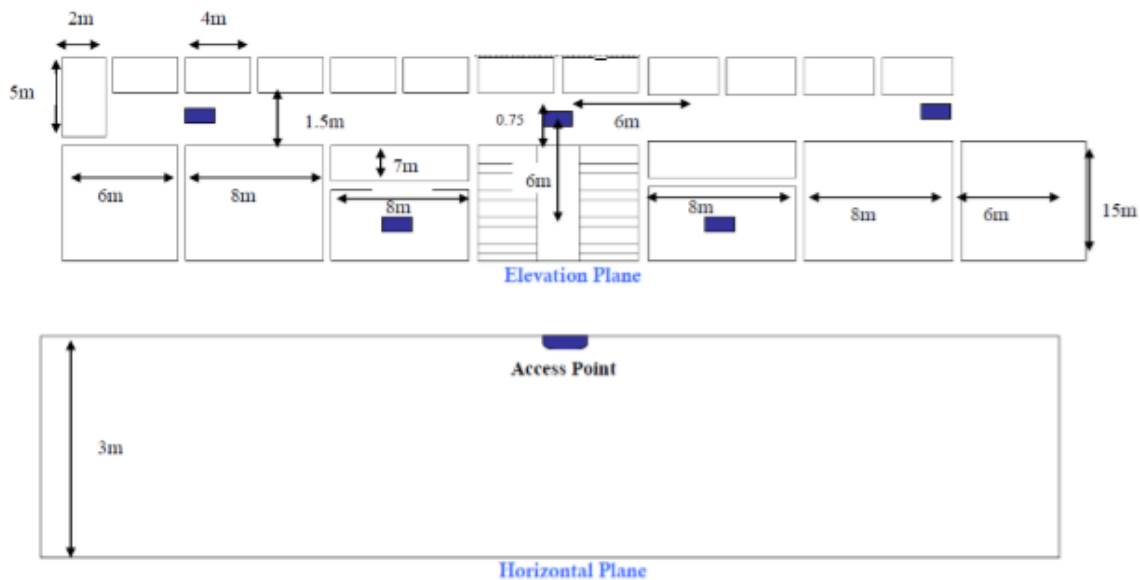


## Mobile Communication Networks [NETW 705]

### Project

*Deadline 23-12-2021*

*Evaluations in the week starting 25-12-2021*



The above is 2nd floor C3 building in GUC; which is Indoor covered by 5 WLAN Access Points (AP). Partition Attenuation Factor (PAF) = 3 dB per wall. The stairs impact on the wireless channel can be neglected. The AP transmission power is 20 dBm. Free space path loss is assumed for channel characteristics with factor =3. Grx and Gtx are unity gains. The carrier frequency ( $f_c$ ) = 2.4GHz.

Given below the x and y coordinates for the locations of the Aps and the Walls.

Theses coordinates can be used to calculate how many walls intersect the path between the user and the access points.

```
AP1 = [6,15.5625];
AP2 = [17.5,4];
AP3 = [25.5,15.5625];
AP4 = [33.5,4];
AP5 = [45,15.5625];
```

```
Walls=
[0,0,6,15;6,0,8,15;14,0,8,8;14,8,8,7;22,0,3,15;25,0,2,15;27,0,3,15;30,0,8,8;3
0,8,8,7;38,0,8,15;46,0,6,15;0,15,2,5;2,16.5,4,3.5;6,16.5,4,3.5;10,16.5,4,3.5;
14,16.5,4,3.5;18,16.5,4,3.5;22,16.5,4,3.5;26,16.5,4,3.5;30,16.5,4,3.5;34,16.5
,4,3.5;38,16.5,4,3.5;42,16.5,4,3.5];
```

This matrix shows the coordinates of the walls where each row represents a wall and the columns for each wall are [x1, y1, x2, y2] The axis of the walls are [0,50] for x axis and [0,20] for y axis

Using MATLAB, build a WLAN planning tool that:

### **Input**

User received power from the 5 Aps (Ap1 Ap2 Ap3 Ap4 Ap5)

### **Output**

1. Plot the value of the received power every 0.5 m (or any other reference point) from the AP location and extended to the building area of coverage "Using contour function in MATLAB".
2. Given a certain power received profile from the 5 APs you should return an estimate location for the user.

The two basic methods of finding the position of the user given the signals strength of APs are

**Location signature/fingerprinting:** This technique searches the given input signals pattern with all the other signals in the database and match with the point which corresponds to the nearest neighbor in the signal hyperspace. This can be computed by calculating the least square of the test signals pattern and the other points signal pattern recorded during (1) and selecting the point with the least distance.

Each Known Location "Fingerprint" has a recorded value from each of the Aps (AP1, AP2, AP3.... APN) where the values from each AP has been recorded during a training phase.

Given a Reference point where (AP1\*, AP2\*, AP3\*... APN\*), the location of the reference point will be determined by computing the least distance between the Reference point and the "fingerprints" using Root Mean Square(RMS)

$$\text{Distance}^2 = (AP1^* - AP1)^2 + (AP2^* - AP2)^2 + (AP3^* - AP3)^2 + \dots + (APN^* - APN)^2$$

### **Hints:**

Line intersection tool in MATLAB can be found in:

<http://www.mathworks.com/matlabcentral/fileexchange/8908>

<http://www.mathworks.com/matlabcentral/fileexchange/17751>

<http://www.mathworks.com/matlabcentral/fileexchange/11837>

Use Contourf function in mat lab to plot the Power received map.