Energy and Fault Balanced Method for Effective Target Coverage for Sensor Network

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Abstract: The target coverage is able to monitor the regions of sensor network by setting the specialized node. The target nodes are defined with specialized task and monitoring. To verify the functioning of these nodes, the covers are applied. In this work, a fault and energy balanced method is provided for effective coverage. The method first generated the covers and coverset based on fault and energy analysis. Later, the sequence of coverset activation is defined to improve the target coverage. The simulation results identified the effective target coverage that improved the network life.

Keywords: WSN, Fault, Energy, Target coverage

I. INTRODUCTION

A sensor network is a critical network defined with restricted resources. These resources include the energy limitation, sensing range specification etc. As the network is established in critical real time scenario, the criticality of network increases. Because of this there is always the requirement to optimize the network under critical constraints and energy preservation. In this work, an optimized network reconfiguration model is presented. This work is based on the network analysis applied by setting up the network in smaller zones. Later on zone adaptive analysis is provided for identifying the critical nodes. Based on this criticality analysis, network reconfiguration is applied in this work [1][2][5][6][8][10].

The sensor nodes are applied to observe the specific application components or the behaviour to collect the data. Based on these application components, regions or the various associated activities, the placement of nodes is done in the network. Such kinds of sensor network are localized based on fixed scenarios. The sensor nodes of specific type are defined to acquire the specific kind of information from the network. The node energy, processing power, memory etc are also decided while setting up the network based on the region criticality where the sensor network is applied. These networks are extended because of appropriate energy conservation so that efficient communication will be drawn [4][6][8][9].

A) Network Architecture

As the sensor network is basically defined for specialized applications and environment so that the network is also defined along with specification of architectural constraints. One of such common architecture is zone adaptive architecture. In this architectural form, the network is divided in smaller segments called zone. Each node of the zone is controlled by a controller node that accepts the data from the zone nodes and takes the selective decision. After applying some aggregative operation, the collected data is passed to next base station using a multi hop path. There are number of existing protocols that work on this zone adaptive architecture. The main aim of zone adaptive architecture is to provide the optimize network communication under energy vector. The work is here defined as the energy restriction based architectural improvement to the network so that the better utilization of resources will be achieved [1][2][3].

B) Network Communication

Network architecture does not represent only the localization or placement of nodes, but also present the communication criteria for the communication. This kind of architecture is effective to provide the communication for large network with small sensing range. The multi path communication can also be reduced by using the aggregative information transmission. This network form is also adaptive to provide the reliable and accurate information transmission when the available resources are restricted. This network form has reduced the network communication and resource utilization so that the network transmission is been improved. The network model for this work is given here under

C) Target Coverage

The limited resources, sensing range and energy are the challenging characteristics of sensor network. The real time integration and implementation of this network, place the nodes to monitor the specific components or the regions. As the nodes are distributed to larger scattered space, the captured information is submitted back to the installed controller device or the base station. The coverage is about to provide the range driven connectivity between these sensor devices. Each node must be defined in coverage of other node to provide the communication and connection with sensor network. The nodes that are in coverage of base station itself, can submit the collected information directly.

II. RELATED WORK

Author [1] has improved the network life while addressing the target coverage problem. Author applied two scheduling methods with heuristic search to improve the accuracy and performance of target coverage. The deterministic measures with heuristic search were applied to handle the coverage issues. Author [2] has applied the collaborative detection method with probabilistic estimation on the mobile targets in sensor network. The node density based normalization and collaborative search method was used to improve the deployment of sensor nodes in the network. The direction based theoretical approach was applied to improve the performance parameters and to provide better view to the target nodes. Author [3] has applied the target tracking method for three dimensional underwater environments. The model was defined using the nature inspired evolutionary search method called cuckoo search method to identify the locations of target nodes. The coverage range, range and connectivity parameters were applied collectively to identify the target nodes. The water region parameters, target constraints and node characteristics were applied collectively to improve the tracking of target nodes. Author [4] has developed a sensor control applied to improve the quality of coverage in the sensor network. The location and energy specific parameters were observed to improve the network survivability and to improve the network life. The dynamic features, security and traffic concerns were observed in this work to improve the monitoring of target nodes. Author [5] has reduced the energy consumption by introducing a new target coverage algorithm for sensor network. The paper has observed the packet forwarding on redundant nodes to achieve scheduling the coverage network. The coverage ratio, residual energy evaluation and redundant degree of sensor nodes were used collectively to optimize the target nodes.

