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Research Article

AN ENERGY EFFICIENT ROUTING ALGORITHM FOR WBAN

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Abstract- The wireless body area network is the decentralized and dynamic type of network in which sensor nodes can be added dynamically. The RPL is the routing protocol which is used to establish path from source to destination. The SEAR protocol is the improved version of RPL routing protocol. In this research paper, problem of link failure is resolved with the parameters of buffer size. The proposed mode is implemented in MATLAB and compared with basic SEAR protocol in terms of certain parameters. It is analyzed that proposed model performs well in terms of energy consumption, packet loss and throughput.

Keywords- RPL, WBAN, SEAR, Link Recovery, Buffer Size

I. INTRODUCTION

WBAN or Wireless Body Area Network is a sort of WSN and has acquired much popularity due to its large potential value. At present, the interest in WBANs is developed rapidly as a real-time and continuous monitoring is facilitated in this network regarding a variety of fields. Specially, it assisted in detecting ad curing the chronic diseases at the initial stage. Wireless Body Area network is referred to a type of ultra-short-range wireless networking technology [1]. There are small sensors which are attached to, rooted in, or implanted around human body and capable to communicate wirelessly among themselves using processors within two meters for the formation of a body-cantered system. The medical information related to the patients is easily gathered through several sensor devices by the means of e-healthcare system based on WBAN. The local or remote medical personnel has employed to access and process the gathered information using the network or fixed infrastructure. As a result, this leads to the early release of patients from hospital as the monitoring of their conditions become possible at home. When the condition of patients is deteriorated, medical personnel gets alert to assist the patient. There are two categories of communication in WBANs. The first is In Body communication that is called the RF communication among the invasive sensor devices which are implanted inside the body of human. The second is the On-Body communication in which communication is performed among the wearable sensor devices.

The technique of WBAN is implemented to human body. Therefore, this network is quite complicated in nature. The designing of routing is imperative for the BAN (Body Area Network), as the physical data gathered by this network affects the life and health of human beings to a large extent. Different researchers have presented various routing protocols for WBAN [2]. In general, there are mainly four categories in which routing protocols can be categorized. A key objective of Routing based on Posture is to make analysis of the network topology of the human body in many dynamic postures so that a quick and constant path can be established. It is highly important to analyze several body positions. It is a proven fact that that all types of human body movements are symmetrical in one or other way. This provision can contribute significantly in the designing of a highly improved WBAN. Under the dynamic atmosphere, the role of movement of limbs is quite important for determining whether network topology is fine or not and generates a shadow effect too [3]. The judgment and processing can be made earlier by predicting the subsequent activity in advance in the existing interval. This phenomenon reduces delay and improves the data transferring rate, fruitfully. A popular example of posture-based routing protocol is mobile processing routing protocol MHRP. Acquisition of heart rate is the main

objective behind the designing of this protocol. This protocol deploys seven nodes on the left as well as right sides of the human body. This represents a group of 2 regular motes. Every group includes a base station, a couple of relay motes and a mutual acquisition mote. A kind of a novel fault-tolerant mechanism consists of 2 symmetrical and autonomous groups of nodes. This design aims to make changes in another group, if the present working group less energy, or the interruption in topology occurs. This is helpful for reducing errors and make the data transmission more reliable [4].Temperature-based routing pays heed to the temperature of nodes as the key metric in the process of path selection. This routing approach keeps the temperature of nodes within limit by quickly reducing the temperature of high-temperature nodes, avoids the nodes with high temperature and creates suitable routes. The TARA protocol is more of the classic protocols in this category. The temperature is considered as the only parameter of selecting path in this technique and the neighbourhood device having a least temperature is chosen for the next hop. The data transmitted to the hotpot is cached that is waited for the target mode to turn cold afterward and its retransmission is performed later on. The data is discarded in case of extending of a certain value during the waiting time. When a hotpot is encountered in the broadcasting, the retreat strategy is implemented for coming back of the original data path for discovering a novel pathway [5]. The back-off strategy is carried out in the protocol which provides the effective performance at that time as well as the ideas for future research. . The Cross-layer routing protocol pays attention to the integration of various protocol layers, and combines the benefits of every protocol stack for improving the network efficiency. This routing approach is highly suitable for dynamic wireless body area networks. Moreover, cooperation amidst several layers can effectively meet dissimilar priority data, deliver modified amenities for every data type, and improves the network performance as a whole with a least latency, lofty consistency and better energy efficiency. A CLDO is well known cross layer routing protocol [6]. This protocol by coordinating layer with other network layers makes improvement in different network metrics includingR_i, energy efficiency χ and network lifetimeT_{life}. The main purpose of this protocol is the discovery of optimal transmission command, the optimal relay and the optimal packet size for resolving several issues. Cluster-based routing is quite popular in wireless sensor networks. The clustering technique is more appropriate for WBAN. The network connectivity, the energy efficiency of the network center is balanced; the dynamic topology structure is adapted and the network is become more robust in the clustering technique in case of maximization of nodes and the relative distance among the devices. The nodes are split into clusters of nodes within the network through the clustering routing protocol. A number of cluster nodes and a CH is included in every cluster. The algorithm elects the CH which is responsible for the incorporation and transmission of information within the cluster so that the overhead is alleviated [7]. The DSCB is a dual sink node routing protocol based on cluster. The dual sink nodes are utilized in this algorithm which is the greatest innovation. A shadow effect is occurred in the limb movement and the transmission disrupted due to the shadow effect requires wait for it to be disappeared prior to continue the transmission that leads to create delay in transmission delay within the actual application of WBAN. The transmission is failed and life endangered in case of disruption in the emergency data period at once. The technique of double sink is capable for enhancing the negative effects of the shadow effect, balancing the network load of a single base station and improving the viability of the Wireless Body Area Network.

