

Review Paper on LEACH and Its Descendant Protocols in Wireless Sensor Networks

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Abstract: A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to observe physical or environmental conditions. The economical use of energy supply in a sensing element node is most fascinating criteria for prolong the life time of wireless sensing network. Thus planning economical routing for reducing energy consumption is the vital issue. Leach is one of the basic protocols in the clustering technique where hierarchical routing protocols will be used for minimizing the energy consumed in aggregation and diffusing. We have surveyed the state-of art of various hierarchical routing protocols that have been developed from the LEACH. This paper provide light on a number of the improve version of LEACH protocol. Finally this paper concludes with some comparison of descendents of LEACH with LEACH protocol.

I. INTRODUCTION

Recommended proportion of cluster heads for the network and for Low-Energy adaptive clustering Hierarchy (LEACH) is one among the foremost widespread cluster-based routing protocols that were introduced by Heinzelman in wireless sensor networks [3]. LEACH is a self-organizing, adaptive clustering protocol that uses randomization to distribute the energy load equally among the sensors within the network. In LEACH, the nodes organize themselves into native clusters, with one node acting as the native base station or cluster-head [4]. Every cluster head collects information from nodes and aggregates all information it receives and forwards the aggregate information on to the base station. The election of cluster heads is revolved among the cluster nodes and it's upon determining a priori the variety of times a node has been a cluster head thus far.

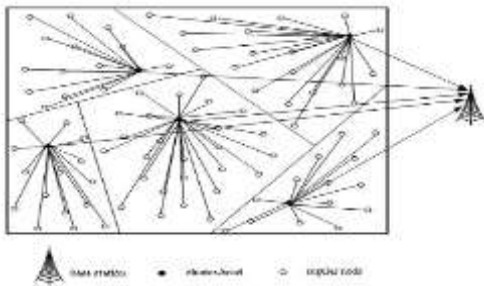


Fig 1: Low Energy Adaptive Clustering Hierarchy [3]

1.1 LEACH-B (Balanced Low Energy Adaptive Clustering Hierarchy)

Attacks are often classified in several classes like internal attacks, External attacks, Active Attacks Passive Attacks. Aggressor will damage the network as internal, external or active; passive therefore this classification is incredibly necessary. nodes. LEACH-B involves the subsequent techniques Cluster head choice algorithmic program, Cluster formation and information transmission with multiple access. By evaluating the energy dissipated in the trail between final receiver and itself, every of the sensing element node chooses its cluster head. Efficiency of Leach-B is best than Leach [5].

1.2 LEACH-C (Centralized Low Energy Adaptive Clustering Hierarchy)

LEACH-C uses a centralized clustering algorithm and same steady -state protocol as LEACH. Within the set-up section of LEACH-C, every node would send its current location position and energy data to the sink node. primarily based on this data from the sensing element nodes the BS can confirm the totally different clusters along with CH node and non-CH nodes of every and each cluster. The BS would able to manufacture higher clusters by utilizing its world data of the whole network and by this method less energy is being consumed for knowledge transmission purpose. In LEACH-C the amount of CHs in every round is equals to a preset best value, whereas in LEACH the amount of CHs would varies from round to round due to the shortage of worldwide coordination between totally different nodes within the network [6].

1.3 LEACH-E (Energy Low Energy Adaptive Clustering Hierarchy)

LEACH-E protocol improves the CH choice method compared to LEACH protocol. The LEACH-E is split into totally different round that's same as LEACH protocol. Within the initial round, all the sensing element nodes would have identical chance to be CH of the cluster. once the primary round of transmission, the residual energy of every node would got totally different and supported this, the node who would have the high residual energy would be chosen as CH

of the cluster and alternative nodes within the cluster would become the cluster member who would have the less energy [2].

1.4 LEACH-F (Fixed number of cluster Low Energy Adaptive Clustering Hierarchy)

In Leach-F, once the clusters are shaped they're mounted and there's no overhead at the start of every round. The CH position rotates among the nodes among the cluster that's same as LEACH [2]. During this protocol new nodes can't be added to the system and don't change their behavior based on nodes dying. Moreover, the node quality can't be handled by the Leach-F [5]. The overhead of re-clustering in basic LEACH is removed by LEACH-F protocol as once the fixed variety of clusters is formed; they're maintained throughout the network [2].

1.5 I-LEACH (Improved Low Energy Adaptive Clustering Hierarchy)

I-LEACH employs the distributed cluster approach as compared to LEACH protocol. The entire sensing element field is split into equal sub-region. The selection of the CH from every sub-region is decided by the threshold approach as in LEACH protocol. I-LEACH is compared with basic LEACH protocol in terms of average energy consumption. I-LEACH provides higher performance as compare to LEACH in terms of energy [2].

