ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 2, Issue 4, April 2015

Enhancing the Coverage Area of a WI-FI Access Point Using Cantenna

B.Anandhaprabakaran[#1], S.Shanmugam[*2],J.Sridhar[*3]S.Ajaykumar[#4]
[#2-4]student
[#1]Assistant Professor,
Sri Ramakrishna Engineering College, Coimbatore, Tamilnadu, India

Abstract: "The next decade will be the Wireless Era." – Intel Executive Sean Maloney and other executives framed. Today's network especially LAN has drastically changed. People expect that they should not be bound to the network. In this scenario, Wireless (WLAN) offers tangible benefits over traditional wired networking. Wi-Fi (Wireless Fidelity) is a generic term that refers to the IEEE 802.11 communications standard for Wireless Local Area Networks (WLANs). Wi-Fi works on three modes namely Ad hoc, Infrastructure and Extended modes. Ad hoc network is P2P mode. Ad hoc does not use any intermediary device such as Access Point. Infra Structure and Extended modes use Access Point as interface between wireless clients. The wireless network is formed by connecting all the wireless clients to the AP. Single access point can support up to 30 users and can function within a range of 100 – 150 feet indoors and up to 300 feet outdoors. The coverage area depends upon the location where the AP is being placed. The AP has the traditional Omni directional antenna The aim of this project is to increase the coverage area of an AP by replacing the traditional Omni directional antenna with Bi-quad antenna with parabolic reflector.

I. INTRODUCTION

A wireless local area network (WLAN) is a network of computers linked without any wires and connected by transmission of electromagnetic (radio) signals. Wi-Fi is the technology that has made it possible. Wi-Fi technology provides wireless internet access through the transmission of radio frequency carrier waves. However, electromagnetic signals weaken with increasing distance from the source. In wired networks, one can simply access far away points by bringing in longer connecting cables, but in wireless networks that is not possible. The signal strength reduces as we go away from Wi-Fi transmission. Imagine a sphere around a Wi-Fi transmission router. As we go away from center of the sphere, signal strength goes down and connectivity becomes difficult. With Wi-Fi internet access facility installed in a house, the range of Internet accessibility is compromised by the walls and the interiors of the house. It is difficult to find an optimum position for a Wi-Fi antenna with a limited range, so that one can gain access easily in the whole house. To remedy this situation and overcome this limitation of reach, one alternative is to use a wireless signal booster. As the name of the device suggests, it boosts the Wi-Fi signals and increases reach of these signals. It enlarges the sphere of reach around the Wi-Fi router. Hence the signals are increased using Wi-Fi signal booster.

II. WI –FI

Wireless fidelity is a popular technology which exchange data's through wireless with access point. A wireless access point (AP) is a device that allows wireless devices to connect to a wired network using Wi-Fi.Wi-Fi is a generic term that refers to the IEEE.802.11 communications standard for wireless local area networks(WLANs).Wi-Fi technology provides wireless internet access through the transmission of radio frequency carrier waves. The wireless network is formed by connecting all the wireless clients to the access point.

Single access point can support up to 30 users. Wi-Fi Access Point with Omni directional antenna which can function within a range of 100 – 150 feet indoors and up to 300 feet outdoors where coverage area depends upon the location of AP.

III. ADVANTAGES OF USING A WI-FI SIGNAL BOOSTER

Wi-Fi signal booster antennas, also called Wi-Fi signal amplifiers are attached to

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 2, Issue 4, April 2015

routers or access points to boost the signal. Good quality and powerful Wi-Fi signal amplifiers can increase the signal strength threefold. Bidirectional Wi-Fi signal boosters increase the strength of transmitted, as well as received signals. That is, they work both ways. They boost signal strength by as much as 600%. They can be used as laptop Wi-Fi signal boosters and extend range of Internet access far beyond your home. The need for seamless, uninterrupted and reliable communication is one of the top priorities of every house. The wide access to some really useful information base, for every kind of user makes it extremely important to set up a repeater, which delivers high performance. Repeater is a networking device which, as the name suggests, repeats the signal or increases the reach of the existing wireless network. Very often, it happens that a device has to be connected to an existing wireless network, but it is away in a remote place in the house or a building, where the signal strength is too low or unreachable. A wireless repeater is used in such cases to boost the signal strength or simply repeat the signal so that the said computer comes under the coverage area.

