Energy Efficient High Throughput Routing Protocol for WSN

E.Suma[1] *V.Glory*[2] *V.srinivas*[3]

[1]*P.G.Scholar, Department of ECE, Swarnandhra Institute of Engineering Technology, Narasapuram, Andhra Pradesh*

[2,3] *Department of ECE, Swarnandhra Institute of Engineering Technology, Narasapuram, Andhra Pradesh*

yedasuma@gmail.com

Abstract— ***Wireless sensor networks are employed in several applications, including military, medical, environmental and household. In all these applications, energy usage is the determining factor in the performance of wire- less sensor networks. Consequently, methods of data routing and transferring to the base station are very important because the sensor nodes run on battery power and the energy available for sensors is limited. One of the nodes should be selected as head to receive all members data and to transmit. In this paper new energy efficient clustering algorithm is proposed for effectively selection of CH and data gathering scheme for Wireless sensor networks. The clustering algorithm mainly consist of two phase, first is Selection of cluster head which elect the cluster head for data aggregation and second is Data Transmission Phase which used to effectively route the gathered dada from cluster head to base station. This project is enhanced by EELEACH. The simulation is done using MATLAB simulator.***

Index Term--- ***Wireless sensor networks (WSNs), scalability, energy efficiency, data aggregation, network lifetime, clustering algorithm.***

1. INTRODUCTION

Wireless sensor networks are composed of several small sensor nodes. Many routing protocols are available now days that are specifically made for WSNs where energy responsiveness is a significant concept. Sensor nodes are distributed autonomously to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure and motion at different locations. Energy of each sensor node plays an important role in wireless

Sensor networks because nodes are battery operated. Each node in a sensor network is typically equipped with one or more sensors, a radio transceiver or other

Wireless communications device, a small microcontroller, and an energy source, since in most Wireless sensor network applications the energy source is a battery, energy plays an important role in wireless sensor network, and preserving the consumed energy of each node is an important goal that must be considered when developing a routing protocol for wireless sensor networks.

Many routing protocols have been proposed in the literature such as LEACH, PIGASIS PAMAS. Leach is considered as the most popular routing protocol that use cluster based routing in order to minimize the energy consumption. In figure 1 the configuration of the WSNs is described, where a sensor network is shown in a cloud that contained the many sensor nodes. These nodes transmit the data to the beds base station or sink node. Sink node aggregates the data from sensor nodes and transmit to the internet. The consumer receives data through internet from sink node

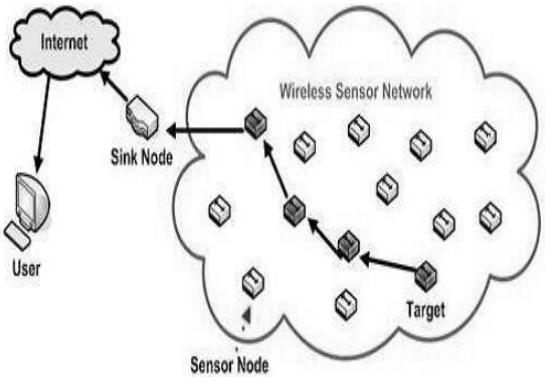

Figure 1 Configuration of Wireless Sensor Network

II.PROBLEM FORMULATION

The wireless sensor nodes are having limited amount of node energy. When the node sensed given area, send the data to head node. The head node is collect data (performs aggregation)

from node and send to base station. This process utilized large amount of energy. Thus, the question can be formulated as: How can we improve the lifetime of network by reducing utilization of node energy in wireless sensor network using the hierarchical routing technique?

