

Wireless Sensor Networks and Clustering Techniques to Improve Network Lifetime: A Review

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ABSTRACT

Wireless Sensor Networks are shaped by many little nodes which have sensing and process capabilities. These little nodes referred to as sensor nodes are powerful however have restricted energy. These nodes are deployed in harsh and unattended surroundings wherever human intervention is impassable. Replacement and recharging of those nodes becomes terribly difficult. Thus period of time improvement has perpetually remained a pivotal issue in wireless sensor networks. Clustering emerged as a strong technique to extend network period of time. In this paper we tend to focused on application areas of wireless sensor network and its numerous clustering approaches that are used for system construction.

Keywords: Applications, clustering, LEACH, power consumption, wireless sensor networks.

I. INTRODUCTION

A huge count of sensor devices forms a wireless sensor system. The sensor device senses atmosphere and accumulates info and communicate this accumulated info to the base station. Wireless sensor network comprise of multiple detector nodes and a base station. These small detector nodes are embedded devices that have restricted energy, bandwidth, and process capabilities. They aggregate and convert the collected data and relay solely the desired info to the base station rather than sending the full collected data as a result of it absorbs ton of power in transferring the info. And from base station the info is collected by supposed users for more process of information.

Efficient energy employment has become a prime issue in coming up with wireless sensing element networks. Every operation from sensing the environment to transferring data consumes energy. That's why it has become primary concern in wireless sensor systems as a result it becomes not possible to recharge or replace the batteries once sensing element devices are spread out in harsh and untended remote areas. Numerous applications of wireless sensor networks embody health watching, pollution monitoring, field monitoring and lots of a lot of.

II. CLUSTERING OF SENSORS

In wireless sensor networks, power exhaustion is taken into account to be a very important issue, since all the sensor nodes have restricted battery power and each operation consumes great amount of energy. Therefore

efforts ought to be created towards minimum utilization of energy. One such approach is cluster of sensors. The wireless sensor network comprises of huge range of sensing element nodes; therefore all the sensing element nodes are divided into individual, disjoint and non-overlapped clusters. Hierarchical clustering of sensors is completed to cut back energy consumption by sensor nodes attributable to less transmission of information amidst cluster devices and the base position. In hierarchical clustering, cluster head is chosen for each cluster. This cluster head is accountable for causation knowledge to base station. A sensor device from an exceeding cluster senses and relay perceived data to a cluster head. It then performs aggregation and processes data into meaningful info and transmits this information to the base station through single hop or multi hop. Clustering offers efficient utilisation of energy, increase network measurability, balances load among nodes and supply fault tolerance.

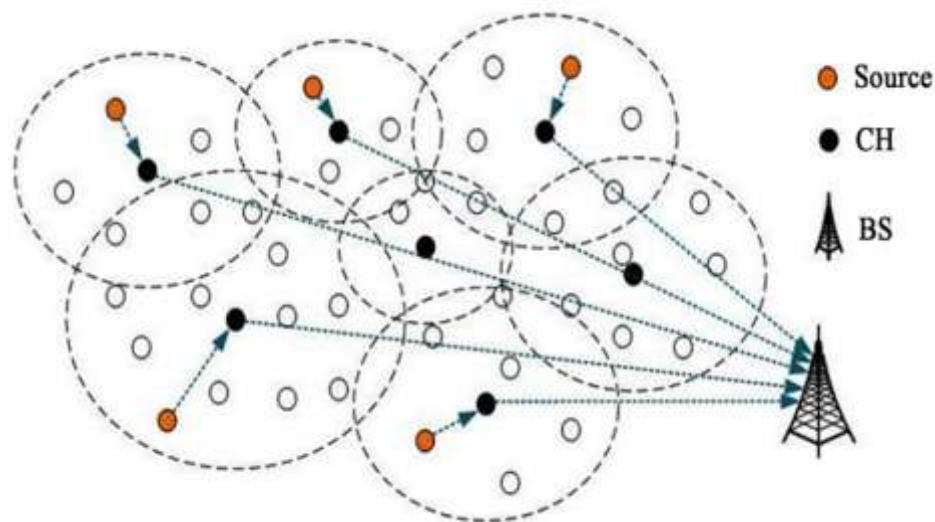


Fig.1: Clustering in WSN

III. ADVANTAGES AND OBJECTIVES OF CLUSTERING

- **Scalability**

Wireless sensor networks are said to be scalable if it is possible to add new nodes in the system after design of a system. Clustering divides all the sensor nodes into individual groups known as clusters and it becomes easy to add new nodes at a later stage.

- **Data Aggregation/Fusion**

All the nodes disseminate sensed data towards their corresponding cluster heads. They then do data gathering and eliminate redundant data and send only meaningful information to the base station. Thus data gathering helps in reducing the energy consumption.

- **Fault Tolerance**

Fault tolerance is a crucial challenge in wireless sensor networks. A node failure can occur if node goes out of energy. So re-clustering can be done in case of node failure.

- **Quality of Service**

Non redundant and quality data is delivered to the end user through clustering at accurate time.

- **Load Balancing**

The sensor nodes are evenly distributed to form clusters. These equal sized cluster heads helps in balancing the load among nodes and prevents premature energy exhaustion.

- **Collision Shunning**

By dividing the resources orthogonally to every cluster will results in collision free information transmission.

- **Fewer Loads**

The cluster head performs data aggregation to remove redundant information and transfers only meaningful information to the base station.

