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A Target Coverage Optimization Model using Dual-Priortization Approach

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ABSTRACT

Target coverage is the adaptive coverage algorithm that provides the regular backup to the critical nodes. In this work, a weight and priority driven method is provided for effective target coverage. The method is divided in three main stages. In first stage, the node level analysis is performed under different parameters. The eligible coverage nodes are identified from this stage. In second stage, the prioritization adaptive balanced coverset formation is done. In the final stage, the sequence scheduling is done using prioritization method. The work is implemented in matlab environment. The result shows that the method has improved the network life.

Keywords : Prioritization, Target Coverage, Area Coverage, Weighted

I. INTRODUCTION

As the sensor network is defined with limited sensing range, it is one of the critical challenges to provide the coverage at node level and network level. The coverage ensures that none of the node is out of network scope so that the communication will not performed by that node. The coverage ensures the network reliability and QoS along with effective resource utilization. The network level and the node level interpretations are defined to utilize the network restrictions and constraints. The coverage is able to provide the connectivity over the weak zones in the network. The architectural improvement is here provided by the coverage methods at different phases. The network deployment and reconfiguration is also provided to improve the network coverage. The coverage can be done in different forms including the target coverage, area coverage and barrier coverage. The basic requirement and characterization of these coverage methods are listed here under

- The coverage performance and constraints depends on the network deployment within the region.
- The coverage ensures the communication reliability as per application requirement.

The parameters required to improve the coverage includes, coverage range, node degree and the energy. The node degree defines the number of nodes within the coverage that can provide the alternate communication for the network. The environmental condition, attack type, fault are the author measures that can be applied to improve the coverage behavior. Most of the coverage phenomenon is associated to the network deployment. The certain range based communication is provided and controlled to improve the network effectiveness. Different coverage forms are defined hereunder

A) Target Coverage

Target coverage problem is defined to provide the monitoring to the critical network nodes. The network is defined with some critical sensor nodes called target nodes and rest are the simple sensor nodes. The sensor nodes provide the monitoring and backup to the target nodes. Here in figure 1, the target coverage is shown. Here t1 to t5 are the target nodes and s1 to s5 are the sensor nodes.

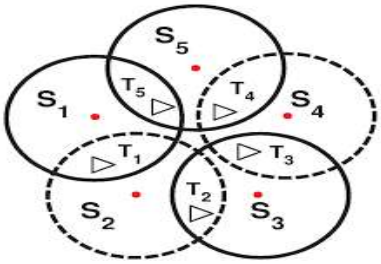

Figure 1 : Target Coverage

Here figure showing that s1 is providing the coverage to target nodes t1 and t5. In same way, s5 is providing the coverage to t4 and t6. The set of nodes that provides the coverage to all the targets collectively forms the coverset. To provide the target coverage, the first requirement is to identify the possible coversets. The sequence of activation of these coversets is also provided to optimize the network communication.

B) Area Coverage

Area Coverage is based on the network deployment that identifies the network impurities at the earlier level. As the communication in sensor network is performed under cooperative behavior, it is required that each node exist in sensing range of other node. The deployment is about the static arrangement of nodes whereas the reconfiguration provides the dynamic adjustment of network. Area coverage provides the evaluation of the network so that the adaptive deployment and reconfiguration can be done. Here figure 2 is showing the area coverage.

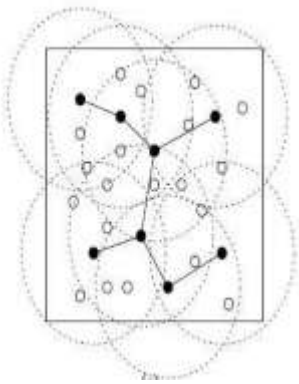

Figure 2: Area Coverage

The figure showing the larger circles to represent the coverage region of nodes. The figure is also providing the coverage adaptive communication.

C) Barrier Coverage

Barrier coverage is about to define a barrier to save the network from intruder. The region level security is provided by the barrier coverage. The barrier coverage is about to minimize the probability of network penetration. The barrier coverage generates the minimum exposure path so that the reliable communication will be drawn over the network. Figure 3 here showing the path barrier defined within the coverage region.

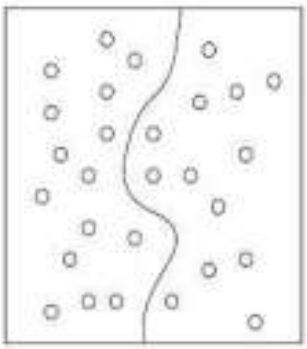

Figure 3: Barrier Coverage

Here figure 3 is showing the barrier coverage with specification of barrier bound. The method provides the minimum exposure path to provide the secure communication over the network

