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Research paper

Intelligent Emergency Vehicle Preemption Using A Density Based System

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Abstract

Transit by road is one of the crude methods of transportation in various parts of the world as of today. The abundance of vehicles utilizing the street is expanding in an ascending order consistently. Because to this reason, traffic congestion in urban areas is becoming inescapable these days. The normal purpose behind traffic blockage is because of poor traffic prioritization, wherein a portion of the paths may have less traffic than the others with measure up to signal light length for both the paths. This Inefficient administration of traffic leads to wastage of crucial time, contamination, wastage of fuel, expenditure of transportation and worry to drivers, and so on however more vitally emergency vehicles like rescue vehicle stall out in traffic. Our project is on density based traffic control with the need to prioritize vehicles like emergency vehicle and fire brigade. In this way, it is especially important to plan a system to keep away from the setbacks. In this way counteracting mishaps, impacts, and traffic jams.

Keywords: *Vehicle pre-emption ;Image Processing; RaspberryPi;Traffic Density estimation*

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1. Introduction

The paper is intended to build an intelligent density-based dynamic traffic priority system. The signal timing changes naturally on detecting the traffic density at the intersection. The ordinary traffic light system is in light of settled time idea allocated to each side of the intersection which can't be differed according to fluctuating traffic density. Intersection timings apportioned are fixed. Some of the time higher movement density at one side of the intersection requests longer green time when contrasted with standard assigned time. The picture caught at the traffic signal intersection is prepared and changed into a grayscale picture after which its edge is computed. In light of the determined outlines the shape has been attracted request to compute the number of vehicles shown in the picture. In the wake of ascertaining the abundance of vehicles, we will know on which side the thickness is high and in view of which the applicable signal will be distributed to a specific side.

A Traffic Signal prioritization system is an automatic system that permits typical task of movement lights at robotized signalized crossing points to be seized. Seizure of signs is by and large done to help emergency vehicles, for example, ambulances, fire tenders, police vehicles so reaction times are diminished and access is given in a effortless and disciplined way. We are endeavoring to fabricate an intelligent model to encourage pre-emption utilizing a radio recurrence (RF) module. The RF signals are transmitted by the system exhibit in the emergency vehicle relying upon the necessity of vehicle development. RF module feds the data to the Raspberry Pi to control the traffic signaling system. This is an amazing arrangement for the issue that is winning in the general public for some time now. This approach can spare numerous lives who depend on emergency benefits by diminishing the response time of
the emergency vehicles by a critical edge without stagnating in the substantial rush hour traffic.

In [1] the authors have used Global Positioning System (GPS) and wireless sensor technologies to build a similar system and micro-controller which Controls traffic signals, as in [2] they have used acoustic systems. These systems are rather outdated and less secure these are susceptible to different type of illicit requests which can exploit the system which was designed to save lives.

2. Proposed System

Our paper is to administer traffic signals with the assistance of reconnaissance camera exhibit at the intersection focuses. The casings of the traffic acquired from the camera through constant video preparing. To ascertain the thickness, a picture from the camera is utilized to figure the number of vehicles in every path. As indicated by the number of vehicles in every path, the ideal opportunity for a particular green signal is given which changes time to time. In the event that there are same quantities of vehicles in the path, the signal will take after the essential clock circuit. Be that as it may, when an emergency vehicle, for example, a rescue vehicle is distinguished, need is given for the last path. The ideal opportunity for which every path will be green appears in the show of the person down counter. On the off chance that, if an emergency vehicle is distinguished, the path with the green signal will end up red and a rescue vehicle image will be shown on the counter. Following a couple of moments, the path having the rescue vehicle will be permitted. In case if there are two rescue vehicle recognized in the intersection, the emergency vehicle which is closer to the signal get the need first. Fruitful execution of our examination will bring about quicker leeway of movement

and change in the transportation of emergency vehicles. Figure 1 depicts our block diagram for the system.

