

# Performance Analysis of LEACH Protocol in Wireless Sensor Network

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**Abstract:** *Wireless sensor network are formed by small sensor nodes communicating over wireless links without using a fixed network infrastructure. A WSN is a collection of three kinds of nodes: sensor node, relay node and sink node. Each node has a limited processing capability and energy sources and communication is performed via wireless medium. WSN are increasingly used in military surveillance, environmental monitoring, drug identification, education, industrial monitoring. LEACH protocol is one of the clustering routing protocols in wireless sensor networks. LEACH protocol, time is divided into many rounds, in each round. Clustering based Energy efficient LEACH (Low-Energy Adaptive Clustering Hierarchy) protocol can effectively increase WSN performance by dynamically changing cluster head. In this paper surveys working of LEACH protocol, its limitations and advancements done in LEACH to improve its performance.*

**Keyword:** Wireless sensor network (WSN), LEACH, Clustering, Clustering protocol, energy efficiency, reliability, network lifetime, etc.

## 1. Introduction

A wireless sensor network consists of large number of sensor nodes scattered in an environment to collect information concerning the environment. Among the main features of such network are that they do not have fixed station or any wire connection to exchange information and to manage the network. The nodes present in such networks work in cooperation with each other. To have this cooperation and coordination, there must be communication among which send information. Wireless sensor network are challenging networks as resources are limited and different network topologies are possible. In WSN, since sensor is a small, lightweight, untethered, battery-powered device, it has limited energy. Therefore energy consumption is a critical issue in sensor network which affect the network's lifetime. To maximize the network's lifetime, transmit data from normal node to CH (cluster head) and from CH to BS (base station) in sensor networks. The selection of an optimum CH has an effective role in increasing a sensor network's lifetime.

Similarly reliability and traffic overhead is an important issue in WSN. For improving the reliability, we must transmit the data in multiple paths from source node to sink node. Source node is a node which collects data through its sensing devices, finds neighbor nodes and sends message to them. Relay nodes are transit nodes which receive data and forward it to another reachable relay node according to the routing policy of the network with the objective of finally reaching the sink node. Sink node is a high energy communication node, which acts as a base station. It collects all the data from relay node and sends them to a home base station where the data are processed. If we transmit the data in those paths which are unable to reach the destination then it is necessary to retransmit the data increasing overhead. Again if we transmit the same data in different path then the network become overloaded.

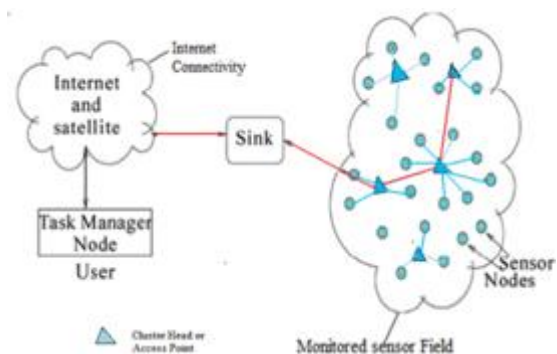


Figure 1: Wireless sensor Network

## 2. Literature Review

The many researchers have been done in field of economic dispatch problem some of the work is described in this paper.

**Muhammad Haneef**, "Multi Group Based LEACH an Energy Efficient Routing Algorithm for Wireless Sensor Network" Done study in this paper, the limited energy resource is the major constraint associated with Wireless Sensor Network. As communication is the major cause of energy depletion in the network so designing of energy efficient routing algorithm is one of the key challenges that need to be address for extending life time of network. In present's energy efficient routing algorithm based upon the frame work of LEACH protocol. A lot of redundant data is available in wireless sensor network due to widely deployed nodes. Redundancy of deployed nodes can be used as an advantage for increasing network life time. Simulation results show that MG-LEACH had outperformed LEACH on the basis of Network life time. Energy constraint is one of the major research topics in proposed MG-LEACH is using same redundant nodes present in the system that locate in the same region for enhancing life time of the whole network. This idea is equally supportive and functional for other energy efficient algorithms discussed in literature. Finding

out the optimal value of “k” in set building phase is very important and our study will also focus it in future [1].

