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A CMeans Adaptive Clustering Model to Optimize Communication in Sensor Network

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ABSTRACT

A sensor network is defined with limited energy and resources. The clustering architecture is applied in sensor network for effective utilization of resources and to optimize the network QoS and life time. In this work, a two phase model is defined to improve the clustered communication in sensor network. In first phase of this model, CMeans clustering method is applied to divide the network in smaller segments. Once the clusters are formed, the cluster head is elected based on energy and fault based consideration. In second phase of this model, the dynamic programming is applied to generate the path between the sensor nodes and the cluster head. The presented work model is simulated on random network in matlab environment. The simulation results show that the model has improved the node energy utilization and packet communication.

Keywords : Sensor Network, Clustered, CMeans, Dynamic.

I. INTRODUCTION

Clustering is the network architecture that organizes and divides the network virtually so that the limited available resources can be utilized. The network is able to improve the communication scope and reduce the number of parallel transmission. The formation of the clusters depends on multiple parameters including the sensing range energy etc. In this architecture, the network is divided in smaller irregular segments geographically. Each of the nodes is identified as the member of particular cluster. Once the clusters are formed, the next work is to identify the cluster head. The cluster head is the controller node that collects the data from each cluster members and combines it as the single packet. This aggregative packet is finally communicated to the base station. The clustering process is shown in figure 1.

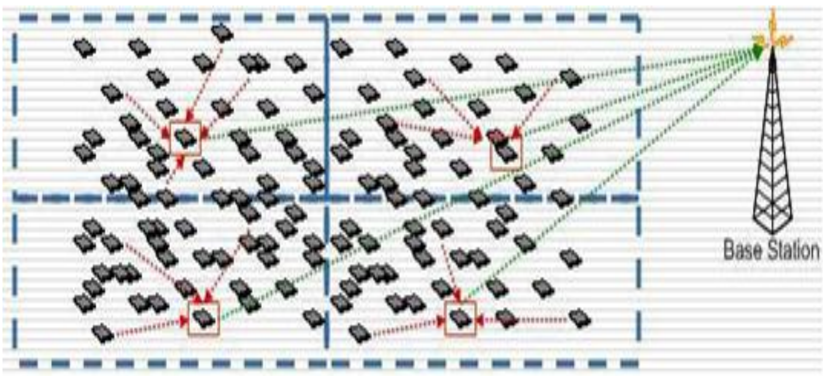

Figure 1: Clustering

Here figure 1 is showing the clustered architecture. The nodes marked by the rectangle are the cluster heads. The red arrows are showing the communication from node to cluster heads. Once the cluster head collects the data the communication from cluster head to base station is performed directly. The green lines show the communication from cluster head to base station. The communication from node to cluster head and cluster head to base station can be performed using single hop or multi hop communication. The single hop communication is performed generally by the internal nodes of clusters. A cluster is defined with internal and external sensing range. The external nodes use the internal nodes as intermediate nodes and perform multihop communication. Whereas the internal nodes are able to perform the direct communication to the cluster head. In the same way, the cluster heads also perform the single hop or multihop communication with the base station. The base station is defined with larger sensing range. The cluster heads that come in the sensing range of base station communicate directly to the base station using single hop communication. Rest of the cluster head generates the multihop path by using other cluster heads as intermediate nodes. As the cluster head collects the data from each cluster members and combine it as the aggregative packet. The aggregative communication is provided by this network. In this form, the clustered communication generates a hierarchical communication structure. In this structure at the lower level, the sensor nodes are present and at the top level base station is present as single root. The leaf nodes use the cluster heads as the parent nodes to communicate to the base station. This aggregative composition of packet is done to reduce the number of transmission. As the transmission is reduced overall communication, energy consumption and the congestion is reduced. The clustered architecture provides the ultimate method to transform the limitation of sensor network to its capabilities. The requirement is here to perform the effective selection of cluster heads and to generate the optimized route.

In this work, a CMeans improved method is defined to optimize the clustering method. The work is divided in two main phases. In first phase, the clustering process is optimized under parametric consideration. In second phase, the dynamic programming method is applied for effective routing. In this section, the requirements, features and working of clustering architecture is defined. In section II, the work provided by earlier researchers is discussed. In section III, the proposed research model is presented. In section IV, the results obtained from work are presented. In section V, the conclusion obtained from work is provided.

