Clustering of Nodes in Wireless Sensor Network (WSN): A Survey

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Abstract **- *Wi*reless sensor network (WSN) is a multi-hop self organization of network system that are formed through combination of large no of sensor nodes .A node is any point with in cluster head (CH) which can be any point in a cluster head. Clustering is an efficient method for solving energy consumption challenges with energy consumption nature of wireless sensors. It is the criteria for determining the overall cost, no. of required cluster head for optimum network usage and longevity for this reason it is widely exploited in wireless sensor network applications. The problem without cluster head was the battery near the sensor node drain faster near to sink ,which leads to decrease in power near the sink, So the paper proposed you to study cluster size, area it can sense, uniform dissipation by reconfiguration the cluster at interval in order to increase its lifetime by reducing energy consumption of WSN. So the paper is all about proposed energy – efficient cluster considering nodes and residual electric power by comparing it for saving energy ultimately ,future scope of WSN is that for identifying and transmit data to cluster head, and from cluster head (CH) it transmit data to sink. In this way data is being transmitted from cluster head to sink. In between sensors –sensors the communications are not allowed. So we define here regarding using tiny low-cost sensor and radio transceiver, a large number of sensors connected by radio waves can be deployed cheaply .so, we define energy – efficient cluster and defining residual electric power by comparing it for saving energy ultimately in this paper . The rest of the paper is as follows .In section (II) we find the cluster size of random deployed WSN's. In section of object on the road in a rainy day. Which function as when receiver transmit line information from the road authority about the state of road including traffic jams, accidents and whether the car transmit information on the road authority regarding speed, distance travelled, and the other one can be moving the base station in wsn.**

Index terms –Cluster Head, Cluster Size, Nodes, Wireless Sensor Network (wsn), Sensors, Energy.

I. INTRODUCTION

Wireless sensor network (***WSN***) is formed through the arrangement of large no. of sensor nodes .In this the monitoring area exchange information with each other by using wireless communications. Sensor node collect data of the perception object within its region and transfer the data to the base station after transmission. In ***WSN*** when it transmit information then the sensor sense.

(III) We define energy-aware communication protocols. In section (IV) we define cluster algorithm based on communication facility with deterministic cluster size. In section (V) we define application oriented Re-clustering and cluster –head (CH) Re-election. In section (VI) we define dynamic change method of cluster size in WSN. In section (VII) we concluded and remarks and future scope in ***WSN***. In section (VIII) we acknowledges.

II CLUSTER SIZE OF RANDOMLY DEPLOYED HETROGENEOUS WSNS

Scalability and energy consumption are among the most important challenges for WSN applications. It can be defined by coverage and the connectivity of heterogeneous WSNs.

Coverage- a point is said to be covered if it is within the sensing range of at least one sensor and this coverage would be meaningful only when a sensor is able to transmit its data to the sinks.(2)

Transmission range – two sensing range for full coverage is when the data is gather data about an entire region. Therefore we consider partial coverage of a randomly deployed mixture of cluster head (CH) and sensors.

Consist of two types of devices sensors cluster head.

N_H cluster head and N_S sensors are deployed randomly over a plan region.
Both N_H and N_S has sensing capability and their sensing range is r_S .

Sensors can only transmit their sensing data to a cluster head and cluster heads transmit data to sink. Communication among sensors is not allowed.

Sensor can communicate with a N_H if it's within a communication range r_t of cluster head i.e. N_H. The N_H is assumed to be connected to the sink.

ON THE BASIS OF COVERAGE

CONNECTIVITY

1. *Coverage –*

Large area D covered N identical sensor scattered and only over the area according to Poisson point process suppose area sensed by each sensor on perfect disk with radius rs and λ is average no. of sensor

Case1- probability of point D being covered
$P_{cov} = 1\text{-}e^{-\lambda\pi r^2_s}$ (1)
Case2- if the sensing region covered by any sensor was A_S, the coverage probability

would be-Pcov = 1-
$e^{-\lambda A_s}$

Case 3- when both sensor (N_S) and cluster head (N_H) having sensing capability N=NH+NS without connectivity, then coverage probability –

$Pcov = 1\text{-}e^{-(NH+NS)\pi r^2_s}/D$

2. *Connectivity-*

If a sensor can reach the N_H i.e. cluster head (CH) directly then it is said to be connected . Probability that sensor is within communication range of NH $Pcon = 1\text{-}e^{-NH\pi r^2 t}/D$
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CLUSTER SIZE IN A HETROGENEOUS WSN

We consider that the part of sensing area covered by connected sensor in order to find actual coverage protocols. We defined a cluster size area covered by each cluster head to find the actual coverage.

