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A Study on Optimization of Wireless Area Networks

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Abstract: Nowadays WLAN in used most of the colleges and workplaces. This paper describes the measurements, analysis and optimization of the Wi-Fi signal power and measurements in college campus. The primary thought was to existing how the alerts had been measured, analyzed and conclusion was based on that analysis. The paper suggests how a normal smart cell phone gadget along with a couple of applications and built-in Wi-Fi antenna can be used for such measurement purposes. Several measurements were taken displaying the affect of all elements on the electricity of the Wi-Fi signal and on the down load and upload speed. We additionally mapped the get admission to points in our campus the usage of Google maps and also their vary and energy and how we can optimize sign electricity by using altering the role of access factors so that complete campus will have web access. Routers used in campus had been of Cisco technologies. Many lookup papers have been posted on optimizing signal strength however has now not been extensively investigated.

Keywords: Optimization, Smartphone, Access Points, Routers,, WLAN, Signal Strength, Antenna

I. INTRODUCTION

A. The IEEE 802.11 WLAN Standard The IEEE 802.11 standard provides various WLAN architectures and topologies for WLAN design. Overview of different available IEEE 802.11 standards:

Standard Name	**802.11a**	**802.11b**	**802.11g**	**802.11n**
Standardization date	January 2000	December 1999	June 2003	June 2009
Modulation technique	OFDM	DSSS, CCK	DSSSCCK, OFDM	DSSS, CCK, OFDM
RF band	5 GHz	2.4 GHz	2.4 GHz	2.4 or 5 GHz
Channel Bandwidth	20 MHz	20 MHz	20 MHz	20 or 40 MHz

The Wi-Fi is a wireless nearby region network (WLAN) which is preferred to be used in nearby premises. The variety of wireless nearby region community (WLAN) hotspots is growing swiftly 12 months by year; due to the simplicity in installation, operation, low price, and efficient mobility provided via the technology. With growing use of Wi-Fi networks, researchers are influenced to do learn about the overall performance and issues in the region of WLAN [1]. The purposes of using WLAN networks are wireless connection of computer systems into a community and imparting mobility of computers [2]. A wi-fi nearby region network (WLAN) system is a device two that includes the distribution gadget (DS), get admission to factors (APs), and portal entities.[3] Access points and the mobile clients are two primary aspects of any Wi-Fi system. A fundamental precept of WLAN communication is, network records is transmitted as modulated electromagnetic waves. A WLAN device contains APs and portals in addition to the distribution systems [4]. The power of Wi-Fi signal depends on its distance from the router, and fine of the device. Wireless communications networks are implemented and managed the usage

of radio verbal exchange [5]. In this paper the radio waves propagation will be investigated using the Wireless LAN 802.11b running at frequency of 2.4 GHz. The paper entails the analysis of sign power of get entry to points of Wi-Fi installed in selected constructing for experiments. And also the effect of materials (glass, wood, and brick) on Wi-Fi alerts in these constructions will be studied [6]. Bluetooth gadgets and WLAN are working simultaneously and very closely, it may want to purpose interference and degrade the overall performance of each gadgets [7],[8]. Furthermore, if the distance between Bluetooth gadgets and WLAN gadgets is less than 2 meters, the throughput will degrade substantially [9-11]. The intention of this research is to examine Wi-Fi network and includes the measurement and analysis of sign energy in various structures chosen for experiment.

II. THE SIGNAL STRENGTH CALCULATION PROCEDURE

The calculation of signal strength is done as follows :
Received Signal Power (db) = Transmitted Power (db) – Power Losses in Medium (db)
Path loss is given as: Loss=Pt / Pr = (4 π)2D2/ GtGrλ2
Where,
Pt = Transmitted power
Pr = Received power
Gt = Gain of the transmitter
Gr: Gain of the receiver
λ: Wavelength of the transmission (m)
d: Distance between the transmitter and the receiver
(m) In dB scale it is equal to $Loss = 20\log 4\pi + 20\log d - 10\log Gt - 10\log Gr - 20\log \lambda$ [6]

The crucial components on which WLAN is composed of, are get right of entry to points (AP) and the mobile customers (MC), generally a laptop computer or a PDA with a WLAN card. While for wired community communications, Ethernet cables are laid down all over the constructing and as a result distinct structures are linked to each different by way of using fibre optics. In Wireless LAN, in order to make a community infrastructure APs are positioned at specific vicinity all over a building and also if needed in exterior as well. Then cell consumers talk with one some other via first speaking to the access points, then to the outer world. A principal principle of WLAN communication is that, community facts is transmitted as modulated electromagnetic waves using antenna.