III.EELEACH

Energy Efficient Low Energy Adaptive Clustering Hierarchy. In this algorithm cluster heads are selected randomly among the nodes in the network. Each node in the network generates a random number between 0 and 1. If the number is greater than the calculated value, the node will appoint itself as a cluster head. A node once selected as a cluster head. In LEACH protocol use the following clustering model: some of the node selects them as a cluster head. These cluster head collect the data from other nodes which are near to the cluster head and finally these cluster head sends the data to the base station. Cluster head changed at every round so it provides the balance energy consumption for all nodes and increase the lifetime of the network. This paper proposes a modification of LEACH's i.e. EELEACH cluster head selection on the bases of remaining energy of nodes and distance from base station to reduce energy consumption. For a micro sensor network we make the following assumptions.

To address the deficiencies listed above, a clustering based algorithm called ECHC (Energy and Node Concentration Hierarchical Clustering Algorithm) is proposed in this paper. In ECHC, node concentration and the residual energy of sensor nodes is considered in cluster-head election, and non-cluster node choose its cluster head according to the residual energy of the cluster head and the size of the cluster.

A. Set-up Phase

Each node decides independent of other nodes if it will become a CH or not. This decision takes into account when the node served as a CH for the last time (the node that hasn't been a CH for long time is more likely to elect itself than nodes that have been a CH recently). In the following advertisement phase, the CHs inform their neighbourhood with an advertisement packet that they become CHs. Non-CH nodes pick the advertisement packet with the strongest received signal strength. In the next cluster setup phase, the member nodes inform the CH that they become a member to that cluster with "join packet" contains their IDs using CSMA. After the cluster-setup sub phase, the CH knows the number of member nodes and their IDs. Based on all messages received within the cluster, the CH creates a TDMA schedule, pick a CSMA code randomly, and broadcast the TDMA table to cluster members. After that steady state phase begins.

B. Steady-state phase

Data transmission begins; Nodes send their data during their allocated TDMA slot to the CH. This transmission uses a minimal amount of energy (chosen based on the received strength of the CH advertisement). The radio of each non CH node can be turned off until the nodes allocated TDMA slot, thus minimizing energy dissipation in these nodes. When all the data received, CH aggregates these data and sends it to the BS. LEACH is able to perform local aggregation of data in each cluster to reduce the amount of data that transmitted to the base station.

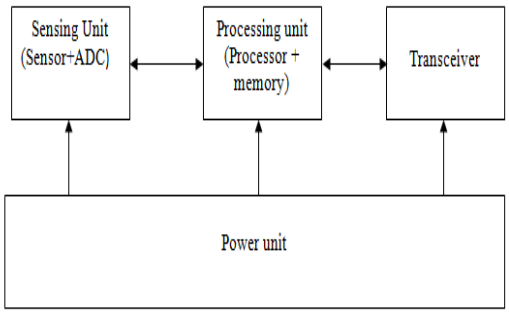

Figure 2 Architecture of sensor node

IV.STEPS TO IMPLEMENT THE PROTOCOL

Step 1: Assumption when nodes are places

When the implementation of this protocol was doing then some assumption are consider which are given below.

- All nodes consider as same in properties
- Each node having same initial energy
- The destination node is consider as a (0,0) coordinate node
- Nodes and cluster are not movable or change that is static in nature.

- Remaining node Except cluster head nodes send data to cluster heads of respective cluster.

Step 2: Parameter for simulation

The following parameter are used in simulation which given in below table.

Table 1. The parameters used in the simulation

Parameter	value	Parameter	value
Size of target area	500 x 500 m^2	Data packet size	512 bytes
Total number of sensor nodes	100	Max no. of nodes	1000
Initial energy	1J	Max no. of Rounds	1000
Transmitting and Receiving Energy	50 nJ/bit	E_{eled}	50 nJ/bit

Step 3: Deployment of wireless sensor nodes

The numbers of sensor node are randomly placed in given area. Initial energy of each node is 1J.

Step 4: Formation of cluster

Given area is divided into number of small region called clusters. Each cluster contains number of sensor nodes.

Step 5: Selection of cluster Heads in each cluster

Selection of cluster head is based on the energy parameter and distance from base station.

