An IoT based Ambulance Guidance System Under Emergency Condition

K. Premkumar, K.V. Hari Krishnaa, R. Remo Dany, S. Sri Siddharth

Abstract: In our country almost all the states are facing traffic congestion severely, mainly in urban areas. The road accidents are increasing because of the traffic blockage which ruin the human lives. Due to population increase, the numbers of the regions are widening and the number of vehicles is also rising. Traffic is the main factor contributing to accident and it also causes some delay in getting to the destination. Thus traffic managing and regulating is the main traffic management problem. The ambulance and the traffic signals are integrated with some embedded systems to find out the accident spot through GPS. The accidents are determined by fixing the sensors in it. This paper provides an idea in order to control the accidents by implementing a solution where Traffic signals are dynamically operated in its way and traffic congestion rates are lowered.

Keywords: Global Positioning System(GPS), Embedded system, Sensors, Traffic monitoring..

I. INTRODUCTION

The human life is in great threatening because of this jump in traffic jam .The soul of patient is also in emergency when there is a lagging in conveying the message to the ambulance immediately. A pre-programmed device will identify the location of the crash and send the alert to the control unit to decide the location of the incident, so that the ambulance can recognize it in time and move to the hospital. Almost all the traffic signals today are automated, when an emergency vehicle passes by an intersection without green signal is a danger to traffic which is approaching the signal from other roads for which the signal is green. The emergency vehicle must therefore wait until the end of the complete traffic signal process to request an approved green signal to avoid major collisions. It is a major reason why emergency vehicle response time is low. IOT plays a major role in relating environmental variables from every remote place to the network [4].

It becomes difficult to find one in today's increasingly traffic congested cities where parking spots are very much required. Now-a-days traffic automation in most of the cities is done by using many technologies.

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Some popular technologies include RFID, Machine learning, Artificial Intelligence etc. But each methodology has its own disadvantages. For example in some cities RFID is used for traffic control [5].

This method demands to install costly rfid readers for every fixed interval. This makes the solution expensive also for this method to detect the occurrence of accidents every vehicle must be equipped with sensors. Another method uses IOT to control traffic. But this method relies more on cloud service. This increases the latency period, and if the network strength is low, it is difficult to connect with cloud service. And some methods used for controlling traffic needs statistical data to make decisions to control traffic. To store and manage this data it is difficult. The proposed system does not use RFID tags and readers and thereby reducing the cost invested on RFID readers, also there is no need for installing sensors on vehicles and on roadside so the number of sensors used are reduced to a large amount. Using this model all types of emergencies regarding health like accidents, cardiac arrests etc. can be addressed and even emergencies like fire accidents etc can be addressed [6].

II. RELATED WORKS

A. Traffic Automation

Lella Sai Krishna et al [9] proposed a system in which they have focused primarily on identifying the accident locations and monitoring the traffic lights along the way of emergency vehicle to decrease the time lag of the emergency vehicle in reaching the destination. If two emergency vehicles concurrently hit the same signal then first come first served principle is followed. Green signal is shown to the vehicle that comes first. The RF transmitter in the emergency vehicle transmits the data to the traffic signals where it is processed and it is supervised. Each vehicle is equipped with vibration sensors and GPS system. The vibration sensor is used to find the changes in reverberation values if the value crosses a certain value, it concludes that an accident has happened and the location of vehicle is sent to ambulance using GPS. The ambulance is installed with RFID tags to differentiate it from other vehicles and when the ambulance passes through a signal RFID reader in the signal, senses that an ambulance passes the signal and makes the signal green along its way.

Varsha sahadev Nagmode et al [10] developed a system in which an array of ultrasonic sensors are utilized to measure the vehicular traffic level at each lane, This data is stored in the controller and sent via a Wi-Fi module to the Web server from there.

