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AN ENERGY EFFICIENT APPROACH FOR ROUTING IN WBAN

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Abstract- WBAN is an emerging technology and is a sub-field of the existing WSN technology. It provides real-time health monitoring of patients with the ability to provide feedback to the central controlling head or the administrator. Sensor nodes are placed on the human body to grasp the vital signs like blood pressure, glucose level etc. WBAN is proving economical and can be deployed in remote areas too. This paper presents multi-hop protocol using the cost function which computes the reliability of path on the basis of distance and residual energy; resulting in higher network lifetime. In our proposed model, sink is placed at the waist and two main nodes of glucose and blood pressure are placed near to it so that their minimum energy is consumed. They remain active most of the time to provide highly reliable data signs. Data collisions at the sink are avoided by the TDMA which further saves energy of the nodes. Results showing comparisons between the old model and our proposed model prove significant improvement in network performance. Thus, our network works for longer period of time.

Keywords- WBAN; Multi-hop protocol; Residual Energy; Cost Function; Delay

I. INTRODUCTION

WBAN technology is a sub-emerging field of the existing WSN technology. WSN is a collection of nodes or sensors that are placed on human body at various parts. WBAN can be used in many applications to facilitate the lifestyle of the people such as entertainment, transport system, health monitoring, emergency reliefs and many more. It is an emerging technology that enables wireless sensor nodes to provide real-time health monitoring of patients. In WBAN, wireless sensors are placed on the human body or implanted in the body to monitor vital signs like blood pressure, body temperature, heart rate, glucose level etc. This proves economical and is widely used in hospitals for patients' health monitoring. Patients get better facilities and longer time to be treated, get medicated and taken care of since sensors continuously sense data and forward it to the central controlling head or the administrator. But, various energy constraints are present on these sensor nodes and hence we need to focus on their minimum level of energy and power consumption. The main problem that arises in WBAN is of battery consumption as it is difficult and not feasible to discharge batteries from body parts for charging them from time to

time. Since the nodes have to travel along distance to forward their signal to the central device which is done at the cost of their energy level consumption. These factors have made energy the most critical resource in WBAN.

We propose a high throughput, reliable and stable routing protocol for WBAN. We deploy sensor nodes on the body at fixed places and place sink at waist. Sensors for ECG and Glucose level are placed near the sink. Both these sensors have critical data of patient and required minimum attenuation, high reliability and long life hence, these sensors always transmit their data directly to sink. Other sensors follow their parent node and transmit their data to sink through forwarder node. It saves energy of nodes and network works for longer period.

II. LITERATURE REVIEW

Jocelyne Elias et al. (2012) had proposed Energy-aware Topology Design for Wireless Body Area Network. In this paper author conclude that the model can be used to minimize both the total energy consumption and the network installation cost, while ensuring full coverage of all sensors.

Q. Nadeem et al. (2013) had proposed a stable increased-throughput Multi-hop Protocol used Wireless Body Area Networks. In this paper author propose a cost function based on residual energy of node and its distance from sink. Nodes with less value of cost function choose as parent, and other nodes become child nodes. Two critical nodes placed near to sink, so that their energy not deplete early. The results of author shows an improvement in compare to traditional thermal based routing.

Javed Iqbal Bangas et al. (2014) had proposed Reliability Aware Routing for Intra-Wireless Body Sensor Networks. The author conclude that average energy utilization and regular temperature of RAR are slightly high as compared to TMQoS because RAR selects desired next hop based on path loss and steadiness instead of least hop count policy be in used in TMQoS.

Gill R. Tsouri et al. (2012) had worked on Increasing Network Lifetime in Body Area Networks Using Global Routing with Energy using up Balancing. In paper proposed global routing approach allows WBANs to operate efficiently for longer periods of time before recharging of batteries is required.

Arash Maskooki et al.(2011) have proposed Opportunistic Routing for Body Area Network. Author attempt to increase the battery life of the node in WBAN which can lead to more comfort of the user or even a necessity in some cases e.g. implantable sensors where changing the energy resource is invasive. The author use thermal energy aware protocol which enhance network lifetime.

