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Wi-Fi Signal Strength and Analysis

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Abstract:- This work includes wifi signal strength survey of 'VIT Campus' wifi network. After analysing the AP's throughout the college, the wifi signal strength on each floor of each building was recorded using "wifi analyser" app. The recorded readings were mapped and discrepancies and redundancies in the placements of AP's was studied considering the facts such as student densities, obstacles, laboratories, classrooms. Dead zones were identified and the AP's were optimised and additional AP's are suggested to have a more effective coverage.

Keywords: *Wi-Fi signal strength, Access points (AP),dead zones, dBm*

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1. Introduction

With the increase in the provision of access to Wireless Local Area Networks and the abundance of user devices capable of utilising Wi-Fi, the design of the network infrastructure has introduced some significant problems[2]. Prior to the installation of Access point, it is difficult to predict whether access can be guaranteed at specific locations. Additionally, to increase the level of security, it is often preferable, despite the use of security protocols[4][7], to ensure that the signal strength is not large enough to enable connection in areas other than those designated.

WI-FI: It is the name of a popular wireless networking technology by Wi-Fi Alliance for devices based on the IEEE standards that uses radio waves to provide wireless high-speed Internet and network connections.[1]

A summary of signal strengths

Table 1: Functionalities of specific signal strength

Signal Strength		Required for
-30 dB	Max achievable signal strength. The client can only be a few feet from the AP to achieve this. Not typical or desirable in the real world.	N/A
-55 dB	Minimum signal strength for applications that require very reliable, timely packet delivery.	VoIP/VoWiFi, streaming video
-70 dB	Minimum signal strength for reliable packet delivery.	Email, web
-80 dB	Minimum signal strength for basic connectivity. Packet delivery may be unreliable.	N/A
-90 dB	Approaching or drowning in the noise floor. Any functionality is highly unlikely.	N/A

Requirements and Variables

Desired signal strength for optimum performance varies based on many factors, such as background noise in the environment, the amount of clients on the network, what the desired data rates are, and what applications will be used. For example, a VoIP or VoWiFi system may require much better coverage than a barcode scanner system in a warehouse.

Understanding Signal Strength

The most accurate way to express wifi signal strength is with mill watts (mW), but you end up with tons of decimal places due to WiFi's super-low transmit power, making it difficult to read. For example, -40 dBm is 0.0001 mW, and the zeros just get more intense the more the signal strength drops.

RSSI (Received Signal Strength Indicator) is a common measurement, but most WiFi adapter vendors handle it differently, as it isn't standardized. Some adapters use a scale of 0-60, and others 0-255.

Next, it's important to know that dB does not scale in a linear fashion like you'd expect, instead being logarithmic. That means that signal strength changes aren't smooth and gradual. The Rule of 3's and 10's highlights the logarithmic nature of dB:

Table 2: Rule of 3's and 10's

3 dB of loss	-3 dB	Halves signal strength
3 dB of gain	+3 dB	Doubles signal strength
10 dB of gain	+10 dB	10 times more signal strength
10 dB of loss	-10 dB	10 times less signal strength

Ideal Signal Strength

For simple, low-throughput tasks like sending emails, browsing the web, or scanning barcodes, -70 dB is a good signal strength. For higher-throughput applications like voice over IP or streaming video, -55 dB is better, and some

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engineers recommend -50 dB if you plan to support mobile devices like iPhones and Android tablets.

2. Software selection and Experimentation:

A. Selecting the software

Wifi Analyzer app is a very reliable app available for measuring wifi signal strenth. There's a built-in signal strength meter with audible alert too. This is good if one wants to

wander around a local network looking for black spots. If one uses this tool, one can often range-extend your wireless network with an extra bit of hardware, or you can move your router slightly to try to get the best signal propagation through the house. signal strength This is to ensure maximum accuracy of results and to avoid any technical errors.

B. Experimentation:

At first, the area of coverage of an Access Point was plotted in terms of signal strength vs distance graph in excel with the help of signal strength readings of one AP as measured by Wifi Analyzer app (Fig 2.1).

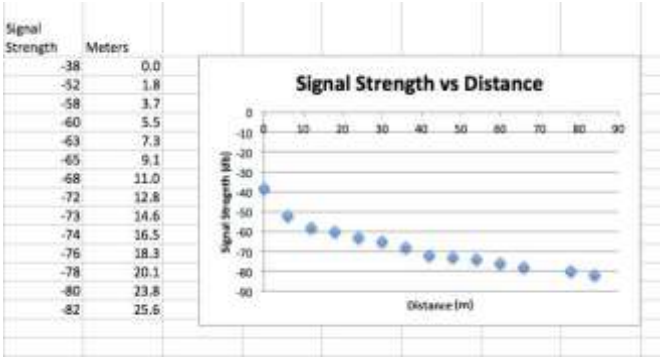

Fig 1 Signal strength vs distance plot

It is hence verified that for one AP in the Campus, the Signal strength varies inversely as the square of the distance.

