Stage improvement of a lifeless node in Wireless sensor network

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Abstract—Energy ability in data selection and communication is constantly an essential aspect in wireless sensor networks (WSN). Thus, reducing energy diversion and expanding network lifespan are key aspects in the design of routing protocols for WSNs. In this paper, represent enhance form of Low Energy Adaptive Clustering Hierarchy (LEACH) protocols, which intent to lessen energy utilization within wireless sensor network and extend the lifespan of network. This protocol forms clusters of the sensor nodes and select one of them to become a Cluster Head (CH) to transmit data cluster to sink. To further DBEA-LEACH (distance-based energy aware) choose a cluster head not only based on range, but also by study enduring energy of the node greater than the average enduring energy level of nodes in the network. For stage improvement of a lifeless node reveal that changes made selection process of a cluster head improves the network ability. The process is to vary the cluster head selection probability along with the threshold level .In this paper, we will present LEACH comportments after a node dies, then we will propose some ideas to invest it.

Keywords— Network Clustering; routing protocol; LEACH; WSN; Node improvement; Lifetime; DBEA-LEACH.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) have gained booming interest in recent years. They are used in various fields: military, agriculture, meteorology and medicine. Wireless Sensor Network consists of a huge number of nodes called sensor nodes. They are deployed in a spacious area. A typical sensor node is made of 4 building blocks: power unit, communication unit, processing unit and sensing unit.Limited network life is one of the most critical inconvenience and limitations of WSNs. It's arduous to recharge or to change batteries in the battery-powered sensor nodes. That is the reason why many researchers have been incorporated to increase the network life time.[1]

LEACH (Low Energy Adaptive Clustered Hierarchy) as the name suggests optimize the limited capacity of battery to Prolong network lifetime and improving quality of service. In wireless sensor network (WSN), a large number of low power sensor nodes jointly gather information from their surroundingenvironments and transmit them towards the Base Station[2].The clustered WSN compromises three types of entities: the base station, cluster head sensor node and non-cluster head sensors.This is done by adopting different strategies for selecting the cluster heads, their threshold values andmonitoring different parameters like the energy level and distance between them.

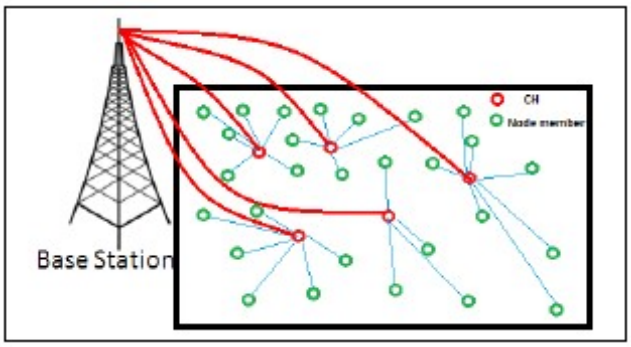

Fig 1 Wireless sensor network

In standard protocols with every round the energy of nodes decays until the node dies. In some protocols nodes directly transmit the data to the base station and the energy consumed by nodes is larger because larger transmission power is required to transmit the data to base station. The nodes which are farthest will die earlier because of larger transmission distance. Several Protocols have been designed to make the network efficient. One of the most common protocol used to make the network efficient is based on clustering [3]. In this method sensors are divided into clusters and each sensor node sends data to central clustering head and the clustering head forwards it to a central cluster Head. Cluster Head Forwards the processed data to the Base Station [4].

In WSN Clusters are created and a cluster head (CH) is assigned to each cluster. These Cluster heads are also known as Master Nodes. Cluster Heads are responsible for collecting and processing the data from their respective clusters, and transmitting this data to the BS. In data processing the power consumption is larger than in data transmission. The aggregation of data at CHs greatly reduces the energy consumption in the network by minimizing the total data messages to be transmitted to the BS. Also, the CHs act as local sinks for the data, so that data are transmitted over a shorter transmission distance [5].The process of cluster formation consists of two phases, cluster-head election and assignment of nodes to cluster-heads. The cluster-head needs to coordinate all transmissions within the cluster, so also it handles the inter-cluster traffic, delivers the packets destined for the cluster, etc. [6-7].

II. RELATED WORK

LEACH protocol is a basic hierarchical protocol for the WSN. It's made up of nodes cluster. Each cluster has a special node as cluster head. This latter collects data from nodes that belong to the respective cluster and transmits it to the base station [1][2].

