

IOT Based Emergency Medical Services

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Abstract:

Emergency Medical Services comprises of reaching hospital within minimum amount of time so that immediate health care is provided. The proposed system gives the nearby hospital's location by the combined usage of Global Positioning System (GPS) hardware and Google Map Application Programming Interface (API). Based on Internet of Things, it also provides information regarding hospital facilities like number of beds, blood level of all types and availability of doctors using various Embedded System devices in real time during major accidents where multiple casualties have to be treated. These real time data are accessed from the ambulance through internet connectivity and alert signals are given to the corresponding hospitals selected by the casualties. This helps in reducing the mortal rate and improves the hospitality of the people.

Keywords — IOT(Internet of Things), API(Application Programming Interface), GSM (Global System for Mobile Communication), GPS (Global Positioning System), PIR sensor, IR sensor, Fingerprint sensor, Ambulance, Hospital.

I. INTRODUCTION

In this fourth Industrial Technological Revolution, the exchange or communication between different devices has become simple. There has been huge rise in road accidents and lack of information about nearby hospitals and clinics which leads to the death of victims of the accidents. This inevitable requirement of emergency medical assistance paved the way to develop Emergency Medical Services application, e.g. locating hospitals, clinics around the place where accidents occur. A tourist or a visually impaired person finds easy to access this information. In the advanced medical information environment, during emergency conditions, the victims expect the information regarding the facilities provided by the hospitals and according to that they can take up treatment in the desired hospitals. Thus people's need are extended to find the availability of specialist, blood type, bed count and ratings of the hospitals. The proposed system provides this information in the ambulance by which the casualties can be guided to select the required hospitals. It also sends alert signals to the selected hospital and particular specialist to make required arrangements in prior.

The integration of monitoring, obtaining and sharing of data like location and facilities of the hospitals through secure service layer is defined as IOT. In simple terms, IOT can be defined as wireless network of devices which communicates through Embedded System devices that can sense and interact within internal states or with external environment without human-machine interaction through internet enabled devices. This technology not only enables the devices to be connected but also robust and comfortable. The IOT in the aspect of health care plays a major role in providing ease to patients and doctors. These large amount of shared information and data have to be recorded and analyzed in future also and it is a big challenge. The technique of Internet of Things Analytics (IOTA) is implemented to solve such problems. The data is converted to useful medical information using data

extraction and data analytics. Acquiring real time data from various sources in this case, location and unlimited services offered by different hospitals for a large period of time has become very easy and fast using the potential of IOT. The emergency health care services are getting better and less costly. Its efficiency is getting improved.

II. RELATED WORK

The location (co-ordinates like latitude and longitude) of the hospital can be viewed from the ambulance by GPS which is installed in the hospitals. With the help of API developed by Google, the distance of the hospital from the current location could be determined. The Google Map pins the nearby hospitals. The user knows where the hospital is located but they may need to access the information of the preferred hospital. During Emergency situation, the user finds hard to browse the services given by individual hospitals through particular hospital website. This difficulty is overcome by the proposed system where the user selects a hospital from the nearby hospitals and the chosen hospital details will be displayed in real time. A smart camera is attached in the ambulance through which the condition of the patient is monitored remotely in the hospital. To ensure immediate treatment of the patients as soon as they enter the hospital, doctors are alerted through automatic call by GSM to make required arrangements with the video of the critical condition of the patients in mind. There is two way flow of information from hospital to ambulance and from ambulance to hospital. These information are initially stored in the web server which hosts the web services. The concept of cloud has been introduced in this project. The cloud is used to store and access information anywhere over the internet instead of using any external storage devices. EMS application can be accessed at any place which increases its reliability and there is very less maintenance required.

The need and importance of communication during Emergency situation is understood well in this project. Emergency situation includes threatening disasters like fire accidents, earthquake, flood, tsunami, or other natural calamities. The project develop a website where the information can be exchanged over internet.

III. PROPOSED SYSTEM

IOT driven emergency medical service application collects information of the hospitals through various smart medical sensors. The some of the information that needs to be collected are given below

A. To find the number of vacant bed

- When there are large number of patients have to be treated but there is insufficient number of beds in the hospital , then the patient have to be shifted to other hospital.
- This consumes time to large extent which leads to increase in death rate, so in order to overcome this problem, the availability of the number of bed is shown to the application user in prior.
- Using this information, the user finds easy to approach the appropriate hospital.
- Passive Infrared sensor(PIR) is a motion detector which senses the presence of patients in the bed and using a logic the total number of bed occupied and the total number of vacant bed are found.
- The number of vacant bed is sent to the server through Embedded System device like NodeMCU which is the integration of Arduino and Wi-Fi module.