III. PROPOSED WORK

In paper [3] author presented an opportunistic protocol. In this paper the author deploy sink node at wrist. Whenever sink node is far from node, it uses a hop node to collect data from sensor. In paper [4] the author proposed Multi-hop protocol using cost function for efficient routing. The cost function is based on distance and residual energy, which is not capable of addressing the request when load is higher than residual energy. In our proposed work a cost function is used which computes the reliability of path on basis of factor critical. This also results in enhancing network lifetime and successful delivery of packets. The working of network is as follow:

Initially sink broadcast hello packet to all nodes which contain the position information of the sink. The nodes in form of acknowledgment send ACK packet to sink contain information of node id, energy and distance. These factors help in computing the energy and cost factor.

$$\text{Energy factor } (E_{factor}) = E_r / E_i$$

$$\text{Cost factor} = \text{Distance} / \text{Energy factor}$$

The two main nodes of Glucose and B.P send their packets directly to sink for least energy consumption. The other nodes sent data to sink using best optimal path. To avoid data collision in case two nodes send data at same time to sink, the sink issue TDMA to all nodes. The TDMA also saves energy as nodes status turns to sleep while TDMA has higher value. Using proposed scheme the performance of routing in all terms has been improved.

IV. RESULTS AND DISCUSSIONS

Number of dead nodes- Fig.1 shows the dead nodes and rounds for Old energy aware and Proposed Multi-hop. The Proposed Multi-hop has shown much better results as the usage of energy in proposed Multi-hop is uniformly used which signify that proposed Multi-hop nodes dead around in same range rounds where as in old Multi-hop 3 nodes are dead at 3000 rounds where as proposed Multi-hop there will be no loss at 3000 rounds.

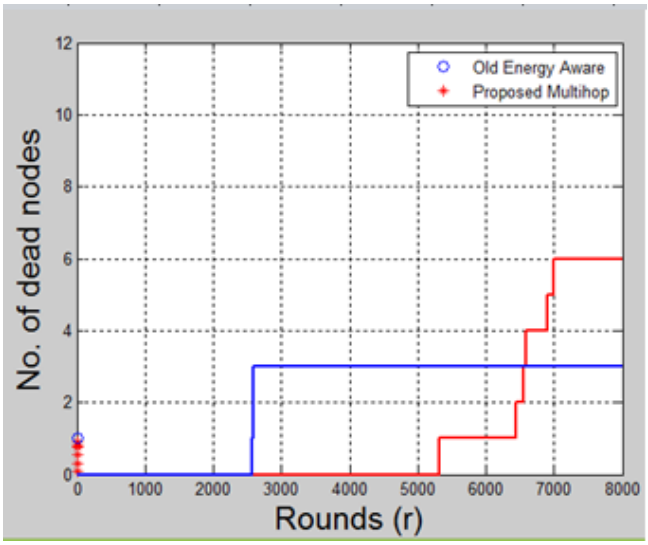

Fig.1 No. of dead nodes

Data sent to Sink: In Fig.2, the data sent to sink has shown for both old energy aware and proposed multihop. It also signify throughput. The proposed Multihop sent lesser data to sink initially as it use energy in uniform manner. Afterward proposed multihop shows great increase than old energy aware because in proposed multi-hop all the nodes are alive but not in energy aware. Proposed multihop achieve high throughput then old energy aware.

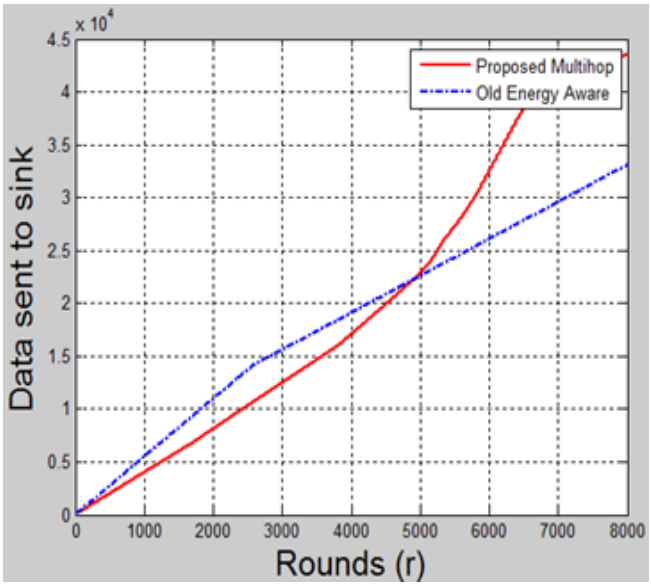

Fig.2 Data sent to sink

Residual energy: In Fig.3, the proposed scheme use energy in fair way, results in residual energy left in nodes is same at all points. It enhance network lifetime, whwere as usage of energy is not optimal in old energy aware.

