

Assessment of Various Clustering Protocols in WSN

Poonam Dabas

(Assistant professor, UIET, Kurukshetra University, 136119, Kurukshetra, Haryana, India)

Abhinav Mahajan

(Mtech Student, UIET, Kurukshetra University, 136119, Kurukshetra, Haryana, India)

Abstract – Wireless sensor network is an infrastructure less network in which sensor nodes collect data from different locations and serve it to the base station. A base station is a node that is used to behave as an intermediate node between the user and the sensor node. It is very difficult to collect data from various sensor nodes and manage this large amount of data. Although, a number of clustering protocols are available in WSN such as LEACH, SEP, HEED and TEEN. These protocols help data aggregation in WSN. In this paper, an attempt has been made to the assessment of these clustering protocols.

Index Terms – Wireless Sensor Network (WSN), Cluster Head (CH), Sensor node, SEP, LEACH, and TEEN.

1. INTRODUCTION

A Wireless Sensor Network (WSN) is a network shaped by an expansive number of sensor nodes where every node is outfitted with a sensor to recognize physical wonders, for example, light, warm, weight, and so forth. WSNs are viewed as a progressive data gathering technique to fabricate the data and communication framework which will incredibly enhance the dependability and effectiveness of foundation frameworks. Contrasted and the wired arrangement, WSNs highlight less demanding sending and better adaptability of devices [1]. WSN is a network imparting utilizing a many-to-one model with various sensor nodes scattered into an objective perception territory with the goal of gathering and routing information to the end clients by means of a solitary sink node additionally called base station.

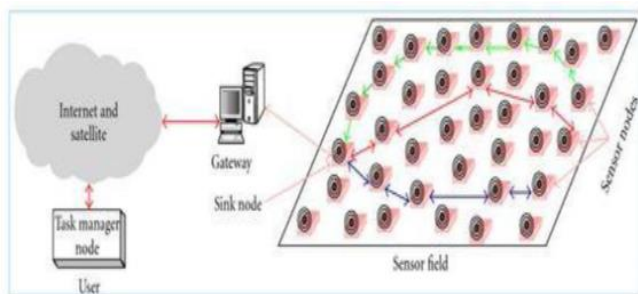


Figure 1 Deployment of Wireless sensors Network [1]

In WSN nodes use a lopsided measure of energy for communication and the required energy as far as battery power to transmit the packet will vary among the transmissions as for

the separation between the sender and receiver nodes. consequently, multi-hop communication is prescribed.

To upgrade the network lifetime properly many routing conventions and group-based calculations are utilized to satisfy the application prerequisites in WSN. From existing exploration techniques, upgrading energy dissemination for communication turns out to be exceptionally basic. For expanding lifetime of the WSN, some portion of an energy utilization of every sensor node has an imperative part while conveying among other sensor nodes [2].

1.1 Characteristics of WSN

Presently WSN is utilized as a part of certifiable for measuring different parameters, so for the proficient arrangement of the wireless sensor network, we ought to consider different qualities of the wireless sensor networks [3]. There are different attributes of the wireless sensor network and some of them are portrayed as takes after:-

Distributed Sensing and Processing:

In wireless sensor network different nodes are haphazardly dispersed and each of these nodes is equipped for handling, accumulating, gathering and sending information to the sink. Because of which this circulated detecting and handling gives heartiness to the framework.

Energy Efficient:

In WSN energy is utilized for various purposes like preparing communication and capacity. This energy is given by a lithium battery in the sensor nodes. A distinctive measure of energy is utilized for various procedures some require increasingly while some require lesser energy. The convention and calculation must be considered in the planning stage for the power administration as this wellspring of energy may come up short on power and bringing about a dead node.

Low Cost:

As wireless sensor network comprises of hundreds to thousands of sensor nodes for measuring physical or natural conditions. So to reduce the general cost of the network, the number of nodes ought to be kept low however much as could reasonably be expected.

Security and Privacy:

For anticipating unapproved access, assault and inadvertent harm to the information in the sensor nodes every node ought to have some security and protection instrument [4].

1.2 Challenges of WSN

As the utilization of the WSNs is expanding and developing at a fast pace. A few difficulties are additionally being looked by engineers in the meantime. Some such issues and difficulties identified with wireless sensor networks are as per the following [5]:

Self Management:

The wireless sensors once conveyed ought to have the capacity to work with no human mediation. It ought to have the capacity to perform operations like adaption, the arrangement of network and upkeep independent from anyone else.

