

Improving Energy Efficiency and Lifetime using DCD And VFA in MWSN

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Abstract— *Mobile Sensor Network is the collection of independent and scattered sensors with capacity of mobility. Mobile Sensor Network can simply be defined as Wireless Sensor Network in which sensor nodes are mobile. In recent years, Mobility of Sensor has been utilized to improve the target coverage quality and network connectivity in randomly deployed mobile sensor networks. Target coverage and Network connectivity are two main challenging issues of mobile sensor networks. Target coverage aims to cover specified points of interest in the deployment region of a WSN. Network connectivity is necessary for the sensors in WSN to collect data and report data to the sink node. Mobile Sensor Deployment (MSD) problem in Distributed manner is one of the main challenges in WSN. The MSD problems offend decomposed into two sub- problems: the Target Coverage (TCOV) problem and Network Connectivity (NCON) problem. So Distributed Center deployment (DCD) Algorithm and Virtual force Algorithm (VFA) has been proposed for MWSN. Distributed Center Deployment (DCN) algorithm to solve MSD problem in distributed manner in order to minimize the energy consumption and to increase network lifetime .Virtual Force Algorithm (VFA) are proposed to minimize the total movement distance of the sensor and to achieve maximum sensor field coverage.*

Keywords— *Mobile sensor network, Target coverage, Network connectivity, Mobility, Virtual force.*

I. INTRODUCTION

Mobile wireless sensor networks can be simply defined as wireless sensor network in which the sensor nodes are mobile nodes. In recent years sensor mobility has been exploited to improve the coverage quality and connectivity in randomly deployed WSN by relocating some mobile sensors to new position to enhance the coverage quality and connectivity of the network. MWSN are smaller, emerging field of research in contrast to their well establish predecessor. MWSN are more versatile as they can be deployed in any scenario and cope with rapid topology changes .MWSN can be used in health monitoring, environmental monitoring, and military application..

The issues in MWSN are

The MSD problem concerns two issues, namely target coverage and network connectivity. Thus, we divide it into two sub-problems and conquer them one by one. First, we focus on deploying mobile sensors to cover targets with minimum movement. These mobile sensors are called coverage sensors. Next, we deploy the rest sensors to provide connectivity between coverage sensors and the sink. The definitions of the two sub-problems are given below.

- Target Coverage (TCOV) problem: given m targets with known locations and n mobile sensors deployed randomly in the task area, move sensors to new positions such that all the targets are covered and the total movement of sensors is minimized.
- Network Connectivity (NCON) problem: given a sink, the set of coverage sensors, and the rest mobile sensors after the TCOV problem is solved, NCON seeks the deployment of the rest mobile sensors to connect coverage sensors and the sink with minimum movement.

The proposed system contributions are summarized as follows

- In this paper, “Distributed center deployment algorithm and virtual force algorithm” is proposed that focuses on the network lifetime extension by considering TCOV and NCON problem in a distributed manner due to MSD.

- We present the virtual force algorithm (VFA) as a sensor deployment strategy to enhance the coverage after an initial random placement of sensors
- Extensive simulation results reveal that DCD and VFA algorithm can significantly extend the network lifetime at relatively at low sensor movement

II. RELATED WORKS

In [2] Distributed deployment strategies has been proposed for mobile sensor network where the coverage priority of different points in the field is specified by Function In [5] this paper sleep/active mode is proposed by adjusting sensing range to maximize the total number of rounds and two distributed solutions have been proposed. In [3] a competition based and pattern based scheme is proposed in WSN to solve the k- coverage placement problem and Distributed dispatch problem. In [1] efficient sensor deployment algorithms are proposed to improve the coverage area in the target field. The proposed algorithm calculate the position of the sensors iteratively based on existing coverage holes in the target field and the voronoi diagram is used to discover coverage holes corresponding to different sensors with sensing range.

III. PROPOSED DCD AND VFA ALGORITHM DESCRIPTION

3.1 DCD algorithm for sensor node deployment using virtual force

We present the virtual force algorithm (VFA) as a sensor deployment strategy to enhance the coverage after an initial random placement of sensors. As a initial sensor node deployment step, a random placement of the sensors in the target area (sensor field) is often desirable, especially if no prior knowledge of the terrain is available. Random deployment is also practical in military application, where wireless sensor networks are initially established by dropping or throwing sensors into the sensor field.

