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ENERGY EFFICIENT SCHEME FOR CELLULAR NETWORK USING G-LEACH

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Abstract: -

This paper proposes an energy efficient scheme for cellular network using G-LEACH (Genetic Low Energy Adaptive Clustering Hierarchy). By using the genetic algorithm based upon adaptive clustering protocol the energy consumption of the every node can be reduced and then the lifetime of each node in the cellular network can be increased. The proposed algorithm is compared with LEACH (Low -Energy Adaptive Clustering Hierarchy). The G-LEACH is implemented by using three phase. They are preparation phase, set-up phase, and at last steady-state phase. The preparation phase is the initial phase of the algorithm, in this phase the cluster head extraction process is executed by within all the random cellular network nodes. All nodes send the condition and position within the cluster as a resubmit message to the base station of the cellular network. By using the resubmit message base station exploring the node as cluster head which has the most eminent energy for foster process. By using this phase the energy consumption of the node is reduced. In the set-up phase the base station disseminate the message to all the node and help the random node to form a cluster within the cellular network. At last the steady-state phase is executed merely once ahead the set-up phase in the process of cellular network. Simulation result shows the comparison between LEACH and G-LEACH and energy consumed by the each node in the cellular network.

Keyword: *G-LEACH, cellular network, node, genetic algorithm, lifetime.*

1. INTRODUCTION

Recently Wireless Sensor Networks (WSNs) are becoming an important part of many application surroundings that are used for military and civilians. The fundamental applications of WSN are habitat monitoring, target tracking, surveillance, and security direction [2]. WSN generally consists of a prominent number of low cost, low power and multifunctional sensor nodes that are small in size and communicate over a short distance. Their construction and characteristics depend on their electronic, mechanical and communication restriction but also on application specific necessity [3]. One of the major quandaries for a WSN is energy consumption during communication between sensor nodes. The longer distance between sensor nodes, the more they wasted the energy. Therefore to increasing the lifetime of the WSN, there are various studies on communication length of the sensor nodes. Techniques that are cluster-based are useful for environment supervising. The use of clusters for sensor networks shorten communication length for most sensor nodes, involving only a few nodes to sending long distances, e.g., Base Station (BS)[4]. A cluster-based protocol separates the network into a number of clusters based on the population. For each one cluster has a cluster head (CH) that gather information from all member nodes in its cluster. These CHs then combine the gathered information and it passes to the BS. This technique intensely decreases the communication cost of the sensor nodes hence that the lifetime of the network greatly expands.

LEACH (low energy adaptive clustering hierarchy) is coming under the hierarchical routing protocol this work focuses on a communication protocol for micro-sensor networks. In leach arranging the nodes in the network, then the clusters are formed based on the population each cluster has a cluster heads (CH) [5]. In LEACH protocol, whole the nodes are grouped into the clusters, and in every cluster has assigned a single Cluster Head (CH) from the cluster member node. CH gather the information from the bordering nodes and send it to the base station. Generally, initial assignment of CH is stochastic and the function of CH is revolved for every fixed continuance hence that each node will behave as a cluster head (CH) at the least once in its lifetime. LEACH algorithm has two phases. They are set up phase and steady state phase. Setup phase is used to selecting a CH and steady state phase is used to preserve the CH during the transmission of information [6]. The lifetime of the network are increased in LEACH but not much as G-LEACH. LEACH does not assurance the optimization for the number and location of cluster heads. G-LEACH (Genetic-Low Energy Adaptive Clustering Hierarchy) is a definitive clustering algorithm, which is widely used in cellular telecommunication networks. G-LEACH randomly chooses cluster head node circularly to equalizer energy of each node in the whole network. In the master G-LEACH algorithm, it only handles cluster-head nodes by taking sorting of cluster, and cluster-head nodes can take energy in the action of data transmission between with the base station. The genetic algorithm
(GA) to minimize the communication distance in the network and maximize the lifetime of the network. In GLEACH is to providing the co-ordination between the cluster heads

