Energy Efficient coverage in Target-Oriented Wireless Sensor Networks

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ABSTRACT
Convectional Omni directional sensors that always have an omni angle of sensing range, directional sensors may have a limited angle of sensing range due to the technical constraints or cost considerations. A directional sensor network consists of a number of directional sensors, which can switch to several directions to extend their sensing ability to cover all the targets in a given area. Improving the energy efficiency is still an important issue. This paper solves the problem of data replication in sink node and avoids overlapping area for Wireless sensor networks.

1.INTRODUCTION
A wireless sensor network (WSN) consists of spatially distributed autonomoussensors to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, enabling also to control the activity of the sensors. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer application, such as industrial process monitoring and control, machine health monitoring [1].

One important criterion for being able to deploy an efficient sensor network is to find optimal node placement strategies. Deploying nodes in large sensing fields requires efficient topology control. Nodes can either be placed manually at predetermined locations or be dropped from an aircraft. However, since the sensors are randomly scattered in most practical situations, it is difficult to find a random deployment strategy that minimizes cost, reduces computation and communication, is resilient to node failures, and provides a high degree of area coverage. The notion of area coverage can be considered as a measure of the quality of service (QoS) in a sensor network, for it means how well each point in the sensing field is covered by the sensing ranges. Once the nodes are deployed in the sensing field, they form a communication network, which can dynamically change over time, depending on the topology of the geographic region, internodes separations, residual battery power, static and moving obstacles, presence of noise, and other factors.

The network can be viewed as a communication graph, where sensor nodes act as the vertices and a communication path between any two nodes signifies an edge.

2. COVERAGE AND CONNECTIVITY
Coverage and connectivity are two important properties to WSN. Coverage describes how well sensors in the network can monitor a geographical region in question. Connectivity simply describes the connectivity properties of the underlying network topology and it is often desirable that the network is connected. If the network is partitioned, the sensed data cannot be known by sink and the sensor network is failed.

Connectivity is a fundamental issue in wireless ad-hoc environment. Many schemes have been addressed to conserve energy while maintaining the connectivity, which is also related to how to construct the minimum connected dominating set problem. Much research focused on designing energy-efficient distributed algorithms to construct a near optimal connected dominating set .

Historically, three types of coverage have been defined by Gage [10]:

1. Blanket coverage — to achieve a static arrangement of sensor nodes that maximizes the detection rate of targets appearing in the sensing field

2. Barrier coverage — to achieve a static arrangement of sensor nodes that minimizes the probability of undetected penetration through the barrier

3. Sweep coverage — to move a number of sensor nodes across a sensing field, such that it addresses a specified balance between maximizing the detection rate and minimizing the number of missed detections per unit area

2.3Target Coverage Problem
Consider a number of targets with known locations that need to be continuously observed (covered) and a large number of sensors randomly deployed closed to the targets. Also consider a central data collector node, which refers to as the base station (BS). This BS can be the cluster head into a more general, cluster-based framework. Sensed data might be processed locally by the sensors or at the BS, from where it is aggregated and forwarded to the user. Also assume the sensors have location determination capabilities.

Assume the number of sensors deployed in the field is greater than the optimum needed to perform the required task; an important energy-efficient method consists in scheduling the sensor nodes activity to alternate between active state and sleep state. We consider that a sensor node radio can go to the sleep mode when the node is not scheduled to perform the sensing task.

Given m targets with known location and energy constrained wireless sensor network with n sensors randomly deployed in the targets' vicinity, schedule the sensor nodes activity such that all the targets are continuously observed and network lifetime is maximized.

The sensor scheduling mechanism can be accomplished as follows [1]:

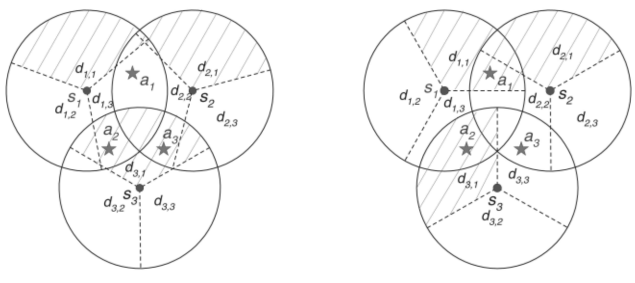
1) Sensors send their location information to the BS

2) BS executes the sensor scheduling algorithm and broadcasts the schedule when each node is active

3) Every sensor schedules itself for active/sleep intervals.

Here designing the node scheduling mechanism are concerned, and do not address the problem of selecting which protocol is used for data gathering or node synchronization. To efficiently transmit data from the sensors to the BS, a mechanism like LEACH or PEGASIS can be used.

