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Improved Transmission in WSN Using a New Vice-Cluster Head Selection Approach in V-Leach Protocol

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Abstract

Wireless sensor network incorporate hundreds or thousands of small compact devices, called sensor nodes, equipped with sensors (e.g. acoustic, seismic or image), which are installed in a particular region to check certain conditions in the environment surrounding them. The sensor nodes collect the required information and then transform the collected data into electric signals which can be processed to give knowledge of some characteristics about the phenomena occurring in a particular region. Data Packet Transmission to the base station is one of the major concerned topic in a Wireless Sensor network. In this work, an enhancement in existing V-Leach protocol is done by introducing a new approach for Vice-Cluster Head selection using some energy and distance parameters. And hence, an improvement in the transmission of packets of data to the base station is noticed.

Keyword: *Wireless Sensor Network, Packet Transmission, Base Station, V-Leach, Vice-Cluster Head.*

I. INTRODUCTION

A wireless sensor network is composed by hundreds or thousands of small compact devices, called sensor nodes, equipped with sensors (e.g. acoustic, seismic or image), that are densely deployed in a large geographical area. These sensors measure ambient conditions in the environment surrounding them and then transform these data into electric signals which can be processed to reveal some characteristics about phenomena located in the area around these sensors. Therefore, can get the information about the area which is far away . The applications may be environment control such as office building, robot control and guidance in automatic manufacturing environments, interactive toys, high security smart homes, and identification and personalization [11]. Wireless sensor networks (WSNs) are the products which integrate sensor techniques, embedded techniques, and distributed information processing and communication techniques. The appearance of the wireless sensor network is a revolution in information sensing and detection. Although there have been significant improvements in processor design and computing, advances in battery technology still lag behind, making energy resource considerations the fundamental challenge in wireless sensor networks. Consequently, there have been active research efforts on performance limits of wireless sensor networks. These performance limits include, among others, network capacity and network lifetime. Network capacity typically refers to the maximum amount of bit volume that can be successfully delivered to the base station ("sink node") by all the nodes in the network, while network lifetime refers to the maximum time limit that nodes in the network remain alive until one or more nodes drain up their energy. In this dissertation consider an overarching problem that encompasses both performance metrics. In particular, study the network capacity problem under a given network lifetime requirement. Specifically, for a wireless sensor network where each node is provisioned with an initial energy, if all nodes are required to live up to a certain lifetime criterion, what is the maximum amount of bit volume that can be generated by the entire network? At first glance, it appears desirable to maximize the sum of rates from all the nodes in the network, subject to the condition that each node can meet the network lifetime requirement. Mathematically, this problem can be formulated as a linear programming (LP) problem within which the objective function is defined as the sum of rates over all the nodes in the network and the constraints are: 1) flow balance is preserved at each node, and 2) the energy constraint at each node is met for the given network lifetime requirement. However, the solution to this problem shows that although the network capacity (i.e., the

sum of bit rates over all nodes) is maximized, there exists a severe bias in rate allocation among the nodes. In particular, those nodes that consume the least amount of power on their data path toward the base station are allocated with much more bit rates than other nodes in the network. Consequently, the data collection behavior for the entire network only favors certain nodes that have this property, while other nodes will be unfavourably penalized with much smaller bit rates.

After reading out number of research papers I have concluded that WSN always suffer from the problem of energy loss and the life time of the network. Such kind of network always requires power for efficient utilization of energy of a battery operated devices, and routing optimization for energy efficiency is a good area for research work. We intend to optimize energy usage of battery operated devices and increase the lifetime of network in wireless sensor network. From this survey we have concluded some points as

The most common problems in Sensor Network is Network Life. Either the network is clustered of not, each node release some amount of energy with each transmission.

The energy reduction results the short network life. Lot of work is done in this direction respective to different protocols.

In a clustered network, the cluster selection is one of the major WSN protocol. In this literature we studied different approaches of cluster head selection based on distance, energy and other parameters.

The another problem we studied is the localization of nodes. The node placement in different order or based on different topology also affect the network life.

These papers shows that a network always need the improvement in QOS in WSN. Lot of work is done in this direction respective to protocol modification etc.

II. LEACH Protocol

The LEACH protocol is one of such clustered architecture [5] based protocol that works in a hierarchical manner. LEACH provides a significant reduction of overall energy consumption over other non clustering protocols. The major benefits of the clustering architecture include the (i) Low power consumption [4] over the network (ii) Improved fault Tolerance (iii) Reduction of Congestion.

