iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 3 **Issue:** VII **Month of publication:** July 2015

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Survey on Clustering Algorithms in Wireless Sensor Networks

Ms Radha D N[1], Ms Rashmi K[2]
Dept of Computer Science and Engineering, CMRIT, Bangalore

Abstract - To monitor the disaster management and industrial automation we make use of wireless sensor network. In order to achieve this sensor nodes have to be grouped together to operate and gather the aggregated information autonomously in the network. Sensor nodes are often grouped into disjoint and non-overlapping subsets called clusters to support the better data integration and scalability. In order to utilize the limited resources of sensor nodes and to prolong the network lifetime cluster create the hierarchical wireless sensor networks. The main of this paper is to study the varied clustering algorithms for wireless sensor networks.
Keywords: Cluster, Cluster head, Residual energy, Base station, Wireless sensor network

I. INTRODUCTION

Wireless sensor network is most innovative field, this particular network is used in various application [1], [8] like military, medical etc. The network consists of various sensor nodes they may act dynamically or statically in the field. If we assume sensor nodes as static and they arranged randomly then here is need of forming sensor nodes in to group. The group of nodes called as clusters. The leader node in one cluster act as cluster head .The reason for forming cluster and cluster head is for easy communication among sensor nodes and also to save the resource among sensor nodes, the entire communication of all cluster heads pass to the base station which is central station stores all data of the sensor nodes.

II. COMMON TECHNIQUES TO CREATE CLUSTER HEAD [14]

A. Deterministic technique.
The cluster head is formed based on the parameters like sensor node unique identification number and also the degree of the sensor node.

B. Base station dependent technique.
In this technique cluster head will be elected by base station, based on the communication distance from base station to the sensor node.

C. Fixed parameter technique
In this technique the sensor which is having highest signal strength that particular node act as cluster head.

D. Resource dependent technique
In this technique different parameters will be taken as consideration like residual energy, average energy of node, energy loosed in last rounds.

III. CLUSTERING PROCEDURES

There are various techniques are there to make cluster and cluster head selection .The following are the 3 major categories for the clustering procedure.

A. Centralised Procedure:
In centralised algorithm the decision of electing cluster head depends on a centralised system. The below are the few examples for the centralised algorithms.

1) LEACH_C: In this, centralised system is base station [2].The main idea of this algorithm is the number of cluster heads are not fixed, they will keep on vary based on the condition in the network. In the first phase all the sensor nodes sends the details of their position ,location, energy information to the base station .The base station in turns calculates the average energy of all nodes. The node one who contains the highest energy that node act as cluster head, The cluster node id will be sent by base

©IJRASET 2015: All Rights are Reserved

station to the remained sensor nodes .In the second phase the data transaction will happen in the network through cluster head to the base station from sensor nodes.

B. Decentralised algorithms

In this particular algorithms every sensor node can participate for electing as cluster head, The below are the few examples for decentralised algorithms.

1) *LEACH:* The basic algorithms for cluster formation is LEACH algorithm, in this algorithm [1],[2],[5] the cluster heads will be keep on changing on each round, this makes the algorithm more efficient one. The entire algorithm can be divided in to two phase called as set up phase and steady phase. The below is the detailed explanation for the working of algorithm.
   a) *Set-up round:* In this round the node will be assigned to value as either 0 or 1, later the particular node will be compared with the parameters of current round ,during the last round which nodes are not elected as cluster heads, desired percentage of cluster heads. After comparing if any node selected as cluster head it will send an advertisement link, then the remaining nodes will choose the nearest cluster head.
   b) *Steady round:* This particular round mainly meant for data transaction among all the sensor nodes, Here mainly we are using TDMA (time division multiple access) concept for data transmission The time is divided in to slots and each slot is allocated for particular sensor node to make the data transaction to the cluster head and finally to the base station, after certain amount of time again the steady round will turn in to setup round to elect the cluster head.

2) TL_LEACH: This is an enhanced version of LEACH [10] algorithm. The main difference between in this algorithm is two cluster heads will be electing as primary and secondary, The secondary head will be always communicating with sensor nodes, gathers information and transmits the data to the primary head.

*3) EECS (Energy efficient clustering scheme):*In this algorithm [7] each node broadcasts its own residual energy in the network, the node which have highest residual energy it will act as Cluster head, this in turn indicates an better resource usage and increase in the network lifetime.

