ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 16, March 2016

Enhancing Energy Efficiency And Lifetime Of Wireless Sensor Networks Using Regional Energy Aware Clustering With Isolated Nodes

K.DEEPA RUBIYA[1], *J.MEENA*[2], *A.SELVA PRIYA*[3], *I.MARYSHEEBA*[4]
rubiyadeepa@gmail.com, meenajeganathan95@gmail.com, selvapriyaalagirisamy@gmail.com
1, 2, 3 UG Scholar and 4 asst.professor, CSE
1, 2, 3, 4 P.S.R.Rengasamy College of Engineering for Women, Sevalpatti.

Abstract- **A suitable clustering algorithm for grouping all sensor nodes can increase energy efficiency of the wireless sensor networks. These clustering require some additional overhead like cluster construction, cluster head (CH) selection and assignment. This proposes a new regional energy aware clustering scheme using isolated nodes for WSNs called Regional Energy Aware Clustering with Isolated Nodes (REAC-IN). In this the cluster heads (CHs) are selected based on weight. Weight is calculated using residual energy of each sensor and the regional average energy of all sensors in each cluster. Improperly designed distributed clustering algorithms can cause nodes to become isolated from CHs. This isolated node communicates with sink node by consuming huge amount of energy. To enhance the network lifetime, the regional average energy and the distance between the sensors and the sink node are used to identify whether the isolated nodes sends its data to the sink or the CHs in previous group.**

I. INTRODUCTION

In distinctive wireless sensor network (WSN), a sensor node consists of sensing components along with communicating and dataprocessing components. Sensor nodes can be used in many fields such as industrial, military, agricultural application like transportation monitoring, seasonal monitoring, battle field surveillance etc., In this sensor nodes are deployed in ad-hoc manner and operate autonomously. In this environment, these sensors cannot easily be recharged or replaced and energy consumption is the major problem that must be considered.

Numerous energy efficient schemes have been introduced for WSNs. The clustering is mainly useful for relay based sensor networks which requires scalability to hundred or even thousands of sensor nodes. A cluster consists of at least a cluster head (CH) with cluster members. CH is responsible for coordinating the nodes within the cluster and transmitsthe aggregated data to the remote observer called sink node. During the period of re-clustering the node with higher residual energy serves as a cluster head (CH). The lifetime of the network is extended using performance of the data aggregation, which involves in combining the data from source to small set of information and make data transmission more efficient. However, these clustering algorithm exhibit disadvantages such as additional overhead when CHs selection and assignment and during cluster construction process.

In recent years, researchers have proposed several cluster-based protocols to maximize the lifetime of the network. LEACH (Low Energy Adaptive Clustering Hierarchy) is a self-organizing adaptive protocol which uses the distributed formation clustering algorithm [5]. In this CHs are selected on the basis of predetermined probability, other nodes choose those clusters by calculating the closest CHs. However, this LEACH does not guarantee uniform distribution of CHs in the network.

In LEACH, CHs become overloaded that cause degree of load balance to decline. Moreover, the node can be selected to be CH for more than one round of an operation, thus it consumes more energy than others. In [6] the HEED (Hybrid EnergyEfficient distributed Clustering) combines the strategy of energy and communication cost for generate CHs. It prevents two nodes within same transmission range from becoming CHs because energy is distributed uniformly across the nodes. In HEED all nodes must constantly communicate with the neighboring nodes for given numbers of iteration during selection of CHs. Therefore extra communication cost is required. The [7] DEEC (Distributed Energy-Efficient Clustering) is a clustering based algorithm in which CHs are selected based on the probability of the ratio of the residual energy to the average energy of the network. Therefore, each node is not required to have global knowledge about the network. The

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 16, March 2016

main drawback is overhead involved in processing the average energy.

