IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Volume-5, Issue-4 E-ISSN: 2347-2693

Energy Efficient Routing Protocol for Secure Wireless Sensor Network

R. Kumar[1*], S. Tripathi[2], R. Agrawal[3]

[1*] Dept. of CSE (Ph.D. Scholar), Indian Institute of Technology (Institute School of Mines), Dhanbad, India
[2] Dept. of CSE, Indian Institute of Technology (Institute School of Mines), Dhanbad .India
[3] Director , BAJAJ Institute of Technology and Management,Greater Noida, India

Corresponding Author: ranjit_kumaruitbu@yahoo.co.in, Mob: 91-9971074301

www.ijcseonline.org

Received: 15/Mar/2017, Revised: 24/Apr/2017, Accepted: 24/Apr/2017, Published: 30/Apr/2017

***Abstract*-** WSN (Wireless Sensor Network) has proved to be a boon for data collection from hard to reach places which were otherwise beyond the physical constraint of humans. WSN has found its way into key fields such as Environment monitoring, transportation, security, military, catastrophic area and medical industry. WSN strives on limited power consumption, as charging the battery in some circumstances is not a practical solution and so energy consumption of WSN has to be looked after and for energy efficient communication in WSN, a series of routing techniques has been adopted, the most effective being LEACHES. Simulation results shows a decrease in energy consumption when distance between the cluster heads is reduced.

***Keywords*-**Wireless Sensor Network, LEACH, Hierarchical Routing, Cluster Heads, Energy Efficient Communication, Energy Conservation.

I. INTRODUCTION

WSN can primarily be described as a network of thousands of sensor nodes capable of sending and receiving data breaking the traditional ways. It has enabled us to process the environment variables and constraints through the [1]means of sensor nodes, which was not possible before due to plausible causes In difference to traditional networks, the WSNs exhibit unique asymmetric traffic patterns. The traffic of WSNs can be either single hop or multi-hop. The multi-hop traffic patterns can be further divided, depending on the number of sending and receiving nodes, or whether the network supports in network processing [1].

WSN has found its way in several places now, namely Environment monitoring, transportation security, military, catastrophic area and medical industry. However as for all wireless networks, the thing to look after for WSN is the energy efficiency levels by the various routing protocols for the effective application of the network. The sensor nodes present responsible for transmitting and receiving data consumes energy in the three stages namely transmission, receiving and idle stage and the fourth stage being sleep which consumes no energy. Many routing protocols have been adopted, tried and tested to reduce energy consumption, the most effective being LEACH, as it happens to reduce the distance between the intermediate nodes and therefore less energy, is needed for transmission and receiving data and also eliminating data redundancy[2].

The organization of paper is as follows Section II describes the Literature Survey regarding LEACH protocol. Section III gives the Problem Statement regarding the topic. Section IV gives the Proposed Approach. Section V describes the results obtained using the approach. .Section VI represents Conclusion

II. LITERATURE SURVEY

LEACH Protocol
(Low Energy Adaptive Clustering Hierarchy)

LEACH is one of the most energy efficient cluster based hierarchy protocol used in WSN networks which helps in efficient data exchange [3]. It tends to aggregates information before transmitting it further to transmitting it to the base station which is often done by a cluster head. And thus, is such manner energy is conserved.

A Cluster head or a CH is chosen such as that it still has the maximum power among other nodes and is able to communicate on behalf of the cluster and is re-elected so that the node can function for such a high energy task efficiently. It then further sends a message to other nodes to join the cluster and a hierarchy is thereby formed and as contrary to direct communication which involves high energy consumption, this helps is reducing distance and therefore low energy consumption levels.

Also, CH provides a phase to the cluster nodes so as to avoid any sort of collision. This protocol is used as and when a

constant monitoring is required by the sensor nodes as data collection is centralized (at the base station) and is performed periodically [4].