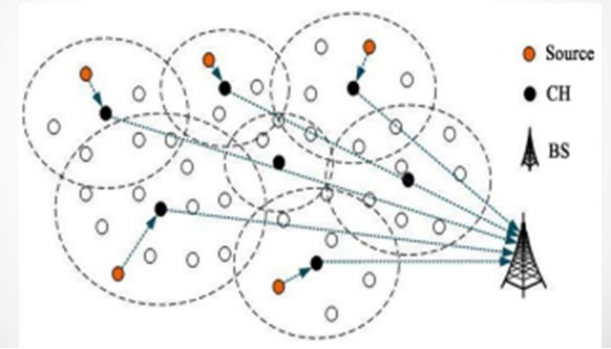

Fig 2 Leach diagram

LEACH protocol has two phases, the set up phase and the steady state phase. In set up phase, the clusters are formed and the cluster heads are chosen. Each node decides if it will become a cluster head. The decision is made by the node selecting a stochastic number between 0 and 1. If the number is less than a threshold T(n), the node becomes a cluster head for the current round [1].

The threshold is set as.

$$T(n) = \begin{cases} \dfrac{p}{1 - p * [r \bmod \left(\frac{1}{p}\right)]} \end{cases}$$

- p is the probability of needed being selected as a cluster head node.
- r is the number of rounds passed .
- G is the collection of ordinary nodes mod denotes modulo operator.

In the steady state phase the cluster head is maintained and the data is transmitted between nodes. The cluster head sends all the data to the base station after receiving and aggregating it. Each cluster communicates using the TDMA technique, which divides time of communication by duration, each time duration corresponds to a node of the cluster that can deliver data in their time slot. A node is free only when a node is out of area or dead. A protocol was proposed named LEACH (low energy adaptive clustering hierarchy) based on distributed clustering. Each cluster consists of CH which collects data from it neighboring nodes and transmits toward the base station [7] [8]. New cluster head will be formed on the basis of probability and residual energy of nodes. Here energy dissipated in transmission ETX (l) to transmit a l bit message is given by

$$E_{Tx}(1, d) = E_{Tx-elec}(1) + E_{TX-amp}(1, d) = 1 * E_{elec} + 1 \in_{amp} * d^2$$

and the receiver energy ERX (l) to receive a l bit message is given by

$$E_{RX}(1) = E_{RX-elec}(1) = 1 * E_{elec}$$

For Cluster head the energy requirement is generally higher as energy is also required to aggregate data received from all nodes in a cluster.

III. METHODOLOGY

A new approach using LEACH is proposed which focus on lifetime maximization as well as on Quality of Service (Qos). The performance of WSN depends upon many parameters but lifetime maximization is important aspect of any network. In proposed method for improving lifetime an Qos, two parameters are chosen i.e. node died time Enhancement and cluster head selection probability using DB-LEACH.

In this protocol the selection process for Cluster head node is morelikely to be selected as a cluster head if the distance of it from the BS is nearly equal to the average distance of the network sensor nodes to the BS. In CH nodes selection phase of DBLEACH algorithm, each SN generates a random numberbetween 0 and 1. [5] Then the random number is compared with improved threshold obtained from equationThe threshold is reset to the value it as follows:

$$T(n) = \begin{cases} c \times \dfrac{|d_{toBSavg} - d(i,BS)|}{d_{toBSavg}} & , \text{if } n \in G \\ 0 \end{cases}$$

$$d_{toBSavg} = \frac{\sum_1^N d(i,BS)}{N}$$

The below figure shows that before and after formation of cluster and how cluster head helps to improves the quality of service and maximization of lifetime of wireless sensor network[5]. Fig 4, shows how cluster head select and how send the data to the base station.

