Wireless Sensor Networks applications and Protocols- A Review

Er. Pooja
Student(M.Tech), Deptt. Of C.S.E, Geeta Institute of Management and Technology, Kurukshetra University, India

ABSTRACT

The design of an energy-efficient wireless sensor network protocol is one of the major issues in wireless sensor networks (WSN). In this study, we present a review of protocols adapted to a particular class of WSNs. These protocols are mainly used for nodes energy efficiency. It could be used by WSNs dedicated to environment monitoring where each node senses a parameter periodically.

Introduction

Wireless sensor networks (WSNs) are a widely used technology in particular for monitoring various environments. WSNs are composed of small wireless devices (sensors) connected to transducers. In general, WSNs are dedicated for monitoring physical environment and collecting data from it. They are used in various domains [1], [2] as ground monitoring, patient monitoring, animal monitoring,.... Thus, many works deal with WSNs where various interesting challenges and research issues have been tackled. WSNs were previously only dedicated to catch data from an environment and to transmit them to a sink or base station. For this reason, many researches focus on new methods to transmit data efficiently in order to reduce the energy consumption [2], [3] or to guarantee messages arrival [4], [5].

Our idea is to suggest a technique able to schedule communications over all nodes in an ordered way. This structure will contribute to assign a specific slot for each node to listen its previous neighbour, to compute aggregated data and to send modified data to its next neighbour. This method ensures to save high amount of energy.

A. Routing Challenges in Sensor Networks

Some of the routing challenges in WSN are as follows.

Energy Consumption : As sensor nodes in WSN have limited battery power, it becomes challenging to perform computation and transmission while optimizing energy consumption[1]. In fact the transmission of one bit of data consumes more energy than processing the same bit of data. Sensor node life time strongly depends on its battery life.

Node Deployment : Sensor nodes are usually densely deployed in the field of interest depending on application thus influencing the performance of a routing protocol. The deployment can be either deterministic or self-organizing. In deterministic case, the sensor nodes are manually placed and sensed data is routed through determined paths. In selforganizing systems, sensor nodes are scattered randomly creating a topology in an adhoc manner[2].

Data Delivery Models : Data delivery models can be time driven, data driven, query driven and hybrid (combination of delivery models) depending on the application of sensor nodes and time criticality of data reporting. These data delivery models highly influence the design of routing protocols especially with regard to reducing energy consumption[3],[4].

Node Capability : Depending on the application, a sensor node can have different role or capability such as relaying, sensing and aggregation since engaging all these functions on the same node would drain the energy of that node more quickly. Different capabilities of sensor nodes raise multiple issues related to data routing and makes routing more challenging[5],[6],[7].

Network Dynamics *:* Most of the network architectures assume that sensor nodes are static but the mobility of base stations and sensor nodes is necessary in some applications [8]. Routing packets in such dynamic architectures becomes challenging in addition to minimizing energy consumption and bandwidth utilization.
Data Aggregation *:* Since sensor nodes generate redundant data, cluster heads or base stations may receive similar packets from multiple nodes and these packets need to be aggregated before being forwarded to the base station. Signal processing methods can also be used for data aggregation[9].

II. TAXONOMY OF ROUTING PROTOCOLS

We present taxonomy of routing potocols for WSNs based on various classification criteria such as data centric, hierarchical, location based, negotiation based, multipath based, quality of service and mobility based as shown in figure 1
1. The objective of taxonomy is twofold:
(1) to provide a framework Wireless Sensor Network in which routing and data dissemination protocols for WSNs can be examined and compared; and
(2) to gain new insights into the routing and data dissemination protocols and thereby suggest avenues for future research.

