Intelligent Traffic Light Control Using Image Processing

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Abstract- *In India, with the developing number of vehicles, traffic blockage at intersections has gotten to be a genuine issue. The density of vehicles is expanding day by day and there is a critical requirement of versatile activity signals which can do genuine time observing of traffic density. This paper depicts a framework which employs image processing for controlling traffic. As traffic lights used in India are usually pre-timed whereas time for each lane to have green signal is fixed. We propose a system where the traffic lights are controlled depending on the density of vehicles in each lane. A camera is used to take pictures of vehicles. The pictures are processed using MATLAB and depending on the density of vehicles traffic lights are controlled. This reduces the traffic congestion as priority is given depending on the density of traffic.*

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

I. INTRODUCTION

Traffic Lights play a major role in developing countries like India. In India the number of vehicle users are increasing day by day as the population in India is growing as a result people using vehicles are increasing. There are 3 signals for controlling traffic. They are red, green and yellow. Red signal is to stop. Green Signal is to proceed or go and yellow signal is to get ready. The problem with existing traffic light control systems is that the traffic lights used in India are usually pre-timed. The time for each lane to have green light is fixed.

In some areas human resources are used for controlling the traffic. Traffic police control the traffic in some busy areas in order to clear the traffic and control the traffic congestion. In this project the traffic is controlled automatically depending on the density of vehicles. A camera is used to take pictures of each road. These pictures are then compared with the reference image. The reference image used here is the empty road. The reference image is compared with the images that are taken by the camera placed at the junction. Depending upon the percentage matching traffic lights are controlled. The hard ware used in this project is only a camera so the hardware failure of the system will be less.

II. EXISTING TRAFFIC LIGHTSYSTEM:

The traffic lights employed in India are basically pre-timed where in the time of every lane to possess a green signal is fixed. During a four lane traffic light one lane is given a green signal at a time. Hence the traffic lights allow vehicles 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 whether or not the traffic density during a particular lane is that the least, it’s to attend unnecessarily for a protracted time and when it gets the green signal it unnecessarily makes other lanes watch for even longer durations.

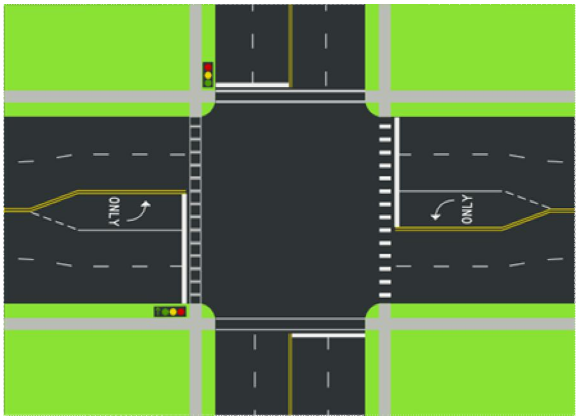


Fig.1 Lane diagram

III. METHODOLOGY

The proposed system basically consists of four steps. They are a) RGB to gray conversion b) Image resizing c) Image enhancement d) Edge detection. These steps are done for reference and captured images.The above mentioned steps are carried out for both reference and captured image simultaneously. At the end percentage matching for both the images are carried out and accordingly timing is given for controlling traffic at the junction.

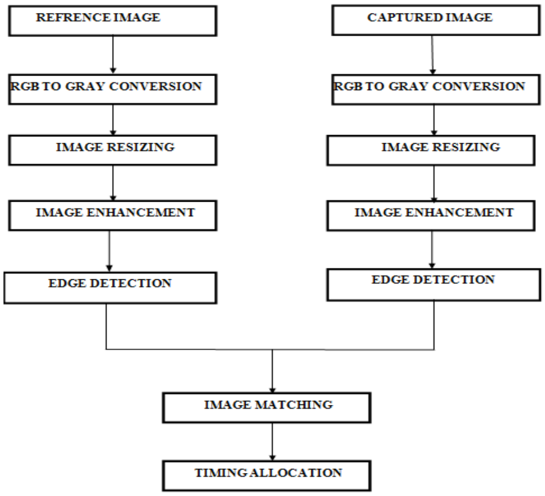


Fig.2 Block diagram

A. RGB to gray conversion:

Human beings sense colour through wavelength-sensitive sensory cells called cones. There are three different types of cones, each has a different sensitivity to electromagnetic light of different wavelength. One cone may be sensitive to green light, one to red light, and one to blue light. By emitting a specified combination of these three colours red, green and blue and hence stimulate the three types of cones. We are able to generate almost any colour. This is the main reason behind why colour images are often stored as three separate image matrices; one storing the amount of red (R) in each pixel, one the amount of green (G) and one the amount of blue (B). We can call such colour images as stored in an RGB format. In grayscale images. When translating an RGB image to grayscale, we have to consider the RGB values for each pixel and make as output a single value reflecting the brightness of that pixel. One of the approaches is to take the average of the contribution from each channel: (R+B+C)/3. However, since the perceived brightness is often dominated by the green component, a different, more "human-oriented", method is to consider a weighted average,

$$e.g:0.3R+0.59G+0.11$$

We convert the captured image from RGB to gray at the same time we convert the reference image from RGB to gray in order to make the further process simple. The gray converted image is then resized for further processing. RGB to gray conversion is an important step in image processing technique. RGB to gray conversion is done by using the average method and it is the easiest one. You simply have to take the common three colours. Since it is an RGB image, it is a skill that you have to add r with g with b and divide it by 3.

