



REVIEW ON TRAFFIC LIGHT CONTROL SYSTEMS FOR EMERGENCY VEHICLES

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Abstract

With the growing number of vehicles, traffic congestion and transportation delay on roads are increasing day by day. Due to this increase in traffic, emergency vehicle such as ambulance, fire services etc. get stuck and wait for a long time, which is not desirable. Therefore it is important to develop a powerful method that helps in solving the traffic congestion problem adaptively and efficiency of transportation especially for emergency vehicles such as ambulance. Image processing technique can be used to solve this problem effectively, so that the vehicles can reach their destination at the earliest.

Keywords: traffic congestion, image processing, traffic control

I. INTRODUCTION

With growth in traffic, there is occurrence of a number of problems and some of them are increase in traffic congestion, accidents and transportation delays. Emergency vehicles such as ambulance, VIP vehicles etc. get stuck in traffic signal and waste their valuable time. So an easy and flexible system should be there which would easily control the traffic signal adaptively. Image processing techniques can be used for controlling the traffic light and for avoiding the traffic congestion.

II. LITERATURE SURVEY

Traffic congestion is a problem which has contributed a huge obstacle to the transportation system. Traffic light signal control for emergency vehicles has been developed using a number of techniques. It can be detected using ZigBee module CC2500, Using 434 MHz Radio and Programmable Integrated Circuit (PIC), CMOS

image sensor along with ripple algorithm performs template matching procedure to detect the presence of emergency vehicle and traffic light control. Automated voice sensor can be attached to the signal post in order control the traffic light by analyzing the siren sound.

III. METHODS FOR TRAFFIC LIGHT CONTROL

Ilmudin, M.H.A., et al [1] has designed a system which will be operated when it received signal from emergency vehicles based on radio frequency (RF) transmission and used the Programmable Integrated Circuit (PIC) 16F877A microcontroller to change the sequence back to the normal sequence before the emergency mode was triggered. When an emergency vehicle approaches the traffic light intersections, the emergency vehicle will send a signal to the receiver which is placed at traffic light. The traffic signal will change from red light to green light in a specific duration of time as soon as the receiver or controller receives emergency signals. This system will reduce accidents which often happen due to emergency vehicles. Traffic light control system for emergency vehicle using this radio frequency (RF) will easily make emergency vehicle to cross the traffic light intersection. . The radio frequency of 434 MHz is used as the medium for emergency vehicle to communicate with traffic light system.

Karthikeyan [2] has implemented a system for detecting emergency vehicle using ZigBee modules. ZigBee is a low-power, low data rate, and close proximity wireless and hoc network. Due to its low power consumption, transmission distances limits to a range of 10–100 meters line-of-sight, depending on power output and

environmental characteristics. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. In Emergency vehicle detection system, ZigBee transmitter module will be placed on all the emergency vehicles and the ZigBee receiver will be implemented at the traffic junction. The buzzer will be switched ON when the vehicle is used for emergency purpose. This will send the signal through the ZigBee transmitter to the ZigBee receiver. It will make the traffic light to change to green. Once the ambulance passes through, the receiver no longer receives the ZigBee signal and the traffic light will turn to red. This system is implemented in cross roads. According to F. Andronicus [3], visible CMOS image sensor can be used to detect the presence of emergency vehicle such as ambulance. The captured video will be processed in Matlab software based on a ripple algorithm. The ripple algorithm uses the templates of an ambulance from the number of frames abstracted from the input video. Images will be taken from different angles. Then it compares all the frames with the selected template one by one. Thresholding is done to convert greyscale images in to binary images. Template Matching is done for image matching with the similarity matrix. The maximum correlation occurs when the template and corresponding image are identical. Hence from the given template the emergency vehicle can be detected. Then the output is sent through UART to ARM processor in order to control the traffic lights. If an Ambulance is detected the signal goes green and if it is not detected the light goes red. And in normal cases, the signal continues between green, yellow and red lights. Ghazal, Bilal, et al. [4] discussed about a handheld portable device that can be mounted on emergency vehicles or implemented in the traffic control center. The portable device will have two push buttons labeled EA and EB. The EA button is pressed when the emergency vehicle arrives at the intersection from one side of traffic light say A and a configuration is set in such a way that the green light will ON in order to provide sufficient time to the emergency vehicle to pass the intersection. Next, the EA button is pressed again to return to the normal mode. The EB button is pressed when the emergency vehicle is approaching from the other side of traffic light, say B. If emergency vehicles approaches from