Issues Related to Data Collection and Transmission:

The primary target of sensor nodes is to gather the detected information and afterward transmit it to the sink. The issue related to information accumulation and information transmission is that occasionally information gathered by the sensors is excess in nature and there is no utilization of transmitting such information as it will just devour energy. So mind must be taken amid the procedure of information gathering and information transmission.

Issues Related to Deployment:

From sending we mean the usage of the wireless sensor networks in certifiable areas. The sending procedure is hard and hard to convey as it relies upon the statistic areas. On areas which are hard to achieve sensors are put by dropping them from the helicopters and on a few areas sensors are put as per the related topologies. It is difficult to supplant batteries of such sensors because of which energy-related issues emerge.

Limited Memory and Storage Space:

As sensor nodes are little devices with a constrained memory and storage room keeping in mind the end goal to have a successful security component the product composed for such nodes should likewise be littler in the estimate which is a test identified with the wireless sensor networks[6].

2. CLUSTERING PROTOCOLS

2.1 LEACH (Low Energy Adaptive Clustering Hierarchy):

LEACH [7] is a self-sorting out and versatile clustering protocol. Randomization is utilized for the dispersion of energy stack among the sensors in the network. The accompanying is the presumptions made in the LEACH protocol: a. All nodes can transmit with enough power to achieve the base station. b. Every node has enough computational power to help distinctive

MAC protocols. c. Nodes found near each other have associated information. As per this protocol, the base station is settled and situated a long way from the sensor nodes and the nodes are homogeneous and energy obliged. Here, one node called cluster-head (CH) goes about as the neighborhood base station. Drain haphazardly turns the high-energy cluster-head with the goal that the exercises are similarly shared among the sensors and the sensors devour battery power similarly. Filter additionally performs information combination, i.e. the pressure of information when information is sent from the clusters to the base station accordingly diminishing energy dissemination and upgrading framework lifetime. Drain separates the aggregate operation into rounds—each round comprising of two stages: set-up stage and relentless stage. In the set-up stage, clusters are shaped and a CH is chosen for each cluster. The CH is chosen from the sensor nodes at once with a specific likelihood. Every node produces an arbitrary number from 0 to 1. In the consistent state stage, nodes send information to their CH amid their assigned schedule vacancy utilizing TDMA. At the point when the cluster head gets information from its cluster, it totals the information and sends the packed information to the BS. Since the BS is far from the CH, it needs high energy for transmitting the information. This influences just the nodes which are CHs and that is the reason the choice of a CH relies upon the rest of the energy of that node.

2.2 SEP (Stable Election Protocol) :

It is used for clustered heterogeneous wireless sensor networks. The principle thought behind SEP is to build the strength time frame. SEP is utilized to conquer the impediment of the LEACH protocol as SEP is utilized for heterogeneous WSN though LEACH is utilized for homogeneous WSN. In homogeneous WSN there are various types of nodes with each with various energy, the node with most noteworthy energy is picked as the cluster head. The nodes with the lower energy are called ordinary node they have a weighted decision plausibility $P(nrm)$ which is lower than the propel nodes [8].

2.3 HEED (Hybrid Energy-Efficient Distributed Clustering) :

It upgrades the LEACH protocol by using remaining energy, node degree or thickness as essential parameters for cluster improvement to fulfill control altering. This protocol was proposed with three essential parameters: the First parameter is to enhance network lifetime by scattering energy usage, second clustering closes inside a settled number of cycles third minimum control overhead and fourth the cluster heads was all around appropriated. The estimations proposed in this protocol discontinuously pick cluster heads in light of the two essential parameters. The foremost fundamental parameter is the rest of the energy of each node; the second parameter is the intra-cluster correspondence given a part as a segment of cluster thickness or node degree [9].

2.4 TEEN (Threshold sensitive Energy Efficient sensor Network protocol) :

This is a progressive protocol whose principle point is to manage sudden changes in the detected qualities, for example, energy. This protocol combines the tree based procedure in accordance with an information-driven strategy. The nodes retain their condition steadily, however, the energy utilization in TEEN can most likely be considerably less than that in the proactive network, because of the reason that information transmission between nodes is done in a less regular way. High schooler performs operations by characterizing two threshold capacities [10]: Hard Threshold: This threshold is a threshold work an incentive for the detected component. It is the supreme incentive through which the node that has detected this esteem must exchange to its transmitter and educate to its CH. Delicate Threshold: The delicate threshold is a little change in the estimation of the detected property which makes the node exchange to its transmitter. In the TEEN protocol, a CH transmits its nodes a flag of hard threshold and a delicate threshold. The hard threshold tries to limit the information communications by allowing the nodes to send just when the detected trait is within the scope of sending region. The delicate threshold limits the information communications that may have happened when there is little or no adjustment in the detected characteristic [11].