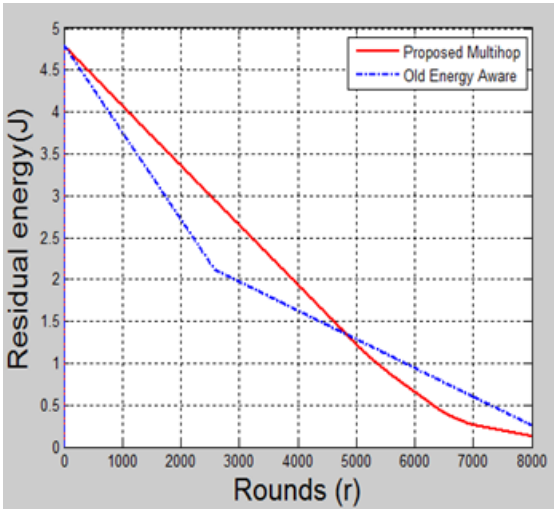

Fig.3 Residual energy

Delay- The delay for both proposed and old energy aware shown in Fig.4, the average delay shown by proposed multihop is much lesser than old multihop. It also signify that throughput of proposed mutihop is better,. The lesser delay justify the efficiency of proposed multihop protocol routing in WBAN.

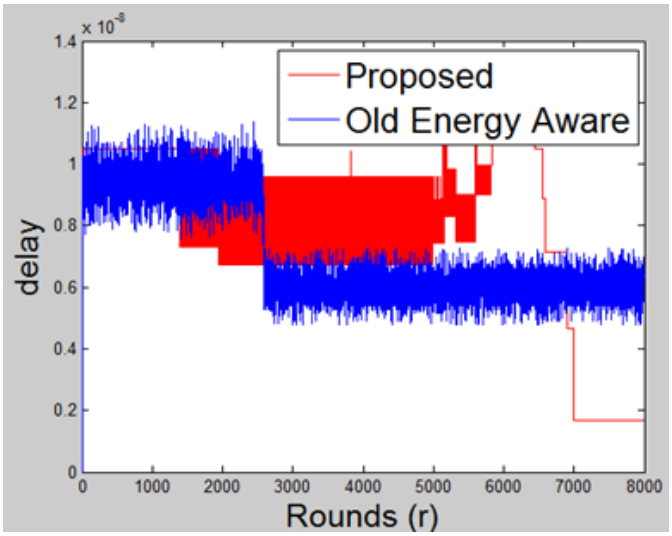

Fig.4 Delay

Path loss or Dropped- In Fig.5, Path loss for old and proposed multihop has shown. The proposed multihop results in less path loss, as it use minimum distance scheme for forwarding. The proposed multihop is better than old multihop in term of path loss. Pathloss shown in Fig 5 is a function of distance and frequency. It is calculated from its distance to sink with a constant frequenct 2.4 ghz. Propoed multihop topolgy reduces the path loss in the Fig 5 due to fact that multihop transmission reduces the distance which leads to minimum path loss. Initially in old multihop at 3000 rounds path loss dramatically decrease because some nodes of old multihop topolgy die minimum number od alive nodes has mimnmum cummulative path loss as our proposed multihop has longer stability period and more alive nodes has more commulative path loss.

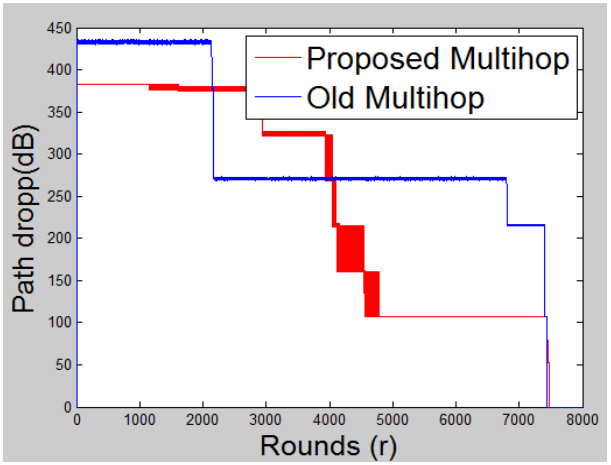

Fig. 5 Path loss or drop

V. CONCLUSION

Wireless body area networks are widely used for patient monitering. The biggest constraint in WBAN is its battery power, which is responsible for the network lifetime. In our proposed approach an attempt has been made to enhance the network performance by optimal use of residual energy and enhancing network lifetime. The work done is carry forward from Multi-hop routing protocol [3], which is and efficient way of routing in wireless body area networks. In our proposed approach a new cost function is proposed which is depending on distance and energy factor. The energy factor computes the critical paths which are not capable of sending requested data. The critical paths are dropped as some request with lower load can be fulfilled using that path. This approach save the energy and make transmission successful too. Using our proposed cost function, there is significant improvement in performance of network which is computed on basis of various factors like dead node, residual energy, data packets sent and received to sink and delay etc.

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