A Study on Challenges Associated in Coverage Problem in WSN

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ABSTRACT
To optimize the QoS in a sensor network, it is required to optimize it under various coverage problems. A network is defined under three main coverage aspects called target coverage, area coverage and barrier coverage. If the network is optimized under all these coverage's, the scalability, reliability and efficiency will be achieved. This kind of optimization can be achieved statistically during deployment or dynamically with optimization algorithm. In this paper, a study on the challenges associated with different kind of coverage problems is defined.

Keywords– Area Coverage, Target Coverage, Challenges

1. INTRODUCTION
A sensor network considered as the critical network that is connected to the real time scenario with the specification of application area. One of such application area is critical or situational monitoring over the network. This kind of network is connected to the real environment and extracts the information by observing the environmental constraints. When such kind of network is established, some nodes are directly interacting to the environment called critical nodes. The requirements of these critical nodes are higher. This requirement includes the processing capability, memory requirement, energy requirements etc. To extract the environmental information, it is required that these critical nodes are in process regularly. To achieve such continuous environmental monitoring, it is required to keep these critical nodes alive. Target coverage approach defines such a phenomenon in which critical nodes are addressed as critical nodes and these critical nodes are monitored by regular sensor nodes. To provide the regular backup to nodes, specialized node set is generated called cover set. A coverset is able to provide energy backup to all target nodes. The target coverage is identified as the fundamental problem in sensor network. It is considered as the solution process to improve the network life and QoS. The goal of target coverage is to provide the regular backup to the critical nodes and to improve the communication reliability over the network. Other than this, the network is having some other kind of coverage concepts. One of such coverage type is area coverage. The area coverage is about to use the network area effectively so that the communication from any location over the network will be possible. To optimize the network, it is required to generate the network and network localization under the strengths of area coverage and target coverage

This kind of coverage includes two main features

The coverage performance is evaluated based on the node deployment and region monitoring.

The coverage performance assessment is here performed based on the application as well as situational requirements.

The coverage is here been featured based on the monitoring quality as well as the area specification. This kind of coverage can be performed in optimized way during the localization time or it can be optimized during the monitoring process. There are number of vectors that affect the different kind of coverage. These coverage parameters are shown in figure 1.

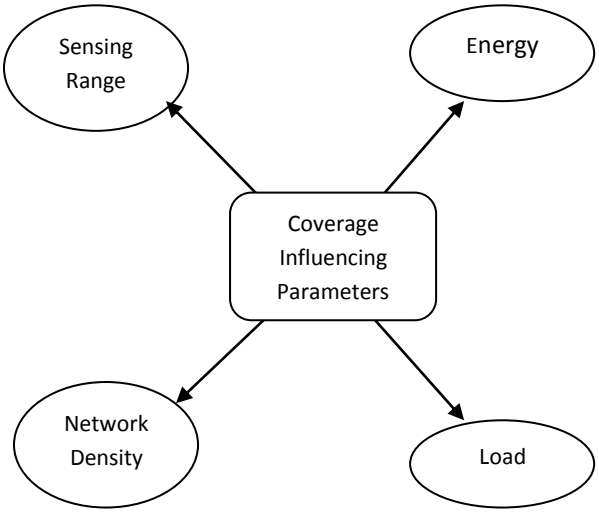

Fig 1: Coverage Influencing Parameters

Either the coverage is performed statically or dynamically, there parameters defined in figure 1 are critical. First critical parameter is the area and network density analysis. The density is about the number of nodes in a specific area. Higher the density, more effective and reliable the coverage will be. Higher density will be able to generate more coverset in target coverage problem as well as provide the more reliable and efficient coverage. Higher the number of coverset, more time the network will reside in case of target coverage. In case of area coverage, the dense network having lesser chances to find uncovered space. Second parameter for effective coverage is the sensing range. Sensing range actually represents the distance or the area covered by a node itself. Higher the sensing range, more area can be node set cover. It also depends on the lesser common area. The higher sensing range increases the option nodes for coverage so that the network reliability and selection criteria increase. Higher the selection criteria more reliable the coverage is. Energy is the most required parameter for any sensor network operation. In target coverage, the energy vector play important role. Based on this parameter, the reliability of target monitoring can be achieved. A coverset generation with energy nodes is more reliable then a coverage with lesser energy specification. The

energy criticality increases the coverage criticality. The final parameter that affects any kind of coverage is load. Load is the dynamic parameter that actually represents the number of communication links on a node at particular instance of time. Higher the load, more the energy on that node will be consumed and the reliability vector on that node will decrease.