II. LITERATURE SURVEY

In this section, the work provided by the earlier researchers to improve the clustering and coverage phenomenon is presented.

Author[1] has defined a connectivity based node tracking method to improve the network coverage. The work was defined by the author on mobile sensor nodes with restricted capabilities. The algorithmic method was defined for tracking the individual nodes and to improve the network communication.

Author[2] has provided the tracking of multiple tracked nodes based on multiple parameters. The probabilistic analysis at node level was provided for effective constraint mapping. The network life improvement was suggested by the author to utilize the network resources effectively.

Author[3] has defined a new utilization model to improve the probabilistic strength of node selection. The weight specific modeling was defined by the author to track the disjoint nodes. The nodes profit specific mapping was also done based on the statistical estimation. The coverset management and the relative sequence tracking were also provided by the author.

Author[4] has used the probabilistic measure to track the M nodes in the realistic sensor network. The threshold specific heuristic algorithm was defined by the author to achieve the maximum coverage. The probabilistic distribution based computation was defined to improve the tracking and to improve the network reliability and effectiveness.

Author[5] characterizes the network coverage with real life derivation so that the node communication will carry out with real constraints. The industrial environment based parameters such as energy, coverage, network life were considered by the author. Author applied the work in noisy environment and setup the assumption to identify the network level problems. The connectivity and coverage based analysis was provided by the author.

Author[6] has used the constraint optimization approach for effective activation of controller node. The constraint based target racking was provided by the author. The heuristic method was defined with disjoint coverage analysis using centralized and distributed algorithm. The sensing range and coverage constraints were analyzed by the author to improve the network effectiveness. The greedy improved heuristic algorithm was defined to assign the priority at node level and to configure the local environment. Author[7] has used the mobile node tracking with specification of architectural control the geometric analysis was provided by the author for node tracking and connectivity analysis. The tracking rate based algorithmic control was defined to setup the constraint driven cell control. The improved node tracking was suggested by the author. Author[8] has used the multi-factor scheduling method to improve the network life. The target location based analysis and the sensing range adaptive analysis was provided by the author. The weight specific mapping and the coverage maximization was achieved by the author. The greedy algorithm was defined for weight specific coverage selection. Unequal targets and sensing behaviour based analysis was implied to improve the network life.

Author[9[has used the scheduling algorithm to improve the data collection and to achieve the effective target coverage. The density driven analysis was provided by the author to reduce the coverage time and to improve the coverage area. The approximation algorithm was defined under extensive life time parameter at bounded parameter specification. The greedy based parameter improvement was suggested by the author.

Author[10] used the linear programming method for improving the coverage aspect. The discrete point was specified with route formation and scheduling optimization. The constraint based sink node tracking was defined to achieve the full connected coverage. The method has improved the network life and reduced the energy consumption.

Author[11] used the integer programming method to achieve the network maximization and reduce the problems of target coverage. The sensing capabilities of nodes were used to connect the neighbors and to achieve the cluster head tracking. The performance driven features were used by the author to improve network life.

Author[12] has identified the challenges in mobile sensor network and improves the network configuration and deployment aspects. The work defined by author performed the node connectivity analysis and later on applied the exact algorithm to generate the optimal network solution. The greedy and voronoi inspired algorithm was defined by the author to improve the region coverage and to improve the movement specific coverage. The algorithm was defined to reduce the distance connectivity.

Author[13] has provided a greedy based heuristic method to improve the target selection based on prior coverage. The key target based extensive method was defined to improve the network stability and adaptability. The priority based analysis was defined to reduce the computation and to improve the network life.

Author[14] has used the direction and movement based analysis to improve the effective tracking of critical nodes. The Omni direction based coverage and sensing was defined to generate more reliable network architecture. The direction specific analysis has improved the gain ratio. The directional observation with distance consideration was defined to improve the network life.

Author[15] has defined a work on target coverage improvement by generating the segments and applying the separate algorithm on search segment. The graph specific mapping was defined by the author to achieve the coverage under scalability vector. The graph processing has reduced the complexity and improves the accuracy of the communication. The feature specific modeling in real time network was suggested by the author.

