Intelligent Traffic Control System for Smart Ambulance

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Abstract – *The growth of industrialization and urbanization has lead to an immense increase in the population invariably leading to rise in the number of vehicles on road. The resulting traffic congestion and traffic jams are the major hurdles for emergency vehicles such as ambulance carrying critical patients as these emergency vehicles are not able to reach their destination in time, resulting into a loss of human life. To solve this problem to some extent we have apparently come up with "Intelligent Traffic Control System(ITCS) for ambulance". The proposed system clears the traffic congestion by turning all the red lights to green on the path of the ambulance, hence helping in clearing the traffic and providing way towards its destination. The system consists of an android application which registers the ambulance on its network. In case of emergency situation, if the ambulance halts on its way, the application sends an emergency command to the traffic signal server and also the direction where it wants to travel along with this the current position with the help of Global Positioning System (GPS). The nearest signal is identified based upon the current position of the ambulance. And that particular signal is made green till the ambulance passes by and later it regains its original flow of control. In this way it acts like a lifesaver project as it saves time during emergency by controlling the traffic lights.*

Key Words: *Server, Mobile app, Arduino, LCD Display, GPS Tracking System.*

1. INTRODUCTION

The pace at which the world is developing is very high today. Reformations in technology every day is evolving and improving efficiency in healthcare sector is one of the most difficult and challenging jobs also with the advent of Industrialization and Urbanization, as the population increases day by day the number of vehicles also increases on the roads. This leads to high traffic jams in big cities. Traffic congestion causes many adversary effects on countries transportation.

One of the widely affected service due to traffic jams is that of an ambulance. Many a times, ambulance consist of emergency or critical patients which needs to be taken to the hospital in minimum amount of time providing proper treatment to the patient so that chances of surviving increases in critical condition. A Patient may lose his life if there is delay in reaching of ambulance to the hospital. According to the surveys 95% of the heart attacks cases can be treated, if the ambulance can reach the hospital at current time without stucking into the traffic. For this, it is needed that the vehicles on the road to make way for the ambulance.

But sometimes, the ambulance gets stuck in the traffic which in turn wastes a lot of time waiting for the traffic to get clear.

We can overcome these limitations by the emerging technology such as IoT i.e. Internet of Things. Various software implementations and hardware devices can be connected with the help of wireless networking tools or wired tools. In IoT the components are connected and controlled by the internet. Thus the impact of IoT in today's era is significant as it helps to represent the object digitally and makes itself something greater than the object by itself.

In this paper, we have come up with the 'Intelligent Traffic Control System for Smart Ambulance'. The main objective of this system is to make it possible for the ambulance to reach a particular location without having it to stop anywhere until the destination is reached. This paper proposes monitoring of traffic lights and its controlling by the driver of the ambulance. Basic information of the patient is taken along with the status of the patient such as critical or non-critical. This information is further used to send it to the hospital. Depending upon the emergency, the driver sends the direction towards which it wants to travel. Depending upon the command, that particular signal is made green to provide way to the ambulance and simultaneously the others are changed to red. Using this method, way is provided to the ambulance resulting it to reach the destination in minimum time.

2. LITERATURE REVIEW

In [1], hardware is used to calculate the health parameters. Serial communication is used to store it in PC which is in ambulance through which they are transferred to the hospital. RF communication is used to control the traffic.

The two systems which are combined in this paper are - health monitoring and traffic controlling systems. Data acquisition will take place in Health monitoring system and parameters will be sent to the hospital server via PC. The driver of the ambulance controls the traffic using the keypad in the ambulance. Both the systems will work simultaneously. The doctor in the hospital monitors the patients' health parameters. The signals could be manipulated by the driver of the ambulance at the same time.

By adding a GPS navigation system with a congestion detection module, this system can be improved for the real time scenario.

In [2], the main aim of the paper is to design a Microcontroller based intelligent ambulance system which can change the traffic lights upon its arrival at traffic light junction using IR(Infrared) sensors.

The ambulance system also has Global System for Mobile Communication based information device that alerts the doctors about the patient's condition and informs the doctors to report to the nearest hospital for patient's quick recovery.

There could be a case where two Ambulances are exactly at equal distance from traffic light, in this case the traffic light receiver will give chance to the transmitter of any one Ambulance randomly without considering any fact.

In [3], the large amount of data that is generated by these devices can be handled by cloud computing and it can also be used to send command to those devices to perform a task. This project is based on the IoT and cloud. This project is to establish the communication between the traffic signals and the ambulance so that the traffic signal can respond to the arrival of the ambulance.

The application needs a required bandwidth for the instantaneous communication between the ambulance and the traffic signal.

In [4], the system will be image processing based adaptive signal controlling. Proposed system will be based on traditional system along with automated signal. Digital camera is mounted on the motor for rotation. This faces the lanes and gets the sense of the traffic. The artificial vision is captured with the help of the digital camera. The camera's direction changes in the steps of 90 degrees, it faces each lane and captures the image. In order to change the direction of the camera, it is controlled by the PC through microcontroller. Load of the traffic on each lane is estimated by Image processing techniques. The accuracy of the image processing compared to GPS is low. If a vehicle of a bigger size than an ambulance is in front of the ambulance, then the camera will not be able to capture the ambulance.