**Yun Li**, in this paper, “Enhancing the Performance of LEACH Protocol in Wireless Sensor Networks”, LEACH protocol is one of the clustering routing protocols in wireless sensor networks. In LEACH protocol, time is divided into many rounds, and in each round, all the nodes contend to be cluster head according to a predefined criterion. In this paper focuses on how to set the time length of each round, prolong the lifetime of the network and increase throughput, in which is denoted as the amount of data packs sent to the sink node. These functions can be used to enhance the performance of cluster-based wireless sensor networks (WSN) in terms of lifetime and throughput output. The LEACH is a well-known routing protocol for cluster based wireless sensor networks (WSN). This paper analyses the performance of LEACH-based wireless sensor networks in terms of lifetime and throughput. In the reasonable number of frames in a LEACH round is deduced to prolong the lifetime and increase the throughput [2].

**Mortaza Fahimi Khaton Abad**, “Modify LEACH Algorithm for Wireless Sensor Network”, this paper, in research on wireless sensor networks has recently received much attention as they offer an advantage of monitoring various kinds of environment by sensing physical phenomenon. In prolonged network lifetime, scalability, and load balancing are important requirement for many sensor network applications. The clustering sensor nodes are an effective technique for achieving these goals. In this work, introduce an energy efficient clustering algorithm for sensor networks based on the LEACH protocol. The LEACH (Low Energy Adaptive Clustering Hierarchy) is one of popular cluster-based structures. LEACH uses a TDMA based MAC protocol, in order to maintain balanced energy consumption. Tin the proposed protocol adds feature to LEACH to reduce the consumption of the network resource in each round. In the proposed protocol is simulated and the results show a significant reduction in network energy consumption compared to LEACH [3].

**Abdul Sattar Malik**, this research paper proposes, a clustering is an efficient techniques used to achieve the specific performance requirements of large scale wireless sensor networks. In this paper have carried out the performance analysis of cluster-based wireless sensor networks for different communication patterns formed due to application constraints based upon LEACH protocol, in which is among the most popular clustering protocols proposed for these types of networks. On the other hand the time during which all the nodes within the EF are dead remains approximately the same for different values of E/S and hence after this time even though there are still many nodes which are alive, but since all these nodes are located outside the EF, so they dissipate all of their remaining energy in idle listening whenever they take the role to act as CH. For continuous communication model, in observed that for smaller values of role of CH the number of nodes alive over time does not follow the sharp edge effect, in indicating unbalanced energy consumption among sensor nodes. In this highlights the need for a generalized, standardized & adaptive clustering technique that can increase the network

lifetime by further balancing the energy consumption among sensor nodes. Simulation results Based upon this protocol identify some important factors that induce unbalanced energy consumption among sensor nodes and hence affect the network lifetime. In this highlights the need for an adaptive clustering protocol that can increase the network lifetime by further balancing the energy consumption among sensor nodes [4].

### 3. Observation

The nodes and time steps (rounds) is the major parameter on which the performance of different methods has been evaluated. The various results of different paper are summarized and different methods. Muhammad Haneef, in this paper are discussed algorithms with parameters values  $n = 300$ ,  $p = 0.1$ . The MG-LEACH method ( rounds 1800) and LEACH (rounds 1000) time stamps (Rounds). MG-LEACH performs significantly better than LEACH. Mortaza Fahimi Khaton Abad, “Modify LEACH Algorithm for Wireless Sensor Network”, this paper, in research on wireless sensor networks. The performe of LEACH method, compare total energy to no. of rounds.

### 4. Conclusion

The various papers and literature has been studied for LEACH. The comparisons of the methods have been given in the form of observation. The Low-Energy Adaptive Clustering Hierarchy (LEACH) and MG-LEACH perform better in the recognition but required higher computation time. In future, the wireless sensor network (WSN) with various other feature extraction techniques may be useful.

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