VI. Drawbacks Of Existing System

Omni directional antenna radiates in all directions which produces interfering signals. It cannot focus on reception or transmission signals. The coverage area of a wifi access point is less. Its cost is expensive. Smart Antenna Technology Basically consists of Switched-beam and Adaptive Array Antennas. Switched-beam systems have several available fixed beam patterns. A decision is made as to which beam to access, at any given point in time, based upon the requirements of the system. Adaptive arrays allow the antenna to steer the beam to any direction of interest while simultaneously mulling interfering signals. Smart antenna systems are also a defining characteristic of MIMO systems, such as the IEEE 802.11n standard. Conventionally, a smart antenna is a unit of a wireless communication system and performs spatial signal processing with multiple antennas[6]. Multiple antennas can be used at either the transmitter or receiver. Recently, the technology has been extended to use the multiple antennas at both the transmitter and receiver; such a system is called a multiple-input multiple-output (MIMO) system. As extended Smart Antenna technology, MIMO supports spatial information processing, in the sense that conventional research on Smart Antennas has focused on how to provide a beam forming advantage by the use of spatial signal processing in wireless channels. Spatial information processing includes spatial information coding such as spatial multiplexing and Diversity Coding, as well as beam forming. The dual purpose of smart antenna system is to augment the signal quality of the radio based system through more focused transmission of radio signals while enhancing capacity through increased frequency reuse. Smart antenna provides some drawbacks such as : The higher number of antenna elements making up the small base station antenna array, the higher the available gain, the larger the size and higher the price. Lower gain results in reduced size and price.

Table 1 gives the various features and benefits provided by the smart antenna technology

V. Design And Implementation

The Aim is to design different Wi-Fi booster antenna and analyze the performance to improve the signal strength for long distance. To overcome drawbacks of existing technology such as :

The High Cost of booster Antennas available in the market. The booster antennas available in market costs very high in dollars and are easily available in foreign countries. This adds to the cost of travelling or shipping the product to the user destination.

The reduced Wi-Fi signal strength for long distance. This aims at increasing the number of access points but in spite of these there are some hot spots or locations where the range is not available because of which we receive weaker signal strength.

For this, the objective is to use home made Wi-Fi booster antenna. Home made antennas solve the purpose of cost, making it cost effective. It provides us with improved signal strength. To achieve this, we need to study the various parameters of booster antenna available in the market, and increase the signal strength thereby improving the performance of our antenna .The Work can be done on Real –

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 2, Issue 4, April 2015

Time basis by testing the performance of Booster antenna in the campus at locations where the signal strength is weak.

The proposed plans of work for booster antennas include:

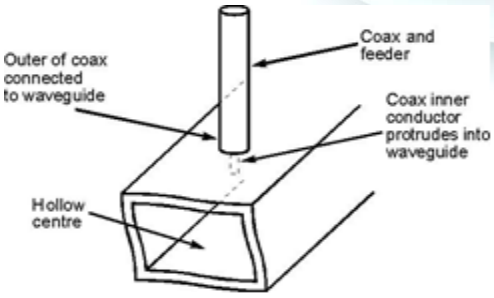
- To Design different booster antennas and then analyze their performance to increase the signal strength [Manual building and software based testing].
- To Implement Wi-Fi monitoring application.
- Test booster antennas for internet connectivity.

- Co-axial Cable with connectors.
- Wi-Fi access point.

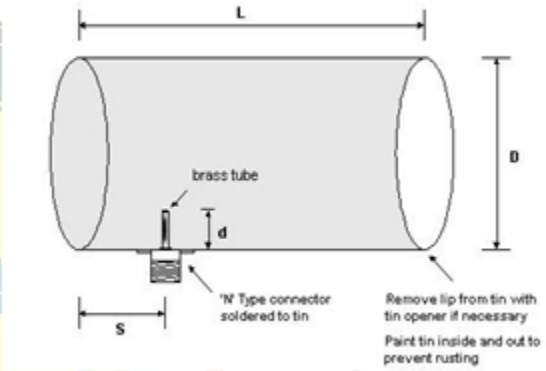
Software Requirement

- Wireless Monitoring Tool.

They boost signal strength by as much as 600%. Thus the Wi-Fi booster antenna is used in improving the signal strength by considering the above mentioned points. It is Cantenna devices function by focusing and strengthening the radio wave receiving area of communication devices such as wireless phones, internet, television and radios as opposed to conventional antennas which receive signals over a broader area with minimal strength. When a radio wave enters the opening of the can it bounces off the can walls until it reaches the receiving wire within the can. This receiving wire sends the information to the communication device with minimal static or interference. The area in which the Cantenna can receive the optimum signal is also adjustable, allowing the Cantenna to be used in a variety of locations and environments. A Cantenna consists of a hollow tube (usually a 40oz can) and a coaxial cable, as shown in Figure



This can acts as a microwave waveguide by capturing, confining and propagating the radio frequency signal within its metallic walls. The radio frequency is introduced into the can by a protruding conductor of a coaxial cable. The probe can transmit and receive signals from the waveguide. The frequency that a Cantenna can propagate is a function of the diameter of the tube. Cantenna operate as high pass filters since they can only propagate signal above a certain cut-off frequency. In the case our project, we will be using the common wireless networking (WLAN) standard, IEEE 802.11n-2009 which is transmitted at a frequency of 2.4GHz.

