A Survey on Energy Efficient Target Coverage in wireless Sensor Network

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ABSTRACT

Sensor networks have been applied in a wide variety of situations. Recently directional sensor networks consisting of directional sensors have gained attention. Network life is very crucial parameter for sensor network. In this paer, we use artificial intelligence to deploy sensor node with objective of maximize life of network. Simulation results shows that proposed method perform well.

Key Word- *wireless sensor network, deployment, netweork lifetime*

I. INTRODUCTION

Technological advances in recent years have made feasible the deployment of hundreds or thousands of sensor nodes in an ad-hoc fashion, that are able to coordinate and perform a variety of monitoring applications ranging from measurements of meteorological data (like temperature, pressure, humidity), noise levels, chemicals etc. Sensor network generally made of a base station and a group of wireless sensor nodes. Nodes are responsible for monitoring the data and send this data to base station. The base station works as a gateway for the wireless sensor network to exchange data with application to fulfill their aim.

The base stations have continuous power supply and the nodes deployed in sensing area are usually battery operated. The batteries are inconvenient and sometimes even impossible to replace. When a sensor node runs out of energy, its coverage is lost. The mission of a sensor application would not be able to continue if the coverage loss is remarkable. Therefore, the value of a sensor network isdetermined by the time duration before it fails to carry out the mission due to insufficient number of live sensor nodes.

It is both missions critical and economically desirable to manage location of node in an energy-efficient way to extend the lifetime of sensor networks.

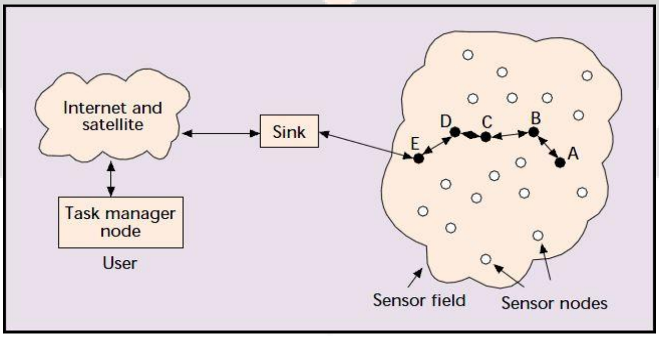

Fig.-1 Sensor network

Coverage in a WSN needs to guarantee that the region is monitored with the required degree of reliability. Locations of sensor nodes constitute the basic input for the algorithms that examine coverage of the network [2]. Coverage problems can be broadly classified as area coverage problem and target coverage problem. Area coverage focuses on monitoring the entire region of interest, whereas target coverage concerns monitoring only certain specific points in a given region. Target coverage can be categorized as simple coverage, k-coverage and Q-coverage. With simple coverage, each target should be monitored by at least one sensor node. For k-coverage, each target has to be monitored by at least k sensor nodes, where k is a predefined integer constant. In Q-coverage [3], the target vector T = {T1, T2, . . . ,Tn} should be monitored by Q = {q1, q2, . . . , qn} number of sensor nodes such that target Tj is monitored by at least qj number of sensor nodes, where n is the number of targets and $1 \leqslant j \leqslant n$.

In deterministic deployment, the details of the region will be known and since a provision of deploying nodes at specific locations prevails many ways by which network lifetime can be maximized. As target location [4] known, upper bound for network lifetime is calculated and it used as a fitness function in artificial intelligence [5] to get best sensor node location to extend network life.

The remainder of this paper is organized as follows. In Section-II and III, we present the proposed deployment scheme for target coverage. Section IV contains the experimental results of proposed method and performances of the proposed scheme.

II. LITERATURE SURVEY

1.amitabhaghosh[a],sajalk.das[b] (7): in this paper we study how to maximizing coverage as well as maintaining network connectivity using the resource constrain node is a nontrival problem.

2.mohamedyounis[a],KemalAkkaya[b] (4): in this paper we study optimized node placement in sensor network.also to categorized the various approaches in the literature on Node positioning into static and dynamic.

3.mihaela cardie,jiewu (10): in this paper we survey recent contributions addressing energy efficient coverage problem in the contex on static wireless sensor network the coverage problem is subject to be covered target and areaand study about scheduling sensor nodes to alternate between sleep and active mode is an important method to conserve energy resouces.