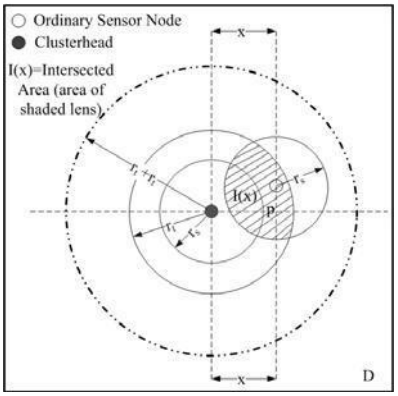
$P_{cov} = 1\text{-}e^{-N_H S_{cluster}}/D$
Average no. of sensor connected to a single cluster head be ns, since N_S sensor and N_H cluster head over region D, ns can be found using-

$n_s = N_S/N_H\ (1\text{-}e^{-NH\pi r^2_t}/D)$

In order to find the area covered by N_H and ns sensor connected to it for simplicity, consider area covered by single cluster head (CH) over a region D (fig 1)

Since there is n_s sensors in the communication range of cluster head, the number of sensor in the square C_S, should be:

$n_s/C_S = \pi r^2_t/D$ D = C_S * $\pi r^2_t/n_s$ C_S = D $n_s/\pi r^2_t$
fig-1



r_s = point from the center is covered by N_H point outside the inner circle can be converted by a sensors

III - ENERGY-AWARE COMMUNICATION PROTOCOL

Large portion of energy aware routing protocols for WSN are clusters based the problem without clustering was that as sensor node drain fast near the sink which in turn induces successive layer of node from sink. The exhaust their battery quickly .so , consider different strategy for limiting cost sensor, more reliable and long lasting sensors ability, energy efficient, data diffusion(6) , quick processing(8), media access control(7) for limiting the energy wastage.

We define two points for energy aware:-

1. Individual sensor node and information it collect is important. Application like Icy road conduction, Surveillance camera, structural health of buildings and bridges etc. here the sensor nodes are fixed though they may be moved in controlled direction remotely.

2. Individual sensor data is not important. Assembled data from a region or cluster is all that is to be delivered. The applications are mainly environmental monitoring for climate change or like, nodes may drift due to bad weather condition.

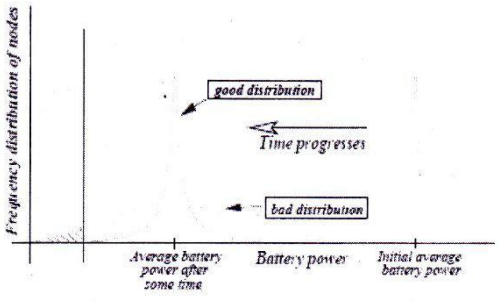


Fig -2 Frequency distribution of sensory node vs. the remaining battery power.

MAIN GOAL OF WSN

1. Slower decrease of average battery power with time. connected to N_H .

2. Lower variation of the distribution of remaining

   battery level.

Although all the energy aware protocol emphasis on slower decrease of average battery power with time (fig-2), but in reality both are important.

DIFFERENT APPROACHES FOR ENERGY

AWARE

If nodes do not always sends packets to their nearest nodes, but transmit different ratio of packets at different nodes could be made uniform.

If (CH) cluster heat collects packets from all members of the cluster and transmit to sink through immediate CH. Here the nodes near CH are overloaded. Some use LEACH protocols for dynamically change in cluster configuration, so that the load is uniformly shared by nodes over a long time.

Network model & assumptions

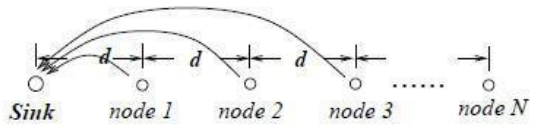


Fig. 3. Simple linear node distribution

This model tells us that when each nodes are equidistance, then consider the distance between 2 nodes bed (fig-3). We assume that nodes can adjust the transmission power to transmit

Defining the constrained optimization problem

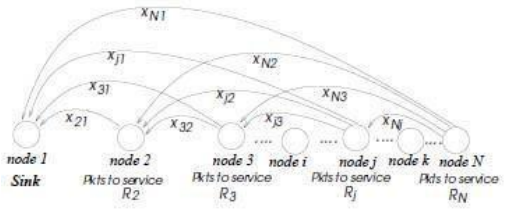


Fig. 4. The linear network showing proportion of packets transmitted to different nodes towards the sink