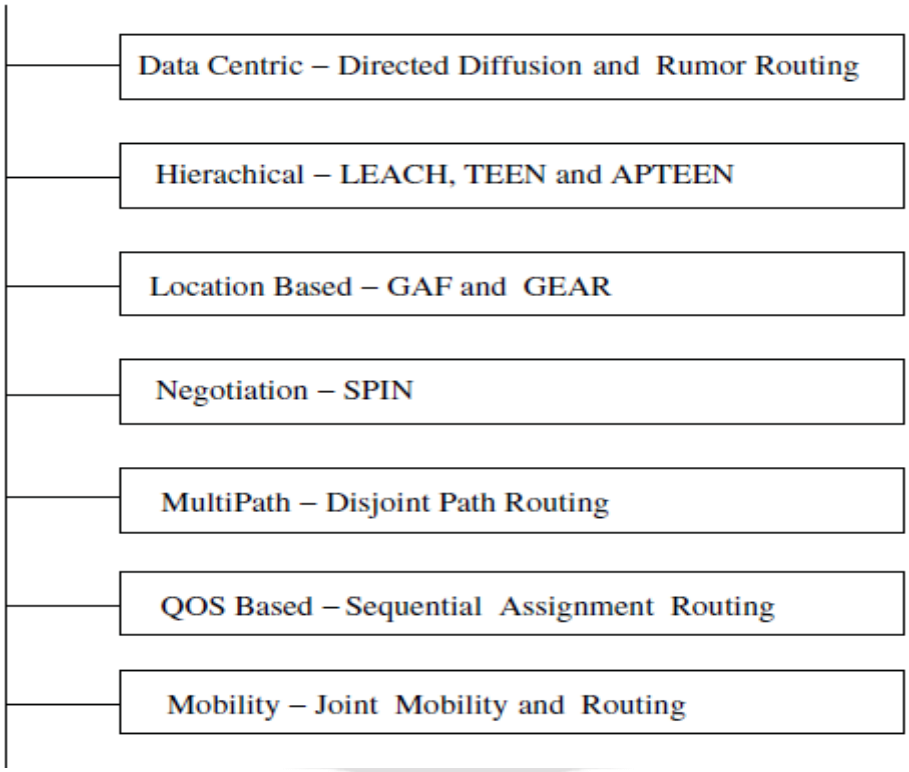

Figure 1: Taxonomy of Routing Protocols in WSN

PERFORMANCE ANALYSIS

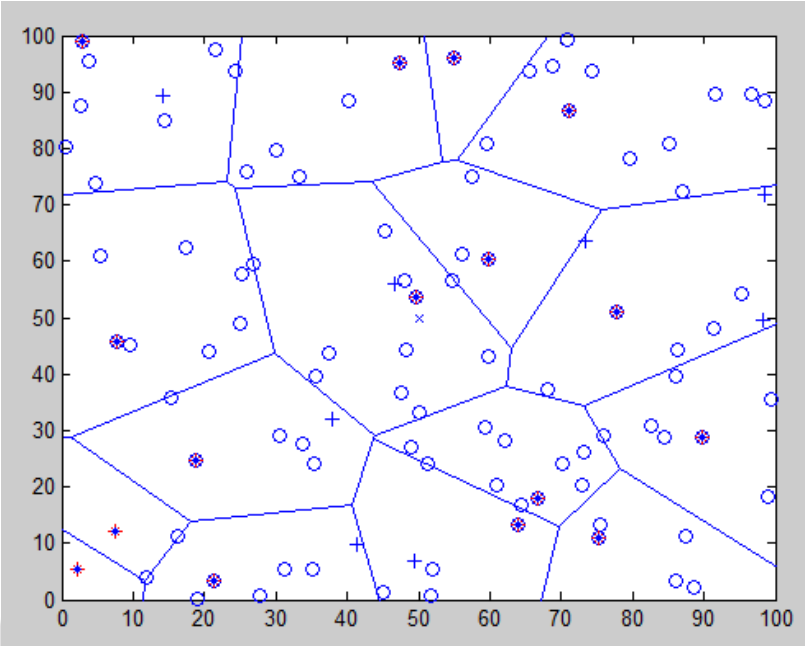

Fig2:- Showing the WSN structure and Cluster heads as Active nodes

Figure 2 is showing the WSN in active mode where all nodes are active. Nodes represent by circles are normal nodes and nodes with circle and star (*) are cluster heads.