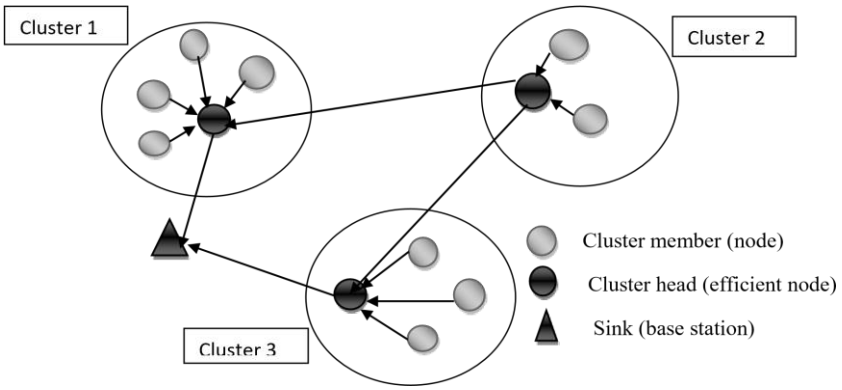


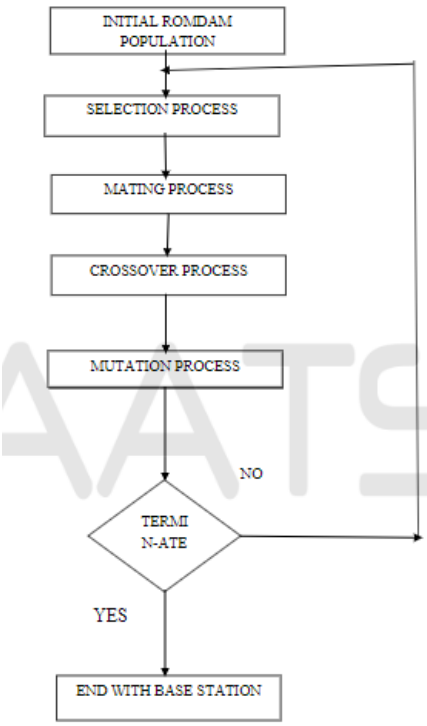
Fig 1. An example of cellular network

2. GENETIC ALGORITHM

GA is an adaptive method for search optimization problem and its solving both constrain and unconstraint optimization problem- based natural selection process. GA is a combination of two protocols. The search techniques used in computational to find true or approximate solution of the optimization problem. GA provided the best solution are selected to reproduce and to form the next generation. It is able to create a high quality of the solution and we use GA to reduce the communication length in the network and increase the lifetime of the network. The genetic algorithm is based method is to optimize the lifetime of the node. This method is clusterbased approach like LEACH. The genetic algorithm is based on three phases. The set-up and steady phase is important for each round in the G-LEACH protocol and the preparation phase previous the beginning of the first round

1. Preparation phase
2. Set-up phase
3. Steady phase

Figure 2. FLOW GRAPH FOR GA

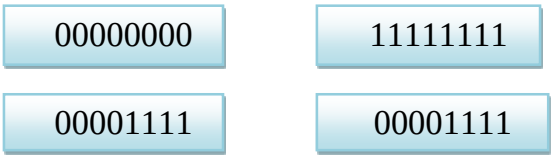


2.1 SELECTION PROCESS

This process determines which of the node from the current cluster group will create a new node by doing crossover and mutation. The new node joins the existing cluster group. The node which have better fitness values has bigger chance to be selected. [9]

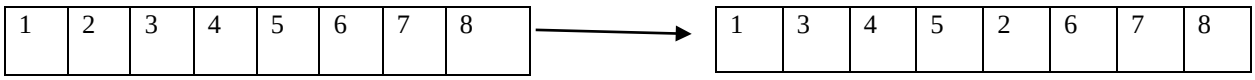
2.2 CROSSOVER PROCESS

Crossover is a genetic operator that generates two new node from the two cluster. Crossover process depends on the probability defined initially before GA start. The probability that the crossover will take place depend on the crossover rate. Only crossover can combine information from the clusters. The existing clusters are combined to form a new clusters. [9]



2.3 MUTATION PROCESS

After a crossover is performed mutation takes place. If the problem is raised in cluster the mutation will solve the problem. Mutation changes every bit of the new node with a probability called mutation rate. The mutation can introduce new information pair of the alternative form of cluster. [9]



2.4 PREPARATION PHASE

The preparation phase is an additional phase to the beginning of the initial round. This phase is performed only before the set-up phase of the initial round. In the initial round to gather the information about the node status, ID's, location and sends it's to the base station (BS). Once the base station (BS) obtained the data from all nodes, them it searches for optimal chances of nodes.