*4) HEED (Hybrid energy efficient distributed clustering):*This is similar like EECS [7],[8] algorithm. here also the residual energy will be taken in to consideration along with the communication cost, The advantages of this algorithm is that it uniformly distributes the cluster heads in the network and ensures a better workload balance

The algorithm is partitioned into three steps:

a) *Initial aspect:* An initial amount of cluster head among the sensors is set first by the algorithm so that it is possible to limit the cluster head announcements to other sensors. Each sensor make an announcement of being a cluster head based on the maximum energy or the current energy in the sensor i.e. the fully charged battery where the care should be taken that the energy should not fall below the certain threshold.
b) *Iteration aspect:* In this step, each sensor searches for a cluster head so that it can transmit with the low transmission power or energy repetitively. As the sensor goes to the next step it doubles its value. When the value reaches 1 it stop its execution. The sensor can announce to its neighbour about the status of cluster head by the following two methods
c) *Temporary status:* If the value is less than 1then the sensor becomes the temporary cluster head. If it's finding a lower cost cluster head it can change its status to a regular node at later iterations.
d) *Terminating status*: when the value reaches 1 the sensor will permanently become the cluster head

Last aspect: Near the base stations cluster head may die earlier. Well distributed cluster head ar enabled across the HEED algorithm. In this step the final decision is made by the sensor about its status. Near the base station there are sensors which cannot sustain.

5) Energy efficient unequal clustering(EEUC) – In a multi-level Wireless sensor network, the cluster head which are near to base station tend to die faster because they rely on much more traffic than the remaining remote nodes i.e. hot spot problem. In inter-cluster and intra-cluster communications, EEUC proposes to balance the energy consumption among clusters in which the cluster size near the cluster head are much smaller than clusters far away from the cluster head in order to save more energy. EEUC is a distance based scheme similar to the EECS and every node needs to have a information about the location and distance to the cluster head. It elongates the network lifetime, solves the hot-spot problem; the distance from the base station is

©IJRASET 2015: All Rights are Reserved

proportional to the cluster size.

6) EEHC (Energy Efficient Hierarchical Clustering) – [1, 11, 4] – Cluster heads collect information from non-cluster head node in variety of clusters and sends an aggregated dta to the base station and hence it is a randomized and distributed algorithm. This algorithm is partitioned into two phases – initial and extended. In the first phase, as the probability of p each sensor node announces itself as a cluster head within its communication range. These cluster heads are also known as volunteer cluster heads in single hop clustering. All the sensor nodes which are within the communication range of this cluster head receive the announcement by direct communication or by forwarding. Any sensor node that receives these announcements and is not itself a cluster head becomes the member of the closest cluster. Forced cluster heads are nodes that are neither cluster head nor belong to a cluster. If the announcement does not reach to a node within the certain period of time t that is calculated based on the time taken by the packet to reach a node which is h hops away, the node will become the forced cluster head assuming that it is not within the h hops of all volunteer cluster heads. In the second phase, known as multi hop clustering builds h hops of cluster hierarchy. The energy dissipated by the cluster heads far from the base station is reduced is ensured by this algorithm in the inter-cluster communication.

7) Multi-hop routing protocol with unequal clustering (MRPUC) – It is a distributed clustering scheme which is portioned into three phases – set-up cluster, data transmission and inter-cluster multi-hop routing information. In this phase cluster head is elected based on the maximum residual energy and the other nodes gathers the information from its neighbouring nodes. The cluster heads closer to the base station have small cluster sizes to save the energy for the inter-cluster forwarding task. The remaining sensor nodes join the cluster head which have maximum residual energy and closer to them. This algorithm depends on the residual energy so that the early death of the cluster head can be prevented. Cluster head routes to the neighbouring clustering head having the highest residual energy.

