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RECOGNITION OF EMERGENCY VEHICLE USING LIGHT DETECTION AND TRAFFIC LIGHT CONTROLLING

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Abstract - *This paper is proposed with an idea to recognize the emergency vehicle especially the ambulance using the emergency lights emitted from the beacon lights of the emergency vehicle and to control the traffic light. Ambulances are usually identified by the siren sound but in some cases where the drivers in the closed car couldn't hear the sound properly and also there exists confusion in the lane in which the ambulance is arriving. In some cases, the siren is turned off in order to reduce the tension on the patients. The proposed system would provide a solution for this problem This system uses a sensor that detects the blue and red lights emitted from the beacon of the ambulance at a distance from the traffic signal in order to clear out the congestion on the road and to provide a faster movement of the emergency vehicle to serve the patients in need of emergency. The advantage of using this system is that lights have greater wavelength and it is easy detected from a distance. We conducted a survey at different times of a day and also at different climatic situations to study the wavelength of the beacon lights.*

Key Words: Light detection, Raspberry Pi 38, ZigBee, Arduino, TCS3200

1.INTRODUCTION

The number of vehicles on the road has increased due to the demand to reach the workplace on time. This led to traffic congestion because of which the movement of vehicles especially the emergency vehicles is delayed. Ambulance services are the first providers of a 24/7 response to medical and trauma-related emergencies. They supply a disciplined and organized system, allowing a timely response of appropriately qualified health care workers- often to potential or confirmed medical emergencies. Ambulances are used to answer medical emergencies by emergency medical services. For this motive, the flashing warning lights called beacon lights and sirens are equipped. They rapidly transport paramedics and other first responders to the scene, carry equipment for administering emergency care, and transport patients to the hospital or other definitive care. Most ambulances use design-supported vans or pick-up trucks. Proper service to the patients cannot be provided when an ambulance is stuck in traffic. This mainly happens in big cities where the congestion on the road extends more than 2 km. In some cases in India, there has been loss of lives of the patients due to the delay in the service of the ambulance which has stuck in heavy traffic. Due to the congestion on the road, the emergency vehicle is delayed, which stops the patients from getting medical assistance at the right time. In a real-time scenario with help of the siren sound, the emergency vehicle is identified. Sometimes the emergency vehicle turns off the siren and only the lights will be on in certain situations. This is done to reduce the stress of the patient in the vehicle at times of serious emergencies. It is difficult for other vehicles to identify the nearing emergency vehicle to move and clear the traffic in this situation. The proposed system would detect the flashing blue light (450 - 495 nm) and red light (620 - 750nm) of the ambulance and controls the traffic signal for smoother movement of the ambulance to provide proper service to the patients without any delay.

2. LITERATURE SURVEY

Signal clearance for Emergency Vehicle N.Prakash, E.Udayakumar, N.Kumareshan [1] provides a system in which the object detection sensor deployed at the traffic signal path measures the density of the vehicle in the road. Depending on the density it provides the automatic signal timing accordingly. The particular path signal will change to blue along with a green signal, indicating the ambulance arrival. Thus it reduces time & saves the lives of many people due to existing traffic system limitations. Also, a stolen vehicle can be easily detected with the help of RFID.

In the Paper, Detection of Ambulance Siren [2] in traffic the authors DharmaRane, PushkarShirokar, Trilochan Panigrahi, S.Mini have elucidated a method to identify the siren sound of the ambulance in a traffic signal using the smart phone. Upon detecting the ambulance siren sound an alert message is sent to the driver's phone with the App installed.

Recognition of Emergency vehicle P.Gowtham, P.Eashwari,[4] the study of this paper provided an idea of a method for character recognition of the emergency vehicle. In this paper, a unique method is used for a significant task analysis of images and in applications of pattern classification and recognition of the recent world of Image processing. The Ambulance character

recognition system uses Neural Networks to recognize the character. Thinning and Hilditch algorithm basis and structural characteristics of a character in the image. Experimental results show that the proposed method and has achieve increased accuracy in character recognition.

