# LEACH Protocol for Gathering The Data in Wireless Network by using EE-LEACH Protocol

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**ABSTRACT**

*A wireless sensor network (WSN) consists of a huge number of sensor nodes that are inadequate in energy, storage and processing power. One of the major tasks of the sensor nodes is the collection of data and forwarding the gathered data to the base station (BS). Hence, the network lifetime becomes the major criteria for effective design of the data gathering schemes in WSN. In this paper, an energy-efficient LEACH (EE-LEACH) Protocol for data gathering is introduced. It offers an energy-efficient routing in WSN based on the effective data ensemble and optimal clustering. In this system, a cluster head is elected for each clusters to minimize the energy dissipation of the sensor nodes and to optimize the resource utilization. The energy-efficient routing can be obtained by nodes which have the maximum residual energy. Hence, the highest residual energy nodes are selected to forward the data to BS. It helps to provide better packet delivery ratio with lesser energy utilization. The experimental results shows that the proposed EE-LEACH yields better performance than the existing energy-balanced routing protocol (EBRP) and LEACH Protocol in terms of better packet delivery ratio, lesser end-to-end delay and energy consumption. It is obviously proves that the proposed EE-LEACH can improve the network lifetime.*

**Keywords:** Clustering; Cluster head; Energy-efficient routing; Low energy adaptive clustering hierarchy (LEACH);Wireless sensor networks

## INTRODUCTION:

A wireless sensor network (WSN) consists of a large number of small-sensor nodes used to monitor areas, collect and report data to the base station (BS). Due to the accomplishment in low-power digital circuit and wireless transmission, most of the applications of WSN are implemented and used in military applications, object tracking, habitat monitoring. A typical WSN is com- posed of a huge number of sensor nodes, which are randomly disseminated over the network. The signals are picked by all types of sensors and the data acquiring unit, processing and transmitting them into a node called *sink node*. The sink node requests for the sensor information by forwarding a query throughout the net- work. When the node discovers the data matching the query, the response message is routed back to the sink node. The energy conservation of the network can be minimized by allowing the porting of the nodes called cluster heads. The data gathered from the nodes are aggregated and compressed by the cluster heads. After that, the aggregated data is forwarded to the BS, but it has some problems. The major problem is energy consumption and it is concentrated on the cluster heads. In order to resolve this issue, the cluster routing is used to distribute the energy consumption with the cluster heads. Data gathering is an efficient method for conserving energy in sensor networks. The major purpose of data gathering is to remove the redundant data and save transmission energy . A data-gathering algorithm includes some aggregation methods to minimize the data traffic. It reduces the number of message exchange among the nodes and BS. The performance of data gathering in WSN can be characterized based on the rate at which the sensing information can be gathered and transmitted to the BS (or sink node). In particular, the speculative measure to capture the demerits of

collection processing in WSN is the capacity for many-to-one data collection. Data-gathering capacity reflects how efficient the sink can gather sensing data from all sensors under the presence of interference. Performing the data-gathering function over CH still causes significant energy wastage. In case of homogenous sensor networks, CH will soon die and re-clustering needs to be initiated. It causes higher energy consumption.
An energy-efficient LEACH Protocol is introduced. The proposed method focuses on defining an energy-efficient routing based on low energy adaptive clustering hierarchy (LEACH) clustering and optimal cluster head (CH) selection. The Gaussian distribution model is incorporated for the node deployment. The data are forwarded from the different sources to the BS based on the energy-efficient routing strategy. The rest of the work is organized as follows. Section 2 presents a basic task of the WSN is to effectively collect the data with lesser resource consumption. Most of the data- gathering algorithms are aimed to minimize the energy consumption problem.
LEACH is a hierarchical protocol, in which the node details are handled by CHs. The CHs gather the data and compress them and forward to the base station (sink). Every node uses the stochastic algorithm to find out the CH. Figure 1 shows the architecture of the standard LEACH Protocol. During the setup phase, each node creates a random number between 0 and 1. If the random number is smaller than the threshold value, then the node becomes a CH for the present round.
A sensor node is selected as the CH-using distributed probabilistic approach, whereas the non- cluster nodes calculate which cluster to join based on the signal strength. This approach assures lower message overhead, but cannot assure that CHs are uniformly distributed over the network. The entire network is divided into clusters and load imbalance among the CHs may lead to minimum network lifetime. It is assumed that all nodes are isomorphic and all nodes have similar amount of energy capacity in each election round. Such a supposition is impractical in most application circumstances. Hence, LEACH should be enhanced to report for node heterogeneity.

