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Implementation on Maximizing Network Topology Lifetime using Mobile Node Rotation

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Abstract: Wireless sensor network (WSN) is facing key challenges like extending network lifetime due to sensor nodes having limited power supplies. Extending WSN lifetime is complicated because nodes often experience differential power consumption. For example, nodes closer to the sink in a given routing topology transmit more data and thus consume power more rapidly than nodes farther from the sink. Inspired by the huddling behavior of emperor penguins where the penguins take turns on the cold extremities of a penguin "huddle", we propose mobile node rotation, a new method for using low-cost mobile sensor nodes to address differential power consumption and extend WSN lifetime. Specifically, we propose to rotate the nodes through the high power consumption locations. We propose efficient algorithms for single and multiple rounds of rotations.

***Keywords**— Wireless sensor networks, network lifetime, energy optimization, mobile nodes, voronoi clustering technique, wireless routing*.

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I. INTRODUCTION

A wireless sensor network (WSN) is made up of tens to thousands of interconnected sensors that are randomly or deterministically deployed in a field of interest to monitor various environmental changes such as light, temperature, air pressure. Recent years have witnessed successful real-world deployments of wireless sensor networks (WSNs) in a wide range of civil and military applications. Sensing coverage and network connectivity are two of the most fundamental issues to ensure effective environmental sensing and robust data communication in a WSN application.

This paper presents fundamental studies on the sensing coverage and the network connectivity from mathematical modeling, theoretical analysis, and performance evaluation perspectives. Both lattice WSNs that follow a pattern-based deployment strategy and random WSNs that follow a random deployment strategy are considered. The aim of this chapter is to deliver a systematic study on the fundamental problems in WSNs and provide guidelines in selecting critical network parameters for WSN design and implementation in practice.

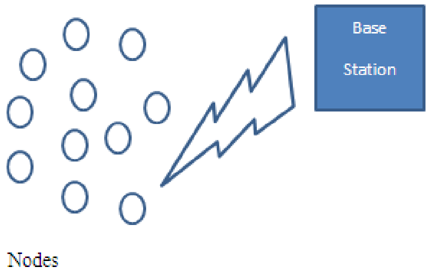

Fig. 1 Wireless Sensor Network(WSN)

II. LITERATURE SURVEY

Several approaches have been proposed for extending the lifetime of a network. In general, they can be classified into four main groups: duty cycling, data reduction, topology control and controlled mobility. In duty cycling approaches nodes alternate turning their power on and off and save their energy when they are turned off. In data reduction approaches, nodes reduce the amount of data that they generate and/or transmit and consequently reduce the energy consumed by the radio component. In topology control approaches, the main idea is to reduce the energy consumption by reducing the initial topology of the network. In this we reduce the transmission power to the minimum levels needed while keeping connectivity. In cluster based topologies are proposed. In contrast with our approach where nodes perform a physical rotation, cluster based approaches perform role rotation where nodes switch between cluster head and cluster member. The last scheme for extending the lifetime is through controlled mobility. These approaches include mobile base stations, data mules, and mobile relays. In mobile station approaches, a powerful mobile base station node moves around the WSN and collects data from other nodes through one or multiple hops transmissions. Similar to base station approaches, these approaches incur high latencies since nodes have to wait for a mule to pass by to transmit the data. In mobile relay approaches the mobile nodes in the network relocate to different positions to reduce the communication distances between nodes. Our approach shows several advantages over existing approaches. First, our simulations in Section 8 show that our approach significantly outperforms previous approaches in increasing network lifetime.

Problem Formulation

A wireless sensor network (WSN) is made up of tens to thousands of interconnected sensors thatare randomlyordeterministically deployed in a field of interest to monitor various environmental changes such as light, temperature, air pressure.

In a WSN, every sensor has a limited sensing range, denoted as rs, and a limitedcommunication range, denoted as rc. The union of the sensing ranges of all sensorsis defined as the network sensing coverage, which reflects how well the area ofsensor field is monitored.

In addition, to communicate successfully, a WSN mustprovide satisfactory network connectivity, so as to eliminate the isolation of sensorsand enable each sensor to report its sensing data to its fusion center. In order tounderstand the sensing coverage and network connectivity in a WSN, severalfundamental models including network deployment

model, sensing model, andcommunication model must be introduced.

