Abstract
One of the important issues in wireless sensor network is the inherent limited battery power within network sensor nodes. Minimizing energy dissipation and maximizing network lifetime are important issues in the design of sensor networks. LEACH (low-energy adaptive clustering hierarchy) is well-known because it is simple and efficient. LEACH divides the whole network into several clusters, and the run time of network is broken into many rounds. In each round, the nodes in a cluster contend to be cluster head according to a predefined criterion. However, since CHs consume more energy in aggregating and routing data, it is important to have an energy-efficient mechanism for CHs’ election and rotation. Our proposed algorithm for cluster head selection is based on max residual energy, minimum distance, and minimum energy. The main purpose of this paper is to develop a mechanism to increase the lifetime of homogeneous sensor nodes controlling long distance communication, node balancing and efficient delivery of information.

Keywords
Wireless Network, Life Time, Leach, Cluster, Energy

I. Introduction
Wireless sensor network is a class of wireless Ad-Hoc networks in which sensor nodes collects process and communicate data acquired from the physical environment [2]. They are distributed event-based systems that differ from traditional communication networks in several ways: sensor networks have severe energy constraints, redundant low-rate data, and many-to-one flows. Wireless sensor network can be looked as an event-based system with one “sink” subscribing to specific data streams by expressing interest and queries. The remaining sensors act as “sources” to report environmental events to the subscriber sink [1]. A simple classification of Wireless sensor networks based on their mode of functioning and the type of target application is given below.

A. Proactive Networks
The nodes in this sort of network periodically switch on their sensors and transmitters, sense the environment and transmit the data of interest. Hence, they collect the data for the relevant parameters at regular intervals. They are well suited for applications requiring periodic data monitoring. Some known instances or protocols of this kind are the LEACH (Low Energy Adaptive Clustering Hierarchy) protocol [17], some improvements on LEACH such as [23-24] and PEGASIS (Power-efficient gathering in sensor information systems) [22].

B. Reactive Networks
The nodes of the networks according to this scheme react immediately to sudden and drastic changes in the value of a sensed attribute. They are well suited for time critical applications. Typical instances of this sort of networks are [16,18].

C. Hybrid Networks
The nodes in such a network not only react to time-critical situations, but also give an overall picture of the network at periodic intervals in a very energy efficient manner. Such a network enables the user to request past, present and future data from the network in the form of historical, one-time and persistent queries respectively. Such kind of network takes advantages of Proactive and Reactive networks. Some instances of this kind of networks are [19-21].

D. Clustering
It is a process in which the network is divided in to clusters and deploying each cluster, a cluster-heads to perform data aggregation. The job of these cluster-heads is aggregating the data received from the sensors and transmitting them to the BS. In most scenarios, they do not perform any sensing. LEACH [5], PEGASIS[5] and ESPDA [5] are some of the routing protocols that uses the concept of clustering. Figure 1 shows the hierarchal clustered network [6], that contain one base station and 3 clusters.

A clustered sensor network could also be classified as
- Single hop Model
- Multi hop Model

![Hierarchal Clustered Network](image)
Cluster Based Routing Protocols

In this every cluster has a cluster head which aggregate sensed data from non-CH nodes and then send to base station. The goal of hierarchical routing is to manage the energy consumption of WSN efficiently by establishing multi hop communication within a particular cluster. The following are the protocols which uses hierarchical network model:

- Low Energy-adaptive clustering hierarchy (LEACH) [26]
- Power-efficient gathering in sensor information systems (PEGASIS) [22]
- Threshold-sensitive energy-efficient sensor network protocol (TEEN) [16]
- Adaptive threshold-sensitive energy-efficient sensor network protocol (APTEEN) [19]

II. LEACH

The LEACH routing protocol is developed by Dr. Wendi Rahnir Heinzelman in 2002. LEACH [17] uses a periodic distributed clustering function to balance energy costs throughout the network. Time is divided into rounds, and every sensor has a certain chance of self-electing itself as a cluster head.

