Implementation of Dual Hop Concept in DEEC Protocol

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Abstract- Wireless sensor networks are composed of many homogeneous or heterogeneous sensor nodes with limited resources. A sensor node is comprised of three components: a sensor, a processor and a wireless communication device. These sensor nodes dispersed throughout the network area to monitor, collect, and transmit data. The sensors are simple, and their power source is irreplaceable. Due to limited sensor nodes energy in wireless sensor network, it is very important to save the energy for prolonging networks lifetime. Knowing the sensors power levels cannot be restored, many protocols have been developed to make collecting, receiving and transferring data more energy efficient. Low Adaptive Clustering Hierarchy (LEACH) protocol is an efficient routing approach which has been widely adopted and enhanced to improve the lifespan of deployed sensor networks. Clustering is a successful approach in wireless sensor network, which can increases network lifetime and scalability. In this project, we propose a dual hop cluster based routing protocol which is more energy efficient than single hop protocol. To achieve the higher degree in the lifetime of the nodes, the residual energy of the nodes for dual hop node choice is taken into consideration. Stimulation results show that the protocol offers a better performance than single-hop clustering routing protocols interms of network lifetime and energy consumption by improving stability period of the network. The adoption of dual hop communication instead of direct communication in cluster field has optimized the communication in the network.

Keywords- WSN, clustering routing, data transmission,dual hop.

I. INTRODUCTION

In order to measure the parameters of a large geographical area, a collection of the hundreds or thousands of sensor nodes are deployed over that area. These sensors nodes sense the data by using their sensors from remote locations which are interacted with the physical environment and then relay the information by coordinating among them. The sensor node consists of an, radio transceiver for communication, embedded microprocessor, limited memory and on-board sensors for sensing the parameters such as temperature, humidity, pressure etc. The collected the data by the sensor nodes from the sensing field is forwarded to the base station (BS). Due to the ability of WSN that is enabling the communication of the environmental data to base station directly or through neighboring node makes the sensor network suitable for remote control monitoring and surveillance[1].

The sensor nodes are of limited in capabilities like bandwidth, energy supply and also are of low mobility. The lifetime should be as long as possible for these networks. The battery recharging in many cases may be difficult or impossible. Even though the intial energy of each node is same, but due to radio communication characteristics the energy of each node will differ after transmission of data among the nodes. This is all By the efficient usage of energy the lifetime of sensor networks and sensor nodes can be prolonged. Several energy efficient algorithms and energy efficient protocols have been proposed for WSN [2].

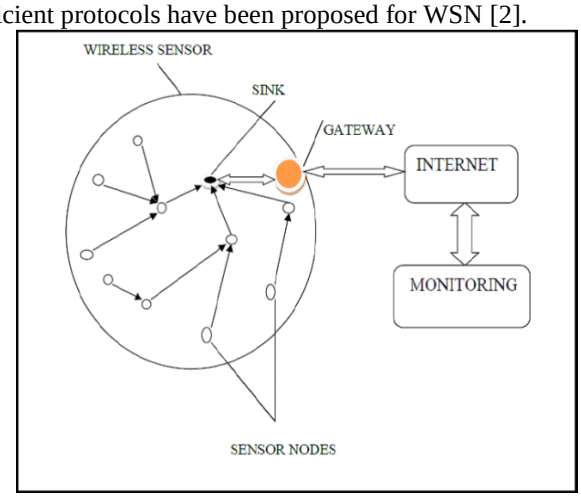

Fig.1: Wireless sensor network

Literature survey:- LEACH (Low Energy Adaptive Clustering Hierarchy protocol) is a hierarchical routing algorithm which is a mostly used protocol in the sensor networks. The LEACH protocol [3] divides the total wireless sensor network into many clusters. The cluster head node is selected randomly, every node can be selected as a cluster head with equal probability to which energy consumption of whole network is averaged.

Problems in LEACH protocol are:

In LEACH protocol the cluster head node is randomly selected. There are few shortcoming attributes like equal probability for every node to be selected as cluster head. After several rounds, the nodes will have same likelihood or probability to be chosen as cluster head no matter whether they contain greater remaining energy or smaller remaining energy [4][5]. If the node with smaller remaining energy is chosen as cluster head, it will run out of the energy and die quickly, due to which the network's lifetime becomes short and the robustness of the network can also be affected. DEEC is called as distributive energy efficient clustering protocol. DEEC uses the initial and residual energy level of the nodes to select the cluster-heads [6]. Cluster-heads are elected by a probability based on the ratio between residual energy of each node and the average energy of the network.

