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A Dynamic Programming Adaptive Model for Effective Target Tracking in WSN

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ABSTRACT

Sensor network is the real time critical network with specification of normal and specialized sensor nodes. These specialized sensor nodes require the continuous energy backup and regular monitoring. In this paper, a parameter adaptive dynamic programming model is provided to improve the target tracking. At the earlier stage of this model, the node features are explored in terms of energy and fault evaluation. Later on, the dynamic programming method was defined to achieve effective target tracking. The work model is implemented in matlab environment. The results show that the method has improved the network life.

Keywords: Target Tracking, WSN, Dynamic Programming, Fault

I. INTRODUCTION

A sensor network is the adaptively deployed network defined with specification of environment constraints and applied in real time network. The restricted resources and constraints increases the criticality of the network. To optimize the network, there is the requirement to improve the architecture and the communication behavior of the network. Different factors that affect the network life and the performance are listed hereunder

A) Topology

The topology is the architectural specification of the network that depends on the application and the activity performed in the network. It actually defines the deployment and placement of nodes and the controllers in a specific pattern so that the network utilization will be done. In the lower form, the topology is defined in standard form such as ring topology, star topology etc. In the higher form, network scenarios are defined. These scenarios include classroom scenario, war-zone scenario etc. The distribution of the resources is also defined by the network.

B) Application

The requirements and communication characterization can be adjusted based on the application. According to the application and the process, the roles of sensor nodes are defined. The heterogeneous or the homogenous node type, architecture type can be defined for the network. The node criticality, energy left, fault prone features can be defined based on the application specification. The network problems, distortion and attack probability is also defined according to the application specification. The security requirement, optimization requirement can be defined based on the application type. Some constraints at different level can be upgraded or updated based on the application environment.

C) Routing

After setting up the architecture and the protocol, the final requirement is to perform the communication over the network. According to the application and the process requirements, the communication can be single-cast or multi-cast. To ensure the effective data delivery, there is the requirement of an effective routing approach. The routing must be controlled by some environment specific, domain specific and communication specific constraints. The routing is about to generate the cooperative multihop adaptive path under distance and energy optimization. In a more critical network, fault and some other constraints are considered for route optimization. In clustered network, the intra-cluster and inter-cluster routing are the major requirements to optimize the network communication.

To optimize the network communication, the stage specific solution is required. In a sensor network, the main objective is to achieve the energy adaptive and fault prone communication. Different methods and the improvement in various stages are given hereunder

A) Deployment

The first level improvement to the network can be achieved by deploying the network adaptively. The arrangement of the nodes and controller is done so that the maximum network coverage and resource utilization will be achieved. The deployment is about to provide the equalized distribution of resources so that the startvation, bottle neck and congestion situations will not occur. The deployment must be considered in such way, the node degree must be higher so that the alternative node selection will be done for requirement. Deployment must be adaptive to the application, environment, architecture and the routing. The network density, infstructure devices and the service distribution is provided for effective network deployment.

B) Topology Control

The topogy control is the another architectural constraint defined to provide the effective communication and resource management. The energy consumption over the network can be controlled by controlling the topology. The topology adjustment is required to achieve the communication at node level and network level. The transmission control, communication control can be achieved via topology control.

II. RELATED WORK

To provide the monitoring of critical sensor nodes based on the application, different target tracking methods are provided. These methods are defined to reduce the energy consumption or the communication fault. The work is provided by the researchers to optimize the target tracking using different measures and methods. In this section some of the work provided by earlier researchers is presented. Author [1] has provided a work on target tracking using PSO (Particle Swarm Optimization) approach. Author has reduced the energy consumption and defined an improved scheduling model to provide the effective target tracking. The method used the cluster based approach to utilize the architectural features and defined a neighbor specific analysis. The cluster formation is here done using PSO approach. Later on the cluster specific target tracking is done within cluster.