both sides then both buttons will be pressed and the priority will be given to first button i.e. EA. P. Rohini Priya [5] has discussed Traffic light control system using pre-emption that can be used for emergency vehicles. An automated voice sensor is used if emergency vehicles like ambulances, fire engines etc. want to pass by when the signal is red. The sound of any vehicle is absorbed by the voice ICAPR9600 and sent to the microcontroller. Here this automatic voice sensor will be attached to the traffic light. Once the emergency vehicle approaches, voice sensor will recognizes the siren sound of the emergency vehicles and shifts the red signal to green. This is done in such a way that the voice that is absorbed by the voice IC is matched with the already saved pattern of the siren. If the pattern matches, then it will instruct the control system to change the light system accordingly. Siren sound can be recognized from a distance of 500m from the signal. When the path for emergency vehicle is green signaled then the other three sides of the traffic signal will be red. This is done by setting the other ICs to the inactive state till the particular emergency vehicle passes. The normal operation of the traffic light continues when the sensor recognizes the decrease of the siren sound.

Dangi, Vikramaditya, et al.[6] proposed an image processing based technique for emergency vehicle detection. A camera is fixed on the traffic signal post in order to acquire the video. Then the video is processed in Matlab in order to detect the presence of emergency vehicles. Here in the image sequence, the presence of emergency vehicle is detected by analyzing the red beacon light. Once the red beacon light is detected, then it will check whether it is from the emergency vehicle or not. The beacon light is detected by analyzing the blinking frequency of red light. The blinking frequency of detected beacon light will be compared with the standard blinking frequency of emergency vehicles. If it matches, then we can say that the red beacon light detected is from an emergency vehicle. And thus we get the direction of the emergency vehicle. Inter frame difference is taken in order to find the absence of beacon light. In order to extract the red light from the video sequence, thresholding is applied. The areas with high intensity of red light will be detected and comparatively lesser intensity of blue and green color. The headlights of the vehicle may also be detected, which will lead to a false output. So the red light must satisfy

some additional blinking conditions. Along with that a condition has been taken is that the red light may appear in every third frame only. The other lights do not appear in the image sequence with this frequency and thus it can be eliminated. Some of the beacon light conditions are as follows:

Night time :

For red light: $R > 230$, $G < 250$, $B < 250$

In the intermediate frames: $R < 230$, $G > 230$, $B > 230$

Day time:

For red light beacon: $R > 230$, $G < 250$, $B < 250$

In the intermediate frames: $R < 230$, $G < 230$, $B < 230$

If these conditions are satisfied, then the normal conditions will get cancelled and the direction from which the emergency vehicle is being approaching will given priority. The green light will turn ON automatically until the emergency vehicle will pass the intersection. Here these functions are carried out with the help of Matlab tool. Code is written in such a way to perform all these functions and the camera which is placed at the signal post will be connected to the server.



Fig:1.a) Image of a vehicle during daytime, (b) Detection of all lights, (c) Emergency vehicle detected

The Fig:1 shows the experimental observations of the author. Once the emergency vehicle is detected, the traffic signal can be controlled adaptively giving way for emergency vehicles. So that they can reach their destination at the earliest.

iv. PERFORMANCE COMPARISON

Traffic light control system has significant importance in the surveillance. Most of the methods that are used for traffic light control for emergency vehicles are hardware based systems, which make use of transmitter and receiver

modules, that increases the complexity. Conventional technologies use the manual or semi manual systems. Manual system uses the manpower. The semi manual methods use the fixed interval traffic light and image processing which do not distinguish between the emergency and other vehicles. Image processing based method will reduce the hardware complexity and make the system easier and simpler.

v. CONCLUSION

Traffic congestion and transportation delay on roads are increasing day by day. Therefore it is important to develop a powerful method that helps in solving the traffic congestion problem and efficiency of transportation especially for emergency vehicles such as ambulance. Image processing method will make this process simpler, easier and flexible compared to other conventional method. Traffic signal is controlled adaptively so that the emergency vehicle will reach their destination at the earliest.

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