Research on Traffic Signal Controller paper of Kumar,R.R, K. Kavitha [6] provides a method to control traffic using image processing. The image captured in the traffic signal is processed and converted into grayscale image then its threshold is calculated based on which the contour has been drawn in order to calculate the number of vehicles presenting the image. The traffic is analyses through data collected from cameras and depending upon the volume of traffic, the traffic light durations are set. It also demonstrates how the durations can be changed dynamically. Raspberry pi is used as a microcontroller which provides the signal timing based on the traffic density.

In the paper Emergency Vehicle to traffic signal System the authors Nasser Al-Ostath, Zainab Al-Roudhan, Fatma Selityn, Mohammed El-Abd [7] presented a system to supply a smooth flow for emergency vehicles like ambulances to succeed in their destinations in time and thus minimizing the delay caused by traffic jams. The ETL system will control the traffic lights within the path of the emergency vehicles, stopping conflicting traffic, and allowing the emergency vehicle right-of-way to assist in reducing their reaction time.

K. Thatsanavipasa, N. Ponganunchokea, S. Mitathab, and C. Vongchumyenb within the paper Wireless traffic signal Controller [13] provides a system for a wireless traffic signal controller which makes the traffic policeman effectively control the road junction with a wireless remote. The remote will respond by checking the bearing of the pressed button on the remote employing Hall effects sensor regarding the position and direction of the remote. Then it sends an impact signal to the traffic signal controller board and in automatic mode, the traffic signal controller board will change the sequence consistent with the patterns and time delays

3. METHODOLOGY

The following method was incorporated for the development of our project.

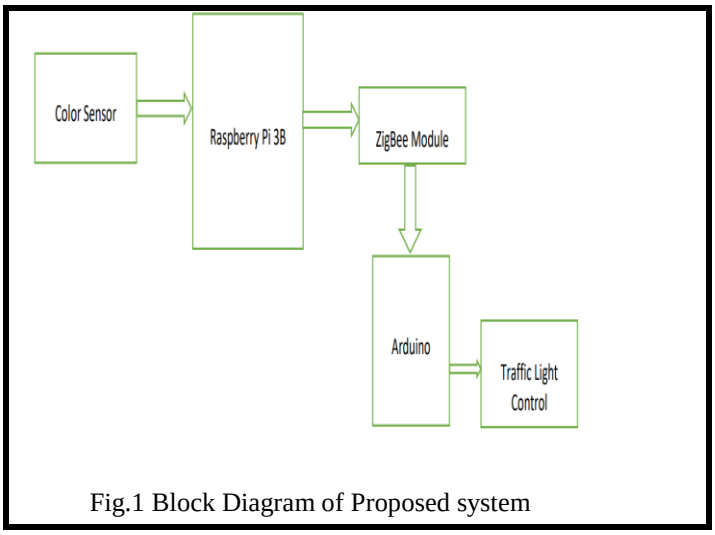

Fig.1 Block Diagram of Proposed system

A) RASPBERRY PI 3B

Raspberry Pi 3 Model B is a powerful processor, which is 10x faster than the first generation Raspberry Pi. Wireless LAN and Bluetooth adds extra value to it. Raspberry Pi is Programmed is easily programmed with python to implement real world projects.

B) TCS 3200 COLOUR SENSOR

The TCS230 programmable colour light-to-frequency converter. It has 4 filters mainly a red filter, a blue filter, a green filter, and a clear filter. TCS230 allows only the primary colours to pass through the filter and blocks others when a specific colour filter is chosen.

C) ZIGBEE MODULE

ZigBee is a wireless mesh network standard, is integrated with radios and with microcontrollers, and delivers low-latency communication because of which it is used in wireless control and monitoring applications.

D) ARDUINO

Arduino is an opensource easy to use hardware as well as the software for electronic real time projects. Arduino sense the input with the help of sensor and controls the environment based on the inputs received.