4.zhao cheng,markpenillo (3): in this paper we study a comprehensive analysis on the maximum achievable sensor network lifetime for different deployment startergies and we study about general network lifetime model to evaluate multiple sensor network deployment strategies.

III. Performance index of node deployment

The key points of node deployment algorithm are to increase the coverage area, enhance network connectivity, prolong the network lifetime, make the load balance, improve the accuracy of the data transmission and strengthen the tolerance of nodes. Obviously, it has the certain difficulty if just using random node deployment to completely meet those design goals. At the same time, how to reduce the deployment cost is still needed to be solved, although it can meet the needs of major and minor deployment objectives. Generally, the optimization of the sensor nodes deployment mainly includes the following performance indexes.

(1) Coverage Area

How to get maximum coverage is always the hotspot of the optimization problem in wireless sensor network deployment. Coverage is important issue and is related to energy saving, connectivity, and network reconfiguration. It mainly solves how to deploy the sensor nodes to achieve effective coverage of the service area so that every point in the service area is monitored at least by one sensor node. A good coverage is indispensable for the effectiveness of wireless sensor networks [7]. Assume that the sensor radiation range is the coverage area of disk shape, the radius equal to radiation range, and the ratio of the area covered by node against whole area of deployment is the index of the monitoring area coverage. There is a kind of model similarly to grid scanning algorithm, wherein the obstacle will hinder the detection of sensor node to the target and the accuracy of the target detection probability is changing with the distance between sensor nodes and detection target.

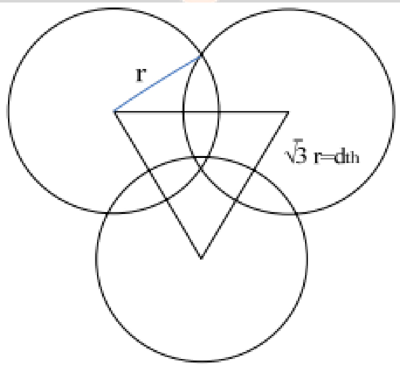

Figure II.1 Triangle grid computing

There is a method of using the minimum quantity of sensor nodes to realize the maximum coverage, and presents the triangle grid computing algorithm which makes any three adjacent nodes form an equilateral triangle. By regulating the distance between nodes to control coverage and proved that the detection area will be completely covered.

(2) Net Connectivity

Network connectivity is the communication between the wireless sensor nodes, the node and base station, base station and the client, the client and the server. But in the early days, the network connectivity is not difficult problem. A case considered in the complete coverage and connectivity of the sensor nodes, which are located in the sensing radius of node and are connected. For this, we only need to build routing between the node and base station to send the data.

(3) Network Lifetime

One of the most important requirements is to reduce the energy consumption. Hence, there is a need for energy efficient communication and routing techniques that will increase the network lifetime [8]. The major cause of energy waste is collision. When a node receives more than one packet at the same time, these packets are termed collided, even when they coincide only partially. All packets that cause the collision have to be discarded and retransmissions of these packets are required, which increases energy consumption. The second reason for energy waste is overhearing, which means that a node receives packets that are destined to other nodes. The third energy waste occurs as a result of control-packet overhead. They investigate differences of the behavior of our agent based SMAC protocols in real deployment compared to the results produced using our custom based simulator, which ignores the lower layers effects, such as packet collision and overhearing.

(IV) Target coverage problem

In target coverage problem, the fixed number of targets is continuously observed by a number of sensor nodes with the aim of maximizing the lifetime of the network. Possibly, each target is monitored by at least one sensor node. There are a specific number of targets which are to be covered by a set of sensor nodes. After getting deployed, the sensor nodes start the task of monitoring the said targets. Since sensor nodes are provided with only some limited resources and can't withstand extreme environmental conditions,

