An EXTENED VICE-CLUSTER SELECTION APPROACH TO IMPROVE V LEACH PROTOCOL IN WSN

Mrs. Asha Ahlawat,
Department of electronics and communication,
Hindu college of engineering
Sonepat, India
E-mail: {asiadadiya@gmail.com}

Ms Vineeta Malik
Department of electronics and communication
Hindu college of engineering
Sonepat, India
E-mail: {vineetamalik7@gmail.com}

Abstract-The paper presents a new version of leach protocol called Improved VLEACH which aims to increase network life time. In this paper we first completely analysed the typical clustering Routing Protocol-LEACH and its deficiencies and proposed improved v-leach. The work to be done in improved v-leach protocol on selection of vice cluster head. The Vice Cluster head is that alternate head that will work only when the cluster head will die. The process of vice cluster head selection on the basis of three factors i.e. Minimum distance, maximum residual energy, and minimum energy. The proposed approach will improve the network life as never the cluster head will die. As a cluster head will die it will be replaced by it's vice Cluster head. After a number of simulations, it was found that the new version of improved v-LEACH outperforms the original version of leach protocol by increasing the network life time 49.37%.

Keywords—Clustering, LEACH protocol, V-LEACH, Wireless Sensor Network, Network life time

Introduction

Wireless Sensor Networks (WSNs) are networks of light-weight sensors that are battery powered used majorly for monitoring purposes [2]. WSNs are increasingly equipped to handle some of these complex functions, in-network processing such as data aggregation, information fusion, computation and transmission activities requires these sensors to use their energy efficiently in order to extend their effective network life time. Sensor nodes are prone to energy drainage and failure, and their battery source might be irreplaceable, instead new sensors are deployed. Thus, the constant re-energizing of wireless sensor network as old sensor nodes die out and/or the uneven terrain of the region being sensed can lead to energy imbalances or heterogeneity among the sensor nodes. This can negatively impact the stability and performance of the network system if the extra energy is not properly utilized and leveraged. Several clustering schemes and algorithm such as LEACH, DEEC, have been proposed with varying objectives such as load balancing, fault- tolerance, increased connectivity with reduced delay and network longevity. A balance of the above objectives can yield a more robust protocol. LEACH protocol and the likes assume a near to perfect system; an energy homogeneous system where a node is not likely to fail due to uneven terrain, failure in connectivity and packet dropping. But more recent protocols like SEP considered the reverse that is energy heterogeneity where the factors mentioned above is a possibility, which is more applicable to real life scenario for WSN. Thus, energy heterogeneity should therefore be one of the key factors to be considered when designing a protocol that is robust for WSN. A good protocol design should be able to scale well both in energy heterogeneous and homogeneous settings, meet the demands of

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different application scenarios and guarantee reliability.

Conventional protocol designs do not address these situations. This research explores existing work done in this area. The goal is to present a modified protocol design that is more robust and can ensure longer network life-time while taking other performance measures into consideration. Mathematical modelling and computer simulations are used for proof of concept and testing.

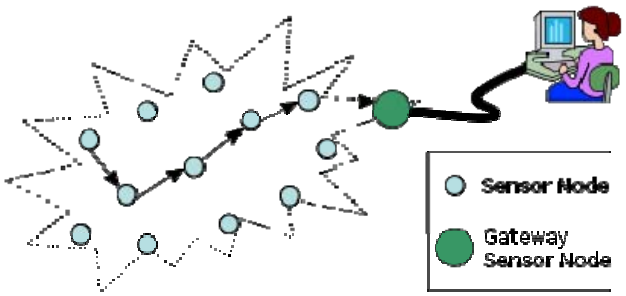

Figure 1.1: Typical Wireless Sensor Network Architecture

LEACH

LEACH is a kind of self-adaptive cluster-organized Topological algorithm. Nodes organize themselves into clusters, one node in every cluster would acts as cluster head [6][7].The process is executed in periodical manner; every round is divided in two phases: cluster building phase and stable data communication phase. In the phase of cluster building, close nodes make a cluster dynamically, and one certain be selected as cluster head randomly; In the phase of stable data communication, nodes in one cluster would send their date to the cluster head, then cluster head would fuse the data and send it to sink node. Because cluster heads need to fuse the data and communicate with sink node, they consume more Energy than ordinary nodes. LEACH algorithm could guarantee that every node in one cluster would be selected as cluster head in equal possibility, which makes every node consume energy relatively equally. The procedure of selecting cluster head in LEACH is like following:

Every node produces a random number between 0 and 1, and if this number is less than threshold value T(n), then it pronounce itself as cluster head. In every round, if one node has been cluster head before, then T(n) is set to 0, so that this node will not be selected again. For the nodes that have not been selected once, the possibility of being selected is T(n). As the number of nodes which have been cluster head increases, T(n) will increase, so the possibility for the rest nodes to be selected will increase. When there is only one node left, T(n)=1, which means this node will be selected for sure. T(n) could be defined as follows [3]:

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

Means the percentage of the number of cluster head in the total number of nodes; r means the number of the current round, G means the set of nodes that have not been elected in the past 1/p rounds of election. When one node is selected, it will inform other nodes. No cluster-head nodes will choose a cluster to join in, according to the distance between them and the cluster heads. When cluster heads have received all the messages for joining in, they will produce a time message TDMA to inform all the nodes in their clusters. To prevent interference from nearby clusters, one cluster head could determine what CDMA code will be used in its cluster. This current used CDMA code will be sent along with TDMA time message. When every node in the cluster received this message, they will send data in their time-slice separately. After transmitting data for a period time, cluster head

collects received data, executes fusing algorithm to process the data, then sends the result to collecting node.

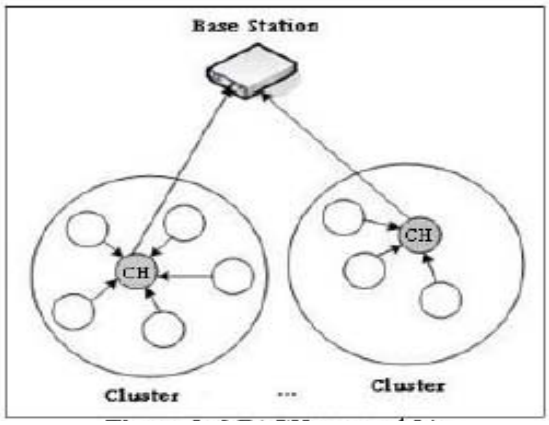

Fig 1.2 LEACH Protocol

Drawback of LEACH

- Cluster heads are selected randomly that does not take in to account energy consumption
- It is energy consuming
- Expandability is limited

Improved V-LEACH

In our new version of LEACH protocol, the cluster contains; CH (responsible only for sending data that is received from the cluster members to the BS), vice-CH (the node that will become a CH of the cluster in case of CH dies), cluster nodes (gathering data from environment and send it to the CH).

In the original leach, the CH is always on receiving data from cluster members, aggregate these data and then send it to the BS that might be located far away from it. The CH will die earlier than the other nodes in the cluster because of its operation of receiving, sending and overhearing. When the CH die, the cluster will become useless because the data gathered by cluster nodes will never reach the base station.

In our improved V-LEACH protocol, besides having a CH in the cluster, there is a vice-CH that takes the role of the CH when the CH dies. The process of cluster head selection criteria is different. It is on the basis of three factors i.e. Minimum distance, maximum residual energy, and minimum energy. Based on received signal strength, each non-cluster head node determine its cluster head, greater the signal strength means shorter the distance between them and if distance is small then for the transmission less energy is required .The proposed approach will improve the network life as never the cluster head will die. As a cluster head will die it will be replaced by its vice Cluster head.

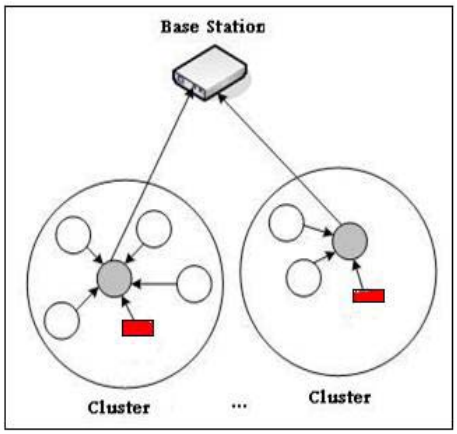

Fig 1.3 Improved V-LEACH

By doing this, cluster nodes data will always reach the BS; no need to elect a new CH each time the CH dies. This will extend the overall network life time.

