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Data Aggregation Technique using Genetic Algorithm

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Abstract: *Wireless sensor network are now the part of almost all the applications. The lifetimes of network and data aggregation are the major issue in Wireless sensor networks which can be resolved using variousClustering techniques.The main aim of the data aggregation is to collect data in such a manner that network lifetime will be enhanced. In this paper we have discussed data aggregation technique using Genetic algorithm. We have used MATLAB 2013 to find the optimum value using Genetic algorithm.*

Keywords: *Wireless sensor network, data aggregation, Genetic Algorithm*

I. INTRODUCTION

The wireless sensor network are comprised of sensor nodes which are miniaturedevices having battery, processors and trans-receivers .These sensor nodes collect the data from the surrounding environment and send it to the base station for further analysis. In doing this more effectively sensor nodes use different data aggregation algorithms. The main objective of data aggregation algorithms is to collect and combine data in an energy efficient manner so that network life span is increased.Though there are many routing protocols also There have been numerous routing protocols that have appeared in WSNs. The first low-energy adaptive clustering hierarchy i.e. LEACH[1] was proposed by Heinzelman et al[2]. It is a hierarchical and self-organized cluster-based approach. The area whose information has to be transmitted i.e. the area under monitoring where the sensor nodes are deployed is subdivided randomly into several clusters. Within each cluster CH (cluster head) is selected which collect data from the associated member nodes in their clusters based on Time Division Multiple Access (TDMA) scheduling. The outcome is transmitted to the base station or sink as a data packet after the removal of redundant data. CHs are selected through a BS message after a pre-determined period of time In this paper the concept of Genetic algorithm for data aggregation is used on the network size of 30 nodes which results in the optimum value.

II. DATA AGGREGATION

The process of collecting the data from the sensor nodes is done by various data aggregation approaches or algorithms[3]. The basic Algorithm employs sensors nodes collecting the data from the surrounding the algorithm then aggregates the data using aggregationalgorithm like LEACH, LEACH-GA, centralized approach etc after this the data is send the base station. The data aggregation can follow any of this technique In network Aggregation, Tree based approach and Cluster based approach as shown in the figure 2.1 and Figure 2.2 besides this in the centralized approach all the nodes send data to the central node called as Leader through the shortest routing path and by multi-hop process.In this paper the we have discussed the selection of node on the basis of distance and energy by defining the function in MatLab and calling it in GUI GA tool used for genetic algorithm.

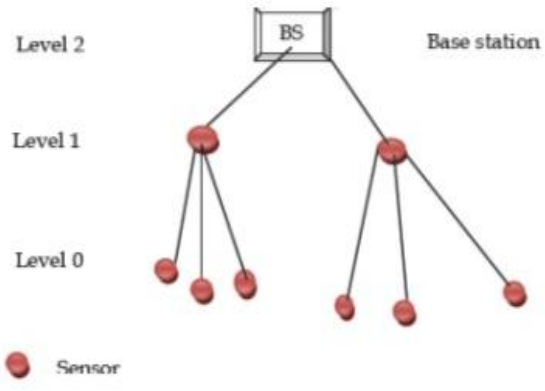


Figure2.1 Tree based approach

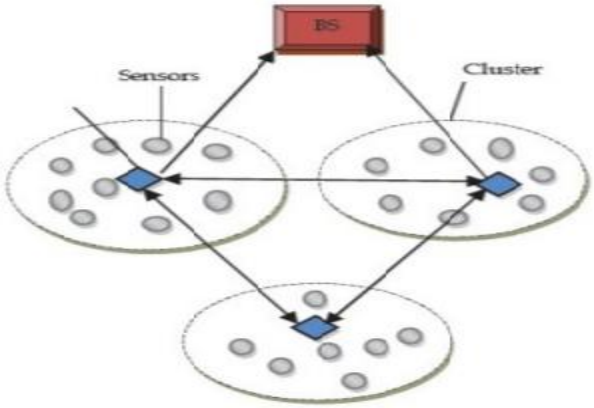


Figure 2.2 Cluster Based approach

III. GENETIC ALGORITHM

GA is commonly used in applications where the search space is huge and the precise results are not very important [4,5]. As GA is relatively computation intensive, it is executed only at the base station.It is used for randomized search and generation of optimum solution. There are three fundamental steps of Genetic algorithm namely population initialization, fitness function and selection for the cluster head. The flow chart for the genetic algorithm shown in Figure 3.1