In a clustered network [6][7] the main challenge is about the selection of Cluster Head. The cluster head should be selected such that it will reduce the communication over network. Because of this the network load as well as the energy consumption over the network will be reduced. LEACH protocol itself resolves this problem up to some extent. But still there are some limitations that it contains. To resolve these problems, modifications are already done in LEACH protocol and number of other improved LEACH protocols are present like M-LEACH, V-LEACH and many more.

III. Cluster Formation

The set-up phase begins with cluster formation. Suppose there are N nodes in the network, in order to ensure certain number of cluster is formed during each round, each sensor elects itself at the beginning of the round with a probability Pi (t) chosen such that the expected number of cluster head nodes for this round is k_c, the choice of probability is based on the assumption that every node has the same level of energy at the beginning of the network and also each node has data to send in each round. To complete the set-up phase, each node sends a join-request message after they receive a broadcast from the elected cluster-heads using a non-persistent CSMA MAC protocol. The cluster-head creates a TDMA as shown in the LEACH flow chart and finally the nodes forming each cluster wait for their schedule before transmission. The steady phase starts immediately after the set-up phase. The cluster-heads gather all data from their respective cluster members. The cluster-heads performs data aggregation using signal processing techniques before sending the refined data to the BS in each round. The idea of the TDMA schedule ensures the efficient use of the bandwidth and the data aggregation process reduces communication cost and energy, thus, improving the network life-time. The sections that follow discuss variants to LEACH protocol that were proposed as an improvement by extending the network life-time. Most of these schemes are more of energy management techniques rather than cost-based models.ALGORITHM

ImprovedVLeach(N)

/* N is Numer of Nodes in the Network*/

{

1. Define Each Node with Respective Energy Parameters. Intially Each Node is Normal Node
2. For r=1 to Number of Rounds
   [Repeat Steps 3 to 7]
3. if r=1
   {

   Work Same as Basic Leach Protocol

   }
4. For i=1 to N
   [Repeat Step 5 to 7]
5. if ProbabilityVector(Node(i))=True and Energy(Node(i))> 0
   {

   Set Node (i)=> ClusterHead

   Node(i).Type='C'

   Find Minimum Distance and Maximum Energy Node Near to Node (i) called Node (j)

   Set Node(j)=>ViceClusterHead

   }
6. if(Energy(Node(i))<=0 and Type(Node(i))=ClusterHead
   {

   Find ViceClusterHead of Node(i) called j

   Set Type(Node(j))=ClusterHead

   Find Minimum Distance and Maximum Energy Node Near to Node (i) called Node (j)

   Set Node(j)=>ViceClusterHead

   }
7. Calcuate the Network Statistics in Terms of DataTransmission, ListofDeadNodes,ListofAliveNodes
8. Exit

}

IV. Results

This section is devoted to the representation of the experimental results. All of the results refer to the simulations. The experimental results show that the modification in V-LEACH protocol, decreases the number of dead nodes and increases the number of alive nodes. The experimental results show that the lifetime of the network gets improved because of the dynamic clustering and increased packet transmission rate.

Parameters, which have been used for simulation process are as follows:

n= 100

P= 0.1;

Eo= 0.5;

ETX= 50*0.000000001;

ERX= 50*0.000000001;

Efs= 10*0.000000000001;

Emp= 0.0013*0.000000000001;

EDA= 5*0.000000001;

EDA= 5*0.000000001;

a= 1;

rmax= 5000;

do= sqrt(Efs/Emp);

This section presents the results of existing work along with the proposed work.

The section provides the results of the existing work.

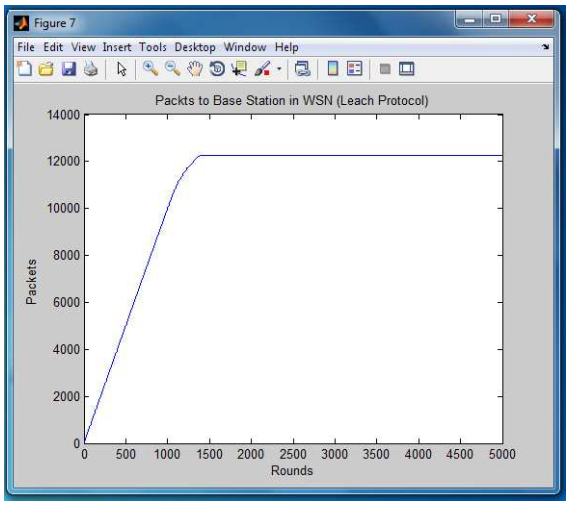

Figure 1: Packets Transmitted to the Base Station (Existing Work)

In Figure 1 we can see after the simulation that the number of packets transmitted to the base station, is approximately 12015.

