

# LEACH Protocol for Wireless Sensor Network

Pratibha Sachan<sup>1</sup>, Faseeh Ahmad<sup>2</sup>

<sup>1</sup>M. Tech Student, Department of Electronics & Communication Engineering, Goel Institute of Technology & Management, Lucknow

<sup>2</sup>Assistant Professor, Department of Electronics & Communication Engineering, Goel Institute of Technology & Management, Lucknow

\*\*\*

**ABSTRACT:-** A Wireless Sensor Network (WSN) is a group of cooperative sensor nodes acting together into an environment to monitor an event of interest. The wireless sensor networks (WSN) consists of several autonomous sensor nodes with sensing, processing and wireless communication capabilities. These sensor nodes are distributed spatially to monitor physical and environmental conditions, such as temperature, pressure, humidity, vibration, sound, motion or pollutants and cooperatively send the sensed data to the end user through the network. Here sensor nodes are battery-operated. So energy saving is an important factor in WSN. To develop efficient LEACH, the primary objectives of this paper to develop a simulated environment of WSN having configurable parameters, and to create efficient LEACH (EN-LEACH) from LEACH on MATLAB for optimizing its various parameters.

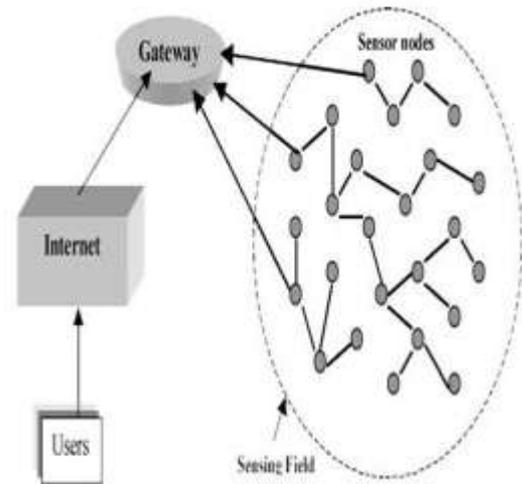


Figure 1: Wireless Sensor Network

**Keywords:** IoT, WSN, LEACH

## 1. INTRODUCTION

Wireless Sensor Networks (WSNs) have been widely considered as one of the most popular technologies for recent years. The constant progress in wireless sensor network technology makes it possible to implement the Wireless Sensor Network (WSN) in a variety of scenarios. WSN consists of thousands of tiny sensor nodes deployed in a physical environment for observation of an event of interest. WSN consists of a potentially large set of devices that are capable of sensing, processing, and communicating physical phenomenon to meet a common application task by some kind of cooperation. The sensors in the locality of an occasion must be able to monitor it and report back to the sink sensor node. A sink sensor node can communicate with the outside world such as laptop, base station etc. A WSN typically has no infrastructure. It consists of many sensor nodes (a few tens to thousands) working together to monitor a region to obtain data about the environment [1].

There are two types of Wireless Sensor Networks: Structured and Unstructured.

An unstructured Wireless Sensor Network (WSN) is one that contains a dense collection of sensor nodes. Sensor nodes may be deployed in a specific manner into the field. In an unstructured Wireless Sensor Network- WSN the network maintenance like managing connectivity and detecting failures is difficult since there are so many nodes. In a structured Wireless Sensor Network (WSN), all the sensor nodes are deployed in a preplanned manner. The advantage of a Structured WSN network is that fewer nodes can be implemented with lower network maintenance and management cost. Some nodes can be deployed since nodes are placed at specific locations to provide coverage while ad hoc deployment can have uncovered regions.

**1.1 LEACH (Low Energy Adaptive Clustering Hierarchical):** It is one of the energy efficient hierarchical routing protocols. This routing protocol uses a clustering method to transmit data to obtain an advantage in the reduction of energy consumption. [5]. In this method whole network is divided into several groups known as cluster and each cluster is ruled by a cluster head which is randomly selected based on the energy level. The other low energy node senses the data from surrounding and transmits it to the cluster head, where it aggregates and communicates it to Base Station.

This method reduces energy consumption as the transmission will only be done by a cluster head rather than all sensor nodes.

## 2. APPROACHES

In Figure 2, a flowchart of LEACH is provided.