2.5 SET-UP PHASE

The second phase is "set-up phase" In this phase cluster are formed and cluster heads are selected based on a certain chance for each round. But the cluster is not animated for each round. Non-CH node attributed to the cluster based on their distance to the CHs. Those non-CH nodes join into the cluster.

2.6 STEADY-STATE PHASE

In this phase which the member nodes transmit their data to the cluster heads predicated on a TDMA

schedule. After the cluster head (CHs) receives from all member nodes, it "fuses" the data packet into one packet and sends it to the base station (BS). When all CHs send their data to BS, a round is culminated. At the terminus of every round, the BS checks the energies of CHs and the cluster member nodes. If the energy of a CH is under the average energy of member nodes of its cluster, an associate CH is culled from the member nodes of the cluster. Therefore, G-LEACH is to ameliorate the lifetime of the network and decreases the energy consumption in the network.

3. SIMULATION RESULT

Simulation results will be shown by using NS2 NAM (network animator) window. In the simulation, result proves that this cluster head selection method is more energy efficient compared to LEACH.

A. ENSURING OF NODE FORMULATION IN NAM WINDOW:

As we observed before 50 node were prepared in NAM window. We used different color between nodes for simple recognition. Here we announce a gateway and a (base station) sink to demonstrate the data transfer between the nodes.

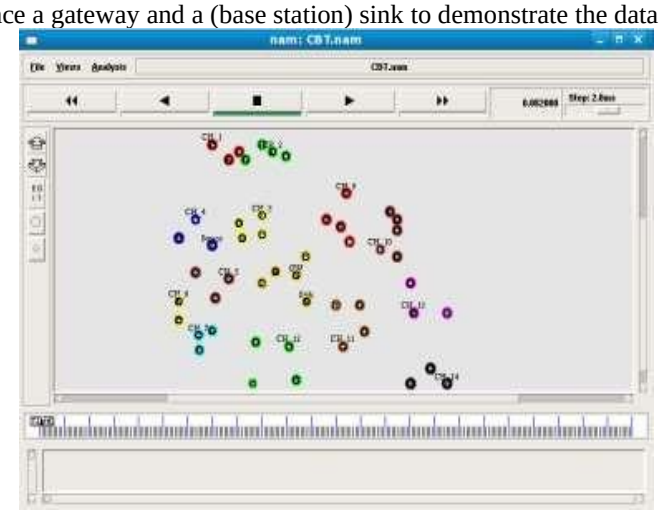


Figure 3. Node formulation

This is the initial stage of the clusters where all the nodes are being starting and their cluster heads (CH) are being nominated for the cluster and a gateway and a base station (sink) is used for communication.

B. COMMUNICATION BETWEEN THE NODES

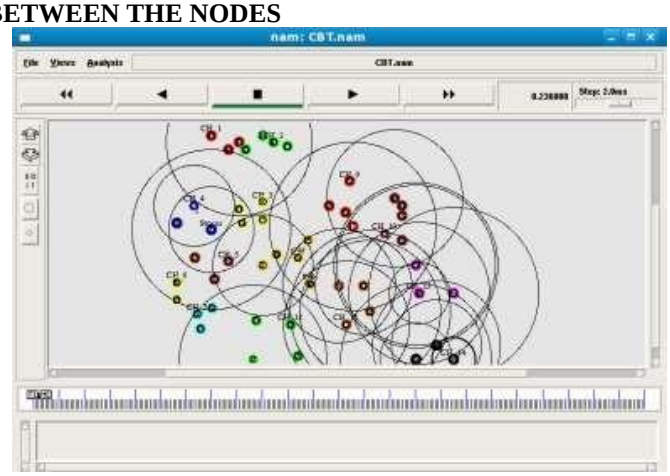


Figure 4. Communication between the nodes

In this form the each and every nodes in the network is being communicated to each other to suggest all the nodes are active and they are prepare for combining the data from the bordering.

