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Deployment of Wireless Sensor Nodes Using Voronoi Diagram

Ankita Dhiman, Sandeep Singh Kang

Department of Computer Science

Punjab Technical University

India

Abstract— A wireless sensor network is a network which consists of a number of sensor nodes that are wirelessly connected to each other and can communicate in short distances. WSN's are being used in many applications like health monitoring, military purposes, and home automation. So, area coverage problem is nowadays an important factor due to variety of applications of WSN. The VORONOI Diagram (VD) is a fundamental algorithm for resolving the coverage problems of wireless sensor networks. Most VD based coverage algorithms collect global location information and construct a VD using a centralized construction algorithm. However, the collection process of global location information is expensive and cannot be guaranteed in all scenarios. Based on a localized VD construction algorithm this paper proposed region coverage algorithm and their overall analysis over different factors. The performance of such algorithms is evaluated by the throughput and energy consumption through the set of simulation experiment. The result show that the comparative view for proposed algorithms.

Keywords-Wireless Sensor Network ;VORONOI Protocol; Energy; VORONOI Diagram

I. INTRODUCTION

Wireless networks are networks which provide users with connectivity regardless of their actual physical location. WSN's (Wireless sensor Networks) are a new type of networked systems, characterized by severely constrained computational and energy resources, and an ad hoc operational environment. The coverage problem of wireless sensor networks is an area that has been researched considerably over the past few years. They have characteristics that are unique to them,such as the ability to withstand unfavourable environmental conditions, path planning , communication failures, large scale of deployment, scalable node capacity, node mobility, unattended operation as well as limited power, to name a few. that act as a gateway between the sensor nodes and the end user. The energy source of sensor nodes in wireless sensor networks (WSN) is usually powered by battery, which is undesirable, even impossible to be recharged or replaced. Therefore, improving the energy efficiency, throughput and minimizing the message overhead are the major challenges in sensor networks.

The assignment of routing protocol is to establish routing between sensor node and sink node, and send reliable data. Here, we use Robot, obstacles and Goal. The original intention of the proposed routing protocol VORONOI is to resolve the energy exhausting about routing protocol in WSN and also improve and compare their results by using different algorithms for requisite metrics used. This paper review the performance of two algorithms for generating VORONOI diagram and compare their results on the basis of requisite metrics like throughput and also improves the broadcasting nature of the simulation by using Euclidean distance and improves the area coverage through path planning. Furthermore, we have to work over one more parameter energy consumption for the associated algorithms in the next publication for the requisite one.

II. VORONOI ROUTNG PROTOCOL & VORONOI DIAGRAM

The VORONOI diagram itself is named after Greogry VORONOI who was a German mathematician. In 1908, VORONOI formalized the n dimensional case for the concept by which we now know as VORONOI diagrams. In short, a VORONOI diagram records information about the distances between sets of points in any dimensional space. For path planning, VORONOI tends to be used in two dimensional space, where sets of points all lie within a plane. As seen from the figure above, a plane is divided into cells so that each cell contains exactly one site. For every point in the cell, the Euclidean distance of the point to the site within the cell, must be smaller than the distance of that point to any other site in the plane.

As stated earlier, VORONOI diagrams can also be used for path planning. Imagine you have a robot that needs to move through a cluttered room without hitting any objects.

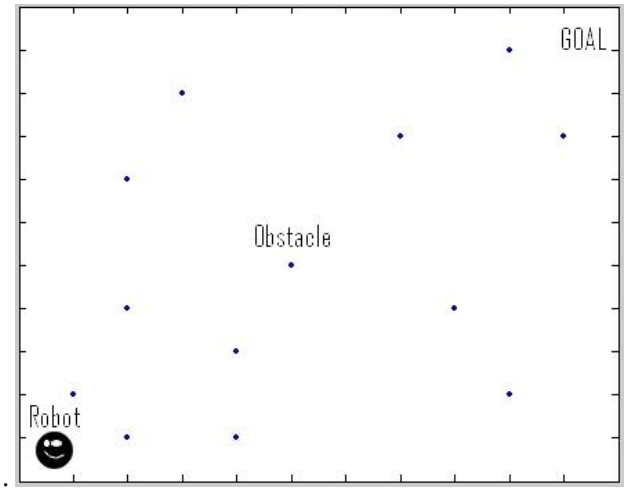

Figure 1 VORONOI Diagram

The safest route would have the robot move in a path such that it is as far away from the nearest obstacles as possible.
The VORONOI Diagram (VD) is a fundamental algorithm for resolving the coverage problems of wireless sensor networks