II. RELATED WORK

This particular work is focused on optimization of target coverage problem. But, the solution to the same problem is provided by different researchers in different ways. In this section, the work provided by various researchers is presented. Author[1] has defined a new heuristic search method to generate the coversets and to provide the solution to target coverage problem. The energy effective method was provided by the author for improving the network life time under target coverage solution. Author[2] has provided the directional observation in realistic environment. Author

divided the network in smaller segments and applied the coverage rate and ratio specific analysis to estimate the performance of work. The target specific observation is here provided to obtain the directional sensing over the network. Author[3] has provided a column specific generation method to generate the optimal solution. The mathematical formulation was provided under the iterative communication and the behavior analysis. The precision specific communication was provided in the real environment. Author[4] has provided the directional observation on group sensor with coverage restriction. The finite area based coverage was analyzed with effective of constraint specification. Author track the target nodes with specification of sensor devices and the positional estimation. Author[5] has defined a weight driven greedy method to formulate the coverage set and to provide the effective target coverage. The target monitoring within the region was provided to achieve the higher network computation. The sensor specific coverage was provided using partition based approach.

Author[6] has provided a work on phase transition method to provide the uniform tracking of nodes. The shape specific observation was provided to achieve the effective network tracking. The ability of work is to achieve the fault driven estimation so that the communication responsibilities will be improved. Author[7] has provided a work on coverage improvement by using the approximation analysis method. The method was defined using polynomial time observation. The weight driven node tracking was provided using energy sensor nodes. Author[8] has provided the work on connection based target coverage so that the static and dynamic target tracking will be done. The heuristic solution was provided within the polynomial time. The successive target monitoring is here provided to achieve the network deployment and relatively provided the convergence solution. Author[9] has defined a work on linear programming based integer problem to build the heuristic solution. The performance driven extensive measure was provided to generate the adaptive work solution. The method was based on the coverage feature and provided the adaptive strength based measure. The flexible improve with extensive flow was provided by the author. Author[10] has defined a theoretical depth specific approach under optimal solution. Author provided the time table specific work allotment to achieve the maximum coverage and life time. The optimization method was provided to improve the communication with theoretical behavior.

Author[11] has defined a scheduling and deployment based work so that the computation minimization and life improvement was provided using scheduled approach. Author defined the combined PSO and bee colony based heuristic approach to setup the optimized processing sequence. Author[12] has provided a work on energy consumption and balancing in the directed communication mode. The feature specific measure was defined to improve the coverage in realistic environment. Author[13] has defined the redundant target based optimized solution using divide and conquer approach. The sub-graph specific network processing was provided by the author in real environment. The stage specific model was provided to achieve the effective target coverage. Author [14] defined the effort specific scheduling in specification centralized greedy algorithm. The remote target tracking was provided to achieve the relative cover on target nodes. Author[15] has provided work on the connectivity analysis with movement specific observation. The deployment driven analysis was provided to track the nodes and to provide the relatively adaptive communication between the node pairs.

III. RESEARCH METHODOLOGY

In this work, an improved heuristic model is presented to improve the target coverage method. The work model is divided in three main stages. In first stage, the coverset generation is done. In this stage, the analysis on the eligible sensor nodes will be applied under different parameters. These parameters will be applied in a sequence to filter the significant nodes. The parameters that will be considered include coverage range, degree and energy of nodes. These parameters will be applied with weight driven method to form the coverset. Once the coverset will be generated, the next work is to apply the prioritization and the sequence of activation of these coversets. The dynamic analysis will be applied at this stage to define the effective utilization of generated coversets. In the final stage of this method, the conditional observations will be applied on strength analysis of each coverset. Based on this observation, the regeneration of coversets will be performed. The proposed work model is here shown in figure 4.

The figure shows that the model begins with the formation of the network with random specification of sensor nodes and the target nodes. Each of the sensor and target nodes is also defined with relative energy specification. The first level analysis on nodes is performed under energy, distance, coverage, degree and load parameters. Based on these parameters, the weights are assigned to each node. The load and the coverage limit based identification of eligible nodes are done.

Once the eligible nodes are identified, the next work is to form the coverset. Here the balanced coverset formation is defined based on the aggregative energy and load analysis at coverset level. The coverset level prioritization is here defined to generate the effective balanced coverset. In the final stage of this model, the coverset activation is done. The cover set activation is here done based on the balanced energy consumption. The coverset activation is here provided to provide the adaptive coverset activation. This adaptive balanced coverset formation and priority adaptive coverset activation method has improved the network life and reduced the energy consumption over the network.