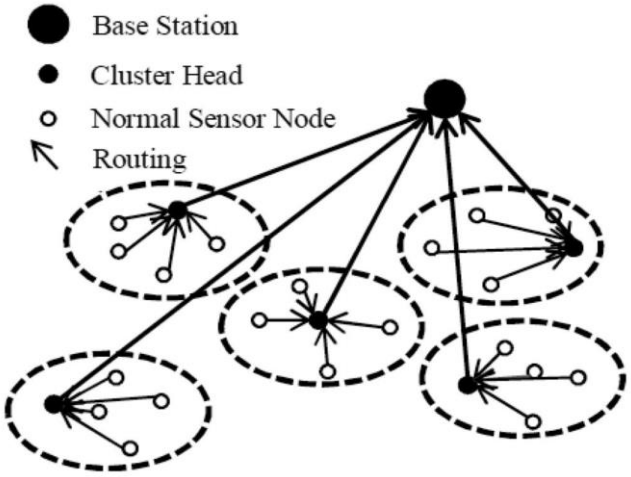

Figure 1: Clustering in LEACH Protocol

LEACH operations can be divided into two phases:-
1. Setup phase
2. Steady phase

In the setup phase, the clusters are formed and a cluster-head (CH) is chosen for each cluster while other nodes in the cluster are considered as the cluster members. While in the steady phase, data is sensed and sent to the central base station. This is done in order to minimize the overhead cost. After certain time network goes back to set-up phase again and enter another round. The operation of LEACH protocol operation is divided into rounds, where the round start with a set-up phase, when the cluster are organized, followed by the steady-state phase as shown in Fig. 2[5].

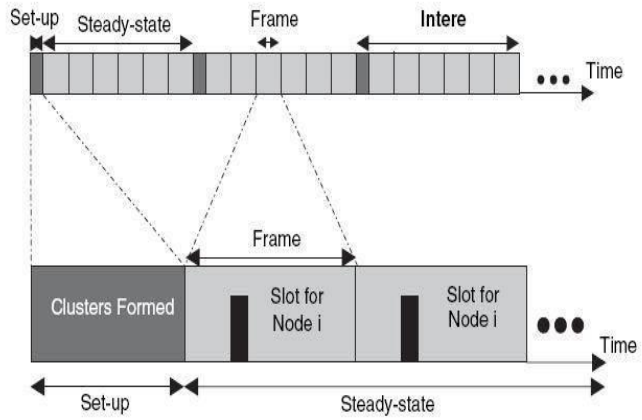

Figure 2: LEACH Protocol Phases

WSN can be deployed in different places in different ways with different architectures after deployed LEACH protocol works.

There are four main phases of LEACH

a) *Advertisement phase*
In this phase, if any cluster nodes wish to become a cluster head, it can choose any random number between 0 and 1. If the random number chosen is less than threshold value T (n), the node becomes cluster-head for the current round. The threshold level is set by:

$$T(n) = p/(1 - p(r * mod(1/p)) \qquad if\ n \epsilon G$$

$$0 \qquad \text{otherwise}$$

Where x is ratio of cluster-heads, r is the current number of round and S is the cluster node set which has not been selected as cluster head in the last 1/p round.

b) Cluster Set-up Phase
As there are number of cluster heads in WSN. So, in this phase after it is decided that which nodes will become Cluster head, the other cluster would request to cluster-head to be part of that cluster head.

c) Schedule Creation
In the schedule creation phase cluster-head receives all the messages from the cluster-node. It is based on the number of nodes in cluster. It creates a TDMA schedule to tell when it can transmit. This phase of schedule is broadcasted back to nodes in that cluster.

d) Data Transmission
When TDMA schedule is fixed, the data transmission begins .The information is collected and compressed before transmitting to the base station. This is the steady state operation of sensor network using LEACH protocol. After some time these four phases would be repeated [6, 7, 8].

III. PROBLEM STATEMENT

As in leach protocol the nodes are chosen randomly. If node loss their energy then it will do nothing in the network means it will be loss their communication capability resulting in network partitioning, which is serious in ad hoc networks. Those nodes which are loss there energy will not be a part of network, but nodes having a capability to take part in communication having a sufficient energy to do communication in the network. Due to suddenly loss of session following problems are occurring:

Maximize the loss of packets.
Maximize the routing load.
Minimizes energy utilization

By using maximum energy concept we try to remove the problem of "suddenly loss of session" and do the energy efficient routing. If any nodes in the network having a value smaller or equal to threshold value cannot take a part in communication and also calculate the average energy of all possible paths and select the path that has contain the maximum average energy level. Proposed solution will definitely improve the:

Maximizes energy utilization.

The cluster head will be selected from among the nodes.
LEACH protocol changes the cluster head at every round and once a cluster head is formed, it will not get another chance for next 1/p rounds.

Formulae of selecting cluster head:

$$T(n) = p/(1 - p(r * mod(1/p)) \quad if\ n \epsilon G$$
$$0 \quad \text{otherwise}$$

If the cluster head has less energy than required threshold, new cluster head will be selected.
According to LEACH algorithm otherwise the same node will remain acting as cluster head if it has higher than threshold value.

