IJCSE International Journal of Computer Sciences and Engineering Open Access
Survey Paper Volume-5, Issue-4 E-ISSN: 2347-2693

A Survey on Smart Ambulance Traffic Control System -A Support for Implantable Medical Devices

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www.ijcseonline.org

Received: 14/Mar/2017, Revised: 26/Mar/2017, Accepted: 20/Apr/2017, Published: 30/Apr/2017

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(TCS) 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.

Keywords: Server, Mobile app, Arduino, LCD Display, GPS Tracking System.

I. 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 strucking 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.

II. 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.

RFID-based system, which manages and regulates the traffic signals at junctions when the emergency vehicle approaches, by allowing the straight forward passage out of the traffic congestions. This paper proposes an approach which controls the Traffic Signals so as that when the emergency vehicle is on its way to a selected destination. The case of ambulance is tracked by using GPS. This location is send to the application. The application performs the algorithm with the help of this data and so the google map. It controls the signals on its path. They also introduced a current blue light to stoplight to avoid the chaos within the mind of the people waiting at the stoplight. The working of the system relies on two important modules.

The GPS

The ambulance or any emergency vehicle must be equippedwith the GPS System. This GPS System will send thecoordinates of the vehicle at every moment to applicationServer. Each vehicle must be logged in to the androidapplication. This application keeps tracking the vehicle andtracks the route. The route is already selected by the motiveforce this route is additionally accessed by the server. Theapplying server accepts all the knowledge, based on thisinformation the server finds this location of the vehicle andalso the route selected to the destination. This helps tolook out the following stoplight in its vicinity. Wheneverthe vehicle comes within the space of certain meters fromthe signal the server must send the required action so as thatthe vehicle doesn't must wait at the signal. A symbol isadditionally sent to the destination hospital so as that thehospital authorities are able to handle the patient. Hospitalsalso assign the priority to the patient supported theirsituation. It's useful when two ambulances arrive to the dentical signal at same time. There is also certain decision that the software must take supported things of the signal lights. Variety of these possibilities is as follows if the signal is already green it'll remain the identical as long because the ambulance doesn't glide by. there's also a threat that individuals might think that it's technical error if it's green for too long only on one track and can break the rule to avoid this a greenhorn blue light is placed on the signal, whenever other signals be Red to grant way to mergency vehicle simultaneously the Blue light is lit as a sign that there's an emergency vehicle passing.

To build an integrated user HPV system through which an HPV driver can send requests to the system to which he system responds intelligently. Road Segments (RS) priority is determined at the intersection and light turns green with highest priority vehicle. They tested the algorithm on SUMO (Simulation of Urban Mobility) and it's shown positive results by saving over 50% time in various traffic intensities (low, moderate, high). The system mainly aims to tackle traffic jams problems for HPV. It's a user interactive system where the user (who is that the driver of HPV) initially attaches itself to the system before moving on for a call. It then sends an invitation to turn light green to the system at a traffic intersection to urge a green signal. The system calculates the priority of every RS of a traffic intersection. The system turns light green for the RS with highest priority value. The system takes good move by calculating the priority value of every intersection after a period of TLDC. Traffic Light Duration Cycle (TLDC) could be a time of 1 traffic cycle consisting of red and green duration of a light at an intersection. The model takes two scenarios into considerationSuppose there is no ambulance at a light intersection on any RS then light runs automatically. Remember there are ambulances on every RS of traffic intersection as the system is determining the priority of any RS of a traffic intersection then the RS with the best priority value turns green over other RS for a whole TLDC during this way the system gives the priority to the ambulances and other essential vehicles.

The opposite intelligent light systems and other transportation systems and came to conclusion and proposed this technique which has allow the android mobile device (emergency vehicle) to override the traditional operation of a stoplight. An android and cloud-based control system using the GSM module is an effective and price competitive solution that can solve this problem. The system comprises of 5 stages which are android mobile device, GSM module, MQTT (IoT) for Arduino IDE, Arduino Uno microcontroller and traffic signals. The developed system has allowed the android mobile device (emergency vehicle) to override the traditional operation of a stoplight. In this paper they developed an android and cloud based control system using the GSM module. The debates on mobility almost exclusively encompass functionalist analyses of how particular mobile technologies can alleviate geographical barriers for act. The developed system during this paper has allowed the Android mobile device (emergency vehicle) to override the traditional operation of a stoplight. They use an android and cloud based control system using the GSM module. The system comprises of Android mobile device, GSM module, MQTT (IoT) for Arduino IDE, Arduino Uno microcontroller and traffic signals this technique are going to be very essential for the benefit and safety of the people of the society, thereby ensuring that there's not a hold up that's experienced currently. MQTT is an "Internet of Things" connectivity protocol and is employed in sensors communicating in home automation and tiny device scenarios, which explains how the system works.