III. RELATED WORK

Lot of lookup has been finished already on Wi-Fi strength analysis in recent years as Wi-FI has grow to be one of the most essential aspect in every day life. The fundamental goal of researchers is to boost a Wi-Fi gadget which is less affected by means of all the parameters and which can supply you larger insurance and better steady strength. The Wi-Fi Mapping Project was once taken in Long Island University (LIU) from 2010 to 2011. The predominant aim of this undertaking was plotting maps showing the availability and electricity of Wi-Fi signal throughout LIU campus[12]. Ahsan Sohail and his group have additionally mapped Wi-Fi sign at the Centre of Geographic Sciences, in Lawrence town, Nova Scotia, Canada in 2006[13]. Authors in [14], have measured the wi-fi signal strength in a campus and analysed the overall performance of the WLAN. In [15], thought of identification and mapping of wi-fi useless zones has been presented. The interference of WiFi and other networks running in the same frequency

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band have been elaborated. Authors in [16] introduced the cooperative coexistence of the Wi-Fi and the IEEE 802.15.4 primarily based Wireless private region networks

IV. APPROACH

1. Tools Available:
There are many equipment available, which can measure Wi-Fi sign strength. Few such tools are presented in the table1 Table 1: Wi-Fi Signal Strength Measurement Tools

S. No.	Name of the Tool	Windows or Android
1	Network Master-Speed Test	Android
2	Speed Test and WiFi Maps	Android
4	Wi-Fi Monitor	Android
5	Internet Speed Meter Lite	Android
6	4G Speed Test & Meter	Android
7	My WiFi: Free Speed Test	Android
8	Meteror	Android
9	SpeedTest	Android
10	WiFi Mobile Network Speed	Android

We have selected Wi-FI Monitor to Monitor Wi-Fi signal strength. The App has 4 screens: Connection Window: shows the signal strength of the currently connected Wi-Fi network.

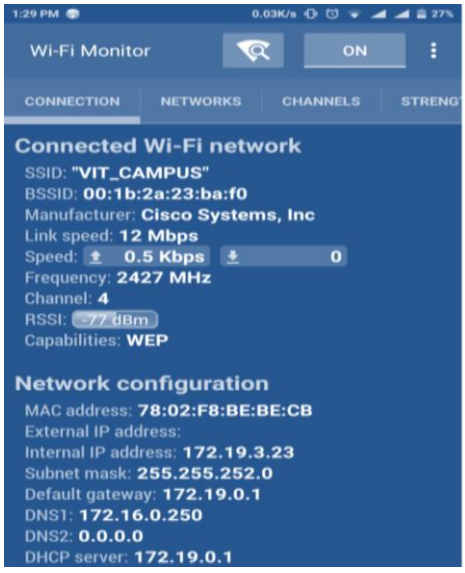

Fig. 1. Screenshot of Wi-Fi Monitor App

Channels: shows the signal strength of all nearby channels in a graphical format.

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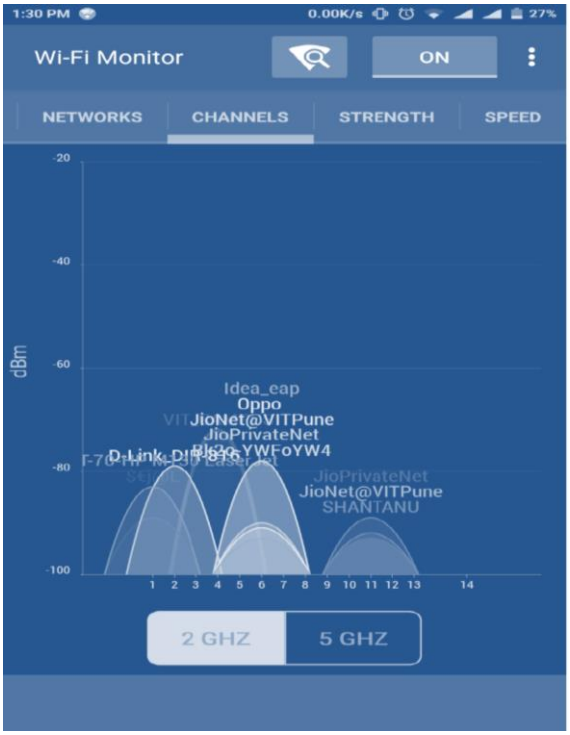

