

Performance Improvement in Lifetime and Energy of LEACH Protocol

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Abstract: One of the limitations of sensor nodes (WSN) is the limited energy of nodes. To maximize the lifetime of the sensor node and the network, it is preferable to distribute the energy throughout the network by this it minimize the maintenance and maximize overall network performance. To investigate the mechanism to conserve and balance the energy consumption in wireless sensor network, energy minimization due to the path loss in wireless sensor network. Many techniques have been proposed for fault detection, fault tolerance and repair in sensor networks. Cluster-based algorithm is the way to performs failure detection and energy consumed significantly low energy, it improvise energy and balance the energy consumption in wireless sensor network, but it has some limitation. Here it is suggest redefining the existing LEACH algorithm in such a way it will reduce the energy consumption during the transmission and also compare with existing algorithm.

I. INTRODUCTION

In wireless Sensor Network Sensors are capable of monitoring a wide variety of ambient conditions such as temperature, pressure, and motion. Because sensors are powered by batteries, the issue of sensors' energy-efficiency is a main concern and it is a most challenging task for the design of wireless sensor network. Speedily development of embedded computing, wireless communication and micro-sensors gives rise to the wireless sensor network (WSN) in which a lot of low-cost micro-sensors are self-organized sensor through wireless links. A node in the network is no longer useful when its battery dies. The fundamental objectives for WSN are ease of deployment, accuracy, flexibility, cost effectiveness, and, reliability. In wireless sensor network (WSN), the majority energy of nodes is used for data transmission and aggregation. Balance this energy consumption and network lifetime have to choose the good Routing algorithm, so a good routing algorithm must balance the energy consumption of nodes to extend the network life time. Many Routing protocols and algorithms for energy-efficiency have been proposed. The cluster-based hierarchical model is better than the one-hop or multi-hop model, so hierarchical based Routing protocol is better than the Multipath Routing Protocol in case of energy saving. One of the best Hierarchical protocols is Low Energy Adaptive Clustering Hierarchy (LEACH).

The main function of LEACH is that the cluster members (CN) elect cluster head (CH) to avoid excessive energy consumption. But still LEACH have some deficiencies such as 1) cluster member nodes exhaust energy after cluster head was dead.; 2) unreasonable CH selection while the nodes have different energy; 3) some are very big clusters and some are very small clusters in the network at the same time

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due to no limitation for the number of members in the cluster means clusters are not balanced. By structure of LEACH, we propose a Redefine algorithm.

II. LEACH Protocol Description

LEACH (Low Energy Adaptive Clustering Hierarchy) is a hierarchical-based routing protocol. LEACH is a self adaptive and self organized. All the nodes in a network organize themselves into local clusters, with one node acting as the cluster-head (CH) and others are normal nodes. In this two level are form 1st level is Base station (BS), and 2nd is Cluster Head level S(CH). Random rotation taken by nodes required to be the cluster-heads (CH) to evenly distribute energy consumption in the network. Then the cluster head aggregates and compresses the information received from all the nodes present in the network and sends it to the base station (BS). Therefore, being a cluster-head (CH) node is much more energy-intensive than being a non-cluster-head node in the network.

If cluster-head node dies all the nodes that belong to the cluster lose communication ability, so Cluster Head play the important role in network. LEACH incorporates randomized rotation by this function avoid draining the battery of any one sensor in the network. Cluster-head node knows all the cluster members, CH create a TDMA schedule that tells each node exactly when to transmit its data to Cluster Head, using a TDMA schedule for data transfer prevents intra-cluster collisions in the network. LEACH divided into rounds and each round consists of two phases.