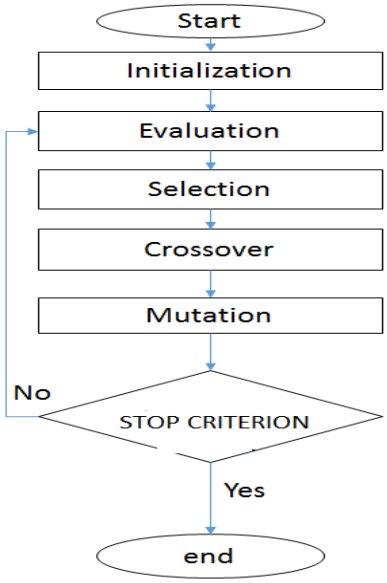


Figure 3.1 Genetic Algorithm

The genetic algorithm continually modifies a population of individual solutions. At each step, the genetic algorithm selects individuals at random from the current population to be parents and uses them to produce the children for the next generation. Over successive generations, the population "evolves" toward an optimal solution. In this paper we have used the GA tool in MatLab which may also be used as OPTIM tool.

IV. PROPOSED WORK

In this paper the effort has put for finding the optitum value for energy and distance in the network size of 30 nodes using MatLab Genetic Algorithm tool.Design steps of MATLAB implemetation of genetic algorithm for solving optimization problems is shown below.Here the the genetic algorithm starts with an elementary population comprised of random chromosomes which includes genes with a sequence of 0 s or 1 s. Next the algorithm leads individuals to achieve an optimum solution by the way of repetitive processes together with crossover and selection operators. The fitness of a chromosome determines the extent to which the consumption of energy is minimized and coverage is maximized. In what follows, some important fitness parameters in WSN are discussed [6].In this paper we find the energy and distance of each node from the current CH and then apply the selection condition for picking the next CH.

- Objective Function which is 0 for minimization / 1 for maximization
- bit accuracy
- Population of the genes here nodes specifying the network size
- Crossover chance
- Mutation probability
- Number of variables followed by Variable name and itslimits.

The program returns optimum value (approximately optimum solution or local optima). It is important that Crossover chance and mutation probability are chosen that the program is not struck in the limits.

V. RESULTS

The algorithm begins by creating the population here we have defined the 30 nodes. At each step, the genetic algorithm uses the current population to create the children that makes up the next generation. The algorithm selects a group of individuals in the current population, called 'Parents', who contribute their genes to their children [7,8]. As the algorithm goes on the graphical plot of each successive generation shows the increasing closeness of the outcome to the global optimum point as shown in Figure5.1.Also thepath comparison with and without genetic algorithm taking Distance as parameter for node is shownin Figure 5.2.

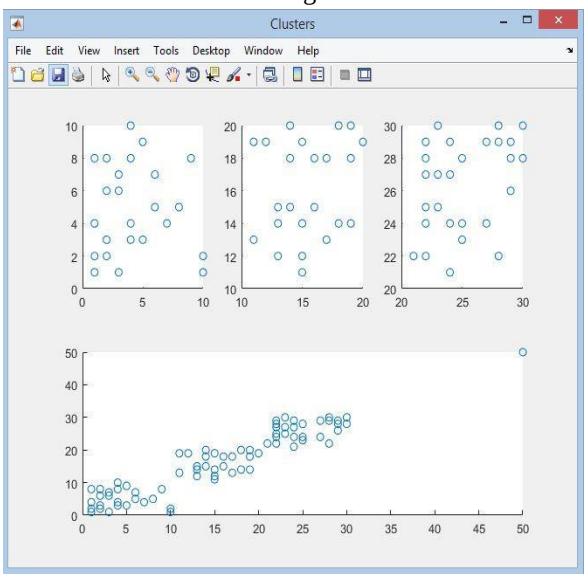


Figure 5.1 Initial populations of Nodes

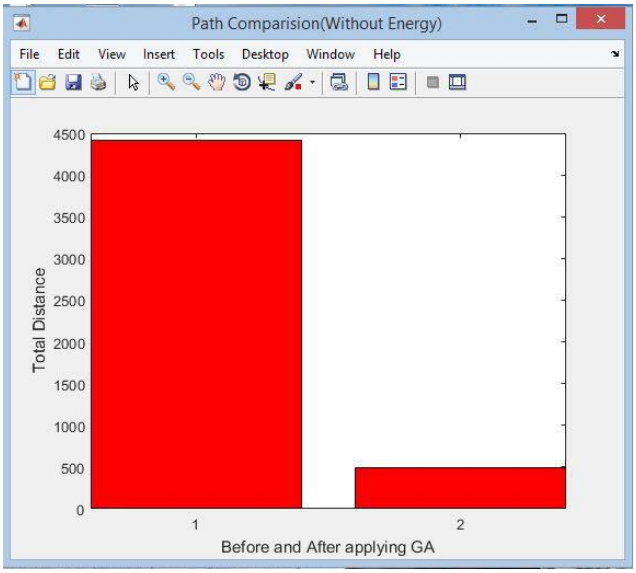


Figure 5.2 Graph showing change in Distance

This genetic algorithm code was used to find the optimum value of the fitness function which was the best distance covering all the nodes.All the distances were added up and compared with former summation of distances. Lowest distance sum was considered final and CH was chosen as best one. An uniform population of size of 30 nodes was used in three different simulations.After getting the best CH for information gathering and transmission we have further refined the results by using the following condition xnew = find(d<2 & d~=0 & ener>60). The CH was termed as final CH and all the transmission was done through it to get minimum energy used and maximum efficiency of whole WSN as shown in Figure 5.3.