3.1. WORKING:

The performance of the system can be clearly extrapolated using the following flowchart.

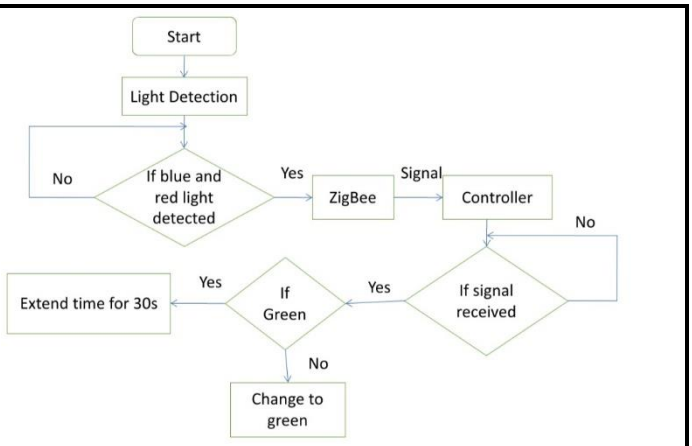

Fig.2. Flowchart of light detection part

The sensor is positioned 6m above the ground and 150 meters away from the traffic signal pole as it would be easier to clear the traffic at the time of arrival of the ambulance near the traffic pole.

The sensor is programmed to detect the flashing blue and red lights of the emergency vehicle as there may be a chance for the sensor to detect the colours of the vehicle or any other object.

When the flashing blue and red lights of the beacon lights of the emergency vehicle is detected by the sensor TC3200, the raspberry pi connected to the senor gets stimulated and this in turn sends a signal to the ZigBee module of the transmitter.

On the receiver side the ZigBee module receives the signal from the transmitter side and sends a signal to the controller here Arduino controller is used. The controller in turns controls the traffic signal. If the red light of the traffic system is on it immediately switches to green light and if the green light is on it extends the tie of the green light for 30s.

The main aim of this system is to provide a smooth flow of the emergency vehicle to provide proper medical assistance at the right time without any delay especially when the emergency vehicle shifts patients with utmost emergency, in order to reduce the stress on the patient the siren, is offed and only the emergency lights are on.

4. STUDY ANALYSIS

The following were some of the researches which was done during the project.

SENSOR POSITION:
In India the Traffic signal pole is 6m heigh from the ground level. The average height of a truck is 4.52m. hence positioning the sensor at 6m from the ground level and at an angle of 45 degrees gives an accurate detection of the flashing lights.

IMPACT OF LIGHT :

Emergency Vehicles use Red and Blue Lights as Red indicates danger and has a wavelength of 620nm – 750nm and blue light has wavelength of 450nm - 495 nm. Red light is more visible during Day and blue light is more visible during night We conducted a study on the wavelengths of blue and red light at different time periods at different climatic conditions and we found the following results.

MORNING (6.15am – 11.59am)

➢ Red light has a wavelength of 600nm – 700nm and blue light has a wavelength of 460nm.

AFTERNOON (12.00pm - 7.00pm)

➢ Red light has a wavelength of 620nm – 700nm and blue light has a wavelength of 450nm.

NIGHT(7.00pm-4.45am)

➢ Red light has a wavelength of 550nm and blue light has a wavelength of 400nm – 490nm.

Fig.3 Blue and red lights at different climatic conditions

5. RESULTS

This project has two segment which are elucidated below:

A) LIGHT DETECTION SEGMENT:
The sensor is programmed to detect the flashing blue light (450nm - 495nm) and red lights (620nm – 750nm) of the emergency vehicle as there may be a chance for the sensor to detect the colours of the vehicle or any other object.

