Abstract— In the health care monitoring system the measurement and evaluation of vital parameters, e.g. heart rate, Temperature, level saline etc. It based on two different designs of a (Wireless) Body Area Network connected to an Android smart phone the Real-Time system. The smart phone approach the sensor nodes acquire physiological parameters and perform signal processing and data storage, analysis and transmit measurement value to coordinator node. The design sensors are connected via cable to an embedded system. In Wi-fi and sensor node approach data are transferred via Bluetooth to an Android based smart phone. The system will continuously monitors the physiological parameter of the patient and if any variation occurred then send alert messages to the medical professional.

Keywords— Android Smart Phone, Body Area Network, Sensor, Alert System.

I. INTRODUCTION

The population in the world is increasing day by day. This brings a need for more healthcare options. To developed healthcare technologies and facilities. The proportion of senior citizens is increased in the society. These senior citizens which requires proper medical care than the rest of the population. So the monitoring and recording of physiological parameters of patients outside the clinical environment is becoming increasingly important in order to take care of senior citizens. 

Today the networking technologies are very much developed. So that the communication or connection between the people, multimedia and services have been greatly changed. Wireless communications technologies has greatly affected on the peoples lifestyle. The wireless technologies are the next step for improving the mobile health applications. Mobile health is also referred as mHealth and electronics health is referred as eHealth. This technology has potential to revolutionize the health care diligence by providing real time patient monitoring capabilities to the health care professionals. Implanted wireless body area networks (IWBN) have emerged as an important and growing area of research. The healthcare servers keep electronic medical records of registered users and provide different services to patients, medical consultants and informal caregivers. The patient’s consultant can access the data from office via internet and examine the patients history, current symptoms and patient’s response to a give treatment. Once WBAN network is configured, the healthcare server manages the network, taking care of channel sharing. A Wireless Body Area Network contains small and intelligent systems or devices attached to the body of the patient which is to be continuously monitored by the mobile health application over a wireless communication device which can be Zigbee or Bluetooth. WBAN gives the continuous data and monitoring and real time graphs and feedback to the user, patient or to the doctor allocated for that patient. Next the values taken are used for analyzing purpose. The analyzed values are used to check that any kind of disease will occur. The data is recorded for the long period of time. Features several capabilities: Data acquisition in the (W)BAN plus the use of the smart phone sensors, patient localization, data storage, analysis and visualization on the smart phone, data transmission and emergency communication with first responders and a clinical server. In the first Smartphone based approach smart and energy efficient sensor nodes acquire physiological parameters, perform signal processing and data analysis and transmit measurement values to a coordinator node. In The formatter will need to create these components, incorporating the applicable criteria that follow.

II. COMMUNICATION PROTOCOL

When two electronic devises communicate with each other, they use cables, infrared rays, WiFi etc. These are some of the various complicated methods used in connecting one device to another. Bluetooth is a similar technology, which is used to connect one electronic device to another, without the usage of any wires and cables. It is a wireless technology to send and receive data between two devices. Bluetooth works by the simple principle of sending and receiving data in the form of
The radio-wave connection between two devices is used to each other. When two devices are trying to be paired, they are actually searching send and receive data between two Bluetooth devices. The data send and received at a time is equal to 720 Kilo bytes per second. There are 79 frequency channels of a frequency 2.45 Giga Hertz through which the devices send and receive data to for a common frequency through which they can send and receive data. When such a frequency is discovered, the devices are "found". The connecting of two devices does not hamper the connecting of two other devices because they usually use different channels of frequency and hence do not overlap. In simple terms, this is the principle behind Bluetooth technology.

**B. WI-FI PRINCIPLE**

WiFi, or wireless networking, is one of the biggest changes to the way we use computers since the PC was introduced. It not only frees you to work on a laptop while remaining connected, it provides an alternative to broadband services at locations that are too remote to justify cables. Wi-Fi is a popular wireless networking technology. Wi-Fi stands for “wireless fidelity”. The Wi-Fi was invented by NCR corporation/AT&T in Netherlands in 1991. By using this technology we can exchange the information between two or more devices. Wi-Fi has been developed for mobile computing devices, such has laptops, but it is now extensively using for mobile applications and consumer electronics like televisions, DVD players and digital cameras. There should be two possibilities in communicating with the Wi-Fi connection that may be through access point to the client connection or client to client connection. Wi-Fi is a one type of wireless technology. It is commonly called as wireless LAN (local area network). Wi-Fi allows local area networks to operate without cable and wiring. It is making popular choice for home and business networks. A computer’s wireless adaptor transfers the data into a radio signal and transfers the data into antenna for users.

**III. BLOCK DIAGRAM**

**C. COMPONENT USED**

1) **Android Phone**

Android is the most popular operating system in the smart phone. It is software stack made for mobile devices which consist of an operating system, applications and middleware. Android operating system is based on a Linux kernel designed primarily for touch screen mobile devices such as smart phones and tablets. Android is open source operating system for touch screen devices and Google releases the code under the Apache License. Android applications are written in the java language.