3. EXISTING APPROACH



(a) (b)

Some targets with known locations are deployed in a two-dimensional Euclidean plane. A number of directional sensors are randomly scattered close to these targets. Each sensor has a uniform sensing region and the sensing regions of different directions of a sensor will overlap.

For example: The a1 target is covered by both s1 and s2 sensor. When the sensors are randomly deployed, each sensor initially faces to one of its directions. These sensors form a directional sensor network so that data can be gathered and transferred to the sink, a central processing base station. The data collected by sink contains duplication where s1 and s2 sends the data of a1.

This can be solved in proposed approach. Both the efficiency can be compared.

4. PROPOSED APPROACH

The interconnection medium for our proposed system is a mesh of wire segments. The mesh interconnection topology is a wireframe that has a regular structure, each vertex being connected to exactly four other vertices.

Energy efficiency is a dominant consideration no matter what the problem is. This is because sensor nodes only have a small and finite source of energy. Many solutions, both hardware and software related, have been proposed to optimize energy usage.

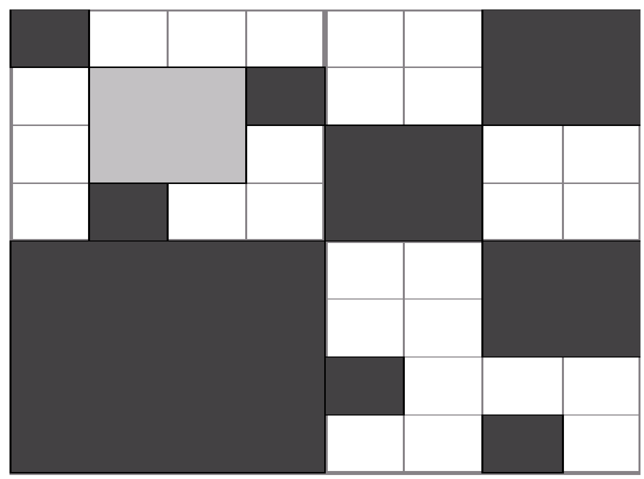
In proposed system the overlapping of sensor region is avoided .The signal received by the sensor in turn sends acknowledgement. If the same signal is received by two or more sensors in same .It results in loss of energy so efficiency is reduced. To avoid it the systems is proposed such that only one sensor in a particular region can receive the signal. Thus the efficiency of sensor nodes can be improved.

Power conservation is still an important issue in directional sensor networks due to the following reasons. First, most sensors have limited power sources and are non rechargeable. Also, the batteries of the sensors are hard to replace due to the hostile or inaccessible environments in many scenarios. We assume that each sensor is non rechargeable and dies when it runs out its power. To conserve energy, we can leave necessary sensors in the active state and put redundant sensors into the sleep state, while keeping all the targets covered.

Grid-based routing [10]

Grid-based routing algorithms use grid as the basic routing infrastructure. Considering different characteristics of networks, different grid construction methods have been proposed. In two-tier data dissemination (TTDD) grid is constructed for large-scale WSN where multiple sinks are mobile. In a virtual grid (VG) is constructed for routing in WSN where all sensors are static. In the proposed system we use virtual grid construction method.

In grid-based routing algorithms, how to construct and maintain the grid is the key problem.