Set-up Phase

Advertisement Phase

(2)Cluster Set-up Phase

Steady Phase

(1) Schedule Creation

(2) Data Transmission

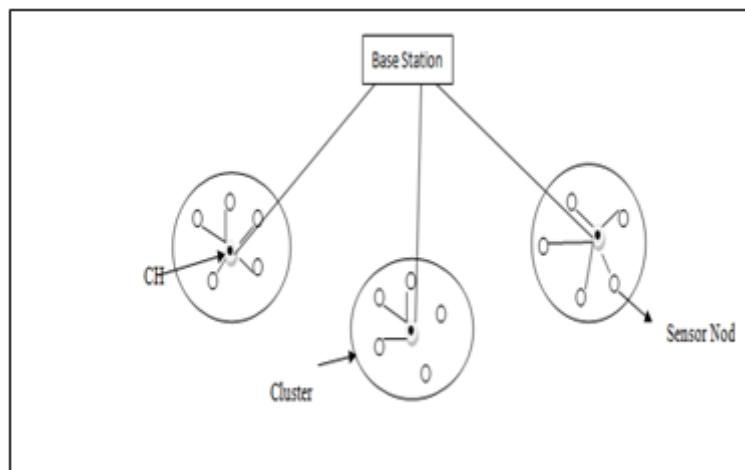


Fig.1. Cluster Formation in LEACH.

Set-up Phase

During this setup phase, all messages received within the cluster, the CH creates a TDMA schedule, pick a CSMA code randomly, and broadcast the TDMA table to cluster members every node wanting to be the cluster-head chooses a value, between 0 and 1, if number is less than a threshold $T(n)$, the node become a cluster head for the current round. The threshold $T(n)$ value depends upon the desired percentage to

become a CH - p , the current round r , and the set of nodes that have not become the cluster-head in the last $1/p$ rounds. Elected CH broadcasts an advertisement message to the rest of the nodes in the network to invite them to join their CH, non-cluster head nodes decide to join the CH Based upon the strength of the advertisement signal.

Steady Phase

All cluster-head (CH) waits to receive data from all nodes in its cluster network and then sends the aggregated data or compressed data result back to a Base Station (BS).

The related work of Hierarchical routing summarize in below table. LEACH inspired many Hierarchical routing protocol such as TEEN (Threshold sensitive energy efficient network protocol), PEGASIS (Power efficient gathering in sensor information system) HEED (Hybrid energy efficient distributed clustering).

Table.1. Below table shows the clustering technique in different type of LEACH

ALGORITHM	CLUSTERING SYSTEM
LEACH	Random probabilistic clustering.
LEACH-F	Clustering with fixed number of clusters.
LEACH-C	Concertize algorithm clustering algorithm to produce better cluster
APTEEN	New TDMA schedule is introduce to avoid collision of close by nodes which fall in same cluster. These nodes sense similar data and try to send their data simultaneously.
TEEN	Total number of transmission is reducing by allowing the nodes to transmit only when the sensed value is less then Threshold value.
PEGASIS	Each node communicates with close neighbor and takes turn in transmitting to the base station, it reduce the amount of energy spent per round.

III. Proposed Methodology

In the proposed methodology an attempt to enhance the energy efficiency is done with initially assuming that all nodes have the same energy and they are static. In this improved methodology of LEACH we take two CHs as compare to older LEACH. At first round find the Primary CH1 from the cluster's sensor node same process do choosing cluster head like earlier in LEACH. Now the same process is follow for choosing secondary CH2, after the selection of two cluster head, primary CH1 is ON mode and secondary CH2 is on sleep mode. Putting CH2 on sleep mode because it saves energy. Primary CH1 do all process done by earlier LEACH after the selection of CH. After the data transmission done by primary

CH1 send all data information of all nodes to secondary CH2. Now the secondary CH2 take the place of CH1 and does all .

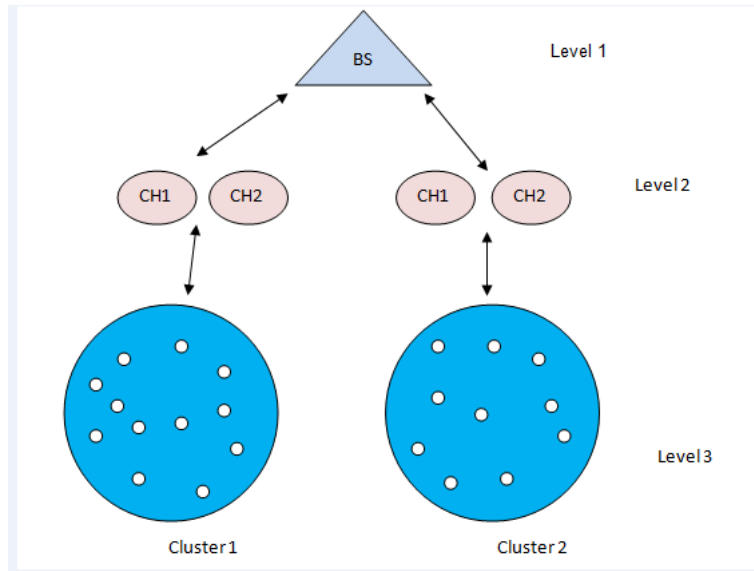


Fig.2.LEACH with two CHs Below improved LEACH algorithm with two CH

Setup Phase

Assumptions: All nodes are static and the initial energy of all the nodes is same

