PERFORMANCE ANALYSIS OF BODY AREA NETWORK WITH ECG SIGNAL: REVIEW

Priyarani .S. Jagatap, Rupali .R. Jagtap.

Abstract— **Now in today society is demanding more and more smart healthcare services that allow monitoring patient status in a non-invasive way, anywhere and anytime. So creating Body Area Network is a communication method used for Medical, Sports applications as well as to communicate with people. BAN System provide information related to health status of patient.ECG is used to measure the rate and regularity of heartbeats then send to radio technology and then Body Area Network System. This is a platform that requires minimum human interaction during set up and monitoring. We also called as Wireless Body Area Network. ZigBee is used as radio technology due to its low power and low data rate features. In this Wireless Body Area Network ZigBee is used to communicate between Physiological signal devices and mobile system.GSM is also used to send the SMS.**

Index Terms— **Medical Sensors, ZigBee Module, GSM Module, personal computer, Interfacing Devices.**

I. INTRODUCTION

The health problem is major issues in today's lifestyle. Mostly health problems lead to heart attack and others serious condition. To overcome this we create wearable health monitoring system has wireless sensors mounted on body this creates wireless network known as Body Area Network. Advantages are 1) very light weight. 2) Number of sensors can mount on patient body. Body Area Network sends information related health condition of patient to hospital centre as well as others medical application by using mobile system. It is continuously aware of the patient. Also Network must be communicated with other wireless system [1]. Monitoring Network requires not only high data transmission speed but also low transmission power. Good reliability gives better quality of transmission. In this paper we propose Body Area Network provides real time monitoring system for wireless Electrocardiogram and also for data transferring and monitoring .It uses many types of Medical Sensors work as individual as well as together to achieve better service. (e.g. Temp.sensor, Heart beat sensor, blood pressure sensor etc.)

Wearable ECG device (Electrocardiogram) is very thin in size uses three lead system more flexible. ECG is a noninvasive and it is the record of variation of the biopotential signal of patients. Noninvasive means that signal measured without entering the human body [13]. The ECG signal detects the information signal of heart as well as used for diagnosing many cardiac diseases. This is realistic record of the direction and magnitude of the electrical commotion which is created by depolarization and repolarization of atria and ventricles [12]. Clinical importance in cardiology is well developed [11]. By comparing with other sensor network BANs are more periodic for registering activities of patient body [9]. Wearable physiological signal devices enables continuous signal monitoring and supports heath related information at any place and any time. The operation of these Wearable devices is done under the Central Processor then data is rapidly transferred to application using Wireless Body Area Network (WBAN) like ZigBee, GSM Modules [4].
BAN system is wireless so it interface other wireless device. Users of BAN system are mobile. The next section of paper describes different address in detail. In Section II, we discuss BAN Architecture in that inter and intra BAN communication technology work. In section III we see Hardware and Devices. Section IV concludes this paper.
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II. BAN COMMUNICATION ARCHITECTURE

Wireless communication is done between sensors. This communication is also occurs between sensors and personal server**.** The ECG, blood pressure sensor, temperature sensor send data to personal server devices. After that these data are sending to number of applications by using mobile system like SMS (e.g. Medical doctor's site, Ambulance site etc). In this Architecture we discus intra BAN, inter BAN communication Technologyas as shown in figure.

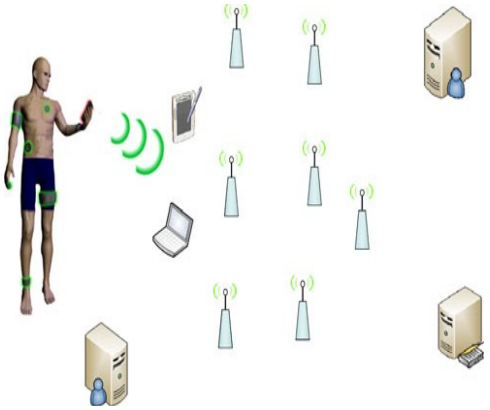

Fig.1.BAN Communication system Architecture.

Intra BAN Communication Technology

Wireless communication is done between sensors and also it happens between sensors and personal servers like personal Computer.

a. Inter BAN Communication Technology

In this communication is done between PC and one or more access points. We divide inter BAN communications into two types 1) infrastructure-based architecture 2) ad hoc-based architecture While the infrastructure-based architectures Provides larger bandwidth with centralized control and flexibility, the ad hoc-based architecture facilitates fast deployment when encountering a dynamic environment[14].

Adhoc based Inter BAN Communication technology made by using WLAN, Bluetooth, ZigBee, GSM which can operates in ISM band with 2.4GHZ frequency that includes guard band to protect adjacent channel interference [10]. ZigBee modules are configured by using a TTL level RS232 bus to transmit and receive AT commands. It requires the start bit, eight bits and stop bit. The baud rate for ZigBee module is set to 9600 [2]. In this BAN system we prepare to use zigBee wireless protocol has mesh, star topology for communication most popularly used because it has low energy consumption, longer battery life etc. ZigBee module operates in transparent mode. A ZigBee Transmitter and receiver protocol are used to receive and transmits information wirelessly. Bluetooth topology can be also used for short range application. BAN System Architecture technique is Adhoc based it has its own advantages over the Infrastructure based Architecture. Infrastructure based Architecture has limited space. Sensor communicates with BAN controllers or gateways which is the main interface between the Body Area Network and Monitoring server. Gateway collects the data from sensors and is responsible for overall management of the BAN Network. Patient information is send to number of application through the gateway device acts as wireless link between these two networks [5]. Various techniques like GSM, PDA can be used as getaway. The biosensors node base consists of LPC2148 ARM microcontroller running at 64 MHZ, 8KB to 40 KB SRAM, and 32KB to 128KB flash memory, UART and SPI port for serial communication, reset circuitry, watchdog and general purpose timers. The microcontroller connects with the biosensor node base via the UART pins on the IO expansion connector.Block diagram is as shown below

