A Wearable Mobile Based Health Care Location Awareness System for Heart Disease Using Hover Positioning System

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Abstract— Information and Communication Technologies (ICTs) are commonly using in healthcare organizations worldwide. The android operating system (AOS) based electronic devices such as Smart phones and computer tablets are extensively used for many purposes like instant messaging, gaming, word processing, Internet and download number of applications online. A rapid growth of android phones has enabled to replace PC's software and other licensed software development technologies. There are different kinds of healthcare applications developed in android Smart phones which help patients and their caregivers to reduce time and cost efficiency. In this research work, an application is developed that locates the nearest hospital. The nearest position of hospitals is calculated with a built-in feature of Global Positioning System (GPS) in Smart phones and finds the route from their current location through Google Map application Program Interfaces (API). An informative survey of different hospitals in Coimbatore is conducted to obtain an accurate list of hospitals. With the help of this application, a ward can find the patient location with abnormal details.

Index Terms— Information and Communication Technology (ICT), Global Positioning System (GPS), Android operating system (AOS), Android Software Development Kit (ASDK), Application Program Interfaces (API).

Keywords - ICT in Healthcare, Smartphone application, Google MAP, GSM

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1 INTRODUCTION

The latest Smart phones made dramatic breakthroughs in processing power, higher random access memory, and secondary storage along with the number of extra features like internet access have opened doors to a broad range of applications development. An Android operating system (AOS) commonly used by Smartphone manufactures because it is an open source operating system based on the Linux kernel and designed primarily for touch screen mobile devices such as Smart phones and tablet computers. The internal hardware of Smart phones especially sensors like proximity, accelerometer and gyroscope sensors are used by some applications to respond to additional user actions [1].

There are different applications (apps) categories available for download from the online Google play store. Everyday thousands of new apps are uploaded in their online database. A number of applications related to healthcare are available in the medical category which is helpful in the diagnosis of vital sign parameters, vaccinations schedule, medicine reminder etc [2]. These kinds of applications are lies in mobile-health (m-health) technology. Some applications determine the location of health clinics, healthcare centres and city hospitals. Authentic and up-to-date information are available about each hospital. Below is the background information about choosing the AOS platform for this application.

1.1 Android Devices

Android is popular in all kinds of technical fields that require a user friendly, low-cost and customizable software or applications for high-tech devices. Due to Android open source style, it encouraged software developers worldwide and devoted them to use the Android platform as a base for Smart phones and PC tablets related projects that add new features

for advanced users [3]. The other operating system's developers are also making their project in AOS for android devices to achieve more success. This kind of accomplishment made a target for patent litigation as part of Smartphone wars between technology manufacturers [4].

1.2 GPS in Smartphone

Global Positioning System (GPS) enabled navigation in devices that precisely determines geographical location by receiving GPS co-ordinates information from the GPS satellites. Originally, it was only used by the United States military, but later this service is available freely worldwide and now most receivers are integrated into Smart phones, PC tablets, airplanes, tracking devices and automobiles [5]. At present, people feel more convenient to just use their Smartphone built-in GPS as navigation tools instead of a separate GPS device. Smartphone navigation typically gets free and speedy automatic updates as compare with commercial GPS devices. Also GPS is widely used for tracking the children and ageing people suffering from dementia and Alzheimer's diseases [6].

1.3 Google Map APIs

Google Maps are commonly used to determine the destination location, calculate distance and approximate time to reach a destination point from your current location. Basically, Google Maps have an extensive array of application program interfaces (APIs) that let you embed the great functionality and effectiveness of Google Maps into your Smartphone applications. Google gives by means of Google play a library for using Google Maps into Smart phones application. At present, Google Maps Android API V2 are available that provides im-

provements to the older API version [7].

2. SYSTEM DESIGN

2.1 Arduino Board

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards (Fig.1) can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

Fig.1ArduinoBoard

2.2 Bluetooth module

HC serial Bluetooth products consist of Bluetooth serial interface module and Bluetooth adapter. Bluetooth serial module is used for converting serial port to Bluetooth. These modules have two modes: master and slaver device. The main function of Bluetooth serial module is replacing the serial port line. This Bluetooth connection (Fig.2) is equivalently liked to a serial port line connection including RXD, TXD signals. And they can use the Bluetooth serial module to communicate with each other. When MCU has Bluetooth salve module, it can communicate with Bluetooth adapter of computers and smart phones. Then there is a virtual communicable serial port line between MCU and computer or smart phone.

Fig.2BluetoothModule

2.3 SQL Lite

SQLite is a software library that implements a self-contained, serverless, zero-configuration, transactional SQL database engine. SQLite is the most widely deployed SQL database engine

in the world. The source code for SQLite is in the public domain.