Fig. 2. Screenshot of Wi-Fi Monitor App (Channel Window)

Networks Tab: Gives information of all the detected networks like: name, mac address, frequency, channel, encryption type and signal strength.

Fig. 3. Screenshot of Wifi Monitor

Speed Window: Contains information regarding the download speed and upload speed the network you are connected to.

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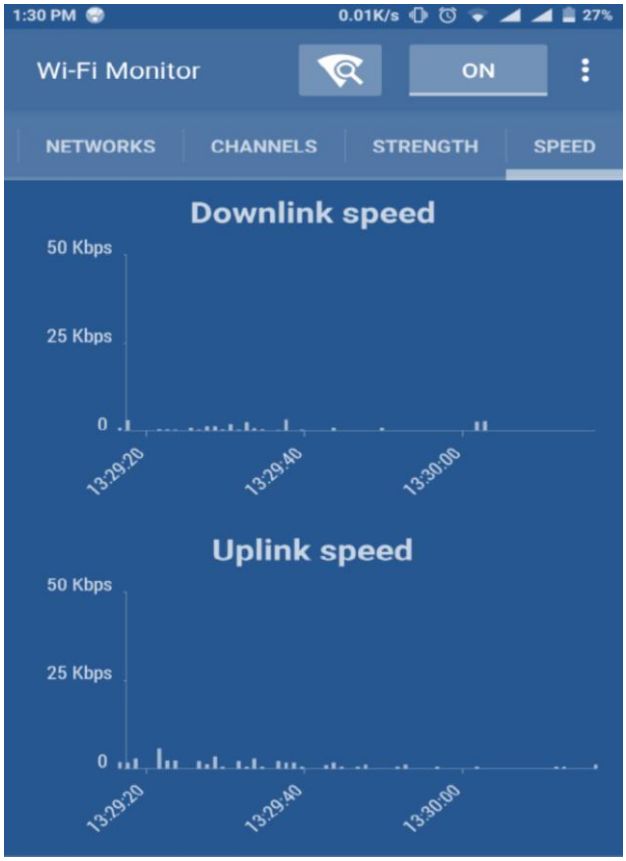

Fig. 4. Download & Upload Speed VS Time Bar Graph

2. Methodology:

Our intention was once to find out the sign energy of chosen Wi-Fi signal at various factors in our college campus and to locate a solution to cowl the complete campus beneath that Wi-Fi network. Basically our campus comprises of four foremost constructions and some outstanding places the place the crowd is extra and we can install Aps. There are a number tools reachable for dimension of signal electricity and warmth mapping of the signal. The tool we have used for analysis motive is "Wi-Fi Monitor". We noted down the signal strength at more than a few spots in dBm and also in percentage. For mapping purpose, we used google maps and paint application. Initially we went all the rooms of university and calculated the signal energy in each. Later we located that the signal electricity did no longer fluctuate tons for two three consecutive classes, so we grouped the three class under one class as it would have been waste of space. We also mapped the role of all the get right of entry to factors on our campus. Some necessary region where true Wi-Fi electricity is required and the contemporary electricity is as follows.

