

ENERGY EFFICIENT ELECTION PROBABILITY AND CLUSTER HEAD SELECTION FOR ENHANCEMENT OF LEACH PROTOCOL USING STABLE ELECTION PROTOCOL IN WSN

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Abstract

Advance wireless sensor network (WSN) technology is Low-power design, has enabled the development of small, comparatively cheap & low-power device technology. The necessary challenges in design of network are two key resource 1) Energy 2) Communication bandwidth. LEACH (Low Energy Adaptive Clustering Hierarchical) protocol are used to design energy efficient system depending upon energy levels of cluster head and cluster-members .So appropriate energy protocol to get balance between lifetime of sensor nodes and latency become key solution. This paper basically a review on LEACH protocol for Wireless Sensor Nodes in Network Simulator (MATLAB) to reduce average latency and increases life of sensor nodes.

Keywords:

Wireless Sensor Network;
LEACH;
Stable Election Protocol;
Energy Efficiency;

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1. Introduction

A Wireless Sensor Network or WSN is meant to be made up of a large number of sensors and a minimum of one base station. Low-cost and small-sized wireless sensors have gained particular attention in efficient monitoring that involves thousands of wireless sensors within the mensuration and report within a target area. Wireless sensors are typically scattered in a wide region without a sophisticated coordination. Since recharging the battery is almost impossible, sensor networks (WSNs) are subject to energy management for maximizing their lifetime [1]. The low-energy adaptive clustering hierarchy (LEACH) protocol is a pioneering work in this type of applications. The LEACH protocol forms multiple clusters of nodes and designates a single cluster head (CH) node in each cluster, with the objective of minimizing the energy consumption of WSNs. In this hierarchy, CH nodes are responsible for the collection of the measurement from member nodes and the delivery of the aggregated information to the base station (BS) as illustrated in Fig. 1.

SEP [8][9] is a two-level heterogeneous proactive network protocol. SEP tries to maintain the constraint of well balanced energy consumption. It assumes that every node within the network has different energy. Therefore in SEP there are two types of nodes; normal nodes and advance nodes. Advance nodes have more energy than normal nodes and the additional energy factor between advanced and normal nodes is denoted by alpha (α).

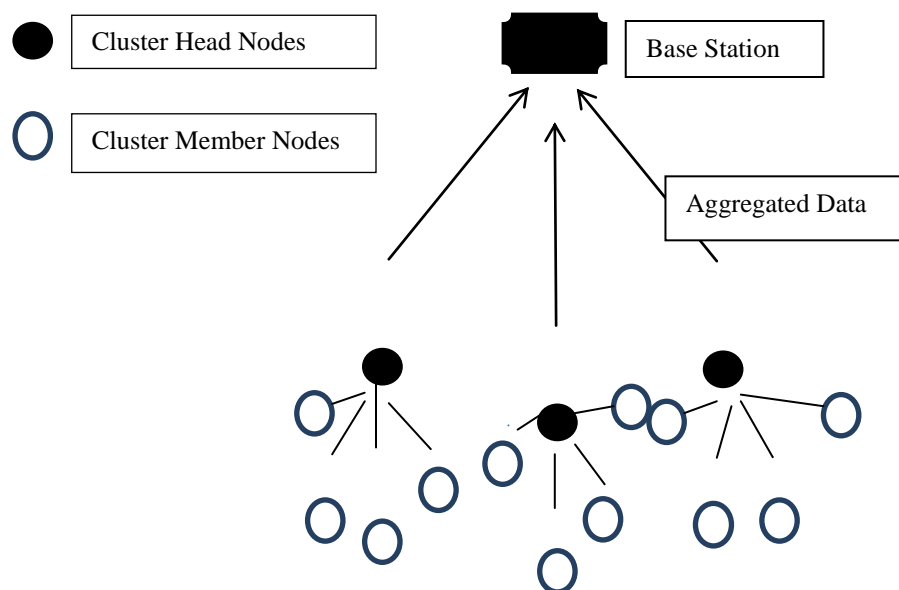


Figure 1. A WSN Model with Low-Energy Adaptive Clustering Hierarchy

Suppose that there are n numbers of sensor nodes in the network and m be the fraction of advanced nodes, which are equipped with a time more energy than the normal nodes. Let E_0 be the initial energy of each normal sensor node. Then energy of each advanced sensor node will be $E_0 = (1 + a)$. The total (initial) energy of the network is equal to:

$$n \cdot E_0 \cdot (1 - m) + n \cdot E_0 \cdot m \cdot (1 + a) = n \cdot E_0 \cdot (1 + a \cdot m) \quad (1)$$

2. Literature Review

2.1. Dongyao Jia *et al.* [1] has proposed the dynamic cluster head selection method for wireless sensor networks (DCHSM) by analyzing the sensor network energy consumption based on the redundant nodes and energy heterogeneity. The method proposed in this paper overcomes the disproportion of the energy consumption, improves the information redundancy in the process of transmission, reduces energy consumption and extends the life time of the network.

2.2. Illsoo Sohn *et al.* [2] has proposed the enhancement of LEACH using Affinity Propagation for practical applications. The proposed LEACH-AP (i) does not require additional hardware functionality for location information, such as GPS, (ii) keeps the signaling overhead minimal regardless of network size, (iii) does not require the predetermination of the optimal number of clusters, and (iv) outperforms existing centralized approaches while providing a fore mentioned benefits inherited from its distributed nature.

2.3. Zhao Han *et al.* [3] introduced a replacement protocol known as GSTEB may be a self-organized protocol, it only consumes a low quantity of energy in every round to change the structure for the purpose of balancing the energy consumption. When lifetime is defined as the time from the start of the network operation to the death of the first node in the network, GSTEB prolongs the period of time by 100% to 300% compared with another protocol i.e. PEGASIS.

2.4. Lianshan Yan *et al.* [5] supported the protocol low-energy adaptive clustering hierarchy (LEACH), we tend to investigate an improved energy-efficient communication protocol for wireless sensor networks (WSNs) within the presence of distributed optical fiber sensor (DFS) links placed at the middle of WSN fields. Network performances in terms of lifetime of nodes are simulated for the cases that 2 WSNs will or cannot communicate with one another. The lifetime of such sensor network with rectangular topology are additional investigated?

2.5. M M Islam *et al.* [8] presents a Stable Election Protocol (SEP) algorithm for cluster head selection during a hierarchically clustered heterogeneous network to reorganize the topology expeditiously. The presented algorithm considers the sensor nodes are static and arbitrarily distributed within the heterogeneous network, the coordinates of the sink and therefore the dimensions of the sensor field are known.

2.6. Arafat Abu Malluh *et al.* [9] propose a modification supported on SEP protocol. Efficient Modified SEP aims to prolong the stable period of the sensor network by preserving balanced energy consumption. This implies that we choose the advanced nodes to become cluster heads more frequently than the normal nodes as the case with SEP protocol. Moreover, EMSEP takes in account the quantity of nodes that are related to every cluster head. Another necessary improvement of EMSEP protocol that if there are over one sensor offer to be a cluster head at definite round, we decide the sensor with highest energy.

3. Leach and Sep Routing Protocol

Low Energy Adaptive-Clustering Hierarchy (LEACH), it is a routing protocol which is proposed in Massachusetts Institute of Technology by many researches, and is taken under consideration to be one of the foremost effective protocols in terms of energy efficiency [1][5]. The LEACH protocol forms multiple clusters of nodes and designates one cluster head (CH) node in every cluster, with the target of minimizing the energy consumption of WSNs. In this hierarchy, CH nodes are responsible for the collection of the measurement from member nodes and the delivery of the aggregated information to the base station (BS).