The data collected are stored and examined in the server. Here traffic signal control method is used to control the traffic, which purely depends on the accurate detection of traffic levels at all lanes. If the high traffic level is detected in any lane, then that lane is given the highest priority and more space is provided for vehicles to pass. Communication between the main system and priority system is given by RF transceivers which transmits and receives traffic related message. At the meeting point of lanes, this system is mounted which is easy, low cost and efficient. Large numbers of ultrasonic sensors are installed on the roadside in the proposed system to monitor traffic levels positioned at the specific distance interval. The traffic volumes are divided into three categories. These levels are low medium and high.The data sensed is in continuous form and is transferred to controller for calculating traffic levels. If the level of traffic is high, then the controller manages the signal timing at that lane and offers more space for vehicles to pass. If low traffic level results then controller controls the signal timing in such a way that it gives less time for passing vehicles. This system also offers greater attention to high-traffic emergency vehicles. RF transceivers are used to send warning messages or any traffic status from the controller device to the priority system to collect them. The Liquid Crystal Display Unit displays these same data. The traffic level data and its date and time are sent to a secure open source provider's server. Such data will then be analyzed and processed for future reference in the cloud database. In traffic monitoring and controlling system ARM7 micro-controller is used which is interfaced with ultrasonic sensors, RF transceiver, keypad, LCD for displaying output, LED bulbs for signals, Wi-Fi module for transferring data to server via internet. PIC microcontroller is used in vehicle priority system as the embedded processor interfacing with LCD, keypad, and RF Transceiver.

`Sayalee Deshmukh et al [11] proposed a system that enables an agile movement to emergency vehicles throughout their way by controlling the traffic signals. The geographical location of vehicle is extracted by using GPS. Transfer the place to the application. With the aid of this data and the google map API, the program then performs those predefined procedures. The algorithm's main function is to monitor and change the signals on its route. Traffic signals are also implemented with a new blue light to escape the state of confusion in the minds of the people who are halted at the traffic signal. The primary requirement is to link an ambulance or any emergency vehicle with the GPS System. This GPS System looks after the job of sending the latitude and longitude of the vehicle at every moment to the application Server. Each vehicle must have an account and logged in to the Android application. This application continuously tracks the vehicle and tracks the route. Also the route must be already decided and chosen by the driver. This route is also accessed and monitored by the Server. After having all the necessary information in the Application server, based on this data the server identifies the present location of the vehicle and the chosen route to the destination. This helps to find the next nearby traffic signal. Whenever the vehicle enters the vicinity region of the signal, the server must initiate the necessary action so that the vehicle can have an agile movement in signal. An intimation is also sent to the destination medical facility so that the respective hospital personnel are aware and prepared to attend the emergency. Hospitals can also assign certain priority levels to the emergency situation based on the patient situation.

Patan Rizwan et al [12] proposed a cost efficient Real-Time smart traffic Management System to offer better amenity by implementing traffic indicators to retrieve the latest traffic details at any given instant. Road is embedded with low cost vehicle detecting sensors in the middle for every 500 meters or 1000 meters. Internet of Things technology is made use of to extract traffic data instantly and dispatch it for further analytics. To analyze the traffic density and provide cost and time efficient solution through predictive analytics there are several analytical scriptures available out there. An android application or a web application is used as user interface to know about the traffic congestion at various places and an alternative way that is free from traffic jam is shown for managing the traffic. It consists of IoT module, bigdata module and UI module. IoT module is used to completely monitor the amount of vehicles present in a road. The Intel IoT kit that contains all latest features and vehicle detection sensors is used. Sensors are places on road at a distance of 1/2 or 1 km, all the sensors are interconnected. Big data module receives data from each sensor with its respective id. Now the analytics operations are carried out, computing the road capacity, leaving vehicle details, road congestion etc. Finally a detailed report is produced by this module making it available on android app or a web app. Real time streaming data processing mechanisms are used in this module. UI module presents the latest analytics of bigdata module to the end user in either mobile or web platforms. Also the user is also offered with the facility of viewing the report on his/her current location by switching on the GPS.

III. PROPOSED SYSTEM

The proposed system does not use RFID tags and readers and thereby reducing the cost invested on rfid readers, also there is no need for installing sensors on vehicles and on roadside so the number of sensors used are reduced to a large amount. Using this model all types of emergencies regarding health like accidents, cardiac arrests etc. can be addressed and even emergencies like fire accidents etc can be addressed. Though this model also uses IOT to control traffic it does not rely on cloud service for signal manipulation and thereby there is no dependency on network strength and thus latency time is reduced. This system does not manipulate signals based on the monitored data from the lanes(road), so there is no need for any statistical data and the overhead of storing a and huge amounts of data is reduced. This system also helps the ambulance in case of health emergency to reach the right hospital by asking the nearby hospitals about facilities available in advance.

