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Traffic Clearance System for Ambulance Services

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Abstract

Now-a-days considering the fast moving world scenario especially in large cities many services especially ambulance get delayed due to traffic jams. Also sometimes doctors are not available in case of emergency, due to which patient does not get medical attention immediately. To overcome this situation this paper describes a solution that is 'Traffic Clearance System for Ambulance Services' which is an android application which also includes a web portal. An android application is developed which will help the ambulance to reach the patient's destination, help the hospital to make prior arrangements required to treat the patient and to help the traffic policeman to clear the traffic. The proposed application will make use of GPS system to track the location of the ambulance which will give a clear picture to the traffic hub/policeman for clearing the traffic and to the user-selected hospital for making preparations to treat the patient as per the user's details.

Keywords: Android application, web portal and GPS (Global Positioning System).

Introduction

Today's world is developing at a rapid speed. Everyday a new technology is discovered and developed. At the same time many problems are being faced by people in smart cities. Some of these problems are heavy traffic jams due to which loss of lives occur if the arrival of ambulance to the hospital is delayed. Also many a times, even if the ambulance arrives at the hospital, the doctors may delay in treating the patient due to several reasons such as the hospital may not have the required facilities to treat the patient, it may not have the specialist required for that particular incident and many other.

Current traffic control techniques include strobe emitter, siren detectors, magnetic loop detectors buried in the road, infrared and radar sensors on the sides of the road. All these techniques provide limited traffic information to make way for the ambulance. Another technology named RFID is a wireless technology that uses radio frequency electromagnetic energy to carry the information between the RFID tag placed on the ambulance and the RFID reader placed on the traffic signal pole. The disadvantage of this system is that it only works within certain ranges.

Technologies like zigbee and GSM can also be used in traffic control but in the zigbee technology, the usages of number of channels vary depending on the radio frequency range. The GSM operates only over a subscription to a mobile operator, just like mobile phone. To overcome these disadvantages an android application is being developed. The main objective of this application is to control the traffic, allowing an ambulance to arrive at a particular location without stopping anywhere until the destination is reached.

The proposed application consists of four modules: the user module, the traffic hub module, the hospital module and the ambulance module. The user module provides the details of the patient. The ambulance module finds the location of the user after receiving the details of the user. The traffic module clears the traffic on receiving the user information. The hospital module makes prior arrangements to treat the patient on receiving the details of the user. The details of the user, the information given by traffic control room and the hospital are maintained by the server.

The proposed application will also use GPS system to track the location of the ambulance which will give a clear picture to the traffic hub/policeman for clearing the traffic and to the user-selected hospital for making preparations to treat the patient as per the user's details. Time management as well as cost management is ensured through this application as a lot of time is saved at signals and shortest distances

are tracked with the help of GPS. This proposed application can be used by all types of ambulances and hospitals.

2. Related Works

2.1 Automatic Ambulance Rescue System using Shortest Path Algorithm

According to this paper, the ambulance is controlled by the central unit which furnishes the shortest route to the ambulance and also controls the traffic light according to the ambulance location and thus reaching the hospital safely. The server also determines the location of the accident spot through the sensor systems in the vehicle which encountered the accident. [1]

2.2 Implementation of an Emergency Vehicle to Traffic Lights Communication System

To bar loss of human life due to accidents, this paper proposes the ETL (Emergency Traffic Light) control system. The ETL control system will control the traffic lights in the path of the emergency vehicles, stopping conflicting traffic, and allowing the emergency vehicle right-of-way to help in reducing their response time. [2]

2.3 Smart Traffic Control System for Emergency Vehicle Clearance

According to this paper, the image sequences from a camera are analyzed using edge detection and object counting methods. Then, the number of vehicles at the intersection is evaluated and traffic is efficiently managed. The traffic signal glows to green as long as emergency vehicle is waiting at the traffic lane. [3]

2.4 Ambulance Tracking and Alternate Routing

GPS and GSM units are used to send the exact location of the ambulance to the control room. If the spot is identified, the information is sent to the hospital through the control room. In the control room, LabVIEW software is used for the effective interface. This system helps to control all the traffic signals from the control room through the computer and provide a easy route for the ambulance to move. [4]