Author [6] has used the genetic algorithm to provide the K-coverage in the sensor network. The proposed optimization algorithm has addressed the algorithm with specification of active cover. The factors addressed by the sensor network were defined to reduce the energy consumption and to conduct more number of parameter specific tests. Author [7] has used the energy based target tracking to improve the routing for sensor network. The node level deployment and optimization was suggested by the author to reduce the energy consumption. The extraction of the prior information and based on it a particle filter was applied to control the behavior of energy consumption in the network. Author [8] has defined a coverage contribution method to provide the K-coverage method for sensor network. The method is applied on centralized as well as distributed sensor network. The coverage contribution area (CCA) was defined to handle the issues of spatial density and to reduce the energy consumption in the network. Author [9] has defined a tree based target tracking for sensor network. The spatial distribution of sensor nodes and dynamic convoy through tree based collaboration was provided for effective tracking of nodes. Author [10] has defined a partial coverage algorithm for sensor network. The learning automata based efficient algorithm was provided in this paper to activate the target nodes. The coverage and connectivity based analysis was provided to improve the target tracking for sensor network. The constraints were defined to improve the performance and to reduce the energy consumption in the network.

Author [11] also provided the solution to k-coverage problem for sensor network. The problem was defined to achieve the maximum usage of dynamic deployment of nodes and to improve the performance and continuity in the network. Maximum target detection algorithm based on electromagnetism (MTDA-EM) has provided the tracking of nodes at maximum level. Author [12] has defined a variable power scheduling based perpetual target coverage method to achieve the energy harvesting for sensor network. The variable power based scheduling method was defined to improve the network utilization and to improve the network life time. The operation satisfaction based perpetual operations were defined to reduce the energy consumption in the network. Author [13] has proposed a new MO-DMS-PSO (Multi-Objective Dynamic MultiSwarm Particle Swarm Optimization) method to improve the target coverage for three dimensional sensor network. The connectivity change, coverage rate and energy consumption parameters were considered to generate the coversets. Author [14] has defined an improved PSO (Particle Swarm Optimization) algorithm to improve the coverage of target nodes in sensor network. The work nodes were defined based on the computational analysis so that the coverage quality can be improved. Author [15] has proposed a grid based mobile sensor deployment method to improve the area coverage for sensor network. The grid based deployment of sensor nodes was provided to generate the effective structure. The supreme utilization of covered area was achieved from the work. The coverage ratio based performance parameter evaluation and to enhance the coverage based on weight value estimation.

III. RESEARCH METHODOLOGY

In this paper, the optimization of target coverage problem is provided to reduce the failure ratio and to achieve the balanced energy consumption over the network. The work is defined to generate the coverset and to set the sequence for effective coverage of targets. The parameter based analysis was performed to improve the network communication and to increase the network life. The functional model for coverset generation and setting up the sequence is defined in figure 1. The proposed model has performed balanced energy and fault evaluation while generating the cover set and while setting the sequence.

