

Smart Ambulance System

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ABSTRACT

Emergency medical response in India is lagging behind other countries. This is partially because of lack of technology implementation at ground zero. To address the issue, we are introducing smart ambulance system. It would take India to competitive position in emergency services around the globe. Over the last few years there is a revolutionary development in the field of Internet of Things (IoT). It can be used seamlessly & widely in large number of end system where subset of a large amount of data can be accessed and processed easily and powerfully. IoT and smartphone technologies help in building a platform which serves every smartphone user. The application collects location information from Global Positioning System (GPS) hardware and uses Google Map Application Programming Interface (API) to plot details of the ambulances on the Google Map Client of the Smartphone App. Same functionality can be used for the other module which enables user to find the hospitals with the number of services provided by those in brief manner. With the help of medically equipped and technologically powered ambulance, information about patient's health details can be sent to the hospital in order to take further action. Interaction between the smartphone and the centralized database can be done using Representational State Transfer Application Programming Interface (REST APIs). The platforms that are used, capable of molding into various services that are implemented and it is believed that these technologies can make a revolutionary work in public GPS work if utilized properly.

Keywords: Hospital, Ambulance, Emergency, Public Safety, Smart City, Smartphones, GPS, REST, JSON.

ARTICLE INFO

Article History

Received: 5th May 2016

Received in revised form :

5th May 2016

Accepted: 10th May 2016

Published online :

12th May 2016

I. INTRODUCTION

In today's era, there are many cities which are working on transforming themselves into Smart Cities. If the city is going to be called as Smart City, then it should have all possible advancements in the sector of smart technology. Improving efficiency in healthcare sector is one of the difficult and most challenging jobs. That includes various aspects such as getting ambulance within minimum amount of time, providing proper treatment to the patient so that the chances of surviving increases in critical condition. Traffic congestion is one of the major problems in urban areas, which have caused much hitches for the ambulance. Moreover road accidents in the city have been increased and to bar the loss of life due to the accidents is even more crucial.

We can overcome these limitations by upcoming technology like IoT[1] i.e, Internet of Things. Various hardware devices can be connected with each other via wired and wireless networking tools and software implementations. Use of various REST APIs can help to communicate between the server and client end which is implemented in this project.

REST APIs are designed in such a way that time complexity will be minimized extensively. This is achieved by exchanging only the required data with server in order to minimize the traffic and loss of data packets in the process of transaction. With the help of cutting edge technology and keeping the goal in mind we've developed this application. It is also an attempt to participate actively in the process of

transforming into smart city and make required services more accessible.

II. ABOUT SMART AMBULANCE SYSTEM

Overview

The system is divided into two modules depending on their functional & behavioural implementation. Both modules work on the principle of IoT [8] with the help of REST APIs. First module is used to find locations of ambulances within the 5km radius from user's location. Also the same module is used to find hospitals and their services within radius of 10km of user's current location.

Here user's location is traced using GPS hardware device. The location is retrieved in the form of double value as latitude and longitude. E.g. 19.54526, 73.87099. This is the format of the latitude and longitude. This location is transmitted to the server by executing POST request. Depending on the user's location, server processes the data and matches with records stored into the database. After processing of such data the result of user's query is sent back to the user in form of JSON format.

Smartphone application reads the response of the server and retrieves the required information and places it on to Google map client of smartphone device or displays in a listed format depending on the user's preference. A marker is used to pin point the location of retrieved data is known as Pin. To differentiate between pins that are used for pointing hospitals and ambulances we've used custom pins. It makes easier to understand the difference even to naïve user. This can be done using Google Map API's functionality. There is a set of predefined markers that are made available by Google in their Google Map API. But for user's convenience custom pins are used. That API guideline is also provided in Google Maps documentation.

Architecture

We've tried to keep the architecture of the system as simple as possible. As there won't be need of any security model the architecture complexity is automatically reduced. Following diagram states working of module one.

Diagram Fig. 1 suggests user sends requested to server regarding the required service i.e. either hospital information or ambulance details.

The second module is used to send live information about the patient's health to the desired hospital selected by the user (Fig.3). Using various smart devices support enabled hardware components, the readings will be recorded by the system which will be available inside the ambulance. The app will send the data in the form of live feeds so that hospital management can make necessary pre-requisites till patient reaches the hospital. It is said that treatment given while taking patient from source place till hospital is most crucial in case of any heart related problem and emergency. Thus Hospital administrative person can guide which actions should be taken until patient it reaches hospital.

