Reducing End To End Delay Through Adaptive Greedy Search Algorithm For Wireless Body Area Sensor Network

E.Ramya, R. Gobinath

***Abstract*: Wireless Body area network is the most important research topic. It is under developing technology in the field of human health care. Body Area Sensor Network plays an important role to improve human health. In the proposed work implementation of wireless body area network connected through hibernating greedy algorithm is developed. The ultimate aim of the system is to reduce the end to end delay of the data transmission. Mobile network is used here and MATLAB based reconfigurable AI-Greedy Search algorithm is developed here. The proposed work enable the fast data transmission as well as Adaptive (adjustable network path) depends on the connective needs of the system.**

Keywords: Wireless Body area network, AI-Greedy Search Algorithm, MATLAB, End-To-End Delay.

I. INTRODUCTION

In Healthcare monitoring system the reliability of transmission of data with low delay is very important. Various technologies and methods have been used in transmission of medical data to the health care center. In this paper we used the Adaptive Iterative –Greedy Search algorithm to reduce the End-to-End Delay of data transmission.

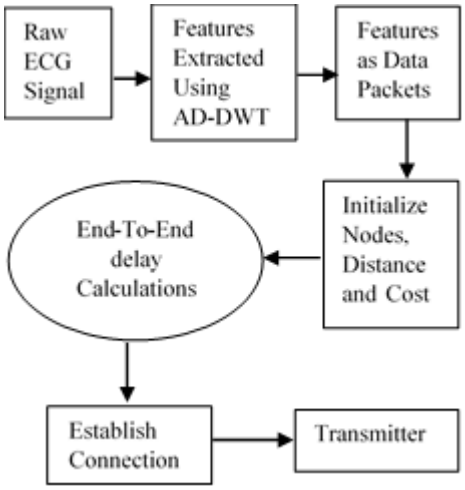

Figure1: Represents Proposed Operation Flow Diagram

1A. Transmission Delay

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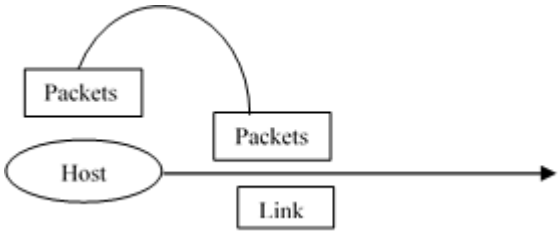

Figure2: Represents Transmission Delay Diagram.

Transmission delay is to transmit a packet on to the outgoing link is called transmission delay. The time taken to transmit the data packet from the host on to the outgoing link is called Tt. Time taken by the host to put the data packet on to the link is called Tt.

Finding out the transmission delay.

If the Bandwidth is 1 bps. Therefore every second one bit is put on to the link. If the data size is 10 bits.

Bandwidth = 1bps
Data = 10 bits.

So the transmission delay is if the size of the data packet is L bits and the bandwidth is B bps then the time taken to transmit the data L bits is

$$T_d = (L/B) \text{ sec.}$$

Transmission delay depends on two things

1. If the length of the packet is too big obviously transmission delay is too big or too high.
2. If the bandwidth is high the transmission is less or low.

If L = 1000 bits B = 1 Kbps.

Then Tt = L/B = 1000/1000 = 1 sec.

Data can be expressed in the terms of powers of 2 and the bandwidth is expressed in the terms of powers of 10

1B. Propagation Delay (Tp)

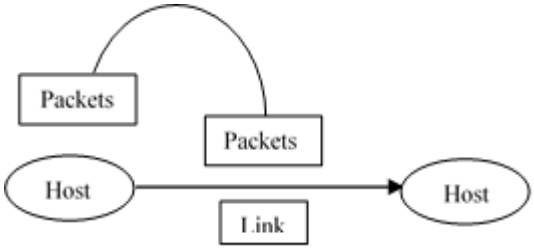

Figure3: Represents Propagation Delay Diagram.

Propagation Delay (Tp) is

1. **Distance:** If the distance of the link is too much obviously the propagation delay is going to be very high.
2. **Velocity:** If the speed of the signal is very high then it could reach the other end fast.

