ISSN 2350 - 0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 1, Issue 1, August 2014

A Survey on Mobile Sensor Scheduling in Wireless Sensor Network

Jothimani.S

Department of Computer Engineering, Nehru Institute of Engineering And Technology, Coimbatore, India

ABSTRACT: The real time mobility related applications like Military need to meet the performance requirements using the sensor nodes. The nodes sometime fail to achieve the required performance. The mobile sensor nodes are used to minimize the limitations. In this paper we discuss the use of mobile sensors which address the limitations of the static sensors for the target detection. The static and the mobile sensors are collaborated together to achieve the performance requirements of higher detection probability and to minimize the false alarm rate and for bounded detection delay. The PSO algorithm is used to ensure the high quality of coverage by placing the sensor nodes in the right position.

KEYWORDS :sensing capacity, detection probability, false alarm rate, coverage.

I. INTRODUCTION

The wireless sensor network is a collection of randomly dispersed devices which has the ability to monitor the environmental conditions in real time such as pressure, light, temperature etc. The sensors have the ability to provide the efficient reliable communications through the wireless network.

The use of wireless sensor network is extended to health, traffic, industries. The sensor nodes include the transceiver, antenna, microcontroller, interfacing electronic circuit and the energy source. The sensor node can be in any of the size range from as small as dust. The cost of the sensor depends upon the functionality of the sensor nodes like energy consumption, computational speed, bandwidth and memory.

The static sensor has the limitation to meet the performance requirements of coverage, detection and communication capabilities. Whenever new demand task arises, the requirements exceed the planned network capability. The sensor failed in one region also affects other sensor nodes that are deployed in other regions. The mobile sensor nodes have the capability to dynamically reconfigure whenever the on-demand task arises. The static and the mobile sensor are collaborated together, the mobile sensor moves close to the targets and increases the signal to noise ratio. The static and the mobile sensor collaboration change the sensing density and reduce the number of sensor needed to detecting the target.

The sensors are randomly deployed will bring the problem of coverage in terms. In order to maximize the coverage the sensors need to be placed in the position to fully utilize the sensing capability to ensure the quality of service. It reduces the number of nodes and maximizes the coverage in the network. The particle swarm algorithm is used to find the optimal positions of the sensors to determine the coverage of best. This is an optimization technique belongs to swarm intelligence. The PSO shows the good effect in solving the problem of coverage.

Particle Swarm Optimization is used successfully used in numerous engineering, neural networks, image identification, structural optimization, environmental monitoring, smart home building and military applications. Coverage includes location identification, tracking and deployment. In this coverage the nodes have the responsibility of covering the predefined area. Hence the sensor deployment in an effective manner maximizes the sensor coverage.

II. SENSING MODEL

The sensor measures the signal power that is d meter away from the target by,

$W(d) = W \cdot w(d)$ ……………………(1)

w (d) is w (0) = 1 and w (∞) = 0
w (d) is the signal decay function.

A.Detection probability and false alarm rate

The sensor networks are organized into clusters and the sensors send their energy measurement to the cluster head, which will compares the average of all measurement with the threshold ŋ. If it is greater, the target is present. Otherwise there is no target.
The detection probability and the false alarm rate are denoted as $P_{d,}$ $P_{f.}$

$$P_D = 1 - X_n\left(n\eta - \sum_{i=1}^{n} W(x_i, T)\right) \quad \ldots\ldots.(2)$$

$$P_F = 1 - P\left(\sum_{i=1}^{n} N_i^2 (T) < n\eta\right) \quad \ldots\ldots (3)$$

III. MSD PROBLEM

The objective is to minimize total moving distance of the sensor with the constraints

1. The probability detection not lower than 90 %
2. The false alarm rate less than 1 %
3. The bounded detection delay 20s

The network is organized into cluster around surveillance location by the clustering protocol. If the surveillance location is static for the constant target distribution then the static clustering algorithm will be applied. If the surveillance location is dynamic then the dynamic clustering algorithm will be applied.

