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Survey on Leach Protocol in WSN

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Abstract: ***In wireless sensor networks (wsn) power is the most essential resource because each sensor node has limited batteries. So Many kinds of existing clustering protocols have been developed to balance and maximize lifetime of the sensor nodes in wireless sensor networks. In this dissertation we present T-LEACH which is a threshold-based cluster head replacement scheme for clustering protocols of wireless sensor networks. T-LEACH reduces the number of cluster head selection by using threshold of residual energy. Reducing the amount of head replacement and selection cost. The lifetime of the entire networks can be extended compared with the existing clustering protocols. Our simulation result shows T-LEACH provide better results as compare to LEACH in terms of balancing energy consumption and network lifetime.***

Keywords: Wireless sensor networks , Clustering protocols, Cluster head selection, Cluster head replacement Energy-efficiency, T-leach

1. Introduction

As a new information acquisition and processing technology, wireless sensor network （WSN) has a wide range of applications in military, environmental monitoring, smart furniture and space exploration and so on. Wireless Sensor Network can be described as an autonomy system consisting of lots of sensor nodes designed to intercommunicate by wireless radio and it can collaborate in real time monitoring, perceiving and collecting information of various environmental or monitoring objects and transfer this information to the base station. It does not need a fixed network support and it has rapid employment, survivability and other Characteristics, so it has a good application prospect.

A WSN is a specialized wireless sensor network made up of a large number of sensors and at least one base station. The sensor nodes are small devices that consist of four basic components:
1) Sensing subsystem
2) Processing subsystem
3) Wireless communication subsystem
4) Energy supply subsystem

The sensor nodes have limited communication range, memory and battery power etc. In most cases, the sensors forming these networks are exploited randomly and left un-attended to and are expected to perform their mission efficiently and properly. Sensor networks are also energy constrained since the individual sensors are extremely energy-constrained.

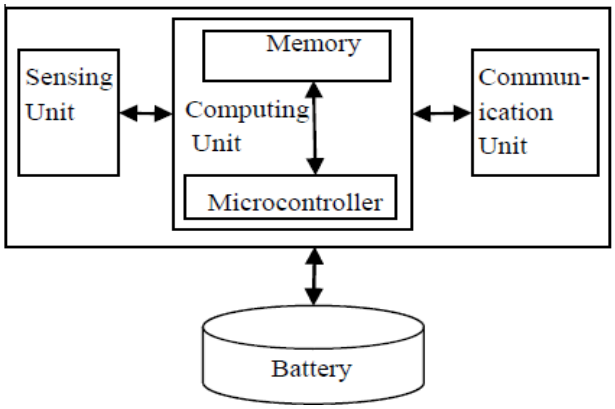

Figure 1: Block Diagram of WSN

2. Cluster Based Routing Protocol

In WSNs, broadcasting is an essential process for data transmission. Broadcasting is a process in which a source node transmits a message to all other nodes in the network. Clustering is one of the methods of Broadcasting. Our main worry is only about clustering because LEACH is using this. LEACH (Low Energy Adaptive Clustering Hierarchy), a clustering based protocol that exploits randomized rotation of local cluster based station (cluster-heads) to evenly distribute the energy load among the sensors in the network. LEACH uses localized allocation to enable scalability and robustness for dynamic networks and integrates data fusion into the routing protocol to reduce the amount of information that must be transmitted to the base station.

2.1 Working mechanism of Cluster based Routing

In clustering schemes, there are two kinds of nodes in one cluster, one cluster head (CH) and several other cluster members (CMs). Cluster members gather data from the environment periodically and send the data to cluster heads. Cluster heads clusters the data from their cluster members, and send the clustered data to the base station (BS). There are two kinds of communications between cluster heads and the base station, single-hop communication and multi-hop communication. In the multi-hop communication clustering algo's, the energy consumption of cluster heads consists of the energy for receiving, clustering and sending the data from their cluster members, well known as intra-cluster

energy consumption and the energy for forwarding data for their neighbor cluster heads known as inter-cluster energy consumption. The main goal of cluster-based routing protocol is to efficiently maintain the energy consumption of sensor nodes by involving them in multi-hop communication within a cluster. Also, it uses data clustering and data fusion in order to decrease transmission distance of sensor nodes and the number of transmitted messages to the sink.

