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A Modified Approach for Aggreration Technique in WSN

Er. Balihar Singh[#1], Er. Varinderjit Kaur[#2]

[#1 #2]*Ramagarhia Institute Of Engg and Tech*

Abstract*—Data Aggregation is a fundamental problem in wireless sensor networks (WSNs). From both economic and applicable concerns, designers always would like to provide guaranteed QoS of coverage of WSNs. In this paper, we address two path-coverage problems in WSNs, maximum k-support path coverage (a.k.a. best case coverage) and minimum k-breach path coverage (a.k.a. worst case coverage), in which every point on the desired resultant path is covered by at least k sensors simultaneously while optimizing certain objectives. We present an approaches to find optimal solutions for both maximum k-support coverage problem and minimum k-breach coverage problem.

I. INTRODUCTION

In computer science and telecommunications, wireless sensor networks are an active research area with numerous workshops and conferences arranged each year. A wireless sensor network (WSN) consist of spatially distributed autonomous sensors to cooperatively monitor physical and environmental conditions such as temperature ,sound, pressure, vibration, motion or pollutants. A sensor node is a node that is capable for performing some processing, gathering sensory information and communicating with other connected nodes in the network. Basically a sensor network normally constitutes a wireless ad-hoc network, in which each sensor supports a multi hop routing algorithm where node function as forwarders, relaying data packets to a base station. Wireless sensor network are used in many application such as military, agriculture and medical monitoring and environmental surveillance. One of the most active research fields in wireless sensor network is that of coverage. Coverage is usually interpreted as how well a sensor network will monitor a field of interest. It can be thought of as a measure of quality of service. There are several issues in WSN that need to be addressed. However some of these issues create conflicts and constraints to coverage optimization. Therefore works not only focusing in maximizing coverage but also optimizing these issues. A better WSN can be achieved by enhancing the existing coverage strategies which results a superior coverage strategy and a comparative analysis is made between Square grid based coverage strategy and Delaunay triangulation computational geometry based coverage strategy.[1] Despite the wealth of Previous research studies conducted separately on sensor network and coverage of sensor network and coverage of sensor network which are surveyed i.e joint consideration of those two concepts for WSN is so common. Eyuphan Bulut, Zijian Wang and Boleslaw K.Szymanski[2] concludes a neighbour graph as the graph formed by the neighbours of a node and analyses the effect of different levels of connectivity in neighbour graphs on the coverage redundancy of sensor nodes. J. Naskath, Dr.K.G.Srinivasagan, S.Pratheema[3] focuses on the sensor replacement problem in WSN consist of mobile sensors. Gao Jun Fan and Shi Yao Jin[4] presented a survey of coverage problem where two challenges are described, namely, maximizing network lifetime and network connectivity. Ridha Soua, Leila Saidane, Pascale Minet[5] proposed an approach to use a mobile robot to assist the initial sensor deployment and to improve sensing coverage and connectivity of monitored area. Fariha Tasmin Jaigirdar[6] provides a novel grid approximation algorithm for efficient and low cost deployment of inductive charger so that the minimum number of chargers along with their placement locations can charge all the sensors of the network.

Coverage Scheme

Here this scheme focuses on the coverage strategies we used to achieve the maximum coverage .These coverage strategies are divided into three categories:-

1.Force Based
2.Grid Based
3.Computational Geometry Based

1. Force Based:

Force based deployment strategies rely on the sensors mobility, using virtual repulsive and attractive force, the sensors are force to move away or towards each other so that full coverage is achieved. The sensors will keep moving until equilibrium state is achieved; where repulsive and attractive forces are equal thus they end up canceling each other. In [7] the sensors and objects in the ROI exert virtual repulsive force that pushes sensors away from the objects and also from each other so that their sensing areas are not overlapping. The sensors will keep moving until static equilibrium state is reached. The static equilibrium state is reached based on the fact that the total energy is reduced with time. Although this method does ensure full coverage and full connectivity, but it extremely depends on mobility, which is a high power consumption task.