In this paper, the new regional energy aware clustering method with isolated nodes for WSNs called (Regional Energy Aware Clustering – Isolated Nodes) REAC-IN is used. In this LEACH is used in REAC-IN for the consumption of energy for rotating the CHs role among all nodes. Improperly designed distributed clustering can cause nodes to become isolated from CHs. Such isolated nodes communicate with the sink node by consuming excess amount of energy. Further, the regional average energy and distance between the sensor nodes and sink is calculated to identify that whether the data in isolated nodes transmitted to sink or to the CH in previous round.

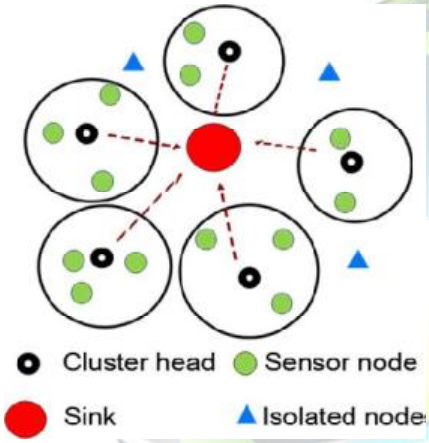

Fig: 1 isolated nodes.

II. PROBLEM DEFINITION

A. Isolated Nodes

Each sensor nodes in the WSN consumes energy to sense the environment and transmits it data to the sink node. In improperly designed clustering algorithm, the nodes become isolated due to randomly selected CHs as in fig: 1.

The energy consumption problems become the worse while communicating with the sink node. To prevent the network lifetime, regional average energy and distance between the sink and sensor nodes are calculated that whether data is transmitted to sink or CHs in previous round.

B. Global Average Energy And Local Average Energy:

Fig: 2 show the distribution of randomly deployed sensor nodes. Here, the distribution of residual energy for all nodes is uneven. The original scheme [7] did not consider regional average energy. A node mustconsider the energy level of local nodes when selecting CHs in save more energy [5]. This paper provides the REAC-IN scheme to extend the lifetime of the WSNs by considering the regional average energy of sensor nodes.

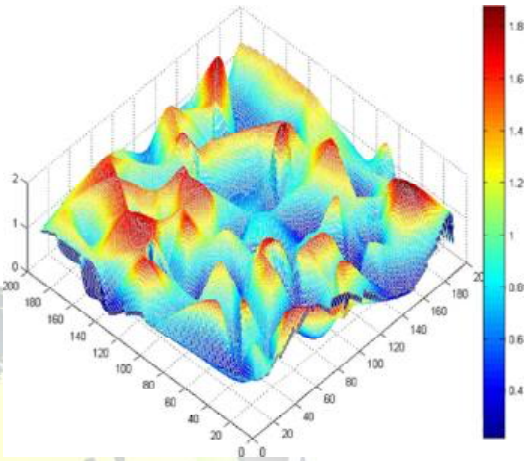

Fig: 2 residual energy distributions of randomly deployed sensor nodes

III. IMPLEMENTATION

In REAC-IN protocol, the residual energy and regional average energy of all sensors in each cluster are used to select the CHs. To prevent the problem of the node isolation, the regional average energy and distance between the sensor nodes and sink used to determine the whether the isolated node transmit data to the CH in previous round or to the sink node.

A. Ch Selection Algorithm Based On Residual Energy & Regional Average Energy.

Traditionally, in LEACH, the header selection algorithm is divided into several rounds. At each round, a node decides itself as a header based on the threshold which is calculated by the suggested percentage of cluster-heads for the whole network. In every round, each node chooses the random number between 0 and 1. If the number is less than the threshold, the node becomes a cluster-head for the round. The threshold T (*ni*) for the node *ni* is defined as,

$$T(ni) = \begin{cases} \dfrac{p}{1 - p * (r \bmod \frac{1}{p})} & \text{if } ni \in G \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

Where p is the desired percentage of cluster-heads, r is the current round number, and G is the set of

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 16, March 2016

nodes that have not been selected as cluster-heads in the previous round.

