

SMART AMBULANCE GUIDANCE SYSTEM

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Abstract— Increase in population has increased the number of automobiles leading to a steep increase in traffic. Often Traffic jams occur due to the increase in the number of vehicles on the road. An ambulance or any emergency vehicle stuck in traffic is unable to move due to poor traffic signal control. This project aims at providing a solution to the above problem by alerting or controlling the traffic signal before the ambulance reaches the traffic signal using the concept of Internet of Things(IoT). This system uses a central server to control the traffic controllers. The traffic signal controller is implemented using Arduino UNO. The ambulance driver uses a web application to request the traffic controller to make the signal green in which the ambulance is present. A low-cost system which can be implemented throughout the city thereby reducing the number of deaths due to traffic situations has been aimed at.

Index Terms—Ambulance, Arduino, IoT, Smart.

I. INTRODUCTION

The vehicle traffic in cities has been exponentially increased due to a large number of vehicles plying on the road. Due to this heavy traffic, often traffic jams occur on roads because of which the emergency vehicles like ambulance and fire engines get stuck in traffic which may be the cause for losing human lives.

Current traffic control systems are a static case wherein vehicles have to wait for a predefined amount of time until the microcontroller switches the green light for that lane. If the ambulance is stuck near to the traffic signal, then the traffic police can give priority to the ambulance by giving necessary symbol or signs to the vehicles so that the ambulance can get out of the traffic as quickly as possible. Moreover, if the emergency vehicles are stuck in a lane far from the traffic signal, the siren of the ambulance is unable to reach the traffic police, in which case the emergency vehicles have to wait until the traffic gets clear or we have to depend on other vehicles to move aside which is not an easy task in traffic situations.

The project proposes a system in which the ambulance driver can control the traffic signal using the web app developed. The ambulance driver can request the traffic light to turn on green lights for the lane in which he is present. This way the ambulance will be able to quickly skip the traffic and reach the destination as fast as possible.

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II. LITERATURE SURVEY

Madhav Mishra, Seema Singh, Dr.Jayalekshmi .K.R, Dr. Taskeen Nadkar developed an advance alert mechanism for ambulance pass by (A²FAP) for Indian scenarios [1]. This research basically uses the existing technologies along with the concept called internet of things (IoT). The architecture used is server-client architecture. The client is a user using an android application.

Buchenscheit, Andreas, et al. have implemented VANET-based emergency vehicle warning system [2]. They have designed an emergency vehicle warning system that makes use of inter-vehicle communication and also encompasses roadside infrastructure like traffic lights. In this system, other vehicles are warned of an approaching emergency vehicle and also receive detailed route information. Based on this information, a timely and appropriate reaction of other drivers is possible.

B. Janani Saradha, et al. proposed the microcontroller based RFID system that is used to alter the traffic lights upon arrival at traffic light junction [3]. The system creates an android app that connects both the ambulance and the traffic signal station using cloud network. This system makes use of Radio frequency identification technology to implement the intelligent traffic signal control. The basic idea behind the proposed system is, if the Ambulance halts on the way due to a traffic signal, RFID installed at the traffic signal tracks the RFID tagged ambulance and sends the data to the cloud. After the acknowledgment for the user through the mobile app, the particular signal is made Green for some time and after the ambulance passes by, it regains its original flow of the sequence of signaling, if this scheme is fully automated, it finds the ambulance spot, controls the traffic lights. This system controls the traffic lights and saves the time during emergency periods.

Tammishetty, Sneha, et al. have proposed the use of GSM, Arduino, Android mobile system [5] The proposed method enables the emergency vehicles to signal the traffic signal controller placed in the traffic junction regarding their arrival so that the traffic will be regulated. This system requires the users traveling in the emergency vehicle to signal the traffic controller hardware through the android application deployed in their mobile phones.

III. SMART AMBULANCE BASED GUIDANCE SYSTEM

The previous systems have used RFID tags for ambulance detection; the problem with such system is that the ambulance has to be close to the RFID detectors. Also in [5], android app is used by the ambulance driver, the limitation is that it will work only on android platforms or the app has to

be developed for other platforms as well. This paper implements the system in which a Web application is used by the ambulance driver to request the traffic controller to make the signal green for the lane in which the ambulance is present. Since web can be accessed from any platform this system will be useful in emergency situations.

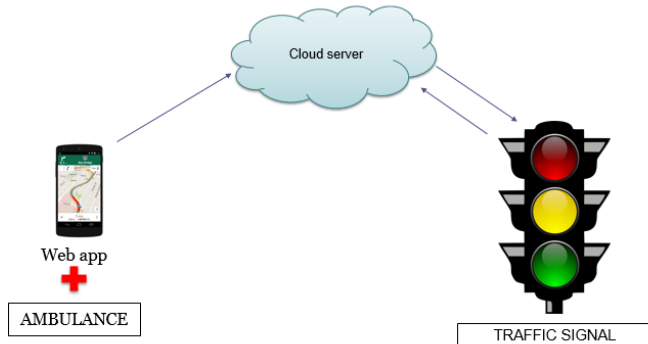


Fig. 1: Block diagram of the smart ambulance system

The whole system is divided into three parts. Their description is as follows.

1) Web Application: A web application is designed for the ambulance driver. Advantages of a web application over an android application would be as follows:

- Can be used on any platform e.g. Android, iOS, Blackberry, Windows.
- Helpful during emergency situations, the user can use any device available.