Simulation and results

The simulation tool is MATLAB (version 7.10), which provides an efficient way for comparing the performance of the New Improved V-LEACH protocol against that of the original LEACH protocol. The random, 100-node network shown in Fig.1.4 the BS was placed at location (50, 50). The test network parameters are shown in Table 1.

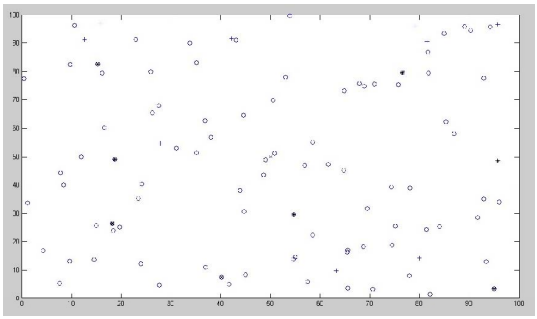

Fig 1.4 shows 100 node networks

Table-1 Input parameter

Parameter	Variables
Node	100
Network size	100m*100m
BS location	(50,50)
Node energy	0.5 j
Node position	Based on network topology
No of rounds executed	5000
Energy dissipation for transmission	50*0.000000001 j/bit
Energy dissipation for reception	50*0.000000001 j/bit
The probability that a node can be cluster head	0.2
Data aggregation energy	5*0.000000001 j/bit