The cluster heads communicate in a multihop method that is from cluster head to another cluster head. Hierarchical leach is the efficient protocol which minimizes the energy level using minimization of transmission distance as then less power will be required for packet or data transmission

IV. PROPOSED METHOD

We consider a heterogeneous model having N number of nodes initially distributed over the network in XY region.

As the node as distributed randomly, one cluster may have many nodes while other cluster may be having fewer nodes. This will result in some of cluster heads having more number of nodes to die faster reducing efficiency of data transmission. To solve this we will choose nearest nodes to allocate them to the clusters heads. These nodes will be less than a number q that is pre defined, if they exceed number q, and then they will be allocated to the other cluster. Suppose each cluster contains N_{cls} number of nodes, whose value can vary from 1 to q. We take q=6. Thus we divide the region into different clusters of different shapes. Heterogeneous network is considered in this paper. The paper assumes the network is divided into two energy levels of nodes. The nodes with higher energy level are called advanced nodes and the nodes with low energy level are called normal nodes. The percentage of advanced nodes is m. Each advanced node possess a times more energy than a normal node. The initial energy of each cluster is equal to E_{cls} .

Parameters	***Value***
Number of nodes, n	100
Network size X × Y	100 × 100..
Receiver Energy, ERX	50Nj
Transmitter Energy, ETX	50nJ
Free space Energy Consumption, Efs	01nJ
Multipath Energy Consumption, Emp	0013pJ
Initial Energy,E0	0.5J
Data Aggregation Energy, EDA	5nJ
Packet size	1400bits
Percentage of advanced nodes, m	0.1, 0.2& 0.3
Multiple of normal node energy	1, 2, 3

Formulae for energy :

$$E_{cluster} = Ech + \frac{N}{k} Enon - ch$$

where E_{CH}, energy dissipated by the cluster head in reception, aggregation (EDA) and transmission of data to the BS is given as:

$$E_{CH} = lEelec * N/k + lEda * N/k + l\varepsilon mp * d$$

and E_{non-CH}, energy consumed by the cluster member in transmitting data to the cluster head.

$$E_{non\text{-}CH} = lEelec + l\varepsilon fs * dtoCH$$

Thus by increasing the equal number of nodes in each cluster and reducing the distance between cluster heads we can minimize power of transmission

V. RESULTS

Figure 3 shows the relation between energy dissipation v/s number of cluster by decreasing the distance between the cluster heads to half of what it was before. As a result the Energy for the Proposed LEACH is reduced to that of LEACH.
The Energy for each cluster earlier was $1.1702*10^{-6}$ whereas the energy of each cluster for proposed LEACH after reducing the distance comes out to be $1.0535*10^{-6}$. Thus we can say that by decreasing the distance between cluster heads, power consumption is reduced.

