Android Based Health Care Monitoring System

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Abstract— **Health monitoring system plays a vital role in the overall development of the physiological as well as social well being of the society. Observance of prevention in the area of health has a significant impact on economic productivity and most importantly on quality of life of the common people and hence it is very essential to focus on the topic. Health parameters of a patient are being monitored continuously globally but monitoring is done under the observance of the health service provider. This paper discuses a monitoring system in which the vital health parameters such as temperature, SpO2, ECG, heartbeat, blood pressure and the body position of the patient can be monitored continuously. This paper intends to provide information using wireless network technology such as raspberry pi, wireless sensor networks (WSN), sensors. The gathered data from the sensors can be monitored remotely in real time. The sensors will gather the data of the various body parameters and provide it to the ARM controller. The collected data will then be wirelessly transmitted to web portal.**

Keywords: Health monitoring system, Android smartphone, biomedical sensors, GSM.

I INTRODUCTION

Communication technologies and information are transforming our lifestyles, social interactions and workplaces. One of the most promising applications of information technology is healthcare and wellness management. Healthcare is moving from an approach based on the reactive responses to acute conditions to a proactive approach characterized by early detection, prevention, and long-term management of health conditions.

The purpose of this paper is to monitor the critical conditions. At the patient's side the vital parameters of the patient such as temperature, SpO2, blood pressure (systolic and diastolic pressure), heart rate, body position and ECG will be monitored continiously. All the readings of the vital body parameters of the patient will be accessed by the care givers and the doctors through the mobile application also a sms will sent to the doctor's number.

The main objectives of the project are-

1. Real time monitoring of health condition of person.
2. Alerts in emergency to predefined contact numbers.
3. Works anywhere in the world (with GSM availability).

II RELATED WORK

Literature reports the clear and effective advantage of specific patient monitoring well tuned to the patients clinical condition. Zarina Md Amin, SuryaniIlias, Zunuwanas Mohamed has implemented ECG monitoring system using Bluetooth technology. In this system ECG analog signal from sensor converted into a binary bit sequence by using A to D Signal processing ckt. Act as intermediate nodes between ECG sensor ckt. & PC and ECG data is sent to display device via Bluetooth link [2].

S.Gayathri, N.Rajkumar,V.Vinothkumar, has proposed a system Human Health Monitoring System Using Wearable Sensors. In this system real time monitoring of patient health parameter. Get input from sensor and proceed during microcontroller. And for emergency send message . There are several way to monitor human health parameter depending on the application. The research in this project will focus on system which measure human health parameter which involves different sensors are used to measure B.P., Heart beat rate, ECG, from human body. Using Bluetooth the measured signal reading is sent to the doctor's smart phone and automated SMS is send using standard GSM modem. Through the concept is not relatively new, it is yet challenge to implement Real time human health monitoring system using Bluetooth & GSM modem. To the best of our knowledge, our work is the first attempt to systematically design the Bluetooth & GSM based Real time human health monitoring system for Medical Application [4]. In daily practice, management of patients with HF relays on relatively simple physical signs such as the ones mentioned above plus body weights which however need to be carefully monitored in order to optimize the efficiency of treatment, to prevent the relapse of HF and the need of hospitalization.

Smartphones and Tablet PCs take over tasks of the traditional PC, once again changing the hardware base of computer science. Therefore it is a natural development to use smartphones as mobile sinks for WSNs, and integrate them as central modules of a telecare system. In addition to a (W)BAN a typical smartphone features around a dozen internal sensors, some of them may be used in a medical application. The BAN architecture uses an Atmel board as sensor platform.

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Table 1: Comparison of various techniques

Literature	Parameters monitored	Sensors	Communication Modules
BIOTEX (3)	Sweat Rate, ECG, R, SpO2	PH Sensor, solid sensor, ECG electrode	Bluetooth
Proe-tex(4)	HR, BP, BT, SpO2, dehydration	Piezoelectric sensor, textile electrode	ZigBee,Wi-Fi
Magic System(5)	ECG, SpO2, r, Posture	ECG Electrode, 3D acceleration	Bluetooth
Glucose Monitoring(6)	Blood Glucose	Glucose Sensor	RF
AMON(7)	ECG, SpO2, HR, BP, Pulse	ECG Sensors, 2 axis acceleration	GSM Link, Bluetooth
Healthware(8)	Pulse, HR, SpO2, Activity	Optical biomedical sensor, fabric electrode	3G
Smart phone healthcare(9)	SpO2, HR	ECG electrode, BT sensor	USB
Smart Shirt(10)	ECG	ECG Electrode	Wires
Life Shirt(11)	R, ECG, BT	Blood Sensor, ECG Sensor	Wires & Bluetooth
Posture monitoring vest(12)	Multi posture	Accelerometer	Bluetooth
Wearable sensing device(13)	Movements	Textile strainsensors	Conductive yarns and devices
Sweat monitoring(14)	Sweat	Camera	Wires
weat closes(15)	ECG, ENG, R, BP	Wearable sensor	Wires & Bluetooth