2.5 Improved Traffic Control Systems for Emergency Vehicle Clearance and Stolen Vehicle Detection

According to this paper, each vehicle is placed with an RFID tag. Whenever the RFID reader reads the tag of ambulance it turns ON the green light for that particular path till the reader reads the RFID tag. The position of theft vehicle is located with the help of GPS and the information is transferred through GSM to the control room. When the tag of stolen vehicle is read by the reader it turns on the Red signal. [5]

2.6 Design of an Automated Traffic Control System for Emergency Vehicle Clearance

This paper proposes an "automated traffic signal ". This system provides clearance to Emergency vehicles using RFID module that consists of RFID tag and an RFID reader and a GSM modem. GSM acts as a wireless network to send the message from emergency unit end and receive the same text message at the traffic junction end. [6]

2.7 RFID and Zigbee based Intelligent Traffic Control System

According to this paper, Vehicle is equipped with RFID tag. RFID reads when a vehicle comes in the range, and counts the number of the vehicles on a particular path for a specified duration and determines the congestion and hence the green light duration. In addition, when an ambulance with an emergency case approaches the junction, it communicates wirelessly with the traffic controller using Zigbee modules to turn ON the green light. [7]

2.8 RFID and GPS based Automatic Lane Clearance System for Ambulance

The traffic signal, in the path of the ambulance, is turned to green when the ambulance is at a certain distance from the traffic junction. The communication between the ambulance and the traffic signal post is done through transceivers and GPS. [8]

2.9 Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance and Stolen Vehicle Detection

Each individual vehicle is equipped with special RFID tag. RFID reader is used to read the RFID tag attached to the vehicle. If the RFID-tag-read belongs to the ambulance, then a message is sent using GSM to the traffic controller to turn on the green light. [9]

2.10 Automatic Lane Clearance System for Emergency Vehicles

This system includes image processing, wireless technology and embedded system. This device will be interfaced with the signal approached by the

ambulance in its desired destination. The signals will be turned green, a particular time before the ambulance reaches the signal. [10]

3. Proposed System

The proposed system is divided into four modules namely the user module, the ambulance module, the hospital module and the traffic module. It contains an android application used by all the modules and a web portal used by the hospital and the traffic hub.

3.1 User Module

In this module the user plays the major role. The user must first install the application on his/her mobile device. After installation, when an emergency arrives, he/she should first register as a user providing all the required details and then login using the username and password which he/she had created during the registration process. After logging in the user will be able to view his/her location and the ambulances nearer to his/her place.

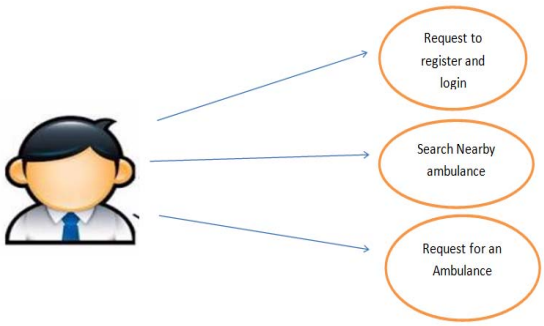

Figure 1: Use-case diagram for user module.

3.2 Ambulance Module

In this module the ambulance driver plays a major role. Same as the user, the driver must also install the application on his mobile device. After installation, he must provide the details such as driver name, mobile number, vehicle number and location. These data are stored in the local host and compared when the driver login to the application using the same details. Hence, establishing the authentication. On signing in, he will receive the list of users who have booked for his vehicle. This list contains the name, phone number and location of the users. He can also view his location at the same time. The driver can accept the request made by the user by tapping on the notification received. Once he accepts the request, a map will appear on his phone showing the directions to the user's location.

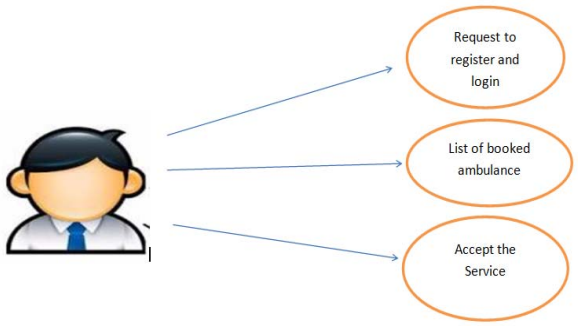

Figure 2: Use-case diagram for ambulance module.