The stoplight unit is going to be constructed and can be controlled by an Arduino Uno microcontroller with the relevant program code. . The android mobile device are going to receive messages and send commands to the microcontroller via the cloud environment and MQTT cloud server with the GSM module is been used which may be compatible to both the cloud environment and therefore the Arduino microcontroller thus helps user to figure in user friendly mode.

The system which comprises of 5 stages which are Android mobile device, GSM module, MQTT (IoT) for Arduino IDE, Arduino Uno microcontroller and traffic signals this paper, they need proposed an adaptive Traffic Management System (TMS) combined with a symbolic logic based scheme so as to require appropriate actions to hurry up the progress of emergency vehicles while avoiding the creation of bottlenecks around their routes. This is often achieved through. The TMS has multiple steps at its disposal to ensure the quickest possible response to an emergency; a number of these will be performed at dispatch time whereas others must be performed dynamically while the EV is on the way toward the emergency location.

In present world, the matter of traffic jam has become a significant concern. It's not just restricted to megacities or metropolitans but even for little cities; hence they require a wise or intelligent control system. Their present control system is not adaptive but relies on time and independent of the traffic density. This static nature makes it noisy, unstable and inefficient. A true time traffic information processing and monitoring program is proposed for addressing this problem of controlling traffic ppaths. This model monitors the clearance time of each lane sequentially and is based on the real-time density of traffic. The approach is very hybrid a mix of sensors networks and camera technology. A united result of image processing and IOT ensures more accuracy and efficiency instead of native approach. Besides traffic jam minimization, prioritization for emergency vehicle is additionally achieved through RFID. Other technology like stolen vehicle racking/detection is additionally deployed. Simple GUI to be used adds a bonus to the system making it easy for room to handle.

The model can be used foranalysis purpose and hence predict traffic jams and traffic status at different times. Hence this model is cost-effective and time efficient smart control system. This model provides solution to the growing tie up problem and may effectively replace the present traditional methodologies or control system. Since the green path time could be a function of the traffic density it may be varied with the varying traffic densities and conditions. Clearance time calculation is adaptive and intelligent, additionally to the current prioritization for emergency vehicles and detection or tracking of the stolen vehicles makes it smarter.

The hybrid approach employed in this model creates a grip over other methods. The info is collected at both local and central level hence makes it better for situation when one in all them fails. The cumulative density calculated gives precise clearance time since both the individual methods have some drawbacks in certain conditions that the hybrid model tries to scale back errors in one method and hence provide more accurate results. All the info collected and standing of the traffic is reported to the room and will be accessed by simple GUI. These may be further extended to indicate traffic status to the users. The info collected of traffic density at different times of day is used for analysis purpose and prediction of the traffic at different times of daily. The analyzed data then may be accustomed predict traffic jams at different locations of town. Hence the model could be a complete package for smart control system which may be extended for creating complete transportation intelligent.

III. 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.

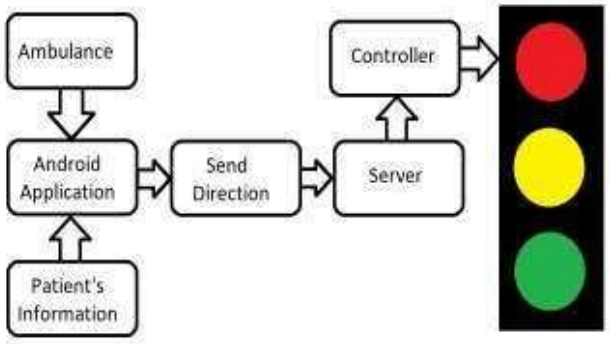


Fig. 1: Flow of Control

IV. 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. 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.

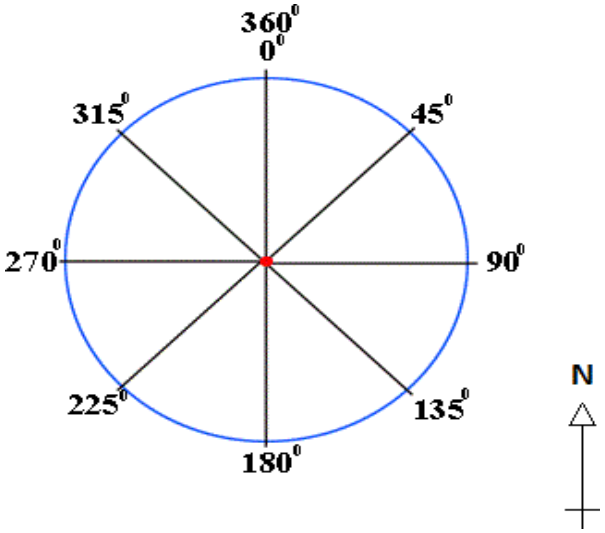


Fig. 2: Compass

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.