The method has reduced the reduced the energy consumption and improved the network life. Author [2] has defined an energy adaptive target tracking. Author defined a new protocol to improve the coorperative communication and saved the energy consumption. The protocol level improvement is provided to reduce the sleep time and to provide effective node tracking. The model also provided the tracking for moving target based on cell switching. Author[3] has defineda preventive and dynamic target tracking based on time interval analysis. The power optimization is provided by the author for proving the tracking in real time conditions. The component specific lookup and tracking is also provided to reduced the power consumption based on functional interpolation. Author[4] has defined a work on energy efficient target tracking for sensor network. Author defined a locality information analysis under Gaussian and Markov based mobility model. The neuro-Dynamic algorithm is defined to perform the prediction. The energy conserved and accurate tracking of target is provided by the author.

The predictive model was provided the author based on the location area analysis for tracking the multiple targets. Author[5] has defined target node tracking for underwater sensor network. The floating mobility based node position analysis is done by observing the neighbor nodes. The effective scheduling is also provided using probabilistic finite state automata. The work model has reduced the energy consumption and improved the network communication. Author[6] has provided a work on sleep scheduling based on the moving direction for effective target tracking. Author defined a sleep scheduling algorithm to generate the sleep pattern so that the selective monitoring can be done. The probabilistic distribution model was provided by the author. Two models are defined here based on the legacy circle based proactive waking scheme. The reducing algorithm is also defined to improve the performance of detection algorithm.

Author[7] has provided a cluster based target tracking for mobile sensor network. Author improved the deployment process for sensor network placement so that the spanning circles will be reduced. The defined polygonal region tracking with dynamic clustering improved the tracking rate and reduce the failure ratio. Yeow et. al.[8] has improved the target tracking for sensor network by reducing the energy consumption. Author defined a more dynamic and effective tracking under the concept of sensor magement with trajectory region analysis. Author used the Gauss-Markov Mobility model for decision process analysis so that the neurodynamic programming for the sensor network will be defined. Author reduced the tracking accuracy for the prediction of the sensor nodes. The spatial management for multiple targets was provided by the author.

The accuracy improvement and effective target prediction was defined by the author. The optimality equation using the Bellman formulatio was provided with stationary and dynamic equation analysis. The discounted cost method reduced the energy cost of tracking and optimized the network. Author[9] has defined a hierarchical Markovian method for improving the process of target tracking. Author defined the target reinforcement for learning algorithm so that the convergence for tightly coupled network will be improved. A solution specific target tracking with policy specification was provided to reduce the cost and energy of target tracking. Author achieved the higher accuracy with lesser cost for target tracking. Author[10] has defined a work on control based target tracking for sensor network. The complete coverage control for the sensor network was provided by the author to reduce the tracking time. Author also provided the trajectory prediction model and provided the robust algorithmic model target racking in the network. A network lifetime based tracking with reduced efforts was provided by the author. The neighborhood analysis with region tracking was provided by the author. The feasible mobile match with marked and optimal mobile match was also provided to reduce the cost of target tracking.

Author[11] has defined a work on guided target tracking with Alpha-Beta filters. Author used these gudiance parameters for tracking the node position in dynamic changing network. The eveluation and interception analysis was also provided to reduce the effective guidance tracking in the network. The logical extension based target tracking with interception analysis was also provided by the author. The guided navigation with propotional filteration to the network was provided to reduce the cost. Author[12] has defined conservation strategy based target tracking to achieve the energy consumption in the network. Author defined the neighborhood cluster analysis with sensor node specification so that the sleep time for the node tracking will be reduced. The energy drop and the performance evlaution was provided by the author and a dynamic measure was applied to improve the efficiency of proposed approach.