Therefore Propagation delay is

Tp = d/v

Most of the fibers now are optical fibers instead of optical fibres. If distance is 2.1 km and velocity is 2.1 X 10^8 m/s

Tp = d/v = 2.1 X 10^3 / 2.1 X 10^8 = 10^{-5} sec.

1C. Queuing Delay (Tq)

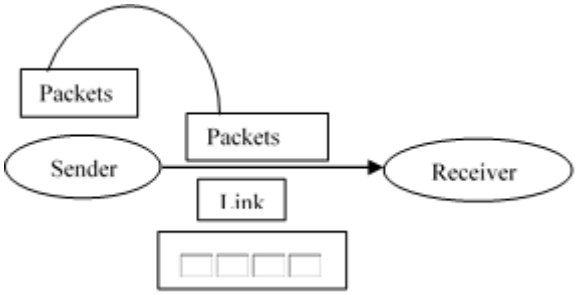

Figure4: Represents Queuing Delay Diagram.

Amount of time the packets waiting in the queue before being taken up for processing is known as Queuing delay (Tq). Once the packet is received by the destination the packet will not be processed by the destination immediately. The reason is the packet is going to go and sit in something called queue so there will be a buffer in which all the packets that had sent to the destination are going to go and sit and whenever the receiver has time the processing time then it is going to take the packets one by one from the queue so the amount of time any packet sit in the buffer and wait before being processed is called queuing delay.

For transmission delay and propagation delay we have the foremost evaluative but then in order to find out the queuing delay there is no formula so in general there is no calculations for queuing delay.

ID. Processing Delay ($T_{process}$)

The packet will be taken by the receiver and then it will be processed that is called processing delay and again processing delay also does not have any formula that depends on the speed of the processor so therefore queuing delay and processing delay both of them depend on the speed of the Processor that the receiver is having if the speed of the processor is very high then the queuing delay will be less and even processing will be less.

II. LITERATURE REVIEW

Philipp Hurni et al, (2008) research work focused on 16 used cross-layer optimizations between routing protocols and routing MAC and achieved higher network lifetime. The proposed work shows the performance obtained of 10-15% in respect to average end-to-end delay and throughput. However the efficiency of the system is low. Routing protocols in were mostly considered to find a single route from a source network to the destination network. During the route finding process, the protocols are focused on finding the finest route with the lowest cost. Multi-path routing protocols focused on finding more than one routes. Finding and maintaining several paths are causing definite overhead, and also gives more advantages, namely fault tolerance, load balancing, reduced delay and bandwidth aggregation.

Wenjuan Liu et al, (2012) research work focused on delay performance on Wireless sensor network. They proposed the delay performance and packet drop with the cluster tree topology. End to end delay in the sensor network was dependent on similar locations between the sensor and the sink. A model of analytical method was developed for finding the end-to-end delay of packet which comes from different clusters.

Huasong Cao et al, (2010) research work focused on Average Queuing Delay, Throughput, and Energy consumption. They focused on quality of service with the framework for body area sensor network by employing the 802.15.4 super-frame structure in beacon mode. Admission controller algorithm and superframe scheduler were used for effective time constraint performance [4].

Kim, Joohwan, et al, (2009) research work focused on reducing the delay and increasing the lifetime of the event-driven sensor network. Sleep-wake scheduling protocol is used for prolong the energy constrained in wireless sensor network [5].

II. PROPOSED METHODOLOGY

III A. Proposed Adaptive Greedy Algorithm

Self-organizing routing is the key concept enable us to implement the new approach on adaptive greedy algorithm which alters the routing maps according to the delay status of the each node. A Normal greedy approach uses a best possible node and establish the connectivity using those nodes. Adaptive greedy approach recalculates the delay and organize the route accordingly. Adaptive greedy search is a new approach on modifying the existing greedy model with recalculated delay and mapping constraints.

The nodes are randomly distributed in the network model. Each nodes in the network was assigned to the random distance and cost. Each parameters of cost and distance were stored simultaneously in the temporary register. Adaptive greedy search algorithm measures the distance at every iterations and rearrange the network accordingly.