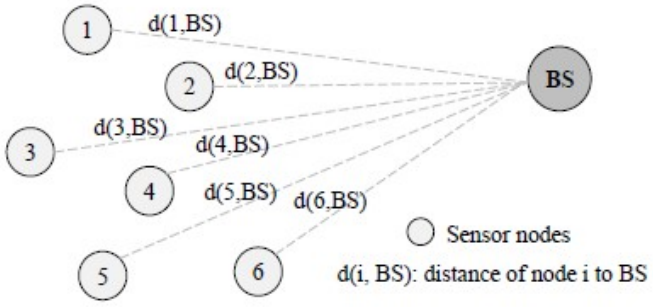

Fig 3 Example of before the formation of cluster

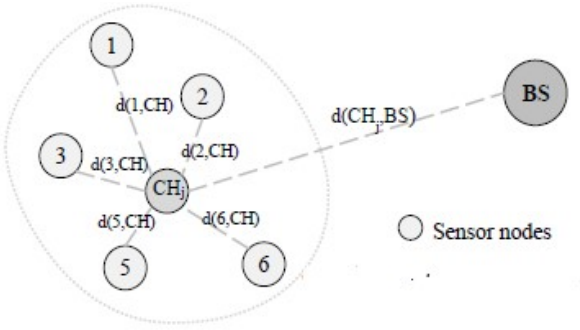

Fig 4 Example of after the formation of cluster

In below figure 6, there exist two paths from Node to sink i.e. Path1 = (Node-CH1, CH1-Sink) and Path2=(Node-CH2,CH2-Sink). Here, length of Path1 is greater than length of Path2 i.e. (D1+D2) > (D3+D4) where D1<D3. According to LEACH, node joins the closest cluster head CH1 even though resultant distance (D1+D2) > (D3+D4). To extend network lifetime and to solve this extra transmission problem, the proposed algorithm considers distance of node from the first cluster head plus distance of cluster head from sink vs. distance of node from the second cluster head plus distance of that cluster head from sink while cluster formation. By considering same example, if a Node joins cluster- head CH2 instead of cluster-head CH1 even though CH1 is closer to Node then extra transmission can be minimized, as (D3+D4) < (D1+D2), as shown in figure 6.[6]

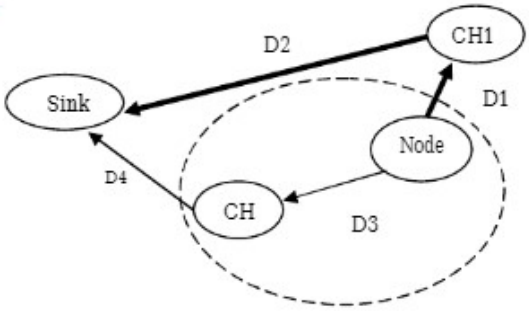

Fig 6 showing how extra transmission can be minimized

The Flow chart of Priority LEACH is shown in Figure 5. Subsequently first round of transmission, the level of energy of Cluster Head is compared with the energy of remaining nodes in the cluster. Selecting the higher energy node as new CH, if energy of current CH is higher, the same cluster head will carry on the operation otherwise new cluster head will be formed.[3]

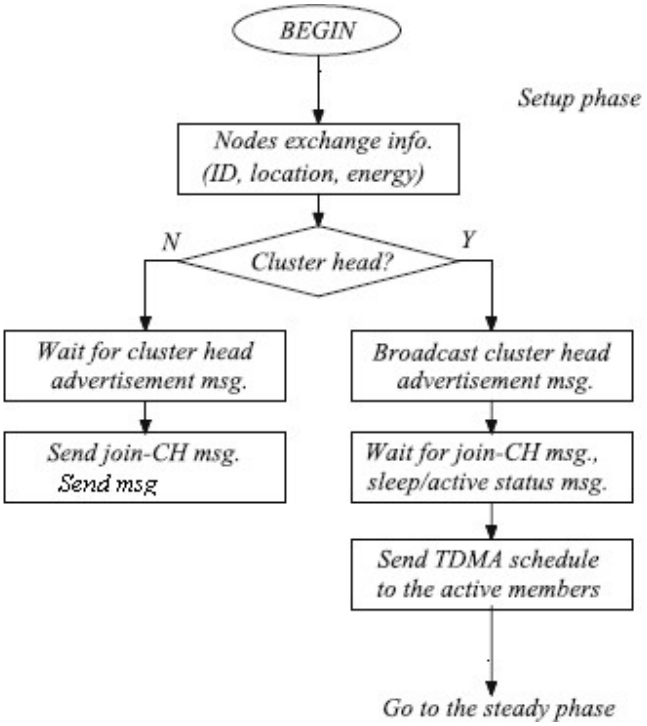

Fig 5 Flow chart of proposed modified LEACH

In simulation a wireless network of 150 nodes was deployed in an area of 100m x 100m dimension. It is assumed that there are k numbers of clusters in the network. At startup the cluster heads are selected on energy basis only. Table-1 enlists all parameters of the simulation carried out. The other parameters are probability for cluster head selections and threshold for cluster head selection.

Table 1: Simulation parameters

Parameter	Value
Number of nodes N	150
Number of cluster	k
Rounds (r)	5000
Network size M*M	150m*150m
Node Deploy Region	x(0,100) y(0,100)
Base station location	x=50, y = 175
Length of data message l	2000 bit
Radio electronics energy Eelec	50 nJ/bit

Random deployment of 100 nodes and position of base station is shown in figure-2. The network was made tocomplete 5000 rounds and after the completion of rounds results are analyzed.