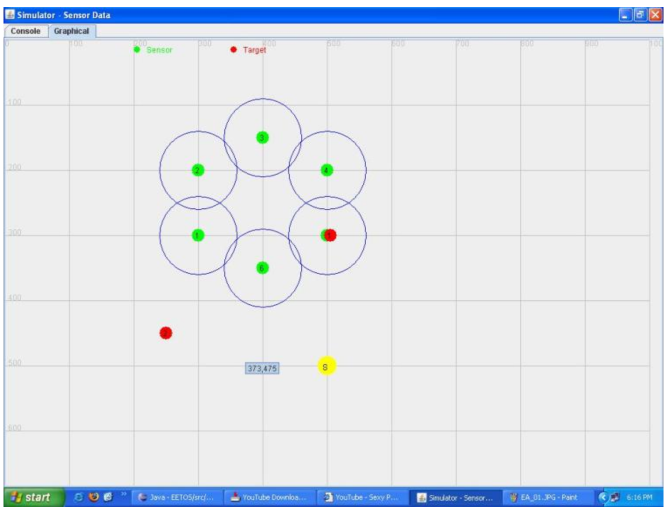


Global partitioning of the area

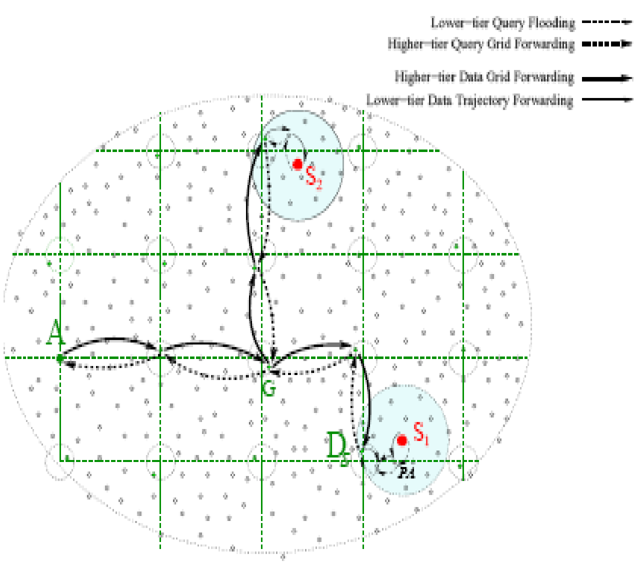
GLS (Global Localization Service) is based on the idea that a node maintains its current location information in some location servers distributed throughout the network .GLS provides for distributed location lookups by replicating the knowledge of a node's current location at a small subset of the network's node, which is referred to as the node's location servers. In GLS, grid-based partition is arbitrary and any other balanced hierarchical partition of the space can be used. It is presumed that all nodes know the same global partitioning of the area into a hierarchy of grids with squares of increasing size, as shown in above Figure. One smallest square is called an order-1 square. Generally, four order-1 squares make up an order-2 square, and so on. Sometimes, a particular order-n square is part of only one order-n+1 square in order to avoid overlap. This maintains an important invariant: a node is located in exactly one square of each size. If square size is increased, fewer location servers are selected for nodes at greater distances.

The location servers are not specially designated and are acted by each node. The location servers for a node are relatively dense near the node but sparse farther from node to balance the efficiency and energy consumption. Each node recruits nodes with IDs "close" to its own ID to serve as its location servers. The node closest to node, X, in ID space is defined to be the node with the least ID greater than X. A node selects location servers in each sibling of a square that contains the node. In B recruits three servers in order-1 squares, three servers in order-2 squares, and three servers in order-3 squares .Once all nodes have provided their coordinates to their location servers, the grid state is complete. If one node (S) sends the data to the destination (D), S sends the query to the least node greater than or equal to D for which S has location information. The query is forwarded in the same way. Eventually, the query will reach a location server of D, which will forward the query to D. Since the query contains S's location D can respond directly using geographic forwarding.

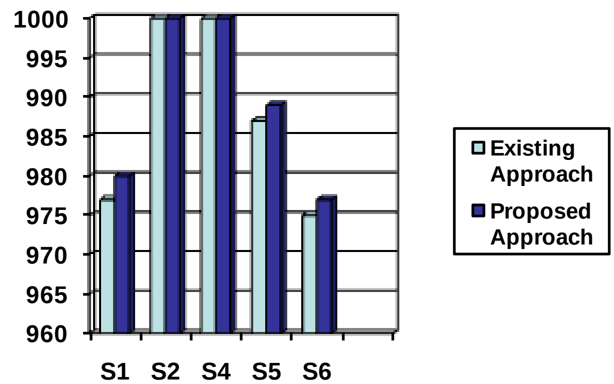
The grid constructed for the proposed system



Query and data forwarding



After the grid is constructed, the whole data forwarding process can be described as follows. The sink floods its query within a cell and only sensors located at grid points need to acquire the forwarding information. When the nearest dissemination node for the requested data receives the query, it forwards the query to its upstream dissemination node toward the source, which in turns further forwards the query, until it reaches either the source or a dissemination node that is already receiving data from the source. This query forwarding process lays information of the path to the sink, to enable data from the source to traverse the same two tiers as the query but in the reverse order.



Grid-based routing algorithms are based on the grid structure. The key problem is how to use the position information to construct and maintain the grid. In different algorithms, the grid is constructed by different sensors (for example, source, sink). Once the grid is constructed, data forwarding can use suitable methods, such as geographical greedy forwarding, curve-based forwarding.

5. CONCLUSION:

Sensor Networks hold a lot of promise in applications where gathering sensing information in remote locations is required. It is an evolving field, which offers scope for a lot of research. Their energy-constrained nature necessitates us to look at more energy efficient design and operation. There are lot of ways and methods to improve the energy level .In this paper we have mainly concentrated on coverage area of the sensor nodes to improve the energy efficiency.

6. REFERENCES

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