B. To find blood level of different blood types

- The application user feels easy if he/she knows the blood types and its level before opting a specific hospital during emergency situations.
- This information can be collected automatically using Infrared Sensor(IR). It is an electronic device which emits and receive radiation. It senses the change in the radiation hence provides the level of the blood.
- The blood level information is then stored in the hospital database automatically and through internet, these details can be viewed in the ambulance.

C. To find the availability of the doctor

- Many monitoring devices that displays patients conditions are provided in the emergency wards but there are instances where the doctor is not available during emergency periods.

- To ensure the availability of doctor, the number of specialist available in the hospital is sent to the server which can be accessed in the ambulance.
- This details would be helpful for the user in selecting the hospital which reduces the death rate.
- Fingerprint sensor checks the number of doctors available in the hospital. The fingerprint of the various doctors are initially loaded to the sensor and on daily basis the doctor's attendance is marked by matching the current and loaded fingerprint.
- The details of the doctor through biometric technology is sent to the cloud and are accessed in the ambulance which improves the hospitality.

A Research is made on automatic emergency medical services and the following inference is concluded.

**Table 1.
Inference**

S.no	Hospitals	Distance between hospitals and accident zone(km)	No.of vacant beds available	Blood level (litre)	Doctors availability
1	Apollo	5.3	12	52	6
2	Frontier Lifeline	6.1	8	34	4
3	Medical care	10.6	5	29	2

The above result tells us that Apollo is the nearest hospital which is located at 5.3km from the accident zone. It also tells the real time medical services provided by the hospital which assist the supporting staff to choose the right hospital.

D. Block Diagram

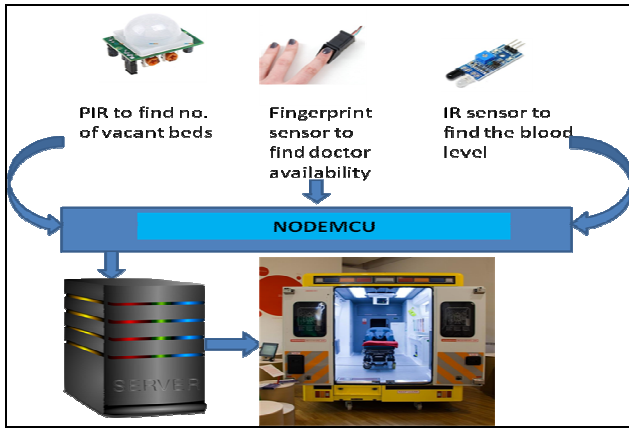


Fig.1. Sensor Data From Hospital To Ambulance

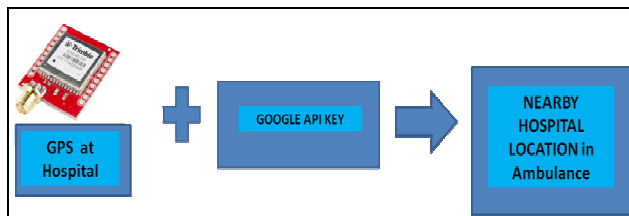


Fig.2. Hospital location To Ambulance

client. The response contains the status information about the request and may also contain the requested content.

A. Cloud

Cloud is a network or internet which is located at remote place. It provides various services like servers, storage, database, networking and application. Cloud computing is behind all the scenes like Google Drop box, Drive and retrieving mail from the server. There are various applications of cloud like to create new apps and services, store, backup and retrieve data, to host websites and blogs, to stream audio and video and to analyze data for patterns and predictions. Similar to that the information are accessed from the cloud for future purposes.

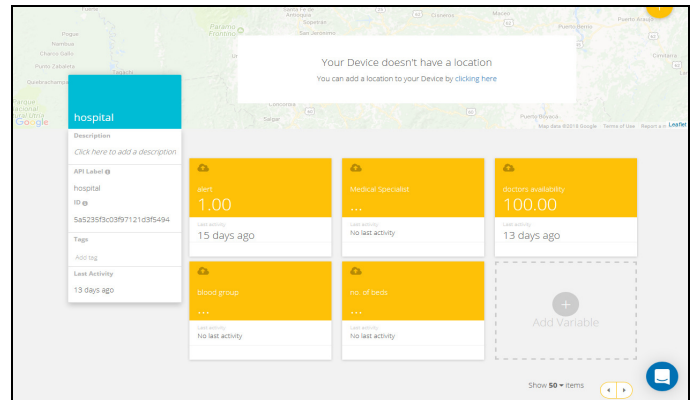


Fig.3. the experimental results

E. The functions of EMS communications are

- To provide the exact location of the hospitals nearby the accident zone.
- To access the details of the hospitals during emergency situations.
- To notify the receiving hospital of emergency patient in order to coordinate personnel.
- To link all the EMS sub systems, thus enhancing the user compatibility.