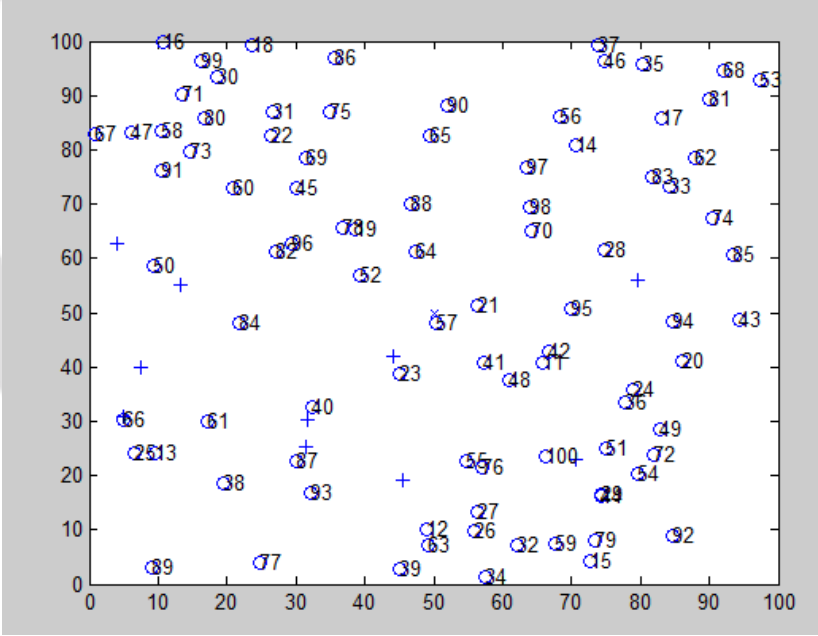

Fig3:- Distribution of nodes in a WSN

Figure 2 shows the WSN node distribution over the area. In this figure every node is shown with its node number by which it is represented in the network. This clears that there is no fixed position or pattern for the topology of the WSN node.They are distributed over the area randomly to perform functions assigned to them. The entire network has a base station that
is responsible for the collection of data from all other nodes.

First Dead Node

First dead node time is a matric of the WSN network that is known as the stability time of the network. The stability time in other word s can be defined as the time up to which all nodes of the network are alive and working properly. In the stability time each node of the network contribute to the functioning of the network.

As the node is dead it is represented by a red Dot in the network.

All Dead Node

All dead nodes is the metric of the WSN network which measures the time in which all nodes of the network dies in the network. This measure provides the information about the life time of the network greater the life time of the network greater is the extent up to which it can serve in the network by collecting information from the area and sending it up to the base station.

Comparision of the networks can be shown as :

Algorithm	Parameter	Analytical Study Result
LEACH	First Dead Node	1000
	Last Dead Node	1400
ELEACH	First Dead Node	1500
	Last Dead Node	2700
SEP	First Dead Node	900
	Last Dead Node	3000
ESEP	First Dead Node	1800
	Last Dead Node	3500

Packets Send To Cluster Heads

This metric of the WSN tells the information about the communication pattern in the network. It deals with the information exchange in the network. These packets are the number of packets which are sent by the nodes in the network working as a normal nodes to the cluster head of that area. Node which lie in the area of a cluster head only communicate to the cluster head which further communicate with the base station to fulfill the required goals.

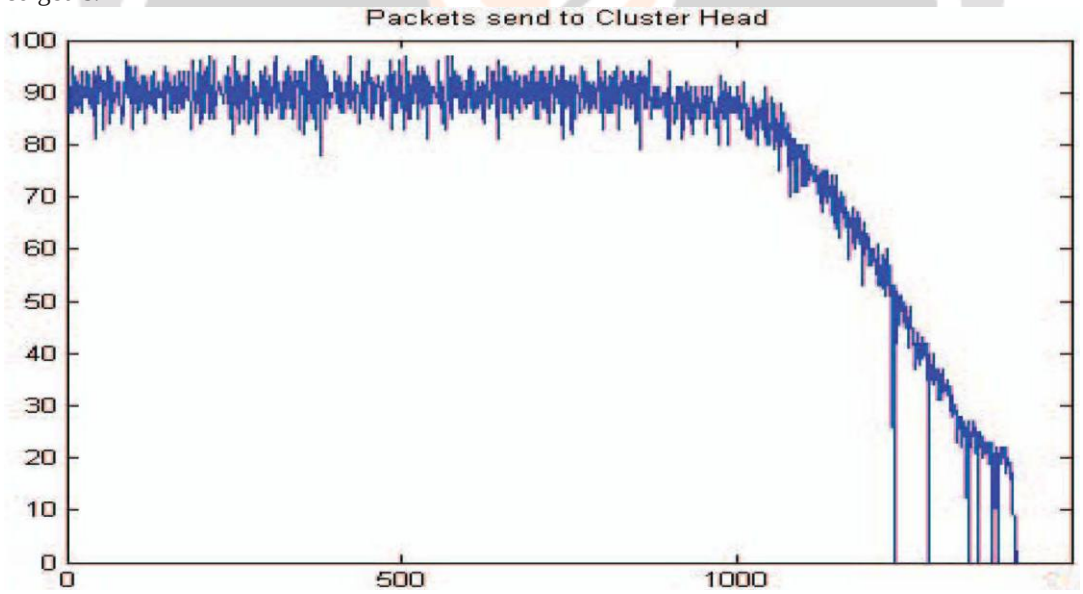

Figure :- Packets Send to Cluster Head of Leach Protocol

The above figure gives the information about the no of packets send to cluster head during its network life time of LEACH protocol.