An Android based Smartphone has been chosen because of its powerful and Java-based development kit, Android SDK, its excellent documentation and library including classes like Bluetooth Health, and the possibility to develop on many platforms, like Linux, Mac Os and Windows [36]. For development different Smartphone’s are being used with Android 2.2 and 4.2

Nowadays, android is the very popular operating system in the Smartphone’s. It’s popularity increasing day by day. It has simple and powerful java based development kit and ability to develop on any platform such as Windows, Linux or Mac. So the user can developed an android application according to its requirements. Android software development kit (ADK) is used to developed android applications. The officially supported integrated development environment (IDE) is Eclipse using the Android Development Tools (ADT) plug-in.

From the BAN Architecture the Smartphone should acquire data from wireless BAN and provide a Graphical User Interface (GUI), on which different physiological parameters are displayed. So to do this an Android application is required, this application should feature several functions such as data acquisition from wireless BAN using Bluetooth.
communication.

Fig.3 Patient Monitoring Block Diagram

The data analysis and representing this data using GUI and transfer of data to a medical server via Wi-Fi or cellular network. Also for future work internal Smartphone sensors can be used, e.g. GPS, accelerometer etc., provide additional opportunities, i.e. location of patient and possible detection of alert.

In our proposed block diagram shown in fig.3, android phone display continuously all changing physiological parameters and send the message to the Doctor and user pc through the Wi-Fi.

2) Sensors
The different sensors such as the ECG sensor, temperature sensor and heart rate sensor start collecting the physiological data of the patient. We can use here up to 8 sensors like blood pressure, sleep pattern, weight, blood glucose, level sensors etc.

It is now extremely easy to collect data about our own health. The biomedical sensors either link to our Smartphone through the sense platform App, which sends the data to commonsense.

By importing the data from these biomedical sensors we can enrich them by using all the other state information that is available at commonsense. We see how our heart rate is influenced by the amount of exercise we do in day.

In our proposed block diagram heart beat sensor and temperature sense the physiological data of the patient and gives to the block ADC.

The Pulse sensor is based on the principle of photoplethysmography (PPG) which is a non-invasive method of measuring the variation in blood volume in tissues using a light source and a detector. Since the change in blood volume is synchronous to the heart beat, this technique can be used to calculate the heart rate. Transmittance and reflectance are two basic types of photoplethysmography.

3) ADC
Analog to digital conversion is an electronic process in which a continuously variable (analog) signal is changed, without altering its essential content, into a multilevel (digital) signal. The input to an ADC consists of voltage that varies among a theoretically infinite number of values. Examples are sine waves, the waveforms representing human speech, and the signals from a conventional television camera.

After sensing all physiological data, sensors gives his output to ADC and performs its task. ADC receives all data from sensors continuously and converts it into digital form. After performing action on data ADC gives his output to the controller for storing.

4) Controller
ATmega32 is an 8-bit high performance microcontroller of Atmel’s Mega AVR family. ATmega32 is based on enhanced RISC (Reduced Instruction Set Computing) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. ATmega32 can work on a maximum frequency of 16 MHz.

ATmega32 has 32 KB programmable flash memory, static RAM of 2 KB and EEPROM of 1 KB. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively. It has 32 Programmable I/O Lines and internally 8 channel 10 bit ADC.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. This controller used for storing data in controller, then the output of the controller is given to the Bluetooth controller and ULN device driver.

5) ULN Device Driver
Featuring continuous load current ratings to 500 mA for each of the drivers, the Series ULN28xx high voltage, high-current Darlington arrays are ideally suited for interfacing between low-level logic circuitry and multiple peripheral power loads.

Typical loads include relays, solenoids, stepping motors, magnetic print hammers, multiplexed LED and incandescent displays, and heaters. All devices feature open-collector outputs with integral clamp diodes.

The ULx2803A, ULx2803LW, ULx2823A, and ULN2823LW have series input resistors selected for operation directly with 5 V TTL or CMOS. These devices will handle numerous interface needs particularly those beyond the capabilities of
standard logic buffers. All devices are pinned with outputs opposite inputs to facilitate ease of circuit board layout. Prefix ‘ULN’ devices are rated for operation over the temperature range of -20°C to +85°C. ULN device driver used here for controlling devices.

6) **Bluetooth Controller**
The Bluetooth is standard IEEE 802.15 communication protocol for exchanging data over short distances from fixed and mobile devices. It works on the 2.45 GHz frequency band. Bluetooth is operated on a very low power of 1.8 to 3.6 voltage. It provides 3 mbps data rate for distances to 20 meter, which is very good.
The Bluetooth module is simple to use and fully certified, which provide the complete wireless embedded solution for short distances. Bluetooth controller sends data wirelessly to the Android Smartphone.