IV. COMMUNICATION PROTOCOL

NodeMCU is an open source, low cost, simple, smart, Wi-Fi enabled device used to develop a prototype for IOT project. It is the combination of Arduino and ESP8266 Wi-Fi which has TCP/IP protocol stack. It also has integrated cache to improve the performance to the system and minimize the memory requirements. This device enables easy way to connect the things automatically. The baud rate for NodeMCU is 115200 where the data transformation takes rapidly

EMS website is created at the beginning and to send data to the website, the basics of Hypertext Transfer Protocol(HTTP) is understood well. HTTP works as a request-response protocol between server and client. The web browser may be the client and the EMS application that host web site may be the server. e.g. A client(browser) submits an HTTP request to the server, then the server returns response to the

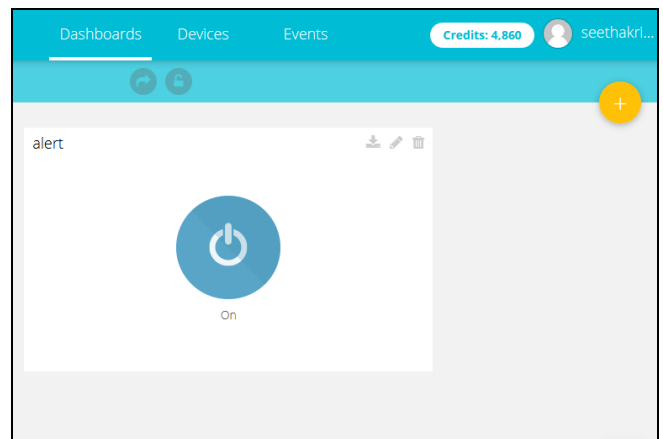


Fig.4. alert button to call doctor

B. Experimental Results

The application display the location of the nearby hospital by calculating the difference between distance of the current location and the hospital location. Once the user has selected a particular hospital, the details of the hospitals are shown in a fraction of seconds. The Fig.3 shows the output of the prototype which comprises of the number of vacant bed, doctor availability, blood level of various blood types and rating of the hospital. The result can be viewed in the laptop,

smart phone, tablet, and other devices which are connected to the internet. Some cloud computing services are designed to work with REST API which gives developers multiple options. It is very cheap and the performance is highly appreciable. Highly secure connection is established in case of using private cloud, while the public cloud provides less secure connection compared to private cloud. Fig.4. displays the alert button which is enabled by the user to notify the selected hospital by a call through Global System of Mobile Communication(GSM) . If a particular doctor is not attending the call, then the alternate numbers are provided . The response is also received once the doctor picks up the call which ensures the availability of the doctor. A google assistance application is utilised here for visually impaired people whose voice command gets converted into text. Thus improves the system's flexibility.

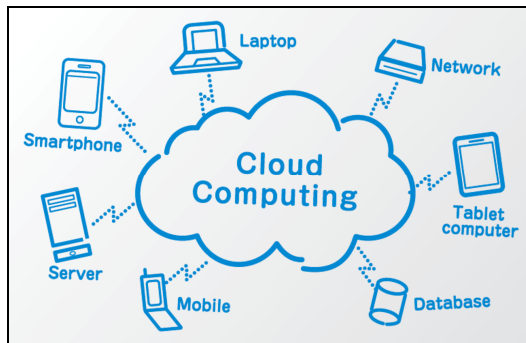


Fig.5. Cloud

V. CONCLUSION

It is impossible to identify and locate a better hospital by a tourist during emergency situations. During those critical times and during massive accidents the proposed system will be very helpful. The main idea of proposed system is to provide better and efficient hospitality for the patient approaching the hospital by implementing networked information cloud. The final model will be equipped with all the automated devices in the hospital so that the staffs required to maintain the hospital database would be reduced and also improved efficiency would be achieved. The proposed model can be deployed as a mobile app so that the system is easy to access across the globe.

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