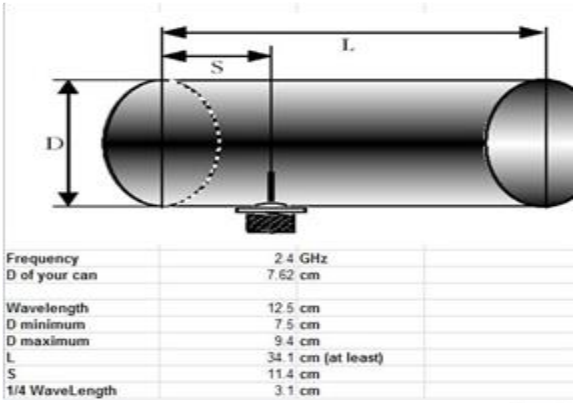


1. Prepare the can: Obtain a clean, empty can (with one end open) of radius of 3.65cm - 4.67cm. It might be necessary toremove the lip at the edge of the can so that it does not interfere with reception. Here: r = 3.65cm

2. Mark the position for drill holes: Use a Cantenna Calculator to calculate the dimensions - there are several availableonline. Below, is one based in an Excel spreadsheet and another on a do-it-yourself website (Figure 3). Mark the position for the N connector (at ¼ of the waveguide length) with a pencil. Here: ¼ LO = 3.1cm

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 2, Issue 4, April 2015



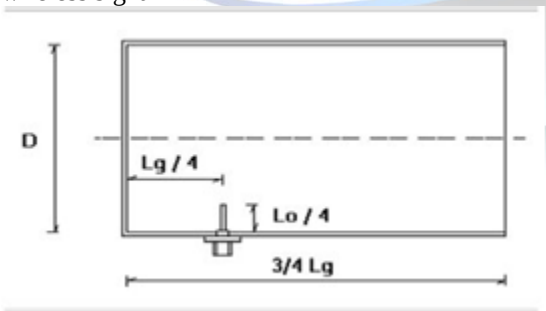
Frequency	2.4 GHz
D of your can	7.62 cm
Wavelength	12.5 cm
D minimum	7.5 cm
D maximum	9.4 cm
L	34.1 cm (at least)
S	11.4 cm
1/4 WaveLength	3.1 cm

3. Drilling holes for the N connector and bolts: Using a drill (or a nail in combination with a hammer if an electric drill isnot available), drill a hole large enough to insert the N-connector and four holes for the securing bolts.

4. Soldering the N connector and copper wire: Cut the copper wire such that in total, the length of the connector and thewire is ¼ LO = 3.1cm. Solder the wire onto the connector. After cooling, bolt the N connector into the can (to reduce obstructions, keep the bolts inside the can and the nuts on the outside).

5. Connect to WLAN: Connect the Cantennato the computer's wireless card using a pig-tail cable. Note: One of end of thecable will have the matching N male connector, the other will connect to the wireless card.

6. Find the best reception: Cantenna are linearly polarized. Rotate the Cantenna until the strongest signal is achieved. UseKismet (Linux-compatible) to determine the strength of the wireless signal



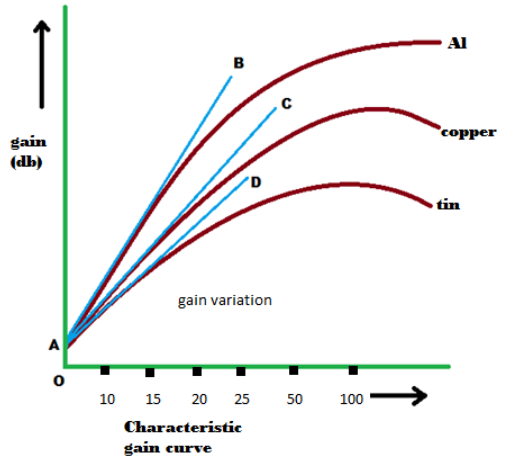
The Antenna testing is basically done on a desktop computer in college lab . The requirements for testing are :

1. Wi-Fi access point
2. Antenna
3. LAN card
4. Wireless software for wireless connectivity

The LAN card is fitted in the CPU and then an antenna is attached to it .The wireless software installation was done for enabling the wireless connectivity. I had developed a software coding through which we can measure the strength of signal in percentage which shows the accuracy in how much signal strength exactly we are getting. This idea came to my mind because our campus is WI-FI campus and there are around 86 access points all over the campus , but still the signal strength in some locations are still weak and due to which the speed is less. I had developed an Cantenna and tested in ourcampus at locations where the signal strength was found low and the results we observed was more than originally we had with dipole antenna that was being used as a booster .