Author[16] has defined directional observation on node selection. The directional point based polynomial derivation as suggested by the author. A point specific location selection method was suggested in this work. In this section, the contributions of earlier researchers are defined. Based on this study, a new clustering model is presented in next section.

III. RESEARCH METHODOLOGY

In this work, an improved clustering architecture is defined for fault inclusive sensor networks. A fault inclusive sensor network is the most critical form of sensor network in which energy nodes are defined with possible node failures. At the early stage, the node fault and load analysis are evaluated with energy and probability vectors for cluster head selection. The parameter adaptive CMeans clustering is proposed at this stage. Once the clustering is done, the next work is to divide the network into zones so that the internal and external nodes are identified. The internal nodes will perform the direct communication with cluster head, whereas the external nodes will perform multi-hop communication. The multi-hop route formation will be done here under energy, distance and fault evaluation vectors. In the final stage, the aggregative route will be established between the cluster heads. This route formation will be done using a dynamic programming approach. The work is about to provide effective communication in clustered network. Multiple parameters are defined at each stage to derive more accurate and more constraint specific execution. During the cluster formation, the coverage range is considered as the main parameter. The algorithmic formation is shown in figure 2.

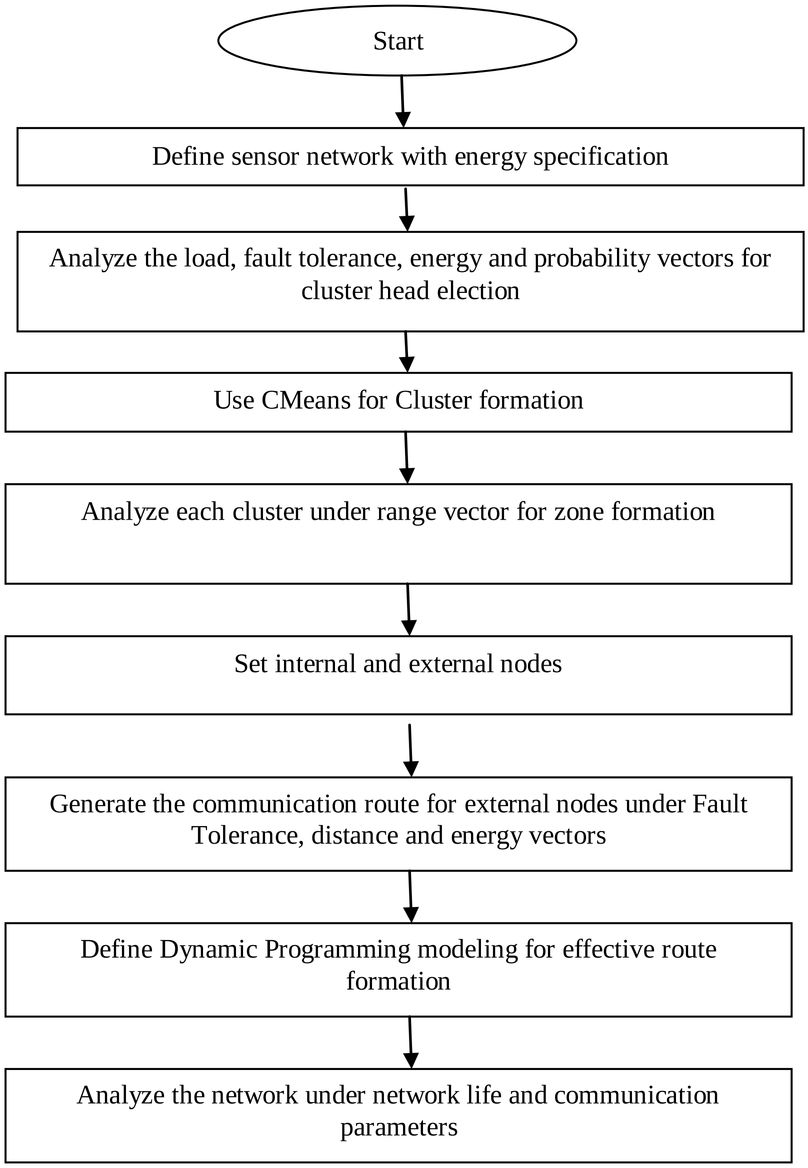

Figure 2 : Proposed Model

Figure 2 shows the main processing model to divide the network in smaller clusters and to select the cluster heads. The proposed approach used the CMeans clustering methods to divide the network in smaller regions based on coverage analysis. Later on, the energy and load parameters are considered for election of cluster head. At the final stage, the dynamic programming method is applied to generate the communication route.