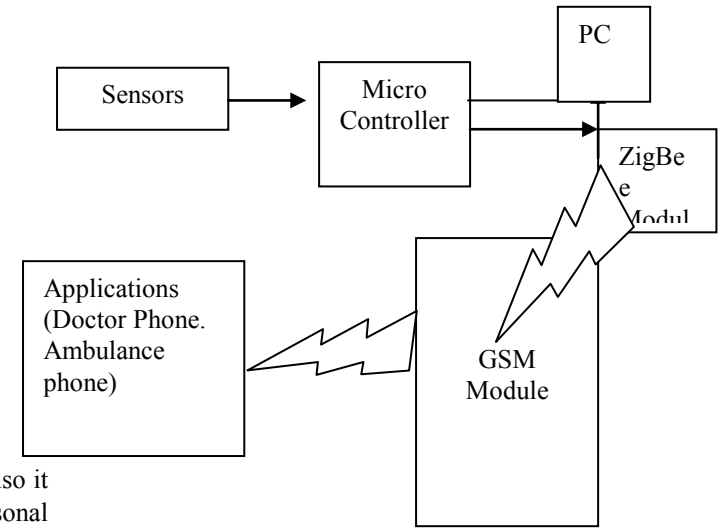

Fig.2. Block Diagram

III. HARDWARE AND DEVICES

In this section we discuss how this Body Area Network System is actually built up by using components and sensors.

a. Body Sensors
b. Radio Technology

A. Body Sensor

Body sensors are also called as Biosensors. This can be implemented in different ways. Some of body sensors are used under the human body so that electric property of human body affects the signal propagations. In other we can be used on –body sensors are integrated into clothes because of that we are able to measure heart rate, ECG rate [3]. Biosensors are used for monitoring the physiological signals (heart rate, oxygen level in the blood, blood pressure and body temperature). The hardware of these sensors consists of microcontroller, an ultra - low power RF transceiver, and data converter, analog signal conditioning circuitry, also a battery module to power them. These biosensors require an operating system for task switching and managing the system's power. Table shows the types of medical sensors [5, 9].

Electrocardiogram Detect	Detect heart rate and rhythm.
Blood pressure	Hypotension, emergent hypertension, and pathophysiology
Temperature	Medical diagnosis
Accelerometers	Movement pattern analysis; measures the depth of chest compressions during cardiopulmonary resuscitation

Fig.2. Types of Biosensors

B. Radio Technology

As we know that there so many radio technology for BAN Network are available. We do study some of them.

- BLUETOOTH

IEEE 802.15.1 standard is used for Bluetooth wireless communication technology. Bluetooth is a low tier, adhoc, terrestrial and wireless standard used for short range communication. This Bluetooth technology operates with three different classes as class 1, class 2, class 3 and range is about 100 meters, 10 meters and 1 meters. Bluetooth is basically operates on 2.4 GHZ ISM band. As we know that Bluetooth is commonly used at high data rate application [6].

- ZIGBEE

IEEE 802.15.4 is standard for Wireless Personal Area Network is known as ZigBee.This device has longer lifetime than Bluetooth because it requires lower power consumption and low complexity [3]. ZigBee Network layer supports both star, tree and mesh networks. Its nodes go from sleep to active mode in 30ms in short it has long sleep mode so that its power consumption is low and battery life is long. IEEE 802.15.4 is a low-power standard designed for low data rate applications. It offers three operational frequency bands: 868 MHz, 915 MHz, and 2.4 GHz bands. There are 27 sub-channels allocated in IEEE 802.15.4, such as 868 MHZ with 1 channel, 915 MHZ with 10 channel, and 2.4 GHZ ISM band with 16 channels [7]. It is formed by WPAN which specifies the physical layer and medium access control (MAC) layer protocol. IEEE 802.5.4 defined three devices one is full function device (FFD) another one reduced function device (RFD) and third one is the network coordinator so that this standard is more attractive for providing service over the network sensors.Zigbee module allow a very reliable and simple communication between microcontrollers, computers, systems, really anything with a serial port, Point to point and multi-point networks are supported. Some features of ZigBee. Security requirement in wireless Body Area Network is most important the fundamentals are Data Confidentiality, Data integrity, Secure Management and Efficiency [8]. ZigBee has much smaller network joining time. It is more advanced than other devices.

- GSM Technology

GSM technology is also used in WBAN system. It has two way communication and area covered by a GSM network is divided into a number of cells each cell has its own base station. In Body Area Network GSM technology is used as a gateway just for transferring data to application through the mobile station (mobile phone) by sending the short SMS for that SMI 900 AT command is used. GSM technology has so many advantages than the other [15]. . GSM uses Frequency Division Multiplexing AND Time Division Multiplexing. FDMA divides the frequency ranges for GSM, which are 890-915, 935-960 and some others that the book didn't have. Each is divided into 200 kHz wide channels. As far as TDMA goes, each time slot is 577 micro seconds long, 8 time slices is a frame, lasting for a grand total of 4.615ms. A multi frame consists of 51 frames, 51 multi frames make up a Super frame, and 2048 Super frames make a Hyper frame which is 2715648 frames.

IV. CONCLUSION

We developed a healthcare system which is wireless that allows the patient to be managed and have their health monitored anytime, anywhere. Such type of system improves the quality of life and reduces the time, cost etc. We used low power consumption IEEE 802.15.4/ ZigBee network. We discussed wireless body area network system architecture, hardware and devices. Some medical sensors also seen in this paper. Data security and privacy in wireless body area network is an important and there are still so many considerable challenges to overcome.

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