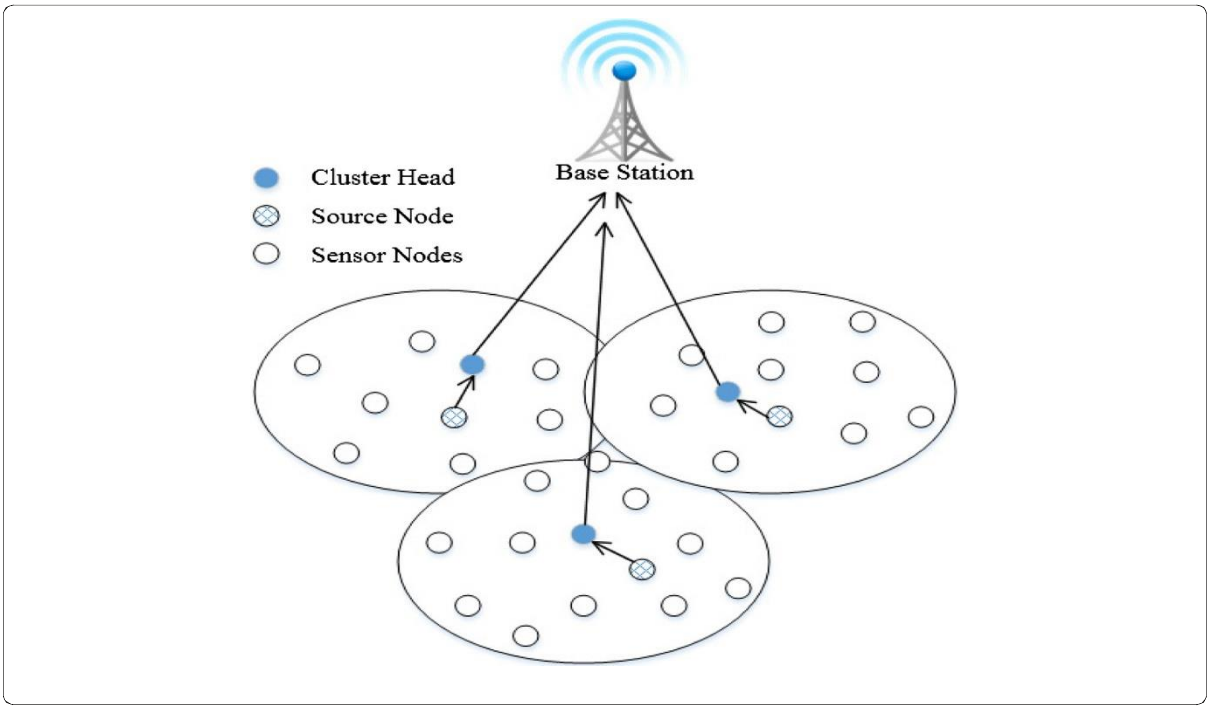


**Figure 1: Schematic structure of the LEACH Protocol**

LEACH involves source nodes to send data to CHs directly. However, if the CH is extremely far away from the source nodes, they might expend excessive energy in data transmission. Further, LEACH requires CHs to transfer their aggregated data to the sink node over a single-hop link. Nevertheless, single-hop transmission may be quite costly when the sink appears far away from the CHs. LEACH also holds an assumption that all sensor nodes have sufficient power to reach the sink node if necessary, which might be resistant for energy- constrained sensor nodes.

**RELATED WORK:**

- **EE-LEACH: energy-efficient LEACH Protocol:**

An efficient-energy-aware routing protocol is mandatory for data gathering. All the sensor nodes have similar significance and equal capabilities. This motivates the need for improving the lifetime of the sensor nodes and sensor net- work. The objective of the proposed EE-LEACH Protocol is to reduce the energy consumption and increase the net- work longevity. Here, Gaussian distribution model is used for effective coverage of the sensing network area. Also, conditional probability theorem is used for node aggrega- tion. The flow of the EE-LEACH Protocol is depicted in Figure 2.

**Topology Construction:**

Consider a sensor network of *N* nodes and base station *BS* is distributed over an area. The position of the sensor nodes and the base station are known beforehand. Let us consider a network in 2D plane with *N* nodes and it is deployed on the sensing field by 2D Gaussian distribution. It is described as: Where, $(m_i,n_i)$ denotes the deployment point, $\sigma_m$ and $\sigma_n$ are the standard deviation for *m* and *n* .

