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A Survey on Clustering Protocol LEACH using Static Deployment Technique for WSN

Priyanka khralkar
Dept. of Computer Science, Godwana university(Maharashtra)
Priyankact22@gmail.com
www.ijcseonline.org

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Abstarct-Advance wireless sensor network (WSN) technology is Low- power electronics and Low-power radio frequency design has enabled the development of small, relatively inexpensive & low-power sensor technology. The important challenges in design of network are three key resource1) Energy 2) Communication bandwidth 3)coverage area . LEACH (Low Energy Adaptive Clustering Hierarchical) is a hierarchical clustering algorithm. It is more efficient than proactive n reactive protocol. LEACH protocol have some disadvantage. To overcome disadvantage we improved LEACH protocol by using optimal path forwarding algorithm and multihop technique i.e O-LEACH protocol. O-LEACH is more efficient than LEACH protocol and it uses static deployment technique.

Keywords- LEACH protocol, Wireless Sensor Network , Energy Efficient

Introduction

wireless Sensor Network is a popular area for research because now a days due to its vast potential usage in different areas. Wireless sensor network (WSN) [1,2] consists of hundreds and even thousands of small tiny devices called sensor nodes distributed autonomously to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure and motion at different locations. Micro-sensor network consist of many spatially distributed sensors, which are used to monitor various kinds of ambient conditions like temperature, humidity, etc and then transform them into electric signal. A sensor is equipped with a radio transceiver, a small microcontroller, and an energy source, usually a battery. Usually sensors are physically small and inexpensive. Small sensors are not as reliable as more expensive macro-sensors, but small size and small cost of an individual sensor, allow production and deployment in large numbers. A wireless sensor network contains hundreds or thousands of these sensor devices that have ability to communicate either directly to the Base Station (BS) or among each other. The nodes in WSNs are usually battery operated sensing devices with limited energy resources and replacing or replenishing the batteries is usually not an option. Thus energy efficiency is one of the most important issues and designing power efficient protocols is critical for prolonging the lifetime. Usually, sensor nodes are scattered in the sensing field, being the area where we want to monitor some ambient conditions. Sensor nodes have to coordinate among themselves to get information about the physical environment. The information collected by sensor nodes is routed to the Base Station either directly or through other sensor nodes. The Base Station is a fixed node or mobile node, which is capable to connect the sensor network to an infrastructure networks or to the Internet where users can access and process data. Application of WSNs exists in variety of fields including environmental applications, medical monitoring, home security, surveillance, military applications, etc [3]. Sensors in WSNs are generally equipped with data processing and communication capabilities [4]. But there are many challenges for implementation of WSNs due to different constraints like limited battery power, heterogeneity of sensor nodes, mobility of nodes, dynamic network topology, etc. In addition to these challenges, the network must be scalable and must have the ability to withstand harsh environmental conditions

Literature Survey

Weidi B. Heinzelman & Anantha P.Chandrakasan[1] in 2002 have described, networking together hundreds or thousands of cheap sensor nodes allows users to accurately monitor a remote environment by intelligently combining the data from the individual nodes. These networks require robust wireless communication protocols that are energy efficient and provide low latency. In this paper, develop and analyze low-energy adaptive clustering hierarchy (LEACH), a protocol architecture for sensor networks that combines the ideas of energy-efficient cluster-based routing and media access together with application-specific data aggregation to achieve good performance in terms of system lifetime, latency, and application-perceived quality.

Yuhua Liu &Yongfeng Zhao &Jingju Goa[2]in 2009 have described, analyses the cluster-heads generating algorithm among LEACH and presents improved approach that adjusting the nodes, Threshold function. When non cluster-heads choose optimal cluster-head

they consider comprehensive nodes residual energy and distance to base-station.

Beibei Wang & Chong Shen& Jing Li[3]in 2009 have described, analyzes the clustering mechanism in LEACH. One of problems in the LEACH protocol is that it depends on the time period to re-establish new clusters among whole network without considering the differences of energy consumption between the various clusters. In improved LEACH protocol, after clusters are established. Improved LEACH protocol effectively prolongs the network lifetime and effectively improve node's energy efficiency.

V. Loscrì, G. Morabito, S. Marano[4] in 2005 have described, a two-level hierarchy to realize a protocol that saves better the energy consumption. TL-LEACH uses random rotation of local cluster base stations (primary cluster-heads and secondary cluster-heads). Where it is possible, a two-level hierarchy. This permits to better distribute the energy load among the sensors in the network especially when the density of network is higher. TL-LEACH uses localized coordination to enable scalability and robustness. They evaluated the performances of our protocol with NS-2 and observedthat protocol outperforms the LEACH in terms of energy consumption and lifetime of the network.

