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Wi-Fi Gun as a Range Extender

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***Abstract*: Wi-Fi is a fascinating gadget which is present in domestic areas, corporate areas, public areas, etc. If we consider the coverage area of these Wi-Fi they provide a good connection between User and Wi-Fi about 50 to 100 meters. To increase the range it is possible to build the antenna which is replaced with the antenna of the access point. Internet have become day today necessity of human being.**

The Wi-Fi are used at individual, business, public and government level. However the customers are not satisfied with the strength of the signal when customer is far away from the Wi-Fi access point beyond 100 meters. This happens due to the Wi-Fi access points, network cards, USB adapters are placed in the closets, against the wall, in congested areas which leads to diminishing signal strength and limiting bandwidth due to absorption, interference. To overcome this problems users relocate the Wi-Fi router, access point. This research paper consists of different topics covered as construction of antenna, requirements and antenna testing at laboratory and public places.

Keywords: Wi-Fi, Routers, Access point, Wi-Fi cards, Antenna, signal strength, booster antenna.

I. INTRODUCTION

Wi-Fi is the name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections. A common misconception is that the term Wi-Fi is short for "wireless fidelity," Devices that can use Wi-Fi technologies include desktops and laptops, video game consoles, smartphones and tablets, smart TVs, digital audio players and modern printers. Wi-Fi compatible devices can connect to the Internet via a WLAN and a wireless access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors.

Wi-Fi most commonly uses the 2.4 gigahertz (12 cm) UHF and 5.8 gigahertz (5 cm) SHF ISM radio bands, these bands are subdivided into multiple channels. ALOHA net, also known as the ALOHA System, or simply ALOHA, was a pioneering computer networking system developed at the University of Hawaii. ALOHA net became operational in June, 1971, providing the first public demonstration of a wireless packet data network.

Wi-Fi signal booster antennas, also called Wi-Fi signal amplifiers are attached to routers or access points to boost the signal. The need for seamless, uninterrupted and reliable communication is one of the top priorities of every house. 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. Wireless signals are susceptible to a lot of data loss. Besides everything, the wireless network cards, that come inbuilt, have very limited power and range. The answer then lies in using a wireless signal booster. A simple solution is getting a wireless external antenna.

The taller the antenna of your wireless booster, the better the reception. A wireless signal booster consists of two antennas - the transmitting antenna and the receiving antenna. The receiving antenna is connected to an intermediate amplifier. The other input to the intermediate amplifier is a radio signal source.

The intermediate amplifier amplifies the difference between the two signals; the received signal and the radio signal, and passes it over to a low-noise amplifier. This is done to remove any unwanted signals. The low-noise amplifier is connected to the transmitter. The low-noise amplifier further amplifies the received signal and sends it to the wireless card. The wireless signal antennas in the laptops are located internally. Generally, there are two parallel antennas located on the two sides of the LCD screen. The internal location of the wireless antennas causes bad reception of the wireless signals. So, the first problem that a wireless signal booster needs to solve, is to provide an external high gain antenna. This antenna needs to be directed to the access point. The biquad is defined as a high gain antenna with an exceptionally large beam width.

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II. LITERATURE SURVEY

A. Need of the WI-FI Extender.

Normal consumer Wi-Fi routers have small range and they do not provide city-wide coverage of Wi-Fi networks. The Wi-Fi router covers the area around up to 150m. Consumer cannot access the Wi-Fi beyond that range, Even if we go away from the Wi-Fi we get low internet speed. In big campus area or at any stations we cannot get Wi-Fi access from one end to another end. Nowadays it is important to have a long distance Wi-Fi range.

B. Why we go for Wi-Fi Gun?

The Wi-Fi gun is an antenna which accesses Wi-Fi network placed at long distance. It's very simple device which user can install easily and acquire long distance Wi-Fi with good internet speed. It covers up to 1km coverage area. It is useful for the college campus, trekking camps, wildlife photographer camps and bus stand and railway stations.

C. How Efficient is This Technology?

This gun is simple in construction, cheap in cost, reliable and easy to repair and maintain. After reviewing many articles, there is one research paper that has discussed enhancing the coverage area of Wi-Fi; however, there has been no mention about having actuators to modify.

According to "ENHANCING THE COVERAGE AREA OF WI- FI ACCESS POINT USING ANTENNA" Associate professor, Dept of ECE, Kings Engineering College,UG Scholars, Dept of ECE, Kings Engineering College, Chennai proposed system We are here to design a Wi-Fi access point with antenna preceding Omni-directional antenna to achieve received signal strength index for long distances. The drawbacks of existing technology are: The declination in Wi-Fi signal strength for long distance. Increasing in number of access points increase signal strength, but some hot spots are available where the range is very weak.

For this, the objective of our project is to use homemade Wi-Fi antenna. Homemade antennas are cost effective with increased signal strength. To achieve this, we need to study about the various parameters of antennas to increase the signal strength for long distances. The Work should be done on Real –Time basis by analyzing the performance of antenna in the campus at locations where the signal strength is very weak such as in rural areas. The proposed plans of work for antennas include: 236 To Design Antenna and then analyze their performance to increase the signal strength [Manual designing and software based testing]. To analyze and test Antenna for internet connection.