B.Isolated Node And Its Data Transmission Mode

First isolated nodes occur in a WSN in the following situation. After the cluster head (CH) selection process is finished, all selected CHs broadcast a join-request message to the rest of the nodes in the network. If the non-CH node receives many join-request messages, the node would decide to join the cluster which is closest to it. Those non-CH nodes that do not receive a join-request message are considered as isolated nodes. Christo Ananth et al. [4] discussed about Reconstruction of Objects with VSN. By this object reconstruction with feature distribution scheme, efficient processing has to be done on the images received from nodes to reconstruct the image and respond to user query. Object matching methods form the foundation of many state- of-the-art algorithms. Therefore, this feature distribution scheme can be directly applied to several state-of-the-art matching methods with little or no adaptation. The future challenge lies in mapping state-of-the-art matching and reconstruction methods to such a distributed framework. The reconstructed scenes can be converted into a video file format to be displayed as a video, when the user submits the query. This work can be brought into real time by implementing the code on the server side/mobile phone and communicate with several nodes to collect images/objects. This work can be tested in real time with user query results.

Second, the data transmission method for isolated nodes can be determined according to the condition in the previous round and the current situation. In our work, we use the First Order Radio Model (FORM) [5] as the power consumption model for the data transmission between the transmitters and receiver. The energy cost for transmitting a k-bit message can be written as k (Eelec+$\in$amp*D^2), Where D is the distance between the transmitter and receiver.

IV. SIMULATION RESULTS

This section describes a performance evaluation of the REAC-IN protocol conducted using Network Simulator 2 (NS2). Main configurable parameters are used in our simulations referred from the study in [5]. All schemes select CHs at the same period in the same topology. The performances of the schemes proposed in [5]-[7] were compared with implemented one. Figure 3, figure 4, figure 5,figure 6 shows the comparison between REAC-IN with other protocols such as, LEACH, HEED, DEEC.

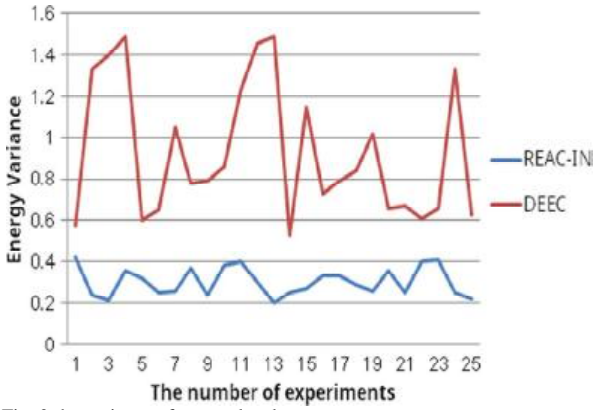

Fig: 3 the variance of energy level

The variance of energy level: Fig. 3 shows the comparisonbetween the variance of residual energy distributionproduced by the DEEC protocol and our proposed REACINprotocol. The variance of the energy levels of all thenodes is the primary measure of the residual energy withlocal or global average energy in DEEC and REAC-IN. Ahigh variance indicates the global average energy of thenetwork cannot accurately represent the state of the entirenetwork.

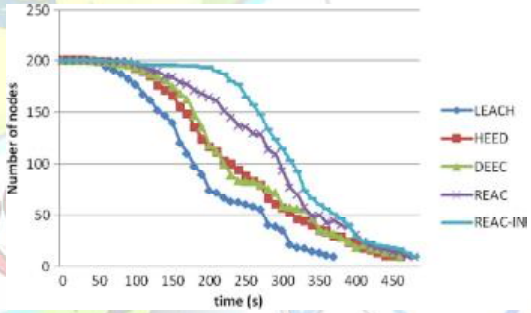

Fig: 4 the number of nodes alive over simulation time.

The number of nodes alive: In Fig. 4, we can find the advantage of using the regional average energy, as well as reducing the problem of isolated nodes. The lifetime and the number of alive nodes in REAC-IN are better than other protocols. Although incomplete data transmission may occur on isolated nodes, but this scheme can still protect the low energy nodes and which are far away from the sink.

