International Journal of Computational Engineering Research||Vol, 03||Issue, 5||

Energy Based Routing Protocol for Wireless Sensor Networks

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ABSTRACT:
The main aim of the project carried is to provide an efficient routing mechanism that helps in data transmission in wireless network. The project is combination of mainly two algorithms, LEACH-c algorithm: it selects the cluster head by the base station. DCHS: it is also used to select cluster head by considering both factor of energy and factor of threshold. With the deployment of both algorithms it maximize network lifetime in wireless sensor networks, the paths for data transfer are selected in such a way that the total energy consumed along the path is minimized. It also helps to solve issues like load imbalance, signal interference and reduce time delay.

Keywords- *Base station, Cluster Head, DCHS, Leach-c, WSN.*

I. INTRODUCTION

In wireless sensor networks there are large number of sensor nodes involved in the communication. The data that has to be transferred has to travel through various nodes due to which there is a chance of data loss or may get corrupted. As data transfer in the WSN is in haphazard manner so when data is transferred from source to destination it travel through various nodes randomly due to which the consumption of energy is huge and other issues may also rise.

LEACH is well known algorithm for the WSN's because it considers groups and cluster heads for transmission of data. The cluster heads are selected in rounds randomly. LEACH algorithm Data transmission is the major consumer of power, so it is important to have power-efficient protocols. In order to reduce the total power consumption in the network LEACH uses cluster heads in rounds for transmission to long distances. Hence an algorithm is needed which is more efficient than LEACH which has better energy efficiency.

As WSN is based on the concept of clustering and this concept has become the area of research. In my paper I have considered two algorithms to form cluster in WSN. The LEACH-c which is the form of centralized algorithm is been used to form cluster and to select a cluster head, so that nodes in a particular cluster will have a prior information of node they have to transfer data. The DCHS which is the form of distributed algorithm only requires cluster heads rotation to prevent the cluster head failure. Cluster heads rotation of each cluster don't need to complete in the same time and exchange information with each other until some heads in clusters runs out of energy.

II. PROPOSED SCHEME

In the current approach Gradient-Based Routing (GBR), while being flooded, the 'interest' message records the number of hops taken. This allows a node to discover the minimum number of hops to the user, called the node's height. The difference between a node's height and that of its neighbor is considered the gradient on that link. A packet is forwarded on the link with the largest gradient. Hence by using Gradient minimum number of hops route is found out. Secondly while maximizing the network lifetime is clearly a useful goal, it is not immediately obvious how to reach this goal using observable parameters of an actual network. As the finite energy supply in nodes' batteries is the limiting factor to network lifetime, it stands to reason to use information about battery status in routing decisions. Hence battery optimization is achieved. The concept of shortest path is used find the route which is shortest path. So in order to reduce total power consumption in the network a combined algorithm considers energy efficiency and threshold both to have a cluster head.

The proposed solution has following steps.

1. All the nodes present in the network have to send their information to the base station.
2. Base station based on the information divides nodes into various clusters and also selects respective cluster head.
3. Cluster head selection is carried out within the cluster, in this process it selects cluster using distributed algorithm.
4. Access the node energy levels after its involvement in transfer of data.
5. Cluster head rotation to prevent the cluster head failure.

The first two steps fall under LEACH-C algorithm and remaining fall under DCHS algorithm. So the two processes run alternatively which helps in resolving the issue of load imbalance.

III. LEACH-C ALGORITHM

LEACH-C organizes the sensor nodes into clusters with each cluster a cluster head and divides a round into set-up and steady-state phases. It uses a high-energy base station to finish the choice of cluster heads. In the set-up phase of each round, every sensor node sends its information about energy to remote BS. Then the BS selects the cluster heads based on the energy information and broadcasts the IDs of cluster heads to other member nodes. This method can make the nodes with more energy and more chance to become the cluster head in the current round. But in this phase, every sensor node needs to send its ID and energy information to remote BS to compete for the role of cluster heads, which causes energy consumption on the long distance transition. We can obtain that there will be a certain amount of energy needed to be spent on the transition of energy information for each sensor node in every round, which cannot be neglected in communication; especially the BS locates far away from the monitor field and the network has a lot of sensor nodes.

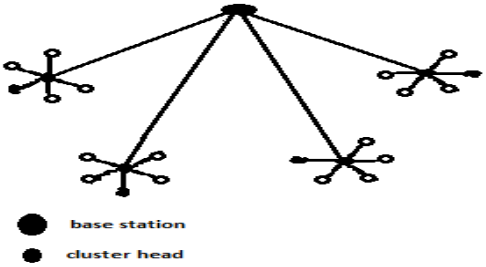

Figure 1: LEACH-c Algorithm

IV. DCHS ALGORITHM

DCHS is a distributed process for selection of cluster head. It selects the cluster head based on energy and threshold value of a node. As in this project the main emphasize is on reduction of energy utilization of nodes, so it require to contentiously change the cluster head in a particular cluster as in cluster head more energy is utilized while sending or receiving of data as compare to other nodes present in the cluster. If the energy of most of the nodes present in the cluster is lesser then the threshold level it sends the information to the base station where the processes starts again. The nodes in cluster communicate with each other and select the node with highest energy, this way the cluster head is again selected within the node. The diagram is as shown below in figure 2.

