Chapter 5
QoS-Aware Data Dissemination Mechanisms for Wireless Body Area Networks

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ABSTRACT

To reduce healthcare costs and improve human well-being, a promising technology known as wireless body area networks (WBANs) has recently emerged. It is comprised of various on-body as well as implanted sensors which seamlessly monitor the physiological characteristics of the human body. The information is heterogeneous in nature, requires different QoS factors. The information may be classified as delay-sensitive, reliability-sensitive, critical, and routine. On-time delivery and minimum losses are the main QoS-factors required to transmit the captured information. Various researchers have work to provide the required QoS, and some have also considered the other constraints due to the characteristics and texture of the human body. In this research work, we have discussed the communication architecture of

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WBANS along with the various challenges of WBANS. Furthermore, we have classified and discussed the existing QoS-aware data dissemination mechanisms. In the end, a comparative study of existing QoS-aware data dissemination mechanisms highlights the pros and cons of each mechanism.

1. INTRODUCTION

Rapid increase in population of elderly people living with chronic diseases is inevitable in years to come which requires round the clock monitoring of such patients (Movassaghi et al., 2013). According to World Population Ageing 2017, the worldwide elderly population (60+ aged people) is predictable to be increased from 962 million to 2100 million between 2017 & 2050 and 3100 million in 2100 (World Population Ageing, 2017). Similarly, as per report of World Health Organization (WHO), the world's population of 60+ aged people between 2015 and 2050 will be almost doubled (12% - 22%) (World Health Organization (WHO) - Ageing and Health, 2017). Besides the people suffering from chronic diseases, the patients inside the hospital also require different level of monitoring ranging from a couple of times a day to continuous monitoring. The continuous and on-and-off health monitoring requires a huge amount of additional medical and health-care cost (World Health Organization (WHO) - Gobal Health Observatory, 2018). The aforementioned statistics ask for major change towards proactive and more affordable management to prevent or detect the diseases at an early stage (Movassaghi et al., 2014). The merger of pervasive computing, wireless sensor technologies and bio-medical engineering has led to the emergence of a promising technology called as Wireless Body Area Networks (WBANs), as shown in Figure 1. WBANs provide continuous and unsupervised vital-signs monitoring of human body. It can be utilized in various monitoring applications, such as medical assistance and health-care, sports, entertainments and rehabilitation systems.

WBANs offer the paradigm change towards proactive arrangements and early detection of the different diseases. In WBANs, with the help of various on-body, on-cloths (wearable) and/or implanted sensors (Ullah et al., 2010) like temperature[1], heartbeat[2], electromyography (EMG)[3], pH-level[4], blood pressure[5], electrocardiogram (ECG)[6], electroencephalogram (EEG)[7], respiration rate[7] data collection and analysis is performed thereby reducing the health-care cost. Such sensors are commonly known as Bio-Medical Sensor Nodes (BMSNs). Different BMSNs are shown in Figure 2 where upon sensing and locally processing, the vital signs information is further reported to a Body Coordinator (BC), located locally near the human body or on the human body.

Various types of data packets are generated by the heterogeneous natured BMSNs which require different QoS parameters among which latency and reliability are of key importance (Monowar et al., 2014). Certain data packets can tolerate some losses but require delivery within certain time-frame and others might require shortest delay and highest reliability. There may be some data packets that should be delivered with highest reliability while others may not any such constraints.

2. COMMUNICATION ARCHITECTURE OF WBSNs

The communication architecture of WBSNs is consisting of three tiers as shown in Figure 3.