8) Dynamic clustering and distance aware routing protocol (DDAR) [12] - For selecting the cluster head it takes the distance from the node into account. It is one of the dynamic approach in selecting the cluster heads and super cluster head node which is near to the base station in the two-hop hierarchy. It consumes about 15.5% less energy than conventional LEACH protocol. The dynamic selection of the cluster head not only reduces unnecessarily selecting a large number of cluster heads and also makes it possible for the network to operate even when the number of alive nodes is less in the network and also when large number of nodes in network is dead. While selecting the cluster heads we use the average distance of the nodes from the base station in order to reduce the greater energy consumption in the cluster head as the distance is large from the cluster head to base station. The nodes which are greater than this average distance will not be selected as a cluster head. The super cluster head in the network divides the cluster into two level hierarchies i.e. the child and parent clusters.

9) Two Hop Clustering Protocol (THC)[13] – This protocol increases the energy saving in sensor nodes. Based on the remaining energy and node degree the cluster head is selected. This algorithm is partitioned into three steps:

a) *Initial Step* – Fixes the cluster area and selects the initial cluster heads and also allows the nodes to create 1-hop and 2-hop neighbours table. This step consists of two stages: Cluster selection stage and neighbour discovery.
b) *Distributes node clustering step* – Cluster of nodes is created by the cluster head in this phase and the cluster head select the next cluster head for the next round. This step consists of two stages: next head selection stage and advertisement stage.
c) *Data transmission step*: In this step, the cluster head create the time slots, gather the information from other sensor nodes and finally transmits the aggregated data to the base station. This step consists of three stages: data gathering stage, routing stage and schedule creation stage.

IV. CONCLUSION

The clustering methods in routing algorithms reinforce an energy efficient path for transmission of data. The varied clustering techniques such as distributed, hybrid and centralized are discussed in this paper. The study of varied clustering techniques will help to design a novel clustering approach which reduces the energy consumption and prolong the network lifetime.