The below result shows Cantenna results which were taken in our campus area where the signal strength was found to be 70% initially and testing with the Cantenna gave the height of almost 20% (Figure 4*)* at the same location with the same network as we were connected to

Graphical representation

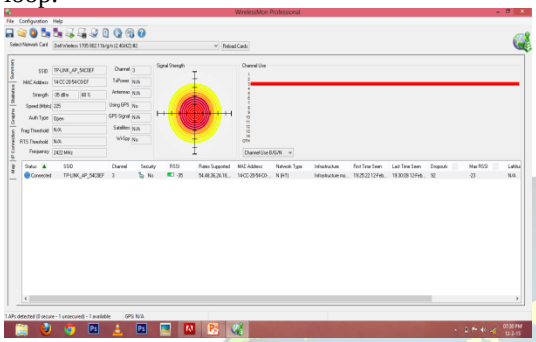


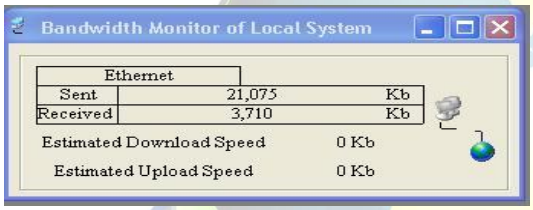
Bandwidth Monitoring module (Figure 5) is basically deal with monitoring network traffic. Traffic in the sense whenever data is transferred over network cable it get measured. Different application gets data or sends data over network. Data has some size. This is size can be considered as bandwidth. This module of project keeps watch on data transfer and measures it and monitors it. This module also shows sent and received data size. Logic behind that is will read

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 2, Issue 4, April 2015

LAN adaptor information continuously. First get the object of LAN card controller class. Then read different data from its object. Whenever data get transferred data member of this object get changed. And project will show this changed value in loop. It won't required any special programming logic. It need only reading data in loop.





VI. Conclusion

Wireless networks are clear benefits (mobility, flexibility, ease of installation, low maintenance cost, and scalability) but also has some disadvantages (use demanding equipments for operating parameters such as humidity , temperature etc). Smart Antennas can be used to achieve different benefits[14]. The most important is higher network capacity. It provides better range or coverage by focusing the energy sent out into the cell, multi-path rejection by minimizing fading and other undesirable effects of multi-path propagation. Smart antennas are a solution to capacity and interference Problems. Good quality and powerful Wi-Fi signal amplifiers can increase the signal strength threefold. Bidirectional Wi-Fi signal boosters increase the strength of transmitted, as well as received signals. That is, they work both ways. They boost signal strength by as much as 600%. Thus the Wi-Fi booster antenna is used in improving the signal strength by considering the above mentioned points. It is basically effective in locations where there is coverage problem in case of mobile or when the signal strength becomes less as the distance increases . Thus we conclude that , on testing the antenna the signal strength reduces with the increase in the distance between the antenna and the Wi-Fi access point

VII. Future Work

It includes designing of manually build booster antenna by following the above mentioned steps and testing the performance in the real environment where the signal strength is low . Testing of the antenna on the desktop as well as laptop . Future work also include the manual designing of other booster antennas such as parabolic antenna booster and cantenna and testing their performance in real environment. Testing comparison with antenna and manual build booster antenna . The performance of the antenna could be better tested on laptops , where the signal strength could be easily observed going high or less as the distance increases . The testing of antenna outside the campus area also adds to the obstruction of the signal by walls or trees.

REFERENCES

[1]. Marius-Constantin popescu, *"New Aspect On Wireless Communication And Network"* International Journal Of Communications Issue 2, Volume 3, 2009.

[2]. Richard H. Roy, *"Application Of Smart Antenna TechnologyIn Wireless Communication Systems"* , 1997 IEEE.

[3]. "*Using Mimo-Ofdm Technology To Boost Wireless Lan Performance Today"* , Version 1.0 June 1, 2005.

[4]. "*Using Mimo-Ofdm Technology To Boost Wireless Lan Performance Today"* , Version 1.0 June 1, 2005.

[5]. *Communications"*,Session A3 Communication Networks And Services Research Conference 2003.