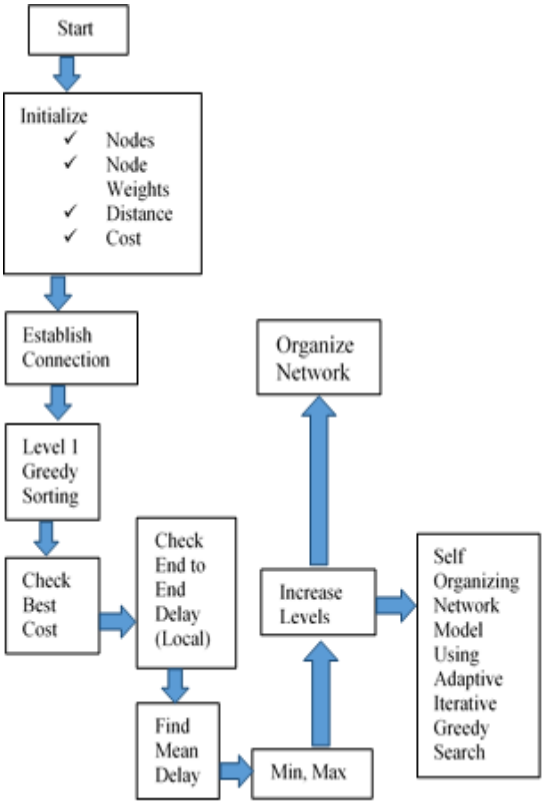

Figure5: The Flow diagram of Reducing End-to-End Delay using AI-Greedy Search

III b. Functions

Node Creation

This module consists of creation of random nodes in which the network model is created by random distribution. Each node is assigned with specific (Random) Cost and distance depends upon the iterative loops. The number of times the loop has to run iteratively will be assigned in a Loop index.

Distance Measure

Each node are assigned with random distance and each distance parameters are simultaneously stored in the temporary register. ADAPTIVE GREEDY model measure the distance at every iterations and rearrange the network model accordingly.

Vertex Finding

The vertex finding is another important step in the AG Algorithm, path from vertex v to vertex j for example v and j are adjacent vertices, it should be found.

Cost finding

Cost matrix is created by allocating the cost values in of all the selective path and store in a matrix in the form [1: n, 1: n];

Adaptive Model

AG Algorithm is created in an adaptive model since the network rearrange its connectivity depends on the algorithm score provided at every iterations of the search process

Validation & Checking

The distance updates are done at every iterations of the loop. The score provided every iteration of the search process is indexed in the separate loop [x]. The validation process if the final step in which the end to end delay is found out to be less comparing with the average values stored in the LUTs.

Total Number of cluster Heads=Number of Nodes N * Probability

Total number of member nodes = (N-CH)/CH

Residual Energy = (Initial Energy – Consumed Energy) * Time Delay

End to End delay or one way packet delay is nothing but time taken for the encapsulate packet to reach the destination from source

$$\text{Delay}_{(\text{End-End})} = N\,(D_{\text{Trans}} + D_{\text{Prob}} + D_{\text{Process}} + D_{\text{queue}})$$

N = Number of Links

D_{Trans} = transmission Delay

D_{Prob} = Propagation Delay

D_{Process} = Processing Delay

D_{queue} = Queuing Delay

II C. Adaptive Iterative Greedy Search Algorithm

Greedy algorithm is normally familiar for shortest path finding, dijikshtra's model, Huffman, fitting problems etc. The adaptive greedy algorithm is framed here to find out the efficient path to reduce the end to end delay of the network model under test. The following are the important steps sequenced by the AI-Greedy Algorithm.

PSEUDO CODE FOR AI-GREEDY ALGORITHM

```
Start @ Loop = 1 : Number_of_iterations
{
set Greedy(set Candidate) {
   Solution = new Set();
While(Candidate.isNotEmpty()) {
       Next = Candidate.select();
// returns value by removing from candidate
If(solution.isFeasible(next))        //     constraints
satisfied
    Solution.union(next);
If(solution.solves())
      return solution  }
//No candidates and no solution
Return null
}
If(Best_Route=Less_End_to_End_Delay)
{
 Stamp Best_route
Stamp Total_Cost
Stamp Distance
Else
 Continue
  Return null
}
```

IV. RESULTS AND DISCUSSIONS

Base network of X axis is randomly distributed network nodes and the Y axis is randomly distributed network nodes. Base network establishes the wireless network in particular coverage. Node connectivity starts from source node to destination node. Each network selects its own cluster head.