B) TRAFFIC LIGHT CONTROL SEGMENT
Upon receiving the signals from the transmitter side the controller controls the traffic signal based on the information available. If the red light of the traffic system is on it immediately switches to green light and if the green light is on it extends the tie of the green light for 30s.
C) SNAP SHOT OF THE RESULTS

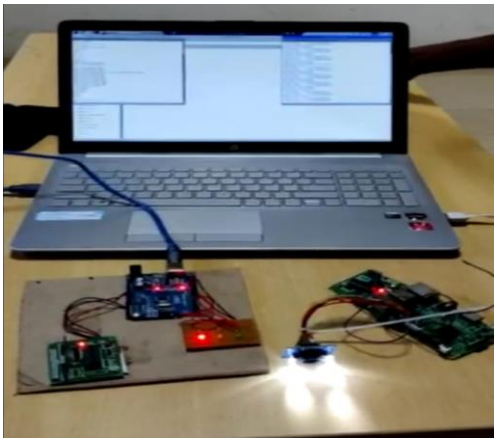

Fig:4 Normal traffic

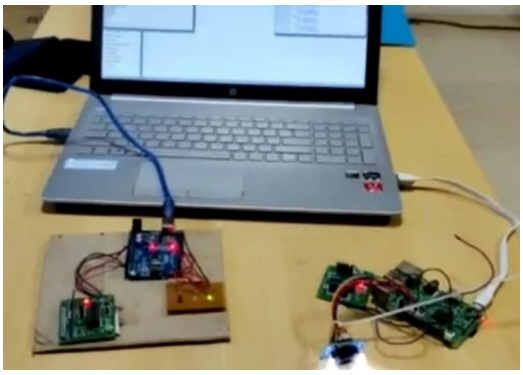

Fig:5 Ambulance detected

The above Fig 4 shows the working of the system at normal condition when the lights are not detected. The above Fig 5 shows the working of the system when the flashing blude and red lights of the beacon lights of the ambulance is detected. The traffic signal immediately changes to green.

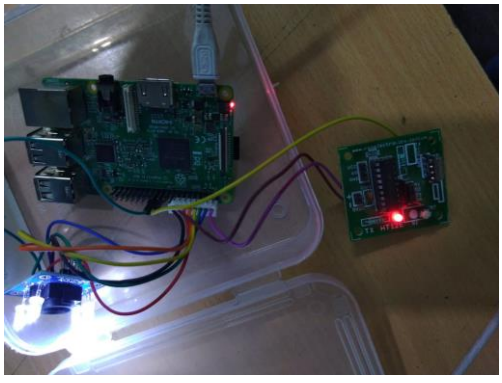

Fig:6 Light Detection segment4

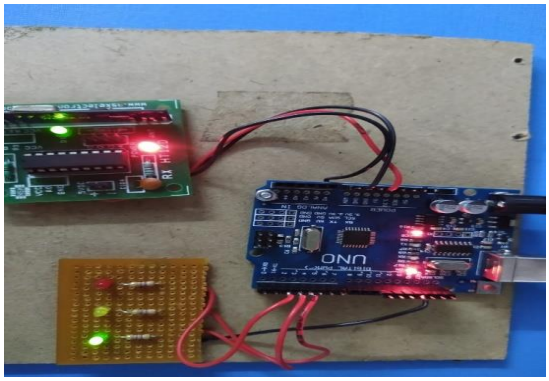

Fig:6 Traffic Light control segment

6. CONCLUSIONS

This system provides an optimal solution for the smooth movement of the emergency vehicle at the time of heavily congested traffic. With this system, the traffic signals can be controlled at the time when the emergency vehicle arrives near the traffic signal. Fixing the colour sensor at the correct angle is the only con of this system. This is a very effective solution even at different climatic conditions as the red light and the blue light have a quite good amount of wavelength. The colour sensor at a very modest can detect up to 1m. In the existing system, the vehicle is identified by the siren sound but this causes confusion on the road regarding the direction in which the vehicle is approaching. This is best suited for areas where the traffic congestion is high especially near the hospital zones. It helps to provide the right service to the patients at the right time. The red light is more visible during the day and the blue light is more visible during the night. The traffic lights are controlled when the emergency vehicle is detected 150m from the traffic signal so that the congestion is cleared for the fast movement of the emergency vehicle.

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