

# Relay Node Based Fault Recovery Technique in IEEE 802.15.4 based WBAN

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## ABSTRACT

*Wireless sensor networks comprises of many individual nodes which interconnect to form a system that operates as one. These sensor nodes play the main task of sensing the environmental conditions and maybe control them too. A WBAN consist of portable, miniaturized, and independent sensor nodes for monitoring body function for health, sporting, emergency and entertainment, applications. It provides long term health monitoring of patients under natural physiological states without constraining their normal activities. In body sensor networks it allows communication between implanted devices and remote monitoring. The proposed algorithm reduces the chances the chances of fault in the network. The proposed and existing algorithms are implemented in NS2 and results are analyzed in terms of certain parameters.*

**KEYWORDS:** WBAN, Relay, Fault,

## I. INTRODUCTION

Wireless sensor networks comprises of many individual nodes which interconnect to form a system that operates as one. These sensor nodes play the main task of sensing the environmental conditions and maybe control them too[13]. We need a collaboration of large number of such sensor nodes as it is not possible for a single node to cover large geographical areas. Sensor networks perform two main operations; they are data dissemination or spread of queries throughout the network and second is the data collection or gathering from individual sensor nodes and pass it on to sink. The wireless sensor networks have emerged as an important part of our lives as they are known to support a wide variety of applications in day-to-day life; also because of their property of

flexibility they pose as a research challenge [1]. Every WSN has its individual set of requirements; thus no one size fit solution is possible as all situations are unique. Type of network and sensors used is application dependent; so to suit to our requirements, physical parameters and sensor technology can be altered in a node of a WSN. WBAN is latest technology in wireless field which is uses in number of application for monitoring of health and fitness, device control and emergency response [2]. In this network there are some low profiles, low power devices that are interconnected in this way so that it creates sensor nodes consist of one and more sensor device known as microcontroller unit (MCU) and one radio transceiver that get rid of wire to make connection with coordinator nodes to transfer data from one node to other [3]. A WBAN consist of portable, miniaturized, and independent

sensor nodes for monitoring body function for health, sporting, emergency and entertainment, applications. It provides long term health monitoring of patients under natural physiological states without constraining their normal activities. Personal Device is a device which is chargeable and collect information received from sensors and actuators and handle interaction with other users. Through external gateway, information can be passed through the users to the display. This is called body gateway, sink, and body control units [4]. Sensors in WBAN maintain many parameters internally and externally in parameters. These nodes can gather information and give response to the query by physical stimuli. These sensors can be physiological, ambient and bio kinetic. Some of them can be used in wrist watch, mobile and ear phones which can be monitor anywhere or everywhere. The actuator interacts with user to receive information and data from sensors. Its main role is to provide valuable information. The best example is to provide pumping dose of the medicine in health care applications. There are several routing protocols proposed for WBANs. In Mobility-supporting Adaptive Threshold-based Thermal-aware Energy-efficient Multi-hop protocol (M-ATTEMPT), high data rate nodes are placed near the human sink. Nodes are placed away from the sink when they have low data rates [5]. The protocol operation applied on the different phases. Hello messages are broadcast in initialization phase. This contains information neighbor and from sink in terms of hop count. In the routing phase, routes with minimum hops are selected for data transmission from nodes to the sink. In SIMPLE (Stable Increased Throughput Multi-hop protocol for Link Efficiency in WBAN), eighteen nodes are placed at different location of the body and having sink at the waist. SIMPLE protocol is divided into different phases. In the initial phases sink broadcasts information packet of short length to the other nodes to inform its position on the human body. Every node contains a node ID, residual energy value and its location. In the next phase, a forwarder node is selected which route the data of other nodes with saving energy [6]. FEEL (Forwarding Data Energy Efficiently with Load Balancing in WBAN) is a protocol which improves stability period and throughput. Total eight numbers of nodes are deployed on the human body. Node 8 is for ECG and node 7 for glucose level sensor. Mostly two

types of topologies have been used for sink deployment.