The sensor closer to the target will be selected as the head. Every static sensor belongs to only one cluster. But the mobile sensor belongs to more than one cluster

A data fusion centric detection model as follows: all the sensors periodically send their measurements to the cluster head which compares average energy with the threshold ŋ1. If the positive detection decision is made, the second phase of detection is initiated.

A key advantage of the above two-phase detection model is the reduced total distance of moving. Moreover, this model makes easy the collaboration between static and mobile sensors. As the decision of the first phase is made based on the measurements of all sensors in a cluster, the static sensors help filter out false alarms that would trigger needless movement of mobile sensors.

In addition, the accuracy of the final detection decision is improved in the second phase because the signal to noise ratios (SNR) are increased as the mobile sensors move closer to the target location.

IV.SENSOR COVERAGE

If the sensor is placed in the location point (x_1,y_1), it can cover the area $(x_{2,}y_2)$.
The distance between two points can be
$(x_1\text{-}x_2)^2 - (y_1\text{-}y_2)^2 <= r^2$ …………….(4)

Here r is the sensing range of the sensor. The sensing range is the distance between the sensor node and the farthest location point. Area A is divided into R regions and each region is positioned with a sensor node by minimizing the distances between location points and their closest centre point. Area A is enclosed with R sensor nodes.

The coverage problem is an optimization problem and defined as: *P* is the set of points and R is the fixed number of sensors, the optimum location for deploying all *R* sensors such that every location point is covered is

$$F = \forall_R \forall_j (\max\, (distance\, (S_R\, , P_j))) \quad \ldots.(5)$$

Where *SR* is the sensor deployment point and *Pj* is the location point, distance refers to the Euclidean.

ISSN 2350 - 0328

International Journal of Advanced Research in Science, Engineering and Technology
Vol. 1, Issue 1, August 2014

The objective is to minimize the F, such that the sensing ranges r, necessary to cover all the location points.

V.PARTICLE SWARM OPTIMIZATION

PSO algorithm is a strategy based on particle swarm and parallel global random search. This algorithm determines search path according to the velocity and current position of particle. The PSO algorithm has better performance than early intelligent algorithms on calculation speed and memory occupation, and has less parameter and is easier to realize. All these algorithms inform a set of solutions applying some operators

In PSO algorithm, every individual is called "particle", which represents a potential solution. The algorithm achieves the best solution by the variability of some particles in the tracing location. The particles search the solution space following the best particle by changing their positions and the fitness frequently, the flying direction and velocity are determined by the objective function.

PSO is a novel stochastic optimization algorithm based on the study of relocation behaviors of bird flock in the process of search food. In this process of searching food, each bird can find food through social teamwork of neighboring birds and the birds who have found food can guide other birds about them to fly to the food location.

Once these birds also find food, they can lead more birds to find the location, which increases the possibility of bird flock finding food. PSO differs from these algorithms by simulating the social performance and moment dynamics of a swarm.

The i^{th} particle of the swarm in a d-dimensional search space is denoted by the position vector

$X_i = (X_{i1} , X_{i2},\ldots\ldots X_{id})\ldots\ldots\ldots\ldots(6)$

The velocity of the particle is represented as

$V_i= (V_{i1},V_{i2}\ldots\ldots V_{id}) \quad \ldots\ldots\ldots\ldots(7)$

The best visited location for the particle is

$P_{ibest} = (P_{i1},P_{i2},\ldots\ldots\ldots p_{id}) \quad \ldots\ldots\ldots\ldots(8)$

The velocity and positions of every particle are updated by,

$V_i(t+1) = W^* V_i(t) + C_1{}^* \text{Rand}()^*(P_{ibest} - X_i)+C_2{}^* \text{rand}()^*(P_{gbest} - X_i) \ldots\ldots(9)$

VI.PROBLEM FORMULATION

The objective of the present work paper is to minimize the distance between the neighboring nodes, maximizing coverage in the network, while concurrently satisfying all constraints.

- All of the sensor nodes are homogenous and have mobility.
- We assume the deployed sensor nodes can entirely cover the sensing field. Sensing coverage and communication coverage of each node is understood to have a circular shape without any irregularity.
- The design variables are the two-dimensional coordinates of the sensor nodes.
- All the nodes can cover equal sensing field area.