III. PROPOSED SCHEME FOR IMPLEMENTING VORONOI DIAGRAM AND COMPARE THE RESULTS FOR DIFFRENT PROPOSED ALGORITHM

In this, we will compare the two algorithm for implementing VORONOI diagram or VORONOI protocol compare their results on the basis of area coverage problem and broadcasting nature.
We start the procedure by adding energy aware VORONOI protocol on the wireless sensor network (WSN's) in the NS2. In this a group of mobile nodes are created. One of node is elected as ROBOT. The ROBOT node moves and go towards the destination range for every obstacles one by one, collect the valuable and authenticated data in the form of packets and further moves towards the other node or obstacles for continuing the procedure. Nodes with minimum packet drops are chosen as trust nodes and it is more reliable for data sharing. In this simulation carried out for in accordance to implement the actual way of VORONOI protocol. The scripts consists of a ROBOT(source node), Goal(destination node) and sets of obstacles in which the source node moves towards the each obstacles one by one in the communication range according to their coverage area and share their information as per applicable if the data is unauthenticated then the packets will be drop as per reducing overhead or increasing throughput value and finally reached towards the GOAL(destination node).
Here, we also randomly declare the associated distance value for every obstacles and supporting nodes. The simulation is actually carried out to demonstrate and compare the results for propose two algorithms namely divide and conquer and incremental algorithm on the basis of performance analysis as per their area coverage for the appropriate broadcasting or communication and gives their specific results. Moreover, we compare the results for both algorithm using same deployment scripts with difference in their algorithm nature and get their results according to their performing nature.

Divide and conquer algorithms:-

1.The set of point generators, P, is split by a dividing line into subsets L and R of about the same size.
2.The Voronoi diagrams Vor (L)

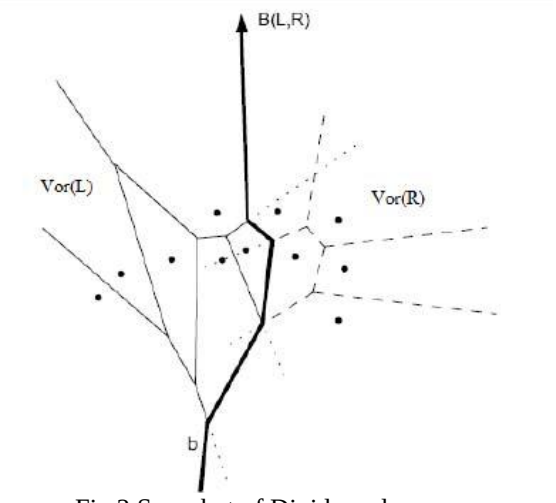

Fig.2.Snapshot of Divide and conquer

Properties of divide-and-conquer algorithms

1.Implementation details are somewhat complicated

2.Numerical errors are likely by construction

3.The average and worst case time complexity is (nlog n) and it is possible to achieve better performance using other methods.

.***Incremental algorithms:-***

Properties of incremental algorithms

1. As the region of q can have up to n - 1 edges, for n = |P|, this leads to a runtime of O (n2).Several authors have further tuned the technique of inserting Voronoi regions, producing efficient and numerically robust algorithms that have average time complexity of O (n).

2. The implementation of incremental algorithms is simple compared to other techniques

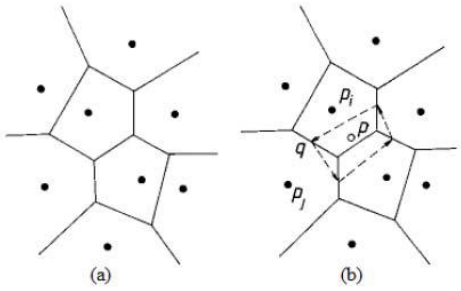

Fig.3.Obtain Vor (P) from Vor (P - {q}) by inserting the site

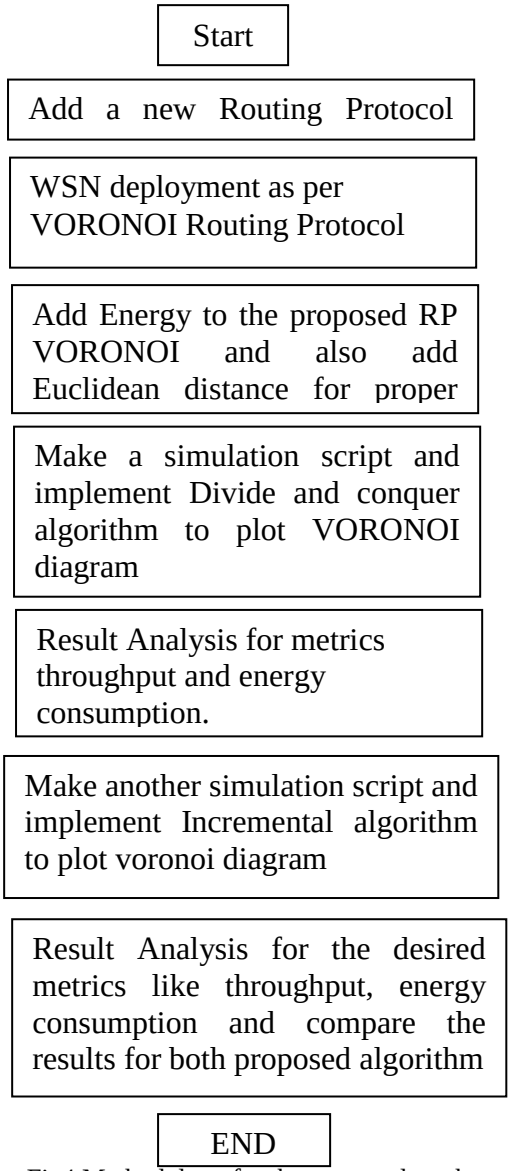

Fig4.Methodology for the proposed work

IV. SIMULATION AND PERFORMANCE ANALYSIS

We use NS-2 simulation to carry out simulation. NS-2 is an event-driven tool useful in studying the dynamic nature of computer network. It provide the simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP). In general, NS2 provides users with a way of specifying such network protocols and simulating their corresponding behaviours.

