Coverage Issues in Wireless Ad-Hoc Sensor Networks

K. Vimala
HOD
Department of Computer Science,
Pavai Arts and Science College for women,
Rasipuram, Namakkal

S. Gayathri
M.Phil., Scholar,
Department of Computer Science,
Pavai Arts and Science College for women,
Rasipuram, Namakkal

V. T. Kruthika
Assistant Professor,
Department of Computer Science,
Pavai Arts and Science College for women,
Rasipuram, Namakkal

ABSTRACT: Wireless Ad-Hoc sensor networks have a broad range of applications in the military,vigilance, environment monitoring, and healthcare fields. Coverage of the sensor networks describes how well an area is monitored. The coverage problem has been studied extensively, especially when combined with connectivity and well-organized. Coverage is a typical problem in the wireless sensor networks to fulfil issued sensing tasks. In general, sensing analysis represents how well an area is monitored by sensors. The quality of the sensor network can be reflected by levels of coverage and connectivity that it offers. The coverage issues have been studied extensively, especially when combined with connectivity and energy efficiency. Constructing a connected fully covered, and energy efficient sensor network is valuable for real world applications due to limited resources of sensor nodes. The survey recent contributions addressing energy efficient coverage problems in the context of static WASNs, networks in which sensor nodes do not move once they are deployed and present in some detail of the algorithms, assumptions, and results. A comprehensive comparison among these approaches is given from perspective of design objectives, assumptions, algorithm attributes and related results.

***Keywords**: wireless ad-hoc network, coverage issues,coverage of wireless Ad-Hoc networks.*

*****

I. INTRODUCTION

Wireless Ad-Hoc Networks are a collection of two or more wireless communications devices with which networking capability. These wireless devices can communicate with other nodes immediately within their radio range or one that is outside their radio range. For the laternodes should deploy an intermediate node to be the router to route the packet from source to destination. The Wireless Ad-Hoc sensor Networks do not have gateway; every node can act as the gateway. Since 1990s, lot of research has been carried out on wireless communication medium. Hence in the 1990s, the concept of commercial Ad-Hoc networks arrived with notebook computers and other viable communications equipment.

To mention only a few examples, now a days wireless users can rely on their cellular phone to check e-mail and browse the Internet; travellers with portable computers can surf the internet at airports, railway stations, cafes, and other public locations; tourists can use Global Positioning System terminals installed inside rental cars to view driving maps and to locate tourist attractions, files or other information can be exchanged by connecting portable computers via Wi-Fi and other wireless technology like Bluetooth and chirping technology in the latest phone of the apple after apple-3 series of company phone. While attending conferences or meetings and celebrating occasions, and at home, a family can synchronize data and transfer files between portable devices and desktops. The cost of the technology downing in the fold, now we can see that the mobile devices getting smaller, cheaper, more convenient, and more powerful, they also run more applications and network services. All of these factors are fuelling the explosive growth of the mobile computing equipment market seen today.

EXISTING RESEARCH ON COVERAGE ISSUES IN WIRELESS SENSOR NETWORKS

As an important research issuedcoverage problem hasbeen studied extensively and many solutions have been proposed.Some solutions focus on pure coverage problems to the characterize coverage of wireless Ad-Hoc sensor networks.Other solutions integrate network connectivity into coverageproblems. Network connectivity indicates whether anytwo nodes in a sensor network can communicate with eachother is necessary for successful data transmission. Algorithms to construct a sensor network with connected coverage are valuable to real world applications. Furthermore, minimizingthe energy consumption to prolong the lifetime of a sensornetwork is considered. Some algorithms and protocols aredesigned to the achieve energy efficiency while maintaining a fullycovered connected wireless Ad-Hoc sensor network. Coverage has been studied extensively in the literature: Areacoverage, where the goal is

ISSN: 2454-4248
20 – 23

to monitor a specified region, has been considered. Target (or point) coverage.

Coverage has been studiedfrom the perspective of maximal support (or breach) path. Deterministic sensor placement allows for the topologyawareof placement and role assignment, where nodes can eithersense or serve as relay nodes. Zhang and Hou show that ifthe communication range of sensors is at least twice as large astheir sensing range, then coverage implies connectivity. Theyalso develop some optimality conditions for sensor placementand develop a distributed algorithm to the approximate thoseconditions, given a random placement of sensors.The notion of classifying sensor nodes into disjoint sets,such that each set can independently ensure coverage andthus could be activated in succession, has been considered.

