Enhancing the Performance Through Simulated N-LEACH Balance Cost Cluster Head Selection Algorithm

Rachna Dasondhi , Deepak Kulhare , Megha Singh

Abstract— Potential use of wireless sensor networks (WSNs) can be seen in various fields like disaster management, battle field surveillance and border security surveillance since last few years. In such applications, a large number of sensor nodes are deployed, which are often unattended and work autonomously. Clustering is a key technique used to extend the lifetime of a sensor network by reducing energy consumption. It can also increase network scalability. Sensor nodes are considered to be homogeneous since the researches in the field of WSNs have been evolved, but some nodes may be of different energy to prolong the lifetime of a WSN and its reliability. In this paper, we study the impact of heterogeneity of nodes to the performance of WSNs. The simulation results show that the algorithm proposed by this paper behaviours better performance than LEACH in the following aspects, the numbers of life nodes, energy consumption and packet transmission.

Index Terms- WSN, Routing, LEACH, Energy consumption, Cluster, energy efficiency, network lifetime.

1.Introduction-

In this paper, the N-LEACH is proposed, the algorithms of LEACH is improved which from the method of cluster head node creating to the balance of cluster number and the data transmission for saving energy and then prolonging the lifetime of WSN. The WSN topological model of N-LEACH and LEACH is same basically, the difference between them is that N-LEACH algorithm took into account the difference of remaining energy after each round running, LEACH was assumed it is the same that energy consumption of nodes each round. N-LEACH algorithm is operated by round; there are two phases in each round that cluster establishment and stable data transmission.

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Process of cluster establishment consist two parts, **(i)Cluster head node producted and(ii)Spanning tree built**. The cluster head node of the first round is generated by base station, the cluster head node of remaining rounds generated from the node which had largest residual energy in last round, cluster head node elected periodically and cluster producted dynamically. The power control is carried out when the node sent data throughout the whole process. Since the initial energy of all nodes in the initial state is in the same round, the election of cluster head node is in accordance with LEACH. The number of cluster head node is determined based on area of the monitoring location, size and scale to the WSN. After the cluster head node in the first round elected, each cluster head node sent broadcast messages to all WSN, the node received broadcast signals and compared their strength, then chose to join the cluster, and informed the cluster head node. The cluster head node created TDMA schedule for all nodes in cluster, in accordance with schedule, cluster node sent data to the cluster head node. The cluster head node integrated all

received data, sent them to the base station. Cluster node sent its residual energy with the last frame data according to schedule to its cluster head node. The cluster head node compared the residual energy of each node and elected the largest one as the coming cluster head node in second round. The cluster head node broadcasted the ID of coming cluster head node in the cluster, cluster node received ID and compared it with its ID, it would be cluster head node of the second round if they were same. The cluster head node election process of subsequent rounds is same as the second round; cluster creation and data transfer process after cluster head node election were same as the first round. *B. to Ensure Load Balance* As the cluster head node is selected by round of forwarding in N-LEACH, each node could be cluster head node, in the node stationary case, and the difference of distance between the base-stations could not recuperated. When the WSN is divided into clusters, each cluster should pay attention to the load balance, which is to try to ensure the number of nodes to be balance, if the number of nodes inter cluster failed to achieve balance, the clusters farther from the base station should be more nodes, the first purpose was as little as possible when the node consumed energy, the second is decreased the cluster head node data sending to reduce energy consumption. When cluster creating, if A received the broadcast information from B and the same time as C, and the same intensity, it shows A is the critical node of B and C, it balanced the number of nodes between different clusters with critical nodes, after the other nodes joined cluster B and cluster C.**[32]**

2. Literature survey- After LEACH, several algorithms was derived for energy efficient WSN routing and balancing energy among the nodes in a WSN. Different algorithms and the criteria used to select the cluster head are given in. As we have used number of supported nodes for clustering rule so we called it NLEACH. Most of the proposed algorithm are based on residual energy. Probability of nodes for being cluster head is varied using different parameters in these algorithms. LEACH is one of the best routing protocols for WSN. In LEACH [1] topology is divided into clusters. Few nodes are selected as cluster heads and other nodes use these cluster heads as routers to the sink. All the data processing such as data fusion and aggregation are performed at cluster head. Cluster heads change randomly over time in order to balance the energy dissipation of nodes. A node becomes a cluster head for the current round if the chosen random number is less than the following threshold,

$$T_n = \begin{cases} \dfrac{p}{1-p.(r \bmod 1/p)} & \text{if } n \text{ in } G \\ 0 & \text{otherwise} \end{cases}$$

here p is the desired percentage of cluster heads (In [2]p is 5% of total number of nodes for maximum lifetime), r is current round and G is a number, which decides eligibility to become cluster head and form a set of nodes that have not been cluster heads in the last 1/p rounds in one epoch. Fig.1shows the value of T(n) for p = 0.1 and 10 rounds in one epoch[**35**]

However, there are also many shortcomings, particularly in the following three aspects:

(1)in the cluster head election process, it does not take into account the node's current residual energy, which could in return lead to affect the network's life due to that some nodes' energy consumption too fast if these are selected as cluster head node time and time again.