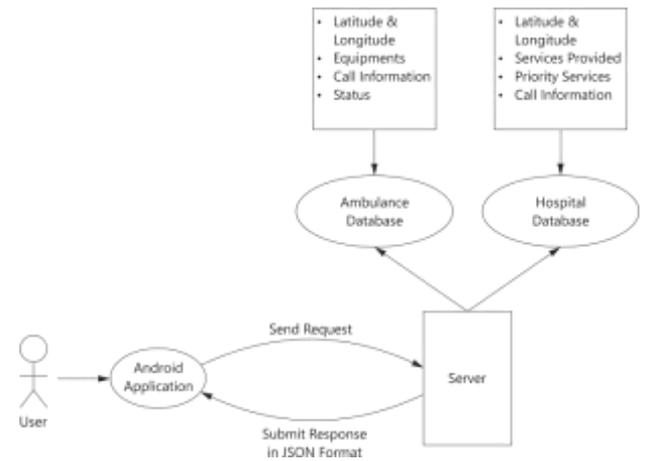


Fig 1. Module One: Finding Ambulances & Hospitals



Fig 2. Module Two: Sending patient's information to the hospital

Design and implementation

The implementation of this system is divided into server client architecture in order to make small size application and keep all the data available centrally. Thus client is nothing but a smartphone having the application and the server side used for handling user requests and respond by processing them.

1) User application

This application will initially be based on Android & iOS. On launching the app first device will automatically detect the location of user using the GPS devices [6]. Later depending on the user's requirement/need user will choose option of finding nearby ambulances or hospitals or just view services provided by hospitals. This query is sent in the JSON format to the server. Server will process on it and respond accordingly. The response from server will also be in JSON format [7]. Smartphone app will read the data from response and plot the coordinates or information according to the user's request.

2) Server end

Server end is designed keeping ease of work in mind. It is designed using PHP. When server will receive a request from device, it will parse the data and extract result from the database. This result will be placed in the JSON format and will be returned to the device which made that same request. Every JSON request will send data depending on request URL type. Every request will be in the form of POST/GET query.

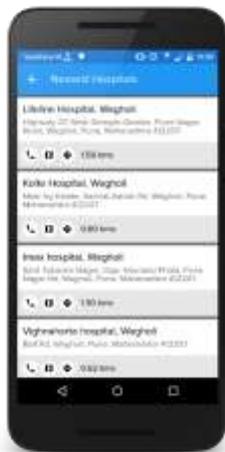
III. RESULTS



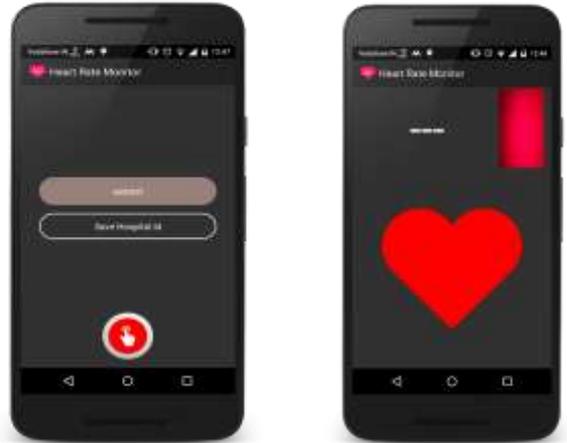
A. User profile screen to fill the user information



B. Option to adjust the radius and view hospitals and ambulances according to the radius specified



C. Information about hospitals along with the contact details and option to call

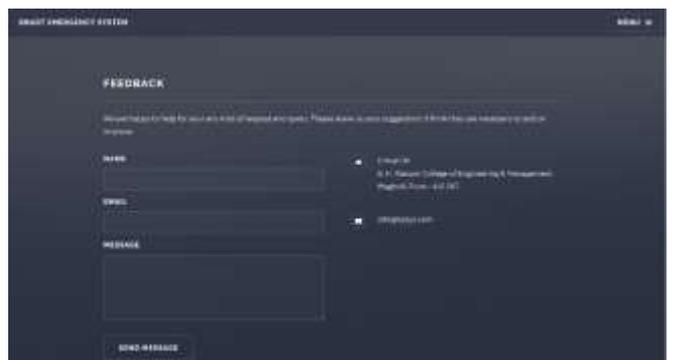


D. Application to measure the heart rate (ECG)

1. Website screen



2. Feedback page



3. Menu page



[7]Grammar-Driven Development of JSON Processing Applications, Antonio Sarasa-Cabezuelo, José-Luis Sierra, Fac. Informática. Universidad Complutense de Madrid. 28040 Madrid (Spain), Proceedings of the 2013 Federated Conference on Computer Science and Information Systems pp. 1557–1564.

[8]An IoT-Aware Architecture for Smart Healthcare Systems. Luca Catarinucci, Danilo de Donno, Luca Mainetti, Luca Palano, Luigi Patrono, Maria Laura Stefanizzi, and Luciano Tarricone, IEEE INTERNET OF THINGS JOURNAL, VOL. 2, NO. 6, DECEMBER 2015.

[9]Image/Table taken from Pune Smart City Project. Website : <http://punsmartcity.in>.