III SYSTEM ARCHITECTURE

Figure 1 shows the architecture of a typical MSN. A large-scale MSN accommodates tens of patient area networks (PANs). Each PAN consists of some biosensor nodes and a local processing unit (e.g., tablet PC, smartphone, or laptop PC), which is referred to as the controller.

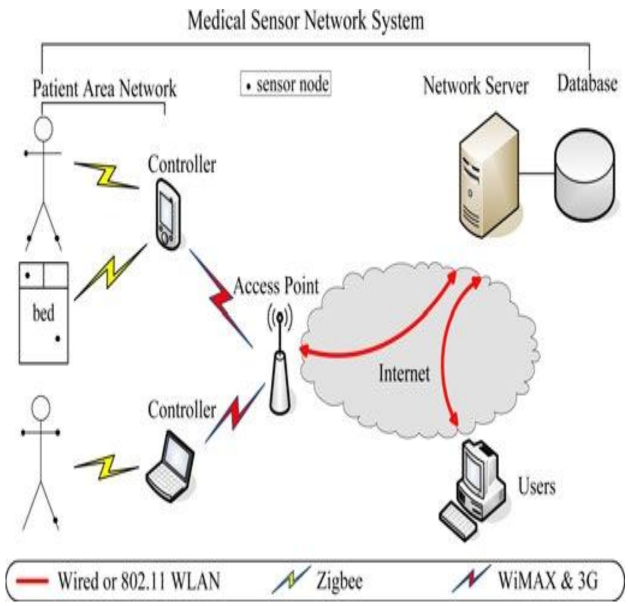

Figure 1 - Overall System Architecture

IV FUNDAMENTAL PRINCIPLES OF MEDICAL SENSOR TECHNOLOGIES

This section mainly introduced five basic sensing technologies widely utilized in wearable monitoring systems. Medical sensors vary according to different working principles such as piezoelectric effect, photoelectric effect and Hall Effect. Sensors in the systems that are used to obtain physiological parameters from patients are consisted of sensitive element and the conversion elements. In general, sensing element, transmission element, signal conditioning conversion circuit and auxiliary circuit are presented in a sensor device. Sensors can be divided into two types based on electrical signal parameter and non-electrical signal parameter. Bioelectricity electrode is an electrical signal parameter sensor based on all kinds of bioelectricity that derives from body such as ECG, electroencephalogram, electromyogram, and neuronal discharge. On the other hand, physical sensors, chemical sensors and biosensors belong to the type of non-electrical signal parameter.

Modern medical sensors compared with traditional medical sensors are more intelligent, miniaturized, low power, multi- parameter, and noninvasive. The review puts emphasis on the principle of several common and important medical sensors rather than the all basic principles of sensors and classification. Five sensors used universally in wearable monitoring systems will be introduced in detail in the following sub- sections A, B, C, D and E.

A. Pulse Oximetry Sensor

Pulse oximetry takes full use of spectral analysis to measure the ratio of oxyhemoglobin (HbO_2) to reduced hemoglobin (Hb) in arterial blood and displays this value as oxyhemoglobin saturation (SpO_2). Two important values obtained from the pulse oximetry including the oxygen saturation of Hb in arterial blood and the pulse rate in beats per minute.

Pulse oximeters depend on spectrophotometry, the detection and quantification of compounds in solution by their unique light absorption characteristics. The central theory of spectrophotometry is the Beer-Lambert law, which states that the amount of light emerging from a substance in solution is determined by the concentration of the absorbing material, the distance that the light must travel through the sample and the probability that a photon at that particular frequency will be absorbed by the material.