(2) The cluster head nodes communicate directly with the sink node thus increases energy consumption of cluster head nodes far away the base station. Moreover, it affects the quality of data transmission to a certain extent, and results in the network size are limited.

(3) LEACH protocol is achieved base on

many assumptions, such as assuming that all nodes in the network have the same structure and start with the same energy, and nodes can be aware of their residual energy, and so on. In response to these shortcomings, , the nodes'.[26]

3.**Proposed(N-LEACH)-**

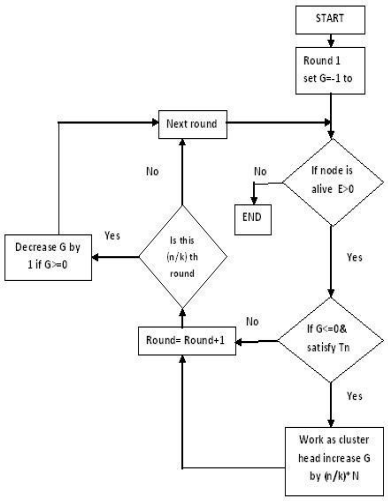

Fig1:Flow chart

3.1 Algorithm [N-LEACH]

Step 1: In first round of data transmission G is set to be −1 for all nodes.

Step 2: Operation for epoch is performed after every n/k rounds. The value of G is reduced by one to all the nodes which are having $G \geq 0$.

Step 3: All the nodes which are having $G < 0$ are eligible to become cluster head.

Step 4: Now the nodes will become cluster head choosing a threshold T_n between 0 and 1 using equation 1.

Step 5: If a nodes become a cluster head, it supports N number of nodes. If this N is greater than $N_{ave} = n\ k$, then this nodes is going to loose high amount of energy, and if N is lesser than Nave, then this node is going to save some energy compared to other nodes, which have already become cluster head or will become cluster head within n k rounds.
We add (k//n)*N to G when a node become cluster head.

Thus value of G become proportional to N, if a node support large number of nodes then this will loose its eligibility criterion for next few n/k rounds as this will not become eligible unless $G \leq 0$ or if support lesser than Nave nodes then it remain eligible to become cluster head.

4. Simulation and Result-We have simulate the wireless sensor network in **Mat Lab** environment. In this simulation 100 nodes randomly deployed in 100 × 100 (Square meter) area. We have placed base station at centroid of nodes. We carry out a comparison between the LEACH, F-LEACH,M-LEACH and the proposed algorithm using MATLAB. The initial power of all nodes is considered to be 0.5 J. Data packet size is assumed L =4000bit/packet. The simulation is performed for 10000 different topology in LEACH, F-LEACH,M-LEACH and proposed(N-LEACH) algorithm. Here

Table : 1 value of parameters

S.no	Parameters	Values
1	Network field	100 m. 100 m.
2	Number of nodes	100
3	Initial energy of normal nodes (Eo)	0.5J
4	Message Size	4000 bits
5	Eelec	5onJ bit
6	Efs	10nJ /bit/ m2
7	Eamp	0.0013pJ/bit/m4
8	EDA	5Nj/bit/signal
9	Threshold distance (do)	70m
10	Popt	0.1

Table shows the parameters which we used in this simulation.
For the case of a network containing m =0. 5 Fraction of advanced nodes having a=1.5 times more energy and mo =0.4 fraction of

super nodes containing b =3 times more energy than normal nodes. From Fig.2 and 3, we examine that first node for LEACH , M-LEACH, F-LEACH and N-LEACH dies at 1117, 1470, 1583 and 1719 rounds respectively. All nodes are dead at 5588, 6180, 9873 and 9873rounds respectively.

Table:2 Nodes Dead During Rounds

Name of Algorithm	First node Die in (Round)	All nodes dies in (Rounds)
LEACH	1117	5588
M-LEACH	1470	6180
F-LEACH	1583	9873
N-LEACH(Proposed)	1719	9873

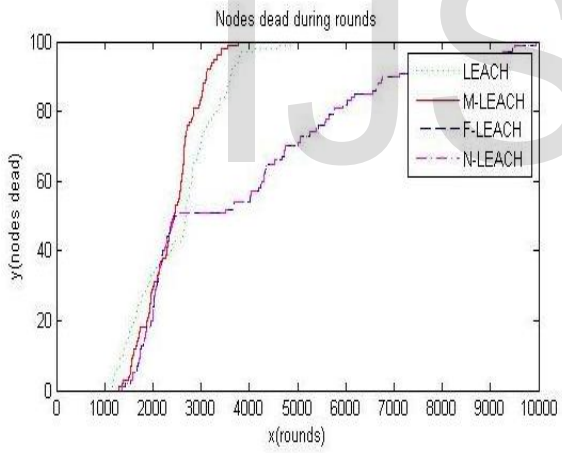

Fig:2

It is obvious from the results of all protocols that in terms of stability period, N-LEACH performs best of all, F-LEACH performs better than LEACH and M-LEACH but has less performance than N-LEACH. The number of nodes alive in N-LEACH is quite larger than F-LEACH because in N-LEACH the formula used by nodes for CH selection is modified by including residual and average energy of that round. So Nodes having high energy will become CHs