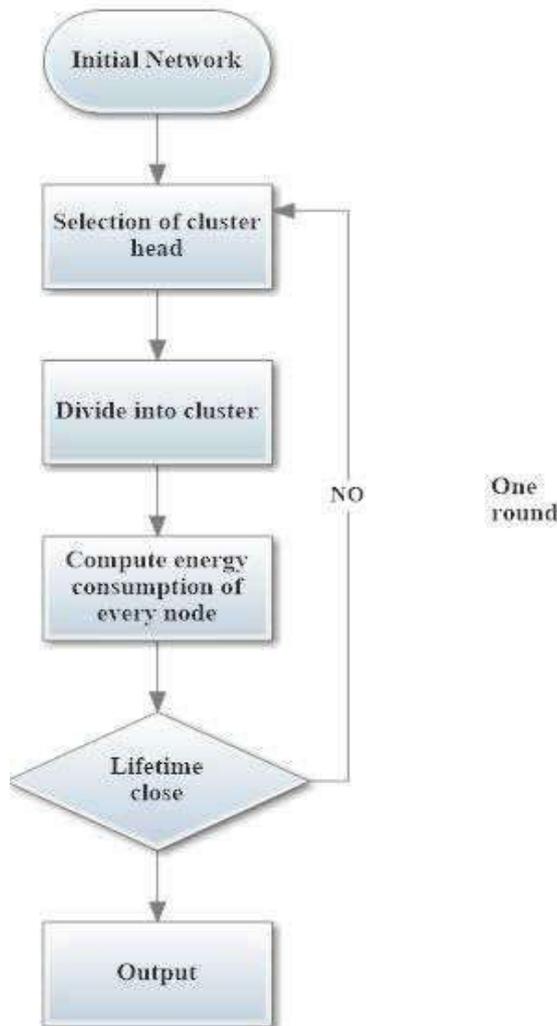


Figure 2: Flow Chart of LEACH

LEACH executes the cluster creation intermittently. Every cluster construction is considered as a round. The LEACH protocol guarantees that every sensor will become a cluster head exactly once every  $1/p$  rounds where  $p$  is a probability of becoming cluster head for each node. Nodes which are selected as cluster heads in the current round cannot become cluster heads in next  $1/p$  rounds. To make a decision for selecting the cluster head, non-elected nodes which belong to set  $G$ , select a random number between 0 and 1, and compare it to their threshold value which is obtained from Equation 1. If the random number is less than the threshold value, the node becomes the cluster head in the current round otherwise node is considered as normal node.

## 3. RESULTS

MATLAB is good simulator for algorithms proposed for WSN. So a study of MATLAB simulation environment is required. We have done performance analysis of our protocol using R2013b simulation environment.

Firstly, Homogeneous and Heterogeneous WSN were created and simulations were obtained for Leach Protocol in both the networks. After considering the assumptions, the simulated environment execution consists nodes describing their energy level as in the following figure '+' describes the nodes having energy = 1, 'o' states the energy level 0 in the network. 'x' represents the sink node in the simulated environment. Then to assess the performance of the protocols, a set of simulation runs were carried out. Further optimal LEACH (EN-LEACH), a variant of LEACH for WSNs was simulated. It represents the improved network lifetime of WSN. The results and analysis conclude that EN-LEACH implemented on MATLAB prolongs the lifetime of the network.

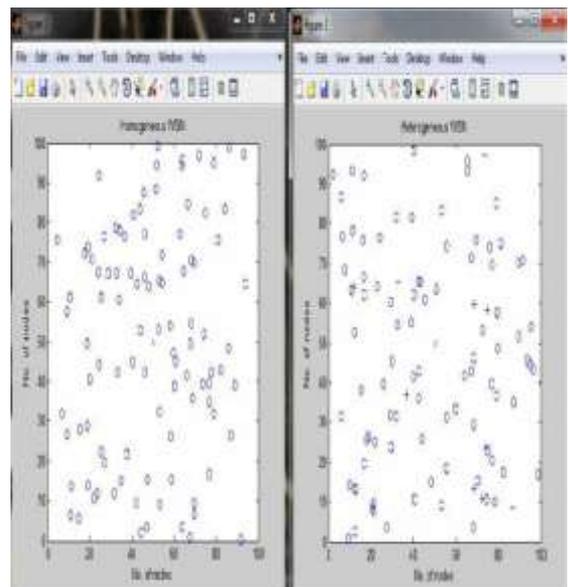


Figure 3: Homogeneous WSN vs. Heterogeneous WSN

Table 6.6: EN-LEACH Lifetime with different set of Energies

Initial Energy(J/Node)	Protocol	Round	
		First node dies	Last node dies
0.25	EN-LEACH	448	778
0.50	EN-LEACH	1004	1556
1.00	EN-LEACH	2041	3201