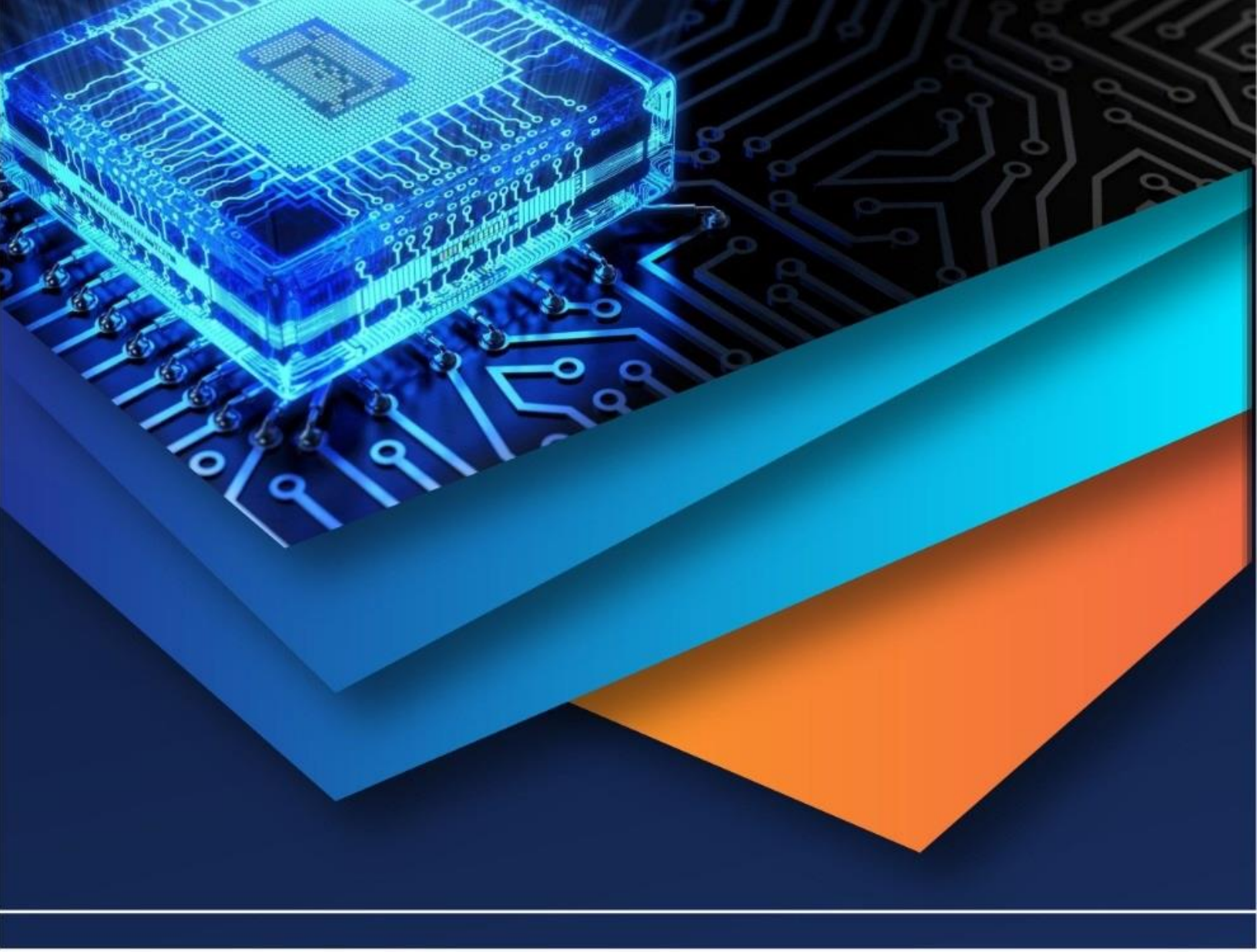
REFERENCES

[1] "A Comprehensive Review of Cluster Based Energy Efficient Routing Protocols for Wireless Sensor Networks", Naveen Sharma and AnandNayyar, IJAIEM,Volume 3, Issue 1, January 2014
[2] "An Application-Specific Protocol Architecture for Wireless Microsensor Networks", Wendin B. Heinzelman, AnanthaP.Chandrakasan, HariBalakrishnan, IEEE Transactions on Volume 1, Issue 4. 2002, pp.660 –670

©IJRASET 2015: All Rights are Reserved

[3] "Survey of Extended LEACH-Based Clustering Routing Protocols for Wireless Sensor Networks", M. Aslam, N. Javaid, A. Rahim, U. Nazir, A. Bibi, Z. A. Khan, IEEE 2012
[4] "Energy Efficient Clustering Algorithms in Wireless Sensor Networks: A Survey", Vijay Kumar, Sanjeev Jain, Sudharshan Tiwari, IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 5, No 2, September 2011
[5] "Comparision of Clustering Algorithms And Protocols for Wireless Sensor Networks", Liliana M. Arboleda C. and Nidal Nasser, IEEE CCECE/CCGEI, Ottawa, May 2006.
[6] "Towards Clustering Algorithms in Wireless Sensor Networks-A Survey", Congfeng Jiang, Daomin Yuan, Yinghui Zhao, IEEE 2009
[7] "Algorithms for Node Clustering in Wireless Sensor Networks: A Survey", P. Kumarawadu, D. J. Dechene, M. Luccini, A. Sauer, IEEE 2008
[8] "A survey on clustering algorithms for wireless sensor networks", Ameer Ahmed Abbasi, Mohamed Younis, published by Elsevier B.V. 2007
[9] "A Survey of Energy Efficient Unequal Clustering Algorithms for Wireless Sensor Networks", G. VenniraSelvi, R. Manoharan, International Journal of Computer Applications, Volume 79- No. 1, Oct 2013
[10] "A Two-Level Hierarchy for Low-Energy Adaptive Clustering Hierarchy", V. Loscri, G. Morabito and S. Marano, Proceedings of Vehicular Technology Conference 2005, vol3, 1809-1813
[11] "An energy efficient hierarchical clustering algorithm for wireless sensor networks", S. Bandyopadhyay, E. Coyle, Proceedings of the 22nd Annual Joint Conference of the IEEE Computer and Communications Societies (INFOCOM 2003), San Francisco, California, April 2003
[12] "Dynamic Clustering and Distance Aware Protocol for Wireless Sensor Networks" , NavinGautam, Won-Il Lee and Jae-Young Pyun, ACM Spain, pages 9-14, 2009-10
[13] Energy Efficient Two Hop Clustering for WirelessSensor Networks", Babu N V, Puttamadappa. C, Bore Gowda S B, IJCSNS International journal of Computer Science and Network Security, Vol.13 No.9, September 2013
[14] "A comparative study of cluster head selection algorithm in WSN", K. Ramesh and Dr. K somasundaram,IJCSES, Nov 2011,vol 2,no.4

©IJRASET 2015: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)