A similar centralized heuristic for area coverage has been proposed, where the region is divided intomultiple fields such that all points in one field are coveredby the same set of sensors. Then a most-constrained leastconstrainingcoverage heuristic is developed which is empiricallyshown to perform well. Consider connected coverage and provide approximation, algorithms to find one minimal subset of sensornodes to guarantee (k-) coverage and connectivity.

Anintegrated coverage and connectivity framework hasalso been proposed where the goal is to allow configuringdegrees of coverage and to maximize the number ofsensor nodes scheduled to sleep at each stage.

The coverageconfiguration protocol is integrated with SPAN toensure connectivity in the network. However, the authors notethat the network lifetime in such a framework does not scalelinearly with the number of sensing nodes due to exchanges.

Prior work most relevant to our approach,where the network lifetime has been considered, however froma ‘coverage only’ perspective.We constraints for the set of sensors to be disjoint and for these sets to operate forequal time intervals, are relaxed and two heuristics, one usinglinear programming and the other using a greedy approach areproposed and verified using simulation results. However, ourapproach is different since we also take network connectivityinto consideration and abide by the assumption that activesets are disjoint to each other.In general, the sensing and communication range of asensor node may be different and these ranges may also varysignificantly across sensor nodes. For instance, in regions withhigh density of target points, deploying sensor nodes withlarge sensing range might prove beneficial to achieve dataaggregation benefits and better resource utilization. However alarge communication range at sensor nodes would lead to more channel contention and collisions in the wireless network.

Onthe other hand, in a remote region with a few target points,it would be beneficial to deploy sensors with a small sensingrange and a large communication range.Area coverage problem can be approximated by that ofpoint coverage using a minute grid and considering only thosegrid points which belong to the area or region. The level ofapproximation is increased with finer grid. Thus a solution tothe point coverage can be extended to thatof area coverage.

II. PROPOSED METHOD

This section describes the approaches with different design objectives on coverage problem including the scope, assumptions, and algorithms. In authors explain the coverage in sensor networks as, two seemingly contradictory yet related viewpoints of coverage exist: worst and best case coverage. In worst-case coverage attempts are made to quantify and quality of the service by finding areas of lower observe ability from sensor nodes and detecting breach regions. In best-case coverage finding areas of the high observe ability from sensors and identifying in the best support and guidance regions are primary concern.

In this paper, our goal is to maximize the Network Lifetime, where the network lifetime is defined as the time until which both coverage and connectivity requirements are met in the network, and beyond which connected coverage cannot be guaranteed.

Typically sensors would not be subject to recharge in uncontrollable scenarios e.g. disaster management. And the sensor nodes belonging to set of active sensors (active set) would eventually get depleted of their energy content, and would die. At this time another sensors from the set of available sensors would need to be activated.

In the presence of significant temporal correlation in the events occurring at different target points, all the sensor nodes in the active set, which were active during the same time interval, would die together. This would lead to activation of a fresh set of sensor nodes, causing newly formed active set to be disjoint from the previous one. In this way mutually exclusive sets of the sensors would get activated in sequence or rounds. Maximizing network lifetime is equivalent to maximizing the number of such rounds.

Therefore determining the maximum number of disjoint sets of sensors, such that each set can be individually ensure coverage and connectivity (i.e. coverage problem and connectivity problem), serves as an optimal solution towards maximizing network lifetime. If the sensor nodes were rechargeable, maximizing network lifetime would lead to minimal energy consumption at the nodes. And a minimum recharge rate for the sensor nodes could then be computed, which would be sufficient to continuously sustain the network. The main contribution of this paper is to develop an algorithm to compute an energy-efficient solution for the lifetime coverage and connectivity problem in wireless sensor networks. Our approach differs from other relevant approaches in the following aspects:

Formulate a simpler problem of energy-efficient coverage using Linear Programming techniques and utilize the structure of the formulation to develop greedy approaches for the coverage phase.

Consider the feasible set of sensor nodes which can be providing both coverage and connectivity. Each of the sensors can sense as well as relay information. Sensing and communication range of the wireless Ad-hoc sensor are independent.

Propose precise metrics for the performance evaluation and compare our solution with optimal solution and with appropriate bounds.