Some of the coverage problems are considered as the fundamental problems and some are specific to the application domain. These problems are defined respective to the target and provide the communication control on network nodes. To optimize the coverage it is required to identify all these fundamental problems and application specific problems. But by using the adjustment to these parameters as well as its optimization can resolve most of the integrated problems.

In this paper, a study based work is defined on coverage problems and aspects. In this section, a brief introduction to the coverage and the coverage issues is defined. The type of coverage and the parameters associated with this coverage are defined in this section. In section II, the work defined by earlier researchers on target coverage and area coverage area presented. In section III, the challenges associated with the coverage algorithms are explored. In section IV, the future work and in section V, conclusion obtained from the work is explained and accessible.

2. LITERATURE SURVEY

Lot of work is already defined by different researchers on the area of target coverage and area coverage. Some of the work defined by these researchers is presented in this section.

Author [1] discussed the types of coverage problem according to different standards. . Author identifies the coverage problem during the network deployment and provided the early solution while generating the network. To improve the coverage performance an algorithm is also proposed in this paper. Using the mobility of nodes, the algorithm can move redundant nodes to uncovered area. Although there are some limits of energy and node hardware, the algorithm is still effective in practice. Author [2] defined a study based work to identify various problems integrated with coverage in sensor network. Author provided the solution study to cover the network area with group generation over the network. Author divided the network in smaller zones and then performed the coverage analysis. Author defined a study on force specific coverage, geometric computation based survey, grid based survey etc. Author defined a study these approaches under cost and benefit estimation.

Author [3] has presented a static analysis on sensor network to take the early decision on area coverage. Author defined the work to improve the network coverage under energy and connectivity vectors. Author also discussed various dependent vectors to improve the performance of network coverage, area coverage and target coverage. Author defined the sensor network models under different vectors so that the coverage performance will be improved. Author [4] has defined an improvement to the existing static coverage by improving the system under energy vector. Author has characterized the network at the deployment time so that the node position can be optimized. Author defined the feature level analysis so that the system energy consumption will be reduced. Author has reduced the energy consumption and improved the network life. Author [5] has presented a study based work to optimize the coverage problem in WSN. Author has limited the study on target coverage methods so that the network life time will be maximized and the improved connectivity over the network will be achieved. Author has summarized the analysis work as the comparative study by representing the change in network life and energy consumption.

Some of the researchers also proposed different algorithm based on set theory and rule generation. These rules are defined to generate the cover set with the specification of disjoint and non-disjoint coverset. The algorithmic studies and evolutions are presented on these coverset generations, sequencing the coverset activation process. Merging of the coverset. To perform this some intersection approaches are combined with coversets so that the coverage reliability will be improved and the fault rate will be reduced. This kind of participation can be obtained under the specification of scheduling algorithm. The nodes weights will be assigned so that effective coverage will be obtained. This coverset generation is been defined by different researchers in different ways. Author [6] has explored the target coverage problems along with associated challenges. Author has optimized the coverset generation phenomenon by assigning the weights to each participating nodes. Based on these weights complete coverset weight will be identified. These weights will be defined specific to the area and specification of the coverage. Once each weight on each coverset will be identified, the scheduling to the coverset activation will be done. This activation is defined based on weighted order assigned to the coverset. The maximum weight will be assigned with higher time frame. The results obtained from system shows that the work has improved the network lifetime and reliability.