The value of oxygen saturation is decided by the relative concentrations of reduced Hb and oxyhemoglobin. Therefore, a wavelength of light must be used that each chromophore will preference absorb. Currently available oximeters use an electronic processor and two light-emitting diodes (LEDs) facing a photodiode through a translucent part of the patient's body, such as a fingertip or an earlobe. The two LEDs emit light at the 660nm (red) and the 940nm (infrared) wave- lengths respectively, because HbO_2 and Hb have different absorption spectra at these particular wavelengths.

HbO_2 absorbs fewer red lights than infrared lights, thus, the tissue's cycling blood volume at high saturation has less influence on the detected red signal. On the contrary, Hb absorbs fewer infrared lights than red lights so that the tissue's cycling blood volume at low saturation has less influence on the detected red signal than on the infrared signal .Currently, a large number of pulse oximetry used in wear- able devices for monitoring patients have been accepted in daily life, which have a great impetus to current medicine. The NellcorTMOxiMax pulse oximetry as a leader in this field is an outstanding instrument to monitor patients.

B. ECG Electrode

ECG [2] is one of the most important human physiological signals. It reflects the electrical activity of the heart-excited process, which has a significant reference value for its cardiac basic function and pathology research. Various arrhythmias can be analyzed and identified through ECG, and it may also reflect the degree of myocardial damage and development process as well as the function structure situation of arterial and ventricular. ECG can roughly be divided into the phases of depolarization and repolarization of the muscle fibers making up the heart. The depolarization phases correspond to the P-wave (atrial depolarization) and QRS-wave (ventricles depolarization)

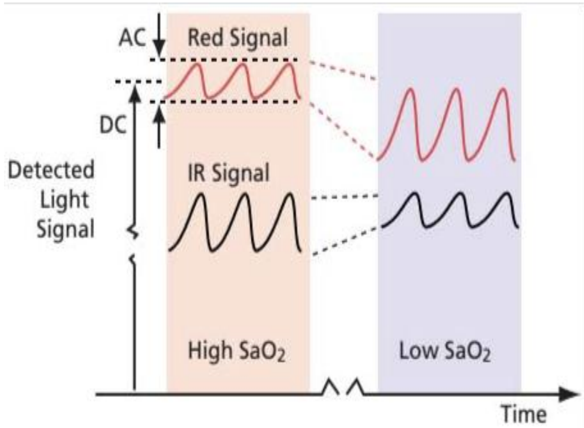

Figure 2- SpO2 Sensor working

while the repolarisation phases correspond to the T-wave and U-wave (ventricular repolarization).

Sensor pad placement is recommended that the sensor pads on the leads before application to the body. The closer to the heart the pads are, the better the measurement. The cables are colour coded to help identify proper placement. In this system sensor pad cable are Black, Blue, and Red in colour. Black on right arm, Blue on left arm, Red on right leg.

Cable Colour	Signal
Black	RA (Right Arm)
Blue	LA (Left Arm)
Red	RL (Right Leg)

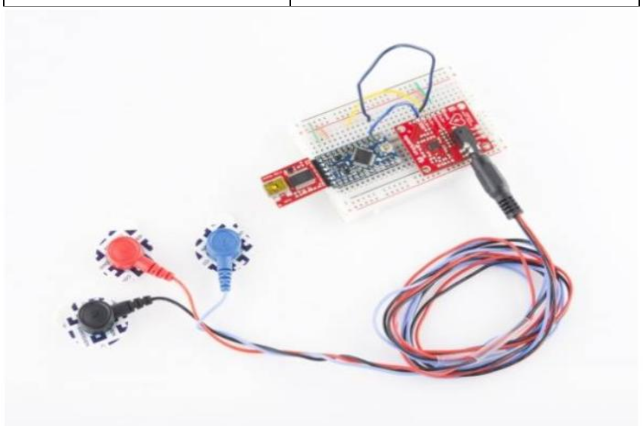

Figure 3 - Sensors connected to Heart Monitor

C. B.P. & Heart Beat Sensor

Heart beat sensor measures the heartbeat of a person Heart beat rate measurement is one of the very important parameters of the human cardiovascular system. It will check the heart beat pulses and the same data will be given to Microcontroller. B.P. monitoring fundaments in this Arterial pressure is the hydrostatic pressure exerted by the blood over the arteries. Systolic arterial pressure is the higher blood pressure reached by the arteries during systole (ventricular contraction), and diastolic.