The structural observation with effective tracking was provided in this work. Author[13] has defined a samle rate specification for effective target tracking. Author used the multi-objective fitness function for adpative target tracking. The experimental evaluation was also provided to reduce the work adaption so that the tracking targets will be improved. The reinforcement learning with effective mapping was also provided by the author. Author[14] used the cluster apative method for improving the target tracking. Author used the cluster head selection approach for edge level analysis to achieve the energy utilization. The cell manageent with role specification was provided to achieve the network characterization. The residual energy based node tracking and monitoring in the clustered scenario was provided by the author.

III. RESEARCH METHODOLOGY

Target tracking is the primary requirement of a network to provide the regular monitoring to the critical sensor nodes. The sensor network is defined with specification sensor nodes and with some specialized sensor nodes. These specialized sensor nodes are called critical nodes or the target nodes. In this present work, a more intelligent and reliable method for target tracking is provided. The presented work is here divided in main three stages. In first stage, the node level analysis is applied to generate the coversets. The parametric observation is here defined in terms of range, fault probability and load parameters. Based on this analysis, the feasible nodes will be identified. In second stage, fuzzy adaptive coverset formation is defined. The energy similarity, balanced load and coverset fault ratio based analysis is applied to generate the coversets. In final stages of this model, the dynamic programming method is applied to generate the optimized sequence of coverset activation. The presented work will be implemented in matlab environment. The work is about to reduce the tracking fault and improve the network life.

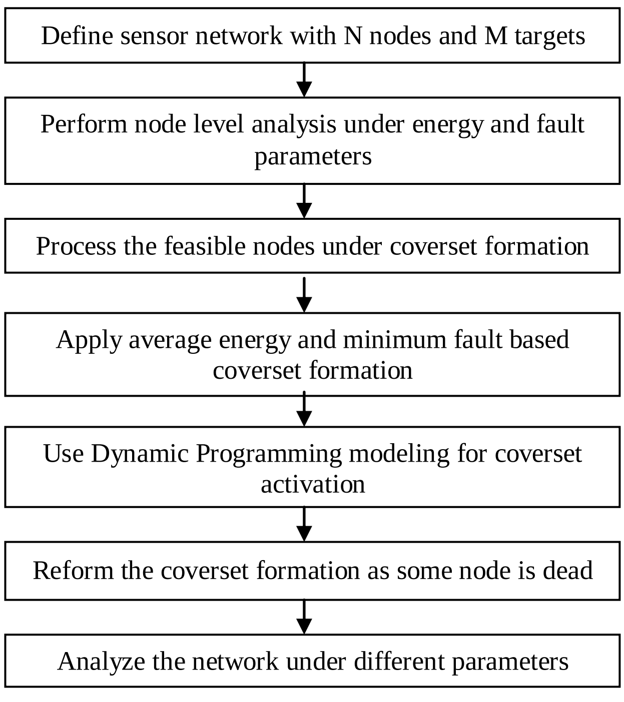

Figure 1 : Proposed Model

Here figure 11 is showing the process of coverset generation and activation. At the early stage, the parameter specific analysis is done to identify the effective nodes initially. Once the first level feasible nodes are identiifed, the coverset formation is done by keeping the average energy and minimum fault condition with coverage range. Based on this analysis, the coversts are generated for the defined work. In the final stage, the dynamic programming model is applied to generate the sequence of coverset activation. The time slice based activation is defined under fault and the energy estimation. As a coverset is activated, the energy of the nodes is consumed. The nodes with zero energy are considered as dead nodes.

IV. RESULTS

The presented work is here implemented in matlab environment with specification of random network sceanario. The communication is performed from multiple target nodes and rest of the sensor nodes. 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 dead node analysis is here provided in figure 2.