Author [7] has defined the coverset generation based on disjoint set analysis. This kind of analysis is based on the coverset generation under disjoint set specification. Author also defined an effective scheduling mechanism to set the order of coverset activation. Author [8] presented a solution on coverage problem using ACO approach. Author has defined an algorithmic approach to improve the network performance significantly. Author has defined the ant based network over the sensor network. Each network ant is defined with some pheromone value and the analysis will be performed on network nodes. Based on this parallel block analysis the optimized generation of target covers will be performed. The ratio level analysis will be performed here so that the energy effectiveness over the network will be performed. Author [9] has presented a new heuristic algorithmic approach to optimize the utilization of sensor network. Author has defined the work to organize the nodes over the network so that the adjustable transformation to the network nodes will be done. This kind of formation can be done with multi hop coverage. This local coverage network will be defined under adaptive node adjustment. This kind of specification is based on the connectivity ratio analysis and energy consumption analysis. Author has improved the scheduling mechanism so that complexity analysis over the network will be performed. This proved that the approach is more robust against the scalability and stability vectors. Author [10] has defined a work to improve the network effectiveness so that the QoS optimization will be obtained. Author has presented the node level analysis so that the feasible network solution will be obtained. Author [11] has presented a hybrid greedy approach to optimize the network coverage under multiple vectors. Author has presented a layered model in which at first coverset is generated under energy and sensing range parameters. Once the coversets are generated, the coverset analysis is performed to assign the weight age to these coverset. Based on this weight age, the optimization to the network is obtained. This kind of priority

based scheduling has improved the network reliability and reduced the energy consumption over the network.

3. CHALLENGES IN AREA COVERAGE

Coverage algorithms are the main requirements to optimize the network organization and communication. But when these algorithms are implemented in such critical networks, some challenges under different parameters are faced by these algorithms. These parameters include the constraint specification on network localization and communication. Because of this to optimize the network communication, it is required to handle various challenges associated with these algorithms. Some of these challenges are explored in this section.

3.1 Network Deployment

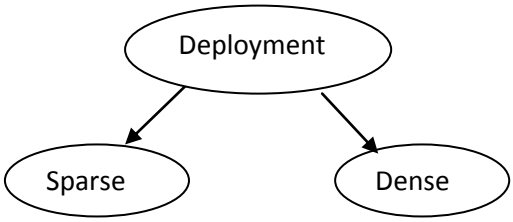

Fig 2: Types of deployment

The foremost requirement of a network is to improve the node placement over the network. In case of area coverage and barrier coverage, optimized network deployment is required. Network deployment defines the static parameter and having its significance in static network. If the network nodes are denser or scattered, the placement of nodes cannot be effective. This kind of formation itself defines multiple constraints. These constraints includes connectivity count analysis, node degree analysis etc. The network deployment must be deterministic so that maximum architectural benefits will be obtained. This kind of deployment is cost effective so that the prohibitive decision for the network can be obtained. The coverage specification with minimum covering sensor adjustment at the time of network formation. This kind of predetermined localization of nodes is able to improve the network performance by improving the network life and reducing the energy consumption over the network.

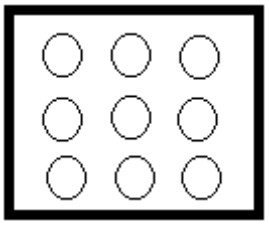

Fig 3: Deterministic deployment.

The deterministic network organization is been formed as the intelligent network topology in which each network node is familiar with the positional vectors of neighboring nodes. If the network is mobile, the location information is updated dynamically. This kind of formation is able to change the network density and node placement dynamically. This kind of deterministic placement of nodes is required to optimize the network coverage. The coverage effect analysis over the network is predetermined and some statistical parameters. This kind of formation is friendly to the environment as well as architecture. One such organized network architecture is shown in figure 3.

