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SMART CONTROL OF TRAFFIC LIGHT SYSTEM USING IMAGE PROCESSING

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ABSTRACT

Traffic congestion at junctions has become a serious issue among motorists due to the growing number of registered vehicles in Malaysia. Traffic light is commonly used to control the flow at road junction. Pre-time and count down timers are widely used in traffic light control system. Often, this control system unable to handle heavy traffic flows due to fixed-time setting and cause traffic jam. Therefore, there is a need of adaptive traffic signals which are able to perform real time monitoring of traffic density. This study proposed a system that uses image processing in controlling the traffic flow in an effective manner by taking images of each lane at a junction. The system applies image processing technic determine the priorities of green signal based on real time traffic density. Edge detection is used to detect the density of traffic at each lane. More time is allocated for the vehicles on the densest road to pass compared to other less dense road. Arduino is used as a microcontroller to control the changes of each signal of the traffic lights based on the traffic density. Smart traffic light system could bring benefits to smooth motion of vehicles in the transportation routes.

Keywords: edge detection, image processing, traffic congestion, traffic light

1. INTRODUCTION

In Malaysia, traffic congestion at junctions has become a serious issue among motorists. Traffic lights play important role in controlling and regulating traffic. There are several types of traffic lights used such as pre-timed traffic light with the timing for each signal is determined based on traffic volume and traffic patterns in each particular area [1]. Another type of traffic light used countdown timer that consist of a two-digit time indicator placed on the pole above the traffic signal to help motorists to be conscious of the time left in the green phase and the traffic flow better [2]. These type of traffic lights often unable to handle unexpected heavy traffic flows and cause traffic jam due to it fixed-time setting. Images processing is a tool used to conduct various image operations to extract certain image information [3]. This study proposed a system that uses image processing to control the traffic by taking images of each lane at a junction. More time is allocated for the vehicles on the densest road to pass compared to other less dense road.

2. METHODOLOGY

The input image of each lane of the road junction is captured by using a camera. The acquired images are then converted to a greyscale image from 3D pixel value (R, G, B) to a 1D value to reduce complexity for further processing. The overall block diagram of the image processing for the control system is shown in Figure 1.

Figure 1. The Overall Block Diagram of Image Processing for the Control System

Canny edge detection is used to extract edges of the vehicles in the acquired images. Dilation operation is then used to preserve the details of the vehicles in the images. After the images have been dilated, the image with vehicles is then being matched with the reference image using image matching technique. The features of both images include edges and texture are being extracted and the percentage of the image matching is calculated. The traffic signal will be controlled and traffic congestion will be estimated based on the percentage of the image matching. Basically, high percentage of the image matching means the traffic at that particular lane is less congested. Therefore, less duration of green signal is given to that particular lane and vice versa.

3. RESULT AND DISCUSSION

Figure 2 shows MATLAB GUI was developed to simulate the traffic light control system.

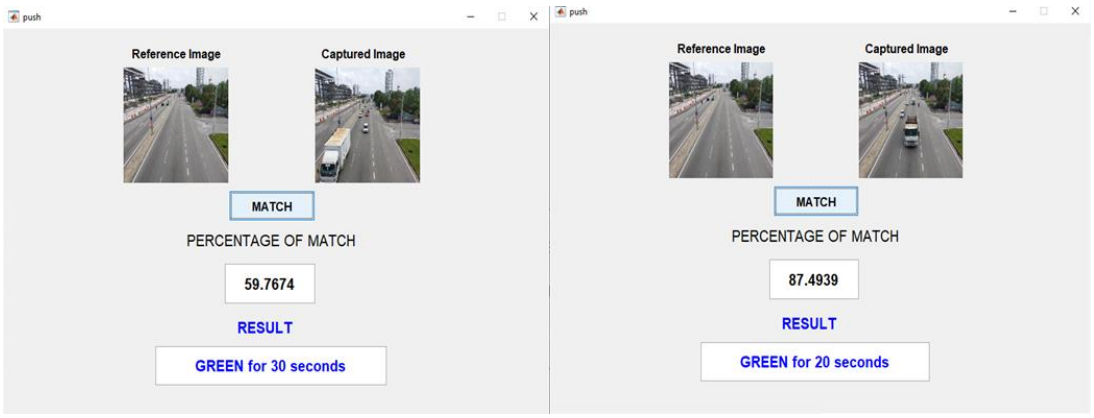

Figure 2. MATLAB GUI Result Simulation

The image of an empty lane to be used as reference and the image of lane with vehicles to match with the reference image were chosen. Both of the images were matched and the percentage of match is determined. The percentage of match will affect the duration of green light for each of the lane. The Arduino board is interfaced with the MATLAB by using a USB cable. The output from the processed images in MATLAB is send to Arduino which responsible in controlling the changes in the traffic light signal for each lane.

CONCLUSION

This paper presents the development of an adaptive traffic light control system by using image processing technique. This technique is much more significant in controlling the traffic. It able to detect the presence of vehicles consistently as real-time images of the traffic are used, thus, time allocation of green signals to the densest lane with vehicles is more compared to other less dense road in order to reduce the traffic congestion. Hence, it is more effective and accurate than other techniques used to control the traffic.

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