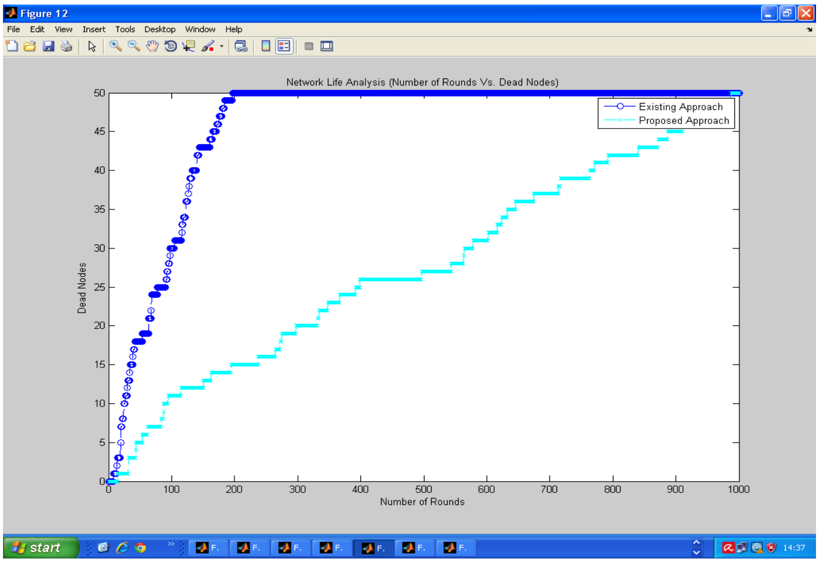

Figure 2 : Dead Node Analysis (Existing Vs. Proposed)

Here figure 2 is showing the dead node analysis applied on the work. The network life is evaluation in this work. The communication is performed for 1000 rounds. Figure shows, The energy consumption in existing approach is more fast. The existing approach the network survice upto 200 rounds whereas in case of proposed approach the network survive for 1000 rounds. It shows that the work model has improved the network life.

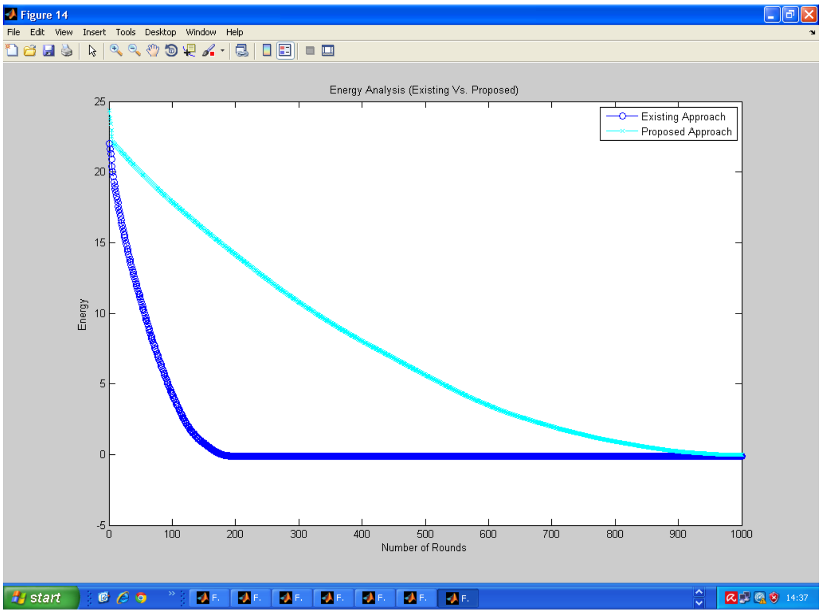

Figure 3 : Energy Consumpiton Analysis (Existing Vs. Proposed)

Here figure 3 is network analysis under energy consumption parameter. The figure shows that the energy consumption rate in the case of the proposed approach is slower than existing approach. Because of this the proposed method has improved the network life and reduced the energy consumption.

CONCLUSION

In this present work, a parameter adaptive dynamic programming approach is defined to improve the target tracking for sensor network. The proposed work model, first analyzed the network under fault and remaining energy parameters. Based on the parameter specific observation, the coversets are formed. Later on, the dynamic programming method is applied for effective tracking of target nodes. The simulation results show that the method has improved the network communication and network life.

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