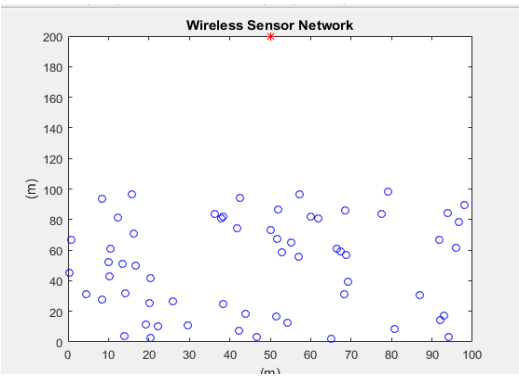

Figure6a: Randomly distributed network nodes

Distance to zero plot was the center or median is selected in any network space the distance of each node from the zero position is plotted here. Distanced to previous node was the next level of network forming is connecting the nodes using basic distance based selection.

In this stage, through greedy selection rule, the first level of sorting is done.

AI - greedy search

Here the adaptive iterative greedy search does a flexible sorting process in which the distance sorted network is retreated to N number of iterations which is adaptive since the network tunes its position based on previous selection.

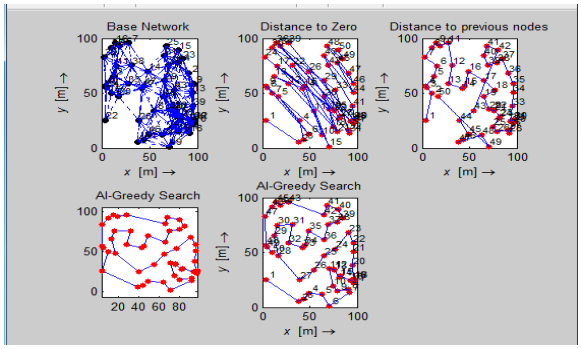

Figure6b: AI-Greedy Search

Hence at every iteration there is an adaptive greedy sorted network is formed. Which is finally shown in the plot.

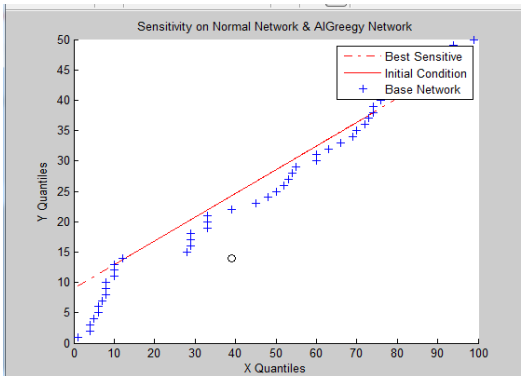

Figure6c: Sensitivity Graph on Normal and AI-Greedy Network

Network Deployment	Random Nodes	Average Distance	Average Cost	Mean Delay
1	100	2118	607.365	62.776
2	100	2215	608.4516	61.235
3	100	2210	609.5312	62.1044
4	100	1942	610.5614	62.2164
5	100	2230	614.1221	64.7199
6	100	2290	609.5292	61.2213
7	100	2350	608.7128	64.2321
8	100	2089	606.8977	63.0526

Table1: Resultant table of AI-Greedy Search

The sensitivity of the network determines when the accountable change happen in the network based on delay. The sensitivity is relative at particular points which have a correlated nodes shown in the plot coincide with each other.

V. CONCLUSION

This paper proposed a solution algorithm for reducing End to end delay in wireless body area sensor network.AI-Greedy search

does a flexible sorting process. This measures the distance at every iterations and rearrange the network model accordingly. In future work of research can be used in Military Warfare Environments, Space Technology and also in Aviation communication.

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