3.3 Hospital Module

This module mainly consists of the hospital faculties monitoring the computer systems. Same as the users and ambulance drivers, they can install the application on their smart phones. They can operate the application by registering onto the application.

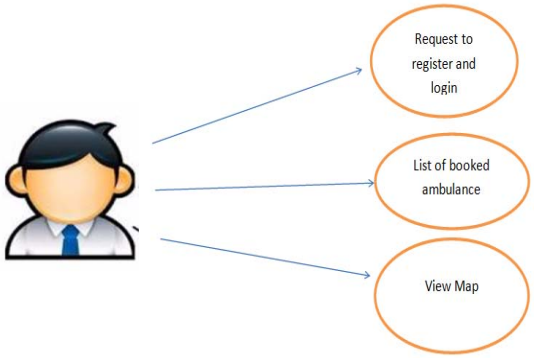

Figure 3: Use-case diagram for hospital module.

In the registration process, the concerned faculty must provide the details such as hospital name, mobile number, landline number and location. A web portal is provided to them which will give them the details of the user who has booked an ambulance. They can login to the web portal by providing the mobile number and password [11].

3.4 Traffic Module

This module consists of traffic control room controlling the traffic by providing on spot information to the concerned traffic policeman. Like other modules, the faculty in the control room must install the application and register by providing details such as control room name, mobile number and location. Similar to the hospital module, a web portal is also provided to them where they can view the details of the user and ambulance. They can login to the web portal by providing mobile number and

password.

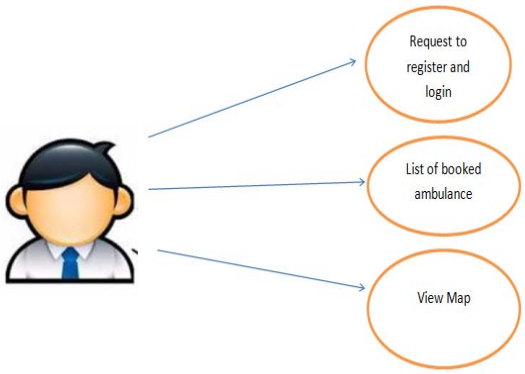

Figure 4: Use-case diagram for traffic module

4. Application Process

Figure 5 shows the process of the proposed application. At first, the users and the ambulance drivers enter the login credentials. These data are stored on a server for future use [13].

If the login details are valid, the application displays the main screen for that particular role what the person who is using the application has chosen. The details provided by the user are shared with the ambulance driver, hospital faculties and the traffic control room. The details of the ambulance driver are shared with the users.

After login process, the user can make a request for an ambulance nearer to his/her location. The ambulance driver can accept this request upon which he will be displayed a map showing directions to the user's location. The traffic control room and the hospital faculties on the other hand can view all these details provided by the user and driver. The control room can monitor the route taken by the ambulance to reach the hospital [12].

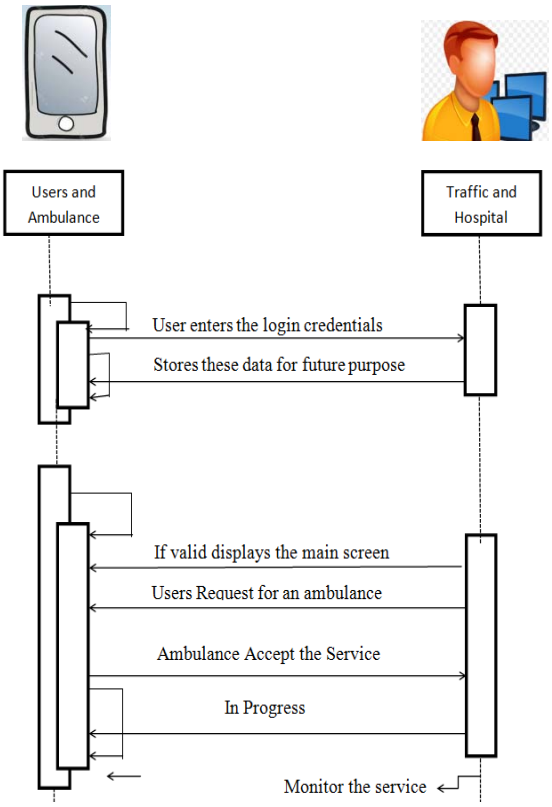

Figure 5: Application process.