1.6 LEACH-L (Energy Balanced Low Energy Adaptive Clustering Hierarchy)

LEACH-L is a complicated multi-hop routing protocol. It's appropriate for big space lined WSNs [6]. The cluster heads will communicate on to the base station after they are situated near it. After they are situated far from the base station, they'll communicate by the strategy of multi-hop method [5]. In this, the sensors area unit allowed to use totally different frequencies and gaps to speak with the base station. The clusters re-established in every round consisting of setup and steady state section. And in every round new cluster heads are elective and therefore the load is distributed and balanced among the nodes in network.

1.7 LEACH-M (Mobile Low Energy Adaptive Clustering Hierarchy)

LEACH-M is been planned to beat from the quality issue that is a very important issue in LEACH protocol. Throughout the setup and steady state section, LEACH-M provides quality to the non-CH nodes beside CH. In LEACH-M the nodes' location assumed to be gain by the GPS method beside the characteristics of the nodes to be assumed to be homogeneous. The CHs are being chooses on the idea of minimum quality of the node and lowest attenuation mode of the node. Once this method standing of the CHs are being broadcasted among its transmission range [6].

1.8 LEACH-S (Solar aware Centralized and Distributed Low Energy Adaptive Clustering Hierarchy)

In Centralized LEACH-S, the sink node would choose the CHs with the assistance of improved central control algorithm. In Leach-S, the solar standing on with the energy of the sensing element nodes is being transmitted to the sink and therefore the nodes with having the higher energy are chosen as the CHs. once the range of solar-aware nodes is obtaining increased, the performance of sensing element network is additionally get enhanced and by this the period of time of the network additionally get raised.

1.9 T-LEACH (Threshold-based LEACH)

T-LEACH protocol, that may be a threshold-based cluster head replacement theme for cluster protocols of WSNs. T-LEACH, minimizes the amount of CH choice by using threshold of residual energy. Life of the complete networks may be extended compared with the present clustering protocols by reducing the number of head choice and cost [2].

1.10 V-LEACH (Vice Cluster Level Low Energy Adaptive Cluster Hierarchy)

V-LEACH the new edition of LEACH protocol during which the cluster contains CH, vice-CH, cluster nodes. In V-LEACH protocol, besides having a CH within the cluster, there's a vice-CH that takes the role of the CH once the first CH dies. By doing that, knowledge collected by the cluster nodes can continually reach the BS. Therefore, there's no need to elect a replacement CH every time the CH dies. This can extend the network lifetime; simulation result show V-LEACH Consumes less energy compared with LEACH, as results of that the network lifespan is increased. That mean the new edition of LEACH outperforms the initial LEACH protocol [2].

1.11 W-LEACH (Weighted Low Energy Adaptive Clustering Hierarchy Aggregation)

W-LEACH could be a centralized information aggregation algorithm. W-LEACH consists of a setup section and a gentle state section almost like traditional LEACH. Within the setup section, W-LEACH initial calculates a weight worth, W_i , and assigns it to every sensing element S_i . A most of parents of alive sensors are, then, elect to be CH supported the calculated weights, such the upper the weights the higher the prospect for them to be CH. Note that not like LEACH, W-LEACH doesn't take into thought whether or not this sensing element was a CH for previous close to rounds. Finally CHs are chosen, clusters are shaped such that every sensor is assigned to its nearest CH.

II. RELATED WORK

In [4] we glance at communication protocols, which might have important impact on the energy dissipation of those

networks. based on our findings that the traditional protocols of transmission mechanism, minimum-transmission-energy, Multihop routing, and static cluster might not be optimum for sensor networks, we tend to propose LEACH (Low-Energy adaptive clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of native cluster base stations(cluster-heads) to equally distribute the energy load among the sensors within the network. Author in [3] had projected associate energy economical formula supported LEACH. Throughout this, author analyses the effectiveness of LEACH protocol in extending the time period for energy-constrained wireless sensor networks. Associate improved protocol LEACH-R is projected supported LEACH protocol. It improves the selection of cluster-head and proposes to choose relaying node compare to LEACH.

In [5] the state-of art of various hierarchical routing protocols that are developed from the LEACH are surveyed. This highlights a number of the drawbacks and problems in LEACH and discusses however these problems are overcome by the descendants of LEACH. It additionally compares the features and performance problems with all hierarchical routing protocols.

Another author in [2] additionally had survey varied Descendant of LEACH based Routing Protocols in Wireless device Networks. Moreover, the timeline and surveyed define table of LEACH and its descendant routing protocol has been given as a results of the drawbacks of LEACH. However, lots of work continues to be needed to seek out lots of economical, scalable These attacks area unit primarily utilized by the one who is outside the network and wish to urge access to the network. and robust bunch theme to boost energy consumption and enhance networks period in very little and large WSN.