Haosong Gou & YounghwanYoo[5]in 2010 have described, the energy efficiency is critical
for the lifetime and cost of WSN. The low-energy adaptive clustering hierarchy (LEACH) and another improved centralized LEACH deploys randomized rotation of cluster-heads to evenly distribute the energy load among all sensors in a WSN. This paper proposes an improved LEACH (LEACH-C) algorithm called partition-based LEACH (pLEACH), which firstly partitions network into optimal number of sectors, and then selects the node with the highest energy as the head for each sector, using the centralized calculations
.
Mohammad Mehdi Shirmohammadi, Mostafa Chhardoli, Karim Faez [6]in 2009 have introduced, a new protocol called CHEFC (Cluster Head Election Full Coverage) is able to tackle with the problem of CH vacancy in the different parts of the network. The function of this protocol is as follows: each sensor should usually have a CH in it vicinity, and unlike the previous protocol, there is no need for each sensor spends more energy to be connected with its own CH located in a farther distance. This protocol which acts on a distributed basis will lengthen the lifetime of the wireless sensor network as well as fully covering the CH in the network.

Mortaza Fahimi Khaton Abad, Mohammad Ali Jabraeil Jamali[7] in 2011 have introduced, In this work, an energy efficient clustering algorithm for sensor networks based on the LEACH protocol. LEACH uses a TDMA based MAC protocol, and In order to maintain a balanced energy consumption. The proposed protocol adds feature to LEACH to reduce the consumption of the network resource in each round. The proposed protocol is simulated and the results show a significant reduction in network energy consumption compared to LEACH.

Ms. V. Muthu Lakshmi [8] have described, LEACH have One deficiency that affects the performance of the protocol is existence of very large and very small clusters in the network at the same time. This leads to the decrease in lifetime of WSNs. In this paper, the proposed and analyzed a new energy efficient clusters protocol (Improved FZ-LEACH) that eliminates the above problem by forming Far-Zone. Far-Zone is a group of sensor nodes which are placed at locations where their energies are less than a threshold. The communication between nodes and Sink is based on the energy consumption and the minimum distance.

Low Energy Adaptive Clustering Hierarchy (Leach) Protocol

Energy efficient routing is possible by means of cluster based routing or *hierarchical* schemes [6]. In *Static Clustering* protocol, the clusters are chosen a-priori and fixed. *Static Clustering* includes scheduled data transmissions from the cluster members to the clusterhead and data aggregation at this cluster-head [6]. However, the limitation of *Static Clustering* routing technique is energy consumption due to fixed cluster head node in every round. To overcome this issue, *Low Energy Adaptive Clustering Hierarchy* (LEACH) was proposed [7]. It is a protocol based on clustering hierarchy architecture. In the LEACH algorithm, the nodes are self organized into different clusters, with electing *Cluster Header* (CH) nodes respectively.

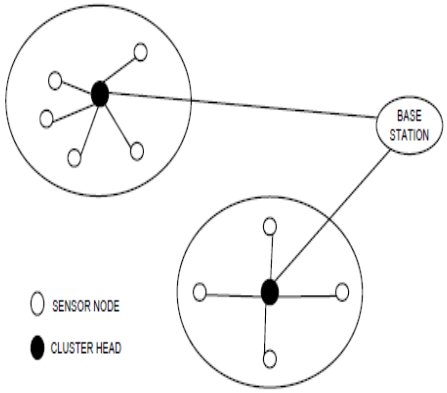


Fig. 2 LEACH Operation

Each cluster can only have one CH. All non-CH nodes send the data to the CH nodes of the clusters which they are in. Figure 2 shows a typical structure of WSN using the LEACH algorithm. In the LEACH algorithm, each node has to be the CH alternately for the sake of avoiding the energy of CH being consumed too fast.

Thus the implementation of this algorithm is separated into several rounds. Each round also can be divided into a construction
stage and a stable transmission stage.

