Survey on Energy Efficient Clustering Algorithms for wireless Sensor Network

S. Santhiya
PG Student,Computer Science and Engineering,Vivekanandha College of Engineering for Women, Namakkal, India

A.Thamaraiselvi
Assistant Professor, Computer Science and Engineering, Vivekanandha College of Engineering for Women, Namakkal, India

Abstract: **Wireless sensor network (WSN) contains large number of tiny sensors that can be used as an effective tool for gathering data in diverse kinds of environments. Communication bandwidth and redundant data transfer is happened between the sensor nodes which leads to loss of energy. To support data aggregation and high scalability, sensor nodes are often grouped into non overlapping subsets called clusters. Clustering of sensor nodes into groups saves energy and also reduces network contention when nodes communicate over shorter distances with their respective cluster-head. This paper surveys on available clustering algorithms to enhance the energy of sensor network.**

Keywords*:* **Residual energy, Wireless Sensor Networks, random distribution, Certificate revocation.**

I .INTRODUCTION

Wireless sensor networking is an emerging technology that enables the deployment of wireless sensor networks (WSNs) for a wide range of applications such as environment monitoring, tracking of objects and data collection. Sensor nodes in WSNs are usually battery-powered and expected to operate for a long period. Moreover, in many applications, it is not possible to recharge batteries once the sensor nodes have been deployed. Therefore, energy is a vital resource in low power wireless sensor networks, and energy consumption should be well managed in wireless sensor networks, and consumption of energy should be managed to prolong the post-deployment network lifetime. In this study, a comprehensive survey of different clustering routing protocols is used for conserving the energy from the deployment of sensor nodes. Clustering is an essential part of the organizational structure, It includes ,

Sensor Node: A sensor node is the core component of a WSN. Sensor nodes have multiple roles in a network. They form a group called clusters.

Cluster heads: Cluster heads are the organization leader of a cluster. Cluster head is not limited to data-aggregation and communication schedule of a cluster.

Base Station: The base station is at the upper level of the hierarchical WSN. Communication link between sensor network and end-user is provided. *End User*: The data in a sensor network can be used for a wide-range of applications. Therefore, a particular application may make use of the network data over the internet, using a PDA, or even a desktop computer.

A.HIERARCHICAL ROUTING IN WSNs

The main target of hierarchical routing or cluster based routing is to efficiently maintain the energy usage of sensor nodes by involving them in multi-hop communication within a particular cluster. Cluster formation is based on the energy conservation of sensors and sensors proximity to the Cluster Head (CHs). Clustering has an important role for energy saving in WSNs. With clustering in WSNs, energy consumption, lifetime of the network and scalability can be improved. Because only cluster node per cluster is

required to perform routing task and the other sensor nodes just forward their data to cluster head. Clustering has important applications in high-density sensor networks, cluster head is manage easily than the whole sensor nodes. In WSNs the sensor nodes are resource constrained thus they have limited energy, transmit power, memory, and computational capabilities. For communicating data from sensor nodes to the base station is the crucial cause of energy depletion in sensor nodes.

B. CLASSIFICATION OF CLUSTERING ATTRIBUTES IN WSN

1. Cluster Characteristics:

Variability of Cluster Count: Based on variability of cluster , clustering can be classified into two types: fixed and variable . Generally the set of cluster-head are predetermined and the number of clusters is fixed. CHs are selected, randomly or based on probability from the active sensor nodes.

Uniform Cluster Sizes: According to cluster size, In WSNs clustering protocols can be classified into two classes: uneven and even ones, thus with size clusters and different size clusters in the network. In common, different sizes clusters are used to achieve more uniform energy consumption and avoid energy hole.

Intra-Cluster Routing: According to the methods of inter-cluster routing, clustering routing in WSNs also include two classes: single-hop intra-cluster routing methods and multiple-hop ones. For intra-cluster single-hop, all mobile nodes in the cluster transmit data to the corresponding Cluster Head directly. Data relaying is used when Mobile nodes communicate with the corresponding cluster head node in the cluster.

Inter-Cluster Routing: Based on inter-cluster routing, it includes two classes: single-hop inter-cluster routing and multiple-hop ones. For inter-cluster single-hop, all Cluster Heads communicate with the Base station and user can get the information.

