ENERGY EFFICIENT TRANSMISSION PATH FOR WIRELESS BODY AREA NETWORK APPLICATIONS

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Abstract - *Wireless Body Area Network, a wireless network with number of small intelligent devices (Sensors, Actuators, PDA) that are attached in the garments, on the human body or under the skin of the person. Which is capable of transmitting data through the wireless medium and topology of the network is based on the placement of nodes in the human body. The main intention of WBAN is to improve health care and quality of life .Applications of WBAN include human health care monitoring(in hospital/home/other places),sports, home automation(poison/gas detection),consumer electronics(MP3 player, head mounted devices, games).In this paper we design a efficient and reliable transmission path for data flow from source to sink node. Using this technique we have to improve the throughput and lifetime of the nodes in network. Simulations are performed via NS-2 tool.*
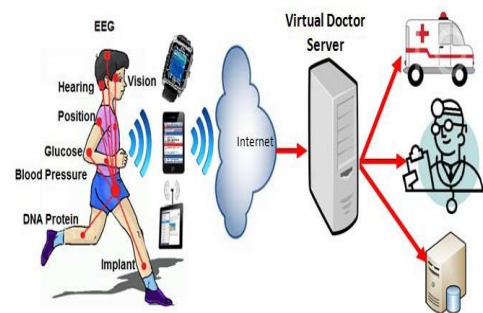
Key words: NS2 tool, WBAN, Energy, Throughput, Cost function

1. INTRODUCTION

Wireless Body Area Network (WBAN) is considering new emerging technology in the recent year. There is no special standard defined for Wireless Sensor Networks or WBANs, but WBAN integrate technology from PAN. The sensors in WBAN include blood pressure sensor, ECG sensor, and temperature sensor.

1.1 ARCHITECTURE OF WBAN

Architecture of WBAN is divided into three tiers. The first tier is called Intra BAN communication and this tier consists of number of sensor /actuator with PDA and range of this communication is2m. The nodes are capable of sensing, processing and transmitting data to its server and gives respond to queries/commands from server.Tier-2 is Inter-BAN communication, which is able to communicate between Tier-1 and Tier-3and this is divided into two kinds of network, either infrastructure based network or Adhoc network. In an infrastructure based network contains centralized management and suitable for hospital environment .Adhoc network is dynamic topology, which extends communication up to 100m.Tier- 3 is application specific and designed for metropolitan areas and which

contains doctors, emergency vehicle, and hospital. The architecture of body area network is shown in figure 1

Figure-1: Architecture of WBAN

2. RELATED WORK

There is numerous survey papers presented based on routing protocols, security, MAC protocols and technologies in WBAN. In [13], authors introduce modified Adhoc on-demand distance vector routing protocol called RelAodv for WBAN. This protocol is used to improve the reliability and Qos of the system. In [14] based on light weight security algorithm and which is called as skipjack. The main motivation of this [14] paper is to provide secure communication between sensor node and mobile node. The proposed system will provide protect against eavesdropping attack. A block cipher (skipjack) support 64 bit block size and 80bit key. Hash function based authentication gives support on both side of the communication (sender, receiver). The authors in [16] present an energy efficient MAC protocol for communication in WBAN. In [15] presents security in WBAN using fingerprint based authentication and which is hard to forge/hack, light weight. In [2] this protocol is based on the hot spot detection and possible of either single hop communication or multihop communication. Priority of data will decide the type of communication. If any hot spot is detected node can able to select the alternate route for data transmission and which reduce the data loss in the network. Sink node use TDMA schedule for communication between sink nodes and root nodes. But

