

International Journal of Advance Research in Computer Science and Management Studies

Research Article / Survey Paper / Case Study

Available online at: www.ijarcsms.com

Comparative Study of LEACH Routing Protocol for WSN

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Abstract: *Wireless sensor network is one of the types of networking that have stable nodes. All the nodes in the wireless sensor network are equipped with battery and thus the main aim to improve the energy that is used to transmit the message from one node to another. In this survey paper we will be focusing on wireless sensor network that has some challenges and some limitations. The paper will also discuss about LEACH protocol which is based on hierarchal routing protocol.*

Keywords: *LEACH, Routing Protocol, WSN, Hierarchal, Cluster.*

I. INTRODUCTION

Mobile wireless sensor networks are the type of networks in which wireless sensor nodes are present and those sensor nodes are portable. MWSNs are a lesser and upcoming field of research. MWSNs are much more adaptable when compare with static sensor networks because they can be organized in any situation and can also deal speedy with changes. As there is no defined topology for sensor networks and this is one of the greatest confront that how to route data from its source to the destination. Normally these routing protocols depict motivation from two fields; WSNs and mobile ad hoc networks (MANETs). WSN routing protocols supply the functionality that is required but can't grip the high frequency whenever changes occur in topology. While, MANET routing protocols are type of protocol that can contract with mobility in the network but they are configured for two way message, in which the sensor networks is not required frequently. Low Energy Adaptive Clustering Hierarchy (LEACH) is known to be a mac protocol which is based on TDMA. It is incorporated with bunching and a plain routing protocol in wireless sensor networks (WSNs). The main motive of LEACH is to lesser the energy utilization which is required to generate and preserve clusters which further improve the life of a wireless sensor network [1, 2].

II. BACKGROUND WRITINGS

There is much study about LEACH in wireless sensor networks. LEACH is defined as the protocol which is based on clustering which make use of arbitrary rotary motion of restricted cluster base stations to regularly give out the energy load in the middle of the sensors in the network [3]. Several Researchers studied about LEACH and its improved version and following are some studies.

Braman.A, UmapathiG. R in the paper," A Comparative Study on Advances in LEACH Routing Protocol for Wireless Sensor Networks: A survey", in the year 2014 studied about the wireless sensor networks along with its routing protocol. Further they studied about the LEACH protocol which is the highest energy proficient protocol with its pros and cons. They also highlighted the improved version of leach and finally compared the previous LEACH with its new LEACH protocol and conclude that energy resourceful and protracted wireless sensor networks; still there is a need to find out more competent, scalable and healthy bunching system for best result [4].

Aslam et.al in the paper, "Survey of Extended LEACH-Based Clustering Routing Protocols for Wireless Sensor Networks" surveyed on the issues which are faced by LEACH and also provide its solutions. They illustrated about LEACH, Multihop LEACH, M-LEACH Solar-aware LEACH hierarchical routing protocols for wireless sensor network. They mainly focus on the

energy competence and throughput improvement of those routing protocols and evaluate the lifetime and delivery of data characteristics by comparing analytically and from simulation results [5].

Kwaśniewski.P et al in the paper, "Comparative Study of Wireless Sensor Networks Energy-Efficient Topologies and Power Save Protocols", paper deal with problem related with power of transmission of data in wireless sensor networks (WSN) which is one of the type of ad hoc networks with immobile nodes. The WSN nodes are the type of nodes that classically have batteries equipped; the major design object is to optimize the quantity of energy which is used in transmission. They have also put some light on methods on energy conservation and also provides algorithms which calculates for energy efficient topologies for wireless sensor networks. The effectiveness of four method based on location, i.e., two methods for control of topology and two algorithms for saving power are talked about which is based on the outcome of simulation experiments. They have also illustrated the energy efficient way of coordinating to wireless sensor networks and claimed that the results acquired save protocol GAF [6].