The details provided by user, ambulance driver, traffic control room and hospital faculty are stored in a database named as TCM (Traffic Clearance Management). Figure 6 shows the explanation as provided above.

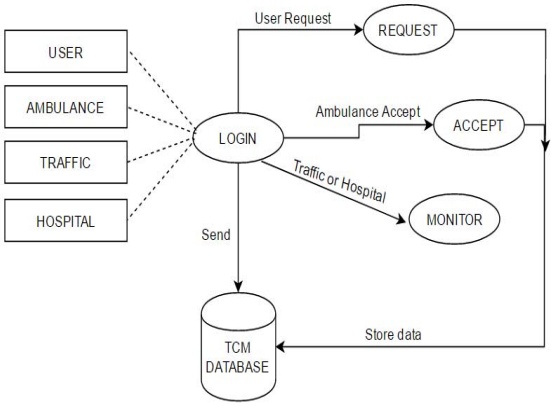

Figure 6: Overview of the application.

5. Application Development

The application is mainly built for Android smart phones. It is developed in android platform using android studio version .The database used here is MySql and Apache. PHP scripts are used for communication between the four modules.

6. Results and Discussion

The proposed application has been tested using two android smart phones, and two laptops. The user, ambulance, hospital, and traffic police can register through an android smart phone. The user can book ambulance after registering through android phones and also ambulance driver can get notification about the booking through phones. The hospital and traffic police uses laptop to get updates about the location and booking. The path of patient's location to hospital and ambulance trying to reach the patient's destination is sent to the traffic hub and hospital. The traffic hub will track the path and will notify the traffic police of that area to clear the traffic in advance before the ambulance reaches that area. This will help the patient to reach the hospital early and also the ambulance driver to reach the patient's location fast.

Figure 7 shows the screen which is seen soon after we open the application. This is basically a login form for user (patient) and ambulance driver. When we click on "tap here to sign-up" this will take us to the role selection form (figure 8). Based on the role selected it will take us to the respective registration form as shown in figure 9. After registering, user can now login by using his/her phone number and password. This will take the user to his/her screen (shown in figure 10) where user can view the list of nearby ambulances and can also book ambulance. Figure 11 shows the ambulance screen which shows the request made by user. When ambulance driver accepts any user's request it will take him to the user's location (shown in figure 12). When the ambulance driver clicks on the direction icon shown in figure 13, it will take him to the Google maps which will show him the direction.

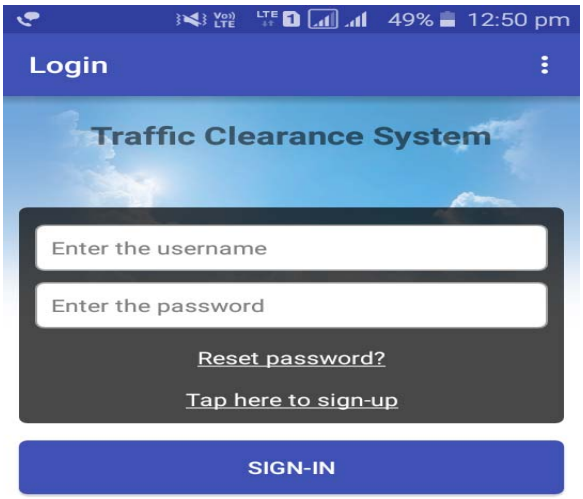

Figure 7: Login Form.