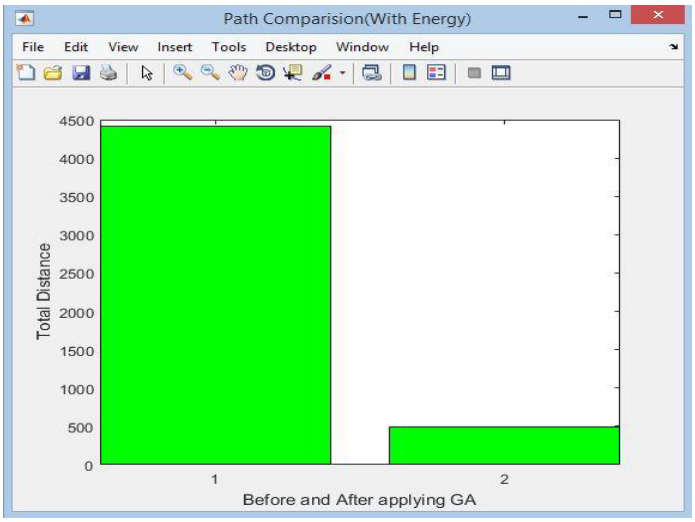
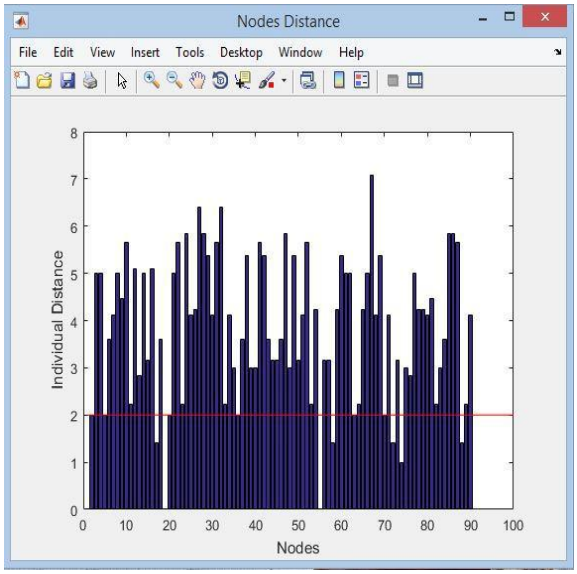


Figure 5.3 Graph showing change in total distance and energy.

The optimum value achieved using fval is 0.7071along with the graph of individual node distance and energy as shown in Figure 5.4 and Figure 5.5 respectively.



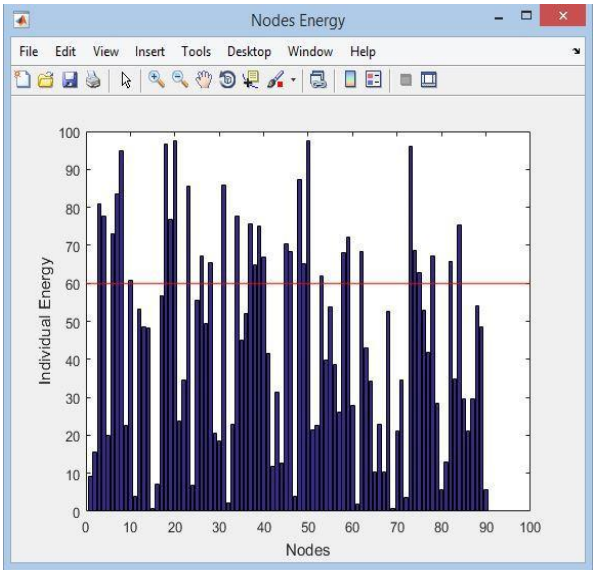


Figure 5.4 Graph of Individual nodes Distance

Figure 5.5 Graph of Individual node energy

VI. CONCLUSION AND FUTURE SCOPE

The use of genetic algorithm by generating the value of the fitness function gives us better results and more efficient use of energy and resources. The lifetime of the sensor network is increased as they become more energy efficient if we use them in the LEACH. But the further work can be improved by increasing the network size and using guided search along with Genetic algorithm.

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