Comparative Study of Various Clustering Protocols Using WSN

Priya Suri[1], Sunil Kumar Gupta[2] and Rajeev Bedi[3]

[1]Dept of C.S.E B.C.E.T, Gurdaspur
[2,3]B.C.E.T, Gurdaspur

Abstract—*The use of Wireless Sensor Network (WSN) is increasing day-by-day in the area of networking and services to provide new technologies and to handle more complex functions. Various clustering protocols are discussed in this paper.*

Keywords: *SEP, LEACH, E-LEACH, Stability Period, Cluster Head, Sensor nodes.*

1. INTRODUCTION

A wireless Sensor network consists of large number of tiny devices named as "Sensor Nodes" which contains limited storage capabilities.

A sensor node may contain three important units named as:
- Sensing Unit: To sense the data from surroundings and collect the data for further use.
- Computing Unit: To process the collected data.
- Communication Unit: Communication unit includes batteries as well as the memory used to store the data.

Data in WSN is first sensed by the nodes and then forward that data towards the centre unit called as "Sink". A WSN is considered to be a collection of sensor nodes that are distributed over the region called as "Sensor Field". The Sink is responsible to communicate with the user through internet.

Since wireless sensor network consists of tiny batteries having limited energy so to charge or to change that batteries are not possible.
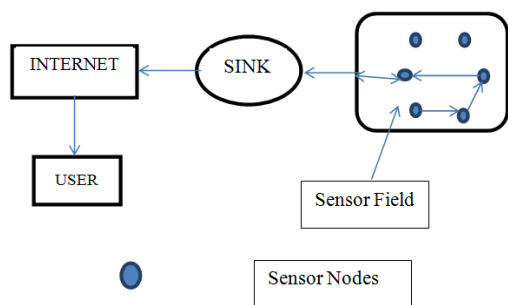

Fig. 1: Architecture of Wireless Sensor Network

So efficient utilization of that energy is important so as to increase the lifetime of the network.

Above diagram shows the how the data is used to travel with the help of "Sink".

1.1 PERFORMANCE PARAMETERS

Various performance parameters are used to evaluate and study of behaviour and its efficiency of various protocols are as follows:
- **Number of Cluster Head**:It denotes the number of cluster heads selected for each respective round.
- **Number of Live Nodes**: Those nodes that have yet not spend their whole energy.
- **Data Packets Received At Cluster Head**: It counts the total number of data packets received by the base station.
- **Number of Dead Nodes:** Those nodes that have already spend their whole energy.

All the above parameters are used to calculate the stability period of the network which concludes the time interval from start of the first node and the death of last node.

2. VARIOUS CLUSTERING PROTOCOLS HAVE BEEN DEVELOPED TILL DATE.SOMEOF THEM ARE EXPLAINED AS FOLLOWS:

2.1 SEP(Stable Election Protocols)
- SEP is based on the collection of heterogeneous nodes and concludes the stability period of the nodes which includes the time before the death of its first node.
- Weighted Election probabilities are used to calculate the probability of particular node to become cluster head in each round.
- SEP proves to prolong the stability period of the network.
- Efficient energy consumption is resulted by SEP.
- The nodes in SEP are divided into two types:
  1. Advanced Nodes.
  2. Normal Nodes.

- Advance nodes become cluster heads earlier than normal nodes.
- The main drawback of Sep is that the nodes are not distributed in a well-defined dynamic fashion which results in wastage of large amount of energy.
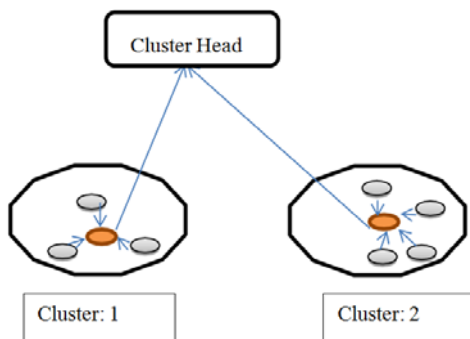

Fig. 2: SEP Protocol Architecture

2.2 LEACH(Low –Energy Adaptive Clustering Hierarchy)

- **L**EACH is based on cluster formation technique.Cluster head is selected in random fashion.
- The data in this protocol isfirst collected and then then aggregated which is then ready to send to the "Base Station".
- The TDMA technique is used for the communication of nodes with their base station.
- The LEACH uses two types of phases:
  1. Set-up Phase:The clusters of data takes place and then, a cluster head among that nodes are selected in a random fashion.
  2. Steady-State Phase:The transfer of actual data takes place and the overall time period of this phase is higher than that of the steady state phase.
- Once a node becomes the cluster head then ,$1/p$ probability is counted in which that nodes cannot be able to become the cluster head again(p denotes the probability).
- The main disadvantage of using LEACH protocol is that a lot of energy is wasted if the cluster head is located a far away.
- Since cluster head are selected in random fashion so energy wastage takes place in the selection of cluster head.