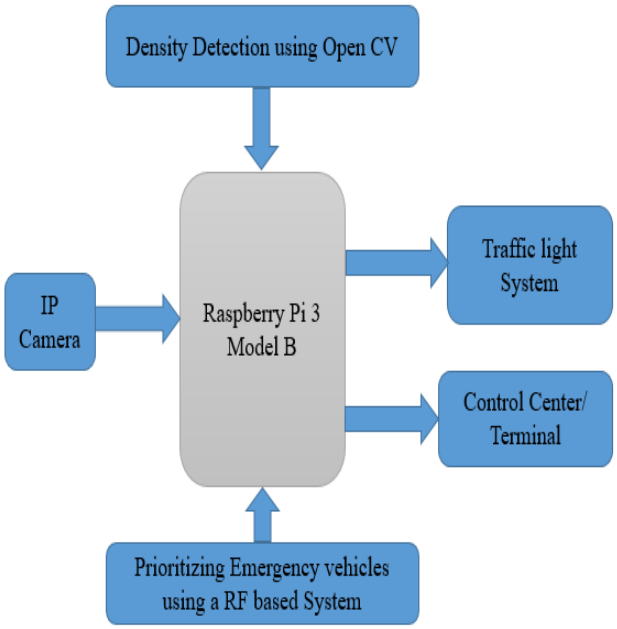

Fig. 1: System Design

A. Algorithm Used

In [4] the author has explained about Background subtraction, also known as foreground detection it is the main idea on which our project is based upon, it is a method in the fields of picture handling and PC vision wherein a picture's forefront is separated for additionally preparing (protest acknowledgment and so forth.). For the most part, a picture's locales of intrigue are objects (people, autos, content and so forth.) in its closer view. After the phase of picture pre-preparing (which may include. Image de noising, post handling like morphology and so forth.) Protest restriction is required which may make utilization of this method.

B. Devices and Implementation

The hardware components that we have used are IP web camera to capture live feed from Traffic Intersections, Raspberry Pi 3 Model B for all the image processing work and controlling of Signaling System as shown in Figure 2. Radio Frequency Module is used for emergency vehicle pre-emption.

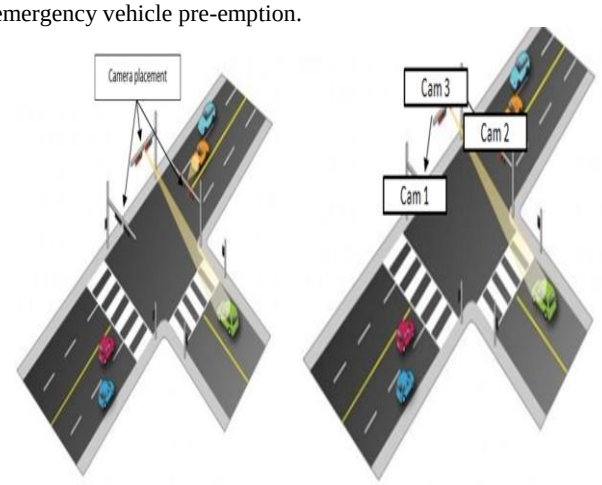

Fig. 2: Implementation at traffic Intersections

3. Flow Chart

The figure 3 given below depicts the flow chart for our proposed system.

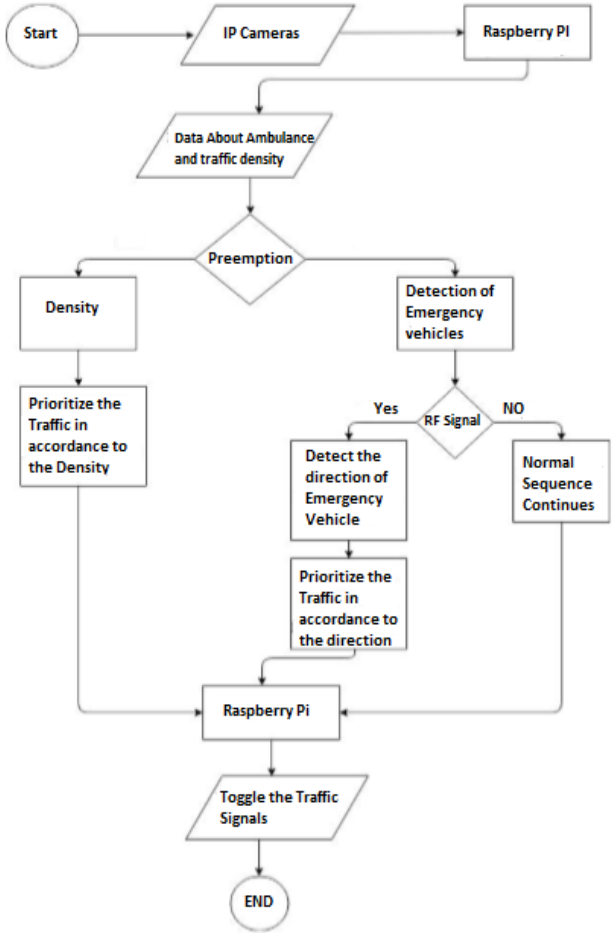

Fig. 3: Flow Chart

4. Vehicle Density Estimation

A. Recognition of Vehicles

To distinguish the number of vehicles out and about the present casing and the Background outline are changed over to grayscale and the pictures are contrasted and subtracted with get nearness of items out and about. Morphological activities, for example, widen and disintegrate are done to expel the promotion extra clamor in the picture and this picture is additionally upgraded and it is changed over to paired image. This picture is then separated utilizing Gaussian channel to acquire just the vehicles out and about as shown in figure 4.

Fig. 4: Recognition of Vehicles

B. Density of Vehicles

To check the number of vehicles at any given time at the traffic intersection the live image feed from the cameras is processed to identify the vehicles and draws an outline of the minimum size of the vehicle then the software gives the number of vehicles available in that particular frame as shown in figure 5 and figure 6.

