

Improvement in Leach Protocol Using T-LEACH in WSN

Sarbjit Kaur¹, Khushdeep Kaur²

^{1,2}Computer Science Engineering Department, Bhai Maha Singh College of Engineering, Bathinda India

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. This kind of protocols select cluster heads periodically, and they considered only 'How can we select cluster heads energy-efficiently?' or 'What is the best selection of cluster heads?' without taking into consideration energy-efficient period of the cluster heads replacement. Unlimited head selection may dissipate limited battery power of the entire 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 unattended 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.

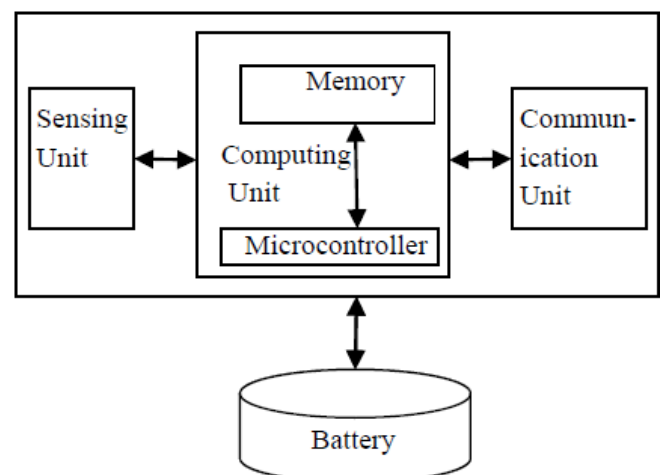


Figure 1: Block diagram of WSN

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 cluster 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. In the phase of cluster formation nodes will generate automatically random number between 0 and 1 and then compare the random number with threshold of current if the former is small, the node will become clusterhead of current round, responsible for communicating with the sink node the formula of cluster head node election is

$$T(n) = \{p/1-p * (r \bmod 1/p), n \in G\}$$

0

T= threshold value

P= Desired percentage

r= Current rounds

G= set of nodes

1/p= probability on nodes of each round

n= Natural number

4. T-Leach

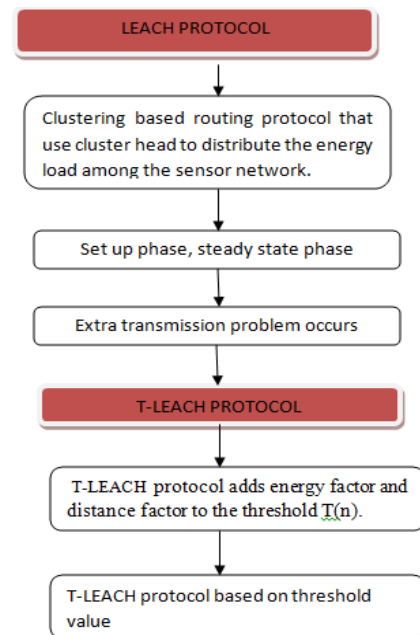
T-LEACH, It is a threshold-based cluster head replacement scheme for clustering protocols of wireless sensor networks. T-LEACH reduces the number of cluster head selection by using threshold of residual energy. Lifetime of the entire networks can be extended compared with the existing clustering protocols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

$$S(i).E = S(i).E - ETX * (4000) + Emp * 4000 * (\min_dis)$$

E= Total Energy

EtX= Transmission Energy

Emp= Multipath Loss



Block diagram

5. Figures & Tables

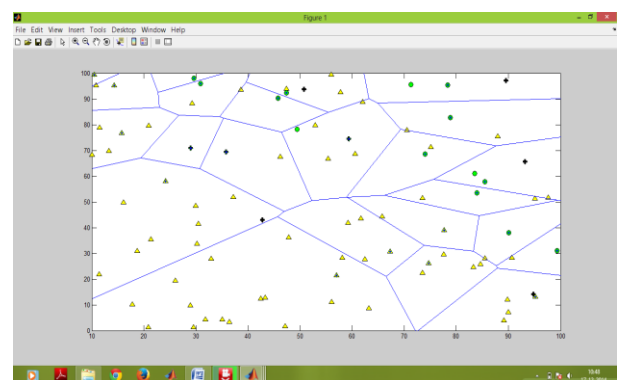


Figure (a)

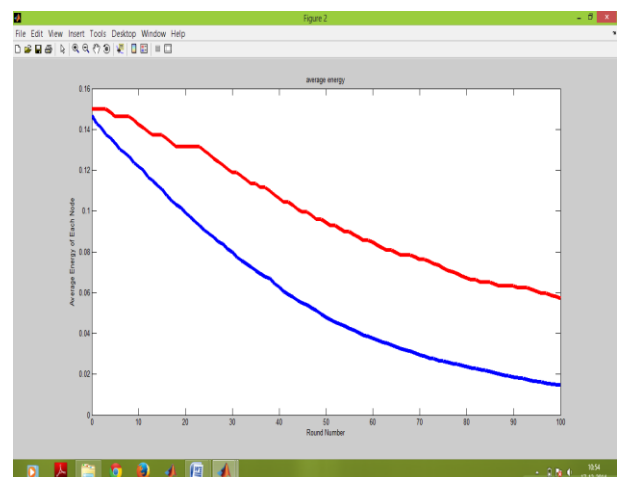


Figure (b)

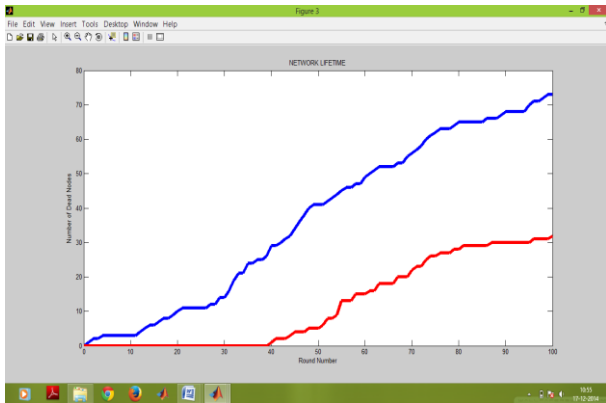


Figure (c)

Table (a): Average Energy of Leach & T-leach

No. of Nodes		No. of Average Energy	
LEACH	T-LEACH	LEACH	T-LEACH
0	0	0.15	0.15
10	10	0.12	0.14
20	20	0.1	0.13
30	30	0.08	0.12
40	40	0.06	0.11
50	50	0.05	0.09
60	60	0.04	0.085
70	70	0.03	0.08
80	80	0.02	0.07
90	90	0.02	0.065
100	100	0.01	0.06

Table (b): No. of dead nodes of leach & T-leach

No. of Nodes		No. of dead nodes	
LEACH	T-LEACH	LEACH	T-LEACH
0	0	0	0
10	10	4	0
20	20	10	0
30	30	14	0
40	40	27	4
50	50	41	6
60	60	46	16
70	70	55	22
80	80	64	28
90	90	68	30
100	100	72	32

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.

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Author Profile



Er. Sarbjit Kaur received the B.Tech degree in Computer Science Engineering from Bhai maha singh College Of Engg. Muktsar, India in 2012. Now I am doing M.Tech from Bhai Maha Singh College Of Engg. 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.



Er. Khushdeep kaur received the B.Tech degree from BGIET (PTU) and M.tech degrees from YCOE, India and Punjabi University, Patiala respectively.