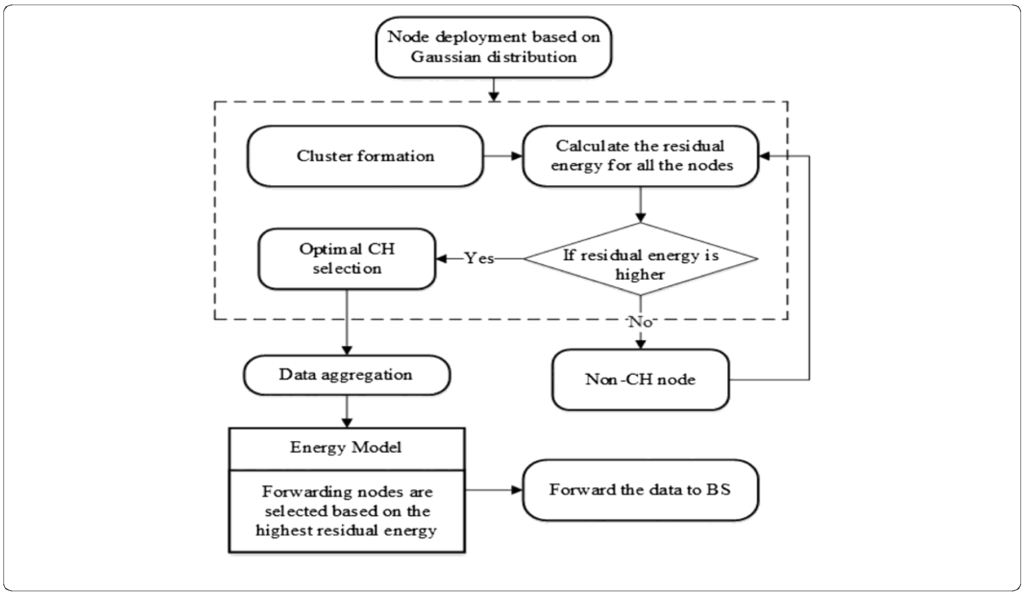


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**Figure 2: Flow of the proposed EE-LEACH Protocol.**

➢ **Optimal cluster formulation**

The formation of clusters in sensor networks highly depends on the time taken to receive the neighbor node message and the residual energy. The protocol is divided into rounds, and each round is triggered to find out the optimal CH.

**PROPOSED ALGORITHM:**

The clusters are formed based on EE-LEACH: energy-efficient LEACH Protocol by the following steps:

**Step 1:** neighbour information retrieval

The neighbour node information are sensed by broadcast- ing the beacon messages throughout the network

**Step 2:** perform sorting algorithm

The sorting algorithm is performed to retrieve the list of all neighbor nodes about its hop distance. The list is sorted into descending order.

**Step 3:** candidate for cluster

When its two- hop neighbor node is not enclosed, analyze all the members of stage 2 one-by-one and crown any one two-hop neighbor for being as a candidate for the cluster.

**CH selection:**

The computations are based on the following simplifications: assume that the intra cluster transmission stage is long. Hence all the data nodes can forward the data to their CH and inter cluster transmission is long enough; hence, all CH having data can forward their data to the BS. The CH needs to perform the data aggregation and compression before forwarding the data to the BS. The optimal probability of a sensor node is elected as a CH based on the function of spatial density. The clustering approach is optimal in the sense that overall energy utilization is minimum. Such optimal clustering is greatly dependent on the energy model.

The selection of CH nodes in the sensor networks can provide the following three benefits.

1.The average energy utilization for transmitting the data from the sensor node to the S will be much lesser than the energy utilized for homogenous networks.
2.Improving reliability of data forwarding - It is generally known that the links tend to be low reliability. Each hop significantly minimizes the packet delivery rate.

**RESULT AND SIMULATION:**

Figure 3 depicts the relationship between the variance of energy with the varying simulation time for EE- LEACH with the existing EBRP and LEACH Protocols. The result shows that the proposed system lesser variance than the existing protocol.
Figure 4 shows the result for average energy utilization of the two protocols. It is visually proven that the average energy utilization is lesser than the existing EBRP and LEACH Protocols. End-to-end delay is the total amount of time the system takes to aggregate the data from the source to BS.
Figure 5 shows the end-to-end delay between the EE- LEACH with EBRP and LEACH Protocols. It shows that the proposed protocol takes lesser time to aggregate and forward the data to BS than the exiting EBRP and LEACH Protocols.