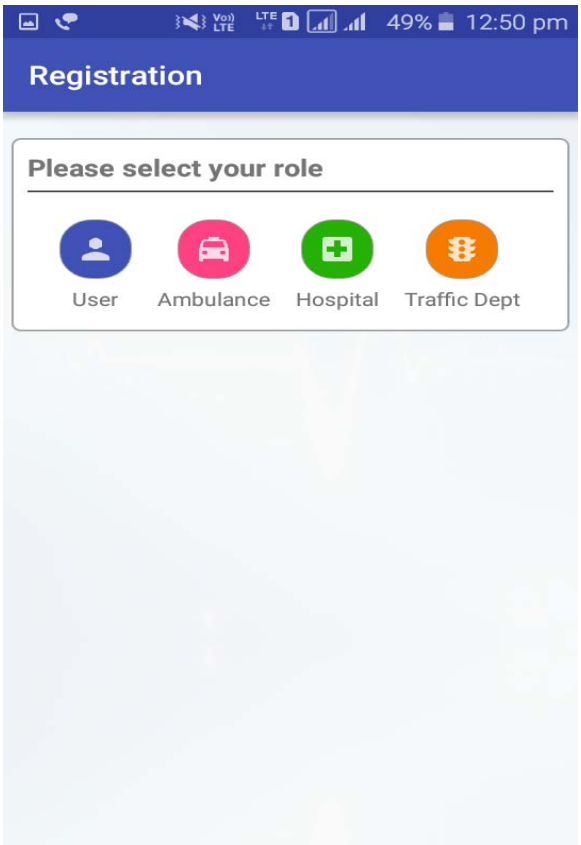

Figure 8: Role Selection Form.

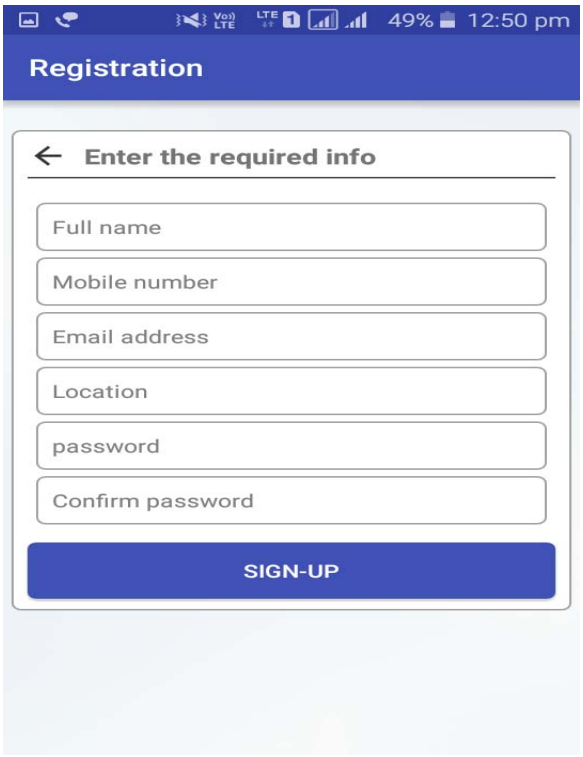

Figure 9: Registration Form.

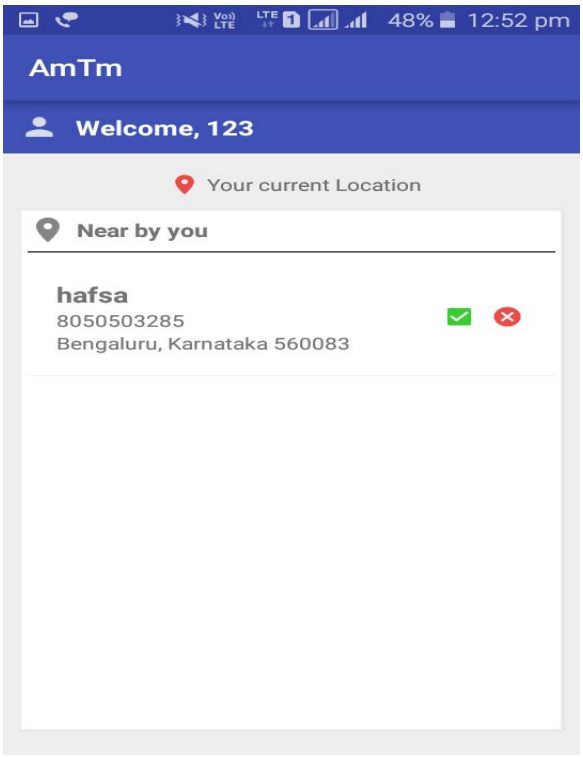

Figure 11: Ambulance Screen.

