A Review: Technologies and Trends for Data Gathering & Communication Approaches in WBAN

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ABSTRACT

Wireless Body Area Network (WBAN) links the independent nodes (e.g. sensors and actuators) that are placed in the clothes, on the body or under the skin of a person. The network becomes more extensible over the human body and each node is connected by using a wireless communication channel. Generally, these nodes follow the Star or Multi-Hop topology. Various fields like remote health monitoring, home/health care, medicine, multimedia, sports and many others uses applications provided by the WBAN, and have advantage of the unconstrained freedom of movement a WBAN offers. WBAN facilitates the doctors and patient to communicate on a wireless network. These sensors can be placed on the body or inside the body. The data collected by the sensors are sensitive and confidential hence in some of the countries there is law to protect this data. This paper provides an introductory review to the field of WBAN its related trends.

Keywords— WBAN, Wireless Body Area Network, Data Packets, Throughput, Data Traffic.

I. INTRODUCTION

WBAN is treated as one of the application of Wireless sensor network which provides inexpensive and continuous monitoring of the patient with real time update of medical records through internet. WBAN makes it possible to collect process and then transmit the data samples such as blood pressure, brain, heart, tissues and other vital information of the body to the medical server for further actions. WBAN contains a coordinator (smart phones, Personal digital Assistant) which receives data from other sensor nodes and distributes received data wirelessly to the medical centres. Now at the receiving end, Medical applications perform continuous sampling of biomedical signals and then monitor vital signal information. These applications also provide data collection, data processing, and data transmission and then provide feedback to the user. Due to the easiness of wireless network it has been empowering Wireless Body Area network. Three basic constraints are involved in the wireless body area network energy consumption, data compression and cost of the device. Thus these parameters need to be considered while applying WBAN in a network. It provides convince to the ill patient as they don't need to go the doctors frequently. Basic implementation behind this criterion is that patient can store its samples on his/her PDA or smart phone and then can forwards to the external database.

As this makes it possible patient mobility and provides comfort by allowing them free from connected hospital equipments which would be required in case of monitoring of their conditions.

This resultant into efficiency of hospital administration capabilities as well as quality of the patient care will also be increased. Additionally, they can monitor more than one patient at a time by deducting health care cost. Nowadays numbers of wireless communication technologies are available in the market. Some of them are Bluetooth, Zing Bee, and WPAN which are applicable for short range i.e. 10 meters but power efficient.
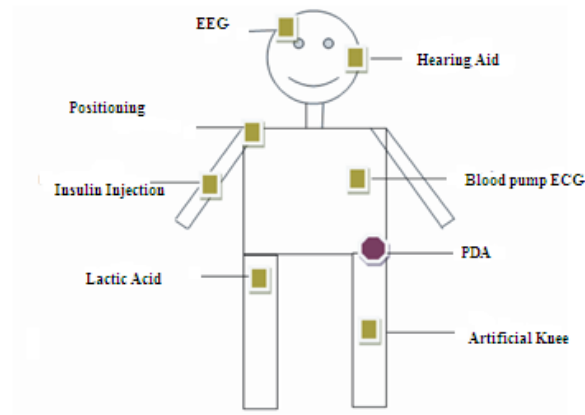

Figure 1 example of monitoring a patient using Body Area Network

II   APPLICATIONS OF WBAN

WBAN is applied in various fields for sensing the internal moments of human body. Following is the list of applications of WBAN:
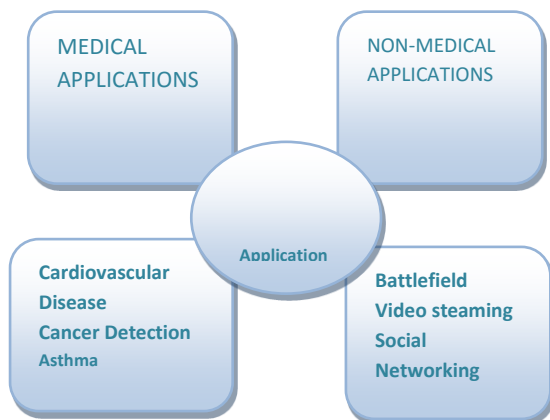

Figure 2 Applications of WBAN

Cardiovascular Disease : Special purpose screens are used for gathering the data. In cardiovascular, the data is collected in the form of rhythms such as cardio rhythms. It is a kind of offline processing. Cardiovascular disease is that disease which directly effects the blood circulation in the body and blood vessels which are connected to the heart. Cardiovascular disease leads to various illnesses in the body like high BP, coronary artery disease, stroke etc. Cardiovascular disease can also leads to the death of the person also.

Cancer Detection : Cancer is one of the biggest causes of death which puts human life in danger. According to survey it about 9 million people are suffering from the cancer disease in late 1999. WBAN can be savior in such case. A set of sensors can be helpful in detecting or monitoring cancer cells and provides physician to diagnose tumors without biopsy

Asthma : Asthma is also a problem suffering by several people. WBAN can help millions of patients by monitoring allergic agents which are present in the air. As a result real time feedback can be provided to the physician.

Telemedicine Systems : Traditional systems use two types of systems for the transmission of information from the source to the medical servers such as dedicated wireless channels and power demanding protocols namely Bluetooth. But in these systems, interference can occur from other devices working in same frequency band. Due to which it cannot used for health monitoring. As a result telemedicine systems can collaborate with WBAN which will be able to support unobtrusive ambulatory health monitoring.

Artificial Retina: Another application of WBAN is aid for the visually inspired people.