Energy consumed

$$E_{TX} = E_{elect} * k + \xi_{fs} * k * d^2$$

Step 6: Data send from non cluster head to cluster head

The sensor nodes has send the data to their respective cluster head within cluster is called as inter-cluster communication

Once the cluster heads are formed other nodes goes to sleep, as they do not take part in routing and required to conserve energy. sleep and wake-up algorithm to decide the mode of the nodes and using this method each node goes to sleep and wake-up when required

Step 7: Path selection

According to shortest path selection method, the path is build from cluster head to the base station.

Step 8: Data transmission from node to destination

The member nodes transmit data to their CHs and the CHs transmit aggregated data to the base station (BS). First, member nodes transmit data to neighbours. Second, neighbour transmits data to cluster head. Third, CH transmits the aggregated data to BS. Fourth, CH checks the remaining energy and sends it to neighbours.

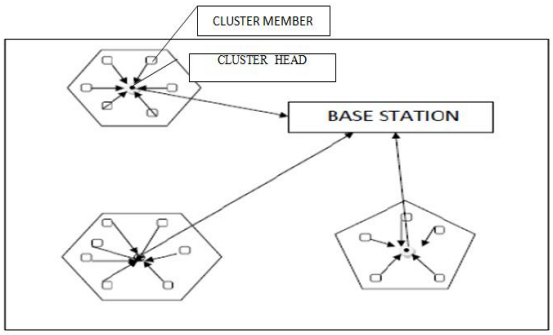

Figure 3 Scenario of communication

V. PERFORMANCE EVALUTION

In this section the different parameter is evaluated and compared with the existing routing protocols. Here we measure network lifetime, energy utilization, data packet delivery ration and average latency of each protocol. The simulation is done using MATLAB software. The definition of different parameter is given below.

A. Data Packet delivery Ratio (DPDR): It is the ratio between the number of data packets received at destination and sent from source.

B. Energy utilization: The energy is used when the data is transmits from source to destination.

C. Average Energy: This term shows average of energy of all nodes at the end of simulation.

D. Average delay: The delay is calculated between the data packet transmitted from source node up to destination.

E. Network lifetime: This term shows the time of the node which energy is completely utilized and at the end it consider dead node.

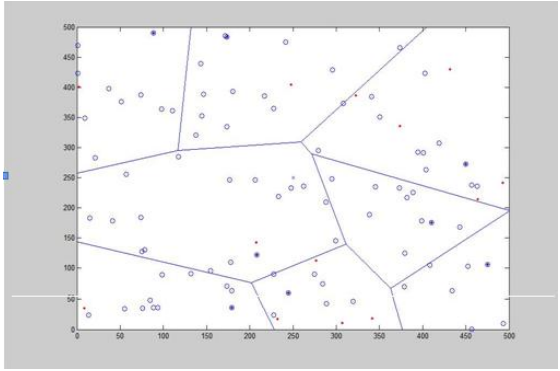

Figure a: Sensor Nodes in a given target area

In the above figure, the sensor nodes are distributed in the given target area, with dimensions of 500x500 axis and 100 sensor nodes. Cluster head is also selected from the sensor nodes

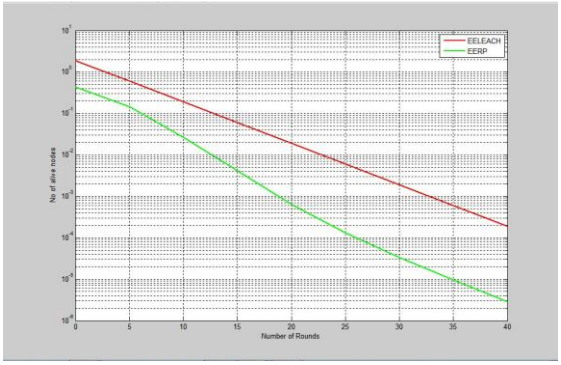

Figure b: Alive nodes

In the above figure, there is a comparison between EERP & EELEACH.The number of alive nodes are more in EELEACH when compared to EERP with respective to number of rounds.

