A Review on Clustering Approaches in Wireless Sensor Networks

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***Abstract* - Wireless Sensor Networks (WSN) increase the focus of researchers in many challenging issues, but energy conservation is the main issue. So, the solution to conserve the energy of the sensor nodes and to increase the lifetime of these nodes as they have limited battery, network is divided into number of clusters. Clustering consists of number of advantages like decrease the delay, energy-efficient, scalable etc. In clustering nodes are divided into clusters through clustering algorithms and every cluster elects its cluster head for data aggregation. Algorithms can be equal clustering algorithm or unequal clustering algorithm. In this paper we presented a brief discussion on different clustering approaches and clustering attributes.**

***Keywords* - wireless sensor network, energy efficiency, clustering, cluster head**

I. INTRODUCTION

Wireless Sensor Network (WSN) is a network which consists of sensing, estimating and transmitting components that provides executive the capability to determine, accumulate and behave to certain circumstances in a defined environment.WSN contain densely scattered nodes that maintain sensing and handle the processing of the sensed data, these nodes are known as sensor nodes. Eachsensor node has in-build storage and processing but its battery energy is restricted and cannot rechargeable. Main function of sensor nodes is to sense the environment, send the sensed data to the base station (BS), BS then further sends the data to the user through internet via gateway. There are several issues in WSN but the main issue is to conserve the energy of the nodes and to increase the lifetime of the network. So, the energy efficient clustering is adopted now days to conserve the energy and to overcome the hotspot problem. In clustering, sensor nodes are splitted into different clusters of equal and unequal sizes. Sensor nodes have different functions like cluster head (CH) and cluster member (CM). Sensor node which acts as CH is a manager of its cluster, which collects the data from the sensor nodes (which act as CM) within its cluster and then aggregates that data and finally forward that data to the BS through multi-hop communication. Clustering is one among the foremost widespread unattended learning methods. Compiling objects into a class, whose associates are similar in some manner is the process of clustering. In clustering data is classified in the terms of packets.

1.1 Clustering attributes

There are certain clustering attributes are discussed that should be considered during clustering process.

Cluster count: In this attribute, the number of clusters to be formed should be either fixed or inconstant. When CHs are elected arbitrary then the count is inconstant otherwise it is fixed.

Size of the cluster: In this attribute, after the clustering process the formed clusters are of equal size or of unequal size. In equal size clusters, every clusterhas same size but in unequal size, clusters far from the BS are large in size rather than the nearest ones.

Intra cluster transmission: In this attribute, the transmission takes place within the cluster. In this CM send the sensed data to the CH directly, but if size of the cluster is large than these nodes sends the data through multi-hop communication to their respective CHs.

Inter cluster transmission: In this attribute, the transmission takes place within the network between CHs and BS. This transmission can be done through single hop communication or multi-hop communication. To conserve the energy multi-hop communication is used nowadays.

Node type: This attribute describe the type of the node which can be either homogeneous or heterogeneous. In homogeneous nodes CHs are elected from the basic nodes but in heterogeneous nodes CHs are elected from the nodes which have high energies.

Clustering effectiveness: In this attribute, the clustering algorithm can be dynamic or static in nature. In static approaches, the CH selection does not depend on the current conditions but in dynamic approaches, CH selection depends upon the current conditions and reduces the clustering overhead which in turn conserves the energy.

Cluster head selection: This attribute describes the criteria for the selection of cluster head. Each clustering approaches have its own criteria for cluster head selection, but generally have three classifications that are: preset, random and attribute based algorithm. In preset category CHs are elected before the deployment of the sensor nodes. In random, CHs are elected randomly and in attribute based algorithm, CHs are elected based on some attributes like distance from the BS, residual energy, local density etc.

1.2 Categorization of clustering algorithms

In this clustering approaches are categorized according to different facts and their objectives.

Mobility-Aware clustering: This clustering approach considers the mobility of the sensor nodes. Nodes which move with same speed considered in one group. Clusters which consider mobile nodes construct more balance structure for clustering.

Energy efficient clustering: This clustering approach utilizes energy of sensor nodes more sensibly as nodes consists of limited battery. The main aim of this approach is to increase the lifetime of the network.
Load balancing clustering: This clustering approach confines the number of nodes in every cluster. This approach consider the equal size cluster to equally distribute the load over the clusters
Low maintenance clustering: This clustering approach provides a balance structure for clustering to the protocols for higher layers. To get the balance structure, control messages for clustering are reduced.

II. LITERATURE SURVEY

L. Malathi, R.K. Gnanamurthy, et al. [1] proposed a hybrid unequal clustering algorithm to increase the network lifetime, reduce the clustering overhead and to avoid the hot spot problem. In this proposed algorithm hybrid is a combination of static and dynamic algorithm. This algorithm distributes the network into numbers of layers and cluster head is elected on the basis of available energy and the distance from the sink. Simulation results shows that proposed algorithm increases network lifetime and conserves more energy compared to other algorithms.
A. Muthu Krishnan and P. Ganesh Kumar [2] proposed an effective clustering algorithm with data aggregation using multiple mobile sinks. In this proposed algorithm data aggregations is done on cluster head as well as on every sensor nodes to conserve the energy of the nodes and four mobile sinks are placed in different locations in a square area. Simulation results shows that proposed algorithm increases the network lifetime with less energy utilization when compared with other clustering algorithms.
Gong Bencan and Xu Shouzhi [3] proposed an unequal density based node deployment clustering (UDNDC). In this nodes are deployed in different areas which depend on load for data forwarding, therefore extra energy is given to nodes for data forwarding early energy drain of some nodes. Simulation results shows that the proposed algorithm increase the network lifetime and perform better than LEACH-C and HEED.
P. Sasikumar and Sibaram Khara [4] proposed both distributed and centralized k-means clustering algorithms. In centralized k-means clustering algorithm centralized node make decisions for clustering but in distributed k-means clustering each node have information required for clustering. Simulation results shows that distributed k-means is more efficient than centralized k-means.
Jeong-Sam kim and Tae-Young Byun [5] proposed a density based clustering approach (D-LEACH). This proposed algorithm based on the local density of the nodes, where each and every node checks its probability to join the cluster. Simulation results show that the proposed algorithm (D-LEACH) reduces energy, increase the lifetime of the network and perform better than LEACH.
L. Chang., Z. Xian et al. [7] proposed clustering algorithm based on cell combination. In this algorithm network area is divided into hexagonal cells. Seven hexagonal cells are given to each cluster andcluster head is elected from centre. Every cell is circular in shape to reuse the channel. Simulation resultshows that the proposed algorithm perform better than other clustering algorithms.
Guan Xin, Wu Hua Yang et al. [6] proposed an energy efficient hierarchical clustering algorithm (EEHCA). This algorithm uses a new method for the selection of cluster head and uses the multi-hop communication and clusters is of equal size. It minimizes the energy and balance the load over every node. Simulation results show that proposed algorithm increases the network lifetime compared with LEACH and HEED.
R. Wang, L. Guozhi et al. [8] proposed clustering algorithm based on virtual area partition. Heterogeneous network is used where every node has different transmission power. This clustering algorithm balances the loads between the clusters and improves communication efficiency. Simulation results shows that the proposed algorithm balances the energy and increases the network lifetime compared to LEACH and LEACH-E.

III. CONCLUSION

In this paper we presented an avant-grade survey on different clustering approaches with equal or unequal size of clusters. In this paper some clustering approaches are classified. This survey shows that unequal clustering approaches are better than equal clustering approaches to increase the lifetime of the network and to avoid the hot spot problem.

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