This model tell us that when we have N-mode places at equal distance "d",node-1 sink node (fig-4).every node generate "m" packets different nodes of these

"m" packets are forwarded to different nodes towards sink

IV -CLUSTER ALGORITHM BASED ON COMMUNICATION FACILITY WITH DETERMINISTIC CLUSTER SIZE

With energy constraints nature of WSN the efficient use of battery power is important factor for wsn in order to increase the lifetime of wsn by changing the cluster size algorithm. As nodes exchange their information by wireless communication(9) from there the sensor node collect data and transfer it to base station .so, the energy and lifetime of sensor is maintained .whether if cluster size big(intra clustering collision) or cluster size small(inter cluster collision).

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Cluster size can be determined by using various algorithms-

1. LEACH(10) (lower energy adaptive clustering hierarchy) in this technique receiver signal strength to form cluster(11)

   .if node becomes cluster head(CH)then it gather data from nodes and transmit data to base station.

2. HEED(12) (hybrid energy efficient distributed protocol) enhanced version of LEACH in which the nodes are reduced in electing cluster head (CH), common nodes determine cluster head (CH).

3. PEGASIS (13) (power-efficient gathering in sensor information system) it uses only 1 nodes of channel to transmit to base station instead of multiple nodes, it avoids cluster formation.

4. WCA(14) (weight cluster algorithm) used for calculating no.of neighbor, transmission power, battery life and mobile rate of nodes.

5. TEEN(16) (Threshold sensitive energy) it is effective sensor network protocol, due to sudden change in the sensing attribute such as weight or condition.

Main aim is that each nodes to calculate CF (communication facility)(18) and CH (cluster head), communication facility intra and inter from lower CF and higher CF depends on two factors- Convenience of node communication with sink node directly.

Convenience of node provide to other node communication with sink

Calculation communication factor-

Each node exchange its CF (communication facility) so,

S=n*p with base station and neighboring nodes.

Where n is the number of sensor node and p is optimizing size of the cluster size.

Node Combination – Each node knows their Neighboring nodes and send message to nearest node in processing of clustering node with biggest CF (communication facility) and key node of communication nodes as shown in fig-5 , In cluster formation (only key node is active) , as F is key node and A,C,E,F as a Combinational nodes.

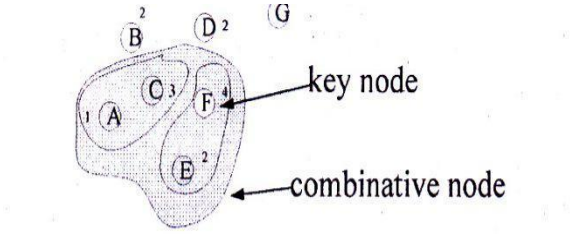

Fig-5 key node and combinational node.

V- APPLICATION ORIENTED RE-CLUSTERING AND CLUSTER HEAD RE-ELECTION

CH election(20) to be based on the energy of sensor nodes because a sensor node with high energy is availability might be poor in computation or has even weak wireless connectivity. The contacts are chosen for communication with nodes not in the immediate neighbored as shown in figure -6. Nodes in the immediate neighbored are consider neighbor or simultaneously run a multitude of application, each with its own requirements. None of the CH based on application specific criteria by depends on Bandwidth, reliability, neighborhood, memory and CPU power.

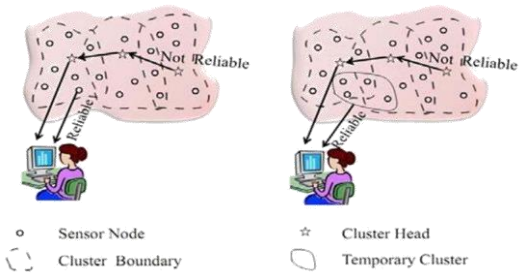

Fig. 6. A scenario for BS connection with CHs for the case of three clusters in CH Re-Election and Re-Clustering

So we define two application oriented on -

1. Re-clustering
2. Re-election

a) *CH Re-election*:- new CH is elected on permanent basis till it loses its capability for t host further application if CH fails then the new CH exchange resource list from previous CH. When application is being hosted on CH then a new web portal client with different criteria not satisfied by current CH then new application has to wait for current application to be over as shown in figure-7. If new CH has to execute previously request application then it could have hosted it either because we had a better alternative available with resource at least for that application and consequently it was elected previously as CH; it doesn't mean new cannot host if its objective function value remains above say 20% of optimized value of application, CH-reelection avoids repeated CH supplying for each incoming application and hence, exchange of extra information.

