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A Review on Wireless Body Area Network for Health Monitoring

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ABSTRACT

The Recent developments and technological advancements in wireless communication, Micro-Electro-Mechanical Systems (MEMS) technology and integrated circuits has enabled low-power, intelligent, miniaturized, invasive/non-invasive micro and nanotechnology sensor nodes strategically positioned in or around the human body to be used in diverse applications, such as personal health monitoring. Body area network (BAN) is the most advanced technology in wireless communications and electronics. The recent BAN's applications prove how this becoming more demanding to each one. Some of these applications are medical applications, it is possible to implant, or wear, tiny health monitoring sensor nodes on the body so that the fundamental body parameters and the movements of the patient can be recorded and communicated to the medical amenities for further actions such as processing and diagnosis as well as it is also used in non-medical application areas such as entertainment, military. Apart from that BAN have specific hardware and network necessities with low power consumption.

Keywords: Research Paper, Technical Writing, Science, Engineering and Technology.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are used for monitoring different types of parameters in various applications like environment monitoring applications e.g. checking temperature, humidity etc., habitant monitoring, combat zone, farming field checking ,air pollution monitoring, nuclear power plant observing and railway industry monitoring applications. Sensors nodes are used in wireless sensor networks for collecting the data, which are the main unit of wireless sensor networks. These sensors are placed in detecting area to screen field [1]. WBAN is new rising subfield of WSN. The main use of WBAN is well being examination. In WBAN, remote sensors are place on the human body or fixed in the body to monitor essential signs like circulatory strain, body temperature, heart rate, glucose level etc. Utilization of WBAN innovation to monitor wellbeing parameters significantly decreases the consumptions of patient in health centre. Through the help of WBAN innovation, patients are observed at home for more periods. Sensors constantly sense information and forward to medicinal server. In WBANs, sensor hubs are worked with partial vitality source. It's needed to utilize least power for transmission information from sensing element hubs to sink. One of the most important obstructions in WBAN is to energize the batteries. A productive guiding convention is needed to overcome this issue of energizing batteries. Numerous vitality proficient directing conventions are planned in WSN innovation. Yet, WSNs and WBANs have distinctive designs, applications and work in various circumstances. It is tough to port WSN steering conventions to WBAN. Hence, vitality effective directing convention for WBAN is required to screen patients for more period. We propose a high throughput, dependable and stable directing convention for WBAN. Sensors for ECG or graphical record and Glucose level are set close to the sink. Each of these sensors have basic data of patient and required least constriction, high unwavering quality and long life thusly; these sensors dependably transmit their information specifically to sink. Different sensors take after their protector hub and transmit their information to sink through forwarder hub. It spares vitality of hubs and system works for more periods. Mainly two varieties of devices can be distinguished: sensors and actuators. The sensors are used to measure certain parameters of the human body, either externally or internally. Examples include measuring the heartbeat, body temperature or recording a prolonged electrocardiogram (ECG). The actuators (or actors) on the other hand take some precise actions according to the data they collect from the sensors or through interaction with the user. E.g., an actuator equipped with a built-in reservoir and pump administers the correct dose of insulin to give to diabetics based on the glucose level measurements. Interaction with the user or other persons is usually handled by a personal device, e.g. a PDA or a smart phone which acts as a sink for data of the wireless devices [2][3].

II. APPLICATION OF WBAN

The major applications are healthcare, control and automation, home and office, environmental monitoring, logistics and transportation, security and surveillance, tourism and leisure, education and training and entertainment. The BAN applications are broadly divided into following categories. Medical applications include collecting various information of a patient and forward it to a monitoring centre for further analysis. BAN can also be used to help disable people. For example, retina prosthesis chips can be implanted in the human eye to see at an adequate level. Presently BANs are widely used for entertainment purpose, which includes 3D video and Games. Further the BANs are used for sports, in which sensors in BAN can collect coordinates movements of different parts of the body and subsequently make the movement of a character in the game, e.g., moving soccer player or capturing the intensity of a ball in table tennis. Last but not the least miscellaneous applications those include forgotten things monitoring, data file transfer and social networking applications. For better functionality authors discussed about the target system that has a scalable platform that requires minimum human interaction during setup and monitoring [4, 5].

III. SYSTEM REQUIREMENT

In order to make a WBASN useful and practical, some essential requirements have to be satisfied. These requirements are strongly related to the specific application. In our case study, the WBASN architecture must satisfy the following requirements:

A. Length of monitoring:

The cardiac activity needs to be monitored for an extended period especially for aged people suffering from cardiac arrhythmia. Long-term analyses on ECGs are required to predict eventual heart attacks. The application must allow continuous monitoring.

