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PERFORMANCE ANALYSIS IN MITIGATING INTERFERENCE FOR WIRELESS BODY AREA NETWORKS (WBANs) WITH ZIGBEE BASED USING OPNET-MODELER

NOOR AISHAH BINTI ZAINIAR

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ABSTRACT

Wireless Body Area Network (WBAN) is a short distance range communication network consists of a single coordinator with several low power sensor nodes and offers wireless connectivity among sensor nodes that operate within close proximity to the human body. The use of WBANs are greatly increasing as more people are accepting the use of wearable monitoring devices for numerous health care. The close proximity between other existing WBANs caused very high possibility in interference. Interference may causes delay and degradation of performance for individual WBAN entirely. The whole performance analysis is performed by taking into account the specific features and recommendations of IEEE 802.15.6 with IEEE 802.15.4 ZigBee standard. Therefore, ZigBee Based scheme is introduced and analysis is vital to reduce delay hence improve the speed performance and reduce interference among the sensor nodes. This research is conducted in OPNET-Modeler 14.5 and the network topologies used in this research are Star and Mesh topologies. This research studied the end-to-end delay, traffic received and sent, queueing delay, and speed performance. The findings summarized that ZigBee Based helps to mitigate significant interference to the network. Eventhough interference has still causes end-to-end delay in sending the data packet to the rest of the nodes, ZigBee Based still helps to increase the speed performance even the WBAN network is facing high interference since large number of sensor nodes are coexist in same location with close proximity either in Star or Mesh topology.

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TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1 Research Background

Wireless Body Area Network (WBAN) has become of the profitable for healthcare technologies. WBAN is a short distance range communication network consists of one (1) coordinator with several low power sensor nodes (Ali, Moungla, Younis & Mehaoua, 2016); and offers wireless connectivity among sensor nodes that operate within close proximity to the human body (Huang & Quek, 2015).

It is energy-efficient and inexpensive sensors that can be either implanted inside or connected to the human body whereby its sensors are used in several applications such as individual health checking, common healthcare and/or life care services which are a part of typical Internet of Things (IoT) applications, sports and military (Huang & Quek, 2015). These sensors are usually arranged in star topology to gather physiological information from the human body and deliver information to the coordinator node for processing (Islam, 2017). For example, the involved sensor may be observing the heart (electrocardiography signal or ECG) and the brain electrical activities (electroencephalographs signal or EEG) as well as blood pressure, core temperature, oxygen saturation carbon dioxide concentration, etc. (Islam, 2017).

WBAN has few wireless sensor nodes in which has different functions and parameters that connecting to human body, and the messages that are to be broadcasted to a central node is known as a coordinator. Coordinator itself is able to be the sensor node or it can solely be an collecting and transmitting device. Coordinator in turn transmits monitored data for further processing to the backbone network through wireless access point (AP). The nodes can be either wearable or embedded into a human body. The nodes may connect with other using short distance wireless technology, e.g. Bluetooth, ZigBee, or Ultra-Wide Band (UWB). A WBAN sensor node consists of fundamentally six mechanisms: processing unit, sensing unit, power unit, storage unit, analog-to-digital converter (A/D converter) and communication unit (radio transceiver) (Sravya, 2017).