KumarV,JainS,TiwariS, in the paper, "Energy Efficient Clustering Algorithms in Wireless Sensor Networks: A Survey" in the year 2011 discussed about clustering algorithm in wireless sensor network. They also discussed about classification of energy clustering algorithm of sensor networks. Finally they discussed about LEACH and its of different types [7].

Choudhary.S and Sharma.S in the paper, "A Survey of LEACH Protocol and its Modified Versions in Wireless Sensor Network" in the year 2014 discussed about LEACH protocol and its versions. They defined Leach as new protocol of energy which is initiated for WSN which bank energy and increases duration of wireless sensor networks[8].

III. A BRIEF INTRODUCTION OF WIRELESS SENSOR NETWORKS

A sensor network consists of huge number of nodes of sensor that are organized in a ample area having very low powered sensor nodes. A wireless sensor network (WSN) can also be defined as a computer network which consists of spatial dispersed self-directed devices. Using sensors which courteously look out the physical or ecological conditions, for e.g. temperature, noise, pulsation, pressure, motion or impurity at different locations [9].

A wireless sensor network is a collection of focused transducers with a communiqué infrastructure for observing and copying circumstances at varied locations. The main features which are monitored in a sensor networks are moisture, heaviness, direction of wind, temperature, speed, intensity of sound, intensity of vibration, illumination intensity, voltage of power-line, levels of pollutants, and critical body functions [10].

Possible applications of sensor networks are as follows:-

- » Industrial Mechanization
- » Automated And Smart Homes
- » Video Examination
- » Passage Monitoring
- » Medical Device Examination
- » Monitoring Of Climate Conditions
- » Control Of Air Traffic
- » Managing Of Robot.

IV. CHALLENGES OF WIRELESS SENSOR NETWORKS

There are many challenges for Wireless sensor networks (WSN) because of having limitless credible as it is gaining momentous importance [11]. Though it is just the beginning in the duration of sensor network system and there are numerous challenges exist and are as follows:

Cost incurred in Hardware:-It is noted that every sensor that is used have very high cost. Fore.g. sensors of moisture, temperature and light are around 4000-5000 per unit when we bought in great quantity. Also sensors which are talented enough for tracking mobility of human inside large construction are at the cost of 15000 single units.

System Design: Still there is no defined system and there is no unified system and networking of structural design that is constant and grown-up enough to make dissimilar applications. Large number of applications and research models are incorporated in a vertical manner to gain maximum performance.

No wired Connection: Wireless passing of messages in interior environments that utilizes low power energy is still irregular. RF transceivers in fastidious in litter environments inside constructions commonly, with number of intrusive electromagnetic fields, for e.g. the one produced by cranes, equipment's and computers.

Programmability: a little figure of revised network programmability is needed. By which conservation forms of energy and communications always remain a confront [12].

V. LIMITATIONS OF WIRELESS SENSOR NETWORKS

Antagonistic Environment

Sensor networks can be organized in isolated or unfriendly areas such as battlefields. In all these situations, the nodes cannot be defended from attacked physically because anybody could have right to use to the location where they are organized.

Haphazard topology

Many of the time, arranging a sensor network in aintimidating environment is completed by casual distribution, such as from an aircraft. Because of that it is not easy to know the arrangement of sensor network in prior.

Power constraints

Because of small size of physical arrangement and be deficient of wires they lifted the power restrictions of sensor nodes. Also there are not many options available of power, because when wires are not present there is a short of stable power supply.

Storage constraints

The partial capacity for storage has an effect on the storage of cryptographic keys as well. As defined in the encryption method which is used, every sensor node require to recognize an amount of keys for every other node in the network with the aim of keeping communication secure and accumulate the keys in the nodes' storage space[13].