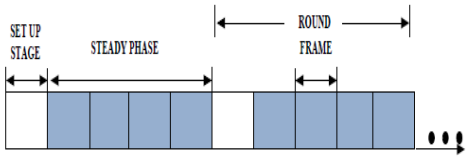


Fig. 3 Working Cycle of the LEACH Protocol

In the construction stage, it is random to choose a node as the CH node, of which the randomness ensures that the high cost of data transmission between the CH and the sink node is evenly allocated to all the sensor nodes. In the stable transmission stage, nodes continuously collect monitoring data and send them to the CH. Then the data will be sent to the sink node by CH after its necessary fusion processing. The working cycle of LEACH protocol and flow chart are shown in Figure 3 and 4 respectively. After the stable stage sustains for a period, the network moves forward into the next working round and reselect CH. For reducing the extra energy cost produced by dividing clusters, the stable stage is much longer than the construction stage [6][7]. Initially, the decision for selection of a CH is made by the node i choosing a random number between 0 and 1. If the number is less
than a threshold T (i), the node becomes a cluster CH for the current round.
The threshold is set as:
: If i ε G
: Otherwise
Where
P = the desired percentage of cluster heads (e.g., P = 0.05),
r = the current round, and
G is the set of nodes that have not been cluster-heads in the last 1/P rounds. The nodes that are CHs in round 0 cannot be CHs for the next 1/P rounds. Thus the probability that the remaining nodes are CHs must be increased, since there are fewer nodes that are eligible to become CHs.

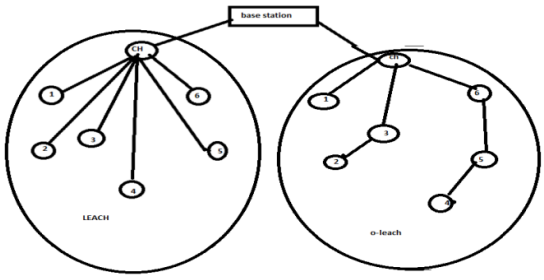
Comparing to the general other routing protocol, the LEACH protocol has a lot of advantages such as (a) it limits most of the communication inside the clusters and hence provides scalability in the network (b) single hop routing from node to CH hence saving energy (c) local data fusion processing (d) dynamic CH allocation and so on. It increases network lifetime in three ways. Firstly, distributing the role of CH (consumes more energy than normal nodes) to the other nodes. Secondly, aggregating the data by the CHs. Finally, TDMA, which assigned by the CH to its members, leaving most of the sensor in sleep mode, especially in event-based applications. Hence, it is able to increase the network lifetime, especially when dealing with the data having high correlations among them. A large amount of redundant data will be eliminated because of data fusion, which makes LEACH have a better performance on energy consumption [2][3][6]. However, Low energy nodes can also be selected as CH because of threshold condition and also additional overheads due to CH changes and calculations leading to energy inefficiency for dynamic clustering in large
networks [7].s

Disadvantage Of Leach

[1] LEACH does not provide clarity about position of sensor nodes and the number of cluster heads in the network.
[2] Each Cluster-Head directly communicates with BS no matter the distance between CH and BS. It will consume lot of its energy if the distance is far.
[3] The CH uses most of its energy for transmitting and collecting data, because, it will die faster than other nodes.
[4] The CH is always on and when the CH die, the cluster will become useless because the data gathered by cluster nodes will never reach the base station.

Optimal LEACH(O-LEACH)

According to survey of leach protocol. we found that there are some disadvantages of leach protocol. To avoid that disadvantage we proposed a new protocol that is optimal leach clustering hierarchical protocol .In this protocol we used optimal path forwarding algorithm. with the help of this protocol source node select shortest path to send data towards the cluster head. Distance is directly proportional to energy consumed .hence we used shortest path to send data towards the clusterhead.It uses static deployment technique that increase coverage area of network.



Advantage of O-leach over Leach protocol

[1]O- LEACH provide clarity about position of sensor nodes and the number of cluster heads in the network because it uses static deployment technique. In static deployment technique postion of node already known .we deploy node in such a way that cover a maximum area .
[2] Each Cluster-Head not directly communicates with BS. Even all non cluster head not directly communicate

with cluster head. It uses shortest path for communication that consume less energy.

[3] The CH uses most of its energy for transmitting and collecting data. Hence we select a CH randomly according to their energy.so it become less chance of CH die early.

[4] CH changes randomly according their residual energy .Each non cluster head get equal chance to become CH.Is uses load balancing that increase the life of network.

Conclusion

Hierarchical routing protocol is one of the simplest and most commonly used in Wireless Sensor Network. For reduce the Energy consumption protocol provide standard solution. But we observed that most of them facing problem of network lifetime. So we propose new design of energy efficient O-LEACH protocol for wireless sensor network. We will use NS2 platform for simulation & performance analysis. We expect the result with reduce the average energy consumption and increases lifetime.

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