Objective

We will present the analysis on sensing coverage, connectivity, and connected coverage for lattice WSNs following pattern-based deployment strategy and a random deployment strategy, respectively.

Toimproves the energy efficiency of the node.

To increase the system efficiency and make sure entire network is covered.

Our main objective is to improve the lifetime of the network by reducing this area, and making sure that the entire network is covered at the same time.

It will also improve the energy efficiency of the node, and thereby improve the lifetime of the network.

III. PROPOSED METHODOLOGY

The main contributions of this project are as follows:

Our motivation is to improve the lifetime of the network by reducing this area, and making sure that the entire network is covered at the same time.

To do this, we will be using **VORONOI**clustering. The **VORONOI** clustering technique will first divide the nodes into clusters.

Each cluster node will have the responsibility to cover only the area inside the cluster, which will reduce the network's dependency on the node to cover the area.

Thereby, if the node was covering the full area before, it needs to cover less than half of the area now. This will improve the energy efficiency of the node, and thereby improve the lifetime of the network.

Voronoi Clustering

Although MST-based clustering methods are effective for complex data, they require quadratic computational time which is high for large number of data points. Hence, we have researched on another neighborhood graph called Voronoi diagram that has less computational cost over MST. In this chapter, we propose three clustering algorithms using the features of Voronoi edges, vertices and circles. Experiments carried out on various two-dimensional synthetic and multi-dimensional biological data are compared with few existing techniques to show the effectiveness of the three proposed algorithms.

Delaunay Triangulation

In mathematics and computational geometry, a **Delaunay triangulation** (also known as a **Delone triangulation**) for a given set **P** of discrete points in a plane is a triangulation DT(**P**) such that no point in **P** is inside the circumcircle of any triangle in DT(**P**). Delaunay triangulations maximize the minimum angle of all the angles of the triangles in the triangulation; they tend to avoid sliver triangles. The triangulation is named after Boris Delaunay for his work on this topic from 1934.

Delaunay Triangulation Relationship withVoronoi Diagram

The Delaunay triangulation of a discrete point set **P** in general position corresponds to the dual graph of the Voronoi diagram for **P**. Special cases include the existence of three points on a line and four points on circle.

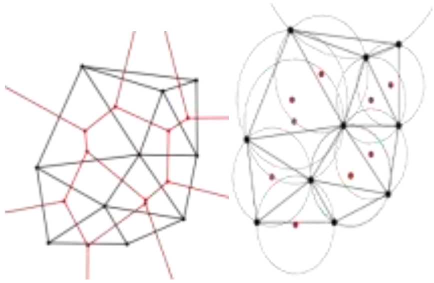

Figure 1.3DelaunayTriangulation Connecting With Voronoi Diagram

Modules

Module 1:-Network Formation

Network formation is an aspect of network science that seeks to model how a network evolves by identifying which factors affect its structure and how these mechanisms operate. Network formation hypotheses are tested by using either a dynamic model with an increasing network size or by making an agent-based model to determine which network structure is the equilibrium in a fixed-size network. A strategic network formation requires that individuals create relations that are beneficial and drop those that are not. One of the most well-known examples in this context is the marriage network of sixteen families in Florence, which showed how the Medici family gained power and took control of Florence by creating a high number of inter-marriages with the other families.

Module 2:-Evaluation of One Hop NeighborFor Each Node

In the network, the sensors will be deployed on a large area and the data collected by the sensor has to be transmitted from the source to the sink with maximum accuracy and least power consumption. Since recharging of power sources of the nodes is intricate, there should be a proficient energy cutback mechanism. On the other hand, for successful communication of sensor nodes in multihop sensor networks the discovery of neighbornodes is indispensable. Thenode in the network acts as routers, which transmits data packets from one neighboring node to another. Most of the sensor networks consist of both static and mobile nodes. Many approaches have been proposed recently for neighbor node discovery. But they are not capable to muddle through the tribulations like frequent addition of new nodes, loss of wireless connectivity, augment in transmission power etc. The most essential prerequisite of a wireless network is efficient routing of information from a source to the desired destination.

