Chapter 17

Energy Efficient Wireless Body Area Network (WBAN)

Prasenjit Maiti
National Institute of Technology Rourkela, India

Sourav Kanti Addya
National Institute of Technology Rourkela, India

Bibhudatta Sahoo
National Institute of Technology Rourkela, India

Ashok Kumar Turuk
National Institute of Technology Rourkela, India

ABSTRACT

Healthcare expenses are a growing concern in most countries. This has forced medical researchers to look for trusted and ambulatory health monitoring of patient’s vital signs. The objective is to reduce patient visits and the use of medical and support staff for frequent examinations. Wireless Body Area Networks (WBAN) consist of implanted, or worn, tiny health monitoring sensor nodes so that the vital body parameters and the movements of the patient can be recorded and communicated to the medical facilities for processing, diagnosis and prescription. WBAN is required to have small form and low power consumption. Reducing energy consumption of the sensor and communication equipment is one of the key research areas. It is also important for WBAN be secure, protected and reliable. Failure to acquire authentic and correct medical data may prevent a patient from being treated effectively, or even lead to wrong treatments. As patient identity can be obtained by correlating physiological information, privacy concerns must be addressed for wide acceptance of the technology. While security is paramount, the cost of implementing security techniques in WBAN may be prohibitive. It, therefore, becomes necessary to find cryptographic solutions that consume less energy. Research efforts are being made to reduce the cost of cryptography used in WBAN. In this paper authors discuss the current and future security solutions for low energy WBAN.

INTRODUCTION

There are many applications of wireless sensor network (WSN). The remote body sensor organizes additionally a sort of WSN and this is determined by the sensors with physiological parameters placed on or around the body. Health care monitoring system is an application of the Internet of Things(IoT). WSN is the main key component of IoT. They try to provide a software and hardware related embedded

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ubiquitous computing and a better wireless communication technology platform. There are many similarities between WBAN and WSN. However, there are many similarities between WBAN and WSN but characteristics are different because of application purpose. Healthcare expenses are a growing concern in most countries. As people age, their dependence on the healthcare system increases. People above the age of 60 years show larger dependence on the healthcare system because of the increased preponderance of age related diseases like cardiac ailments, respiratory problems, arthritis, neurological diseases and dementia. According to World Health Organization (WHO), by the year 2020 people older than 60 years will outnumber children below 5 years. By 2047 people 60 and above will be 2 billion, up from 841 million today. About 80% of this elderly population will be in low and middle-income countries. A fundamental change is needed in the way in which healthcare is delivered. In this section we look at WBAN as an agent that could provide a revolutionary change in the way the medical system works.

1. **Network Deployment:** In a WBAN, the number of nodes being very few provides less redundancy in nodes compared to WSN. Also, WBAN nodes are quite easily accessible compared to WSN environment. If any node failure occurs, it affects the entire WBAN. So each node must be error prone (Lairet et al., 2011).

2. **Node Design:** In a WSN, every node has the same attributes and the size of the nodes is a trivial issue. They perform the same function and they are probably not movable. But in WBAN, different physical signals collected by different sensors and the nodes are deployed as human body moves (Chen et al., 2010). The smaller node ensures the high variability and bio-compatibility (Garg et al., 2010).

3. **Energy Supply:** WSNs and WBAN can be battery powered. WSNs are battery powered by wind energy or solar energy where as WBAN are battery powered by kinetic energy and heat (Cooney et al., 2008; Yoo et al., 2010).

4. **Data Transmission:** The data transfer rates in case of WSNs are approximately same in various WSN applications but it is different in WBAN. The channel assignment and data type of nodes on the body surface is different from those located in the body (Chen et al., 2010).

Finally, considering security and privacy, unlike WSNs, WBAN devices are restricted in terms of communication and power efficiency. Therefore, many numerous security challenges than traditional WSN where real time data transfer and Quality of Service (QoS) also considered (Bui & Hatzinakos, 2011; Kumar & Lee, 2012).

The general architecture of WBAN is shown in Figure 1. Sensor nodes collect and process physical data from the body area network. The data collection is performed by sink node and then transmitted to a base station for data aggregation and shared over the internet.

Nowadays, WBAN research still confronts many key technical challenges which are shown in Figure 2. (Jafari & Lotfian, 2011; Luo et al., 2006; Kwong et al., 2009; Atallah et al., 2010; Song et al., 2005; Preece et al., 2009; Akin et al., 2010; Akyildiz et al., 2002; Korel et al., 2007; Thiemjarus et al., 2006; Natarajan et al., 2007; Tachtatzis et al., 2011; Ullah et al., 2010; Seo et al., 2010; Benoit et al., 2007;