7) **User PC**
The values of physiological parameters of the patient are sent to the clinical server or user PC via Wi-Fi from android smart phone. Here user pc is used for continuously displaying and monitoring physiological parameters of patient by user.
The starting of the system is from the sensors which are mounted on the patient body. The numbers of sensors are mounted on the patient body e.g. heart rate sensor and temperature sensor, etc.
All the sensors collecting physiological data from patient. ADC block perform signal conditioning and analysis of physiological data from sensor. Physiological data coming from sensor is analog in nature. This analog data is then converted into digital form by using ADC for further process. This digital data is then given to the microcontroller, which stores the data.
The main part of circuit was done by the microcontroller ATMEGA 32. Stored data is transmitted to the android smart phone via Bluetooth. Finally result is seeing on the android smart phone. This result is shown on PC via Wi-Fi from android smart phone.

### IV. RESULTS AND ANALYSIS

Initially the reliability test runs with the wireless BAN prototype with the number of sensors connected to it. The three sensors are connected to the coordinator node or system i.e. heart rate sensor and body temperature sensor. All these two sensors worked correctly and got the respective readings of the patient’s physiological condition. These sensors correctly monitor the patient’s physiological condition and send the respective data to an android smart phone via Bluetooth connection.

1) **Working Process**
Detail Steps of this work are given below.

*Step 1:* Initially the reliability test runs with wireless prototype. Firstly we turn on the two things i.e. PC, mobile phone and kit etc. Then check connection between the PC, Mobile Phone and kit.

*Step 2:* After the turn on PC and kit, mobile phone check the connection via the Wi-Fi then coming this windows to check the connections. As shown in fig.4.

*Step 3:* Now we open the netbeans IDE 7.1 software.

*Step 4:* Deploy BAN server, and then we get android application kit.

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**Fig.4** Connection between the PC and Mobile Phone

**Fig.5** Software Window

**Fig.6** Deploy the Net Bean Software window
Steps 5: To run the program then built the target.

![Fig.7 To Run Software Window](image)

Step 6: After the RUN the WELCOME window coming to click on the OK button then fig 7. 1.6 windows come.

![Fig.8 The WELCOME Software Window](image)

Step 7: After Press OK button then come to this window for Login the person to inter the data of that particular person or check the previous data or real time data.

![Fig.9. Login Software Window](image)

Step 8: The different physiological parameters of patient.

![Fig.10. Main screen at Local User](image)

Step 9: Now we design the Android application i.e. Body Area Android. To click on that application is open.

![Fig.11. Main Screen of Android Application](image)

Step 10: After the click on the Body Area Android Application then Coming the below windows

![Fig.12. Body Area Android to Start the Application](image)
Step 11: As we open the application in android smart phone, the setting activity log opens as shown in the figure. It consists of three parameters IP address, mobile number and email ID. The IP address is the address of computer of the medical professional, who monitors the physiological parameters of the patients.

![Android Application Activity Screen](image)

The mobile number and email ID is required to send the alert messages to the concern person. When the initial setting activity parameters are filled, it opens the main screen of the android application.

![Android Prototype Application](image)

Step 12: On this main screen of the android application, three physiological parameters can be monitored such as temperature sensor, heart rate sensor and ECG sensor. All the physiological parameters can be continuously monitored by the medical professional. Just the IP address of the computer of medical professional is to be filled in the initial setting activity of the android application.

![SMS Alert System](image)

Step 13: As the alert system is introduced in the system, whenever the reading of the sensor crosses the threshold value the system will automatically activates the alert. The alert is of two types SMS alert and email alert. This SMS alert is send by the system to the primary contact person, whose number is placed in the application setting. The alert system is very useful from the patient’s point of view. Due to this alert system emergency situation can be handled effectively and patient will get the medical care as early as possible. The figure.15. shows the SMS alert, when patient is in normal condition then send SMS. Whenever we set the threshold value then it’s variation found in then goes the SMS to that particular person which we have registered the number in android activity screen. As below fig.13 This the Email Alert system. When any parameter having some variation then the Email Alert the person the patient in some critical condition.

V. Conclusion

Body area network (BAN) will play an important role in supporting a wide range of applications with BAN devices being operated in the vicinity, on, or inside body. The first design approach, a WBAN, fulfills the basic requirements. Reliability and range are sufficient. The combination of the WBAN with an Android smartphone offers a large functionality.
Crucial parameters can be stored, analyzed and visualized with GUIs designed for the end-user. Security on all levels of the layered system must be further investigated. Certification according to medical safety standards is currently impossible due to the different components used, e.g. the Android operating system. The first version of the proposed system will therefore be used in different research applications of environmental physiology, i.e. heart rate, breathing rate, etc.

REFERENCES