#### Literature Review

**Rui Pan et.al** (2015) explains [7] that sensor node and body worn coordinator is harmful and poor to conditions of channel. This happens due to variations of sensing condition between sensor nodes and coordinators. The main solution of this problem is relay node where direct transmission is not possible. In this paper two hop relay mechanism is proposed in IEEE 802.15.6 standard and divide it into relay node election, channel assessment, data relaying process. After this a predefined data relaying mechanism has been proposed to overcome data relaying failure problem. In this process predefined relaying node is activated without election. Experimental result shows that predefined relaying process improves 50% of packet delivery rate. Moreover network lifetime is also extended to 8%. In future to improve packet delivery rate more, dynamic scheduling algorithm can be used.

**Aashima Arya et.al**(2014) reveals [8] that there are basically three types of wireless body area network which are attached on clothes, on body and under skin. In this paper they have discussed various protocols of MAC protocol and current technologies for WBAN. They have discussed that how anyone can get benefits from WBAN as well as human beings also. They also focused on the technique that how health can be improves using multiple nodes. In this paper they have given an idea to improve health care system of India using Telecommunications and technology with the help of wearable and implantable body sensor nodes without effecting mobility of the patient.

**Amit Samanta et.al** (2015) proposed link-quality aware resource allocation scheme in WBAN to address the situation and maximize its overall performance [9]. This scheme has two schemes temporal link quality measurement and sub-channel allocation among the WBAN's. They also predict correlations among different link quality. Furthermore sub-channel allocation phase divides available bandwidth into number of sub-channel to main network quality. There are number of parameters metrics on the basis of which performance of the network is evaluated. The performance metrics are path loss, throughput, and number of dead nodes. The experimental results show that if link-quality-aware resource allocation is made between WBAN and available APs.

**Jayanthi K. Murthy, V. et.al (2013)** introduced [10] various application in the field of wireless body area networks. WBAN devices have limited energy resources. It is very difficult for all the devices to change and replace battery. The data which is required is of high reliability, low delay and medical information. The main aim of this paper is to evaluate routing protocol performance on static IEEE 802.14 for the suitable routing protocol. Among number of the routing protocol they suggest cluster topology and AODV as the probable candidate. 16% improvements have been done in the case of energy consumption.

**Samiksha Kumari, et.al (2015)** explains [11] that a new technology has been invented under wireless sensor networks for the improvement of the network in human body. In sensor node, data is transfer through point-to-point and multi-hop topology. In wireless body area network, only few sensors are implanted in body. These tiny sensors are implanted on the body to measure body blood pressure, pulse level and glucose level. In WBAN, network is designed using low device that are located on and around human body and used to monitor signals and motion for medical entertainment. In wireless body area network, sensor nodes are typically powered with lower battery which has insufficient life time.

**Iehab A. AL-Rassan, et.al (2014)** examined that [12] the potential limitation of PV's is short keys generation, which can be easily brute forced and high computational cost whereas in Pre-loading the keys are not random and require enough keys storage. In this paper we will merge PV's and pre-loading techniques by using electrocardiography (EKG/ECG) values of PVs and pre-loading based schemes to strengthen the security. The applied technique will enhance the security as well as reduce storage and power consumption.

### Research Methodology

The wireless body area network is type of network which is used to sense the body conditions. The sensors are deployed in such a manner so that efficiently sensed data can be transmitted to transmitter. The communication in the wireless body area network is multi-hop communication. In this type of communication source node establish shortest path to destination. When source node is transmitting data to destination in between some sensor nodes get faulty or battery of the sensor nodes degraded due which fault may arise in the network. The relay based technique used relay

nodes for fault recovery in the network. In this work, further improvement will be proposed in relay based network to reduce network complexity. The proposed enhancement will be based on dynamic routing. In this routing , multiple paths will be established from the source to destination. When battery of any sensor node reduced to threshold value, new path will be automatically chosen for data transmission. This technique may leads to reduce in network complexity, reduce network delay, reduce energy consumption and increase network throughput. There are number of nodes deployed in the network. Sink is also available in the network. Nodes transfer data through intermediate node to the sink. Node which wants to communicate with sink, data is transferred through intermediate node. During data transmission or forwarding data faults may be occurred at intermediate node in the network. Due to fault, network performance degrades in terms of packet exception ratio with single and double coexistence. Transmission of data also affected due to fault occurrence.

