A Modified Approach for Energy Efficient Routing and for Maximizing Network Lifetime of WSN

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ABSTRACT

The design of an energy-efficient wireless sensor network protocol is one of the major issues in wireless sensor networks (WSN). In this paper, the modified approach for the routing makes the better utilization of the heterogenous environment and provide network a better life time and better energy efficiency. As a result the simulation results show the increase in the network life time and efficiency of the network.

KEYWORDS: *energy efficient; WSN; Minimiztion transmission energy; Otimal number of cluster heads; network lifetime*

I. INTRODUCTION

Wireless sensor networks (WSNs) are a widely used technology in particular for monitoring various environments. WSNs are composed of small wireless devices (sensors) connected to transducers. In general, WSNs are dedicated for monitoring physical environment and collecting data from it. They are used in various domains [1], [2] as ground monitoring, patient monitoring, animal monitoring, Thus, many works deal with WSNs where various interesting challenges and research issues have been tackled. WSNs were previously only dedicated to catch data from an environment and to transmit them to a sink or base station. For this reason, many researches focus on new methods to transmit data efficiently in order to reduce the energy consumption [2], [3] or to guarantee messages arrival [4], [5].

The main purpose of energy efficient algorithm is to maximize the network lifetime. These algorithms are modified and adjusted according to requirement of the modified approaches. Energy efficient algorithms can be based on the two metrics: i) Minimizing total transmission energy ii) maximizing network lifetime. The first metric focuses on the number of nodes responsible for communication of data to the base station. Second metric focuses on the residual batter energy level of entire network or individual battery energy of a node [1].

II. RELATED WORK

In [8] Jia Xu et al: - With the help of this paper the authors tries to improve the energy consumption problem by proposing a protocol known as E-LEACH (Enhanced Leach). E-Leach protocol is based on the election mechanism of cluster heads; the number of cluster heads elected per round plays an important role in consumption of energy by the nodes. If the cluster head elected are less in the number , each cluster head has to cover more area which effects the life time if node, and if the number of cluster heads elected per round is large total energy consumed by the network will be increased. So the protocol provides a mechanism which helps to elect a proper number of cluster heads which is neither less. To elect the cluster head spanning tree is generated among the nodes and the node having maximum residual energy at the root position is elected as cluster head. New spanning tree is generated for each round. The round time is initialized at the beginning of the round. Metrics is formed on the bases of rounds when first node dies, half nodes dies and all nodes die.

[19] Bhaskar Krishnamchari et al: - The authors with the help of his paper review the impacts of data aggregation on WSN. Although data aggregation is very important in WSN communication in order to eliminate the redundancy, so that the number of transmissions to the BS will minimum. Some nodes in WSN work as aggregator nodes which only performs the task of aggregation. With reduced number of transmissions energy of the network can be saved, despite of saving the energy, aggregation also has some drawbacks. The tradeoff between prose and cones of aggregation are studied under this review. Aggregation adds some computational complexity to WSN which consumes energy. Delay in packet transmission is occurred because of time spent in aggregation. To overcome these drawbacks related to aggregation, different aggregation models are designed like ER model, RS model etc. Scope of paper includes the formation of optimal aggregation mechanisms.

III. PROPOSED ALGORITHM

A. *Problem Description*

The problem addressed in this proposal is to modify and develop a routing protocol that has as many of the advantages and a few of the disadvantages of the current protocols and to implement these changes into a single protocol. Most protocols written for a WSN only allow for fixed sensors, but a WSN would most likely contain a limited number, if not consist only of mobile nodes. If a sensor is mobile, attached to a person for instance, the static network would be constantly trying to reorganize the network routing structure. Thus further investigation should be conducted to allow for a more flexible routing protocol that can adapt mobility into its environment as effectively as possible.
Wireless sensor nodes themselves are often only provided with a limited power supply. Making efficient use of this available power supply requires all the layers of the device to work in harmony to maximize the lifetime of the node, which in turn increases the lifetime of the network as a whole.

B. *Design Considerations:*

- Initial battery energy (IBE) is 50Jules for normal node.
- Nodes are divided into three types viz. normal, intermediate and advance.
- Keeping track of selection probabilities.
- Considered all possible nodes at beginning.
- Receiving, transmission, data aggregation and data forwarding energies are considered.

C. *Description of the Work:*

- Examine the current state of WSNs and the possible future that they may provide. Any applications that a WSN may be deployed in will be identified as well as their generic requirements. Once these requirements have been determined they should be investigated as to what effect they will have on the protocol and the WSN.
- Investigate the multitude of routing protocols that are available.
- Identify advantages and disadvantages of the various routing architectures being employed.
- Examine currently available simulators for WSNs.
- Investigate the credibility of research to date.