2.4 System Architecture

This research work was conducted in two steps. The first step was find the heart beat rate using wearable device and send the beat rate to the mobile application through Bluetooth device when the heart beat rate is abnormal. The second step was to find the nearest hospitals and send the abnormal heart beat rate to the emergency ward with patient location. Later it will be implemented for other mobile operating system.
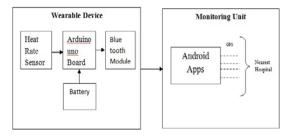

Fig.3System Architecture

Age	Resting Heart Rate(beats/minute)
0-1 month	70-190
1-11 months	80-160
1-2 years	80-130
3-4 years	80-120
5-6 years	75-115
7-9 years	70-110
Above 10 years	60-100
Adults	40-60

Table.1 Pulse Rate Table

2.5 Development Tool Kit

This application is developed in Java Programming Language by using the Eclipse Ganymede Integrated Development Environment (IDE). Android Software Development Kit (ASDK) was used which includes a variety of custom tools that help to develop mobile applications on an android platform [8] and the Android Emulator and the Android Development Tools (ADT) plug-in for Eclipse [9].

2.6 Graphical User Interface

The Graphical User Interface (GUI) is quite simple and user-friendly of this application.

3.METHODOLOGY

3.1 System Model

The heart rate monitoring system is well known application for measuring the heart beats every moment. The main aim of this project is to measure the heart pulse using heart rate monitoring sensor module which are connected to the figure in human body. Here we have developed a heart rate monitoring system using the Arduino Uno board. This Arduino board is contains the circuitry for measuring the heart pulse and connection to Bluetooth module. The blue tooth module transmits measured heart rate to an Android mobile phone Apps. The Apps is designed in such a way that to find abnormality and search the nearest heart specialist hospital with the distance from the current location and send abnormality to the nearest one.

3.2 Hardware

- The Heart rate monitoring sensor.
- Arduino board powered by battery.
- Bluetooth module for communicating with android phone.

The connections between the Arduino Uno board and the Heartbeat Sensor module are made as follows:

Connections between Arduino Board and the HC-05 Module

ARDUINO UNO	HEART BEAT SENSOR
3.3VPOWER OUTPUT	VCC
GND	GND
TX	RX
RX	TX

4.RESULT ANALYSIS

4.1 Compatibility Testing

This application was mainly designed for android Smartphone version KitKat (4.4–4.4.4) as it helps users to find hospitals nearest to them according to their requirement. Different android phones have different screen sizes and resolution. This application has been made compatible with android devices regardless of their screen sizes and android KitKat and older versions.

4.2 Location Testing

A testing was carried out on different centralized locations of the city as mentioned in form of coordinates in Figure 4. This shows the availability of nearby hospitals in the application on a particular point. The specialized hospitals are more in the city center coordinates compared with other areas.
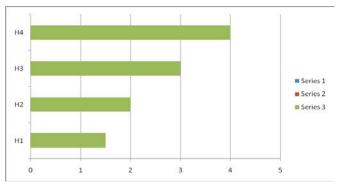

Fig.4 Hospital vs Distances

Y axis - Hospitals
X axis - Kilometers

The application receive the abnormal value from the Arduino kit.For testing, take the coimbatore city multi speciality hospital.The hospital names and phone numbers are stored in the sql lite. Fisrt it finds the nearest hospital based on kilometer and sort out the hospitals list with detailed(Table.2).Using GPS for finding patient location of latitude and longitude.Then send the patient details with heart beat rate to nearest hospital(first row in sql lite table.).In coimbatore city the patient can move anywhere and the hospital list also changing based on the kilometer.

Hospital Name	Location	KM	Phone Number
KovaiMedical Center & Hospital	Indira Nagar,Peelamedu, Coimbatore	2.3	9788823222
PSGMedical College And Hospital Campus	Peelamedu, Coimbatore	3	9245287851
G.Kuppuswamy NaiduMemorial Hospital	PNPalayam, Coimbatore	6	8048403994
KG Hospital	Gopalapuram, Coimbatore	7	9843072000
Ganga Hospital	Tatabad, Coimbatore	9	8757277464

Table.2 Hospital List

The android app is tested for bugs and its hospital information is also tested. First, we open the android Bluetooth terminal app and then click on "Search for Device" option. Then we choose the name "HC-05" from the list of available devices. This name denotes our heart beat monitoring system. If it is the first time we are connecting to the device from our smart phone, then pairing is required. The secret key for pairing is "1234".Once, the lock has been paired with our smart phone, connection is established easily and a new screen appears on our Bluetooth App. In this screen we have provided a button

for Automatic and Manual in the first page of the application.

- The reading of heartbeat sensor values listed in the application of Bluetooth terminal.
- Suppose the value lesser or higher than the normal heartbeat rate the application find out the position of patient using GPS
- Then find the nearest heart specialist hospital location and send the data to emergency ward.

5. CONCLUSION

In this study, a basic and up-to-date medical category application is designed to help the patients and caregivers to determine the nearest hospital with a specific specialization field. The hospital names along with their address and route are determined by Smartphone GPS receiver. With the help of Google Map, the distance and route to each of the hospital is displayed for the user. This application is greatly useful in emergency cases as well as for the non-resident person of the city. Specialized list of hospital in a single application is also useful for later appointments. The future scope of this application is to develop and determine the availability of specialist doctor on a real-time basis near patient's location.

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