C. COMMUNICATION BETWEEN THE CLUSTERS

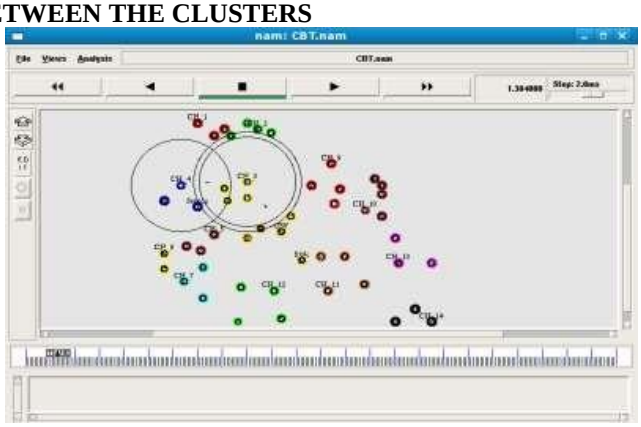


Figure 5. Communication between the clusters

We can detect from the above simulation that the CH4 skunks the data and then it skunked data to its contiguous cluster head CH3 and then the data is being placed to gateway through CH3.

D. MOVEMENT OF NODES

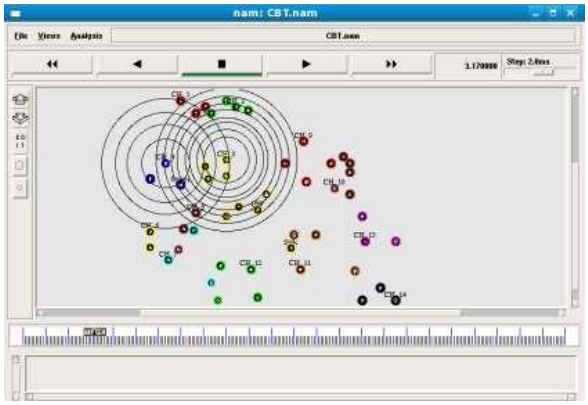


Figure 6. Movement of nodes

In this we can detect the movement of nodes from one cluster to the other in CH7 cluster the node are moved to CH12 to from a cluster and the cluster head moves towards CH6 to form a cluster with CH6.

E. DATA COLLECTION AT THE BASE-STATION

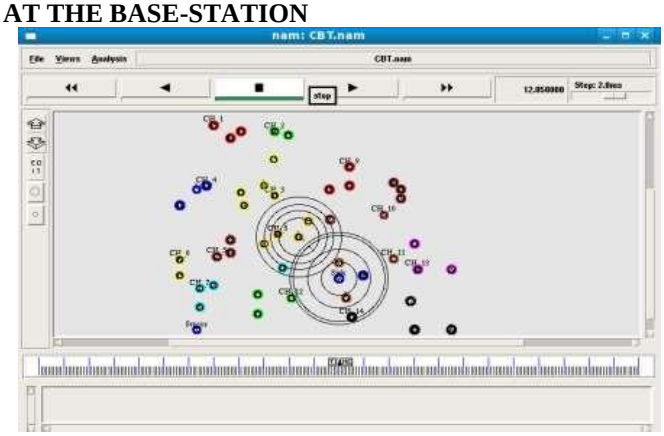


Figure 7 collection of data

All the data which picked-up by the nodes are being rendered to the gateway and the gateway sends the collected data to the base station in between this process the nodes are proceeded from one cluster to another cluster.

F. COMPLETION OF DATA TRANSMISSION

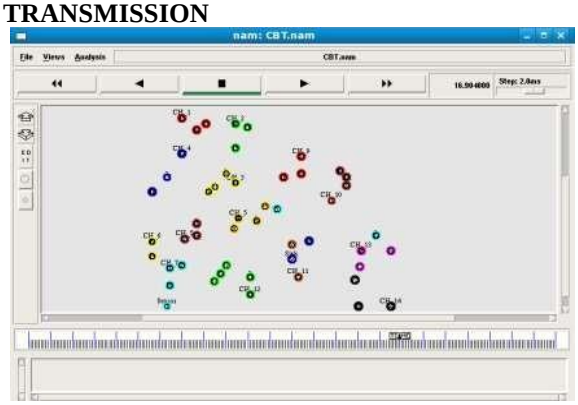


Figure 8. Completion of data transmission.

This is the last step of this simulation here how many nodes being altered from its original posture to its next posture and how many nodes has changed from one cluster to the other.