V. RESULT

Table 2. Signal at Some Important Locations

Places	Signal Strength (in %)	Signal Strength (in -dBm)	Remarks
Reading Hall	55	85	Poor

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Lawn	69	70	Average
Library	81	60	Good
Cafetaria	53	75	Poor
Hostel Mess	59	84	Poor
Ground(centre)	80	55	Good
Canteen	60	77	Average
Middle Building	60	77	Average
Parking	75	59	Good

Table 3. Signal Strengths in Different Rooms

Building No.	**Floor No.**	**Signal Strength (in %)**	**Signal Strength (in dBm)**	**Remarks**
1	-2 & -1	-	-	Dead
	2	100	52	Good
	3	100	54	Good
	4	66	70	Average
2	Workshops	70	66	Average
	2	51	77	Poor
3	Near office	44	80	Poor
	2 Rear side	64	71	Average
4	3Rear side	30	127	Poor
	Whole	-	-	Dead

VI. RESULT ANALYSIS

We calculated the signal power which is necessary to access net easily, and we found out that it should be less than -60dB. We plotted the graph of actual signal strength measured and the strength which is required on each floor of all Building.

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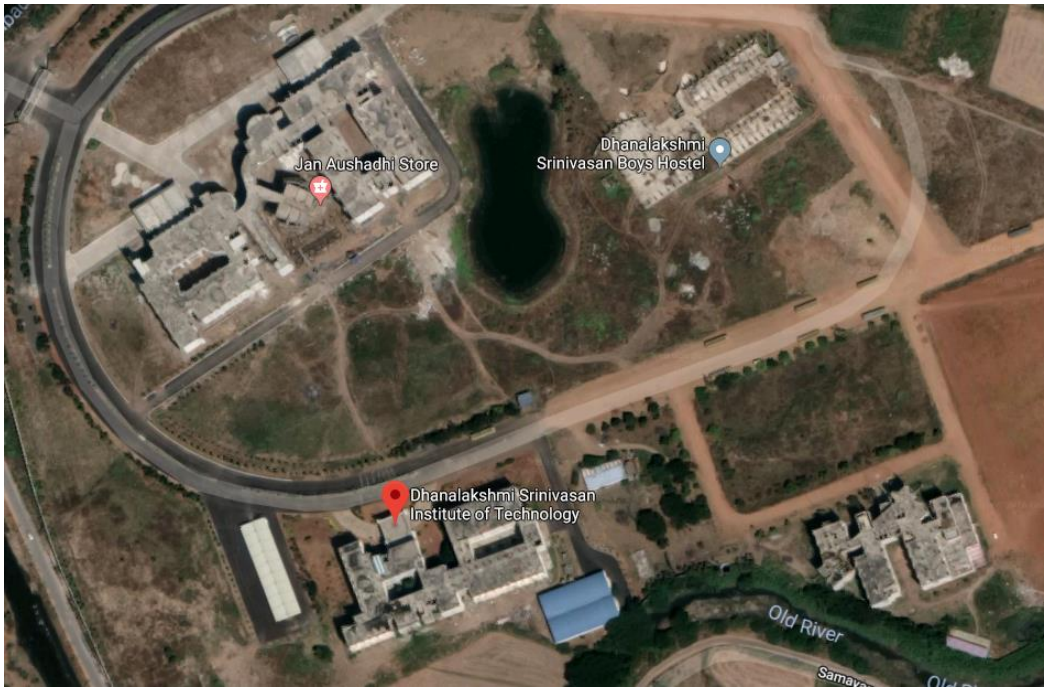