VI.CONCLUSION

The protocols used in this paper are used to sense the data in the given area and also to reroute sensed the data to the Base Station. Here the sensor network lie time is the important concept. Because during the gathering and transmitting the energy of sensor is important. Naming the data helps to construct a query which requests for only certain attributes of the data, thus known as data-centric routing techniques. Regardless, the sensor nodes are grouped for efficient data dissemination to the sink. Hierarchical routing protocols adopt the clustering approach by grouping sensor nodes. This approach is highly scalable and thus used in a number of applications.

REFERENCES

[1] *Hui Lin and Halit Uster "Exact and Heuristic Algorithms for Data-Gathering Cluster-Based Wireless Sensor Network Design Problem" IEEE transactions on networking and system, vol. 22, 903-916, 2014*

[2] *Dr.Sudhir lande, Mr. Sushil Kawale " Review on Energy Efficient Clustering Routing Protocol for Wireless sensor Network" KIET IJCE, Volume. No. 3, Issue No. 2, July-December 2015, ISSN: 2320 - 8996*

[3] *Nagaraju Uppa, B.V.S.S. Subrahmanyam "An energy efficient technique to prolong Network life time of Ad-Hoc Sensor Network" IETE Technical Review, Pages 154-160*

[4] *Tung-Hung Chiang, Jenq Leu and Min-Chieh Yu "Energy Efficient Clustering Scheme for Prolonging the Lifetime of Wireless Sensor Network With Isolated Nodes", IEEE, vol. 19, page 259-262, 2015*

[5] *N. Sharma and Nayyar A. "A Comprehensive Review of Cluster Based Energy Efficient Routing Protocols for Wireless Sensor Networks" (IJAIEM) Issue 1, Volume 3, pages 441-453,2014*

[6] *Stefanos A. Nikolidakis , Dionisis Kandris , Christos Douligeris "Energy Efficient Routing in Wireless Sensor Networks Through Balanced Clustering" Algorithms 2013, 6, 29-42;*

[7] *Amin Rostami1and Mohammad Hossin Mottar " Wireless Sensor Network Clustering Using Particles Swarm Optimization For Reducing Energy Consumption" (IJMIT) Vol.6, No.4, November 2014 , 1-15*

[8] *Mihaela I. Chidean, Eduardo Morgado, Eduardo del Arco, Julio Ramiro-Bargue˜no and Antonio J. Caama˜n , "Scalable Data-Coupled Clustering for Large Scale WSN" page:209-216, april, 2014*

[9] *Chandrakasan, W. Heinzelman A. and H. Balakrishnan. "An application specific protocol architecture for wireless microsensor networks" 33rd Hawaii Internationa. Conf. System, 4, 660-670, 2000*

[10] *Raghavendra C and Lindsey S. "Power-efficient gathering in sensor information systems (PEGASIS)". IEEE Aerospace Conference Proceedings, 3, page 9-16, 2002.*

[11] *Ma B. Rollyi, S.D. Muruganthan and A. Fapojuwo "A centralized energy-efficient routing protocol for wireless sensor networks" IEEE Radio Communications conference, 43, page 8-13, 2005.*

[12] *A. Zanella A. And Depedri "An energy efficient protocol for wireless sensor networks" In Procidings AI Network system, pages 1-6, 2003.*

[13] *G. Morabito V. Loscr and S. Marano "A two-levels hierarchy for low-energy adaptive clustering hierarchy (TL-LEACH)" IEEE 2nd Vehicular Technology Conf., pages 1809-1813, 2005*

[14] *Dai L., Wu , Wang, Zhu H. and B. Xiong. "The clustering algorithm of wireless sensor networks based on multi-hop between clusters" WRI World Congress on Computer Science and Info. Engg, 3:177-181, 2009.*

[15] *M.N. Islam and M.J. Islam. "An advanced solar aware leach protocol for energy efficient routing in wireless sensor networks(A-sleach)". Networking 6th International Conference,4,2007.*