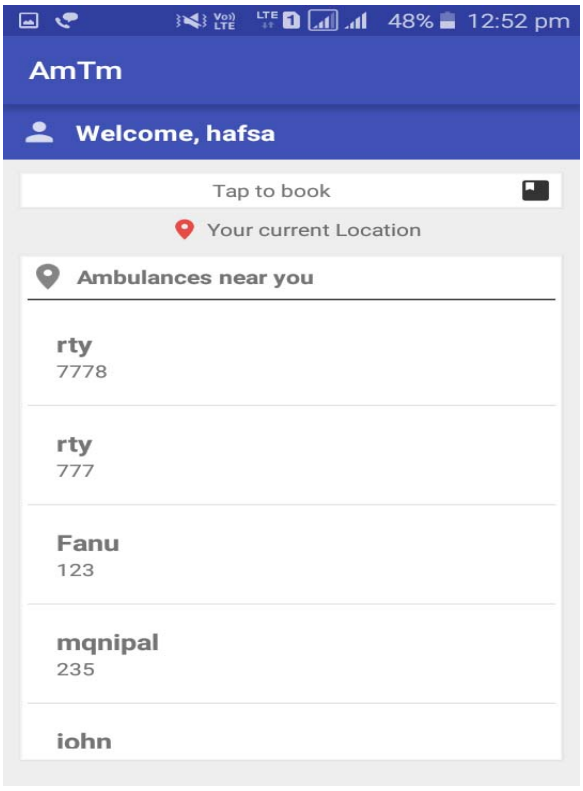

Figure 10: User Screen.

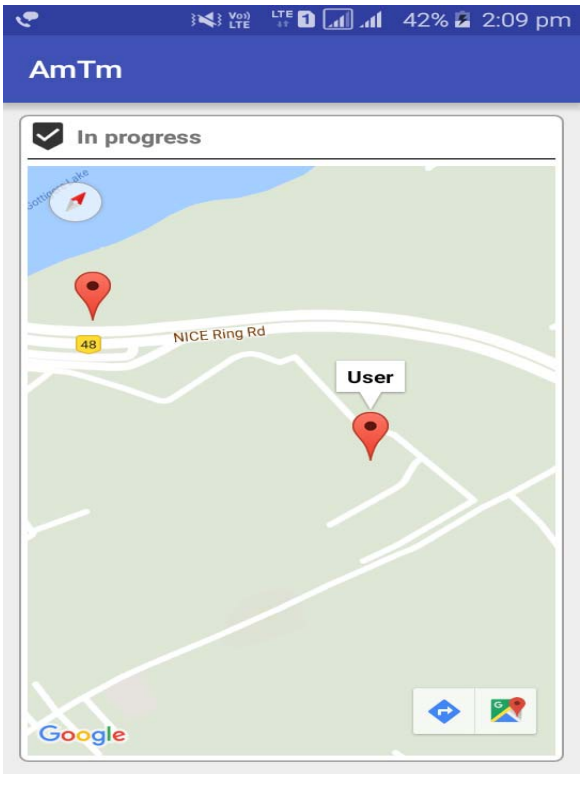

Figure 12: User's location viewed by ambulance driver.

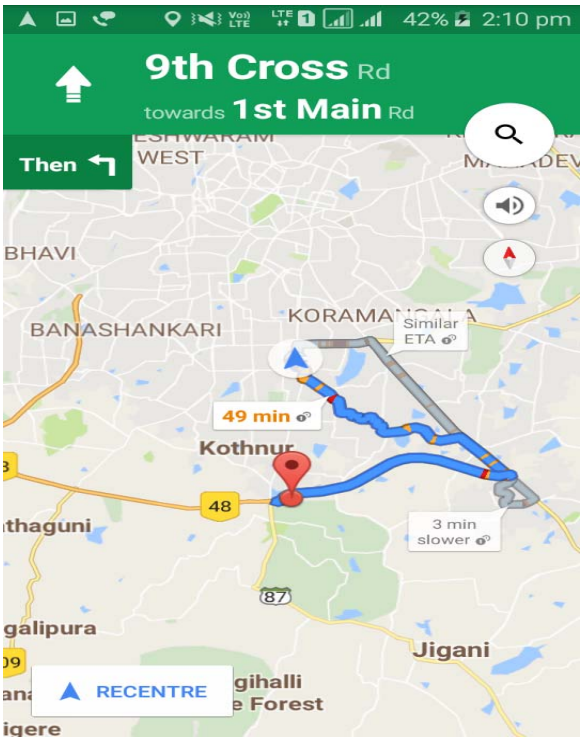

Figure 13: Direction from ambulance to user's location.