Table1 Assessment of different clustering protocols

Protocol	CH Selection	Route Selection	Base station	Inter-Cluster	Simulation Tools
LEACH	Randomly	Proactive	Stationary	Single hop	MATLAB
SEP	Based on Energy	Reactive	stationary	Multi hop	MATLAB
HEED	Based on energy	Hybrid	stationary	Single, Multi hop	MATLAB
TEEN	Randomly	Reactive	Stationary	Multi hop	NS-2

Table 1 illustrates assessment of LEACH SEP TEEN and HEED with parameters like energy used, route selection, cluster head selection, base station and simulation tools used by these protocols.

3. CONCLUSION

Clustering is a method to diminish energy utilization and to give steadiness in wireless sensor networks. For heterogeneous wireless sensor networks, a few clustering

protocols are proposed. The majority of the current energy effective clustering protocols intended for sensor networks depend on leftover energy, normal energy, area, thickness and so forth which are powerful in energy-sparing. In this paper assessment of different clustering protocols such as LEACH, HEED, SEP, and TEEN has been presented. SEP is much better than other clustering protocols as table 1 shown. It is intended to propose a mechanism to improve data aggregation in WSN that will help in energy efficient data transmission with less packet drop rate.

REFERENCES

- [1] V. Raghunathan, C. Schurgers, Park. S, and M. B. Srivastava. 2002. Energy-aware wireless microsensor networks. IEEE Signal Processing Magazine, Volume: 19 Issue: 2, Page(s): 40-50.
- [2] Chi-Tsun Cheng; Tse, C.K.; Lau, F.C.M., "A Clustering Algorithm for Wireless Sensor Networks Based on Social Insect Colonies," Sensors Journal, IEEE, vol.11, no.3, pp.711-721, March 2011.
- [3] Giuseppe Anastasi, Marco Conti, Mario Di Francesco, Andrea Passarella, Energy conservation in wireless sensor networks: A survey, Ad Hoc Networks, ELSEVIER, Volume 7, Issue 3, May 2009, Pages 537-568,
- [4] Ankit Tripathi, Sanjeev Gupta and Bharti Chourasiya, "Survey on Data Aggregation Techniques for Wireless Sensor Networks", IJARCC, ISSN(online): 2278-1021 & ISSN(print): 2319-5940, Volume 3, Issue 7, July 2014.
- [5] Siva D. Muruganathan, Daniel C. F. MA, Rolly I. Bhasin, and Abraham O. Fapojuwo, "A Centralised Energy Efficient Routing Protocol For Wireless Sensor Networks", IEEE Radio Communications March 2005.
- [6] Meenakshi Diwakar and Sushil Kumar, "An Energy Efficient Level Based Clustering Routing Protocol For Wireless Sensor Networks", International Journal Of Advanced Smart Sensor Network Systems (IJASSN), Vol 2, No.2, April 2012.
- [7] Wendi B. Heinzelman, , Anantha P. Chandrakasan and Hari Balakrishnan, " An Application Specific Protocol Architecture For Wireless Microsensor Networks", IEEE Transactions on Wireless Communications, Vol.1, No.4, October 2002.
- [8] W. Rabiner Heinzelman and H. Balakrishnan, "Energy-Efficient Communication Protocol for Wireless microsensor networks", IEEE, Proceeding of the 3rd Hawaii International Conference on System Science, 2000.
- [9] Georgios Smaragdakis and Ibrahim Matta, "SEP: A Stable Election Protocol for Clustered Heterogeneous Wireless Sensor Networks" 2004.
- [10] O. Younis, S. Fahmy, "HEED: A Hybrid, Energy-Efficient, Distributed clustering approach for Ad Hoc sensor networks", IEEE Transactions on Mobile Computing 2004.
- [11] P. Ding, J. Holliday, and A. Celik, "Distributed energy efficient hierarchical clustering for wireless sensor networks", In: Proceedings of the IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS'05) 2005.
- [12] Guihai Chen Chengfa Li, "An unequal cluster-based routing protocol in wireless sensor networks", Springer Science Business Media, LLC 2007.
- [13] Md. Golam Rashed and M. Hasnat Kabir, "WEP: an Energy Efficient Protocol for Cluster Based Heterogeneous Wireless Sensor Network", International Journal of Distributed and Parallel Systems (IJDPS) 2011.