VI. ROUTING IN WIRELESS SENSOR NETWORKS

Routing in sensor networks is a big dare because of few important features that discriminate it from existing communication and wireless ad-hoc networks. Firstly it is impossible to construct universal addressing scheme for the organization of absolute number of sensor nodes, because of which traditional IP- based protocol cannot be used at sensor networks. Secondly in all applications of sensor networks there is the requirement of logic data should be flowed from various sources to a one single sink which is not required in existing communication. Thirdly, data traffic which is produced has considerable job loss because number of sensors generated the similar data within the surrounding area of occurrence [14]. On comparing from existing routing, routing in wireless sensor networks differs in many ways as there is no defined construction, links which are wireless are un trust worthy, chance of failure of sensor nodes and there is strong need of saving energy in

routing protocols of sensor networks. Thus all main routing protocols proposed for WSNs are classified into seven categories[15].

VII. HIERARICAL ROUTING PROTOCOL

When compared with other communication networks, one of the important design issue is the scalability in sensor networks. A single-layer network which can cause the entryway to overkill by increasing sensor's density. The main motive of hierarchical routing is to proficiently preserve the utilization of energy of sensor nodes and grip nodes in multi-hop communication inside a meticulous cluster and data aggregation is performed and combination that reduce the number of messages that are broadcasted to the sink.

VIII. CLUSTER BASED HIERARCHICAL ROUTING PROTOCOL

One of the most proficient routing protocols in wireless sensor networks (WSN) is hierarchical cluster-based routing protocols because it has greater energy efficiency, due to its higher energy efficiency, scalability of network and retransmission of data.

In this protocol the entire network is grouped into clusters and each cluster have its own cluster head which is used for data collection and for broadcasting while those sensor nodes that are not a part of cluster are used for sensing data. The main issue in this scenario is to select the head of cluster and to manage the cluster groups.

a) Advantages of clustering

The major advantages of clustering in wireless sensor networks are listed [15] below:

- 1 Clustering in sensor networks offers the spatial reprocess of all the used resources which increases the capacity of system. For example, the clusters that are not neighbor scan be used at the same frequency for wireless communication.
- 2 The information of routing that is transmitted can only be shared between cluster heads or with cluster gateways. By imposing this condition lessens the number of transmissions that is achieved for routing information. Using these pros of clustering can produced more energy efficient routing protocols.

b) Disadvantages of clustering

There are some disadvantages of clustering also which are as follows [16]:

- » The spending of energy on cluster-heads has not been tackled because nodes will absorb with more calculation and communiqué of data to superior level.
- » In this clustering there is no real life situation but only an idyllic network is assumed.
- » Different clusters have load imbalance possibly.
- » The Overhead is not deemed which is related with the cluster-heads selection

IX. LEACH BASED ROUTING PROTOCOL

LEACH is the first proposed protocol in hierarchical clustering algorithm for energy efficient in WSNs that became so popular and was recommended for reduction in power consumption. LEACH protocol works on aggregation methods that merges or aggregate the unique data into a lesser mass of data that contains only related and useful information to all each sensors.[17] The LEACH works by dividing the a network into a number of cluster of sensors. Those sensors are made by coordination and manage to reduce the quantity of data that are transmitted to the sink and also make routing and data distribution more scalable and vigorous. LEACH deal with this Trouble by randomized rotary motion of cluster-head to save the

battery of each and every node. By this LEACH make best use of network nodes and also decrease the energy indulgence by squeezing the data before transmitting to head of the cluster in LEACH protocol.[5]

The key-characteristics of LEACH are:

- 1 Randomize revolution of the CH and its matching clusters.
- 2 Local firmness to lessen worldwide communication.
- 3 Localized organization and Manage for cluster set-up and action.