However, random deployment does not always lead to effective coverage, especially if the sensors are overly clustered and there is a provided by a random de small concentration of sensors in certain parts of the sensors field. However the Coverage provided by a random deployment can be improved using a Distributed centre deployment algorithm

3.2 VFA algorithm

The VFA algorithm is inspired by disk packing theory and the virtual force field concept from robotics. For a given number of sensors, VFA attempts to maximize the sensor field coverage using a combination of attractive and repulsive forces. During the execution of the force-directed VFA algorithm, sensors do not physically move but a sequence of virtual motion paths is determined for the randomly-placed sensors. Once the effective sensor positions are identified, a one-time movement is carried out to redeploy the sensors at these positions.

For cluster-based sensor network architecture, we make the following assumptions:

- After the initial random deployment, all sensor nodes are able to communicate with the cluster head.
- The cluster head is responsible for executing the VFA algorithm and managing the one-time movement of sensors to the desired locations.
- In order to minimize the network traffic and conserve energy, sensors only send a yes/no notification message to the cluster head when a target is detected. The cluster head intelligently queries a subset of sensors to gather more detailed target information.

The VFA algorithm combines the ideas of potential field and disk packing. In the sensor field, each sensor behaves as a “source of force” for all other sensors. This force can be either positive (attractive) or negative (repulsive). If two sensors are placed too close to each other, the “closeness” being measured by a pre-determined threshold, they exert negative forces on each other. This ensures that the sensors are not overly clustered, leading to poor coverage in other parts of the sensor field. On the other hand, if a pair of sensors is too far apart from each (once again a pre-determined threshold is used here), they exert positive forces on each other. This ensures that a globally uniform sensor placement is achieved. Figure 1 illustrates how the VFA algorithm is used for sensor deployment

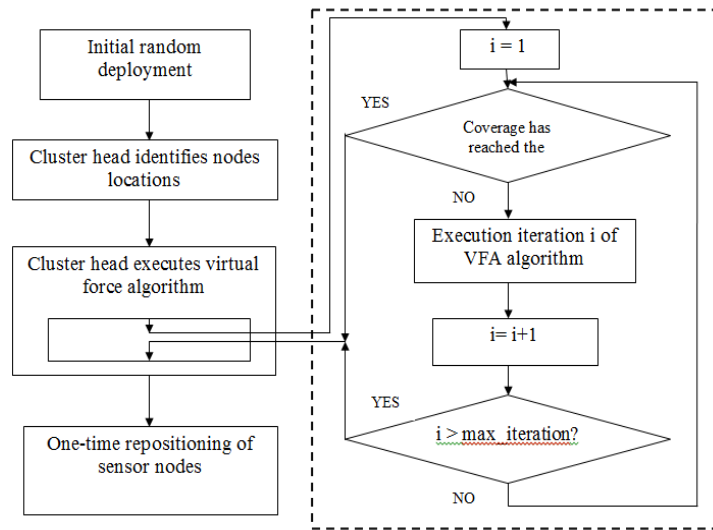


FIG:1 SENSOR DEPLOYMENTS WITH VFA ALGORITHM

IV. SIMULATION RESULTS

The proposed work is simulated using network simulator ns-2.35. By using distributed centre deployment algorithm and VFA algorithm the sensor movement is minimized for target coverage and network connectivity in mobile sensor network. The network lifetime is increased. The whole network is monitored by mobile sensors.

The mobile sensors 1,2,3 and 4 are cluster head and each cluster head has its own mobile sensor. Each cluster head handles several mobile sensor. Each sensor knows its location and can communicate with its cluster head. Sensor is not only used for detecting the target but also it finds the location of all neighbor nodes. The cluster heads are responsible for VFA algorithm.

Sensor movement is minimized and sensor field coverage is maximized by VFA algorithm. Once the target is detected by the sensor it informs it to the cluster head. Cluster head uses VFA algorithm to correct the nodes which gets affected due to coverage whole problem or energy loss.