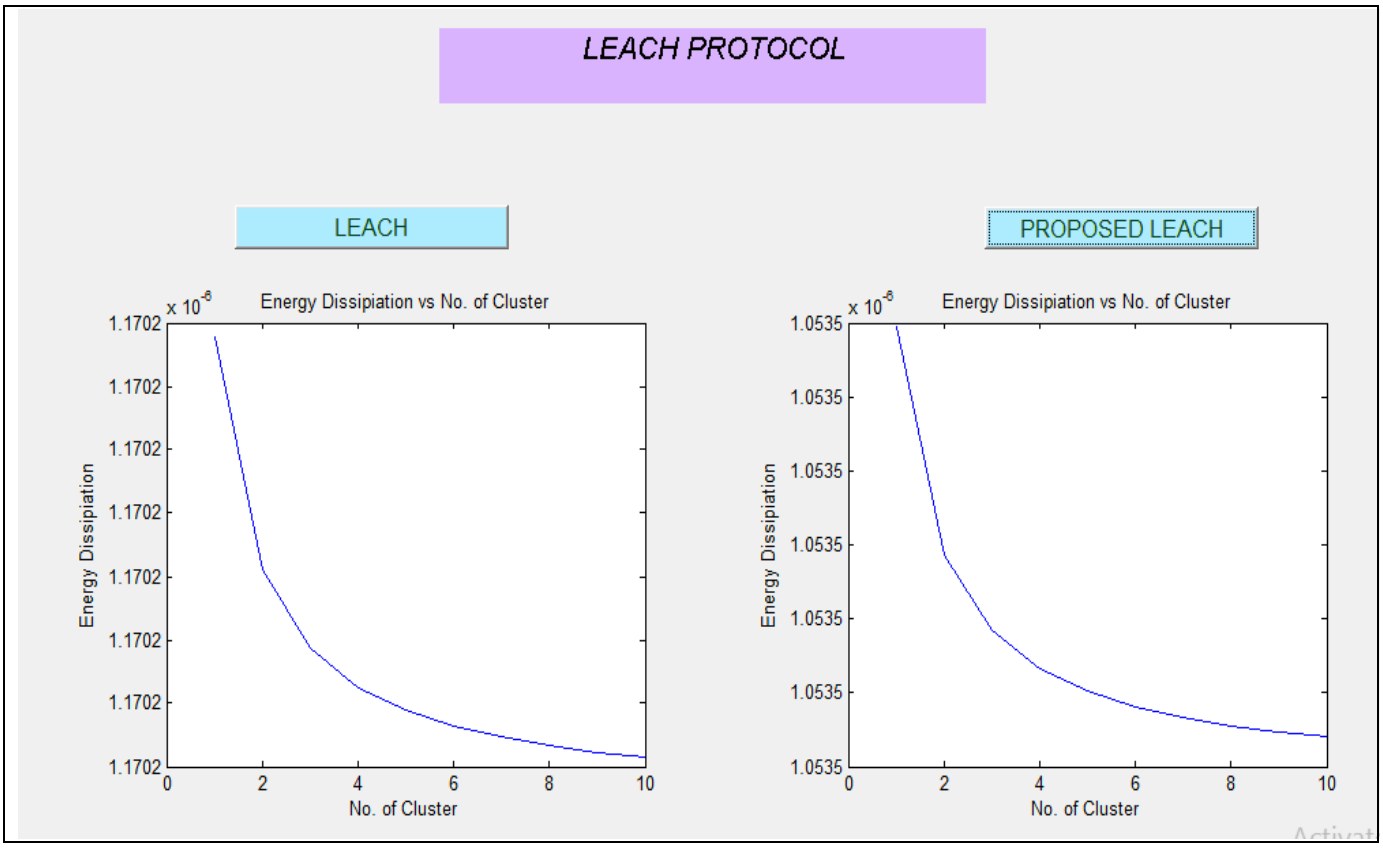

Figure 3: Energy Dissipation of LEACH and proposed LEACH

VI. CONCLUSION

Each clustering contains N_{cls} number of nodes whose value can vary from 1 to q. we have taken q=6 . From a fore mentioned study, we have concluded that -

- Cluster head should be minimum so that power required to transfer data is minimum.
- As we increase the number of cluster, energy of each cluster decreases.
- By reducing the distance between cluster heads we can minimize power of transmission
- The energy dissipation obtained in proposed Leach is less than found in Leach.
- Number of node should be equally divided.

References

[1] Neelam, D. Khosla, "*The Energy Efficient Techniques for Wireless Sensor Network: A Review*", International Journal for Computer Science and Engineering, Vol.4, Issue.11, pp. 36-41, 2016.

[2] AS. Mandloi, V. Choudhary, *"Study of Various Techniques for Data Gathering in WSN*", International Journal of Scientific Research in Network Security and Communication, Vol.1, Issue.3, pp.12-15,2013.

[3] P. K. Batra,K. Kant, "*A Clustering Algorithm with reduced cluster head variations in LEACH rotocol*", international journal of Systems, Control and Communications, Vol.7, Issue.4, pp. 321-336, 2016.

[4] R. Bandaru, RS. Basavala , "*Information Leakage through Social Networking Websites leads to Lack of Privacy and Identity Theft Security Issues*", International Journal of Scientific Research in Computer Science and Engineering, Vol.1, Issue.3, pp.1-7, 2013.

[5] R. Nathiya, S.G. Santhi, "*Energy Efficient Routing with Mobile Collector in Wireless Sensor Networks (WSNs)*", International Journal of Computer Sciences and Engineering, Vol.2, Issue.2, pp.36-43, 2014.

[6] P. Ilango, G.H. Dinesh, S.A. Kumar, "*A Modified LEACH Protocol for Increasing Lifetime of the Wireless Sensor Network*", in Cybernetics and Information Technologies (BAS-Institute of Information and Communication Technologies), India, pp.154-164, 2016.

[7] S. Saini, K. Dayal, "*A Survey on Various Secure Routing Protocolsin Wireless Sensor Networks*", International Journal of Advanced Research in Engineering and Technology, Vol.3, Issue.9, pp. 105-108, 2015.

[8] R. A. Shaikh, Y. Arfat, "*A Survey on Secure Routing Protocols in Wireless Sensor Network*", International Journal For Wireless and Microwave Technologies, Vol.3, pp. 9-19, 2016.

