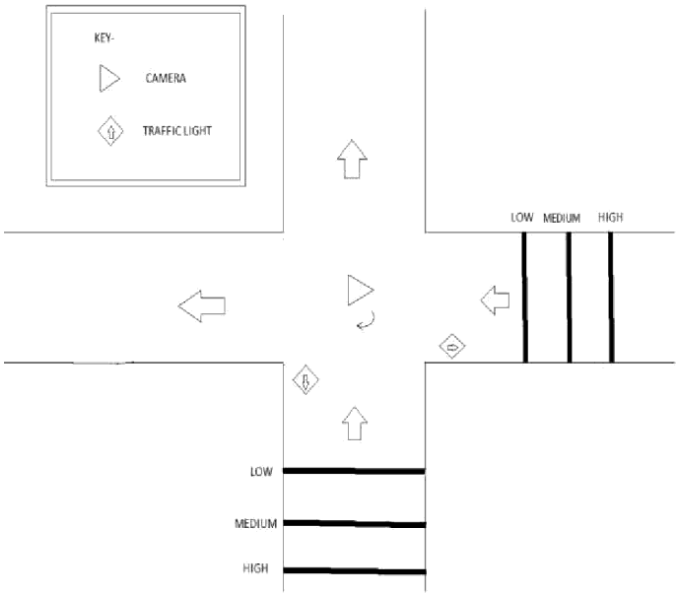
Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensities which characterize the boundaries of objects in an image.It filters out useless information, while keeping the important structural properties of an image. In this proposed system, canny edge detection technique is used. The boundaries of each image are found and the number of objects is calculated.

5) Object Counting

To count the objects present in the image, the close boundaries of the objects are identified. The exterior boundaries of the objects as well as the boundaries of holes inside these objects in the binary image are counted.

IV. PROTOTYPE DESIGN

The traffic monitoring system comprises of camera, led as traffic light. When the power is applied the system starts monitoring, the main road traffic is given the highest priority and the cars are let to pass and have free flow on main road and the side road is continuously monitored . This monitoring is done through the camera, the camera captures the image and image is sent for the processing, through Matlab the image is processed and based on the processed image the traffic signal is switched accordingly.



V. CONCLUSIONS

In this project, a method for estimating the traffic using Image Processing is presented. This is done by using the camera images captured from the highway and videos taken are converted to the image sequences. Each image is processed separately and the number of cars has been counted. If the number of cars exceeds a specific threshold, warning of heavy traffic will be shown automatically. The advantages of this new method include such benefits as use of image processing over sensors, low cost, easy setup and relatively good accuracy and speed. Because this method has been implemented using Image Processing and Mat lab software, production costs are low while achieving high speed and accuracy.

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