3. FLOW OF CONTROL

Whenever ambulance reaches to the accident spot, first the ambulance driver will feed the patient's information in the android application. This information will be sent to the hospital's server for further processes. On the way whenever ambulance halts at the traffic signal, the ambulance driver will send emergency command along with direction from the android application to the server. Also the current GPS co-ordinates of ambulance is also sent to the server. At the server, depending upon the co-ordinates of the ambulance, the nearest signal is detected and the emergency command along with the direction is sent to that particular signal. Depending on the direction received from the server that particular signal is made green.
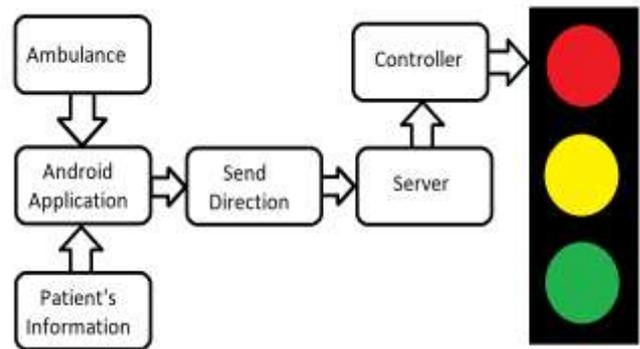
Fig. 1: Flow of Control

4. IMPLEMENTATION

The system is divided into two modules. First module is a software module which consists of android application. Second module is the hardware module of traffic signal implementation.

Module 1:

First module is an android application. Whenever ambulance reaches to the accident spot, first the ambulance driver will feed the patient's information in the android application which consists of patient's name, age, blood group, gender, and the patient's situation like whether it is critical or not depending upon various tests reports like ECG, blood pressure, etc. This information will be sent to the hospital's server so that the hospital staff can be prepared for the requirements needed to the patient. After that, depending on patient's situation driver will send emergency or non-emergency command via android application to the server. This module works on the principle of IoT with the help of REST APIs.

Change in signal occurs by the used of compass and GPS.

Android application has four buttons for four directions. Depending on the route, ambulance driver will select appropriate direction and send activate command for that particular signal. Also Ambulance's current location and current direction of movement is send to the server. Here ambulance's location is traced using GPS hardware device. The location is retrieved in the form of double value as latitude and longitude. E.g. 19.525246, 73.87909. This is the format of the latitude and longitude. Compass is used for detecting the direction of the movement of ambulance. The 360-degree circle of compass is divided into four parts for four directions as shown in the fig.
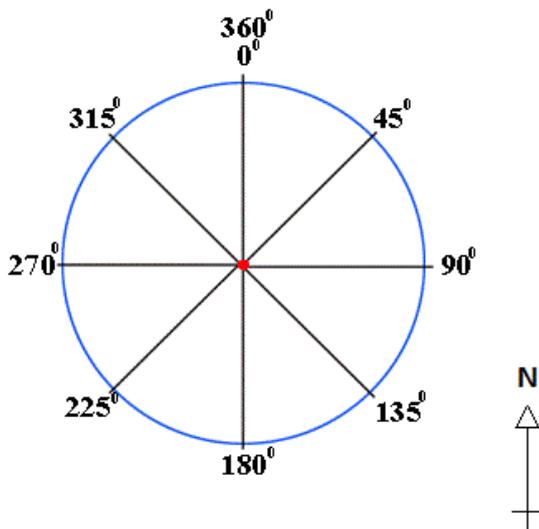
Fig. 2: Compass

Depending on the degree of ambulance, direction of movement of ambulance is detected. For example, if degree of ambulance is between 45 and 135 then it is moving in East direction.

This location and direction is transmitted to the server by executing POST request by the used of Retrofit API.

At the server, depending on the location of ambulance, nearest signal is detected using shortest distance algorithm. Then the commands sent by ambulance driver are transmitted to that particular signal and depending on the direction that signal is made green and rest all other signal are made red. This changing of signal works like an Interrupt at traffic control signal. The signal is changed when status of ambulance is active. As soon as ambulance crosses the signal is sends deactivate command and signal regains its original flow.

Module 2:

Second module is the hardware module of traffic signal. In hardware we have used Arduino for traffic signal. It consists of Wi-Fi module. With the help of Wi-Fi module, it captures information from the server. Because of this Wi-Fi module, the android application is directly connected to the traffic signal.

5. IMPLEMENTATION

An idea is proposed in this paper for saving patient's life in a fastest way possible. So whenever ambulance halts at the signal, the ambulance driver sends emergency command to the server along with the GPS co-ordinates. The nearest signal is detected and emergency command is send to the particular signal. Depending on the direction received from

the server that particular signal is made green. Considering the real time scenario, the system is improved by embedding GPS navigation system. So we can reduce the chance of death rate during emergencies.

5. FUTURE SCOPE

The system does not give the shortest path to the hospital neither does the signal change automatically.

The system is more manual than automatic. In the future scope, this system could be made completely automated as it could find the shortest path to the nearest hospital and if the ambulance halts at the signal, then the signal changes automatically according to the shortest path to the hospital. This saves more time and the patient is taken to the hospital in minimum time possible.

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