The area covered by an AP was mapped using contours on the Campus map with three bands signal strength ranging from -40 to -60 dbm for good signal strength, -61 to --90 for average signal strength, -91 to - 100 dbm for bad or no signal Fig 2.2 shows the Ground floor of the VIT,Pune Campus map.

Each such floor of VIT college campus was serached for AP's and their contribution on the floor was noted with the readings from Wifi Analyzer app on a paper based map as it was more versatile to show the actual trends in the signal strength.

Along with 17 signal strength maps for each floor of the four buildings, a map covering the whole Campus was made(Fig 2.2 Ground floor) which shows the signal strength in areas other than the buildings but inside the campus of VIT,Pune.
Signal strength in each classroom on each floor was measured considering that walls may obstruct signal waves and thus may reduce signal strength and plotted on the maps.

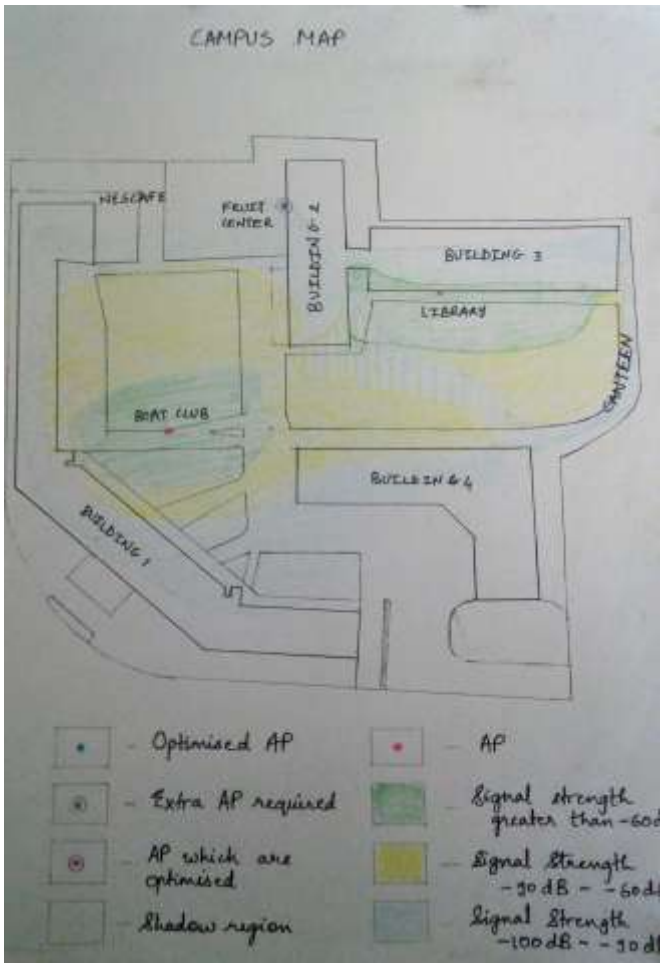

Fig.2 Ground Floor coverage VIT, Pune Campus

3. Result:

Following are the results of the analysis:

- Wi-fi signals with strength greater than -60dbm are very good signals.
- Wi-fi signals with signal strength between than -90dbm and -60dbm are medium strength signals. One can connect to them and work can still be done.
- Wi-Fi signals with signal strength less than -90dbm are too weak to be connected so that data can be exchanged over Wi-fi.
- There are total 21 existing AP's in the college.
- After optimizing the AP's it is found that 11 AP's need to be repositioned.
- 7 more AP's are needed to cover the campus more effectively after studying important factors like student density, signal strength, laboratories, classrooms.
- Dead zones are mainly found at the corner of the buildings.
- ue to many AP’s, the coverage area is overlapped which causes unwanted interference but is unavoidable.

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- 1 AP is required in Students section on ground floor of building 1. It is a busy place where students frequently need to access the internet for official purposes.
- The AP's of 1st floor of Building 1 are optimized as shown in the map for better coverage.
- Placements of the AP's on 2nd floor of Building 1 are appropriate.
- 2 AP's on 3rd floor of Building 1 are optimized to ensure better signal strength to the laboratories and the classrooms.
- There are currently no AP's on 4th floor of Building 1 which is fine because it is under construction.
- Since ground floor of Building 2 is Workshop area, there is no requirement of a new AP because LAN coverage is available for everyone.

4. Conclusion:

VIT, Pune college campus survey was done for Wi-Fi signal strength using the Wi-Fi analyser app. The recorded readings were mapped and discrepancies and redundancies in the placements of AP's was suggested considering the facts such as student densities, obstacles, laboratories, classrooms. Dead zones were identified and suggested placement of AP's for their removal. The AP's were optimized and additional 7 AP's are suggested to have a more effective coverage throughout the campus.

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