The epochs of being cluster-heads for nodes are different according to their initial and residual energy. Nodes with high initial and residual energy will have more chances to be the cluster-heads than the nodes with low energy. DEEC achieves longer lifetime and more effective messages than current important clustering protocols in heterogeneous environments.

In order to avoid the problem, that each node needs to know the global knowledge of the networks, DEEC estimates the ideal value of network life-time, which is used to compute the reference energy that each node should expend during a round [7].

Dual hop Distributed Energy Efficient Clustering Protocol:-

For implementation of dual hop area of any shape can be chosen for the analysis we are choosing rectangular area. Other shapes like circular, square can also be chosen. The sink is placed at the center of the rectangular area.

The nodes can be heterogeneous (different type of nodes) or homogeneous (same type of nodes). Analyzing in heterogeneity i.e. it consists of normal nodes, intermediate nodes and super nodes.

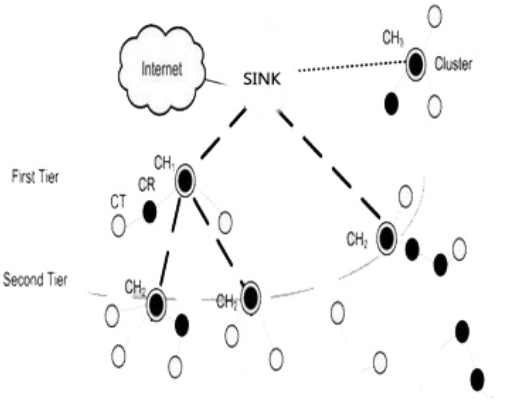

Fig.2: Dual hop sensor network

The above figure shows a part of the deployment of sensor nodes in dual hop DEEC in a rectangular area. The energies of the nodes are different as we are taking heterogeneous nodes. Based on residual energy transmission the nodes with the higher energies will be elected as cluster heads . The sensor nodes are randomly deployed in the region and the coordinates of the sensors are represented as Six and Siy indicating the position of the sensors in the region.

As in the DEEC protocol, even in the dual hop [8] based on the energies of the sensors the cluster heads are elected and the co-ordinates $C(i)x$ and $C(i)y$ represent the exact location of the cluster head, where i is number of cluster head.

In the setup phase of dual hop DEEC, the clusters formed earlier are arranged in the 2-tiers based on the distance between the base station and the cluster head.

The minimum distance between the cluster heads and base station are calculated using the given relation,

$$d = \sqrt{\left(((Bx - C(i)x)^2) - ((By - C(i)y)^2)\right)}$$

On the basis of the distance calculated between the cluster heads and base station, the clusters are arranged into 2 tiers namely (t1, t2) where t1 consists of the first 3 clusters with minimum distance from sink and the following three clusters are placed in the next tier t2. Now calculate the distance between every cluster head in t1 to every cluster head in t2. The data from second tier CH's is sent to first tier CH's.

From here the aggregated data is sent to the sink. In this manner the data reaches the base station in maximum of two hops.

Transmission distance is the important parameter considered in this protocol. The energy consumption increases as the transmission distance increases, so minimum transmission distance must be maintained to reduce the energy consumption. This can be done by dividing the region into two tires. This can be considered as an major advantage of dual hop DEEC.

