STATEMENT OF RESEARCH (MAXIMUM AREA COVERAGE)

ADITYA CHAUHAN chauhanaditya3628@gmail.com

INTRODUCTION

Maximising the area has a huge application in sensor field. This is problem based on static model of sensor and this problem is solved based on computational geometry where points are available in 2-D plane and task is to find disjoint circles around those points in order to maximise the area.

Since this problem does not have a well defined mathematical model related to it and there have been very little research on static sensors in retrospect to this model the solution proposed in this problem is an approximate method with a valid mathematical backbone to it. This method is a greedy approach based on completely valid theoretical development.

The results obtained in this method are not sure to be optimal as there is no pre designed method to calculate or no pre defined research done on these calculation but we used the concept of finding the Local maximum between two points. Thus giving a theoretical advantage that area received as an output is maximum.

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RELATED WORK

Previous work done on similar kind of problem based on static sensors is done by *Xiaoli Wang* and *Chenyu Min* [1] on Optimal Coverage with Reliability Using Static Sensor Networks. They used a multi agent system to cover up the ground like mobile sensors with several advantages like anti-interference and environment suitability. Apart from that most of the research done on static sensors is done in accordance with mobile sensors to get better results and increase efficiency of algorithm and computation of the problem.

There have been extensive research on probabilistic sensors by *Anxing Shan , Xianghua Xu* and *Zongmao Cheng* [2]. Than algorithm to maximise the covered area by *Weilin Wang* and *Stephane Lafortune* [3] using mobile sensor. Another by *Jun Lu* and *Tatsuya Suda* [4] on Differentiated Surveillance for Static and Random Mobile Sensor Networks.

There was one research method used by *Farhad Nematy* and *Naeim Rahmani* [4] to use Voronoi diagram and genetic algorithm to find maximum coverage using wireless sensor network. All these methods along with one of our is used extensively to prove the wide range application of static sensors. And these wide range application and limited work in this area is the motivation behind this project.

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METHODOLOGY

I. ALGORITHM

- For each point, sort distances to other points.
- Find Max of all the min distances.
- Choose vertex with max min distance and draw the circle with radius value obtained.
- Decrement distance of this vertex from other vertices.
- Remove this vertex from vertex set.
- Continue until vertex set is empty.

II. PSEUDO CODE

```
V = {v1, v2 ..... vn}                    // Set of n points in a plane
E = {E(v1), E(v2), ......., E(vn)}
/* Set of distances from each point to each other point*/
E(vi) = {ei1, ei2, .....}                // set of distance from vi to remaining vn-i points

For(each vi ∈ V){
        Sort E(vi) in increasing order;
        /* for each vertex sort distances from other vertex */
        Find Max(E(vi)[0]); ∀ n ≥ i ≥ 1  // find maximum of all min distance

        Choose vi with Max(E(vi)[0]) and draw circle with radius as that distance.

        Decrement this distance from other vertices.

        Remove vi
}
Repeat this untill V is empty.
```

Time Complexity : $n(n^2 \log n + n^2)$

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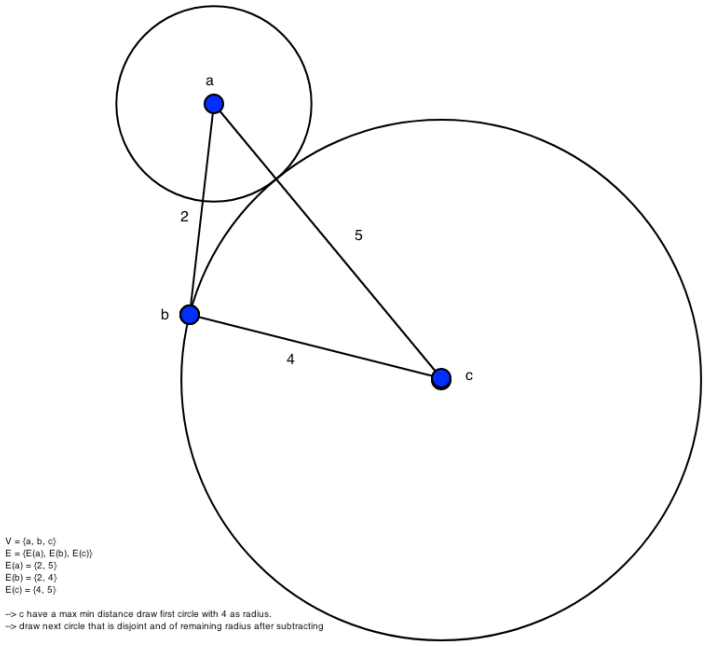
RESULT

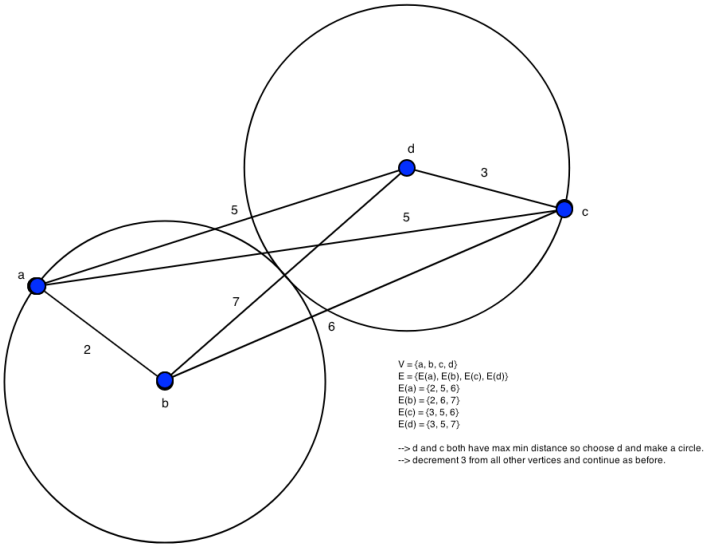
There are two instances given below in which circle denotes the max area that can be drawn around that point in order to maximise the area. As there is no mathematical method for this kind of problem all the calculations are validated according to the algorithm devised in methodology section above.

- **INSTANCE 1**



OUTPUT : 17π

- **INSTANCE 2**



OUTPUT : 13π

REFERENCES

[1] Wang, X., & Min, C. (n.d.). Optimal Coverage with Reliability Using Static Sensor Networks.

[2]Shan, A., Xu, X., & Cheng, Z. (2016, August). Target Coverage in Wireless Sensor Networks with Probabilistic Sensors. Sensors(Basel) .

[3]Wang, W., & Lafortune, S. (2008, June). An algorithm for maximising covered area.

[4]Jun Lu, T. S. (n.d.). Differentiated Surveillance for Static and Random Mobile Sensor Networks.

[5]Nematy, F., & Rahmani, N. (2013, March). Using Voronoi Diagram and Genetic Algorithm to Deploy Nodes in Wireless Sensor Network. The International Journal of Soft Computing and Software Engineering [JSCSE] .

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