The application provides a user interface for the ambulance driver to choose a route and navigate the ambulance accordingly. Ambulance location data is tracked using GPS and sent to the server. When the ambulance is about to reach near the traffic signal, the ambulance driver can send the request to turn on the required lane to green. The data is sent to a server from which the traffic signal switches the lane to green for the ambulance to pass by.

2) Cloud Server: A central server is used, which acts as the medium of communication between the traffic signal and the ambulance. The server will hold the information as to what request was made by the ambulance driver. This information is used by the traffic signal to switch the requested lane to be green. The API and authorization server is created in the Google cloud service platform.

3) Traffic Signal: Arduino Uno board interfaced with Esp 8266 Wi-Fi module is used as a traffic signal. The Arduino module is programmed to fetch the data from the server. The traffic signal looks for an interrupt from the server i.e. a request from the ambulance to turn a specific lane to green. If there is a request, then that lane is turned off till the ambulance leaves. Then the traffic signal resumes from where it left off.



Fig. 2: Block diagram of the traffic light system

IV. IMPLEMENTATION

The System implementation can be explained in two parts-

A. Hardware Implementation

Smart ambulance based guidance system consists of-

a. Arduino Uno-

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists of other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project [11] [12].

b. ESP8266 Wi-Fi Module:

The ESP8266 Arduino compatible module is a low-cost Wi-Fi chip with full TCP/IP capability, and the amazing thing is that this little board has a MCU (Micro Controller Unit) integrated which gives the possibility to control I/O digital pins via simple and almost pseudo-code like programming language. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, one can simply hook this up to an Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers. The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community. [13]

B. Software Implementation

a. Arduino:

The traffic light is implemented using Arduino. The traffic light has to do its normal functioning until it receives an interrupt from the ambulance to turn on a specific lane. Programming is done using the Arduino software.

The algorithm is as follows,

1. Initialize GPIO pins.
2. Turn on normal sequence of the lights.

3. Check for an interrupt from the ambulance driver if yes go to step 4 else go to step 2 .
4. Turn on green signal for the lane requested by the ambulance.
5. Go to step 2.

b. Web application:

The web app is developed using Python and flask framework. The server used is nginx server. Google cloud services are used for the API generation. A free domain name *ambhush.tk* is taken from the website <http://www.freenom.com> for the purpose of the web app development.

The web app will have the following functions:

1. Show google maps.
2. Ask user for location tracking permission.
3. Center the map to the user location.
4. Ask user (ambulance) input which lane to make green.
5. Save user input on the server

Flask-GoogleMaps is used for the google map in the web application. A small interface is given as an input for the ambulance driven as a form. The data when submitted is stored in the server and will be accessed by the traffic controller.

V. RESULTS AND DISCUSSIONS

When the ambulance requests a particular lane to be on using the app the traffic light switches that lane to green and then after sometimes switches back to its original sequence.

The web application created shows a google map and a form to submit the data

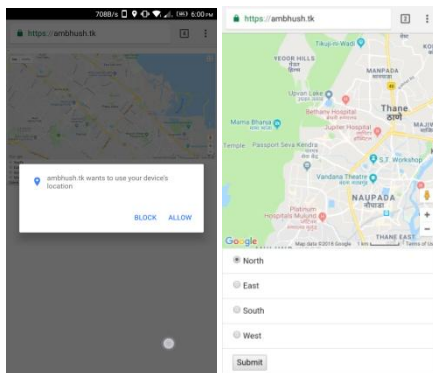


Fig.3: Web application screenshots

The ambulance driver has to click the direction in which he will be moving and press submit. The data is stored on the server as shown below. The data is stored in the form of initials of that particular direction. For e.g. The direction being clicked in fig. 1 is north the data stored on the server is N as shown in fig. 2

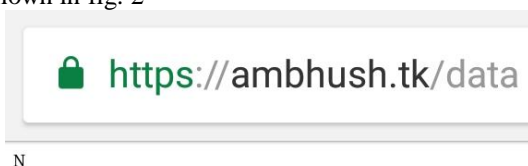


Fig. 4: Direction data stored on the server

The Traffic light controller is implemented as shown below. The traffic lights function normally until the ambulance driver requests for a specific lane to be green.

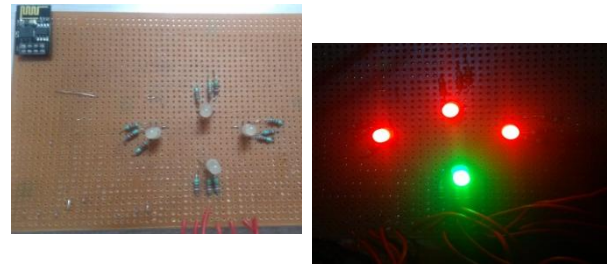


Fig. 5: Implementation of traffic lights on PCB

VI. FUTURE WORK

This model is developed with the aim to help the ambulance reach hospital as early as possible. It can be enhanced further in many ways. Few of them are as follows,

- Considering various traffic scenarios and how this system will respond to them.
- Securing the communication between the ambulance app and the server, so that only authorized personnel is allowed to do the same. For e.g. a login system
- Informing the general public of the traffic signal rules in case of emergencies.
- Sending the patients data to the hospital before reaching so that the necessary arrangements can be done.



VII. CONCLUSION

Death due to ambulance delay is one of the important issues which is faced by most of the countries in the world. The paper implemented the design of a new concept of Smart ambulance guidance system. During the emergency situation, the Traffic signal switches to green and allows the ambulance to pass through the road intersections. This method can help the ambulance to reach the hospital with lesser time consumption. In critical situations, this system can help save lives which would not have been possible otherwise.

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