3. Leach

Low energy adaptive clustering hierarchy uses the clustering principle to distribute the energy consumption all along its network. It is based on data collection network. It is divided into Clusters and Cluster heads are elected randomly. Cluster head collects the information from the nodes which are coming under its cluster. There are number of steps used in the LEACH protocol.

3.1 Advertisement Phase

It permits the first step in LEACH protocol. The desirable cluster head nodes will be issuing a notification to the nodes coming under its area of range to become a cluster member in its cluster. The nodes will be accepting the offer based upon the Received Signal Strength (RSS).

3.2 Cluster Set-up Phase

In this phase the nodes will be responding to their selected cluster heads.

3.3 Schedule creation

In this phase after receiving response from the nodes the cluster head have to make a Time division multiple access scheme and send back to its cluster members to constant them when they have to pass their information to it.

3.4 Data Transmission

The data collected by the separate sensors will be given to the cluster head a period of its time interval and on all other time the cluster subscriber radio will be off to reduce it energy expenditure. Here in the LEACH protocol multi cluster interference problem was solved by using unique code division multiple access codes for each cluster. It helps to prevent energy extract for the same sensor nodes which has been elected as the cluster innovator using randomization for each time cluster head would be changed. The cluster head is answerable for collecting data from its cluster members and attach it. Finally each cluster head will be forwarding the fused data to the base station. When differentiate with its above protocols LEACH have shown a considerable improvement.