### Experimental Results

The proposed technique is implemented in NS2 and the results are evaluated by comparing proposed and existing techniques in terms of different parameters.



Fig 1: Packets Reception Ratio coexistence Graph As shown in figure the packet reputation ratio values of non coexistence,two WBAN and three WBAN is compared . It is analysed that proposed techniques performs well in all existence schemes.

### Conclusion

The wireless sensor networks is the type of network which is used to sense the environmental

conditions like temperature, pressure etc. The wireless body area network is the type of network which is used to sensor the body conditions. In the wireless body area network eighteen sensors are used with sense the whole human body conditions. These sensors sense the conditions and pass information to transmit. The transmitter receives sensed information and performs required actions according to human body conditions. The main problem which occurs in the wireless body area network is of fault. The fault may occur due to failure of sensors and due to battery degradation of the sensors. In the proposed technique, a fault recovery technique in wireless body area network has been discussed. To recover fault author proposed scheme for relay nodes which extra nodes deployed with the sensor nodes. It helps to improve network performance in terms of packet reputation ratio.

#### REFERENCES

- [1] S. Rupali, K. Gurudatt, S. Ramesh, B. Pooja, N. Deshmukh, B. Shrikant, "Energy Management in Wireless Sensor Network", 15th International Conference on Computer Modelling and Simulation, IEEE, Vol. 10, pp1-4, 2013.
- [2] T. N. Qureshi, N. Javaid, A. H. Khan, A. Iqbal, E. Akhtar, M. Ishfaq, "BEENISH: Balanced Energy Efficient Network Integrated Super Heterogeneous Protocol for Wireless Sensor Networks", ELSEVIER, Procedia Computer Science 19 (2013), 920 – 925
- [3] Geoffrey Lo, Sergio Gonzalez-Valenzuela, and Victor C. M. Leung, "Wireless Body Area Network Node Localization Using Small-Scale Spatial Information", IEEE Journal of biomedical and Health Informatics , VOL. 00, NO. 00, 2012
- [4] Zhaoyang, Honggang, Hua Fang, "Interference Mitigation for Cyber-Physical Wireless Body Area Network System Using Social Networks", IEEE Transactions VOLUME 1, NO. 1, JUNE 2013
- [5] Emil Jovanov, Aleksandar Milenkovic<sup>1</sup>, Chris Otto and Pie, "A wireless body area network of intelligent motion sensors for computer assisted physical rehabilitation", Journal of Neuro Engineering and Rehabilitation 2005
- [6] I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", Computer Networks 38 (2002) 393-422, Elsevier
- [7] Rui Pan, Dingjuan Chua, Jaya Shankar Pathmasuntharam, and Yong Ping Xu, Senior Member, "An Opportunistic Relay Protocol with Dynamic Scheduling in Wireless Body Area Sensor Network", IEEE Sensors Journal, 2015
- [8] Aashima Arya and Naveen Bilandi, "A Review: Wireless Body Area Networks for Health Care", International Journal of Innovative Research in Computer and Communication Engineering", Vol. 2, Issue 4, April 2014
- [9] Amit Samanta and Sameresh Rana, "Link-Quality-Aware Resource Allocation With Load Balance in Wireless Body Area Networks", IEEE SYSTEMS JOURNAL, 1932-8184 © 2015 IEEE
- [10] Jayanthi K. Murthy, V. Sambasiva Rao, "Improved Routing Protocol for Health Care Communications", Open Journal of Applied Biosensor, 2013, 2, 51-56
- [11] Samiksha Kumari, Gautam Gupta, "A Review on Applications, Routing and Challenges of Wireless Body Area Networks", INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY, Volume 3, Issue VII, July 2015
- [12] D. Suresh and P. Alli, "An Overview of Research Issues in the Modern Healthcare Monitoring System Design using Wireless Body area Network", American Journal of Applied Sciences 9 (1): 54-59, 2012 ISSN 1546-9239
- [13] Singh, ErSimerpreet, and Narwant Singh Grewal. "Impact of Various Propagation Models on Performance of On-Demand Routing Protocols." (2013).