VII. PSO ALGORITHM

In the particle swarm optimization algorithm, the action to be perform are,

1. Initialize Network information and algorithm parameters like inactivity weight, learning factor, speed boundary value, and the largest iterative number. Array of particles with random position and velocity vectors are initialized.

2. Discover the distance of the interest point to its closest sensor. Fitness is calculated for every particle at its current position using Euclidian distance.

ISSN 2350 - 0328

International Journal of Advanced Research in Science, Engineering and Technology

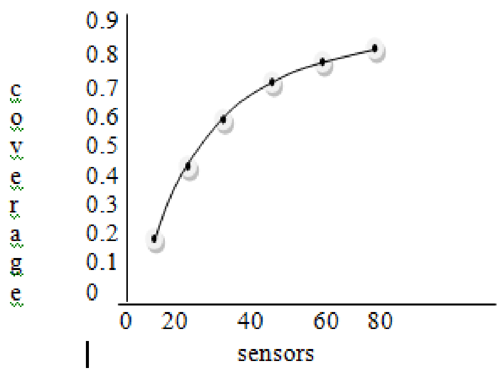
Vol. 1, Issue 1, August 2014

3. Minimization of the fitness value; the fitness value should be equal to zero, where the distance between the interests points with their nearest sensors are within the sensors' sensing range. When the fitness of the particle is lesser than that of the best particle, then the particle will be the best particle for the next move, and the fitness of this particle will be taken as best fitness.

4. Each particle is made to change its current position, current velocity and the distance between current position and P_{ibest}, the distance between current position and p_{gbest}.

5. If the next position of the particle is best, then the particle selects a new position, otherwise, the same algorithm is continued.

6. This process is repetitive in iterations, till all the particles communicate with each other and produce maximum coverage.



VIII.CONCLUSION

The proposed work has the capability to achieve optimal solution of coverage problem with minimum number of Sensors in wireless sensor networks. This approach develops an inventive is idea in employing the PSO algorithm with enhanced reliability. The results show that the PSO approach is effective and strong for efficient coverage problem of sensor deployment and is considered to give almost the optimal solution in WSN. In future, it can be given to achieve 100% coverage with minimum number of sensors. The study of the 100% coverage using various optimal search techniques also presents several motivating challenges.

REFERENCES

1. Bo Li and RenYue Xiao (2007): The Particle Swarm Optimization Algorithm: How to Select the Number of Iteration, IIH-MSP, and vol.2, pp. 191-196, ISBN: 0-7695-2994-1.
2. Eberhart R. and Kennedy J. (1995): A new Optimizer using Particle Swarm Theory, Proc. 6th Int. Symposium on Micro Machine and Human Science, pp. 39-43.
3. Firasath Riyaz (2005): Evolving a Disjunctive Predator Prey Swarm using PSO: Adapting Swarms with Swarms, Thesis (M.S.)--Baylor University.
4. H. Cao, E. Ertin, V. Kulathumani, M. Sridharan, and A. Arora,"Differential Games in Large-Scale Sensor-Actuator Networks,"Proc. Int'l Conf. Information Processing in Sensor Networks (IPSN),2006.
5. J.-F. Chamberland and V. Veeravalli, "Decentralized Detection in Sensor Networks," IEEE Trans. Signal Processing, vol. 51, no. 2,pp. 407-416, Feb. 2003.
6. S. Chellappan, W. Gu, X. Bai, D. Xuan, B. Ma, and K. Zhang,"Deploying Wireless Sensor Networks under Limited Mobility Constraints," IEEE Trans. Mobile Computing, vol. 6, no. 10,pp. 1142-1157, Oct. 2007.
7.W.-P. Chen, J.C. Hou, and L. Sha, "Dynamic Clustering for Acoustic Target Tracking in Wireless Sensor Networks," IEEE Trans. Mobile Computing, vol. 3, no. 3, pp. 258-271, July 2004.
8. N. Bisnik, A. Abouzeid, and V. Isler, "Stochastic Event Capture Using Mobile Sensors Subject to a Quality Metric," Proc. ACM MobiCom, 2006.