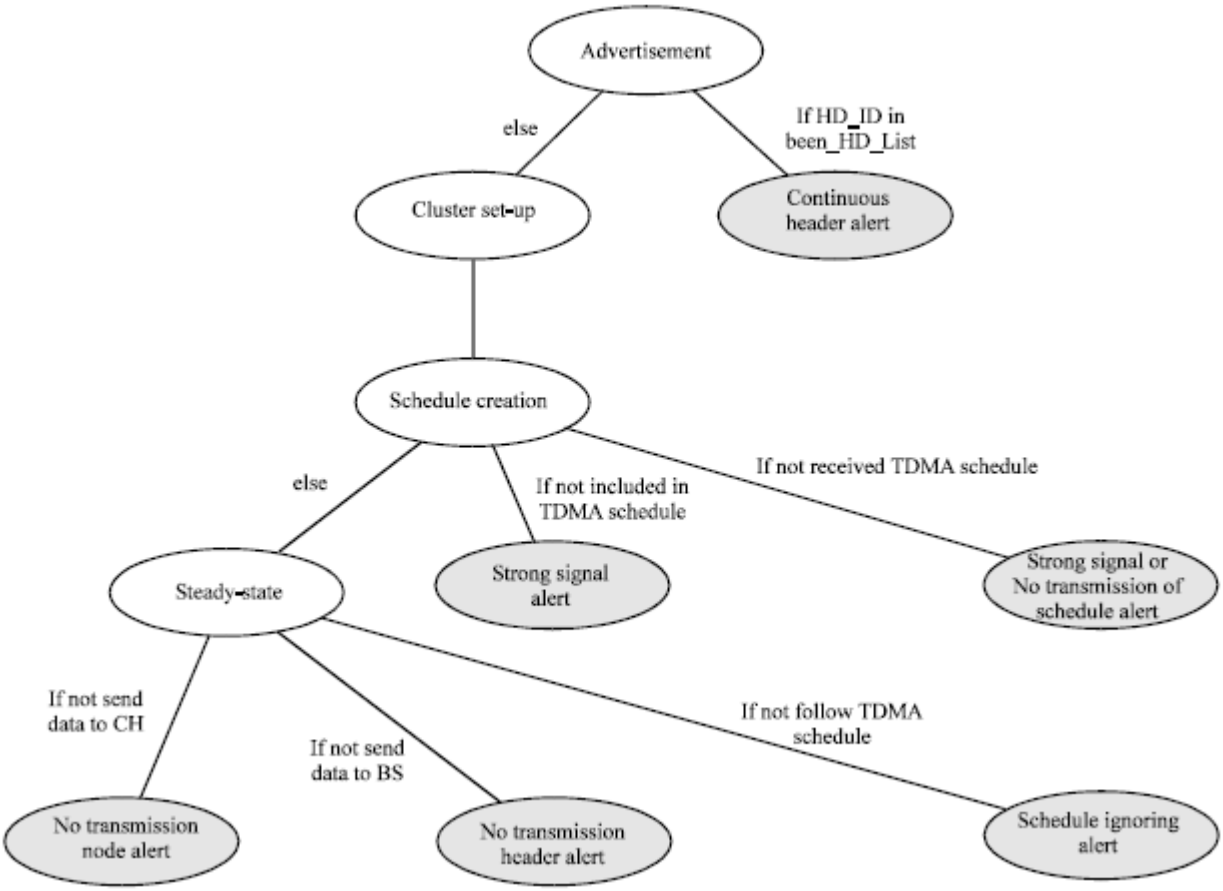

Figure 2. Leach protocol architecture

The key features of LEACH as specified in are -

- Contain co-ordination and control for cluster set up and the operation phase
- Randomized rotation of the Cluster-Heads and thereby their corresponding clusters
- Local compression to reduce the global communication which results in reduced congestion

4. T-Leach

T-LEACH, It is a threshold-based cluster head replacement scheme for clustering protocols of wireless sensor networks. T-LEACH reduces the number of cluster head selection by using threshold of residual energy. Lifetime of the entire networks can be extended compared with the existing clustering protocols by reducing the amount of head selection and replacement cost.

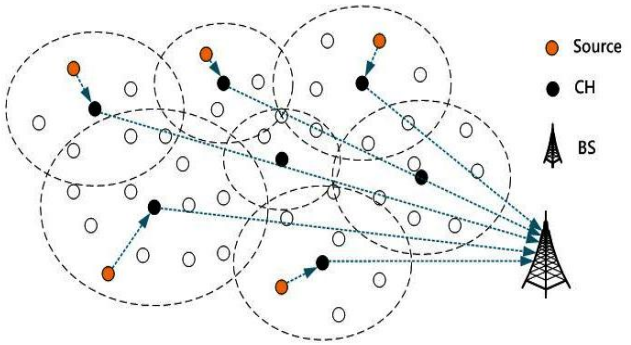

Figure 3: T-Leach architecture.

4.1 Why we use T-leach protocol

In LEACH protocol, due to the randomness of clusters forming, the energy of cluster head is very different, so do the distances between cluster heads and base station. Cluster heads are responsible not only for sending data to the base station but also for collecting and fusing the data from common nodes in their own clusters. In the process of data collection and transmission, the energy consumed by data transmission is greater than that of data fusion. If the current energy of a cluster head is less or the distance to base station is much far, then the cluster head will be died quickly because of a heavy energy burden. To address these issues, this article proposes a new improved algorithm i.e T-LEACH on how to balance the energy loads of these cluster heads.

5. Related Work

Chunyao FU, Zhifang JIANG, Wei WEIand Ang WEI[1] In LEACH protocol, due to the randomness of clusters forming, the energy of cluster head is very different, so do the distances between cluster heads and base station. Cluster heads are not responsible only for sending data to the base station, but also for collecting and fusing the data from common nodes in their own clusters. In the process of data collection and transmission, the energy consumed by data transmission is greater than that of data fusion. If the current energy of a cluster head is less or the distance to base station is much far, then the cluster head will be died quickly because of a heavy energy burden wireless sensor network WSN) has a wide range of applications in military. Wireless Sensor Network can be described as an autonomy system consisting of lots of sensor nodes designed to intercommunicate by wireless radio and it can collaborate in real time monitoring, collecting and perceiving information of various environmental or monitoring objects and transfer this information to the base station It does not need a fixed network support.