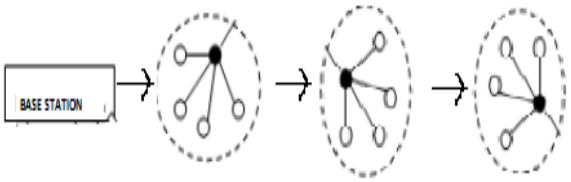

Figure 2 .DCHS ALGORITHM

V. AGGREGATED ALGORITHM

This process is aggregation of both the algorithms discussed above. First it runs out the LEACH-c algorithm and waits until it goes into stable phase after that it starts second process. The process of changeover from one process to other does not hold much complexity. Once the base station gets the information of energy about all the nodes, it selects the set of heads called as cluster heads and then sends the information of heads to other nodes. Node decides which cluster to join order by LEACH-c, and then nodes go into stable phase. Once any head has energy problem, the first process is over.

During second process every cluster changes their own head in house when the head energy becomes low then the threshold value. The nodes in cluster communicate with each other and select the node with highest energy, this way the cluster head is again selected within the node Nodes need not send message to base station. After the second process last for a long period of time, Current energy of each node is very low, and the threshold T (n) is also smaller. Probability that nodes becoming head will greatly reduce. Many nodes go into dead state because of the shortage of energy. For these reasons, cluster needs to be rebuilt. Therefore second process is over, and nodes sent message to base station. Flow is shown in Figure 3.

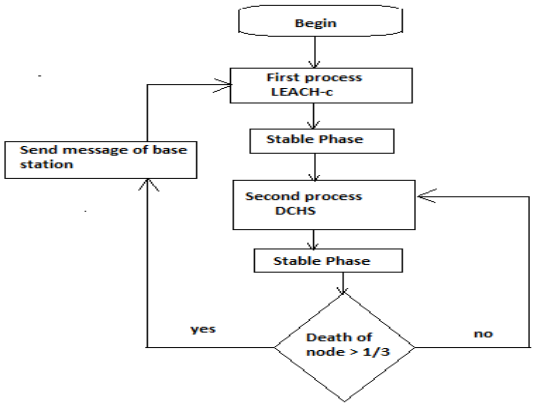

Figure 3 .Aggregated Algorithm

VI. SYSTEM ARCHITECTURE

In the system architecture there are two parts one is base station and the other one is node. The base station consist of three modules internally life time analyzer, Leach-c clustering engine and event collection. Both these modules work simultaneously to meet the objective. The input for clustering engine is current energy value which is generated by the energy monitor present in the second (node) module. The energy monitor monitors the energy by getting updates after every event caused and the involvement of the particular node. The event collection is also maintained at the station side which keeps track of every single event happened.

Once the cluster formation is done with the help of LEACH-c algorithm it passes the output to DCHS algorithm for further processing that is for the selection of the cluster head and continues the process. The life time analyzer is used to analyze the life of the each and every node. As the node reduces it energy once it undergoes any event, finally a stage will come where the node will not be having any energy it is called as dead state and the replacement is require for that to continue the routing process. The diagram is as shown in below figure 4.

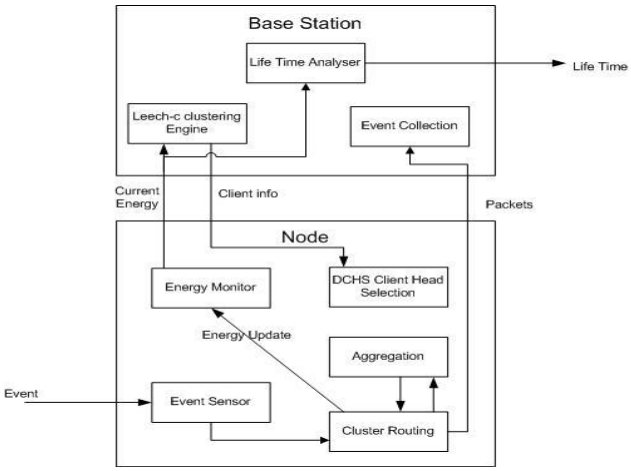

Figure 4 .System Architecture

Combined algorithm compared with other algorithms:

Combined algorithm compare with other algorithm in some areas, such as balance, robustness and soon. Studies have shown that combined algorithm use of the advantages of the other two algorithms efficiently and make up their shortage. But the performance of the algorithm is poor, because algorithm cannot find the best time to rotate.

Comparison of various algorithms is shown in table 1.

Protocol	CH-selection	Formation	Maintenanc	Robustness	Balance
LEACH	Fast	Fast	High	Moderate	Poor
DCHS	Fast	Very Fast	High	Moderate	Poor
LEACH-c	Slow	Slow	High	Good	Good
AGGREGATED	Slow	Fast	High	Good	Good

VII. CONCLUSION

Distributed algorithm (such as DCHS) and centralized algorithm (such as LEACH-C) are analyzed. Comparing two algorithms, a new algorithm being developed. Comparison and simulation results show that the combination of these two algorithms effectively balance network load, save energy, and enhance network scalability. The combined algorithm effectively improves the performance of WSN, including the overall balance, energy consumption, and the distribution of nodes and so on.

ACKNOWLEDGEMENT:

I would like to thank Dr.Ramakanth kumar P, HOD, Department of information science and engineering, RVCE for his valuable suggestions and expert advice.

I would like to thank my guide B K Srinivas, Assistant professor, Department of information science and engineering, RVCE for his help, sharing his technical experties and expert advice.

Last but not the least I would like to thank my parents and friends who have always supported me in every path of my life.

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