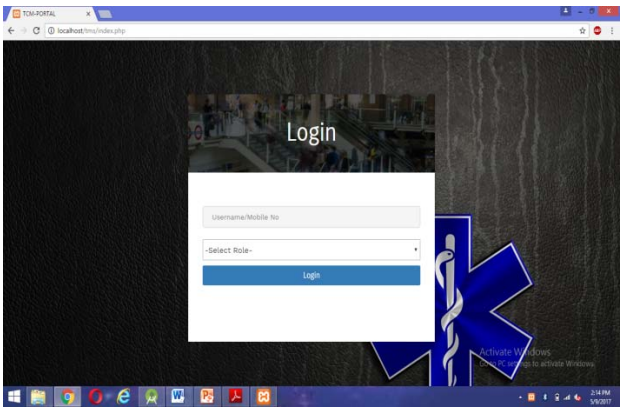

Figure 14: Hospital and traffic login form.

Web portal is used by hospital and traffic hub. The login form for hospital and traffic is shown in figure 14, where a person should enter his/her phone number and select his role (either hospital or traffic). After clicking on login it will show both hospital and traffic list of users who have booked the ambulance with their details (shown in figure 15).

The hospital or traffic can view the user and ambulance location by clicking on "view on map". It also keeps track of the ambulance's location which will help the traffic control room to inform the traffic policeman to clear the traffic in that direction. The direction is shown in figure 16.

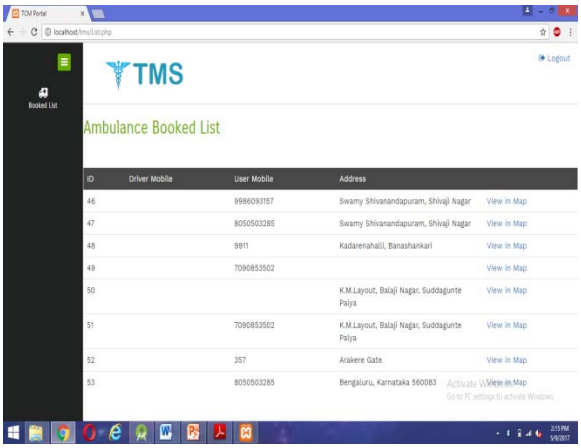

Figure 15: Ambulance booked list.

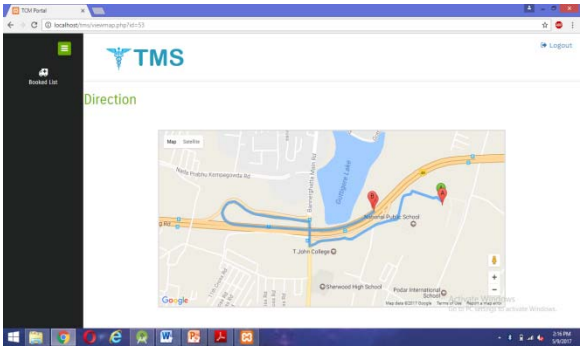

Figure 16: Map viewed.

7. Conclusion

The proposed system is used to develop an android application which will help the ambulance to reach the patient's destination, help the hospital to make prior arrangements required to treat the patient and to help the traffic policeman to clear the traffic.

The application consists of four modules: the user module, the traffic hub module, the hospital module and the ambulance module. The user module provides the details of the patient. The ambulance module finds the location of the user after receiving the details of the user. It will also suggest the nearby hospital to the user. The traffic hub module clears the traffic on receiving the user information. The hospital module makes prior arrangements to treat the patient on receiving the details of the user. The details of the user, information given by traffic control room and the hospital are maintained by the server. The proposed application will also use GPS system to track the location of the ambulance which will give a clear picture to the traffic hub/policeman for clearing the traffic and to the user-selected hospital for making preparations to treat the patient as per the user's details

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