2 . Cluster-Head Characteristics

Existence: In WSN clustering protocols can be grouped into cluster-head based and non-cluster-head based .

Difference of Capabilities: Based on uniformity of energy ,WSNs can be classified into homogeneous and heterogeneous. In homogeneous environment, all the sensor nodes are assigned with equal energy, CHs are selected according to a random way. However , in heterogeneous way sensor nodes are assigned with unequal capabilities in which the roles of CHs are pre-assigned to sensor nodes with more capabilities.

Role: A CH can simply act as a relay for the traffic generated by the sensor nodes in its cluster or perform aggregation of collected information from sensor nodes in cluster. Sometimes, Cluster head acts as a sink/BS that takes actions based on the detected phenomena or targets.

Collision Avoidance: In the multi-hop clustering model, a WSN is divided into clusters and data communications between sensor nodes comprise two modes, *i.e.*, intra-cluster and inter- cluster, respectively for data collection and for data transmissions. The resources can be allocated to each cluster to reduce collisions between clusters and be reused cluster by cluster.

II.LITERATURE SURVEY

A. CLUSTERING ALGORITHMS IN WSNS

1.LEACH (Low Energy Adaptive Clustering Hierarchy):

It is a distributed and single-hop clustering algorithm. Each clustering cycle consists of two phases such as, cluster forming phase and data communicating phase. Simultaneously, LEACH can guarantee not only the equal probability of each node as cluster head, but also consider balanced energy consumption of sensor

nodes. Many proposed algorithms are put forward relying on the work of LEACH algorithm. In the cluster forming phase, the cluster head nodes will inform other nodes once they are selected. The ordinary nodes can choose which cluster to join into according to their distance from head nodes.
LEACH algorithm only considers the probability for each node to become cluster head. In LEACH, the specific location of nodes is left out, so the election of cluster heads takes simultaneously. Additionally, LEACH allows building single-hop cluster, and a large number of clusters might be formed consequently, causing great energy consumption of communications in wireless sensor networks.

2.HEED **(***Hybrid Energy-Efficient Distributed Clustering*)

It is a multi-hop clustering algorithm for wireless sensor networks, is an efficient clustering for selecting the cluster heads based on the physical distance between nodes. In HEED, the range of a node calculated in terms of its power levels, as a node may have multiple discrete transmission power levels.

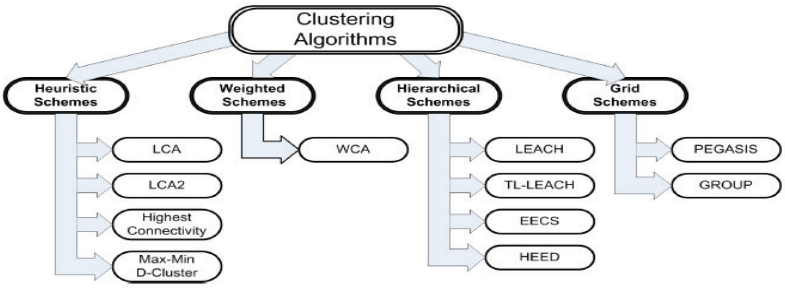

Fig 1.Taxnomy of clustering algorithm

The objectives of HEED are control overhead of the network is minimized. The most important factor of HEED is cluster head selection .Cluster heads are determined based on parameters such as: The residual energy of each node is used probabilistically to choose the initial set of cluster heads.Intra-Cluster Communication is used in nodes to determine, Distributed energy consumption to prolong network lifetime.

3.WCA (*Weighted Clustering Algorithm*)

It evaluates a weight for each node and the cluster heads are chosen based on node degree, distance from neighbors, mobility and available energy. By considering energy consumption, the most stable cluster architecture, it reduces system updates, computation and communication costs are reduced. The cluster head distribution amongst nodes avoids the problem of power drainage for nodes that serve as cluster heads for long period.

4.KOCA (*(K-hop) Overlapping Clustering Algorithm)*

It is a clustering algorithm based on K-hop overlapping is used to overcome the problem of overlapping multi-hop clustering for WSNs. KOCA algorithm generate connected overlapping clusters that cover the entire sensor network with a specific average overlapping degree.
KOCA produces approximately equal-sized clusters, which allow equally distributing the load evenly over different clusters. In KOCA, clustering formation terminates in a constant time regardless of the network size. Under contention and severe errors, up to 10 percent, KOCA communication overhead is reduced due to the dropped packets. Author's simulation results show that clusters are approximately equal in size. This is requiring achieving load balancing between different clusters.

