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Wireless Sensor Network Lifetime Prolonging Self Organisable Cluster Based Energy Efficient and Aggregation Protocol

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Abstract - The main issues in wireless sensor network are prolonged network lifetime, reliable delivery, secured transmission. Since wireless sensor network is the battery powered application energy saving is the main constraint to prolong the network lifetime. Clustering based routing mechanism is one of the best mechanisms for saving energy of wireless sensor network. Novel cluster based energy efficient data collection in and aggregation protocol for improving load balance in which there is controlled amount of dormant node and dormant area during the data transmission process along with the proactive scheme of survivable self organisation is employed for prolonged network lifetime.

Keywords: *clustering, dormant node, data aggregation, survivable self organisation, load balancing.*

I. INTRODUCTION

The wireless sensor nodes are the nodes with processors of limited functionality and limited memory space but when these micro sensor nodes of increased node density forms a good fault tolerant network. When these nodes form a network it constitute to either a single multihop network or a hierarchial organisation with clusters .sensors sense data periodically and transmit to base station for processing. When all the nodes in the network sends the sensed data then redundancy and bandwidth consumption increases and also the network lifetime decreases .by data aggregation technique we get quality ensured information in which the sensed data from the sensors are aggregated at a specific sensor and from which it is going to be transmitted to base station for processing. This aggregation of data technique conserves bandwidth and energy consumption. Here in this technique, the cluster head selection is an challenging task .the classical hierarchial clustering algorithm is low energy adaptive clustering hierarchy (LEACH)[4] in which the this protocol is distributed and hence the nodes are capable of cluster organisation for data aggregation. This protocol involves two phase setup phase and steady state phase .in setup phase the nodes are clustered and in steady state phase the data is transferred to the designated node and then to base station. This reduces amount of information transmitted to sink .another hierarchial clustering based routing protocol is PEGASIS[11] in which the node takes turn to transmit the aggregated data to base station and balance the energy consumption and improves robustness. These type of algorithm should focus on intra cluster and intercluster communication. The cluster head selection should be made properly .The failure of cluster head entirely collapse the network communication. Adaptive dynamic cluster head selection is the solution to improve robustness. The transient failure of cluster head is possible and this isolate the cluster and there is chance of information loss hence survivable clustering is

adopted. The survivable clustering algorithm used is distributed energy efficient dual homed clustering. This reduces early reclustering and reduces overhead occurred by rebuilding cluster. Providing survive ability in distributed fashion that is by providing in node basis not by cluster basis which is centralized one. Dual home schemes are adopted if cluster head fails then the node use back up path to reach the destination instead the primary path to cluster head. Herein this distributed energy efficient algorithm the backup is provided to each node independently and this distributed approach helps when multiple failure occur. This approach of reaffiliation reduce computation overhead than reclustering. For ensuring security a pairwise key exchange procedure could be adopted in which the cluster head should be able to aggregate data without decrypting the encrypted data and base station is capable of detecting altered data that is to identify forge attack.in this paper the main consideration is clustering and in this proposed approach there is degree of node control that is certain nodes are put to dormant state that is sleep state and they wont send the data during transmission phase and this balances the load and conserves energy.

II. PROBLEM STATEMENT

This holds the network model of homogeneous wireless sensor nodes which are fixed and energy constrained . The sensor nodes periodically sense the data and the nodes can directly communicate with base station or neighbouring nodes can relay to base station. The cluster head is elected and is capable of data aggregation to reduce the amount of information transmitted to enhance the lifetime and that aggregated good quality information is sent to base station for processing. Survivable selforganisation algorithm is used in combine with it to prolong lifetime and security is assured by pairwise key procedure. The radio could be modeled as free space and multipath fading channel models which depends on distance between transmitter and receiver.

Design of clustering based energy efficient and data aggregation protocol with survivable self organisation of nodes:

The dormant radius is the coverage range of node and that node will be active and the other nodes within that coverage area will be dormant and that coverage area is dormant area.

A. *Identify security objectives:* Clear objectives help you to focus the threat modeling activity and determine how much effort to spend on subsequent steps.
B. *Create an application overview:* Itemizing your application's important characteristics and actors helps you to identify relevant threats during step 4.
C. *Decompose your application:* A detailed understanding of the mechanics of your application makes it easier for you to uncover more relevant and more detailed threats.

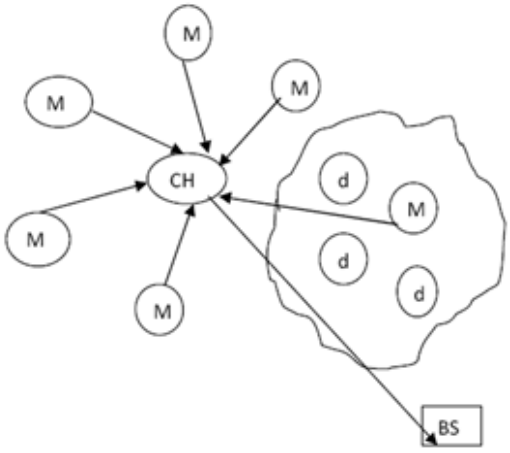

Figure 1:Nodes & Cluster

In this above figure the M stands for member node and CH stands for cluster head and d stands for dormant node which does not sense and transmit data it will remain in sleep state and BS for base station.