there is no guarantee for selected alternate route consumes less energy for communication. The authors in [3] proposes Multihop communication is used to improve life time of the node and minimize the energy consumption. Which is performed by with help of parent node or relay node and selection of parent is based on the cost function. Cost function is relationship between distance from their sink and residual energy of the node. In [4] this protocol sensor node placement is based on their energy level. This protocol uses both direct and multihop communication based on the data type either emergency data or normal data. In either communication selected route contains minimum delay for transmission. Four phases for data transmission which include initialization, routing, scheduling and data transmission phase. TDMA technique is used to same frequency at different time slots. Advantages of this protocol is maximize the life time and minimize the number of packet has been dropped. Link Aware and Energy Efficient Scheme for Body Area Networks has been proposed by [5].This protocol is used to reduce the effects of path loss and maximize the stability period of the network, so nodes can at long time in the network. But previous methods give less attention to the path loss .Simulations are performed at constant frequency 2.4 GHz. Cost function is used to elect the route for single hop and multihop techniques and path loss is calculated for either of the types. Cooperative Link Aware and Energy Efficient Scheme for Body Area Networks have been implemented by [6].This method uses cooperative transmissions in case relay node failure detection in the network. More effective route is selected for data transmission with help of cost function .During transmission source and relay nodes residual energies are compared and which node contains higher energy that will be elected for transmission. Amplify and Forward [10] techniques are used by relay node before starting communicates with destination and combining methods are reducing the effects of fading. MRC widely used technique for improve the channel quality and which combining methods are performed at the destination of the network. Modified LAEEBA Routing in WBAN has been proposed by [1].This protocol modifies the LAEEBA [5] protocol performance. The important changes is low duty cycle MAC [11] implementation and which provide two types of states for nodes like sleep state, active state. Sink node only active at all time and remaining node presents at sleep state except data transmission period. So energy consumption of node very less compared with all other methods. TDMA schedule is used to share the same frequency at different time slots and guard time is used to avoid the overlapping between slots. So packet delivery ratio is get increased and through put also increased. Distance Aware Relaying Energy-efficient to Monitor Patients in Multi-hop Body Area Sensor Networks [8].The sensor nodes are transmitting data either time driven basis or event driven basis. This method can be implemented in hospital and totally fifty six sensor nodes and eight relay nodes, so give high priority all the nodes. DARE protocol provide high through put and stability period compare with M-ATTEMPT

protocol. But this protocol has high propagation delay. Residual Energy Activated Cooperative transmission to avoid the Energy Hole is proposed by [12].In this protocol uses cooperative transmission with range extension for reducing early death of nodes that are one hop away from the sink. The unused energy of the network is effectively utilized and maximizes the network life time. Node that performs cooperative transmission is called as "cooperators" and is performed after the local transmission. Leader node is responsible for selecting the cooperators.

3. PROPOSED METHOD

In our proposed method, Wireless Body Area network contains number of sensor nodes on human body. Which are able to sending data to the cluster head. Existing protocols in WBAN based on energy, distance, temperature .In this paper selecting route for data transmission is based on energy and distance from source node to sink (cluster head) node.

3.1 Algorithm:

Step 1: System configuration

Step 2: broad casting the HELLO packets

Step 3: collect the neighbor's data

Step 4: Based on this data source select the route from itself to sink (Cluster head).It may be Direct or Multihop route

Step 5: Cluster Head send this data to the Base Station

3.2 Simulation Setup

The simulation setup of our proposed method performed in NS2 (Network Simulator-2).Which is discrete event simulator and codes are written in c++ and Tcl script. NS 2.34 works under Linux or windows using cygwins. Assume that each patients with sensor nodes is considered as in cluster based architecture. Each cluster contains three source nodes, one cluster head (Sink) and common Base station for collecting data from all the cluster head. Figure 2 shows the general structure of WBAN

N1-N8-nodes

CH -Cluster Head (sink)
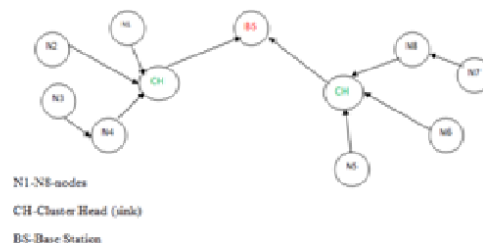
BS-Base Station

Figure-2: Generic structure of Proposed Method

4. SIMULATION RESULTS AND DISCUSSION
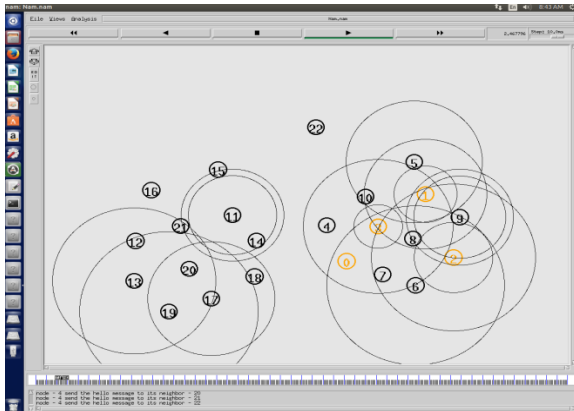
4.1 Identification of Neighbor Node

Figure -3: Each node sends Hello packets to its neighbor nodes

*[22-Base Station and 5, 15-cluster Head]