II. LITERATURE SURVEY

Jiasong Mu, et.al (2019) intended a SEAR algorithm for Wireless Body Area Networks which was utilized for balancing the energy efficiency of node and mitigating the transmission delay [8]. The residual energy and the current load of a candidate related to next hop destination were taken into consideration in the processes to forward the routing request. The replacement of required information was done under the enhanced routing request and routing request response processes. In this way, cost of routing was modified. The compatibility and robustness was enhanced by establishing the added path as an alternative path in the intended algorithm. The outcomes of simulation represented that greater residual energy and throughput of network was obtained and the reduction in E2ED was observed using the intended simplified energy-balanced alternative-aware routing algorithm. In this way, it assisted in enlarging the network duration in efficient way.

Qiongman Huang, et.al (2019) analyzed that every node in the Wireless Body Area Networks had included diverse functions and specifications and the interference was occurred in the selection of the forwarding node due to these differentiations [9]. A new routing method named LBEE was suggested for computing the cost value in accordance with the current traffic load and residual battery of the node, selecting the high-energy, low-load routes to transmit the data and also balancing the load of the network. The outcomes of simulation demonstrated that the suggested protocol was efficient in enhancing the entire life span of network and sharing the load.

Omar Ahmed, et.al (2020) emphasized on constructing a new EOCC-TARA for which the EMSMO was carried out for WBAN based on SDN [10]. Initially, the effects of temperature were taken in account because of the thermal dissipation of sensor devices and a strategy was designed for the selection of the forwarding the nodes adaptively on the basis of temperature and energy in the presented technique. After that, the congestion avoidance concept was added with the energy-efficiency, link consistency and path loss to model the cost function on the basis of which the optimal routing was obtained from the EMSMO. The outcomes obtained after the simulations proved that the presented algorithm performed better in comparison with the conventional routing algorithms with respect to the various parameters.

Egberto Caballero, et.al (2020) recommended a LATOR protocol to perform the routing in WBAN [11]. The PDR was enhanced in intra-Wireless Body Area Networks communication with node overheating prevention using this protocol. The Castalia framework was employed over the OMNET++ simulator to execute and compute the proposal. It was indicated in the outcomes of experiment that the higher performance in terms of packet delivery rate was attained from the recommended protocol when the low quality was presented in the direct communication and better quality included in an alternative path. Simultaneously, the

overheating was ignored within the network and the maintenance of adequate performance regarding Packet Delivery Rate was observed. Even though, the E2E latency was maximized using the recommended protocol, it was proved a feasible alternative for applications of Wireless Body Area Networks.

Beom-Su Kim, et.al (2018) investigated a novel advanced temperature aware routing algorithm was suggested for allocating the temperature of node [12]. For this purpose, the recent temperature was taken in account and expected rise was occurred due to the packets in the buffer. The packets involved in the buffer were utilized to predict the Temperature rise at which hot temperature node was excluded through two hops ahead algorithm. The packets were further forwarded to the base station using this algorithm. The obtained outcomes of simulation revealed that the suggested technique had potential for maximizing the PDR and duration of the network.