2.3E-LEACH(Energy-LEACH)

- E-LEACH improves the selection of cluster head than the LEACH protocol.

- This protocol decides that whether the given nodes can be able to become the cluster head or not according to their residual energy available.
- Nodes having highest residual energy will become the cluster head.
- The network lifetime of the E-LEACH protocol is more than that of the LEACH protocol.
- Wastage of energy is reduced than that of the LEACH protocol.

3. C0NCLUSION

From the above study,it is concluded that the basicclustering protocols waste a lot of energy in selecting their cluster head and also the distribution of nodes re taken in a uniform manner. Hence, a new techniques is to be taken into account whose aim is to distribute the nodes into a uniform manner as well as reduce the wastage of energy to a greater extend.

To acquire the above results, firstly the nodes must be divided into zones and from each zone,an informer is to be elected .The division of nodes must be done in a uniform manner and a cluster head is to be elected in each cluster having highest energy among all the nodes.

REFERENCES

[1] Guisheng Yinl,GuangYang l,2,Wu Yang l,2,Bingyang Zhang l ,2,Wenjin Jin l,"An Energy-Efficient Routing Algorithm for Wireless Sensor Networks",International Conference on Internet Computing in Science and Engineering (IEEE) (2008), pp.181-186.

[2] Haosong Gou and YounghwanYoo,"An Energy Balancing LEACH Algorithm for Wireless Sensor Networks",Seventh International Conference on Information Technology (IEEE)(2010),pp.822-827.

[3] Halkidi M and Kouts Opoulos L,"Online Clustering Of Distributed Streaming Data Using Belief Propogation Techniques",International Workshop on Wireless Ad-Hoc Networks (IEEE) Volume:1(2011), pp.216-225.

[4] Ying He,Jian Wang,Liang-Xi Qin;Lin Mei,"A H-K Clustering Algorithn Based On Esemble Learning Smart And Sustainable City ",International Conference (IEEE)(2013), pp.300-305.

[5] Jianbin Haung,Hali Sun,Quinboo Song,Hongbo Deng "Revealing Density-Based Clustering Structure From Core-Connected Tree Of A Network", International Conference (IEEE)(2013)Volume:25, pp.1876-1889.

[6] Linlin Wang,JieLiu,Wei Wang"An Improvement and Simulation of LEACH Protocol for Wireless Sensor Network",First International Conference on Pervasive Computing, Signal Processing and Applications(IEEE)(20 I 0),ppA44-447.

[7] Ma Chaw Mon Thein, ThandarThein"An Energy Efficient Cluster-Head Selection for Wireless Sensor Networks",International Conference on Intelligent Systems, Modelling and Simulation(IEEE)(2010), pp.287-291.

[8] Meenakshi Sharma and Anil Kumar Shaw "Transmission Time and Throughput analysis of EEE LEACH, LEACH and Direct Transmission Protocol: A Simulation Based Approach",Advanced Computing: An International Journal(ACIJ),Vol.3.

[9] Laveena Mahajan,Narinder Sharma "Improving The Stable Period Of WSN Using Dynamic Stable LEACH Election Protocol", (IEEE) (2014),pp. 1 -4.

[10] Quanquan Gu,Jie Zhou"Learning The Shared Subspace For Multi-Task Clustering And TransductiveTransferClassifiaction",(IEEE)(2009),pp.159-168.

[11] Rupesh Mehta, Abhishek Pandey& Pratik Kapadia "Reforming Clusters Using C-LEACH in WirelessSensorNetworks",International Conference onComputerCommunicationandInformatics(IEEE)(ICCCI - 2012),pp. 1 -4.

[12] Esmin,Coelho,R.A"Consensus Clustering Based On Particle Swarm Optimization Algorithm",(IEEE)(2013), pp 2280-2285.

[13] Smaragdakis. Georgios. Ibrahim Matta. and Azer Bestavros."SEP: A stable election protocol for clustered heterogeneous wireless sensor networks", Boston University Computer Science Department, 2004.

[14] Vivek Katiyar, Narottam Chand, Gopal Chand Gautam,Anil Kumar "Improvement in LEACH Protocol for Large-scale Wireless Sensor Networks",(IEEE)(2011),pp.1070-1075

[15] Jing Wang,Yang Jing,Yue Tang,Qinguing Li "A Novel Cluatering Algorithm For unsupervised Relation Extraction",(IEEE)(2012), pp.16-21.

[16] Yuhua Liu Yongfeng Zhao Jingju Gao "A New Clustering Mechanism Based On LEACH Protocol", International Joint Conference on Artificial Intelligence (IEEE) (2009), pp.715-718.

[17] KumarG,MehraH,Seth,A.R,RadhaKrishnan,P,"An Hybrid Clustering Algorithm For Optimal Clusters In Wireless Sensor Networks", pp.1-6.