IV. PSEUDO CODE

In the WSN, there will be only one sink(Destination) called the base station. Each node transmits the collected sensed data to base station. Data aggregation energy is sufficient to provide the needed energy for required computation. By these assumptions the proposed algorithm steps are:
Step 1) Total no. of nodes present in the network is decided.
Step 2) Different energy consumptions involved in transmission, reception, forwarding, amplification, aggregation are taken according to the energy consumed in the standard hardware taken for these purpose.
Step 3) The total energy for a normal node is taken as 0.5 Joule.
Step 4) Initially all nodes are supplied with energy according to there type.
Step 5) At the creation of nodes, initially it is taken as normal node then on the basis of there probability of selection they are treated as normal, intermediate and advanced.
Step 6) All parameters are initialized to zero.
Step 7) For each node i=0 to n, its probability of selection as cluster head is compared with the selected probability.
Step 8) If the above condition is satisfied, the node is considered as cluster head.
Step 9) The cluster heads take part in the direct communication with the base station.
Step 10) Other nodes surrounding these cluster heads are considered under these for communication.
Step 11) According to distance the energy consumption for the cluster heads is calculated e.g. whether to forward data or forward it with amplification.
Step 12) Remaining energy for these nodes are calculated.
Step 13) Once the process of communication is completed, the process from step 7 is repeated until the nodes are having energy greater than zero.
Step 14) Once all nodes dies, i.e. energy for them becomes zero the network communication paterns also minimizes to zero.
Step 15) On the basis of these stored values of parameters for each round the analysis is done.Generate all the possible routes.

V. SIMULATION RESULTS

Packets to Cluster Head per Round :
Each non cluster head node sends its result to the cluster head to which it is associated, result is send in the form of tiny packets. The comparison of packets transmitted to cluster head per round is done with the help of graph given below

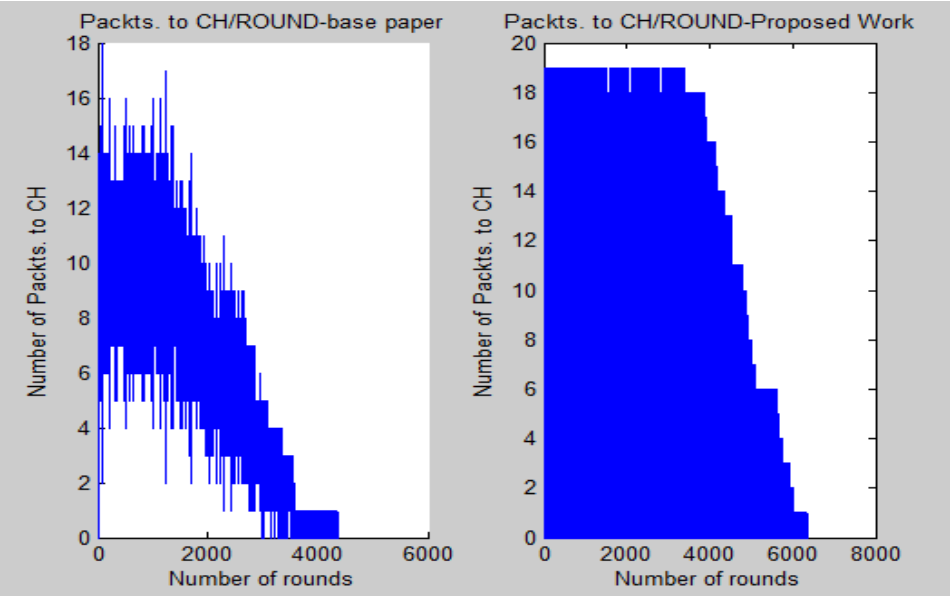

Fig 1 Packets to cluster heads

Packets Send to Base Station per Round :

After all non cluster head nodes have send their data to the cluster head nodes; each cluster head node aggregates the data to remove the redundancy and forwards this data to the BS. A protocol should transmit maximum number of packets to BS before energy of all nodes goes below the given

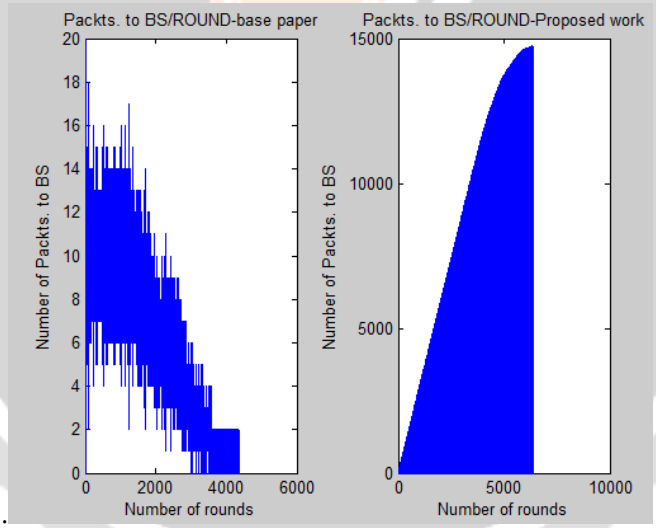

Fig2 : Packets sent to base station

Number of Dead Nodes per Round :

When the nodes begin to transmit they start to consume their energy and their energy goes down after every transmission, and when the energy of node goes below the threshold value node is declared as a dead node. The time from beginning of transmission to first node dies is the stability period of the network and time when all nodes have died describes the overall life time of the network.

