Analysis of Leach and Improved Leach Protocol in Wireless Sensor Network

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Abstract: This paper describes energy-efficient communication in wireless Sensor Networks is necessary and identifies the main sources of energy dissipation as well as counter measures to make sure a long network lifetime. Wireless Sensor Networks can collect trusty and accurate information in distant and risky environments, and can be used in National Defence, Military Affairs, Industrial Control, Traffic Management, Medical Care, Smart Home, etc. The sensor whose resources are reserved is low-cost, and depends on battery to supply electricity, so it's importance for routing to efficiently utilize its power. The main purpose of this Research work is to investigate and find insight into the effect of energy efficient for wireless Sensor Networks using Leach and proposed new Leach protocol and their parameter. As noted, the research consists of both experimental and analytical results on MATLAB tool with the following parameter average energy of each node for different- different no of rounds, number of dead nodes, total number of packet received to base station and end to end delay.

Keywords: WSN, LEACH, Proposed LEACH, Network lifetime.

I. INTRODUCTION

The Wireless sensor network is composed of a cluster of sensor nodes, which are small-scale energy constrained devices. The efficient use of energy source in a sensor node is most adorable criteria to improve the life time of wireless sensor network. Wireless sensor networks advancement is expeditiously increasing and that's why there is an immense field for research in this area. So the design of energy aware routing protocol is essential in order to enhance the network lifetime and to mitigate power losses. Therefore, to optimize network lifetime and achieve high reliability and scalability, routing techniques have been developed. LEACH is the conventional hierarchical clustering protocol traditionally used in wireless network. LEACH is energy-efficient hierarchical based routing protocol that balances the energy expense, saves the node energy and hence prolongs the network lifetime. In this paper we design a new proposed protocol which is based on the LEACH protocol. This proposed routing protocol consists of five different levels of energy nodes. These nodes are named as ultra nodes, super nodes, advance nodes, intermediate nodes, and normal nodes. This routing protocol is threshold sensitive. In the Performance evaluation of existing and proposed protocol on the basis of network lifetime we measure proposed protocol gives better results on same input parameters.

II. CLUSTER BASED HIERARCHICAL ROUTING PROTOCOL

Low-Energy Adaptive Clustering Hierarchy (LEACH)] is a essential hierarchical clustering routing protocol, which accept distributed clustering algorithm where cluster-head rotation mechanism, data aggregation, and data fusion technologies effectively improves the lifetime of a network. In order to improve energy in the network, nodes are selected as cluster head circularly and randomly. The normal nodes called cluster members join the corresponding cluster head nodes on the basis of principle of proximity. Normal nodes sense data and send directly to the cluster head nodes. The cluster head nodes receive sensed data, aggregate the data to remove redundancy and fusion processes are carried out and data is send to the sink (or Base Station). So LEACH increases network lifetime by decreasing network energy consumption, and reducing number of communication messages by data aggregation and fusion. The process of formation of clusters in LEACH is shown in figure 1.
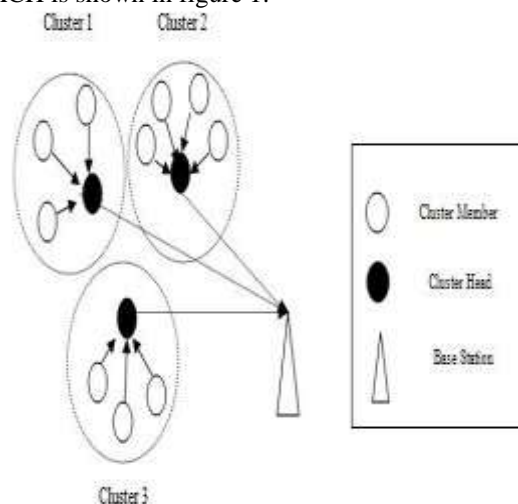

Fig. 1: Formation of Clusters in LEACH

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In order to achieve the design goal the key tasks performed by Leach are as follows:

➢ Randomized rotation of the cluster heads and the corresponding clusters.
➢ Global communication reduction by the local compression.
➢ Localized co-ordination and control for cluster setup and operation.
➢ Low energy media access control.
➢ Application specific data processing.

III. DEFICIENCIES IN CLASSICAL LEACH PROTOCOL

A. Unreasonable cluster head selection
LEACH protocol doesn't take residual energy of each node into consideration for the selection of cluster head node as each node has equal probability of becoming cluster head. If low-energy node is being selected as cluster head node, then the network fails soon due to high energy consumption causes adverse to energy balancing among the network. This results data loss and lower in survival time of the network.

B. Unreasonable distribution of cluster heads
The random selection algorithm of cluster head nodes causes problem of imbalance in energy load. Distance factor is not considered in cluster formation due to which sometimes very big clusters and very class clusters exist at the same time in the network. More the distance between cluster head node and base station, more the energy consumption of that node.

C. More responsibility on Cluster Head node
Cluster head nodes perform data aggregation and send processed data to the base station in single-hop due to which cluster head nodes deplete their energy too fast as compared to normal nodes. Also if a cluster head node fails, the whole nodes linked to it will deplete their energy too.

IV. PROPOSED WORK

Efficiently use of energy in the network has been the main issue in Wireless sensor network for prolonging lifetime of the network. LEACH has found one of the most energy efficient protocol used in Wireless sensor network. In Wireless Sensor Networks the main purpose of designing energy efficient routing protocol is to efficiently use the energy of the network so that the network lifetime get increased.

In WSNs various energy efficient routing protocols are available now-a-days. One of the most energetic routing algorithms everyone uses is the LEACH routing protocol. . In this research work, LEACH protocol has been discussed with its drawbacks and how these drawbacks are overcome by its descendants. A brief study of various improved versions of LEACH protocol has been done in order to compare performance of these descendants with the classical LEACH. It is concluded from given survey that for prolonging network lifetime of WSN, there is need to explore more robust, reliable and efficient protocols in future.