IV.CLUSTERING ALGORITHMS

HIERARCHICAL CLUSTERING	LEACH, HEED,DWEHC, EECS,EEUC
GRID BASED CLUSTERING	PEGASIS, PDCH, GROUP

- **LEACH**

Low Energy Adaptive Cluster Hierarchy (LEACH) protocol proposed by Heinzelman et al. [1] [2] is distributed routing scheme. Within the LEACH protocol each node has associate same contingency to be a cluster head. Two phases are needed which are set up and steady for this protocol. The cluster formation and therefore the choice of cluster head is performed in set up stage and information transference completed in steady stage. Re-clustering is completed once more and once moreover habitual time interval to turn role of cluster heads among all nodes that produce system load equalisation. LEACH protocol do not take in consideration the leftover power of nodes for cluster head choice meaning all sensing element nodes have balanced likelihood of turning into cluster head.

- **HEED**

Hybrid Energy Efficient Distributed Clustering Algorithm [5] planned by Younis et al. could be a Probabilistic Clustering Scheme. In this scheme Cluster Heads are elite on the premise of two criterion i.e. remaining energy and node degree. The cluster head choice isn't done at random as in LEACH protocol.

- **DWEHC**

Distributed Weight Based Energy Efficient Hierarchical Clustering Protocol (DWEHC) planned by Younis et al. is extremely kind of like HEED. Every node during this protocol first locates its neighbours; it then calculates its weight in terms of its residual energy and distance to its neighbours. The node with the biggest weight in a very neighbourhood could also be chosen as a cluster head. Close nodes can then be part of the cluster head hierarchy. DWEHC clusters have smart performance characteristics as compared to HEED.

- **EECS**

Energy Efficient Clustering Scheme (EECS)[8] projected by Ye et al. is analogous to LEACH. During this theme whole network is separated into completely different clusters and single hop communication is employed amidst cluster head and base station. The nodes competency for changing into a cluster head can broadcast their remaining energy to their neighbour nodes and if the remaining energy is lesser than the competency node then the competency device can itself become a cluster head.

- **EEUC**

Energy Efficient Uneven Clustering (EEUC) [6] Algorithm program projected by Li et al. divides all the small devices into clusters having mismatched size, such that clusters that are nearer to the base have petite extent than those farther off from the base position. So cluster heads nearer to the base point can maintain some power for inter-cluster knowledge forwarding. Power exhaust by cluster heads per spherical in EEUC is way below than that of LEACH traditional protocol.

- **PEGASIS**

Power Efficient Gathering in Sensor Information Systems (PEGASIS) [3] given by Raghavendra et al. is a change in LEACH protocol. In PEGASIS instead sending willy-nilly to the base station every node takes a turn to transmit to the base station. During this method it proceeds to reduced consumption of power. During this protocol the nodes reach out with their nearest neighbours and build a row to hand over the info to base station.

- **PDCH**

Pegasis Algorithm Improving Based on Double Cluster Head (PDCH) [4] planned by Linping et al. relies on hierarchic topology which was in the form of chain and this formula uses low level cluster head and high level cluster head to boost weight equivalence. Base station is among the middle of the circle. The base station can predetermine the measure of the levels and each device's farness to base station decides a limit that it belongs

to. Each node collects the striking from the base station, then in line with the signal potency to find gap from base station. PDCH outmatch to formula of PEGASIS and helps additionally for giant networks.

- **GROUP**

GROUP clustering algorithm[9] proposed by Liyang has climbable and economical routing of packet for extensive wireless device networks. Solely few out of entire range of device nodes took part in creation of cluster heads. They coordinate in an exceedingly grid manner and 1st sink (One of the sink), willy-nilly frames the cluster grid. The device known as Greed Seed could be at intervals a given boundary from the first sink.

TABLE 1: Comparative chart of different Clustering approaches

Approach Name	LEACH	HEED	EECS	EEUC	DWEHC	PEGASIS
Extensibility	very less	Moderate	less	high	moderate	very less
Power Proficiency	very less	Moderate	moderate	high	very high	less
Transmission Delay	very less	Moderate	less	moderate	moderate	very large
Load Balancing	average	Average	average	good	very good	average
Approach Complexity	less	Moderate	very high	high	moderate	high
Cluster Stability	moderate	High	high	high	High	less
Overhead in cluster head selection	less	High	less	less	high	less
Considers remaining energy in cluster head selection	No	Yes	Yes	Yes	Yes	No

V. APPLICATIONS

- **Area Observance**

Wireless sensing element networks can be deployed over a sector wherever we would like to observe any development. Area monitoring is one amongst the essential samples of wireless sensing element networks. For

example, in military wireless sensor networks are being deployed for intrusion detection, for pursuit information, etc.

- **Health Care Monitoring**

The health of someone will be monitored with these sensor networks. The sensors will be embedded within the little devices which might get inserted into the physical body for determining the health of a patient. These will be inserted within the wearable devices that square measure at proximity to the users for pursuit the body movements.

- **Natural Disaster Prevention**

Wireless sensor networks helps in preventing natural disasters. With these sensor networks one will pre confirm the reason behind disaster and might take applicable rescue measures. For instance, sensors are deployed in ocean to stop the implications of flood with the rise in water level of the ocean.

- **Home Automation**

Wireless sensor networks helps in building smart homes by monitoring and controlling the parameters like sound, temperature, etc. These networks help in reducing the overall power dissipation. For example, the lights used in the smart homes are embedded with the sensor that automatically gets switched off if there is no person in the room, therefore reducing power consumption.

- **Industrial Monitoring**

Industrial monitoring applications includes machine fitness checking, data centre monitoring, structural fitness monitoring, waste water monitoring, etc.

VI. CONCLUSION

A wireless device network contains an outsized variety of sensor nodes and needs correct design and administration of the wireless network. To support scalability issue clustering of sensors is employed as a vital technique in wireless sensor networks where the whole system is split within many disjoint clusters. Every cluster chooses a cluster head using totally different techniques. This paper primarily highlights the wireless sensor networks and its application areas, clustering and its totally different techniques, advantages and objectives of clustering.

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