Wireless Sensor Networks: A Survey

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Abstract: In recent years Wireless Sensor Network (WSN) has been growing rapidly and provides more services in several areas. Recent advancements in this field of computing, communication and sensing are attracted towards research in WSN. Networks lifetime depends on energy balancing of WSN. Clusters are collection of autonomous servers. The main target of clustering is to improve the scalability and reduce energy consumption. Cluster head absorbs more energy than non-cluster head nodes. Suited option of cluster head grows the network life time and energy efficiency. In this paper, cluster head selection and its techniques has been analysed. It has been observed that Fuzzy based cluster head technique is better than Topology and Coverage area. Because fuzzy logic has the potential to deal with conflicting situations and there are no complex mathematical modelling techniques are required.

Keyword: Wireless Sensor Networks, Clustering and its technique.

1. INTRODUCTION

Wireless sensor networks are sometimes called wireless sensor and actuator networks. These are self-distributed to monitor physical conditions like temperature, sound, pressure, etc. and cooperatively pass their data through the network to a main location. WSN are consisted by large number of homogeneous sensor nodes that have the ability of calculation, perception communication and wireless. Different kinds of sensors are distributed according to its applications. These nodes are sensitive. In these, sensor device is furnishing with non-rechargeable Batteries. Different sensor cluster algorithms are proposed to increase the network life time. The major challenges of WSN are (i) limited energy source (ii) IP address scheme is impossible (iii) Lesser bandwidth and memory. Dynamic topology reduces the network life time. Energy efficiency is one of the big issue in order to increase the life time of sensor networks. Because these are allowed to communicate with the base station and collect the data, and then compress it and transmit the collected data to the base station. Computation burns less energy than communication. We can save this by reducing the number of bits transmitted through computation. The data which consume more energy is facing minimum loss [1]. In other way ZigBee is one of the method that can solve many problems [1]. Each node senses environmental data and transmits it back to the link in the multi hop fashion. Currently, WSN is also advantageous in military applications to examine the goal of intruders and report the army's location to soldiers. In this type of applications, the intruders as well as the soldiers are inherently mobile. Two level network structures are there: the top structure is grid: in bottom number of trees exists. In grid structure it helps to distribute the flow of traffic and deliver them to correct place. Tree structure helps to reduce the energy consumption in data collection. In this, we used data and queries and we kept it into up to date and use it into send info in mobile targets [2]. The most important features of WSN are fault tolerance, scalability, manufacturing costs, hardware, limitations and energy consumption. The advantage of WSN is that it can operate in harsh environment [2].

Cluster head is defining as it collects the data from different network and transmits it to different clusters. Clustering is the best proposed method for (energy and bandwidth) to reduce the traffic load and send the packet to its destination. Cluster network is combination of different network structure and it improves the entire property [1]. Cluster head is the main part of network it combines the coordination, routing and end device to form cluster tree network. In this, some nodes are treated as cluster head and rest work as cluster members. Cluster head consume more energy than cluster members [2].

The rest of this paper is organized as follows: Section 2 discuss the mechanism of cluster head. Section 3 discuss the cluster head and its techniques. Section 4 discuss the strengths and weaknesses of cluster head. Section 5 proposes our conclusions. Section 6 discuss the Reference of Cluster Head Selection.

2.**Cluster head and its mechanism**

Cluster head is defined as local coordinator for its cluster. Cluster head keep in touch with its member nodes and neighborhood clusters. It performs inter-cluster routing, data forwarding and many other applications [3].

2.1 **Gateway Node:** It takes the info from neighbours and forward it in between clusters [3].

2.2 **Cluster member or ordinary nodes:** It is neither a cluster head nor gateway. In fact, it is used to communicate with cluster head and keeps the info update according to corresponding cluster head [3]. We choose the node according to the architecture of cluster tree but the path in which we transmit the data is not ideal, because it transmit the data in large amount and its energy would be exhausted in excess amount and network will be out of whack. There is advancement in performance of network but the problem of its energy consumption is increasing day by day. There are a lot of solutions proposed to overcome the exhaustion of energy. The cluster head combines the data in cluster and send it to the controller. The amounts of cluster head can be decrease by grow up the bottom of cluster. By calculating the energy level, we can determine when we use the new cluster head [1].