3.1 EXECUTION DEVELOPMENT

A. NODE MOBILITY VS PACKET DROPS

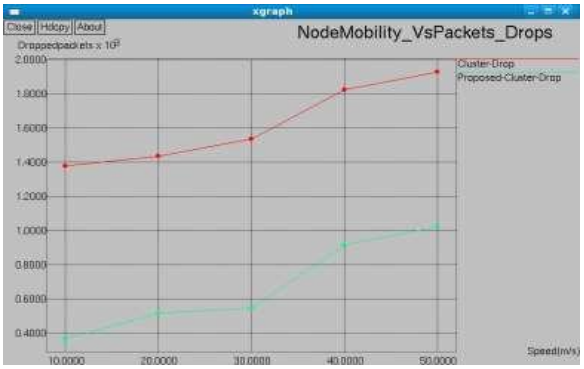


Figure 10. Execution showing the packet loss during the node mobility

In the above graph the comparison between the earlier method (LEACH) and the proposed method (GLEACH) is being done by comparing the results of packet drops during the transmission of data packets. From this comparison it is clear that the execution of proposed method (G-LEACH) has reduced the packet loss from the earlier method in cellular network.

B. NODE MOBILITY VS PACKET DELIVERY RATIO

Figure 11. Execution showing the packet delivery ratio during the node mobility

In the above graph shows the delivery ratio and the speed of the node movements were combined in the earlier method the speed and the packet delivery ratio decreases step by step and then it goes to minimum speed but in the proposed method there is tenuous variation compared to the earlier method and attain a regular speed and constant packet delivery.

C. MOBILITY VS END TO END DELAY

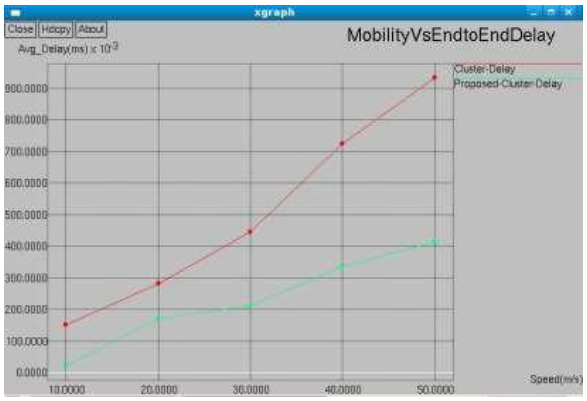


Figure 12. Execution showing the end to end delay during the node mobility

The end to end delay in the LEACH is too high so the packet loss in the network will be high this position is been handled cautiously and the end to end delay is minimized in the proposed algorithm so by reducing this the energy of the nodes are preserved and the lifetime of the cellular telecommunication network is stretched.

D. MOBILITY VS ENERGY

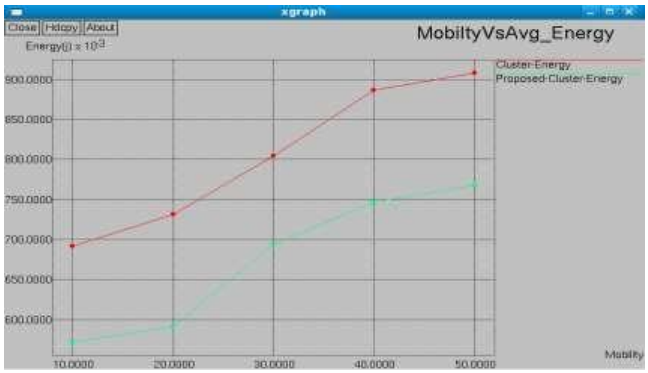


Figure 13. Execution showing the Energy used during the node mobility

This graph shows the mobility vs average energy in earlier method of LEACH and the proposed method of G-LEACH.

4 CONCLUSION

This work proposed a G-LEACH to increase the life time of the cellular telecommunication network. The LEACH protocol involves the node to specify this chance for use with the threshold function in finding whether a node becomes a cluster head or not. However the network operation is majorly sensible to this chance, and it is very difficult to obtain an optimum arranging from usable anterior knowledge. Hence, our set about uses a preparation phase anterior to the set-up phase of the first round to assembled about node status, node IDs and position and sends it to the base station, which decides the optimum chance to use in the cluster head choice mechanism. Our simulation result shows that the optimum distribution of probability coped with the analytical results proposed by our corrected algorithm. Furthermore our proposed G-LEACH method has yield the optimal energy efficient of cluster compare to earlier method LEACH.

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