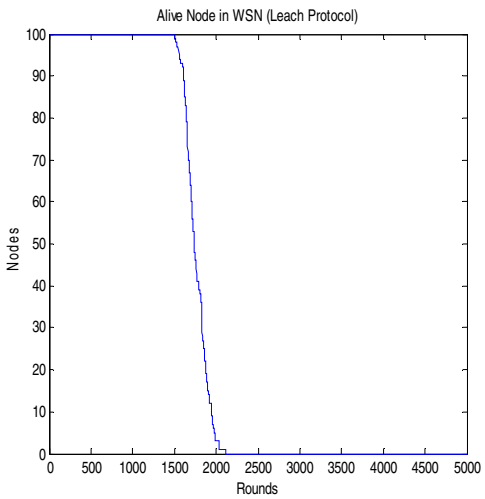

Fig 1.5 shows the alive nodes in LEACH protocol

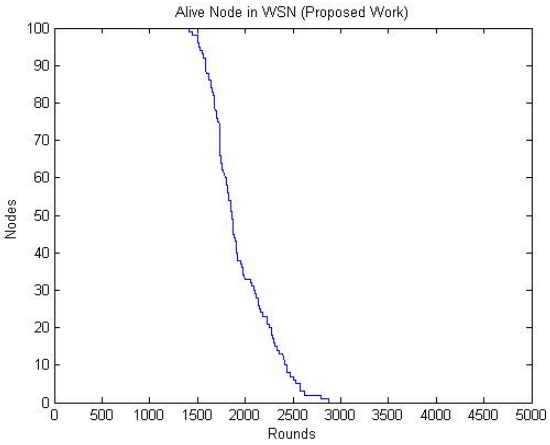

Fig 1.6 show the alive nodes in Improved V-LEACH protocol

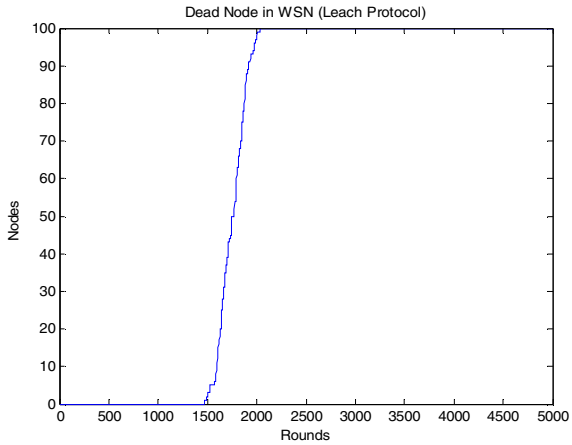

Fig 1.7 shows the dead nodes in LEACH protocol

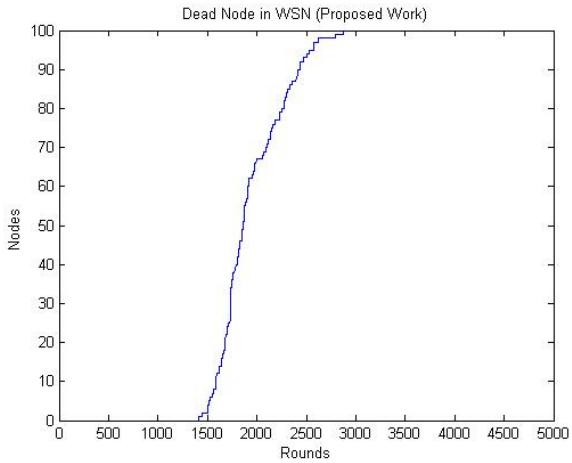

Fig 1.8 shows the dead nodes in Improved V-LEACH protocol

Table -2 Improvement of New Improved LEACH protocol over leach protocol

Rounds	No of alive nodes (improved v-leach)	No of alive nodes (leach)
1000	100	100
1500	88	98
2000	43	2
2500	19	0
3000	4	0
5000	0	0

Table-3 the rounds that nodes start dying and all the nodes are dead in LEACH and improved V-LEACH protocol

Protocol	Rounds when nodes start dying	Rounds when all nodes are dead
LEACH	1535	2096
Improved V-LEACH	1362	3131

Conclusion

In this paper, we have discussed the Low Energy Adaptive Clustering Hierarchy (LEACH) protocol and analysed the protocol based on alive nodes, and dead node in wsn. Followed by an overview of LEACH protocol implementations, then we proposed a new version of LEACH protocol called V-LEACH protocol.

We have put light on the comparison of LEACH protocol and improved V-LEACH protocol. From the simulation results, we can draw a number of conclusions first: the number of alive nodes is more than the original leach. Second, the number of dead nodes is less than the original leach protocol. The network lifetime is increased by 49.37%. That mean the new version of improved v- LEACH outperforms the original version of leach protocol by increasing the network life time 49.37%.

References

[1] W. Heinzelman, A. Chandrakasan and H. Balakrishnan, "Energy-Efficient Communication Protocol for Wireless Micro sensor Networks", Proceedings of the 33rd Annual International Conference on System Sciences, Vol. 2, Maui, 4-7 January 2002

[2] M. Bani Yassein, A. Al-zou'bi, Y. Khamayseh, W. Mardini "Improvement on LEACH Protocol of Wireless Sensor Network**"**

[3] Bo Shen, et al, Cluster-Based Routing Protocols for Wireless Sensor Networks, Journal of Software, 2006.

[4] Zhao Yulan, Jiang Chunfeng "Research about Improvement of LEACH Protocol" 2010

[5] Li Xunbo, Li Na, Chen Liang, Shen Yan, Wang Zhenlin, Zhu Zhibin "An Improved LEACH For Clustering Protocols In Wireless Sensor Networks", International Conference on Measuring Technology and Mechatronics Automation,2010

[6] Xu Long-long, Zhang Jian-jun,"Improved LEACH Cluster Head Multi-hops Algorithm in Wireless Sensor Networks" Ninth International Symposium on Distributed Computing and Applications to Business, Engineering and Science,2010

[7] Mrs. V. Nithya (Asst. Professor), Shad drack Yaw Nusenu (M.Tech Comm. Sys.) , Dr. B. Ramachandran (Professor) a clustering protocol based on tree routing algorithm in wireless sensor networks (wsn) International Conference on Advanced Computing, Communication and Networks'11 1239

[8] Y. Liu, Y. Zhao and J. Gao, A New Clustering Mechanism Based On LEACH Protocol, in Proceedings of the International Joint Conference on Artificial Intelligence, 2009