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TO ENHANCE THE PERFORMANCE OF LEACH PROTOCOL IN WIRELESS SENSOR NETWORK

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ABSTRACT

Wireless sensor network (WSNs) are formed by small sensor nodes communicating over wireless links without using a fixed network. In the present work we try to enhance the performance of Low Energy Adaptive Clustering Hierarchy(LEACH) technique in WSN. In this paper we have taken the deployed redundant nodes in to account which cover major fraction of energy depletion in the network. We presents threshold compression concept for better results to increase lifespan of the network in WSN. The simulation results based leach method identifies some important factors that induce unbalanced energy consumption among sensor nodes and hence affect the network lifetime.

KEYWORDS: Wireless sensor network (WSN), LEACH, Clustering, energy efficiency, reliability, network lifetime.

INTRODUCTION

The wireless network has become a common choice for any data communication because of simplicity of installation of network. The IEEE 802.11 is a simple example of the use of WLAN (Wireless Local Area Network). This system is now available in the daily life of the person. At similar time the industrial plant has also used the wireless network for monitoring the various parameter and control the process. The various sensor nodes are connected to sink and sink may be connect over local PC or remote PC over internet for monitoring the experimental area. A wireless sensor network in its simplest form can be defined as a network of devices which are denoted as nodes that can sense the environment and communicate the information gathered from the monitored field through wireless channel or link. The data is forwarded, possibly via multiple hops relaying, to a sink that can use it locally, or connected to other networks (e.g., the Internet).figure 1shows the data communication for WSN.

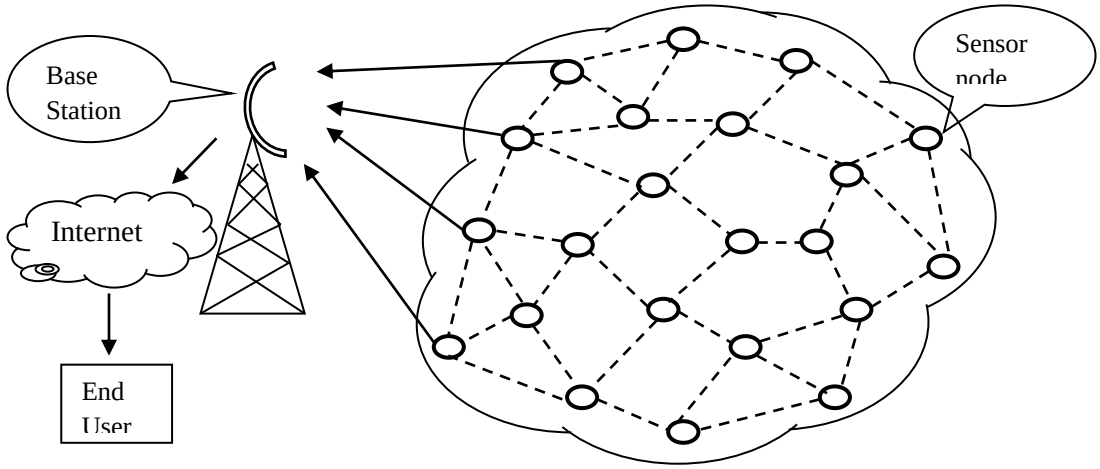

Fig: 1 Wireless Sensor Network (WSN)

Similarly reliability and traffic overhead is an important issue in WSN. For improving the reliability, 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, in 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. The sink node is a high energy communication node, which acts as a base station. 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.

CLUSTERING IN WIRELESS SENSOR NETWORK

For the purpose of balancing the load and prolonging the network's lifetime, and clustering has proven to be an effective approach for organizing the network into a connected hierarchy. The clustering is the method by which sensor nodes in a network organize themselves into groups. Each group or cluster has a leader referred to as cluster head and other member nodes. Member nodes are only allowed to communicate with their respective cluster head. The CH nodes aggregate the data and transit them to the base station (BS) either directly or through the intermediate communicating with other CH nodes. However, because the CH nodes send all the time data to higher distance than the member nodes, they spend energy at higher rates. A solution in order to balance the energy consumption among all the network nodes is to periodically re-elect new CHs in each cluster.

The BS is the data processing point for the data received from the sensor nodes and where the data is accessed by the end user. It is generally considered fixed and at a far distance from the sensor nodes. In some way, CH is the sink for cluster nodes and the BS is the sink for the CHs. The following structure formed between the sensor nodes, sink node and BS.