IV. RESULTS

In this paper, a CMeans clustering and dynamic programming method is defined to improve the clustered communication in sensor network. The work is simulated in matlab environment with random scenario. The scenario parameters are listed in table 1.

Table 1 : Network Parameters

Parameters	Specifications
Area Size	200x200 mtr
Number of Sensor Nodes	200
Initial Energy	Random

Transmission Loss	5mJ
Forwarding Loss	1mJ
Receiving Loss	5mJ

Table 1 has showed the parameters for clustering the sensor network. The node level and network level parameters are shown in the table. The energy parameters, and the network parameters are shown in the figure. The analysis of this work is defined against network life and network communication parameters. The existing work is defined using KMeans clustering method. In this work, the distance and energy are considered as key parameters. The comparative observation under dead node analysis is shown in figure 3.

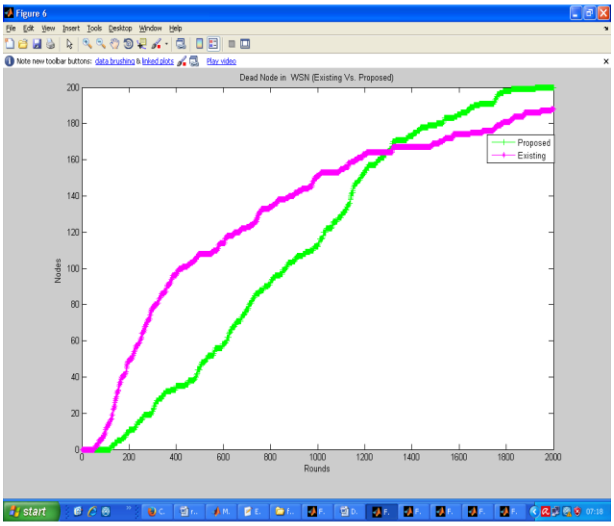

Figure 3 : Dead Node Analysis

Figure 3 is showing the comparative analysis on existing and proposed approach under dead node analysis. The figure shows that the proposed approach has improved the network utilization. In the existing work, the orphan nodes were not tracking which reduced the network communication and energy consumption. But proposed approach gives the maximum coverage and provided the better utilization of network.

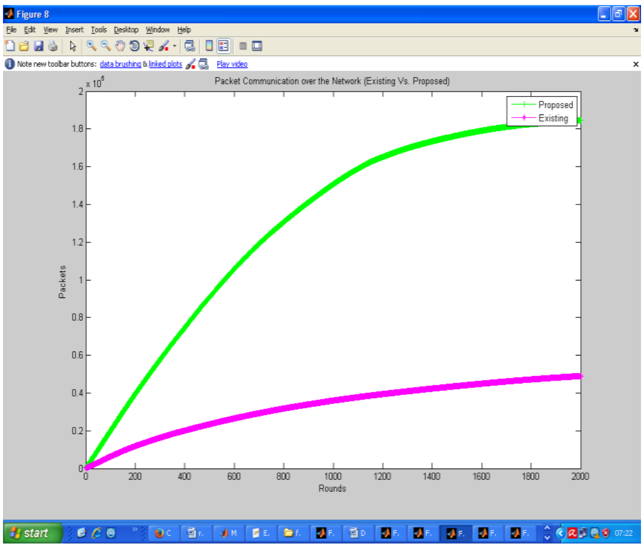

Figure 4: Aggregative Packet Communication

Figure 4 is showing the network communication performed in case of existing and proposed approach. The figure shows that the proposed approach gives the maximum coverage on network nodes so that the network communication is improved.

CONCLUSION

In this paper, a CMeans improved model is presented to improve the clustered communication in sensor network. The parameter based improved was suggested to improve the node tracking and resource utilization. Once the clustering is done, the dynamic programming was applied to generate the route over the network. The work is simulated in matlab environment. The simulation results show that the proposed method has improved the network utilization and network life.

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