Fig. 5. Mapping of Signal Quality on Campus Map

Fig. 6. Mapping of Signal Quality on Campus Map

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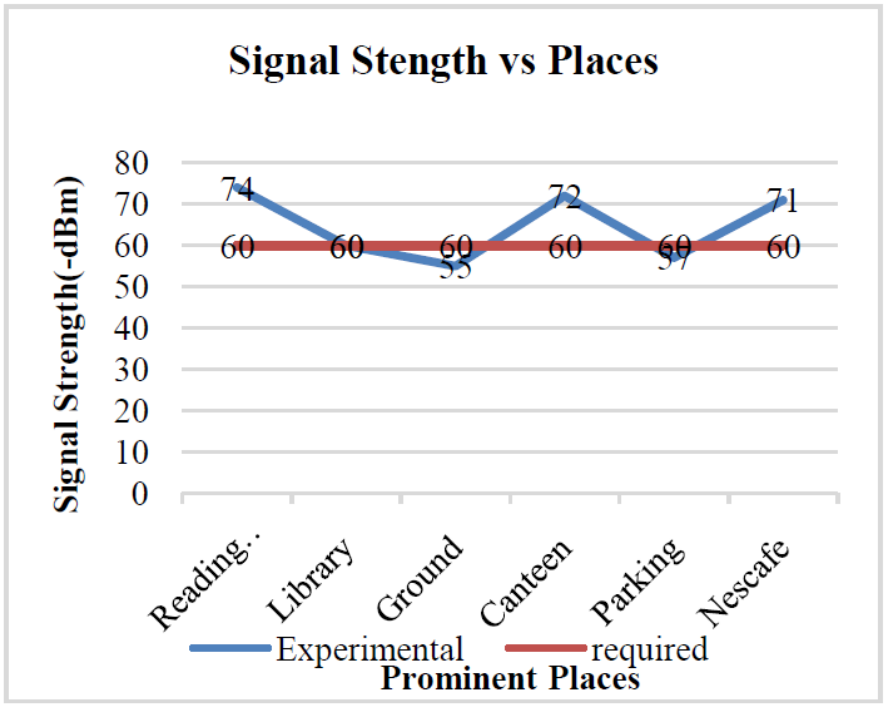