For the artificial retina, input can be extracted externally or internally. If externally then it will be from camera located on glasses and on the other hand it can be extracted by light sensitive wireless sensors.

III   FACTORS THAT EFFECTS THE PERFORMANCE OF WBAN

The overall performance of WBAN depends upon various factors. Some of them are as follows:

Energy Consumption by nodes: The amount of energy consumed by nodes affects the performance of the network. If nodes consumes the energy in access than the energy of the network will exhausted earlier this leads to the termination of processing. If the amount of energy consumed by nodes is higher than the lifetime of the network will be affected.

Data traffic: In a network data traffic occurs when the nodes delivers the data simultaneously. Data traffic leads to the delay in data delivery. Hence the performance of the network gets degraded.

Delay in data delivery: If there is any delay in delivery of data then it means that the data is not reaching to the sink or base station when it is required. Delay in data delivery can affects the process of decision making at the server side.

Packet Delivery ratio: Packet Delivery ratio defines the ratio or amount of the packets delivered to the destination node. If the packet delivery ratio is low then it degrades the performance of the network.

Throughput: The term throughput refers to the average of output produced by a network with respect to given period of time. Minimum value throughput means that the performance of the network is weak.

Lifetime of Nodes: Lifetime of nodes is determined by the amount of remaining energy at the nodes. If the remaining energy at a node is zero then the node will be declared as dead node. If nodes consumes higher amount of energy for data transferring or communication then the amount of remaining energy will be nil due to which the nodes will be declared as dead. The greater number of dead nodes in a network leads to the slower processing and degrades the process of the networks.

IV   RELATED WORK

Savita Sindhu et al (2016)[1] wireless network is the most trending area of nowadays and it is being increasing gradually. Moreover electrical devices are getting smaller in size. Owing to this wireless body area networks (WBAN) expanding in terms of research area. WBAN works with multiple devices whereas these devices take the physiological parameters such as temperature of the body, Blood Pressure, ECG, EEG etc. WBAN provides advantage of mobility to the patient which means that patient do not require to stay in the hospital as WBANs are implanted on the body of the patient. Moreover sensors which are placed are used to fetch private data and forwards to the medical server. As data fetched by the sensors are private thus security is the main concern in WBAN. Due to its various advantages it has become the major research area in past few years. Some of the applications of WBAN are medical and non-medical areas. In the area of medical, health monitoring is beneficial which cares about the health of the patient in real time. In this paper, various aspects of wireless body area network, its implementation techniques and MAC protocols have been explained. Along with this best suited technique to the user had also mentioned.

Aashima Arya et al, (2014)[2]", in wireless body area network sensors are embedded or implanted on or in the body of the patient. Due to its nature of wireless it provides variety of sensors which offers several new and innovative applications in order to improve the health care of the patient as well as adds quality to the life. With these sensors patients were not more compelled to stay in the hospital for frequently checkups or monitoring. This paper explained difference between WSN i.e. Wireless sensor network and WBAN i.e. Wireless Body Area Network. Furthermore an idea had also presented in this paper which can be helpful in improving the healthcare systems in India using telecommunication and information technology. These could be successful by using wearable and implantable body sensor nodes. But this will not affect the mobility of the patients. This paper explains how healthcare monitoring application of Wireless Body area network used multiple sensor nodes. New trends of wireless body area networks were also discussed at the end of the paper.

Sapna Singla et al, (2016)[3]", Wireless body area network is the most trending area of research. Due to its benefits it has been used in several applications. Medical and non-therapeutic applications developing the interest of using WBAN. This paper discussed several protocols used for Wireless Body Area Network and its various techniques used in health care application. Lastly existing work of various authors had been presented in this paper.

Pervez Khan et al,(2015)[4]", in wireless sensor network IEEE 802.15.6 has been used for short range and extremely low power communication. It is a new standard for wireless body area network with high data rates which can access the data in vicinity of, or inside a human body. This new standard has given two contention

based channel access schemes such as slotted ALOHA and another one is carrier sense multiple access with collision avoidance (CSMA/CA). Second scheme uses an alternative binary exponential back off procedure. This paper had focused on the analytical model for the estimation of performance metrics such as energy consumption, mean frame service time and normalized throughput. Furthermore Markov Chain model has employed in this paper which describes different access phases under different priorities and access methods. Lastly it can be concluded that EAP i.e. Exclusive access phase is a method which is not necessary in Wireless Body Area Network using CSMA/CA. Reason behind this conclusion is that it degrades the overall performance of the system in terms of system throughput, energy consumption per packet.

Xin Qi et al, (2015)[5]", wireless body area network is an emerging field of today which provides solution to the mobile health i.e. mhealth. Basically WBAN used to collect data from in-body or around body sensors nodes. To access data in high throughput and low delay in an energy efficient way it is required to design a protocol which is efficient enough. Thus MAC is the protocol which access to the shared wireless medium as well as coordinates nodes. This paper included difference of different MAC protocols such as Energy-Harvesting wireless Body Area Networks (EH-WBANs) and Battery Powered WBANs (BT-WBANs). Progress in energy harvesting techniques and WBAN Mac protocol designs were also described in this paper.

V   CONCLUSION

WBAN is a body area network which is used for diagnosing a patient even if he is far away from the hospital or medical institutes. WBAN is proved as a milestone in both of the field's medical field as well as non-medical field. WBAN is a trendy topic for research work; hence the lot work can be done in this field to enhance the performance of WBAN. There are various parameters that can be considered for doing research work in this field. This paper provides an introductory overview to WBAN along with its various applications. The parameters that affect the performance of the WBAN also defined in this.

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