Parameter	Values
Simulator	NS-2
Simulation Duration	150 sec
Topology	2500 meter X 2500 meter
No. Of nodes	50
Traffic type	FTP (TCP)
Routing protocol	VORONOI

Channel Type	Wireless Channel
Mobility Model	Two Ray Ground Propagation Model
Network Interface Type	Wireless Phy IEEE 802.11

Parameters Used for Comparison

Throughput: is the average rate of successful message or packet delivered over a communication channel. The throughput is measured in kilo bits per second (kbps or kbit/s). Greater the value of throughput means better the performance of the protocol.

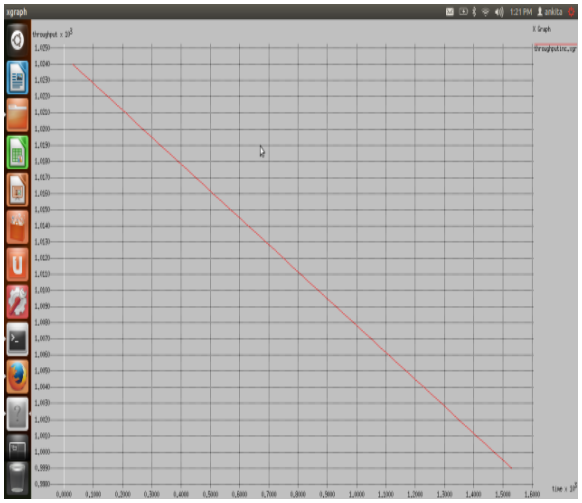

Fig5: Throughput for Incremental Algorithm

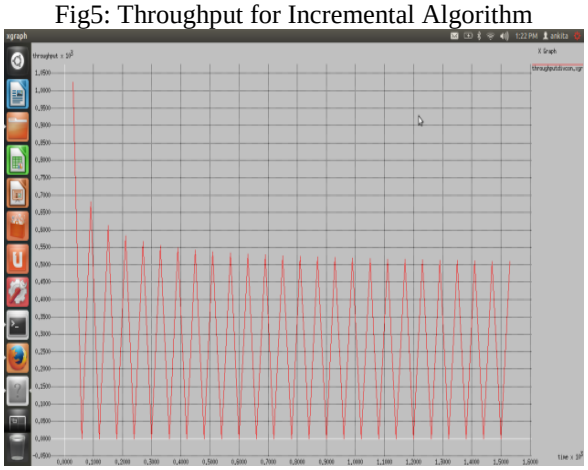

Fig 6: Throughput for Divide and Conquer Algorithm

V. CONCLUSIONS

Our work is totally based over comparing the results of two algorithms for implementing VORONOI diagram or protocol. The results clearly concluded that the throughput obtained by using incremental algorithm for VORONOI protocol is quiet better and optimist as compare to the divide and conquer algorithm. Furthermore, we also concluded more by comparing our algorithm results through some more parameters like energy consumption etc in the next version. Moreover, there is also need to improve the results by using some more different parameters like end to end delay and also need to compare the results by somehow means of adding any attack for both algorithms and their results analysis.

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REFERENCES

[1] Akyildiz, W.Su, Y.Sankarasubramaniam, and E. Cayirci, *"Wireless sensor networks: a survey,"* in Computer Networks. vol. 38, pp. 393-422, IEEE 2002.

[2] Nirav Patel, "VORONOI Diagrams Robust and efficient implementation", IEEE MAY 2005

[3] J Lopez "Analysis of security threats requirements, technologies and standards in wireless sensor networks" Springer, 2009

[4] Meysam Argany, Mir Abolfazl Mostafavi,Farid Karimipour,"Voronoi-based Approaches for Geosensor Networks Coverage Determination and Optimization: A Survey", International Symposium on Voronoi Diagrams in Science and Engineering 2010.

[5] Nadjib Aitsaadi, Nadjib Achir, Khaled Boussetta and Guy Pujolle Multi-Objective WSN Deployment: Quality of Monitoring, Connectivity and Lifetime, Institute Galil´ee – University of Paris 13,99 Avenue J-B Cl´ement, 93430 Villetaneuse, France.IEEE proceedings, 2010.

[6] Ms.Mitali R. Ingle, "An Energy Efficient Deployment of Nodes in Wireless Sensor Network using Voronoi Diagram", IEEE 2011