Ashwini Umare, et.al (2018) discussed that the Genetic Heuristics had implemented for the optimization of routing protocol [13]. The LEACH and DEEC were clustering protocols that had utilized for maintaining the energy consumption of the sensor motes. A system was intended for optimizing the routing algorithm in which the GA was carried out so that the energy efficiency was determined. Thus, the network duration was extended. The comparison of the intended algorithm was performed with the LEACH and DEEC. The results obtained in comparison demonstrated that the effective outcomes were provided by the intended algorithm.

Sobia Omer, et.al (2017) proposed a dual channel routing algorithm known as DCHREL for extending the energy consumption, consistency and load balancing of network [14]. In this algorithm, the lexical routing schemes were executed

for selecting the routes in terms of hop count, E2E link quality and path remaining energy in which the priority of these parameters was carried out in descending order. The outcomes of simulation revealed that the presented algorithm was capable for mitigating the energy consumption as well as attaining more uniform energy usage among nodes led to longer life span of network.

III. RESEARCH METHODOLOGY

WBAN is a decentralized and self-constructing network. The RPL is the efficient routing protocol that is used to create route. The RPL protocol is the reactive routing protocol that establishes route from source to destination. In RPL routing protocol, source node floods RREQ packets across the network and nodes nearest to destination respond by sending RREP packets. The path will be establishment based on the hop count and sequence number. Due to random mobility in the sensor nodes chances of link failure in the network is high. DODAG refers to a sort of DAG (Directed Acyclic Graph) rooted at the sink and uses RPL protocol for organizing the routers. The DIO messages are originated periodically by the DODAG root for initiating the formation of DODAG. The created DODAG is publicized by using link-local multicast. Depending on the information advertised by its neighbors within their DIOs, the router connecting the DODAG defines its rank order. This work devises a new approach to establish stable and reliable path from S to D. As a result of mobility of sensor nodes, the link failure may occur which affect network performance. this work also presents a link recovery scheme in DODAG

protocol to improve performance of routing protocol. The link failure in the network affects the network performance in terms of certain parameters. The performance may decrease the network efficiency.

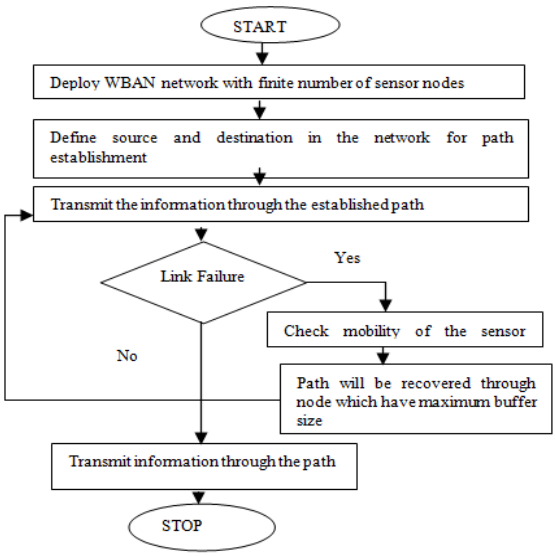

Figure 1: Proposed Flowchart

As shown in figure 3.1, the network is deployed with the finite number of sensor nodes. The source and destination nodes will be defined in the network for the data transmission. Due to high data mobility when the link failure occurred in the network, then the node which has low mobility through that node path will be received to destination.

IV. RESULT AND DISCUSSION

This research work is based on the Link failure of WBAN for the data transmission efficiently in the network. The technique of clock synchronization is implemented in the network to reduce packet loss in the network. The proposed model is implemented in MATLAB by considering simulation parameters given in table 1

Table 1 Simulation Parameters

Parameters	***Values***
Simulator	***MATLAB***
Initial energy	***0.5 joule***
Number of nodes	***200***
Area	***200 * 200 meters***
Channel Access protocol	***MAC***
Antenna type	***Omi-directional***
Medium	***Wireless***