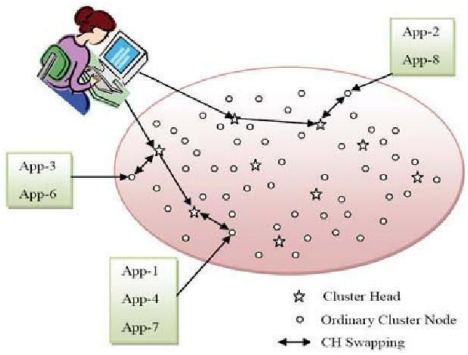

Fig. 7.CH Re-Election

b) *Re-clustering:*- when a web portal (19) customer wants to execute an application on which cannot be executed on a single node due to extensive computation, we use re-clustering. In this whenever an application is requested by a web

portal client and CH simply looks for nodes that are within 20% regulation of optimized objective function value as shown in figure -8. This result in temporary cluster within the original cluster rides with maximum value of objective function is elected as temporary CH and is advertise on the temporary cluster members and update it resource list temporary CH loss functionality till current application is over.

1. One is hosted on temporary cluster another query is received by primary CH check whether the temporary node execute the application, and it saves the overhead of creating temporary cluster again and again; if none of the node in temporary cluster again and again ,if none of node in temporary cluster deems suitable for new application then group of new node which can satisfy new application is created to make another temporary cluster and new temporary CH.CH re-election & re-clustering is similar by the only different is in group of nodes. Instead of CH re-election, here it is assumed that all application requires a cluster for their efficient execution instead of only CH.

c)

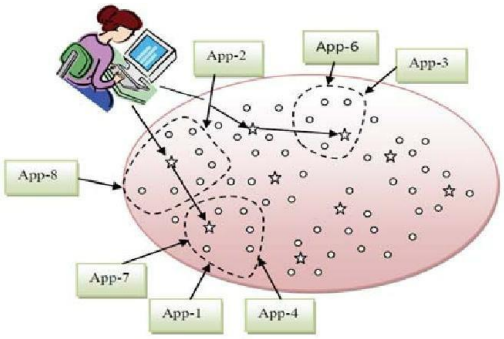

Fig. 8.Re-Clustering.

Algorithm of CH Re-clustering and Re-Clustering algorithm.

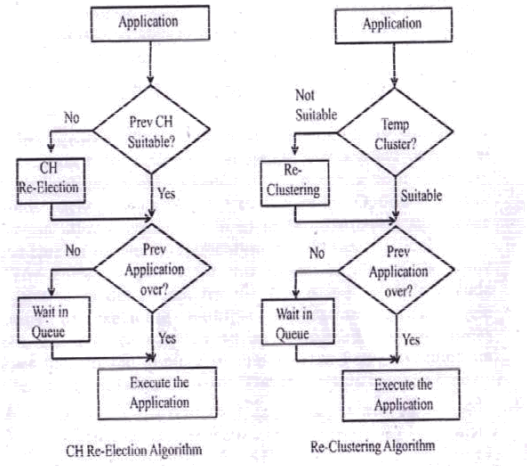

Fig. 9. CH Re-Election and Re-Clustering algorithms.

VI- DYNAMIC CHANGE METHOD OF CLUSTERSIZE IN WSN

Dynamic energy method develop on energy efficient routing protocol so evenly distribute the energy-efficient routing protocol .so, evenly distribution the energy loss among all the sensor node in the network

.so that it will not overlap sensor node that would run out of energy.

LEACH(11)(Based on clustering of sensor nodes

.however energy consumption of nodes tend to become uneven in LEACH as in LEACH when a node becomes a cluster head then it gather data from nodes and transmit to base station, cluster formation is changed periodically and cluster head (CH) is changed periodically.

HEED(24) (extended version of LEACH in which information of residual electric power of nodes. By not considering the adjacent nodes. Therefore cluster head doe not efficient cover the nodes in HEED (30).

HIT(27) (small transmission range and multihop communication, improve performance dynamics energy-efficient algorithm for adjacent nodes and residual electric power).

Due to SENSING, COMMUNICATION AND DATA PROCESSING

VII – CONCLUSION

In this paper we have concluded that WSN is efficient way for finding out the energy conservation and we have finned out different way for finding out area and solving energy distribution.

Future scope of cluster using WSN is that we can detect the moving crowd in rainy

Areas or in that condition where manned vehicle can reach,

By moving the cluster head would be a further research for WSN.

VIII – ACKNOWLEDGEMENT

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