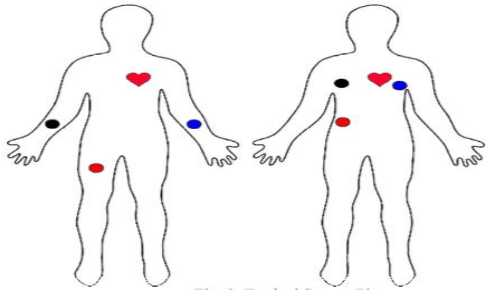

Figure 4. - Typical Sensor placement

D. Blood Pressure monitor Operating Principle

Blood pressure monitor operation is based on the oscillometric method. This method takes advantage of the pressure pulsations taken during measurements.

As mentioned in the System Architecture the smartphone should manage not only data acquisition from the W(BAN), but also synchronization and provide a Graphical User Interface (GUI), among other tasks. In order to do so an Android application is necessary, this application should feature several functions, among these are: Data acquisition from the (W) BAN via Bluetooth; data analysis, i.e. comparison with medical norm values; GUI for configuration, data visualization, and communication; data transfer (synchronization) to a medical server via Wi-Fi or cellular network.

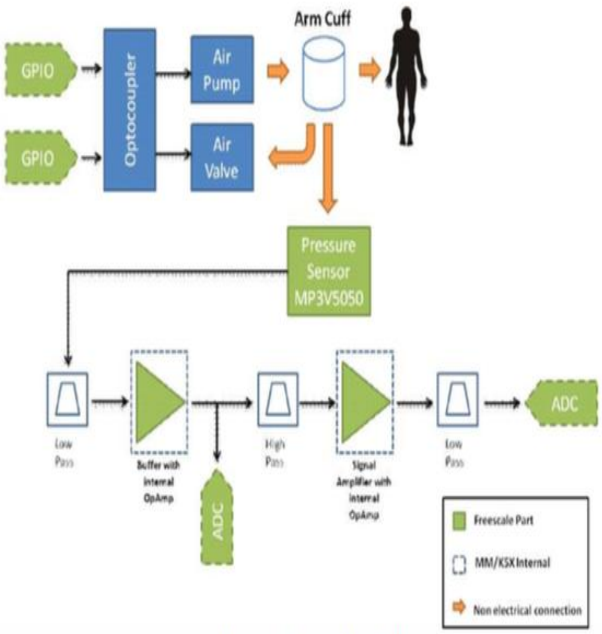

Figure 5 MED-BPM block diagram

Android applications are divided into Activity classes. An *Activity* is both a unit of user interaction, and a unit of execution, which provide reusable, interchangeable parts of the flow of UI components across Android Applications.

In essence the application is responsible to detect the Bluetooth gateway and establish a full duplex communication, including device discovery, pairing, debugging and communication, and to be able to connect to the medical server through the Internet enabling data synchronization between the server and the W(BAN) in soft real-time. The application features numerical analysis and graphical representation of the captured physiological data, an activity for the patient's profile, physical condition, disease history, etc., and activities for the connection with the medical server. For this project some interesting packages available in the Android SDK are: Android.Bluetooth, Android.database.sqlite, Android.net, Android.webkit, javax.net.ssl, Android SDK tool. The use of third party libraries is optional keeping the validation effort for a Safety Critical System in mind.

The app is also responsible to present a GUI, whose design represents the captured data in an understandable way. Together with the basic requirement of a state-of-the-art Android app, the GUI has therefore three principal modes: Configuration, display for patients, display for medical personnel with re- stricted access.

For the proposed application internal smartphone sensors, e.g. accelerometer, GPS, etc., provide additional opportunities, i.e. patient localization and possible detection of a fall. Based on the evaluation of the acquired data the app starts communication to predefined first responders.