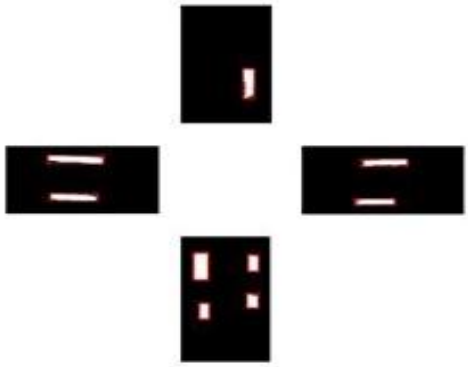

Fig. 5: Density of Vehicles

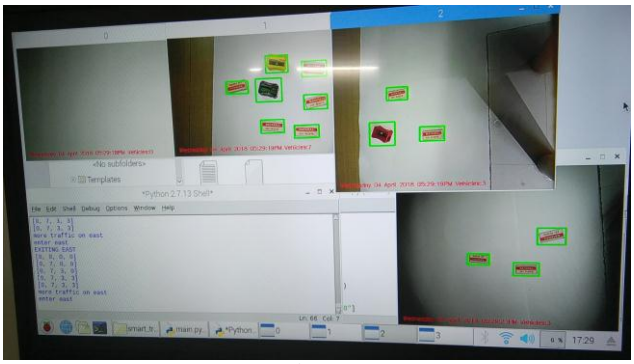

Fig. 6: Output for vehicle detection

5. Vehicle Preemption

In our prototype we are using a RF module to preempt the course of the traffic light to control the activity stream at the crossing point which is taken by the emergency vehicles. A radio frequency transmitter and collector module will be utilized as a part of the circuit to actualize remote correspondence for this task. The emergency vehicle additionally may take control of activity light at a convergence. A transmitter is set on an emergency vehicle that transmits a flag to the RF beneficiaries situated at the traffic intersection whenever it is in crisis mode. The Raspberry Pi processes the received signal and then pre-empts the course of traffic light to control the activity stream at the crossing point which is taken by the emergency vehicle.

6. Working of the Traffic Intersection Light System

An electric circuit with four side traffic light junction has been intended for this task which is worked by a Raspberry Pi unit. The contribution from the RF recipient circuit is utilized by the Raspberry Pi to supersede the arrangement.

A. The Ordinary Sequence

The course of the traffic lights is begun as green light at one course of the traffic light and red light at all alternate directions of traffic lights. The length of this green light mode goes on for 10 seconds and the series is proceeded with alternate directions alike unless the RF recipient triggers any signal from the transmitter to abrogate the arrangement. At that point, the green light of traffic light 1 is off and the yellow light of a similar traffic light is on for 2 seconds. Next, the arrangement turns on the green light of traffic intersection in the second direction and the red light of the other traffic light bearings is On for a span of 10 seconds. A similar thing keeps on happening to the traffic junction lights in the third and fourth directions after an interim of the yellow light at each traffic light for a term of 2 seconds. The Raspberry Pi will continue rehashing this arrangement of the activity light unless the emergency course mode is activated.

B. The Emergency Course

The emergency arrangement is activated when the RF recipient gets the transmitted signal from the RF transmitter to abrogate the ordinary series of the traffic light. For instance, a rescue vehicle approaches at the traffic intersection light in the fourth direction and the green light of the traffic light 1 is on. At the point when the push-on switch 4 is turned on, the RF receiver gets the transmitted signal and change the typical arrangement into the emergency succession mode. The emergency arrangement mode is begun when the yellow of the traffic intersection light 1 is on for 2 seconds. At that point the green of traffic light 4 is on for 10 seconds and after that the yellow light of a similar traffic light is turned on for 2 seconds and the emergency course mode is finished when the arrangement of the traffic light has returned to the typical succession in which the green light of the traffic intersection 1 is turned on.

7. Applications

This system can be practically implemented in real time traffic environment to streamline the traffic based on its density giving priority to emergency vehicles like ambulances, fire brigades, etc. The Implementation of such a system will reduce the response times and access is provided in a nuisance free and disciplined manner.

8. Future Scope

The Intelligent Emergency Vehicle Pre-emption using a Density Based System can further be upgraded with an efficient encryption system to protect it from embezzlement and eavesdropping. A Real time Automated signaling system with a higher connectivity of Radio Frequency Module for the Emergency vehicles.

9. Conclusion

In this paper, we have effectively influenced the model for constant to picture handling for intelligent computerization of traffic signal system for frequency estimation and emergency vehicle identification, for example, ambulance. Our model distinguishes the emergency vehicle by the use of radio frequency module. The density is assessed by the cameras and the Raspberry PI as the command and control center effectively processes the information and gives the expected output.

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