LEACH is a clustering-based protocol that includes the following features:

- Randomized, adaptive, self-configuring cluster formation,
- Localized control for data transfers,
- Low-energy media access, and
- Application-specific data processing, such as data aggregation.

Low Energy Adaptive Clustering Hierarchy (LEACH) is the first hierarchical cluster-based routing protocol for wireless sensor network which partitions the nodes into clusters, in each cluster a dedicated node with extra privileges called Cluster Head (CH) is responsible for creating and manipulating a TDMA (Time division multiple access) schedule and sending aggregated data from nodes to the BS where these data is needed using CDMA (Code division multiple access). Remaining nodes are cluster members [17, 23, 27].

Fig. 2: LEACH Protocol Phases

This protocol is divided into rounds and each round consists of two phases. Fig. 2, represent the LEACH protocol phase.

A. Set-up Phase

1. Advertisement Phase
2. Cluster Set-up Phase

B. Steady Phase

1. Schedule Creation
2. Data Transmission

A. Setup Phase

In the advertisement phase, the Cluster-heads inform their neighborhood with an advertisement packet that they become Cluster-heads. Non-cluster-head nodes pick the advertisement packet with the strongest received signal strength.

In the next cluster setup phase, the member nodes inform the Cluster Head that they become a member to that cluster with “join packet” contains their IDs using CSMA. After the cluster-setup sub phase, the Cluster-Head knows the number of member nodes and their IDs. Based on all messages received within the cluster, the Cluster-Head creates a TDMA schedule, pick a CSMA code randomly, and broadcast the TDMA table to cluster members. After that steady-state phase begins. [17, 23, 27]

B. Steady State Phase

In this phase data transmission begins. Nodes send their data during their allocated TDMA slot to the Cluster-Head. This transmission uses a minimal amount of energy (chosen based on the received strength of the Cluster-Head advertisement). The radio of each non-Cluster-Head node can be turned off until the nodes allocated TDMA slot, thus minimizing energy dissipation in these nodes. When all the data has been received, the Cluster-Head aggregate these data and send it to the BS [27].

C. Disadvantages of LEACH Protocol

LEACH is able to perform local aggregation of data in each cluster to reduce the amount of data that transmitted to the base station. Although LEACH protocol acts in a good manner, it suffers from many drawbacks such like:

- Cluster-Head selection is randomly, that does not take into account energy consumption.
- It can’t cover a large area.
- Cluster-Heads are not uniformly distributed; where Cluster-Heads can be located at the edges of the cluster.
- While the distributed algorithm for determining cluster-head nodes ensures that the expected number of clusters per round is k, it does not guarantee that there are k clusters at each round.
- The set-up protocol does not guarantee that nodes are evenly distributed among the cluster-head nodes. Therefore, the number of nodes per cluster is highly variable in LEACH and the amount of data each node can send to the cluster-head varies depending on the number of nodes in the cluster.

D. LEACH – C

LEACH offers no guarantee about the placement and/or number of cluster heads. In [23], an enhancement over the LEACH protocol was proposed. The protocol, called LEACH-C, uses a centralized clustering algorithm and the same steady-state phase as LEACH. LEACH-C protocol can produce better performance by dispersing the cluster heads throughout the network [17, 23].