Fig.3 RGB to gray converted image

B. Image resizing:

Resizing an image is carried out the usage of a software program to add or subtract pixels, and is referred to as resampling. When a picture is resampled it increases or decreases the width and height of the image in pixels. There are different methods to resize an image, such as cropping it to a smaller size. In MATLAB image resizing is done by using the command im.resize(required pixel size). The reference image as well as captured image is resized to our required size.

C. Image Enhancement:

Image enhancement is the manner of adjusting digital photographs so that the outcomes are extra suitable for display or similarly photograph analysis. For example, you can take away noise, sharpen, or brighten an image, making it less difficult to identify key features. The reference and captured image both are enhanced to improve their quality.

D. Edge Detection:

Edge detection is an image processing approach for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, pc vision and computing device vision. The edge detection method used is prewitt’s edge detection method. The prewitt operator is used in image processing, especially inside part detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image depth function. At every factor in the image, the result of the prewitt operator is either the corresponding gradient vector or norm of this vector.

The prewitt operator is primarily based on convolving the photo with a small, separable and integer valued filter.

IV. IMPLEMENTATION ALGORITHM:

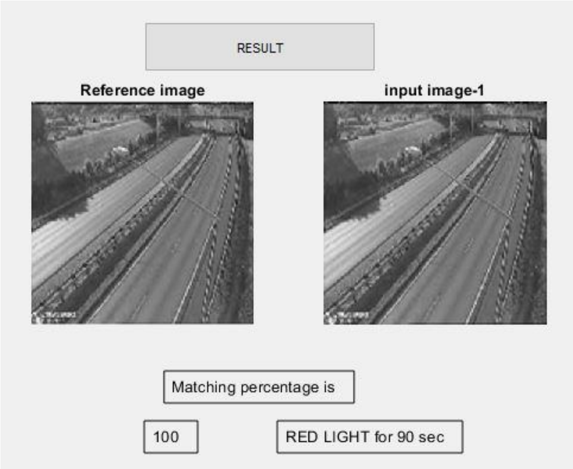
The algorithm behind the diagram consists of following steps. They are

1. The reference image that is to be compared with the captured image is captured by using a camera that is installed at the junction.
2. The images are then processed in to following steps
    a. Images are rescaled to 100x100 pixels.
    b. Then the above rescaled images are converted from RGB to gray.
3. Edge detection of this processed image is done by using the prewitt's edge detection technique.
4. The output images of the previous step are matched using pixel to pixel matching technique.
5. Timing allocation is done depending on the percentage matching. They are as follows
    a. If the matching is between 0 to 30% - green light for 90 seconds.
    b. If the matching is between 30 to 50% - green light for 60 seconds.
    c. If the matching is between 50 to 70% - green light for 30 seconds.
    d. If the matching is between 70 to 90% - green light for 20 seconds.
    e. If the matching is between 90 to 100% - red light for 90 seconds.

The above algorithm is implemented in MATLAB and output is observed accordingly.

V. RESULTS

Depending on the percentage matching mentioned above the results are as follows. In the below figure the matching percentage is between 90-100 so the output will be displayed as RED for 90 seconds.



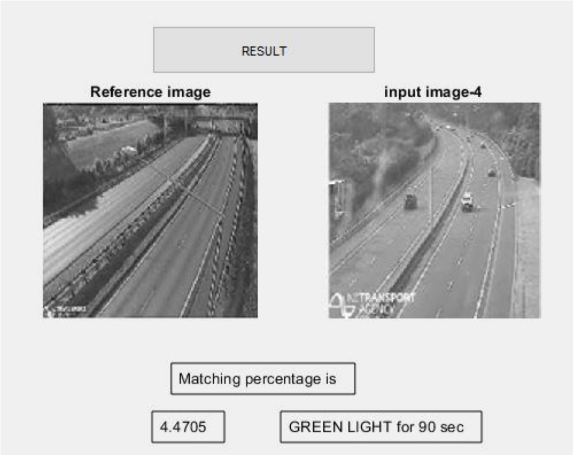
Matching percentage is

100

RED LIGHT for 90 sec

Fig.4 Matching between 90-100%

If the percentage matching is between 0 to 30 the output displayed will be green for 90 seconds



Matching percentage is

4.4705

GREEN LIGHT for 90 sec

Fig.5 Matching between 0 to 30%

VI. CONCLUSION

"Intelligent traffic light control using Image Processing" technique that we proposed overcomes all the constraints. Earlier in automatic control use of timer had a drawback that the time is being wated by green light on the empty road. Now dependig on the percentage matching between the reference and captured road the traffic is controlled at the junction. This is cost efficient as it has only a camera and no hardware is used.

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