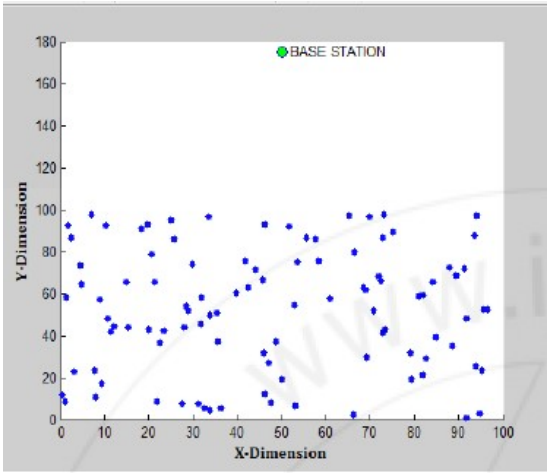

Fig 7WSN establishment

IV. RESULT

Wireless sensor network in real word are of heterogeneous nature. In order to achieve close relation between real networks and simulations random placement of node is done. A comparison is then made between standard LEACH and proposed LEACH protocol. The graph generated form simulation with probability 0.1 and 0.01 of cluster head selection for LEACH and proposed LEACH is shown in figure-3. Here length of the message is taken as 4000 bit. The DEAD NODE time is increase as shown in graph.

The benefit of introducing these ideal algorithms is to show the upper bound on Performance at the cost of an astronomical prohibitive synchronization costs. We compare the algorithms in terms of system lifetime, power dissipation distribution, cost of synchronization, and simplicity of the algorithm.

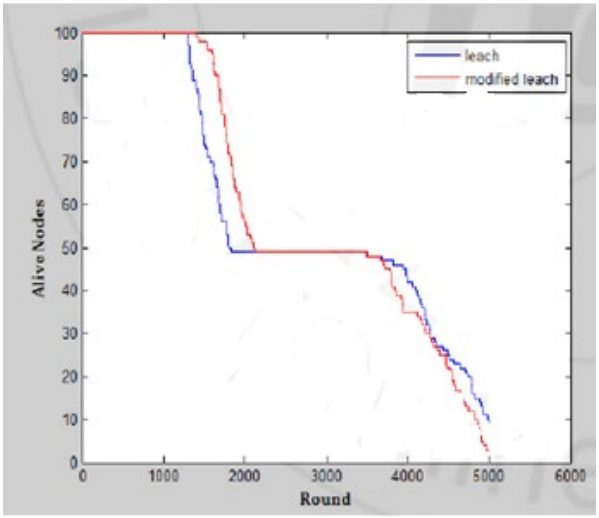

Fig 8Nodes alive vs rounds

Implementing the network with a message length of 2000bit shows an improvement in overall performance of the network. node died time and overall network life is improved in this case. The results are shown in figure-

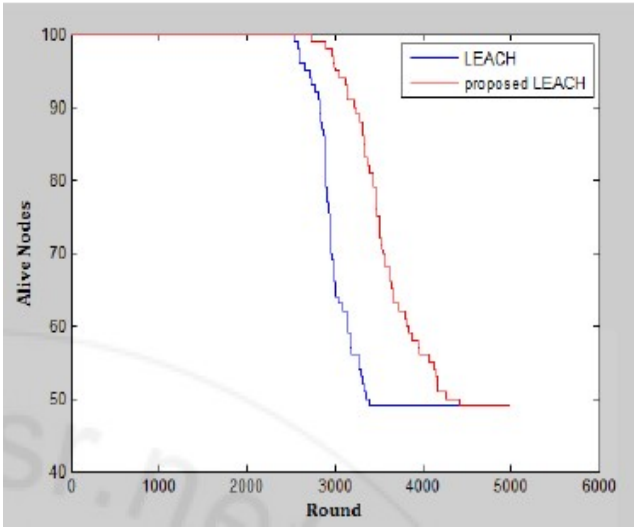

Fig 9 Nodes alive vs round

V. CONCLUSION

Although our proposals can achieve performance improvements, still many aspects of its design need to be investigated using heterogeneous scenarios and constraints As quality of service aware mechanisms, encoding and compression techniques, multi-levels transmissions, and complex clustering modelsimplementing the proposed modified LEACH algorithms shows improvement in network lifetime. It is observed that this algorithm can be optimized for cluster head selection probability function and threshold level for new cluster head selection. Further it is also noticeable that if nature of message is changed the effectiveness of the network can be improved. This protocol proposed is much suitable in cases where the reliability of data is important. As efforts are made to prolong the DEAD NODE time other nodes also remain alive for considerable longer time. This improves the data integrity.

VI. REMARKS

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