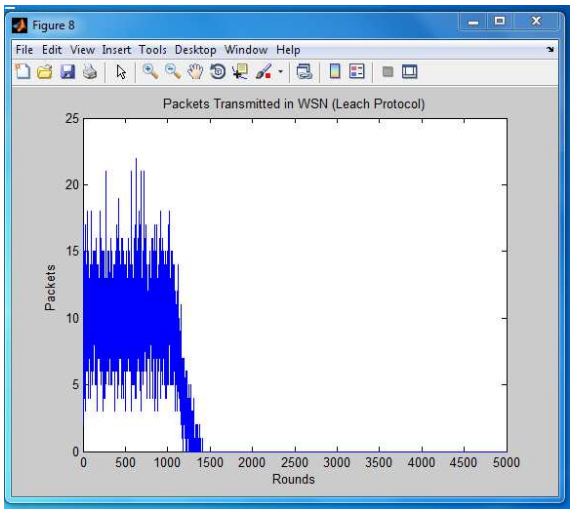

Figure 2: Packets Transmitted in WSN (Existing Work)

In Figure 2, we can see after the simulation that after 1408 number of rounds of communication network loses its connectivity.

After the simulations, the following results were gathered. Based upon these results, a detailed analysis is presented.

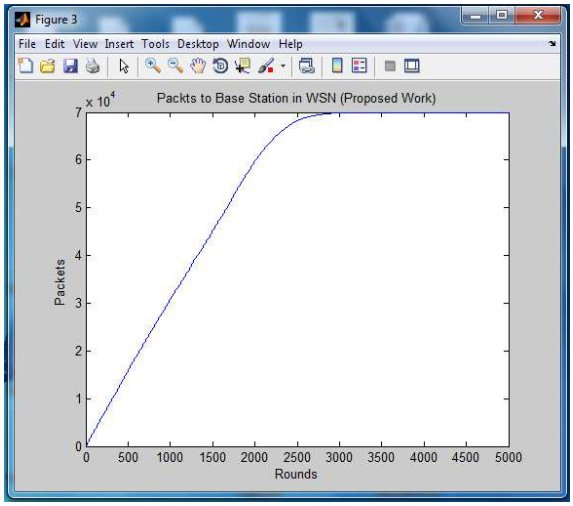

Figure 3: Packets Transmitted to Base Station (Proposed Work)

In Figure 4, after the simulation, the figure shows the number of packets transmitted to the base station which is approximately more than 129691. It means more information is transmitted to the BS.

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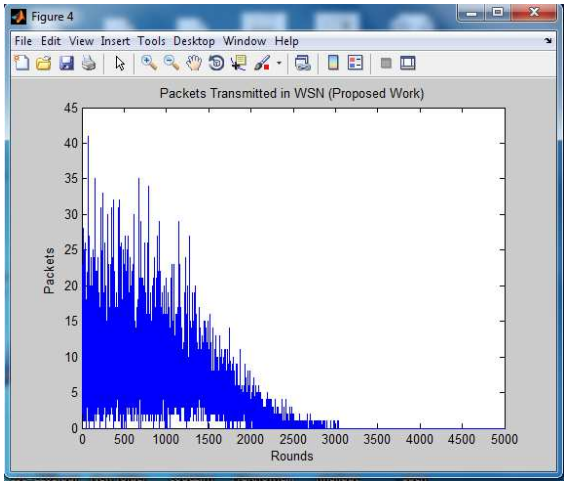

Figure 4: Packets Transmitted in WSN (Proposed Work)

In Figure 4, in this graph we determine the number of rounds of communication, after which the network loses its connectivity. We got 3069 number of rounds.

The results show that along with the network lifetime, the data packet transmission has improved after using the new approach for V-LEACH protocol in WSN.

V. Conclusion

The proposed work is applied in Wireless Sensor networks to improve the data packet transmission and the network life. In this work, an improvement is done in the Vice-Cluster Head selection approach of V-LEACH protocol. On comparing the results of the existing approach and the proposed approach, we find that after using the proposed approach in the V-LEACH protocol, the number of packets delivered to the base station is a lot more than the number of packets delivered by the LEACH protocol. This concludes that the proposed approach is superior than earlier protocol as it sends more information to the base station for longer period of time.

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