Sensor node sends the sensed data TARGET node arrival to node 23 (cluster head) and to the base station. Mobile sensor 1 sends predicted message to mobile sensor 2 likewise mobile sensor 2 sends predicted message to mobile sensor 3 and mobile sensor 3 sends predicted message to mobile sensor 4

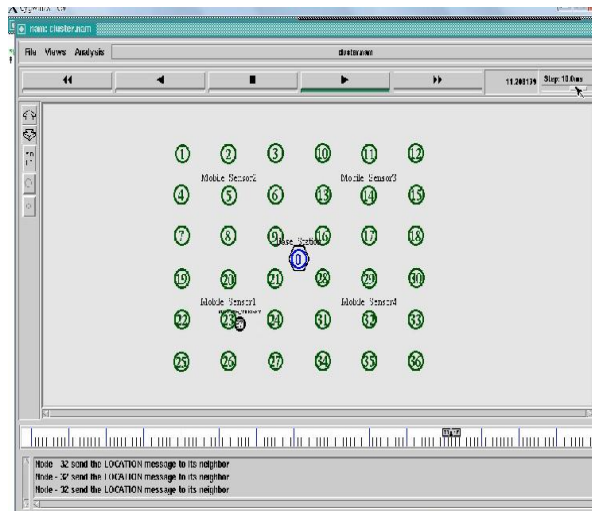


FIG: 2 DATA INFORMATION IS DELIVERED BETWEEN THE TARGET NODE AND THE BASE STATION



FIG: 3 ACTUAL TRACK VS PREDICTED TRACK

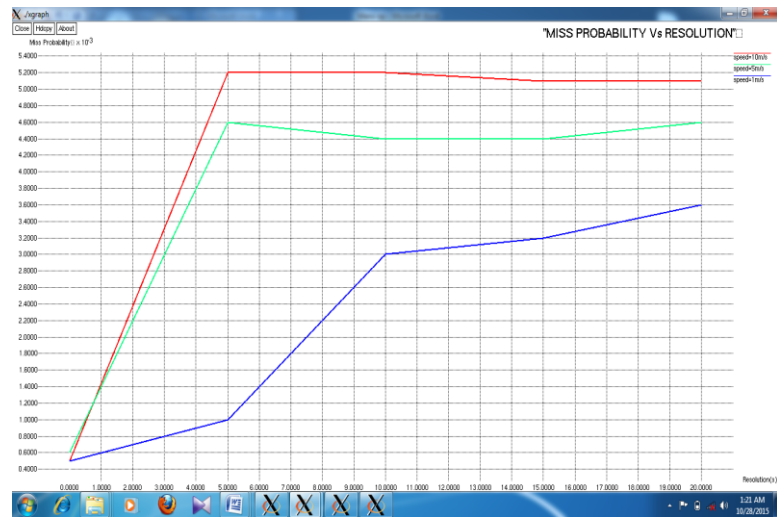


FIG: 4 MISS PROBABILITY VS RESOLUTION

V. CONCLUSION

In this work, we have studied the Mobile Sensor Deployment (MSD) problem in Mobile Sensor Networks (MSNs), in distributed manner aiming at deploying mobile sensors to provide target coverage and network connectivity with requirements of moving sensors. The issues of target coverage and network Connectivity in mobile sensor network are taken into consideration. Target coverage covers a set of interested point in the area of mobile sensor networks. Network connectivity is necessary for sensors to communicate with sink node. To solve the Target Coverage problem (TCOV) and network connectivity problem (NCON) two algorithms are proposed: Distributed centre deployment (DCD) algorithm and Virtual force algorithm (VFA). Distributed centre deployment algorithm minimizes the energy consumption and increasing the target coverage and network connectivity. Virtual force algorithm is used to achieve minimum sensor movement and maximum sensor field coverage. Simulation result obtained validates the performance of the proposed algorithm. Hence, the proposed scheme successfully overcomes the issues of Target coverage and Network Connectivity in Mobile Sensor Networks and increases the network lifetime.

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