II. RESULTS

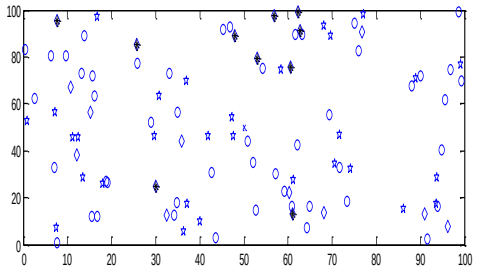

Fig.3: The random deployment of sensor nodes

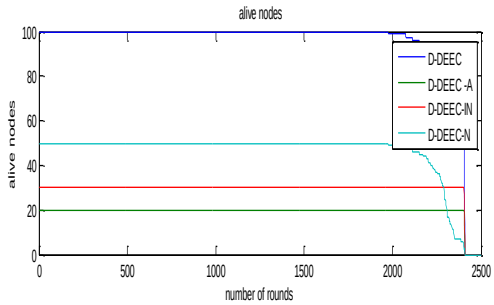

Fig.4: Alive nodes graph for DEEC dual hop

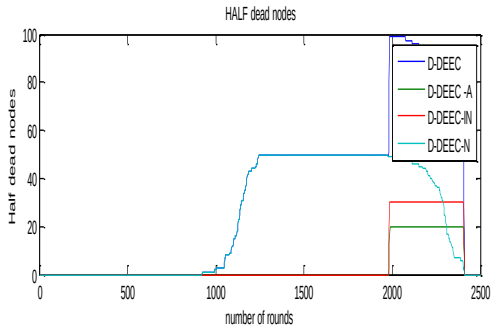

Fig.5: Half dead nodes in dual hop DEEC

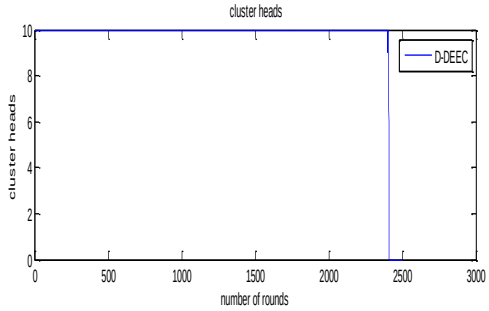

Fig.6: Cluster heads graph in dual hop DEEC

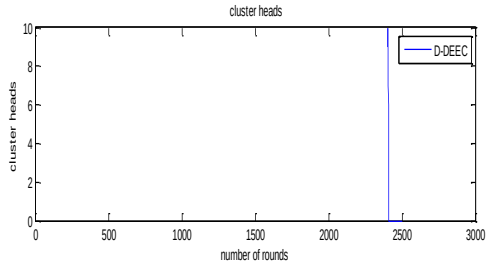

Fig.7: cluster head count graph in dual hop DEEC

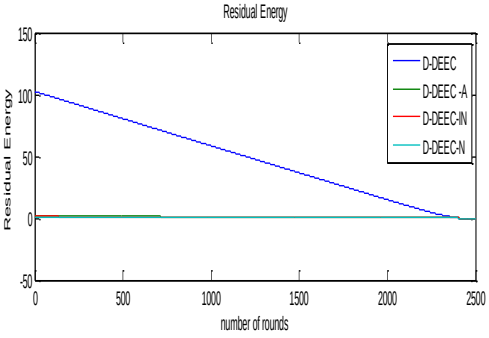

Fig.8: Residual energy in dual hop DEEC

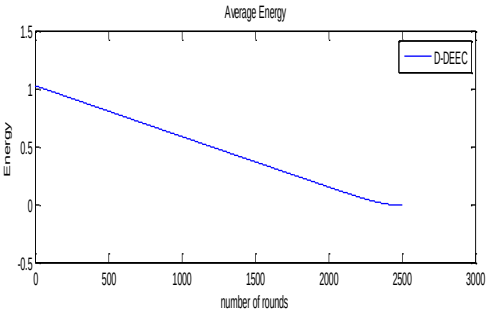

Fig.9: Average energy in dual hop DEEC

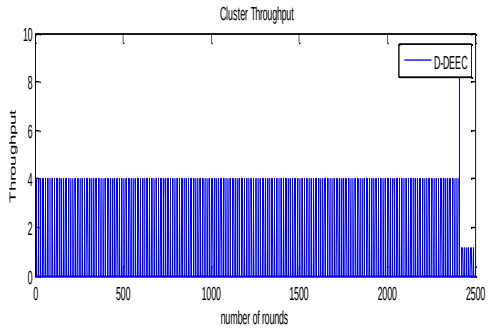

Fig.10: Cluster throughput graph in dual hop DEEC

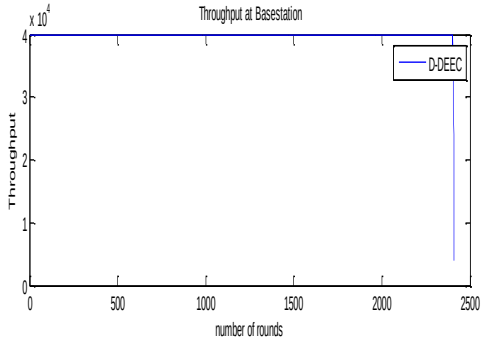

Fig.11: Throughput at Basestation in dual hop DEEC

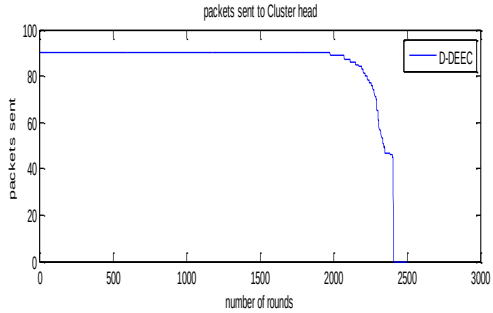

Fig.12: Packets sent to Cluster head graph

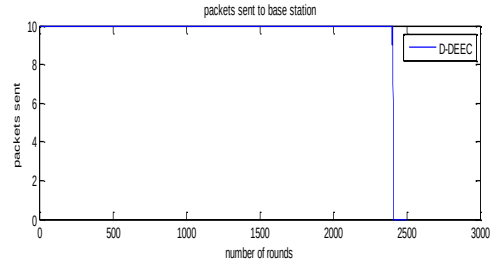

Fig13:- Packets sent to Basestation graph

III. CONCLUSION

The sensor nodes in WSN react to abrupt and drastic changes in the value of a sensed attribute instantaneously when certain event occurs. The proposed algorithm guarantees that the elected cluster-heads are uniformly distributed over the network. Hence, there is no possibility that all cluster-heads will be concentrated in one part of the network. The result of simulations indicates that the proposed clustering approach is scalable and more energy efficient hence effective in extending the network life time compared to LEACH based algorithms. Hence from the simulation results the performance of the proposed scheme is effective in terms of energy consumption compared to LEACH protocol.

Future Scope from this report is energy efficiency of the nodes used in wireless sensor networks can be increased intems of mobility and load-balancing byusing different optimized techniques so that maximum energy of the nodes can be utilized for data transmission better than LEACH.By using multihop DEEC protocol the results can be more enhanced and achieves ideal characteristics compared to LEACH.