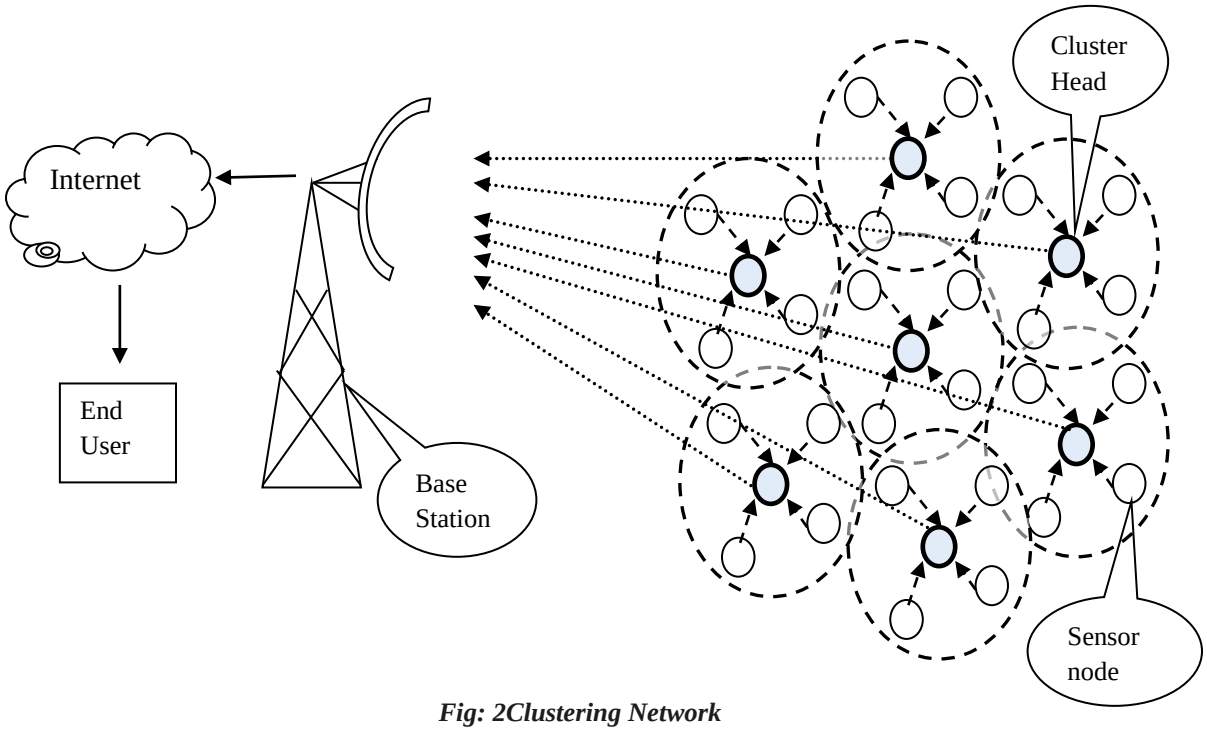

Fig: 2Clustering Network

LOW ENERGY ADAPTIVE CLUSTERING HIERARCHY (LEACH)

LEACH Protocol is a typical representative of hierarchical routing protocols. It is self adaptive and self-organized. LEACH protocol uses round as unit, each round is made up of cluster set-up stage and steady-state stage, for the

purpose of reducing unnecessary energy costs, the steadystate stage must be much longer than the set-up stage. The process of it is shown in Figure 1.

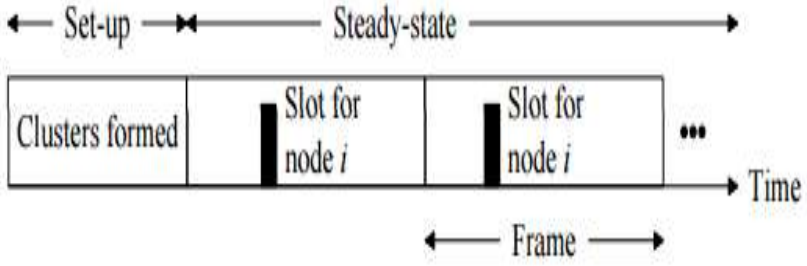

Fig. 3 LEACH Protocol process

LEACH adopts the randomized rotation of CHs to save battery of individual nodes. In this way LEACH maximizes the lifetime of the network and also reduces the energy dissipation by compressing the data before sending it to the BS. Operation of LEACH protocol is based on rounds, where each round consists of two phases. These are setup phase and steady state phase. In setup phase CHs and clusters are created. All node are managed into multiple clusters. Some node elects them as the CHs without consideration with the other nodes.CH nodes elects themselves on behalf suggested percentage P and their previous record as a CH. All nodes which are not cluster heads in the previous 1/p rounds, generates a random number between 0 and 1 and if that value is less than the threshold T(n) then this node becomes CH. Threshold value is set as following formula:

$$T(n) = \begin{cases} \frac{P}{1-P(r \bmod \frac{1}{P})} & \text{ifn} \in G \\ 0 & \text{otherwise} \end{cases}$$

Where G is the set of the nodes that have not been selected as CHs in previous 1/p rounds, P is the suggested percentage of CHs, r is the current round. If a node has become CH in the current round then it will become CH after next 1/p rounds. Now each selected CHs broadcast their status by using CSMA/CA protocol. Non-cluster head nodes select their CHs by comparing Received Signal Strength Indication (RSSI) of multiple CHs from which advertisement came. The sensor nodes send the join-request message along with the CHs IDs to which they want to join. After the clusters are formed, CHs sends TDMA schedule to their respective cluster members.