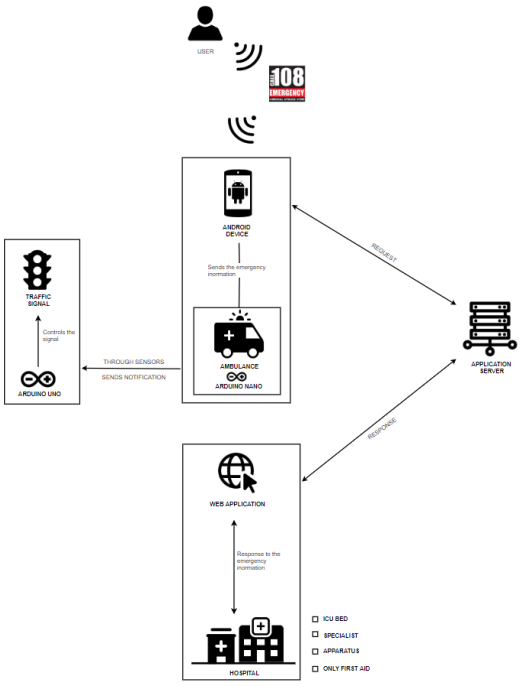


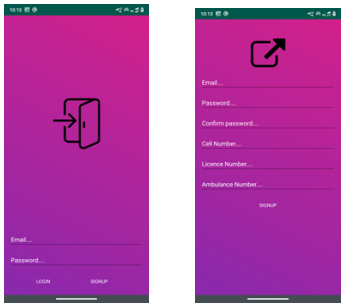
Fig.1 Architecture of Proposed System

A. List Of Modules

- User Authentication
- Map activities
- Request and Response (Android app)
- Request and Response (Hospitals)
- Application Server
- Signal Automation

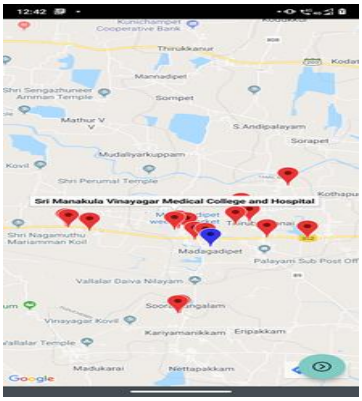
3.1 User Authentication

Login if already registered. Signup if new user. Verify the user details locally. Authenticates the details in the firebase.



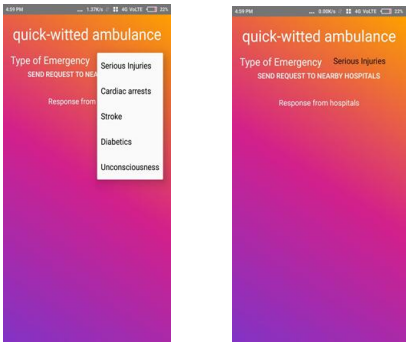
3.2 Map Activity

After login, through maps the nearby hospitals are identified. The hospitals around 1KM of radius are shown. Also the traffic signals around that 1KM of radius will be marked. The google map API is used, Location Sensor for locating Traffic signals. Places API for locating nearby hospitals.



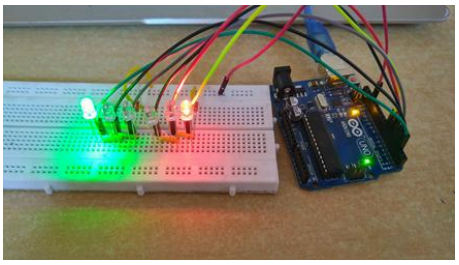
3.3 Request And Response

The situation of the patient is selected. The request is sent to the selected hospital. The response regarding the availability in the hospital is sent back to the user.



3.4 Signal Automation

After getting the signals from Arduino NANO in ambulance, the Arduino UNO manipulates the traffic signals.



IV. IV. EXPERIMENTAL RESULTS

The result of our project is well defined, the outputs of each modules are well defined above with the screenshots and it will work effectively in any conditions since we use local database and firebase to authenticate. The best way is found through the google maps and the acknowledgement is sent. Through the application server the web app and the android app is connected and the finally the output of the automated traffic lights are shown.

V. CONCLUSION

Internet if things is a vast domain and since it is merely the interaction between physical devices its range of application gets broader day by day. It can be applied wherever there is a need for the physical devices to work in a coordinated environment.

It is mostly implemented with physical sensors that collects data from the deployment environment and this data is sent to a server to process the data and is stored in cloud and finally the result is viewed in thin or thick client platforms.

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