SEP [8] is a WSN protocol that assumes heterogeneity in a network, making it the basis to prolong the stability period in a hierarchically clustered. For Heterogeneous networks, it is assumed that each node has different energy, one of the various levels defined (two tiered/ three tiered/ n- tiered). In SEP Nodes are treated differently based on their initial energy levels. The nodes with lower energy are called normal nodes and assigned a weighted election probability P_{nm} which is lower to P_{adv} which is the weighted election probability assigned to the advanced nodes, i.e., the nodes with higher energy levels.

4. Simulation Platform

Simulations are conducted using MATLAB 8.2.0.701 (R2013b) and to get precise plots, confidence interval is taken. Sensor nodes are deployed in random manner and made heterogeneous WSN using MATLAB. The wireless channel is employed as a result of the nodes deployed within the network area unit communication wirelessly supported their distance, transmission range etc. Simulations results can show that Modified LEACH i.e. MODLEACH can perform higher considering metrics of throughput, network life time, location of base station and initial energy of sensor nodes.

5. Conclusion (10pt)

Hierarchical routing protocol is one of the simplest and most commonly used in Wireless Sensor Network. To reduce the average latency LEACH protocol provide standard solution. But we observed that most of them facing problem of Energy Efficiency. So we propose new design of energy efficient LEACH protocol for wireless sensor network by using the concept of another protocol i.e. Stable Election Protocol. We will use Matlab platform for simulation & performance analysis. We expect the result with reduce the average latency per packet, less energy consumption and increases lifetime.

References(10pt)

- [1] DongyaoJia, Huaihua Zhu, ShengxiongZou and Po Hu, "Dynamic Cluster Head Selection Method for Wireless Sensor Network," *IEEE Communication Letters*, Volume 16, Issue 8, pp. 2746-2754, April 2016.
- [2] IllsooSohn, Jong-Ho Lee and Sang Hyun Lee, "Low-Energy Adaptive Clustering Hierarchy Using Affinity Propagation for Wireless Sensor Networks," *IEEE Communication Letters*, Volume 20, Issue 3, pp. 732-740, March 2016.
- [3] Zhao Han, Jie Wu, Jie Zhang, Liefeng Liu and KaiyunTian, "A General Self-Organized Tree-Based Energy-Balance Routing Protocol for Wireless Sensor Network," *IEEE Communication Letters*, Volume 61, Issue 2, pp. 558-561, April 2014.
- [4] Zhen Hong, Rui Wang and Xile Li, "A Clustering-tree Topology Control Based on the Energy Forecast for Heterogeneous Wireless Sensor Networks," *IEEE Communication Letters*, Volume 3, Issue 1, pp. 68-77, January 2016.

- [5] Lianshan Yan, Wei Pan, *Member*, Bin Luo, Xiaoyin Li and Jiangtao Liu, “Modified Energy-Efficient Protocol for Wireless Sensor Networks in the Presence of Distributed Optical Fiber Sensor Link,” *IEEE Communication Letters*, Volume 11, Issue 9, pp. 1815-1819, September 2011.
- [6] Mohammed Abo-Zahhad, Sabah M. Ahmed, Nabil Sabor and Shigenobu Sasaki, “Mobile Sink-Based Adaptive Immune Energy-Efficient Clustering Protocol for Improving the Lifetime and Stability Period of Wireless Sensor Networks.” *IEEE Communication Letters*, Volume 15, Issue 8, pp. 4576-4586, August 2015.
- [7] Saman Siavoshi, Yousef S. Kaviani and Hamid Sharif, “Load-balanced energy efficient clustering protocol for wireless sensor networks”, *IEEE Communication Letters*, Volume 6, Issue 3, pp. 67-73, May 2016.
- [8] M M Islam, M A Matin, T K Mondol, “Extended Stable Election Protocol (SEP) for three-level hierarchical clustered heterogeneous WSN ,” *IEEE Communication Letters*, september 2012.
- [9] Arafat Abu Malluh, Khaled M. Elleithy, Zakariya Qawaqneh, Ramadhan J. Mstafa, Adwan Alanazi, “EM-SEP: An efficient modified stable election protocol”, *IEEE Communication Letters*, May 2014.