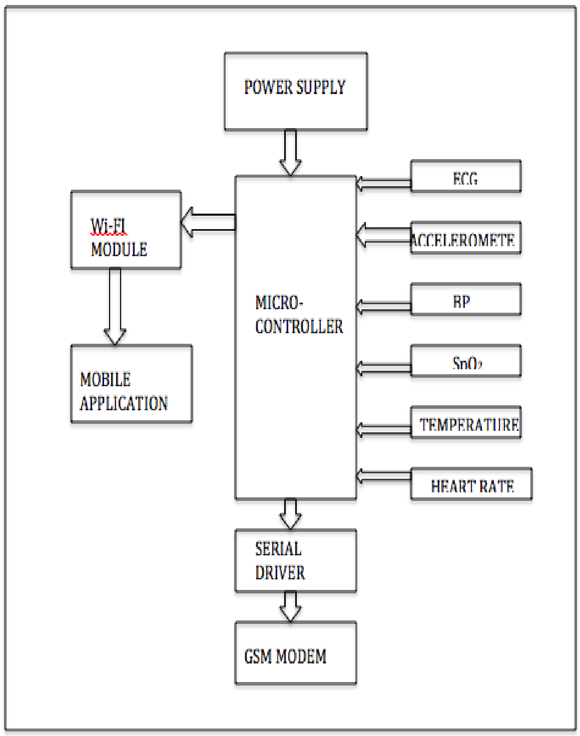

Figure 6 . overall system architecture

Various physiological signals such as B.P., Heart beat rate, ECG are continuously monitored with this system. This system basically consist of in three sections, first section is input section which are used for collecting and analyzing the information from human body. Various types of sensors are used to detect bioelectrical signals.

To sense the B.P., Heart beat rate using MP3V5050 pressure sensor, because it is small in size, it's sensitivity and accuracy is good and ECG is monitor using the neat little chip AD8232 it is to measure electrical activity of the heart. Second section is controller part which is used for processing the data, store in memory and forward the data. The controller used is AT MEGA 328P.

Third section is android smart phone which is receiving the controller stored data reading using Bluetooth on android application and message is sent on doctor's android smart phone with the help of standard GSM modem for remote access for the purpose of medical support.

V RESULT AND DISCUSSION

This system is based on wireless technology using Bluetooth and GSM providing low cost effective solution. This system provides continuous monitoring of vital signal of the patient over long periods of time. The data of the vital health parameters of the patient is uploaded on the web server. Following Fig. 7 shows the result obtained from the device which is displayed on LCD.

Figure 7 – Data received on LCD

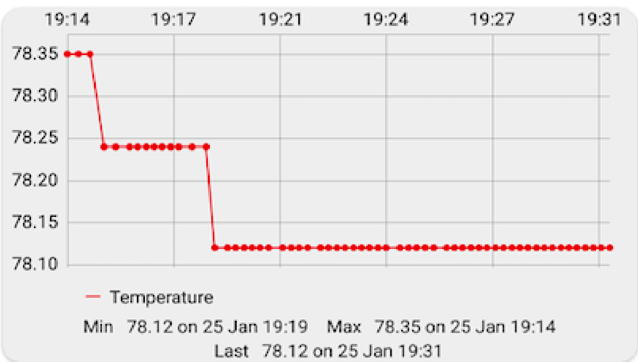

Figure 8.- Temperature reading received on android app.

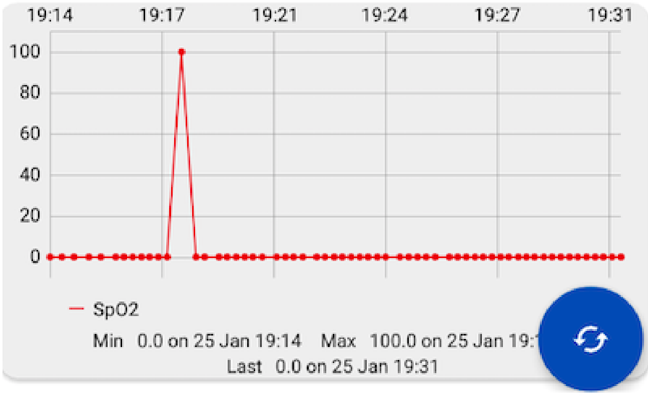

Figure 9. - SpO_2 reading received on android app.

In future may include more number of sensors in a single system to provide flexibility. The main purpose of this system is to develop a patient health monitoring system to alert .so that immediate care is provided to patient.

Figure10 – Data received on existing health monitoring system

Figure 11 – Data received on proposed monitoring system

More Accurate: - In the system database is update time to time Easy and Reliable for Doctors:- This system may be strain for the doctors who have to take care of people. Increase efficiency: - This system increases efficiency.

VI CONCLUSION

The system is design to provide continuous monitoring human health parameter such as B.P., Heart beat rate, and ECG monitoring and inform through wireless communication. The goal of the project is to reduced the hospitalization and assistance cost. This proposed system with low complexity, reliable, low power consumption, and highly portable to monitor human health parameter in real time. The use of wireless technology is to increase the functionality of the whole system. By sending the irregularities of the patient's health .It also beneficial in reducing or minimize to avoid human error, to maintain past data.

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