In present work I have implemented the five different level of energy node. Routing protocol which consists, five different level of energy nodes: Ultra nodes, Super nodes, Advance nodes, Intermediate nodes, Normal nodes. LEACH protocol to improve the network lifetime. To compare the LEACH protocol with Proposed LEACH protocol in the basis of average energy of the nodes and network lifetime of nodes. The Improved LEACH is more effective then the LEACH. In LEACH network lifetime of the nodes is very less as compared to Proposed LEACH and average energy decrease shortly as compared to Proposed LEACH.

V. PARAMETERS USED

TABLE 1 Parameters used

Parameters	LEACH	Proposed Leach
No. of Nodes	100	100
Probability of cluster heads P	0.1	0.1
Initial energy Eo	.5	.5
Transmit energy ETX	50*0.000000001	50*0.000000001
Receive energy RTX	50*0.000000001	50*0.000000001
Free space loss EFS	10*0.00000000001	10*0.00000000001
Multi path loss EMP	0.0013*0.000000000001	0.0013*0.000000000001
Data aggregation energy EDA	50*0.000000001	50*0.000000001
Maximum number of rounds	5000	10000

VI. RESULT AND DISCUSSION

In figure 2 firstly we calculate the alive node by using LEACH protocol represented by the "red line". And secondly we calculate the alive node by using proposed LEACH protocol represented by the" blue line". Result of both algorithms combined on one figure. This algorithm minimizes the amount of energy for non cluster head nodes to transmit their data to the cluster head nodes by minimizing the distance between all cluster head nodes and non cluster head nodes. BS considers some nodes as CHs and Non CHs. BS broadcasts a message of cluster head IDs to all nodes. If node ID is same as cluster head ID, is selected as cluster head and determine TDMA schedule for data transfer.
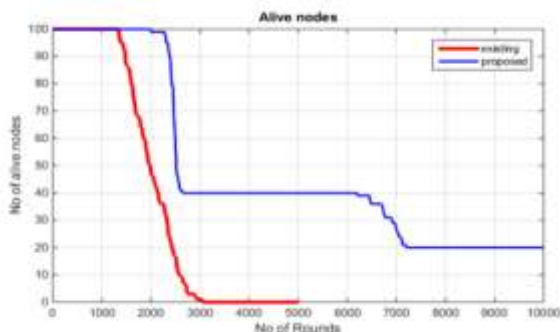
Fig. 2 Comparison of no. of alive nodes

TABLE 2 Comparison of alive nodes

No of Alive Nodes		No. of rounds	
LEACH	Proposed LEACH	LEACH	Proposed LEACH
100	100	1300	2220
90	90	1500	2400
80	80	1650	2500
70	70	1750	2530
60	60	1900	2550
50	50	1900	2570
40	40	2200	5000
30	30	2400	7000
20	20	2500	8000
10	10	2650	8050
0	0	3000	8100

Figure 3 presents the number of control packets versus the number of rounds for the protocols. It clearly seen that the Proposed LEACH protocol have more control packets because five different level of energy nodes. Proposed LEACH has more control packets are broadcast. Proposed LEACH has each node sends information the best cluster head and broad casts a message that obtains the cluster head ID for each node which leads more control packets.
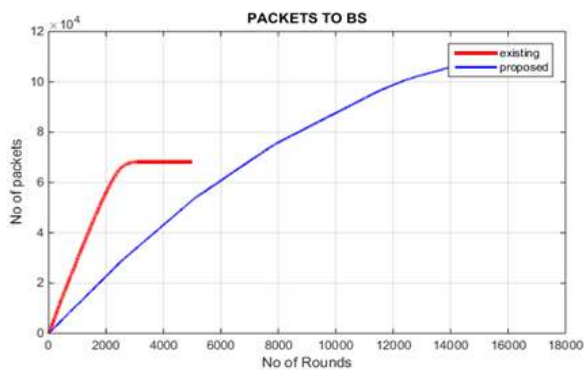

Fig. 3 Comparison of the control of packets

TABLE 3 Comparison of the control of packets

No of Packets	No of Rounds	
	LEACH	Proposed LEACH
2*10000	900	2000
4*10000	1500	4000
6*10000	2100	6000
8*10000		8000
10*1000		12000

In figure 4 "Red line" are declared as LEACH nodes. On other side "Blue line" are declared as Proposed LEACH nodes.
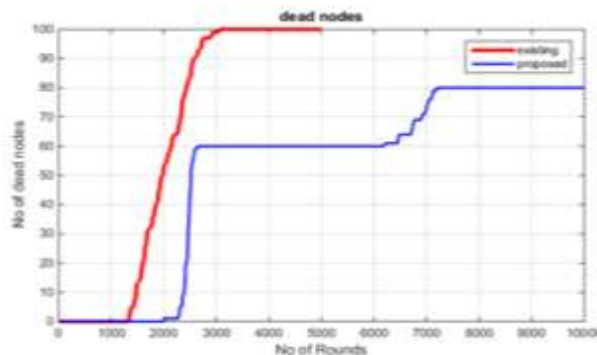

Fig. 4 Comparison of LEACH and Proposed LEACH on the basis of dead nodes

VII. CONCLUSION

In this paper we study the LEACH protocol and design a new proposed protocol which is based on the LEACH protocol. This proposed routing protocol consists of five different levels of energy nodes. These nodes are named as ultra nodes, super nodes, advance nodes, intermediate nodes, and normal nodes. This routing protocol is threshold sensitive. In the performance evaluation of existing and proposed protocol on the basis of network lifetime we measure proposed protocol gives better results on same input parameters.

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