Meena Malik, Dr. Yudhvir Singh, Anshu Arora[2] WSN is a very large array of diverse sensor nodes that are interconnected by a communication network. The elementary components of sensor node are sensing, processing, transceiver and power unit. In WSN sensor node senses the physical quantity being measured and convert into an electrical signal. Then the signal is fed to an A/D converter. It is ready to be used by the processor. The processor will convert the signal into data depending on how it is programmed and it sends the information to the network by using transceiver. The sensor nodes can share sensing data and are used as input for a distributed estimation system. The fundamental objectives for WSN are flexibility, reliability, accuracy, cost effectiveness, and ease of deployment. WSN is made up of individual multifunctional sensor nodes

Erfan. Arbab, Vahe. Aghazarian, Alireza. Hedayati, and Nima. Ghazanfari Motlagh[3] LEACH is one of the most well known energy efficient clustering algorithms for WSNs that forms node clusters based on the received signal strength and uses these local cluster heads as routers to the BS. Since data transfer to the BS consumes more energy, all the sensor nodes within a cluster take turns with the transmission by rotating the cluster heads. This leads to balanced energy consumption of all nodes, and hence a longer lifetime of the network. In an enhancement over the LEACH algorithm was proposed. T-LEACH algorithm uses a centralized clustering algorithm and the same steady-state phase as LEACH. In LEACH each node sends information about its current location and residual energy level to the Base Station. In addition to determining good clusters, the Base Station needs to ensure that the energy load is evenly distributed among all the nodes.

Akyildiz, W. Su, Y, Sanakara subramaniam,et al [4] In this paper they describes the concept of sensor networks which has been made viable by the convergence of digital electronics, micro electro-mechanical systems technology, and wireless communications. First, the sensing tasks and the potential sensor networks applications are considered, and a review of factors influencing the design of sensor networks is provided.

HAN Hong-quan, ZHU Hong-song, MENG Jun [5] This investigation was performed to see if the improved LEACH protocol operates more effectively than the traditional LEACH protocol. The improved protocol adds distance factor and energy factor to the threshold T(n). The multi-hop routing algo of cluster head is introduced too, it is based on the hop count and the remaining energy.

W. R. Heinzelman, A. Chandra kasan, and H. Bala krishnan [6] Wireless distributed microsensor systems will enable the reliable monitoring of a variety of environments for both civil and military applications. In this paper, they looked at communication protocols, which can have remarkable impact on the overall energy dissipation of these networks. Based on their findings that the conventional protocols of direct transmission, multihop routing, minimum-transmission-energy, and static clustering may not be optimal for sensor networks, we propose LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that exploits randomized rotation of local cluster base stations (cluster-heads) to evenly distribute the energy load among the sensors in the network.

Dd V. Loscri, G. Morabito, and S. Marano [7] In this paper they have studied about leach protocol. In this paper they proposed a modification to a well-known protocol for sensor networks called Low Energy Adaptive Clustering Hierarchy (LEACH). This last is designed for sensor networks where end user wants to remotely monitor the environment. In such situation, the data from the individual nodes must be sent to a central base station (BS), often located far from the sensor network, through which the end-user can access data.

6. Conclusion

In this paper, the improved LEACH protocol acts as a remedy to the shortcomings of traditional LEACH protocol. It can solve the issue of the probability of each node to be selected as cluster head is same. The issue of some clusters heads may be in the edge of clusters far away from members cause increase in energy consumption is solved too. The improved LEACH protocol can neatly average energy consumption of network, achieve the balance of network's flow and extend the life-cycle of network.

7. Future Work

1. To improve network life time using different techniques and protocols.
2. To improve the dead nodes.

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Author Profile

Er. Sarbjit Kaur received the B.Tech degree in Computer Science Engineering from Bhai Maha Singh College of Engineering Muktsar, India in 2012. Now I am doing M. Tech from Bhai Maha Singh College of Engineering I have done my major project in ASP.net. During my project I have deal with visual studio and SQL server also. I have put my project live also.

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