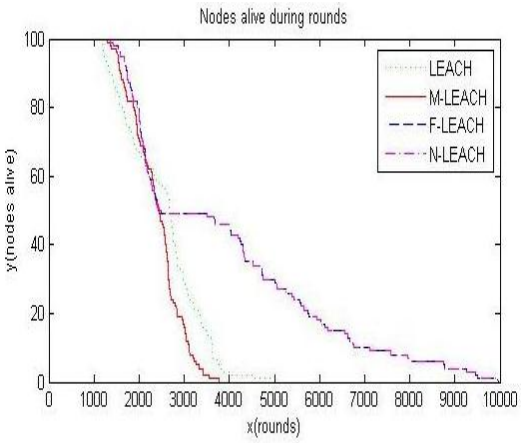

Fig:3

Similarly, by Examining results of Fig.4, packets sent to the BS by LEACH , M-LEACH ,F- LEACH and N- LEACH have their values at 125316, 139314, 391946 and 470248. Now we see that packets sent to BS for LEACH and M-LEACH is almost same whereas, the packets sent to BS for F-LEACH and N-LEACH are almost the same because the probability equations for normal, advanced and super nodes is same in both of them. Now coming to the CHs, the packets sent to CHs increase during the start of the Network and gradually decrease down towards the end due to the nodes dying simultaneously.

Table3:Packets sent to base station by-

Name of algorithm	Sent packets
LEACH	125316
M-LEACH	139314
F-LEACH	391946
N-LEACH(Proposed)	470248

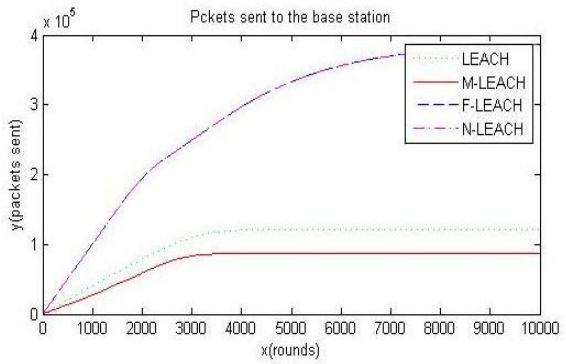

Fig:4

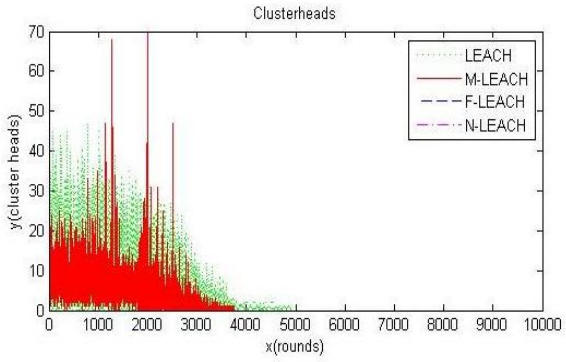

Fig:5

We have examined LEACH , M-LEACH ,F- LEACH and N- LEACH for heterogeneous WSNs containing different level Of heterogeneity. Simulations prove that LEACH and M-LEACH Perform well in the networks containing high energy difference between normal, advanced and super nodes. Whereas, we find out that F-LEACH and N-LEACH perform well in all scenarios. N-LEACH has best performance in terms of stability period And life time. So, N- LEACH is improved in terms Of stability period while compromising on lifetime.

5.Conclusion- As one of the hot field in routing protocol in the WSN, many good protocols have been proposed based on the LEACH protocol by many scholars domestic and foreign. The main aspects of improvement still focus on the setting of Cluster head nodes election threshold, multi-hop Communication between cluster head nodes and data fusion of cluster head nodes, and so on. In this simulation we Simulate N-LEACH protocol which improves stability and energy efficient property of the heterogeneous wireless sensor network and hence increases the lifetime. Simulation results show that N-leach performs better as compared to LEACH, M-LEACH, and F-LEACH in heterogeneous environment for wireless sensor networks.

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[35] Rajiv Kr Tripathi,Grad.Student MIEEE, Yatindra Nath Singh,SMIEEE, Nishchal K. Verma,MIEEE N-LEACH, a Balanced Cost Cluster-Heads Selection Algorithm for Wireless Sensor Network ©2012 IEEE