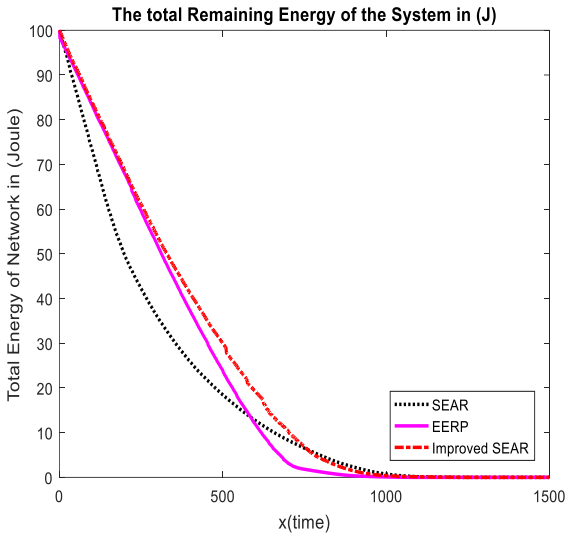

Figure 2: Residual Energy

Figure 2 compares the remaining energy of three protocols which are SEAR, EERP and Improved SEAR. In the improved SEAR protocol, the link is recovered from source to destination which reduce energy consumption of the network.

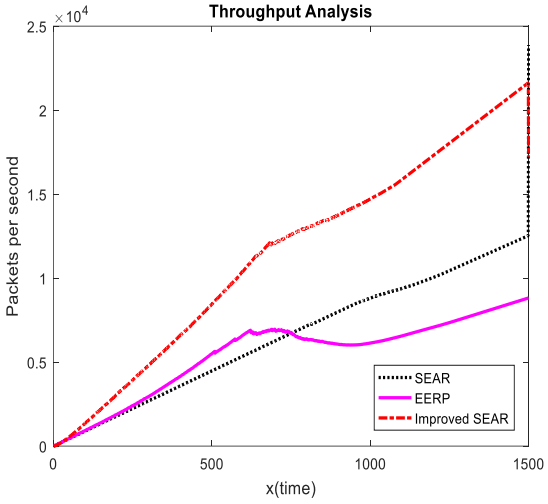

Figure 3: Throughput Analysis

As shown in figure 3, the throughput of the three protocols which is SEAR, EERP and improved SEAR is compared in terms of throughput. The throughput of improved SEAR protocol is high due to link recovery in RPL protocol .

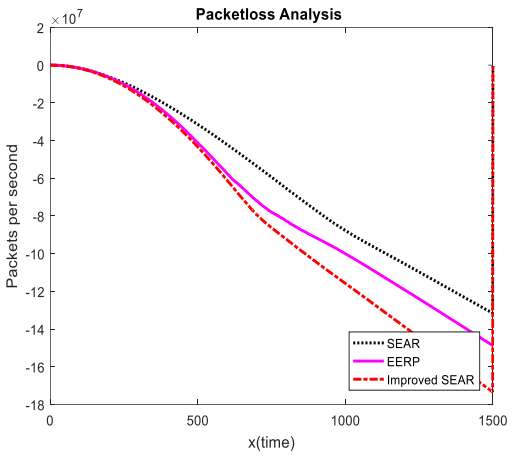

Figure 4: Packet loss Analysis

As shown in figure 4, the packet loss of the three protocols which are SEAR, EERP and improved SEAR is compared in terms of packet loss. The improved SEAR protocol has least packet loss in the network .

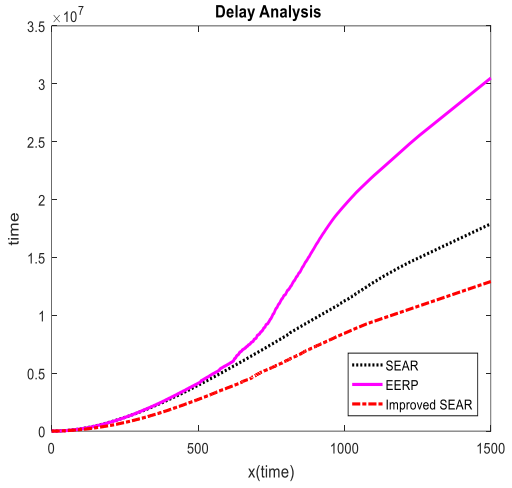

Figure 5: Delay Analysis

As shown in figure 5, the delay of the three protocols which are SEAR, EERP and improved SEAR is compared in terms of delay. The improved SEAR protocol has least delay in the network .

1. CONCLUSION

In this work, it is concluded that wireless body area network is deployed to sense body conditions. The RPL is the routing protocol which is used to establish path from source to destination. The link failure is the problem which occur in the established path which affect network performance. The buffer size-based technique is proposed for the link recovery from source to destination. When the link failure gets occurred in the network, the node which has maximum buffer size will be used for the path recovery. The proposed method gives high performance in terms of throughput, packet loss and delay.

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