The task of topology is to assign functions to each node of network. It decides which node declares itself as a cluster head [6]. In this, node joins to cluster head and becomes a member of cluster head.

3. **Cluster Head Selection and its Method**

The technology of cluster head was popular, but recently it has been improving their parts like digital electronics, semiconductor manufacturing technology and wireless communication leading to the development of low power, cost, and size with embedded sensing, and communication capabilities. A WSN is composed of hundreds of such sensors. Some nodes called the cluster heads, conserve the energy of the sensor devices that are allowed to communicate with the base station. The data assembled by the sensor node is mailed to the base station situated outside the region of the deployment field [4]. Clustering is the best method to utilize resources like energy and bandwidth. Cluster tree routing is a type of immobile routing. Mainly, there are three types of wireless sensor network knowingly topology, coverage and fuzzy based cluster head. Discussing about topology it must have to bring out, which node is going to be cluster head itself. Also it has to provide the functionality of each node in the network. Traditionally these approaches are assumed as if nodes are either connected or disconnected. Practically there are fully connected wireless links called lossy links. With the help of these lossy links more energy efficient topologies has been produced.

3.1 **Topology Based Cluster Head**

The term topology control is used mostly by the wireless adhoc and sensor networks research community. It is the collection of diverse members of computer network. The main purpose of topology control in this domain is to save energy, reduce interference between nodes and extend lifetime of the network [5] Topology control has to be executed periodically in order to preserve the desired properties such as connectivity, coverage, density etc. But there are some weak points in topology due to which length of cable is

limited. It limits the number of nodes to be connected. The network topology can work efficiently with a few numbers of nodes, if we increase the number of nodes then its efficiency deducted [6]. It performs well in low traffic networks. Central bus is the main part of topology, if there is any defect in central bus then whole network will be destroyed.

3.2 Coverage Based Cluster Head

Instead of using topology, coverage based is better. Sensing coverage is one of the fundamental quality of service (QOS) problem in sensor network in sensing coverage. Coverage in sensor network is a measure of how closely the target area is observed by the sensor nodes. To assure that every point of the whole area to be monitored by at least one sensor node, a predetermined percentage of the monitored area is covered [7]. The sensor network remains connected so that the information collected by the sensor nodes can be relayed back to data sinks or controlled [8]. Different applications require different degree of sensing coverage area. Some applications may only require one node to monitor the location, while other application require significantly higher degree of coverage area [9]. In general, area of the coverage degree can be considered as a measure of the quality of service of wireless sensor network. The higher the area of coverage degree, better the field can be monitored [10]. Along with many benefits there are some disadvantages like minimum coverage breach, barrier coverage problem, bandwidth constraint, fault tolerance [11]. One of the major problem, Sensor networks adversely affects the Quality of service. Lesser movement in sensor networks leads to higher coverage.

3.3 Fuzzy Based Cluster Head

On the other hand, fuzzy logic has the potential to deal with conflicting situations and imprecision in data using heuristic human reasoning without any need of complex mathematical modelling [3].

Topology based	Coverage area	Fuzzy based
• Topology control provides tasks to every node of the network. • In this technique, LEACH could work effectively. • Topology control decides which cluster declares itself as a cluster head.	• It scatters the homogenous cluster head, in the network is bear out. • In this LEACH protocol work is based on clustering in which clusters are made randomly in a susceptible and self-organized manner. • It decides where the optimal sensor deployment strategy is connected globally to the network.	• Its task is to find the degree of truthfulness. • Leach protocol is the one of the method to obtain the energy efficiency in the exchanging data between the sensor nodes [4]. • It determines the relative location of every node.

Table1: A comparison of Topology, Coverage and Fuzzy Based cluster heads

4. Advantage & Disadvantage of Cluster Head Selection.

While we send the data collection from cluster node to cluster head then it absorbs more energy. It also affects the coverage area and then transmission becomes lesser. The advantage is it is of low cost and much powerful [12].

5.Conclusion

In this paper we have discussed about Wireless sensor network, cluster head selection and its method. Clustering is backbone of energy efficiency, network scalability and reducing overheads and is a major challenge to select for the same. Researchers have proposed different mechanism for solving selection for cluster head but we are still looking on it and this paper is implied on clustering head importance. From the survey it has been analysed that fuzzy logic is better than coverage and topology. Because in fuzzy no complex mathematical techniques are required and it can also work in violent situations.

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