In [6], the coming up with efficient routing for reducing energy consumption is that the vital issue. During this brief introduction of routing challenges in WSN together with some basic designing problems associated with routing protocols are mentioned. This additionally provide a number of the improve version of LEACH protocol together with its advantageous routing compared to the basic LEACH protocol.

III. COMPARISON OF LEACH AND ITS DESCENDANTS PROTOCOLS FOR WSNS

Varieties of protocols that are the improved versions of the LEACH routing protocol are compared and is shown in table 1.all these protocols show higher performance than the standard LEACH routing protocol.

LEACH & Descendant	Clustering Method	Scalability	Advantages	Disadvantages
LEACH	Distributed	Limited	Load distribution in network	CH are not uniformly

LEACH-B	Distributed	Good	Network lifetime increase	Overhead increase
LEACH-C	Centralized	Good	Achieves more rounds in n/w	Overhead on the BS
LEACH-E	Distributed	Very good	Improves CH selection	CH is always in active
LEACH-F	Centralized	Limited	Delay is small	Cover larger region
LEACH-I	Distributed	Very good	Equally divide field	Periodically updates
LEACH-L	Distributed	Very good	Balanced network load	Needs storage capacity more
LEACH-M	Distributed	Good	Mobility of CH node	Overhead increase
LEACH-S	Centralized	Very good	Power gain from solar	Centrally controlled
LEACH-T	Distributed	Good	Reducing the CH selection	CH based on threshold
LEACH-V	Distributed	Very good	Introduce vice CH	Extra processing for vice CH
LEACH-W	Centralized	Good	Increase lifetime of network	CH selection is random

IV. CONCLUSION

In wireless sensor networks the main purpose of planning energy economical routing protocol is to efficiently use the energy of the network so the network time period get enlarged. during this paper numerous LEACH-based protocols has been mentioned briefly and surveyed outline table of LEACH and its descendant routing protocol has been given. Because of the drawbacks of LEACH, several protocols are come back to resolve these issues. However, additional work continues to be required to search out additional efficient, scalable and strong cluster scheme to boost energy consumption and enhance networks time period in WSN.

REFERENCES

- [1]. S. E. L. Khediri, N. Nasri, A. Wei, and A. Kachouri, "A new approach for clustering in wireless sensors networks based on LEACH," *Procedia Comput. Sci.*, vol. 32, pp. 1180–1185, 2014.
- [2]. R. P. Mahapatra and R. K. Yadav, "Descendant of LEACH Based Routing Protocols in Wireless Sensor Networks," *Procedia Comput. Sci.*, vol. 57, pp. 1005–1014, 2015.
- [3]. N. Wang and H. Zhu, "An energy efficient algorithm based on LEACH protocol," *Proc. - 2012 Int. Conf. Comput. Sci. Electron. Eng. ICCSEE 2012*, vol. 2, pp. 339–342, 2012.
- [4]. W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "Energy-efficient communication protocol for wireless microsensor networks," *Proc. 33rd Annu. Hawaii Int. Conf. Syst. Sci.*, vol. 00, no. c, pp. 3005–3014, 2000.
- [5]. J. Gnanambigai, N. Rengarajan, and K. Anbukkarasi, "Leach and Its Descendant Protocols: A Survey," *Int. J. Commun. Comput. Technol.*, vol. 01, no. 3, pp. 15–21, 2012.
- [6]. A. Braman and G. R. Umapathi, "A Comparative Study on

Advances in LEACH Routing Protocol for Wireless Sensor Networks: A survey," *Int. J. Adv. Res. Comput. Commun. Eng.*, vol. 3, no. 2, pp. 5683–5690, 2014.

- [7]. W. B. Heinzelman, A. P. Chandrakasan, and H. Balakrishnan, "An application-specific protocol architecture for wireless microsensor networks," *IEEE Trans. Wirel. Commun.*, vol. 1, no. 4, pp. 660–670, 2002.
- [8]. Dembla.D Shivam .H: Analysis and Implementation of Improved - LEACH protocol for Wireless Sensor Network (I-LEACH).In: IJCSC,II, Vol. 4,No. 2, pp.8-12, September, 2013.
- [9]. hu.D,Cai.D:Research and simulation of energy efficient protocol for wireless sensor network. In: Proc. 2nd International Conference on Computer Engineering and Technology, Quanzhou, China, 2010.
- [10]. Qian .L, Zhu.H: An Energy Balanced Clustering Algorithm Based on LEACH Protocol. In: Proceedings of the 2nd International Conference On Systems Engineering and Modeling (ICSEM-13), Paris, France, pp-72-73, 2013
- [11]. Jiman .H and Joongjin .K: T-LEACH: The method of threshold-based cluster head replacement for wireless sensor networks," published in *springer Inf Syst Front*, DOI 10.1007/s10796-008-9121-4