IV. REFERENCES

[1]. Akyildiz LF, Su W, Sankarasubramaniam Y, CayirciE. A survey on sensor networks. IEEE Communications Magazine, 2002, 40(8): 102~114.Vol.25, No.4: 114-124.

[2]. SeemaBandyopadhyay and Edward J. Coyle. An Energy Efficient Hierarchical Clustering Algorithm for Wireless Sensor Networks2003 IEEE School of Electrical and Computer Engineering Purdue University West Lafayette, IN, USA.

[3]. W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan. An Application-Specific Protocol Architectures for Wireless Networks. IEEE Transactions on Wireless Communications, 1:660–670, 2002.

[4]. M. Haase and D. Timmermann. Low energy adaptive clustering hierarchy with deterministic cluster-head selection. In *IEEE Conference on Mobile and Wireless Communications Networks (MWCN)*, pages 368–372, 2002.

[5]. M. Ye, C. Li, G. Chen, J. Wu. 2005. EECS: an energy efficient cluster scheme in wireless sensor networks. In IEEE International Workshop on Strategies for Energy Efficiency in Ad Hoc and Sensor Networks (IEEE IWSEEASN-2005), Phoenix, Arizona, April 7–9.

[6]. Ravneet Kaur, Deepika Sharma and Navdeep Kaur. Comparative Analysis of Leach and Its Descendant Protocols In Wireless Sensor Network. International Journal of P2P Network Trends and Technology- Volume3Issue1- 2013.

[7]. Parul Saini, Ajay.K.Sharma, "E-DEEC- Enhanced Distributed Energy Efficient Clustering Scheme for heterogeneous WSN", IEEE Proceedings of the 1st International Conference on Parallel, Distributed and Grid Computing (PDGC-2010).

[8]. Ahmad Al Masri, Gilles Y. Delisle, Nadir Hakem, "Hierarchical routing protocol for multi-level heterogeneous sensor network", Microwave Symposium (MMS) 2016 16th Mediterranean, pp. 1-4, 2016.