#### 4. CONCLUSION

We also propose EN-LEACH, a new variant of LEACH that can further be utilized in other clustering routing protocols for better efficiency. EN-LEACH tends to minimize network energy consumption by efficient cluster head replacement after very first round and dual transmitting power levels for intra cluster and cluster head to base station communication. In EN-LEACH, a cluster head will only be replaced when its energy falls below certain threshold minimizing routing load of protocol. Hence, cluster head replacement procedure involves residual energy of cluster head at the start of each round.

#### REFERENCES

- [1] Sunil Kumar Patel and Ravi Kant Kapoor, "A Survey on: Gluster Based Routing Protocols in Wireless Sensor Network", International Journal of Innovative research in Science, Engineering and Technology 3297: 2007 { Vol. 6, Issue June 06, 2017}.
- [2] S. Jabbehdari R. Sheikhpour and A. Khadem-Zadeh, "Comparison of energy efficient clustering protocols in heterogeneous wireless sensor networks", International Journal of Advanced Science and Technology, 36:27{40, November 2011}.
- [3] Prabhat Kumar, M. P. Singh and U. S. Triar, "A Review of Routing protocols in Wireless Sensor Network", International Journal of Engineering, Research and Technology, Vol. 1, Issue June 04, 2012.
- [4] Arifa Anwar and D. Sridharan, "A Survey of Routing Protocols for Wireless sensor networks in various environment", International Journal of Computer Application, Vol. 112- No. 5, Issue Feb. 2015.
- [5] Akramul Azim and Mohammad Mahfuzul Islam, "A Dynamic Round Time based fixed low energy adaptive clustering hierarchy for wireless sensor networks", International Conference on communication, Dec. 15 - 17, 2009.
- [6] Reddy D. L., "A Review Efficiency of Energy clustering and routing in wireless sensor networks", International Journal of Advancements in technology, Jan. 17, 2019.
- [7] G. Ran , H. Zhang , Shulan Gong "Improving on LEACH Protocol of Wireless Sensor Networks Using Fuzzy Logic" Journal of Information & Computational Science 7: 3 (2010) 767-775.
- [8] P.T.V. Bhuvaneshwari, V.Vaidehi, "Enhancement techniques incorporated in LEACH survey", Indian Journal of Science and Technology vol. 2 no. 3 (May 2009), Department of Electronics engineering, Madras institute technology", Anna University Chennai 2009.
- [9] P. Bakaraniya, S. Mehta "K LEACH-An improved leach protocol for lifetime improvement in wireless sensor network" International journal of engineering trends and technology, vol. 4, issue 5, May 2013.
- [10] M. F. Khatoon, M.A. Jamali "Modify LEACH algorithm for wireless sensor network" International journal of computer science issues, Volume 8, issue 5, No 1, Sept 2011.

#### BIOGRAPHIES



My name is Pratibha Sachan. I was originally born in Kanpur and now I'm pursuing my post graduation (M. Tech.) in Electronics and Communication Engineering from GITM, Lucknow affiliated to Dr. A. P. J. Abdul Kalam Technical University, Lucknow. I did my undergrad degree (B. tech) in ECE from Krishna Engineering College, Ghaziabad, Uttar Pradesh.



Mr. Faseeh Ahmad is currently working as Head of Department (Electronics & Communication Engineering) at Goel Institute of Technology & Management, Lucknow. He has approximately 10 years of academic experience in his field. After pursuing his *B.Tech* degree in Electronics & Communication stream, he further enhanced his skills by acquiring *PG Diploma in Embedded Systems Design* from a premier institution C-DAC, Pune. Further he also pursued a *PG Diploma in Wireless Telecommunication* and worked as RF/DT engineer in telecom sector also. Afterwards he pursued his *M.Tech* degree in Electronics & Communication Engineering to serve in academics field in a more skilled & competent way.