Address scaling of network lifetime with the number of sensor nodes in network.Note that the scaling of network lifetime while providing connected coverage in wireless sensor networks has not been considered previously.

III. RESEARCH APPROACHES

This paper consists of five main methods. The methods are as follows.

- Data Initiation node,
- End node,
- Network Server,
- Coverage Path,
- Group creation and Network Transmitting

SYSTEM IMPLEMENTATION

Sensors size weight and cost restrictions which impact resource availability. They havelimited battery resources and limited processing and the communication capabilities. As replacingin the battery is not feasible in many applications low power consumption is a critical factor to beconsidered not only in hardware and architectural design but also in the design ofalgorithms and network protocols at all layers of the network architecture. Thereforemaximizing the network lifetime is an important of network design objective.

In order to prolong whole sensor network lifetime and maintain the area coverage problems we should have energy-efficient Coverage Preserving Protocol is select the set of active sensornodes. The protocols are designed to be achieving several purposes and put emphasis on thefollowing main goals:

(a) Detect whether monitoring region is completely covered or not.

(b) Detect the degree of coverage in entire monitoring region.

(c) Minimizing the total number of active sensor nodes.

(d) Diminish to the total amount of energy consumption.

(e) Support an extension to satisfy multiple degree of the coverage requirement.

(f) Support an extension to the realize probabilistic coverage model

(g) Support desired communication/computation power usage ratio

The coverage wireless sensor network algorithm proposed are either *centralized* or *distributed*. In the distributedalgorithm decision process is decentralized. By distributed and localized algorithms werefer to a distributed decision process at the each node that makes use of only neighbourhoodinformation, within a constant number of the hops. Because WASN has been dynamic topology andneeds to accommodate a large number of sensors the algorithms and protocols designed shouldbe distributed and localized in order to better accommodate a scalable architecture.

COVERAGE PROBLEMS

In the most discussed coverage problems in literature can be classified in the following types: areacoverage, point coverage and barrier coverage. Based on the subject to be covered (area versusdiscrete points) different problems can be formulated considering to the following design choices:

Objective of the Problem: Coverage maximum number of sensor network or minimum number ofsensors.

(1) **Random Deployment**: Suppose entire sensor nodes are deployed randomly inregular (rectangle) monitoring region and deployed in the uniform distribution. Inaddition all nodes are the static without any moving.

(2) **Location Information Known**: Each sensor node known its own location e.g. throughGPS technique or other localization protocols and each node exchanges ownlocation information with in the 1-hop neighbouring nodes.

(3) **Uniform Power Decay**: Every node is expected to uniform node lifetime, and power decline also uniformly with time.

IV. CONCLUSION AND FUTURE WORK

Coverage and connectivity problem is importantfor characterizing the QoS of wireless sensor networks. Ascheduling mechanism is the frequently used to configure anenergy efficient, fully covered, and connected wireless sensornetworks. The principle of algorithms is scheduling aminimum number of sensor nodes to cover the monitored area.In addition distributed and localized algorithm outperformsa centralized algorithm in energy conservation due to lessmessage transmissions.We evaluated the performance of cooperative transmission nodes in a sending cluster are synchronized to communicate a packet to nodes in a receiving cluster. In our communication models power of the received signal at each node of receiving cluster is a

ISSN: 2454-4248
20 – 23

sum of powers of transmitted independent signals of the nodes in sending cluster. The increased power of the received signals the traditional single-node-to-single-node communication leads to overall saving in the network energy and to end-to-end robustness to data loss.

REFERENCES

[1]. I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci. Wireless sensor networks: A survey. Computer Networks, 38(4):393-422, March 2002.

[2]. Khaled M. Alzoubi,Peng-Jun Wan, and OphirFrieder “Distributed Heuristics for Connected Dominating Sets in Wireless Ad Hoc Networks”, 2004.

[3]. J. Wu and H. Li “ On calculating connected dominating sets for efficient routing in ad hoc wireless networks”,2001.

[4]. MihaelaCardei, Ding-Zhu Du“Improving Wireless Sensor Network Lifetime through Power Aware Organization”2002

[5]. Fei Dai and Jie Wu “An Extended Localized Algorithm for Connected Dominating Set Formation in Ad Hoc Wireless Networks”, 2001.