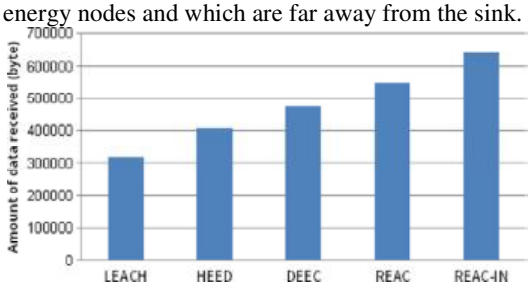

Fig: 5 numbers of data received at the sink

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 16, March 2016

The amount of data received: Fig. 5 shows that the amount of data received at the sink was higher in the REAC-IN protocol than in LEACH, HEED, and DEEC protocols. The result indicates that REAC-IN can help data transmission from nodes to the sink in the entire network.

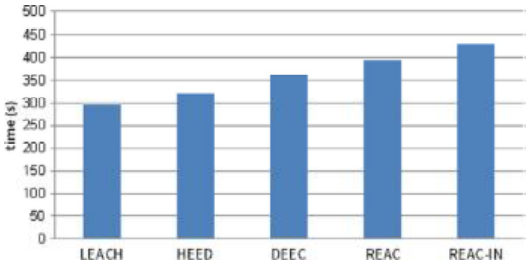

Fig: 6 the average lifetime of 50 simulations

The average lifetime: Fig. 6 shows the average lifetime in 50 simulations. It shows that there is a significant improvement in lifetime by REAC-IN. The network lifetime in REAC-IN is longer than other protocols, and can prolong approximately up to 40% of the network lifetime.
Moreover, the isolated node problem is solved so that it can prolong the whole network lifetime.

CONCLUSION

A WSN is a combination of wireless communication andsensor nodes. The network must be energy efficient and stable,and have a long lifetime. The REAC-IN protocol presentedin this paper improves the cluster head selection process andsolves the problem of node isolation. The simulation resultsrevealed that the performance of the algorithms used in REACIN to improve the lifetime and stability of a network is more favourable than that of the algorithms used in other protocols.

REFERENCES

[1] G. J. Pottie and W. J. Kaiser, "Wireless integrated network sensors," *Commun. ACM*, vol. 43, no. 5, pp. 51–58, May 2000.
[2] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "Wireless sensor networks: A survey," *Comput. Netw.*, vol. 38, no. 12, pp. 393–422, Aug. 2002.
[3] M. Reddy, P. Jagadeeswara, S. Prakash, and P. Chenna Reddy, "Homogeneous and heterogeneous energy schemes for hierarchical cluster based routing protocols in WSN: A survey," in *Proc. 3rd Int. Conf. Trends Inf.,Telecommun. Comput.*, vol. 150, *Lecture Notes in Electrical Engineering*, 2013, pp. 591–595.
[4] Christo Ananth, M.Priscilla, B.Nandhini, S.Manju, S.Shafiqa Shalaysha, "Reconstruction of Objects with VSN", International Journal of Advanced Research in Biology, Ecology, Science and Technology (IJARBEST), Vol. 1, Issue 1, April 2015, pp:17-20
[5] W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "Energyefficient communication protocol for wireless microsensor networks," in *Proc. 33rd Annu. Hawaii Int. Conf. Syst. Sci.*, Jan. 2000, p. 8020.
[6] O. Younis and S. Fahmy, "HEED: A hybrid, energy-efficient, distributed clustering approach for *ad hoc* sensor networks," *IEEE Trans. Mobile Comput.*, vol. 3, no. 4, pp. 366–379, Oct.–Dec. 2004.
[7] L. Qing, Q. Zhu, and M. Wang, "Design of a distributed energy-efficient clustering algorithm for heterogeneous wireless sensor networks," *Comput.Commun.*, vol. 29, no. 12, pp. 2230–2237, Aug. 2006.