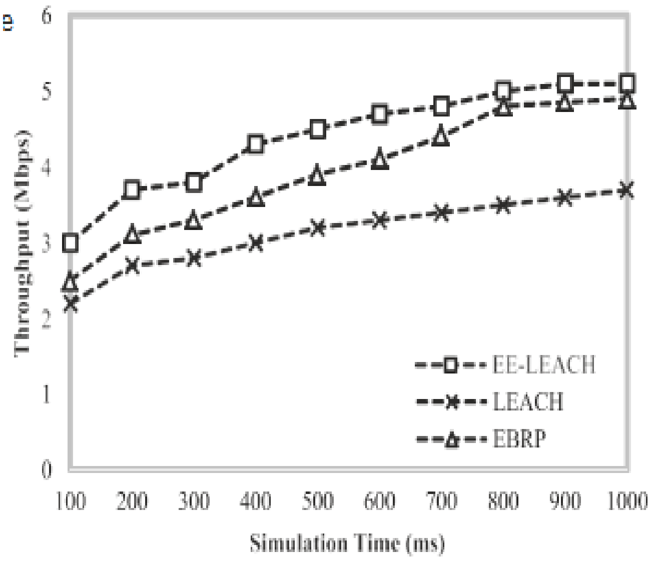


**Figure 3: Shows the relationship between the variance of energy with simulation time**

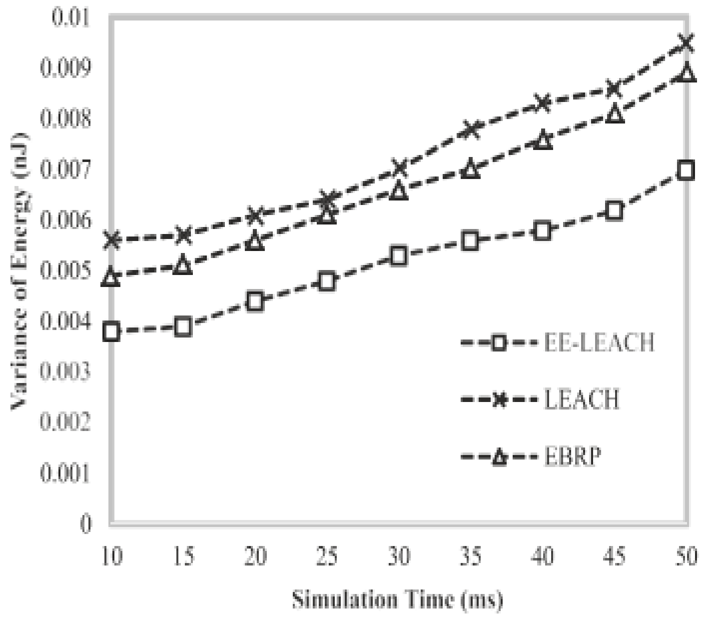


**Figure 4: Shows the result for average energy utilization of the two protocols**

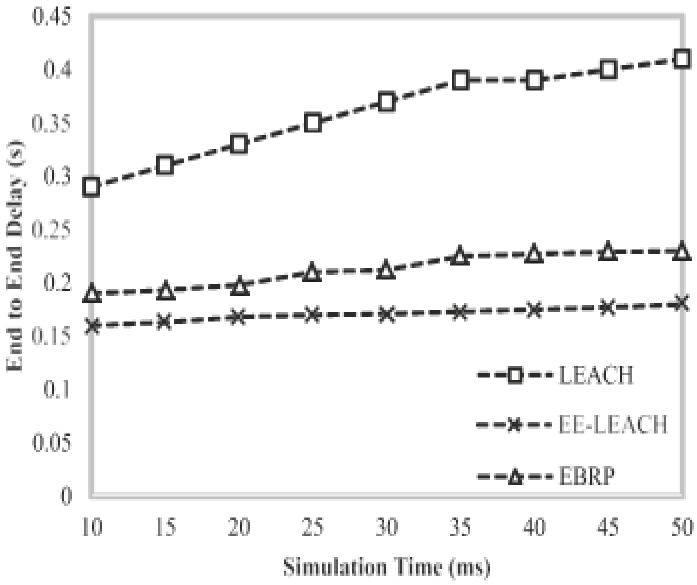


**Figure 5 : Shows the end-to-end delay between the EE- LEACH with EBRP and LEACH Protocols**

## CONCLUSION:

In this work, an energy-efficient LEACH Protocol is presented to improve the lifetime of the sensor network. The coverage probability is derived with respect to the Gaussian distribution. A sorting algorithm based on the residual energy of the neighbour nodes is executed to ob tain the list of neighbour nodes. Data ensemble also takes place while aggregating the nodes. In this only focuses on reducing the energy consumption. But it lacks to provide the confidentiality and integrity of data. We extend this work with the security concepts, which analyses the traffic flow among the sensor nodes. Hence, in the future, the proposed EE- LEACH Protocol is integrated with the security mechnisms to protect the network from security attacks.

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