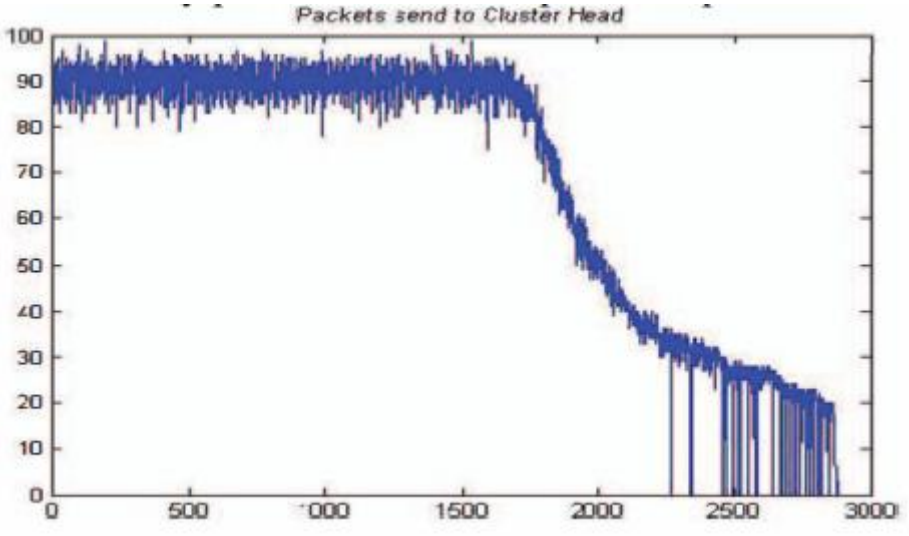

Figure:- Packets send to Cluster Head in case of ELEACH protocol

The above figure shows the number of packets send to cluster heads in case of ELEACH protocol , these packets are having similarity in maximum number with the LEACH protocol but the difference comes with the number of rounds up to which these packets are transmitted to the cluster heads . This protocol have the improvement over the LEACH protocol.

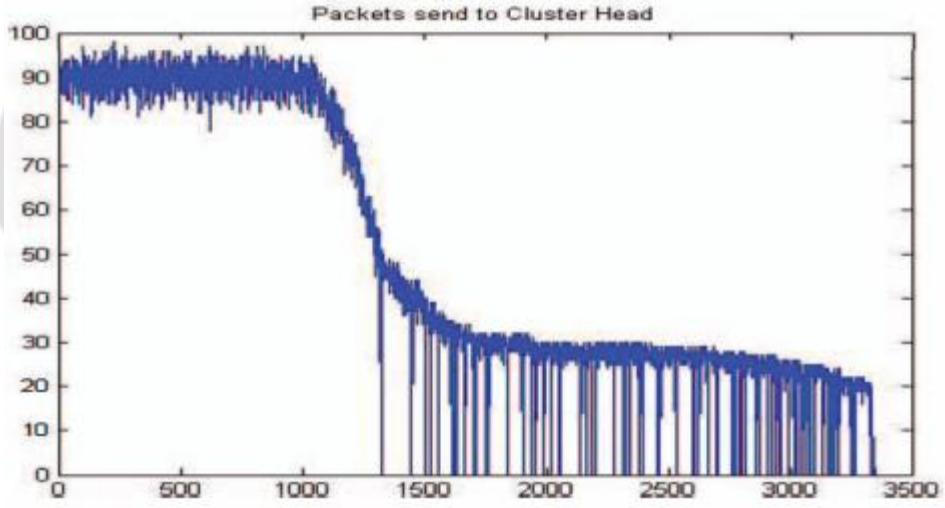

Figure:- Packets send to Cluster Head in case of SEP protocol

SEP protocol is an improvement over LEACH protocol in terms of heteroginity . It introduces the heterogenous network in WSN which is not present in case of LEACH protocol. By heteroginuity we mean that there are more than one type of nodes available in the network. The new type of the nodes are called as the advanced nodes. These nodes have the higher energy than that of the previously known nodes and popularly known as normal ndoes. The increase in life time of the network is directly depicted from the figure.