5.GAF(Geographic Adaptive Fidelity)

It is an energy aware location-based routing algorithm designed primarily for mobile ad hoc networks, but is used in sensor networks as well. This protocol aims at optimizing the performance of wireless sensor networks by identifying equivalent nodes with respect to forwarding packets. In GAF protocol, each node uses location information based on GPS to associate itself with a "virtual grid" so that the entire area is divided into several square grids, and the node with the highest residual energy within each grid becomes the master of the grid. Nodes use their GPS-indicated location to associate itself with a point in the virtual grid. So GAF may lead to death of nodes due to premature depletion of energy, thus incurring unstable network Topology.

6.*ESAC* (*Efficient Self-Organization Algorithm for Clustering)*

The algorithm generates low number of stable and balanced clusters, while guaranteeing a long sensor lifetime and efficiently maintain these clusters. Hence, once the network is divided into smaller logically disjoint clusters, it will be easy to carry out the cluster maintenance process, which relates the admission of new sensor nodes inside a cluster or the departure of the sensor nodes from it either by migration to other clusters or by exhaustion of their battery power.

7.DSBCA **(** *Balanced Clustering Algorithm with Distributed Self-Organization for Wireless Sensor Networks)*

It generate clusters in both uniform and non-uniform distribution with more balanced energy and avoid creating excessive clusters with many nodes, thus it overcomes other existing clustering algorithms. The basic idea of DSBCA is based on the connectivity density and the distance from the base station to calculate *k* (clustering radius). The clustering radius is determined by density and distance: if two clusters have the same connectivity density, the cluster much farther from the base station has larger cluster radius; if two clusters have the same distance from the base station, the cluster with the higher density has smaller cluster radius.DSBCA algorithm can form more stable and reasonable cluster structure, and also improve the network life cycle significantly.

III.CONCLUSION

This paper surveys on energy efficient clustering algorithm for wireless sensor network. In this paper we presented Load balanced clustering algorithm (DSBCA) that form clusters in both uniform and non-uniform distribution with more balanced energy. The clusters that formed has the problem in secure communication, if a node in cluster is compromised or misbehaved, the entire communication link is failed. To overcome this problem we propose cluster based Certificate revocation for enlisting and removing the certificates of nodes that have been detected to launch attacks on the neighborhood. This enhances the energy of sensor nodes from depletion in wireless sensor network and protects the sensor nodes from malicious attacks.

REFERENCES

[1] I. F. Akyildiz,W. Su, Y. Sankara subramaniam, and E. Cayirci, "A Survey on Sensor Netowrks," IEEE Communications Magazine, vol. 40, no. 8,pp. 102–114, Aug 2002.

[2] F.Bajaber, I.awan, "Centralized dynamic clustering for wireless sensor network" in International Conference on Advanced Information Networking and Applications Workshops, 2009, pp 193-198.

[3] B. A. Attea and E. A. Khalil, "A new evolutionary based routing protocol for clustered heterogeneous wireless sensor networks," Appl.Soft Comput., vol. 12, no. 7, pp. 1950–1957, 2011.

[4] O. Younis and S. Fahmy, "HEED: A hybrid, energy-efficient, distributed clustering approach for ad hoc sensor networks," IEEE Trans. Mobile Comput., vol. 3, no. 4, pp. 366–379, Dec. 2004.

[5] Y. Xu, J. Heidemann, and D. Estrin, "Geography-informed energy conservation for ad hoc routing," in Proc. 7th Annu. Int. Conf. Mobile Comput. Netw., Jul. 2001, pp. 70–84.[6] M. Chatterjee, S. K. Das, and D. Turgut.

[6] "WCA: A weighted clustering algorithms for mobile ad hoc networks," Cluster Comput.,pp. 193–204, 2010.

[7] Y. Fernandess and D. Malkhi, "K-clustering in wireless ad-hoc networks," in Proc. 2nd ACM Workshop Principles Mobile Comput. Conf., Oct. 2002.

[8] H. C. Lin and Y. H. Chu, "A clustering technique for large multihop mobile wireless networks," in Proc. 51st Int. Conf. Veh. Technol., May 2000.