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Strategy of Heterogeneous Wireless Access Points Using Concentration Heuristics Algorithm

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Abstract—**In the real world Wireless LAN environment Wireless Access Points are placed instinctively depending on the knowledge or skill gained over time of person installing.This often results in to space or coverage holes. In this paper techniques are used to position the access points at optimum locations which will be working at optimal power using concentration heuristics algorithm.. In this paper single channel is used to find optimal position and optimal power levels.**

Keywords— AP(Access Points), Heuristics, Radius, Algorithm

I.INTRODUCTION

Wireless LANs are operated in the unlicensed frequency bands. These days wireless LANs can be commonly seen at homes. Since these net- works are often deployed spontaneously and in adhoc manner, they often leads to coverage gaps or holes and also large interference due to overlapping of several networks. In this paper algorithms are used to minimize interference between two access points and to cover gaps and holes which work at optimum power levels. Matlab is used to solve the algo.

Power wastage is due to two reasons:

- Neighbouring Access Points causing interference.
- Wireless Access points default settings led them to work at their full power rather than their required radio ranges.

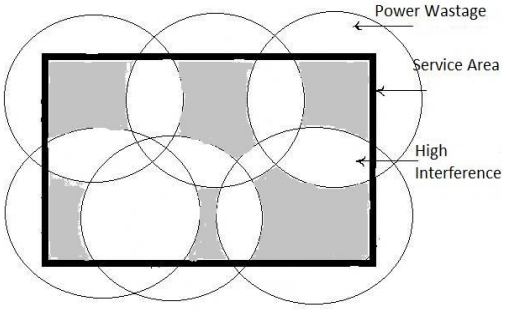

Fig:1

II. EXPERIMENTAL SETUP

A.Concentration Based Heuristics and its Comparison with Other Heuristics

Assuming single channel and known Access Points location, an algorithm to find optimal power level based on Wireless Access point's level of density in its neighborhood is proposed and implemented. The variable increment of every Access point based on heuristics is compared with fixed increments of radius of each Access point under different conditions.

The algorithm is further modified to optimal versions, namely

- Concentration Heuristics Min
- Concentration Heuristics Max

Mat-lab is used for performing and checking experiments. Geometrically two type of service areas are considered i.e concave and convex, but we assume our service area to be of convex shape, mostly rectangle or square shaped. Service area is divided into two dimensional grid points of one unit each. Area is directly proportional to grid points and can be set accordingly. Wireless Access point radius is assumed to vary from zero to predefined maximum radius.

B.Fitness Function

The aim of fitness function will be

- Minimizing interference
- Maximizing the coverage area
- Minimizing the total power consumption

Mathematically, fitness can be defined as

Fitness, F = Total grid points covered - $k\sum r_i$

where r_i is radius of Access Point i and k is a constant

More the fitness function, better the proposed solution.

C. Concentration Based Heuristics

Assuming single channel and known Access Points location, an algorithm to find optimal power level based on Wireless Access point's level of density in its neighborhood is proposed. It distinguishes between low density, when neighborhood of Wireless Access Point is sparsely populated with other Access points and high density, when neighborhood of Wireless Access Point is densely populated with other Access points. To understand the concept, consider the following scenario.

In this scenario, current access point is considered to be of low density because access points are at larger distance from it. See Figure 2. Thus ideally or most of time, its optimal power level or radius will be near maximum level. Thus it will be safe to assume that we can increase the radius in bigger jumps defined as delta radius and check whether this is leading to increase in overall fitness and coverage of the service area. We can keep on doing that till the radius, where we can no longer increase the fitness further. This solution will be better than a solution in which we increase the radius in small increments and check for increase in fitness because it will lead to more iterations per access points.

Thus if density is less, increase in power level should be more at each iteration.

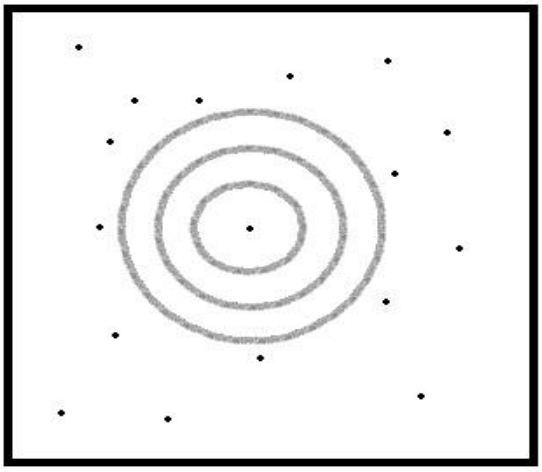

Fig:2 Low Density Scenario

In this scenario, current access point is considered to be of high density due to access points being at closer distance from it. See Figure 3. Thus ideally or most of time, its optimal power level or radius will be near minimum level. Thus it will be safe to assume that we can increase the radius in smaller jumps defined as delta radius and check whether this is leading to increase in overall fitness and coverage of the service area. We can keep on doing that till the radius, where we can no longer increase the fitness further.