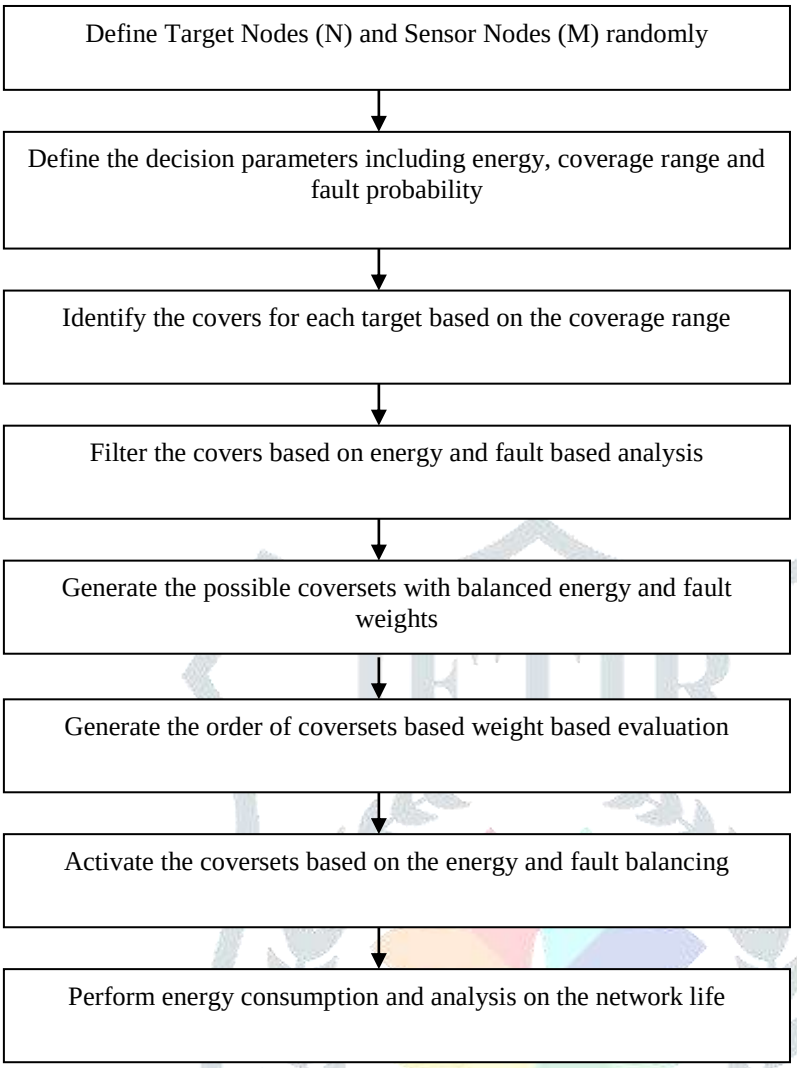

Figure 1: Proposed Model

Figure 1 has provided the complete flow of proposed model for effective target tracking for sensor network. The work is divided in two sub stages. In the earlier stage, the coversets are generated. In this stage, the coverage range based analysis is done to identify the possible covers. The energy and fault based analysis is performed to identify the eligible coverset. Later, the energy and fault balanced method is applied while setting the coverset activation. The method is defined to reduce the load from individual coverset and to increase the monitoring time. The overall life of network is improved by this proposed target tracking method.

IV. RESULTS

In this PAPER, an energy and fault based weighted method is presented to generate the effective target coversets and to schedule the effective sequence for coverset activation. The method is applied on sensor network for continuous and effective monitoring of target nodes. To work with network application the first requirement is to set the network parameters based on which the network communication is performed. The work is applied on a network of 100x100 meter with random placement of sensor and target nodes. The analysis results are provided in terms of network life.