LEACH reduces energy dissipation with the help of following features:

- Reducing number of data transmission by performing data aggregation before sending it to BS.
- Reducing the number of direct transmission to base station by using CHs.
- LEACH increases the lifetime of the nodes by randomized rotation of CHs.
- LEACH makes WSNs scalable and robust.

RESULTS AND DISCUSSION

The result of simulation shows that the nodes are live upto 239 rounds and maximum of 71 CH were elected in between the life span of 239 rounds of WSN. In order to improve the lifespan of network the selection criterion of CH is modified. As shown in figure 05, when the threshold is zero for the selection criteria of CH the life span is 239 rounds. The figure shows that if the threshold is set at 0.22 then the life span of network is maximized up to 297 rounds and maximum of 45 CH were elected in life span of 297 rounds of WSN . In this way the threshold criterion is modified to improve the lifetime of network.

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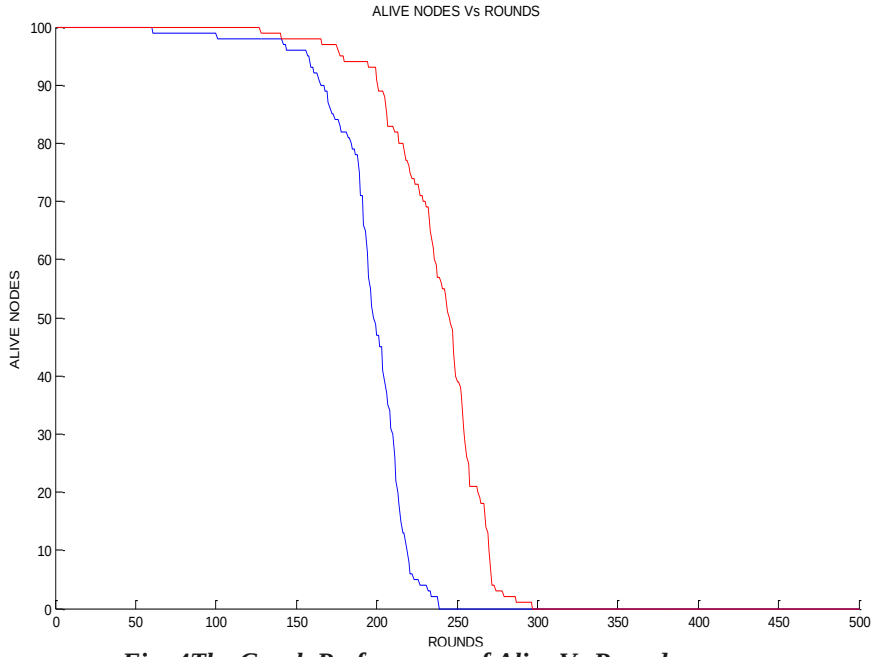

Fig: 4The Graph Performance of Alive Vs Round

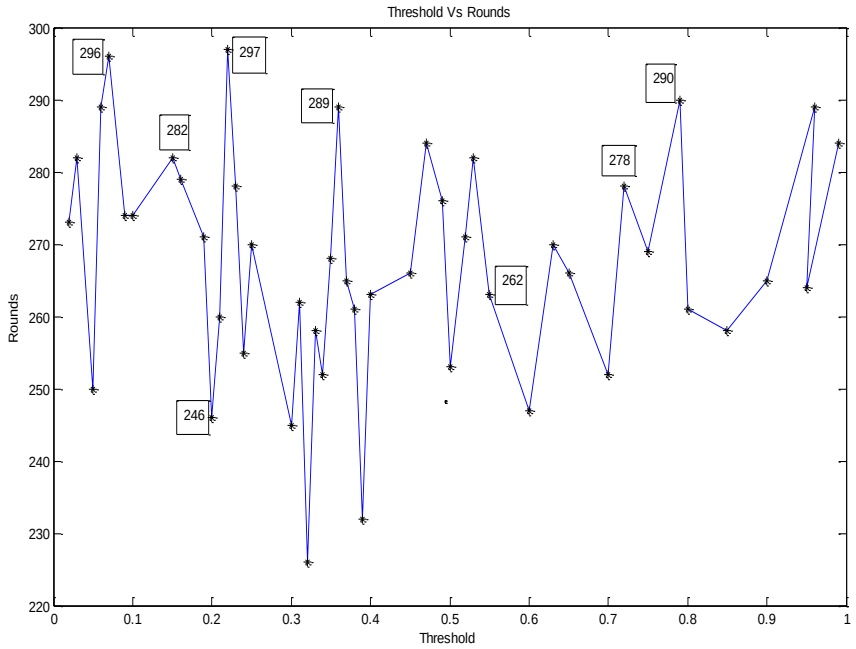

Fig: 5The Graph Performance of Threshold Vs Round

CONCLUSION

In results as shown in fig (4), the lifespan of the network in the form of percentage is 47.80%(upto 239 rounds) with zero threshold then by applying threshold compression(value 0.22) the lifespan of the network is achived 59.40%(upto 297 rounds) which shows better improvement after threshold compression. So the overall improvement during the operation in the lifespan of the network is 11.30% increased.

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