Module 3:-Evaluation of Two Hop Neighbor for Each Node

Ad hoc networks have received a lot of attention as inter-vehicular communications ortemporary networks in natural disasters. In ad hoc networks, every node to compose a network builds a multi-hop wireless network without an infrastructure such as a Wi-Fi access point. Therefore, a routing protocol is necessary to deliver a packet autonomously and effectively in the multi-hop wireless network. In order to prevent wasting communication resources, routing protocols using directional antennas are proposed. Because these protocols can utilize a direction of neighbor and destination nodes, they are possible to reduce redundant traffic by controlling propagation direction of a packet based on the positional relation among nodes.

Module 4:-Implementation ofVoronoi Triangulation and Improving Using Delaunoi Triangulation

For a set **P** of points in the (*d*-dimensional) Euclidean space, a **Delaunay triangulation** is a triangulation DT(**P**) such that no point in **P** is inside the circum-hyper sphere of any *d*-simplex in DT(**P**). It is known[1] that there exists a unique Delaunay triangulation for **P** if **P** is a set of points in *general position*; that is, the affine hull of **P** is *d*-dimensional and no set of $d + 2$ points in **P** lie on the boundary of a ball whose interior does not intersect **P**.

The problem of finding the Delaunay triangulation of a set of points in *d*-dimensional Euclidean space can be converted to the problem of finding the convex hull of a set of points in $(d + 1)$-dimensional space, by giving each point *p* an extra coordinate equal to $|p|^2$, taking the bottom side of the convex hull, and mapping back to *d*-dimensional space by deleting the last coordinate. As the convex hull is unique, so is the triangulation, assuming all facets of the convex hull are surplices. Non simplified facets only occur when $d + 2$ of the original points lie on the same *d*-hyper sphere, i.e., the points are not in general position.

Module 5:-Evaluation and Comparison

Comparison between voronoi and delaunoi triangulations is the Delaunay triangulation of a discrete point set **P** in general position corresponds to the dual graph of the Voronoi diagram for **P**. Special cases include the existence of three points on a line and four points on circle.

Output

Figure:- Network Formation

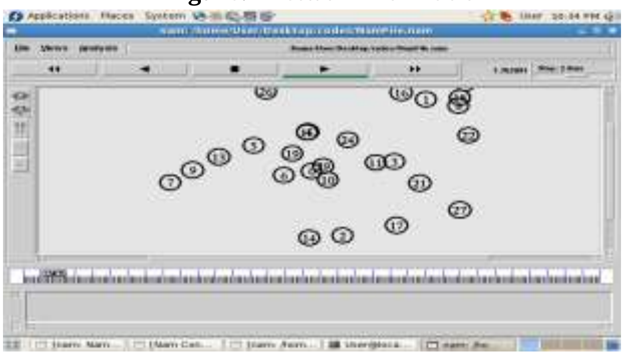

Figure :-Network Formation

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Figure :-Evaluation of One Hop Neighbor for Each Node

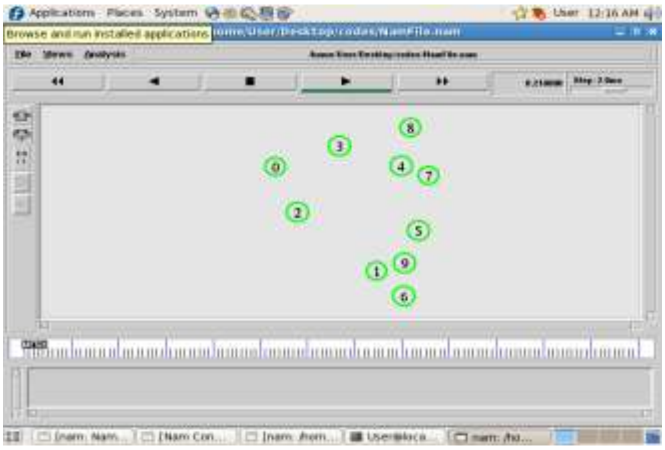

Figure :-Implementation Of Voronoi Traingulation And Improving Using Delaunoi Triangulation

IV. CONCLUSION

In this paper, we present a new node rotation paradigm for maximizing the lifetime of mobile WSNs. Our approach exploits the mobility of nodes to mitigate differential power consumption by having nodes take turns in high power consumption positions without modifying the existing topology. Our node rotation approach is very different than other schemes such as data mules in that all nodes expend relatively little energy on movement and move only a few times during the network lifetime.

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