During the set-up phase of LEACH-C, each node sends information about its current location (using GPS) and residual energy level to the sink. In addition to determining good clusters, the sink needs to ensure that the energy load is evenly distributed among all the nodes. To do this, sink computes the average node energy, and determines which nodes have energy below this average. Once the cluster heads and associated clusters are found, the sink broadcasts a message that obtains the cluster head ID for each node. If a cluster head ID matches its own ID, the node is a cluster head; otherwise the node determines its TDMA slot for data transmission and goes sleep until its time to transmit data. The steady-state phase of LEACH-C is identical to that of the LEACH protocol [17, 23].
III. Research Methodology
Two ideas of LEACH protocol improvement are given. Details of improvement are as follows:
1. The criterion of selecting cluster head node LEACH protocol randomly selects cluster head at each round. Therefore, some nodes may exhaust energy too quickly due to being selected as cluster head many times. In this thesis, our modified protocol makes the nodes with more residual energy, less distance, less energy have more chance as cluster head and this will prevent the whole network to die too early.
2. Multi-hop communication among cluster heads. Cluster heads directly communicate with sink in LEACH protocol. The energy consumption between cluster head and sink are greater than energy consumption among cluster heads, so the cluster head will exhaust energy soon. Multi-hop communication can avoid the whole network from dying quickly and prolong the network lifetime by balancing the energy consumption among the network.

IV. Implementation and Results
The proposed work is the enhancement of some existing protocol in wireless sensor network in respect to the increased time. We are using the leach protocol as the base protocol. The first work is to implement the leach protocol. Till now we have worked on the same. We have implemented the leach protocol in Matlab.

Fig. 4: Improved Network Life Time
From the fig. 4, we can see that death of first node in our protocol is always at later rounds than in LEACH. In our proposed protocol

A. Proposed Algorithm
Parameters:
E-initial = initial energy of nodes
E-Transmission = energy consumed during transmission
E-remaining = E-initial - E-transmission
T-life = life time of node.

Remaining life time of node = (E-remaining/E-initial) * T-Life
T-s = sending time-stamp of last data packet
T-R = receiving time-stamp of last data packet at base station

LEACH has two phases: the set-up and steady-state. In the set-up phase, the cluster-heads are chosen “stochastically”, which is randomly based on an algorithm. A threshold is determined based on this algorithm.
1. The first round will be same as normal leach round.
2. In the 2nd round, clusterhead selection is done on the basis of minimum distance, maximum residual energy, and minimum distance.
3. Formation of cluster :-calculate the distance between the cluster head and the sensor node which have shortest distance that node join that cluster.
4. Now CH receives data from Non-CH nodes and aggregates them. And send to the BS. if the distance between the CH and the BS is more than here we used multi-hopping concept, acc to this if the distance between the CH and the BS is more than one CH send data to the other CH which is more closer to the BS.
5. Now energy dissipated is calculated and subtracted from the remaining energy of every node and if some nodes are having energy less than minimum than those nodes are deleted from the network and the life time close and we get the output. Hence this round will be completed.
6. Otherwise, it repeated from the STEP 2 to STEP 5
the first node died around 1350 rounds while in leach IST node dies around 969. For any protocol it is necessary that the death of first node should be extended as much as possible so that network should be connected and provide the required information to the End user.

V. Conclusion
In this paper, we have discussed the Low Energy Adaptive Clustering Hierarchy (LEACH) protocol which is the first and the most important protocol in wireless sensor network which uses Stochastic Threshold Algorithm for the selection of the CH. After LEACH protocol implementations, then we proposed a new version of LEACH protocol in which cluster head chosen criteria is on the basis of minimum distance, maximum residual energy, minimum energy. Then we have put light on the comparison of LEACH protocol with the proposed LEACH. From the experimental results, we conclude that in the proposed protocol, the death of first node is extended in terms of rounds as compared to leach and the difference between death of first node and the last node indicates that the energy dissipation of the network is also evenly distributed in the proposed protocol. The life time of the network is also increased comparatively.

VI. Future Work
Concept of PEAGSIS and I-LEACH can be combined together to make a new better performing protocol for WSNs. Concept of Chain formation from PEAGSIS protocol and concept of residual energy and certainty of CHs formation of I-LEACH protocol if can be implemented together will perform far better and can be implemented in WSNs and instead of first order radio model different Propagation models can also be tested on these protocols to evaluate the performance of these protocols in urban and semi-urban environment.

References
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