4.2Throughput

Throughput is defined as the number of successful packets received by sink (destination) during simulation period it requires minimum number of packets dropping to achieves highest throughput. The throughput of proposed method is shown in figure 4
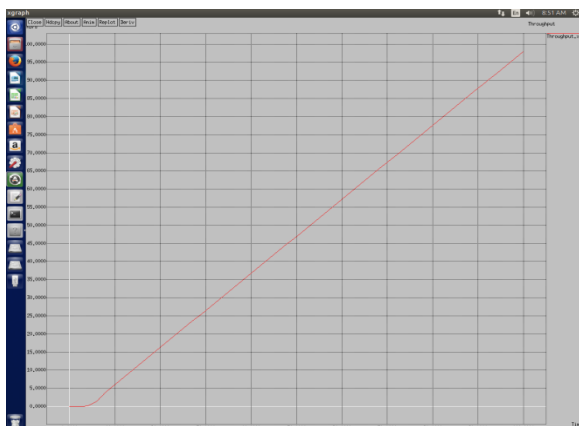

Figure -4: Throughput (bits/sec)

4.3Packet Delivery Ratio (PDR)

It is ratio of number of packets that are successfully received by destination (sink) to the number of packets generated by source. The value of PDR is shown figure 5.
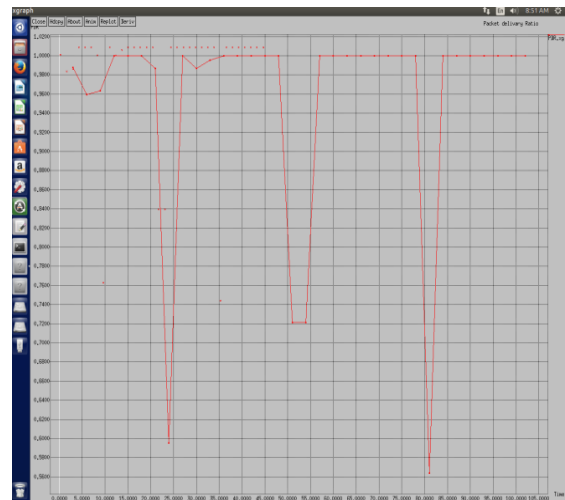

Figure -5: PDR

4.4 Average Energy consumption

It is defined as the total energy consumed by the nodes during operation of the network. The average energy consumption of this proposed method is very less. which is shown in figure 6.
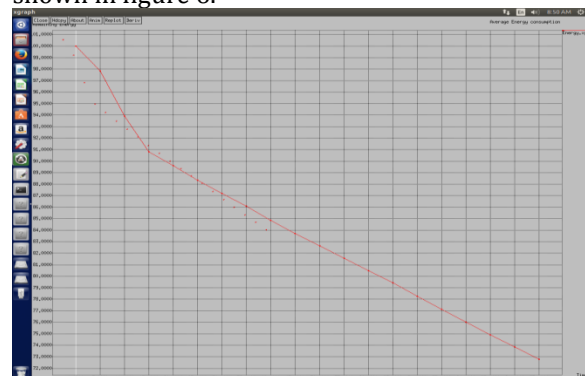

Figure -6: Average energy consumption

5. CONCLUSION

Our proposed method is designed only for two patients with sensor and relay nodes .Each patients with nodes are considered as one cluster. Based on the energy and neighbor list nodes with in cluster transmit the data to cluster head by either direct transmission or using relay nodes. Finally, Cluster head transmit all collected data to access point. This method give high throughput and lower energy consumption, that increases the life time. In our future work the proposed method is extend for 'N' number patients.

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