B. Reliability:

The reliability of measurements and message delivery to healthcare professionals is necessary, due to potentially life threatening episodes.

C. Power Management:

Sensor nodes have low power capacity and are assumed to be dead when they are out of power. The system must save energy especially when the aged subject is outside.

D. Time synchronization:

Each sensor runs at its own clock and has a different sample frequency. Accordingly time synchronization between sensors is needed.

E. Message delivery:

Vital signs are delivered within a certain time determined by the level of emergency. The architecture should allow real-time delivery of emergency vital signs for both indoor and outdoor surroundings. Messages carrying emergency vital signs require least delays.

F. Frequency of signal transmission and the amount of information:

Important questions are how often data has to be transmitted and how much data. In our application the physiological data is acquired for an extended period (8 hours for example) and downloaded to the base station in real time. The system ensures periodic transmission of regular vital signs and instant transmission of urgent messages. The application data traffic is determined by the sample frequency and digitization method.

G. Buffer management:

In the outdoor environment, the regular vital signs are stored. Buffering data may result in a buffer run over due to capacity restrictions. This may lead to data loss or temporal application termination [9].

H. Scalability:

The architecture should balance well in terms of the number of patients and the number of sensors on each patient.

IV. WBAN ARCHITECTURE

WBAN architecture is divided into three following levels:

1. Level 1: Sensing or data collecting part.
2. Level 2: Data transmission.
3. Level 3: Data analyzing.

Figure 1 shows secure 3-level WBAN architecture for medical and non-medical applications.

A. Level 1: Sensing or data collecting part

Level 1 contains in body and on-body BAN Nodes (BNs) such as Electrocardiogram (ECG) – used to monitor electrical movement of heart, Oxygen saturation sensor (SpO2) –used to measure the level of oxygen, and Electromyography (EMG) – used to monitor muscle activity.

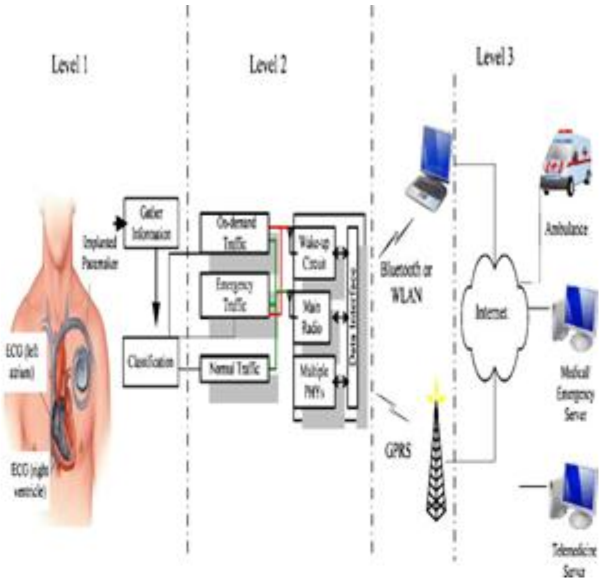

Figure 1. Architecture of WBAN

B. Level 2:Data transmission

Level 2 contains a BAN Network Coordinator (BNC) that gathers patient's vital information from the BNs and communicates with the base-station.

C. Level 3:Data analyzing

Level 3 contains a number of remote base-stations that keep patient's medical/non-medical records and provides significant (diagnostic) recommendations. The traffic is divided into on demand, emergency, and normal traffic. On-demand traffic is processed by the BNC to obtain certain data. Emergency traffic is processed by the BNs when they exceed a predefined threshold. Normal traffic is the data traffic in a normal condition with no time critical and on-demand events.

The normal data is collected and processed by the BNC. The BNC contains a wakeup circuit, a main radio, and a security circuit, all of them connected to a data interface. The wakeup circuit is used to accommodate on-demand and emergency traffic. The security circuit is used to stop malicious interaction with a WBAN [10].

V. CONCLUSION

In this paper current research is reviewed on Wireless Body Area Network in Healthcare monitoring. WBAN is being very useful technology with many benefits for medical applications, patients and society by continuous monitoring and early detection of diseases. WBAN is the type of wireless network which consists low powered for calculating and monitoring the physiological parameters. Basically, WBAN consist the two types of sensing unit one wearable and another one is which is fixed inside the human body and after this data transmitted to the base station which is the data analyzing part.

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