

# Android Based Patient Critical Health Monitoring and Notification System

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**Abstract** - Healthcare environments today have turned to be technology-oriented. Also mobile devices and their usage has increased manifold in recent times. This paper presents the design and development of Android mobile application for patient healthcare. A body area network is a wireless network of biomedical sensors that are around to a human body. The aim of wireless body area network (WBAN) is to facilitate continuous recording and monitoring of a person's health condition and transfer it over a long-distance communication network. The parameters sensed by the individual devices are to be transferred onto a mobile phone or a tablet via wireless network. This data is then gathered, stored, check for threshold and then sent to the physician for continuous monitoring of the patient's health condition. The physician can thus access the patient's health status on the go and this will help the patient to get immediate attention in life-threatening situations.

**Keywords** - Android, WBAN, sensor, threshold, healthcare, heart rate, server.

## I. Introduction

Today healthcare is an important social need for the increasing and ageing population of the world. Emerging technology has brought a lot of innovation and improvement to this healthcare sector and still there is a scope for lot of advancement. Healthcare Deliveries have gradually shifted from acute hospital care to outpatient care and home care. Home care, typically involves periodic visits by a nurse or other caregivers, and it includes patients to maintain detailed records about their diet, and health. This situation is a concern since it will result in a drastic change in the availability and accessibility of healthcare.

To provide better health care, physicians need access to the vital parameters of the patient like heart rate, glucose level in blood, blood pressure and more. Such access while on the move is very helpful to both the physicians and the patients. Android is a most popular operating system for mobiles and its prevalence is only increasing. Since it is open source, custom applications for users can be developed and deployed easily.

We seek to use these features of Android to bring to the physician the facility of accessing patient data anywhere and anytime.

The proposed system is an Android application which helps the physician to view the up-to-date information of the patients' vital health parameters like blood pressure, heart rate. The physician receives a notification whenever a patient is in critical condition, that is, whenever any one of the vital parameters of the patient goes beyond a threshold limit (Here I have considered only Heart Rate).

## II. Motivation for the Work

With the development of the health care industry, people pay more and more attention for their health and many applications are made for the BAN. For this the applications includes the devices or sensors on-body, in-body and around human body. These applications can help the physicians to have a better knowledge of the situation inside the patient body and give a

quick and accurate treatment. And the wearable sensors connected with wireless network can provide a real time monitoring of people's health and in this way the physician in clinic can find patient data before the patient has emergency condition.

The patient per physician ratio is pretty high in developing countries as well as developed countries. Physicians have consultations at two or three hospitals and clinics. They need to monitor many patients at different places. A technology which would allow physicians to view the vital parameters of a patient remotely will therefore be of good use to the physician.

The world is brimming with smart phones, static and mobile sensors, and vehicles with sensing and computing resources. And the access technologies available are Wi-Fi, Bluetooth, cellular, RFID, and NFC. Previously we can see the opportunity of 'unlimited' pair-wise contacts. Opportunistic computing exploits the communication between a pair of devices to enable possible sharing of content, resources, and services.

Such a system was sought to be designed in this paper. The system would have to display the data of the patients under the physician remotely [1]. It would also check for threshold and send notification to physician at critical condition of patient. The application is developed using the Android platform due to its open source characteristics apart from its rich user interface features [2].

### III. Android Platform

An Android enabled device can run the application without any relation to the hardware. Also its wide presence in most of today's smart phones makes Android the most suitable platform for developing the Patient Data Notification System. This flexibility gives the user a range of devices to choose from like mobile phones, tablets, etc. The Android software easily integrates with the device's existing applications. Many healthcare applications are being developed on Android due to ability to interact with hardware at a high level [3].

Another major advantage of Android is its quick and simple installation process for applications. A user must go to the Android Market (which is a pre-installed app on the Android device) and simply load the software by clicking on it. Any needed information can be supplied at the time of installation. There will be no need for a technician to install software and enormously quickens the implementation of a patient monitoring system.

### IV. Patient Data Notification System Design

Figure 1 shows architecture of the Patient Data Notification System. The design comprises components such as heart rate sensor to sense patient heart rate, android mobile to check for threshold, server to maintain Database of Patient's details.

The Patient resides in home will wear the heart rate sensor; this sensor gives the digital data. This data will be sent to Patient's android mobile using Bluetooth where the android application will check for threshold value.

If the data given by sensor crosses the threshold value or safe limit immediately that application sends notification in the form of SMS and Mail to physician and patient's care taker. If that data doesn't cross the threshold value then application will calculate the average data per day and sends notification to both physician and patient care taker. All these data will be saved at database server.

This server has a database of patients with details such as patient's name, age, sex, address, contact number, patient's medical history, patient's care taker and physician details such as name, address, contact number, mail ID.

The software on client side is the application on physician android device. This application interacts with sensor to provide the physician with updated patient information.

The physician opens the app and logs in with his username and password. Once logged in, the app connects to the server and retrieves the list of patients under the doctor's care. When the doctor selects a particular patient, the app displays related information of the patient. Like this patient's care taker can also see the details of patient. The app sends notification at emergency condition of patient's.