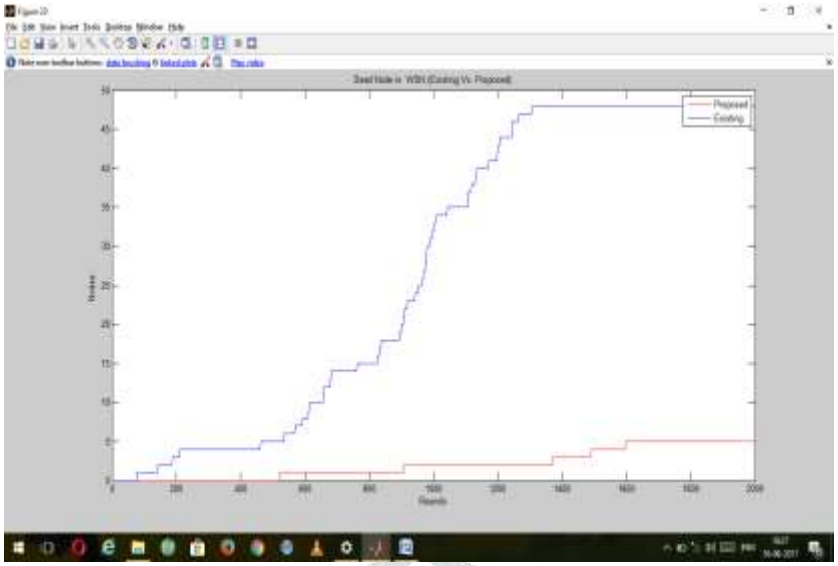

Figure 2: Dead Node Analysis (Comparative)

Figure 2 is showing the comparative analysis on the proposed approach and existing under dead node evaluation parameters. Initially all the network nodes are alive with energy specification. It shows that the proposed approach has improved the network life and network coverage and communication.

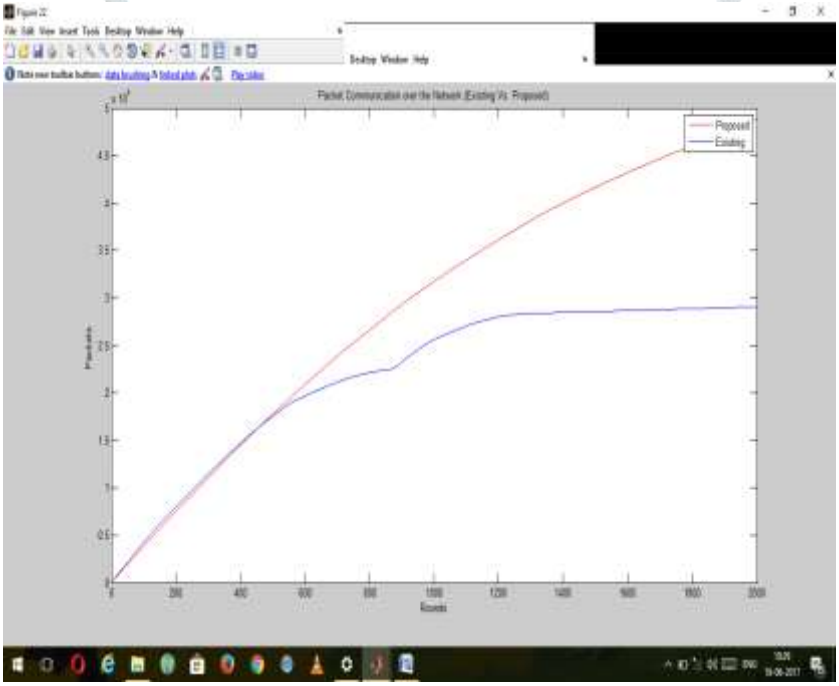

Figure 3: Aggregative Packet Communication (Comparative)

Figure 3 shows the comparative analysis of the existing and proposed approach under aggregative packet communication parameter. The network is defined to perform the communication on all network nodes and deliver it to the base station. The figure shows that the proposed approach has improved the communication extensively because the between network utilization is provided by this proposed approach.

III. Conclusion

The target coverage methods are applied to provide the effective monitoring of sensor network by establishing the target nodes at critical locations. In this work, a weighted and balanced parameters based method was provided for effective data coverage for target nodes. The proposed target coverage method is simulated in random scenario in matlab environment. The random number of targets and sensor nodes were defined. The comparative results identified that the proposed method has provide the effective tracking of target nodes. The method has reduced the energy consumption and improved the network life.

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