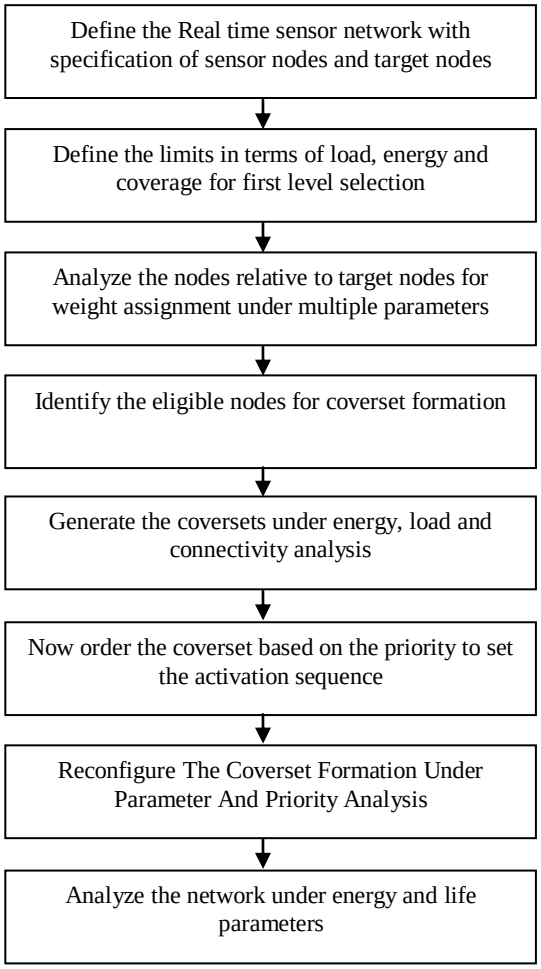

Figure 4 : Proposed Model

Here figure 4 is showing the work model for an adaptive and energy effective method for target tracking. The figure shows that the work is applied on a random network with specification of target nodes. The load and the connectivity analysis were applied to assign priority at node level and coverset level. Finally, the priority adaptive scheduling of overset activation is also provided. The simulation results obtained from the work are shown here in next section.

IV. RESULTS

The presented work is here implemented in matlab environment with specification of random network scenario. The communication is performed from multiple source nodes and single destination node. The network is defined in limited area with random energy specification. Network life analysis is here provided in terms of dead and alive nodes. The comparative observation in terms of network life is provided here.

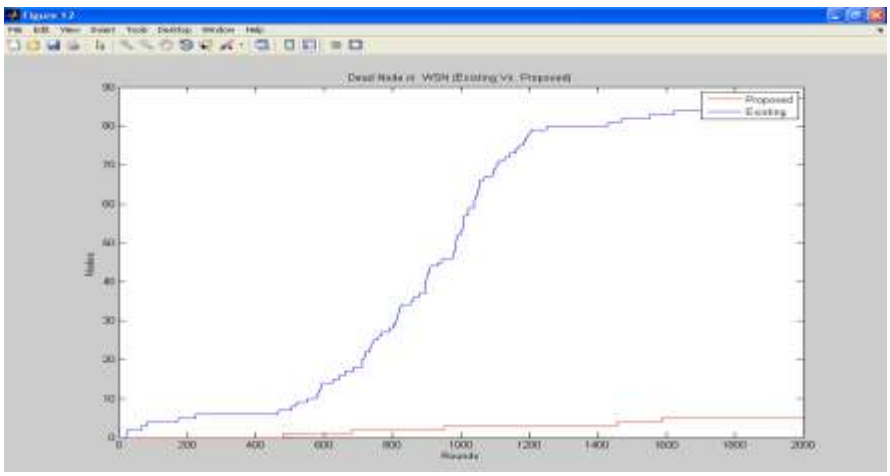

Figure 5: Dead Node Analysis

Here figure 5 is showing the comparative observation in terms of dead node. The figure shows that the red line represents the results of proposed approach which signify that the method has improved the network life. The number of dead nodes in the network is extremely less in case of proposed approach.

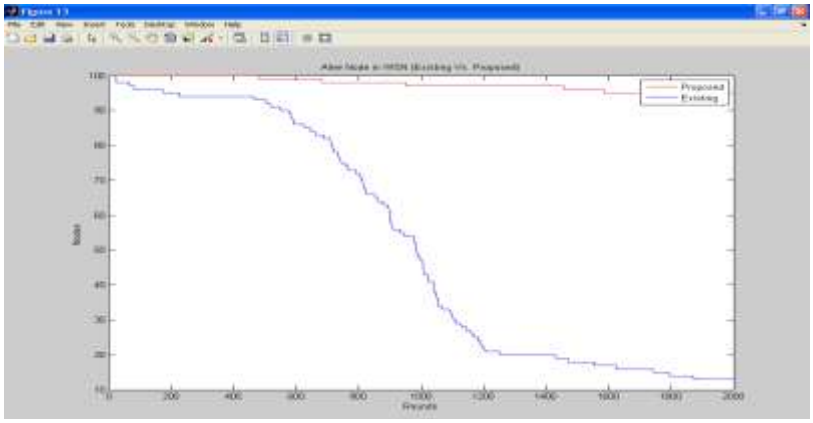

Figure 6: Alive Node Analysis

Here figure 6 is showing the comparative observation in terms of alive nodes. The figure shows that the red line represents the results of proposed approach which signify that the method has improved the network life. The number of alive nodes in the network is extremely high in case of proposed approach.

CONCLUSION

In this present work, the dual prioritization method is defined to improve the working of target coverage. The method has first applied the node level weight assignment and later on applied the coverset specific evaluation. The scheduling is also performed using prioritization approach.

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