2. Grid Based:

Grid based deployment strategies used to determine sensors positions. Grid based is the sampling method in which coverage is estimated as ratio of grid points covered to total number of grid points in the ROI. The cost of this method is determined by number of grid points, name and amount of sensors deployed. The accuracy of the estimation is determined by the size of each grid, the smaller the size the more accurate the estimation is. There are three types of grids commonly used in networking; [8]

(a) Triangular Lattice
(b) Square Grid
(c) Hexagonal Grid

Triangular lattice is the best among the three kinds of grids as it has the smallest overlapping area hence this grid requires the least number of sensors[9]. Triangular Lattice is shown in figure 2(a).Square grid is shown in figure 2(b). Square grid provides fairly good performance for any parameters. Hexagonal grid is the worst among all since it has the biggest overlapping area, shown in figure 2(c).

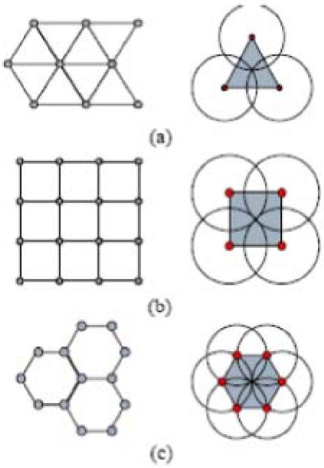


Figure 1: Types of grids (a) Triangular lattice (b) Square grid (c) Hexagonal grid

3.Computational Geometry Based:
Computational geometry is frequently used in WSN coverage optimization,[10] the most commonly used computational geometry approach are
(a) Voronoi diagram
(b) Delaunay triangulation.
Voronoi diagram is partition of sites in such a way that points inside a polygon are closer to the site inside the polygon than any other sites, thus one of the vertices of the polygon is the farthest point of the polygon to the site inside it. Therefore Voronoi diagram can be used as one of the sampling method in determining WSN coverage; with the sensors act as the sites, if all Voronoi polygons vertices are covered then the ROI is fully covered otherwise coverage holes exist. Delaunay triangle is formed by three sites provided if and only if the sites[11] circumcircle does not contain other sites.Circumcircles of Delaunay Triangles is shown in figure 3.The centre point of the circle is a Voronoi vertex with equal distance from each of the three sites.

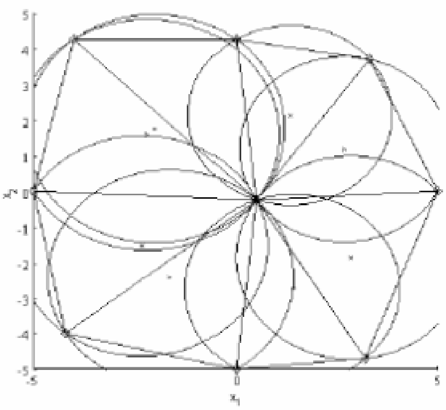
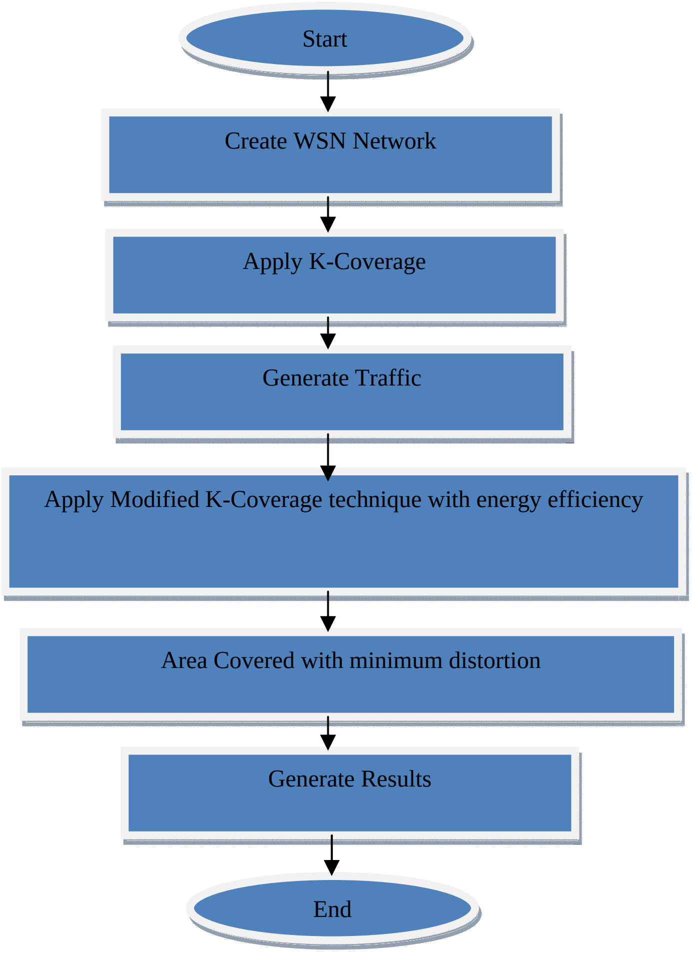