- 1) $CN \Rightarrow r$
- 2) If $r < T(n)$, then primary $CH = CN$ else, go to step1
- 3) For secondary CH, if $r < T(n)$, then secondary $CH = CN$ else, goto step1
- 4) Primary $CH \Rightarrow G: id(CH), join_adv$
- 5) Secondary CH sleep mode ON
- 6) $A(i) \rightarrow Primary\ CH(j): id(A(i)), id(Primary\ CH(j)), join_req$
- 7) Primary $CH(j) \rightarrow A(i): id(Primary\ CH(j)), \langle t(i), id(A(i)) \rangle$
- 8) After data transmission by Primary CH, now Secondary CH sleep mode OFF, Primary CH transfer all node id data information to Secondary CH
- 9) Secondary CH follow step 6,7
- 10) Primary CH goto step1 for finding new CH.

Steady Phase

- 1) $A(i) \rightarrow Primary\ CH(j): id(A(i), id(CH1(j)), info$
- 2) Primary $CH \rightarrow BS: id(CH), id(BS), aggr_info$
- 3) Primary CH sleep mode ON
- 4) Secondary CH follow same step 1,2

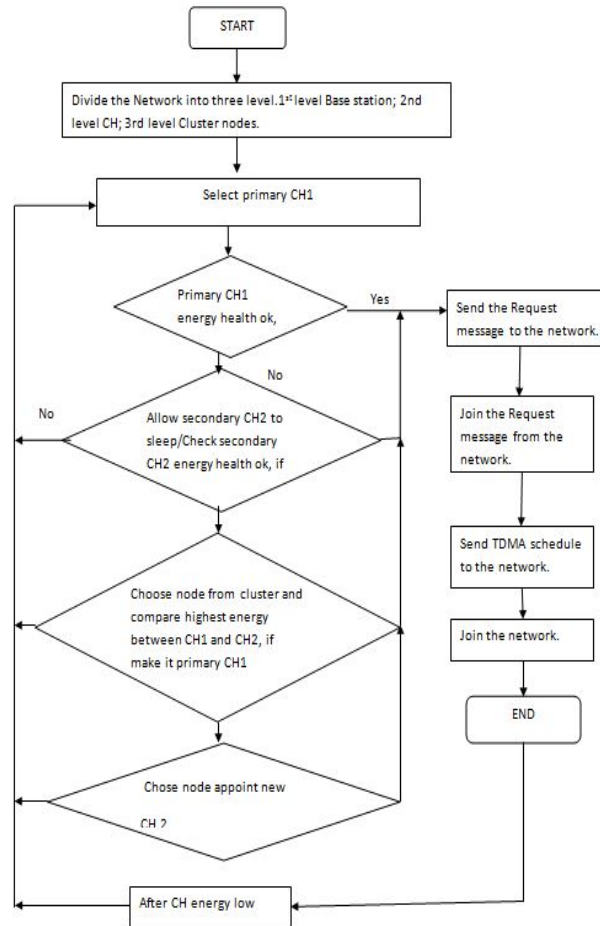


Fig.3.flow chart of Improved LEACH

IV. CONSLUSION

Based on the hierarchical routing principle of LEACH algorithm, a second new cluster head forming mechanism and data transmission mode is proposed. CHs are uniformly distributed over the network. It is expecting to that the proposed clustering approach of CH is more energy efficient and continuous data transfer just like LEACH. We propose an extension of LEACH protocol adding two CH to the respect of LEACH that considers in second level level of the network. Different types of LEACH protocol commonly use in wireless sensor network we observed that most of them facing problem of network lifetime. So we propose new techniques of energy efficient LEACH protocol for WSN. We will use NS2 (Network Simulator) platform for simulation & performance analysis for this project. We expect the result comes with reduce the overload from CH and increases lifetime

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