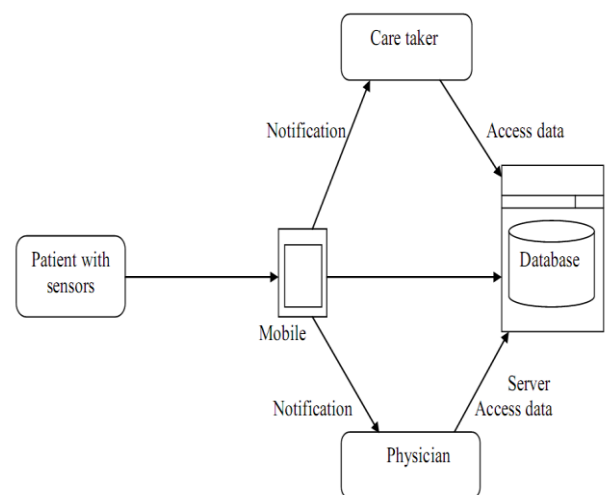


Figure 1: Architecture of Patient Data Notification System

#### A. Software

The Patient Data Notification System has been developed and deployed in Android platform, the open source framework designed for mobile devices. It consists of an operating system, middleware and key programs [4]. The Android SDK provides libraries needed to interface with hardware at a high level and to make and deploy Android applications. Android applications are coded in Java, XML is used for screen layouts and SQLite

databases are used to store data. Any app is made from four components: Activity, Service, Content Provider and Broadcast Receiver [5].

Activity class is extended to create a user interface. Service class is used for background processing such as sending SMS and mail, etc. Content Providers are used to store data for an application. Broadcast Receivers are used for communication between two apps. Intent class is used to start an activity, service or broadcast from another activity. SQLite database is used to store data. It is a light-weight database system specially designed for less power and memory consumption, the common characteristics of mobile devices.

established. If he is a new user he has to register to the hospital database. If he is already registered user he can see the patient health details by login to hospital database. The user name and password are sent to the server for validation .If these are correct, the server sends the details of patients to the mobile. On the patient mobile the application retrieves the received heart rate value from Bluetooth folder and checks for threshold value [6] [7]. If that received value crosses threshold value immediately application will send the notification in the form of SMS and Mail to physician and care taker of patient. Else application will calculate the average heart rate value per day and sends notification to both physician and care taker of patient.

## V. Implementation

The program is divided into three modules: a module for getting and storing information into the database, a module for retrieving information from the database and displaying on the screen and a module for dealing with notification.

### A. Module for receiving and storing data

The sensor sends sensed heart rate value to android mobile through Bluetooth, android application will retrieve that value and checks for threshold value and sends notification to physician and care taker; all these details and patient details are stored at the server database.

### B. Module for displaying data

The hospital server contains all the patient data. When the app is being installed on the mobile, the IP address of the server is supplied. When the physician and care taker of patient supplies login information, the phone connects through the default HTTP client. Then a web connection is established with the server and login details validated. Next, the server supplies the details of the patients to the physician and care taker's mobile.

### C. Notification Module

The application retrieves the received heart rate value from Bluetooth folder and it will check for the threshold value if the received value crosses the threshold value it immediately sends notification and if it not exceed threshold value it will calculate average heart rate value per day and sends notification to physician and care taker. So that care taker can assist patient and physician can give proper medication to patient.

## VI. Conclusion

In this work we have developed a Patient Data Notification System using the Android Open Source Platform. The system helps the doctor to view the patient data and monitor his health condition through the doctor's mobile device. The system will be very useful for medical practitioners who are on the move

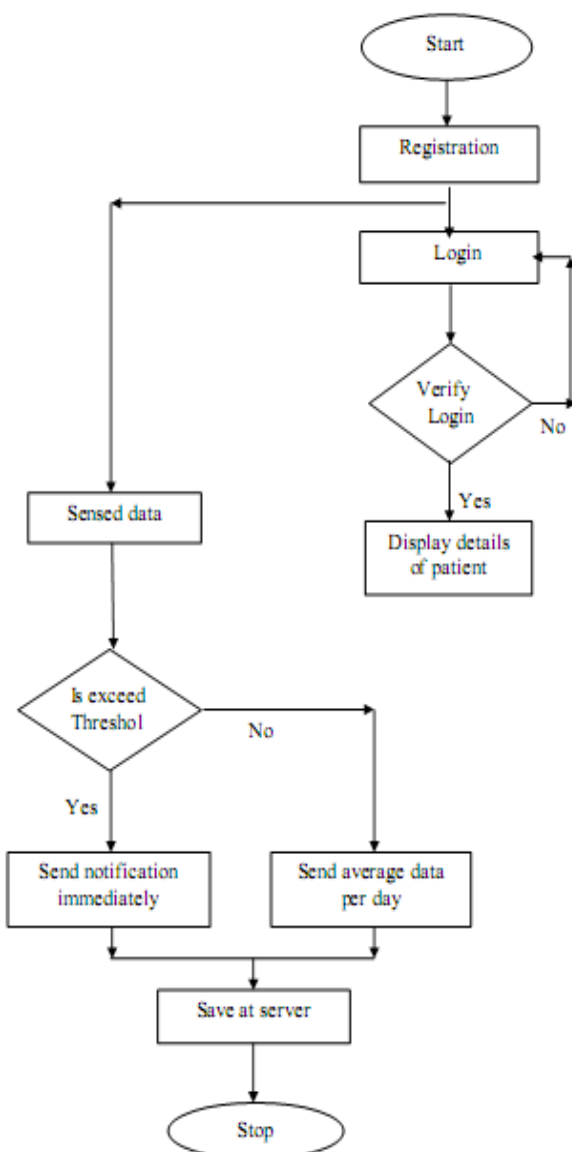


Figure 2: Process flow of the system

### B. Process flow

The process flow of the Patient Data Notification System is presented in Fig. 2. When the application is launched, the app connects to the server of the hospital. A web connection is

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and still want to be in touch with the patient's condition. It is also beneficial to patients who can stay in home and they can be monitored from home.

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