Our proposed Smart Ambulance Traffic Control System (SATCS) uses RFID as a main core of communication between the ambulance and the traffic light junction. The RFID consist of scanning antenna, RFID reader and RFID tag which contains the information of the traffic signal .RFID Transmitter (Tx) in an ambulance will send a signal to RFID Receiver (Rx) placed at the nearest upcoming traffic lights junction. Once the signal is received at the traffic light junction, the Near Field Communication (NFC) module and microcontroller will perform a quick check first to identify the route of the upcoming ambulance and will freeze the current flow of traffic if the ambulance is on a red lane. Then, traffic control will change the traffic lights to green along the ambulance path.

Figure shows the communication process between traffic light and ambulance via RFID signal. Immediately after the ambulance has passed the traffic light junction, the control unit will restore the previous traffic flow according to their priority. Figure shows the block diagram that forms a fundamental design of our proposed system.

Figure illustrates the process flow of the oncoming ambulance route in our SATCS. The SATCs is activated by the oncoming ambulance RFID Tx to facilitate the traffic light control. Once the signal is received from the oncoming ambulance RFID Tx, the microcontroller at traffic light will perform a check on the on coming ambulance lane. If the oncoming lane is red, the signal will then be forced to change from red to green to allow traffic flow in front of the ambulance to clear the path to give way to ambulance to pass through. All other lanes will be in red light to stop the traffic flow. Once the ambulance pass through the junction, the microcontroller then will reset to normal operations.

Figure shows the full-integrated SATCS prototype system that has been assembled. The grove NFC sensor is placed exactly 10 cm away from the traffic light. When the grove NFC module sends a Rx signal from the Tx of the oncoming ambulance, it will temporarily change the current lane signal into red and give priority to the oncoming ambulance by changing the ambulance lane to green. Once the ambulance has passed through the junction, it will change back to red and will resume the flow of the pre-set traffic signal.

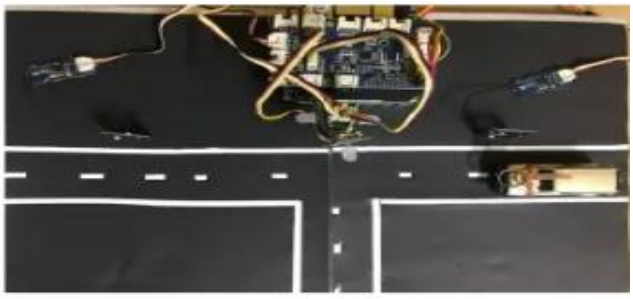


Figure 1. Ambulance and traffic light communication via RFID signal in SATCS.

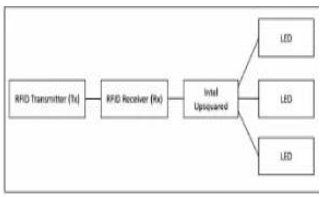
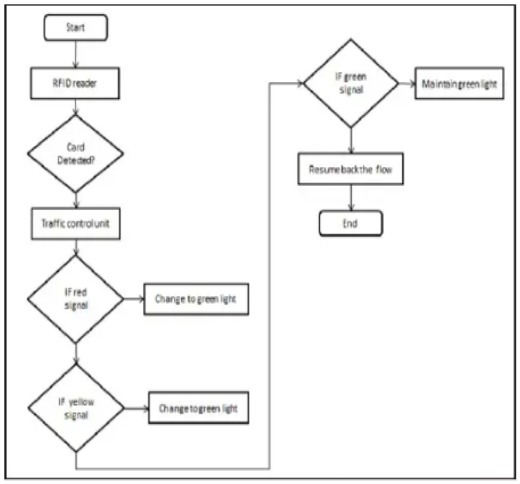


Figure 2. SATCS block diagram.



V. CONCLUSION

The existing system doesn't provide a transparent path for emergency vehicles during traffic congestion. From the literature survey, we've found that RF ID-based smart traffic control system provides an answer to the traffic congestion problem and this can be also an efficient method to supply a transparent path for the emergency vehicles when identified within the lane, as we also implemented sharing of patient's vital data with hospital we updated Arduino uno with Arduino mega board so it'd be sufficient for storing of patient vital parameter and simultaneously it performs capturing of present status of traffic signal present in different path and we also added another system in the junction which repeatedly scans the density of the lanes so that the system can automatically allow the lane which has high density by this technique the emergency vehicles experience less congestion and reach faster to the destination and thus many life's were been saved.

VI. 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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