Fig. 7. Signal Strength Vs Floors in 1st Building

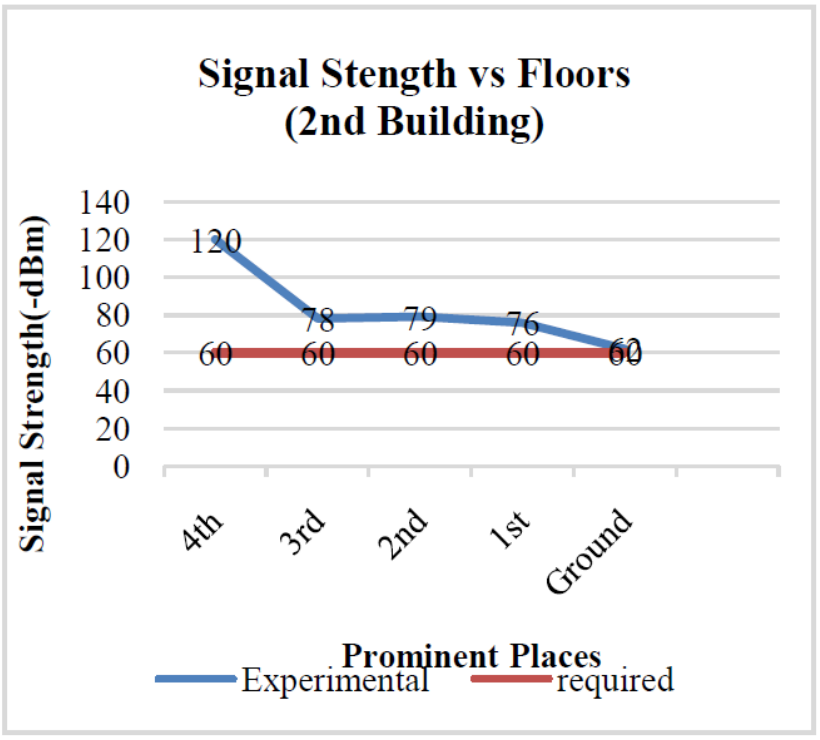

Fig. 8. Signal Strength Vs Floors in 2nd Building

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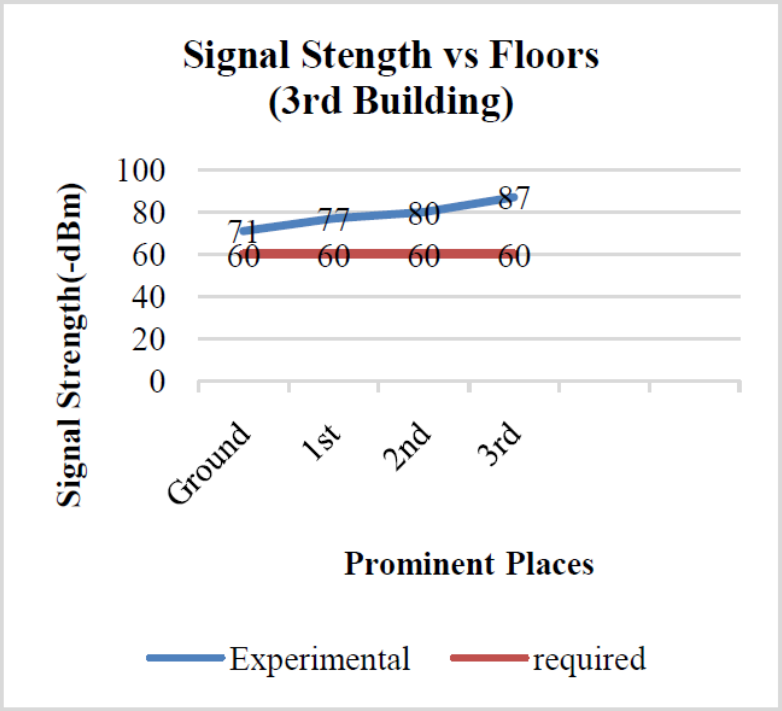

Fig. 9. Signal Strength Vs Floors in 3rd Building

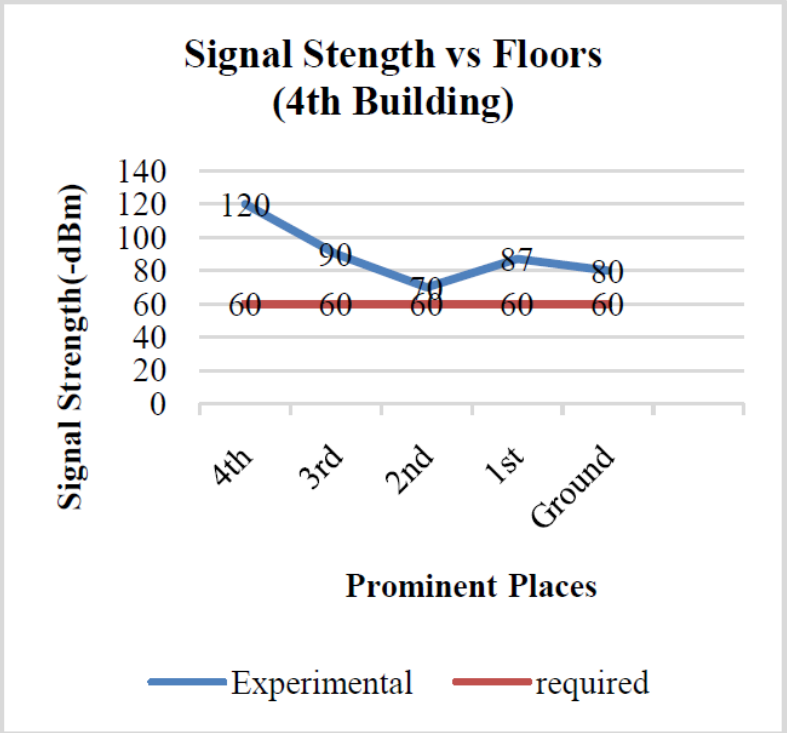

Fig. 10. Signal Strength Vs Floors in 4th Building

VII. DISCUSSION

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From the above graphs in fig.7 to fig.10, we can in reality see that the signal power in most of the cases is poor or no longer enough to have web access, in order to improve the signal electricity at some point of the campus we want to location routers in perfect places so that all the campus get minimum of-60db signal strength. We located that as we cross away from access factor the sign energy goes on decreasing. The routers on our campus are commonly installed on the first flooring of every building, so we had been able to get good energy on first floor, reasonable on 2nd and floor ground and weakest on fourth floor. This trouble can be resolved via desirable placements of get right of entry to points.

VIII. FUTURE SCOPE

We haven't studied the RSS approach which is beneficial in Ap placement, so our subsequent intention will be to learn about RSS and attempt to enforce it our project. Another most important problem considering Wi-Fi networks is the security. We need to amplify the security of our network. Hence in addition lookup we can work on security and also better technique for deployment of APs which covers entire area. As warmness mapping offers you correct notion of a number sturdy and vulnerable field spots, for mapping motive we can use higher software program accessible in the market in our further study.

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