Thus if density is more, increase in power level should be less at each iteration

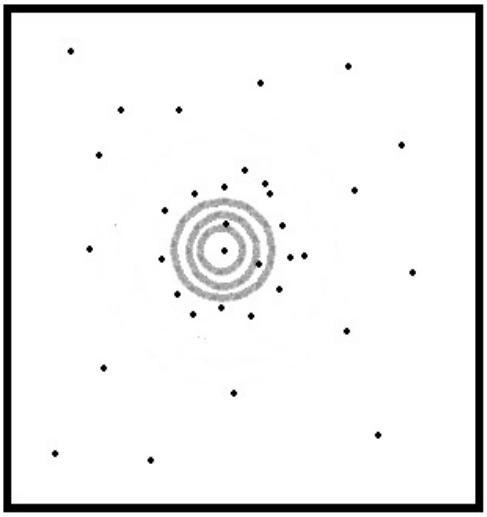

Fig:3 High Density Scenario

C. Concentration Based Heuristic

Pseudo Code

The pseudo code for concentration heuristics can be written as

- .At each iteration, calculate the new radius of each AP i by adding product Of Delta and maximum radius.
- $New\_radius_i = old\_radius_i + Delta_i * Max$
  - $Radius_i$ for each AP i.
- Calculate for which AP,more fitness is gained.
- If there is no AP for which fitness is gained,
- stop else go to step 5.
- Set the new radius for AP which had given maximum fitness.
- Repeat the process.

III.RESULTS

A. Concentration Heuristics and Comparison with Fixed Increase in Power Level

Concentration Heuristics works with

variable increments of Access points depending upon density of that access points with its neighboring access points. Hence we compare it with fixed increments of all access points. We used different increments for our comparison. It is observed that small fixed increments will lead to more iterations whereas big fixed increments will lead to less iterations. We may intuitively feel that small fixed increments will give better results but the problem is that in case of small increments, it may stop at local decrease in fitness, due to neighboring access points. Hence Concentration Heuristics will mostly per - form better than it. The only case when Bigger fixed increments will be comparable to Concentration Heuristics, is when an optimal solution exist where most of the access points will be working at full power.

Here the four access points are packed closely and will interfere with each other. See Figure 4.

If a optimal solution exist where some APs will be redundant and other

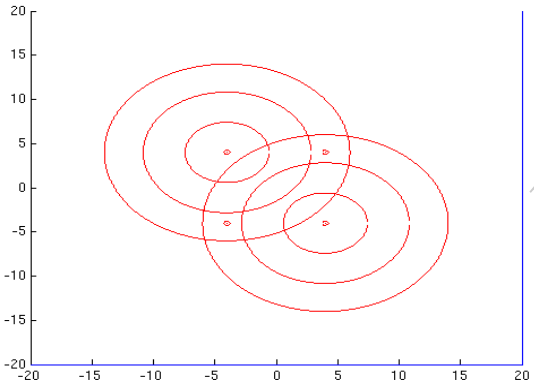

Fig: 4: 4 WAPs: Concentration Heuristics

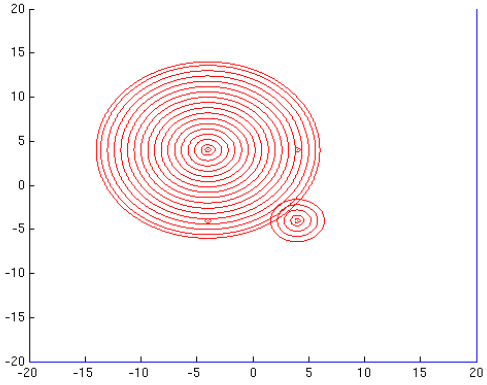

Fig 5: 4 WAPs: 12% of Maximum Radius

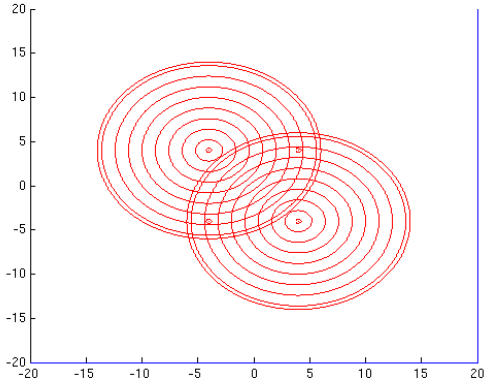

Fig 6: 4 WAPs: 12% of Maximum Radius

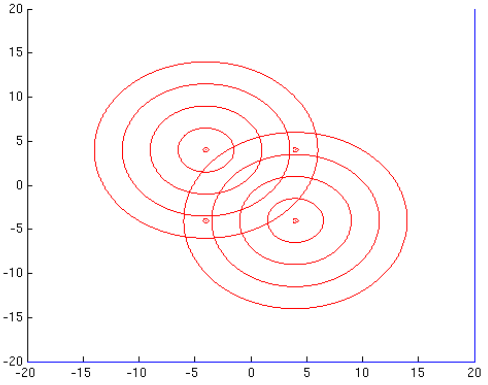

Fig 7: 4 WAPs: 25 % of Maximum Radius

Method used	Fitness Achieved	Iterations
Concentration Heuristics	4 3 2	7
6% of Maximum Radius	347	22
12 % of Maximum Radius	432	19
25 % of Maximum Radius	432	9

Table 1: Fitness Comparison of Concentration Heuristics with Fixed increments

IV.CONCLUSIONS

We applied Concentration Heuristics and optimized it further to give an optimal solution. We checked the results increasingly starting from One Wireless Access Point to any number of Access Points. We conclude that results were optimal for them. We conclude that we have been able to find optimal algorithm for single channel but need a better algorithm for multiple channels.

V.FUTURE WORK

In this paper we find the optimal solution using heuristics algorithm where we know the position of access points but we can also use further algorithum where we don't know the position of access points.

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