III. CONTROLLING THE DEGREE OF NODE IN CLUSTER

Base station deals about node degree control of each cluster. Base station initially decides the dormant nodes of each node in a cluster. Consider a cluster k and the cluster head is CHK and the dormant nodes of node nx are denoted as Dk and the normal nodes in cluster is denoted as NK.the algorithm is as follows

1. get cluster head and then get the dormant nodes of cluster head
2. check all the dormant nodes of cluster head are traversed completely if so then go to 4 else go for 3.
3. get a dormant node from the dormant nodes of cluster head.if that node belongs to this particular cluster then put it thDk else go to 2.
4. check all nodes of cluster are traversed completely if so then go to 6 else go for 5.
5. get node from cluster and if that node is in Dk then go to step 2 else put in NK.
6. calculate the size of NKand DK and then make the TDMA schedule based on rules of
7. node degree and then broadcast the schedule

The node degree control rule is all nodes in NK should send data to cluster head in that TDMA schedule and the nodes in DK will take turn to send data.

This algorithm has three phases namely

1.Cluster Head Selection 2. Node Degree Control 3.Data Transmission

1. Cluster Head Selection

Each node sends its geographical locationinformation and its residual energy dividedby energy usage rate to base station. Thisenergy usage rate is estimated by summingthe energy expense rate defined for extrafunctionalities for cluster head selection.thefunctionalities are

such as data fusion andprocessing base station calculates theaverage of residual energy divided byenergy usage rate based on messages. If thenode's energy ratio is less than averageenergy ratio then it loose its chance of cluster head for this round and with the remaining cluster head it process.then the base station broadcast the clusterhead set to whole network. If the ID matches the node then it act as cluster head.

2. Node Degree Control

Next base station computes TDMA and thenode knows the schedule to transmit dataand sleeps until its time slot arrives and indormant area only one node could send datato cluster head others should wait for theturn.

3. Data Transmission Phase

The dormant node should remain idle and the other nodes could transmit and the cluster head should receive all data's from sending nodes and data aggregation is performed and that single good quality information packet is sent to base station by cluster head. Cluster head failure will result in the isolation of the entire cluster and occurs information loss. Dual homing schemes are adopted in case of cluster head failure. Each sensor will maintain primary communication path and backup path and in case of cluster head failure backup path is used and this creates reaffiliation of mobile nodes and this reduces computational overhead for clustering. This reaffiliation will make the sensor node to connect to any neighbor node or cluster head during transmission.

Impact of Dormant Radius for Data Collection

When within the dormant radius there is no dormant nodes then it is similar to LEACH. When the dormant radius is much maximum then more dormant nodes and there is chance to miss listening. So the dormant radius is maintained with an lower and upper bound and hence there will be not be more dormant nodes to miss the listening and there will be enough amount of sensor nodes to gather information and send to cluster head.

Impact of dormant radius for Energy Consumption

When within the dormant radius there is no dormant nodes then energy consumption is maximum and consumption is similar to LEACH. When within dormant radius the dormant nodes are more then energy consumption is much less. When dormant radius is between an upper and lower end then there will be minimum with better data gathering.

Time complexity is less when compared to LEACH. Time complexity is defined here as number of traversing nodes. The minimum time complexity is o(N.m') tor this proposed work and for LEACH the time complexity is o(N2) where N is number of nodes in whole network and m' is number of dormantnodes.100 nodes random sensor network is simulated the parameter settings to be given for simulation results are initial energy of node dormant radius, data size. The network lifetime is increased 30% than LEACH. The energy consumption is reduced and so energy saving is good in this than LEACH.

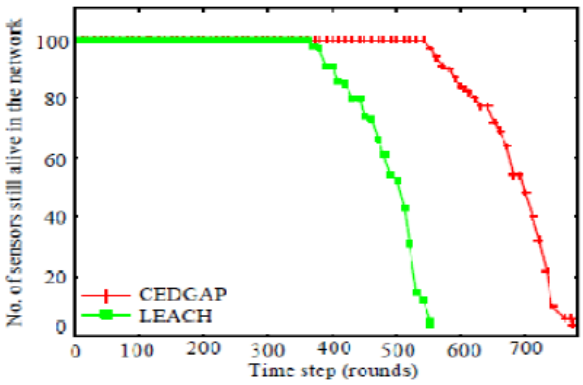

Figure 2.Show nodes life prolonged

IV. CONCLUSION

The energy is saved because of dormant nodes which are in rest until its time slot arrives. This algorithm summarizes that the network lifetime is prolonged and the dual homing scheme works incase of cluster failure avoids computation overhead of reclustering. The cluster head selection is done based on the energy ratio of residual energy to energy usage rate. This algorithm has node degree control mechanism and phases in this are cluster head selection, node degree control and data transmission. This provides better result than classical hierarchical clustering scheme like LEACH. Security can also be ensured by adopting some pairwise key algorithm.

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