Figure 2: Circumcircles of Delaunay Triangles

II. Proposed Work



SQUARE GRID BASED COVERAGE STRATEGY: Grid points are used in two ways in WSN deployment either to measure coverage as used in VFA or to determine sensors positions. Coverage percentage as stated before is ratio of area covered to the area of ROI. Grid is among the sampling method commonly used such as in [15]. The coverage is estimated as ratio of grid points covered to total number of grid points in the ROI. The cost of this method is determined by number of grid points; $n \times m$ and amount of sensors deployed; k.[16][17]

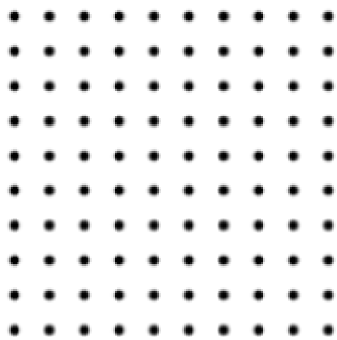


Figure 3: Square Grid

ASSUMPTIONS FOR SQUARE GRID BASED COVERAGE STRATEGY : In the sensor network the following properties are assumed.

1. Square Grid is implemented in 2D.
2 Sensor sensing range is equal to size of grid.
3. Formula used to compute distance is 2*R.
4. Sensor communicate if distance is <=R, where R is sensing range.
5. The sensor nodes sense information and send the information continuously to the next node towards the head.

III. Results and Discussion

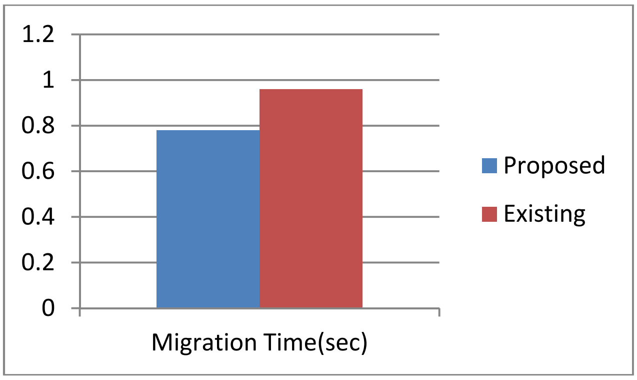


Fig 3: Migration time

Figure 3 defined about the Migration time in existing and proposed approach. Migration time in the proposed approach is 0.79 sec where as in vector dot it is 0.9 sec.

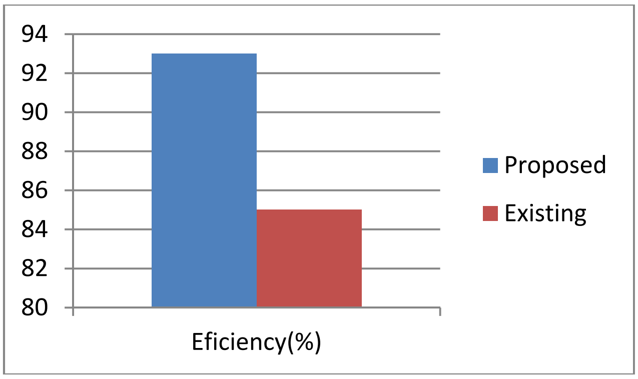


Fig 4. Efficiency

Figure 4 defined about the efficiency of the existing and proposed approach i.e. 93% in proposed and 85% in existing approach.

IV. Conclusion

In this paper a modified coverage strategies of Wireless Sensor Network are compared on different parameters. Almost proposed technique for K-Coverage is more efficient coverage strategy because node are link in a direct manner to each other and approximately independent to each other in their energy consumption. If sensing range is increased in square grid coverage strategy than overlapping of sensing area is increased which is not desirable for valid data in coverage of region of interest.

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