The LEACH protocol is the first proposed hierarchal routing protocol and along with it there are various LEACH based its versions are developed.

a) LEACH-C

As nodes in Cluster head is little uncertain to count. Because of which LEACH-C has been proposed to explain this problem. It presents a resourceful algorithm of clustering configuration, where finest cluster head is chosen having minimum data transmission energy between a cluster head and cluster nodes.

b) E-LEACH

E-LEACH protocol based on LEACH which equilibrium the utilization of energy of sensor nodes which explain the overload energy utilization problem. it is important in LEACH protocol to choose the cluster that is best which consume less energy. Therefore, E-LEACH has minimum spanning tree from where the cluster head having the outstanding energy is selected as the root node. [8]

c) M-LEACH

M-LEACH protocol adjusts LEACH which allows sensor nodes that make the use of multi-hop communication inside the cluster which increases the energy effectiveness of the protocol.

X. CONCLUSION

In this survey paper we have discussed about wireless sensor network and its challenges along with its limitations. We have also throw some light on Clustering and LEACH hierarchal routing protocol. There are some disadvantages in LEACH protocol which need to overcome and we discussed some descendants of LEACH protocol like C -LEACH ,M-LEACH,E-LEACH are described in this survey paper and they make the protocol more efficient.

References

1. http://en.wikipedia.org/wiki/Wireless_sensor_network
2. http://en.wikipedia.org/wiki/Low_Energy_Adaptive_Clustering_Hierarchy
3. Yingu Li and Robert Persaud, "LEACH Protocol for Wireless Sensor Networks,"
4. Braman.A , Umapathi G. R , "A Comparative Study on Advances in LEACH Routing Protocol for Wireless Sensor Networks: A survey", International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014.
5. <http://arxiv.org/abs/1207.2609v1> july 2011
6. Kwaśniewski.P et al in the paper,"Comparative Study of Wireless Sensor Networks Energy-Efficient Topologies and Power Save Protocols",Journal of Telecommunication an information technology,3,2009.
7. Kumar.V,Jain.S,Tiwari.S , "Energy Efficient Clustering Algorithms in Wireless Sensor Networks: A Survey,IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 5, No 2, September 2011.
8. Choudhary et al., " A Survey of LEACH Protocol and its Modified Versions in Wireless Sensor Network ",International Journal of Advanced Research in Computer Science and Software Engineering 4(1), January - 2014, pp. 850-853.
9. Dinesh Kumar Gupta , "A Review on Wireless Sensor Networks," Network and Complex Systems, Vol.3, No.1, 2013-Selected from International Conference on Recent Trends in Applied Sciences with Engineering Applications.
10. <http://searchdatacenter.techtarget.com/definition/sensor-network>
11. John A. Stankovic, "Research Challenges for Wireless Sensor Networks," 2005.

12. NeelamSrivastava, "Challenges of Next-Generation Wireless Sensor Networks and its impact on Society," JOURNAL OF TELECOMMUNICATIONS, VOLUME 1, ISSUE 1, FEB 2010.
13. <http://webhosting.devshed.com/c/a/Web-Hosting-Articles/Wireless-Sensor-Networks-part-2-Limitations/1/>
14. Kemal Akkaya and Mohamed Younis, "A Survey on Routing Protocols for Wireless Sensor Networks," 2005.
15. Alia Sabri and Khalil Al-Shqeerat, "Hierarchical Cluster-Based Routing Protocols for Wireless Sensor Networks – A Survey," IJCSI International Journal of Computer Science Issues, Vol. 11, Issue 1, No 2, January 2014.
16. PrakashgoudPatil, UmakantKulkarni and N. H. Ayachit, " Some Issues in Clustering Algorithms for Wireless Sensor Networks," IJCA Special Issue on "2nd National Conference- Computing, Communication and Sensor Network CCSN, 2011.
17. http://www.cs.ucf.edu/~turgut/COURSES/EEL5937_SensorNet_Spr04/Lecture5-6-Jan20-22-04.ppt
18. Shio Kumar Singh, M P Singh and D K Singh, "A Survey of Energy-Efficient Hierarchical Cluster-Based Routing in Wireless Sensor Networks," Int. J. of Advanced Networking and Applications Volume: 02, Issue: 02, Pages: 570-580 (2010).