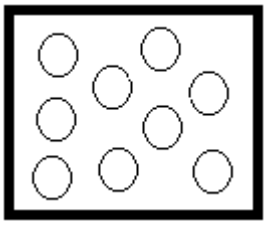

Fig 4: Random deployment

Another kind of network architecture in which dynamic node position estimation is required is shown in figure 4. In such kind of formation, nodes are placed at random position. The network architecture is dynamic and required an intelligent algorithm to generate the coverset and area coverage algorithms. As the nodes information can be obtained dynamically so that it can be used in any network application. This kind of network organization is free from the deployment process algorithm but requires more effective communication algorithms so that the network effectiveness will be improved. This kind of architecture can be ineffective if some dense or scattered architectural formation is done. If the nodes in the network are dynamic and positional change is possible, then network optimization can be done by performing the node substitution over the network dynamically. This kind is done by performing the node movement or node switching over the network. This kind of network deployment can be optimized dynamically so that the network coverage and communication will be improved...

3.2 Node Types

A sensor node is the device with some limited capabilities. But these capabilities are defined in terms of nodes. An intelligent node is having the memory and able to identify its neighbors dynamically. So that such kind of nodes can be used in a random deployed network. But if the nodes are having different capabilities in terms of sensing range, communication capabilities, memory then it is complex to manage the node in different way. Generally in coverage algorithm, the critical nodes are considered as target nodes and normal sensor nodes are defined to provide them required backup. These normal sensor nodes work in a group and provide the effective backup to the main target node. Some of area coverage algorithm requires the equalize distribution of these heterogeneous nodes over the network. This equalize distribution is effective to improve the network capabilities so that network optimization will be done.

3.3 Network Constraints

Constraints are the rules applied on network parameters so that maximum utilization of network architecture will be obtained. The entire coverage algorithm depends on these network constraints in case of static as well as dynamic analysis. Some of these constraints are explained here under

3.3.1 Energy constraint

Energy is the most critical constrain of sensor network on which network communication and QoS depends. Each network node is defined with initial energy specification. With each communication over the network, some amount of energy is lost depending on communication operation. Coverage algorithm also depends on same energy constraints. In this algorithm, the coverset generation is defined on the basis of residual energy of nodes. A coverset in which nodes with higher energy are present will be considered as strong and most effective coversets. To form the coverset some threshold value is specified. If coverset node energy is lesser

then this defined threshold value, the node will be considered as defective node and the coverset will be considered as improper cove set. The analysis of target coverage algorithms is also performed under energy constraints.

3.3.2 Connectivity constraint

Another parameter defined under sensing range analysis is node coverage analysis and group formation. The adaptive cooperative communication over the network is formed under connectivity constraint. The connectivity is defined in different ways under different scenario. One of such way is to identify the node degree. This degree identification is defined as the number of incoming and outgoing connections available on a node within the defined sensing range. The connectivity relationship is here formed with the specification of node pair with node coverage analysis. This connectivity is been defined with constraint specification and range specification. The communication analysis with neighbor node estimation is done to manage the network communication.

3.3.3 QOS constraint

QoS is a wide term that can be used under different aspects. The network life, network communication, delay analysis are the core component of QoS analysis. In coverage based analysis, the quality communication is based on QoS constraints. The sensing quality generation under sampling rate and user interaction is performed to obtain the QoS component vectors.

3.4 Centralized/Distributed Algorithms:

As the network is defined with the specification of cooperative communication over the network, the distributed architecture is formed. This kind of network formation is defined in a scheduled form so that the centralized communication will be improved. The algorithm is here defined based on the specification of target nodes with location formation. This kind of formation is done under multiple constraint specification so that the optimized coordination ith nodes will be done. The circulate formulation of nodes under scheduling algorithm is done to optimize the network communication. Network capabilities are analyzed to optimize the network architecture to improve the communication.

4. FUTURE WORK

Here we will define zone adaptive peak position mapping approach and to generate the coverset adaptive to energy and node failure estimation. It will improve the network life and reduce the failure probability over the network.

5. CONCLUSION

In this paper, the solution of the sensor network problems is defined under various restrictions. The challenges covered here are discussed using coverage based optimization. In this paper, three coverage methods are explored called target coverage, area coverage and barrier coverage. The paper also identifies the problem faced while working with these coverage methods. Some of the solutions in terms of constraint specification and algorithmic approach are also defined in this paper.

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