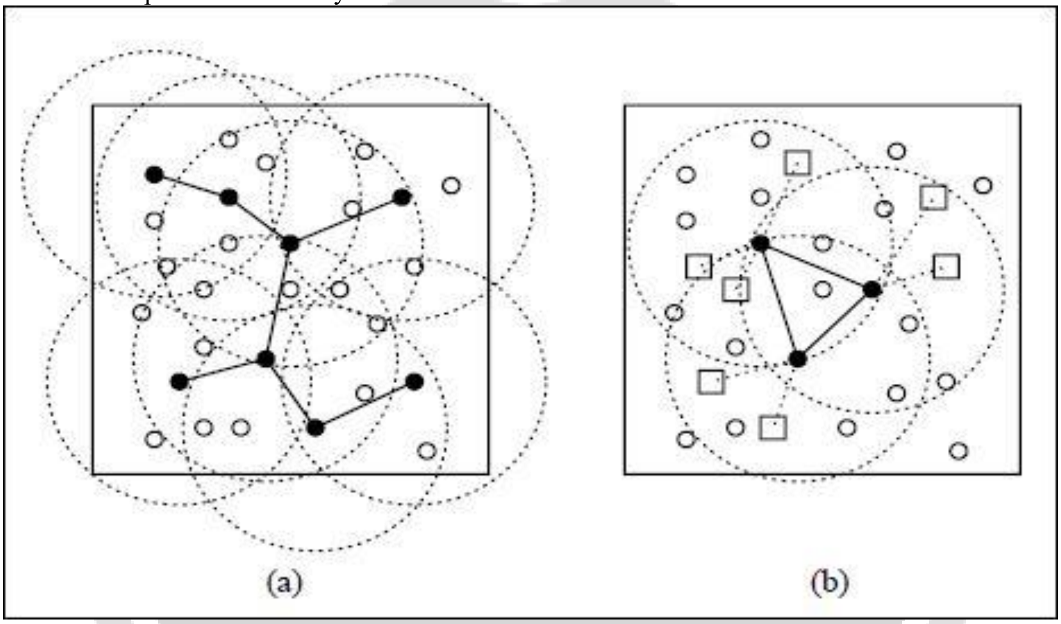

Figure II.2 (a) Area coverage and (b) Point coverage

they are deployed in large number much more than actual requirements. While covering the targets, several issues like maximizing of network lifetime, minimum participation of sensor nodes, minimum consumption of energy, etc must be taken into consideration in order to achieve much efficient target coverage.
Some of the Strategies to cover a specific set of targets are mentioned below

(1) Activating all the sensors at a time

In order to cover all the specific targets, the simplest method is to activate all the sensor nodes deployed for coverage at a time. However, this simultaneous activation of sensor nodes may make them exhaust of their energy at a time. So, only for a limited amount of time they would be able to perform the coverage task.

(2) Formation of disjoint set covers of sensor nodes

An energy efficient method to cover all the targets is to make the sensor nodes alter between active and sleep modes. During active mode, a sensor node is capable of keeping track of the targets and their important information. If a sensor node is having no task, it may enter into sleep mode which consumes a negligible amount of energy. So, some disjoint set covers of active sensor nodes may be made in such a manner that each set cover is covering all the targets. These set covers are activated one after another till the sensor nodes are out of their energy. So, rather than making all the sensor nodes active at a time, they can be partitioned into a number of disjoint set covers with each set cover capable of monitoring the targets.

(3) Formation of non-disjoint set covers of sensor nodes

Another energy efficient method for target coverage is to make the sensor nodes be part of more than one set cover. With the sensor nodes altering between the active and sleep modes. Several non-disjoint set covers of active sensor nodes are made to activate successively where each set cover is capable of keeping track of all the specific targets until the energy exhaustion of sensor nodes.

This procedure is much more energy efficient as compared to disjoint set covers method of target coverage, thus maximizing the network lifetime to some more extent

(4) Partial Target Coverage

Full coverage of targets [12] ensures that all the required targets are to be covered. Information collected by a subset of targets may also be beneficial. A number of set cover of sensor nodes may be activated for partial coverage of the targets, not necessarily covering all the targets. The gathered information about a subset of targets by the sensor nodes may prove to be very important where the main objective is to maximize the lifetime of the network.

(5) K-Coverage

In k-coverag+e ($k \geq 1$) approach [13], a minimal subset of the sensor nodes is determined that can keep track of the required targets, with each target being covered by at least k sensor nodes. The activated nodes collectively gather information about the specific targets and send it to the base station.

conclusions

Sensing range of node, size of network, number of target, number of nodes and scheduling have significant effect on life of network which we have done analyses in the simulation by increasing no. of target and sensing area network life decrease but by increasing node's sensing radius life increases with effective coverage level.

By using artificial bee colony algorithm for node deployment, we achieve the required target coverage level and maximize the network lifetime compared to random deployment. Node deployment by using ABC algorithm works good for simple as well as k-coverage application.

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