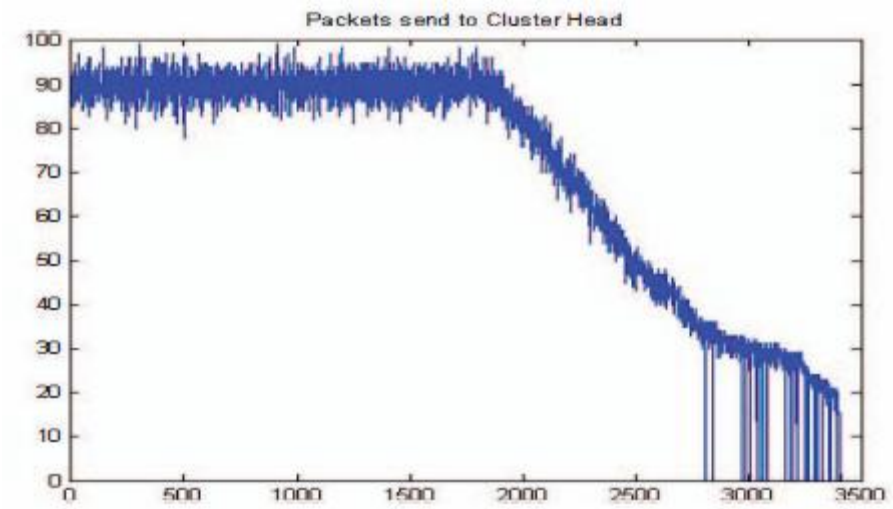

Figure :- Packets send to cluster head in ESEP protocol

The above figure showing the Packets that are sent to Cluster head in Energy Leach Protocol during the lifetime of the Energy Leach protocol. It illustrates the throughput from 0 rounds to 3414 as 3414 is the overall lifetime of leach in our experiment. Here y axis shows the amount of packets sent during running time. It is clearly shown that the packets goes down rapidly recently after the first node dead, which clearly shows the benefits of the stability period of wireless sensor network. However it also shows the progress in terms of network life time and stability period than the simple leach, eLeach,SEP protocol.

VI. CONCLUSION

In this paper we have examined the three protocol of WSN, i.e. Location-based, Data Centric & Hierarchical based routing protocols with respect to their power and reliability requirements. Then we make a comparison between these algorithms with many parameters like scalability, mobility support, power requirement, Quality of Service, multipath, energy efficiency, attribute based, location based, data aggregation and application type. In this time many protocols are focused on the issue like minimizing of energy associated with clustered selection process or with cluster head selection to provide a energy efficient techniques that eliminates all overhead selection process .there are still some challenges that will come. As our study research, it is not possible to give a good, design a routing algorithm. Which will have good under all conditions.

The future research would be based on the issues that how the sensors network will integrates with wired networks (i.e. Internet). Security will also the next issue in my topic which will focus , how to secure the data that is collected from sensor nodes to be transmitted to a server so that future analysis can be done. So further research will based on handling these kind of situations.

REFERENCES

[1] K. Akkaya and M. Younis, "A Survey on RoutingProtocols for Wireless Sensor Networks, Elsevier Ad Hoc Network Journal, vol. 3.

[2] I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, " A Survey on Sensor Networks," in IEEE communications Magazine, vol. 40, 2002, pp. 102-114.

[3] Yi-huazhu, Wan-dengwu, Jian pan, Yi-ping tang, " Anenergy efficient data gathering algorithm to prolong lifetime of wireless sensor networks", computer communication 33 (2010) pp. 639-646.

[4] S.K.Singh, M.P. Singh and D.K.Singh, " A survey of Energy-Efficient Hierarchical Cluster-nased Routing in Wireless Sensor Networks", International Journal of Advanced Networking and Application (IJANA) 2010, vol. 2, pp. 570-580.

[5] Qiangfeng Jiang and D. Manivannan, " Routing Protocols for Sensor Networks", in IEEE 2004.

[6] Shijin Dai, Xiaorong Jing and Lemin Li, " Research and Analysis on Routing Protocols for Wireless Sensor Networks", IEEE 2005 pp. 407- 411.

[7] B.Baranidharan, B.Shanthi, "A Survey on Energy Efficient Protocols for Wireless Sensor Networks", International Journal of Computer Application, vol. 11-no. 10, Dec. 2010.

[8] JunZheng and Abbas Jamalipour, " Wireless Sensor Networks: A Networking Perspective", a book published by a John & Sons, Inc, and
IEEE, 2009