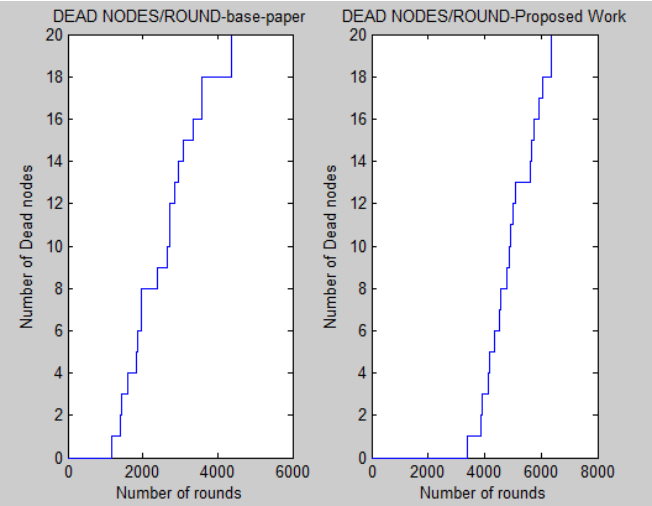

Fig 3 : Number of dead nodes

Number of Cluster Heads Elected per Round :

The process of cluster head election is randomized for each protocol. When the new round begins new cluster heads are elected. Advance nodes are more likely to be the cluster heads. The variation of election of cluster head for each protocol per round is shown with the help of graph .

Cluster heads are elected randomly as in the traditional Leach protocol. Advance nodes are more likely to be the cluster heads. New cluster heads are elected for each round, the number of cluster heads elected should be balanced neither more nor less, because a large amount of energy is consumed in transmission of packets to base station. If number of cluster heads is large more energy will be consumed.

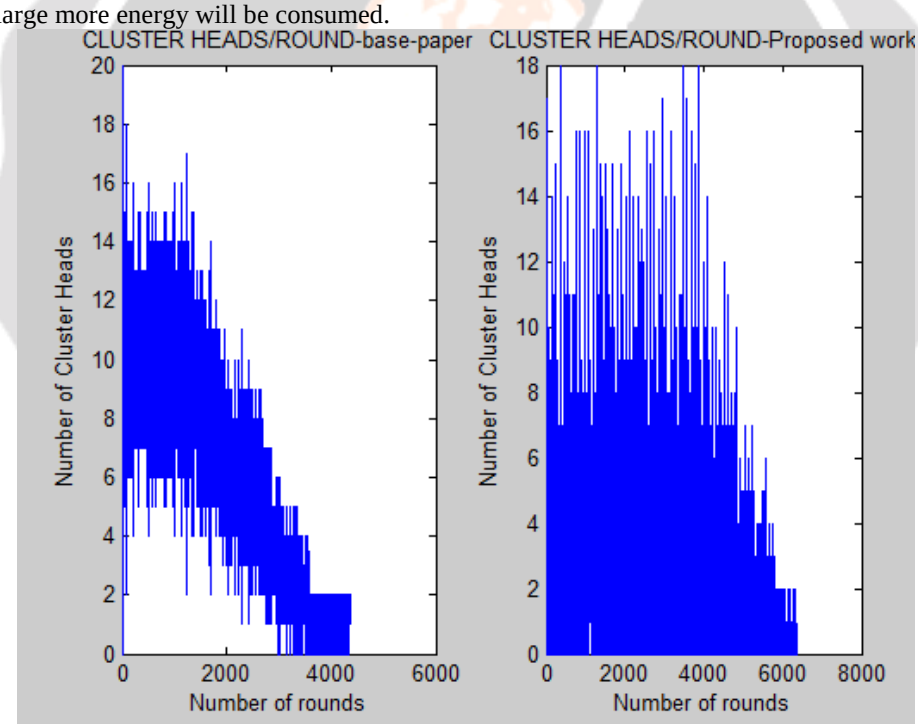

Fig 4 : Number of Cluster heads

VI. CONCLUSION AND FUTURE WORK

The Simulation results are studied and analysed and provides us the information about the performance comparisons of the proposed protocol with the base paper protocol. During the simulation firstly the number of nodes are not fixed, i.e. simulation can be done in the limits provided by the Matlab programming for the no. of elements in an array. For lower no. of nodes the partitions cannot be obtained because, in these cases the Matlab generates an error. The scenario replicates the communication pattern of actual wireless sensor network. The authentication check step is done at the time of selection of cluster heads; if the node has the desired key only then it is allowed to be a cluster head. Only cluster heads take the data to the base station which saves the energy of other nodes. At a time, multiple nodes communicate through multiple paths. The energies confirm the hardware standards set for the wireless sensors which helps to have the nearly same results of simulations as that of hardware. Due to random election each node goes through the selection process. No fix area or number of cluster heads. Network life is increased up to desired levels.

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