III. METHODOLOGY

This antenna device is a directional waveguide antenna, made out of a metal disc connected in series. As shown in a block Fig.a the proposed system consists of a copper disk plate antenna. This consist of several disk plate. This antenna is connected to Wi-Fi module. The main function of Antenna is to focus on the signal strength of receiving radio waves from the communication devices such as internet, ad hoc and mobile networks, and wireless cards and so on. This is so effective when compared to conventional antennas which receives signal from broader area with minimal strength. The radiating element sends the information to communication with minimum amount of interference. The receiving signal of disk antenna can be adjustable and so it can be used in various environments.

IV. ANTENNA DESIGN

Antenna is based on the theory of circular waveguide choosing the frequency is the most important part of design. As the Wi-Fi networking equipment operates at a range of frequencies from 2.412 GHz to 2.462 GHz. Ideally, the TE11 cut-off frequency should be lower than 2.412 GHz and the TM01 cut-off frequency should be higher than 2.462 GHz

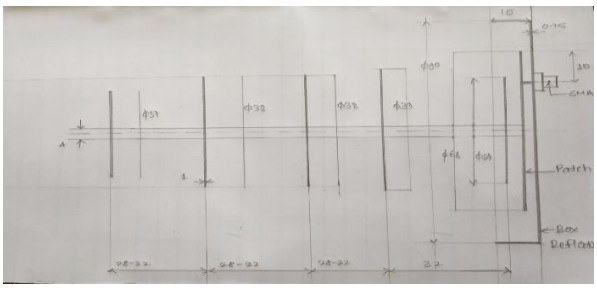


Fig.a design of antenna

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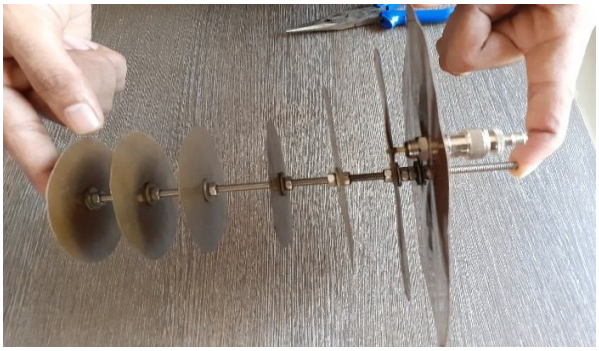


Fig.b Actual antenna

V. ANTENNA CIRCUIT DESCRIPTION

A. Copper Plates

With copper being twice as conductive as aluminum and 6 times more conductive than steel, it makes an excellent choice as an antenna material. The increased electrical efficiency means more of your RF energy will go up and out the antenna and not be trapped, creating heat energy. More efficient radiation also means that you can run higher powers with a copper antenna than with other building materials.

On a pure energy efficiency standpoint, copper is the best material to choose for a base station or permanently mounted antenna. More of your signal will get into the air and less RF energy will be turned into heat by the internal resistance of the metal.

B. Wireless Router

A wireless router is a device that performs the functions of a router and also includes the functions of a wireless access point. It is used to provide access to the Internet or a private computer network. Depending on the manufacturer and model, it can function in a wired local area network, in a wireless-only LAN, or in a mixed wired and wireless network. A router connects local networks to other local networks or to the Internet. A wireless access point connects devices to the network wirelessly, using radio frequencies in the 900 MHz and 2.4, 3.6, 5, and 60 GHz frequency bands. The latest wireless routers are based on the IEEE 802.11ac Wave 2 standard, often shortened to Wave 2.

C. SMA Connector

SMA (SubMiniature version A) connectors are semi-precision coaxial RF connectors developed in the 1960s as a minimal connector interface for coaxial cable with a screw-type coupling mechanism. The connector has a 50 Ω impedance. SMA is designed for use from DC (0 Hz) to 18 GHz, but is most commonly used for hand-held radio and mobile telephone antennas, and more recently with Wi-Fi antenna. It finds many applications for providing connectivity for RF assemblies within equipment's where coaxial connections are required. SMA connectors need a 50 Ohm impedance connection to an external antenna (GPS, Bluetooth, cellular, Nordic, and XBee). It is often used for providing RF connectivity between boards, and many microwave components including filters, attenuators, mixers and oscillators, use SMA connectors.

VI. RESULT

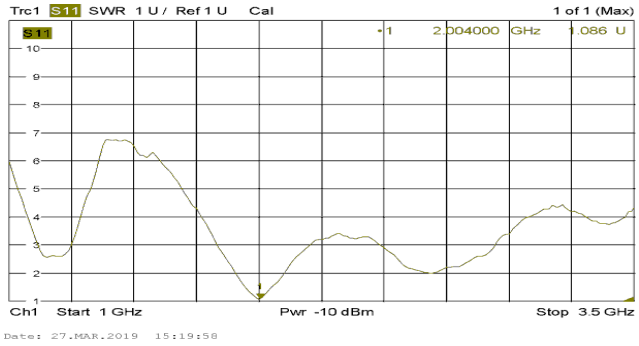


Fig c. SWR

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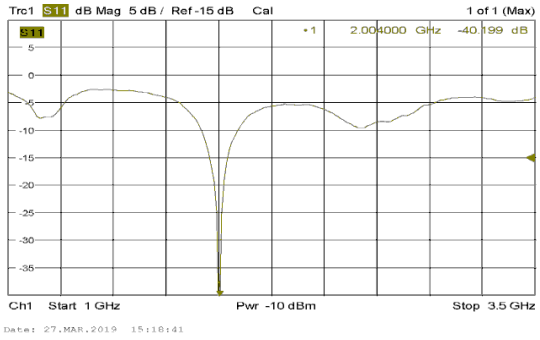


Fig d. Gain

1) Radiation Pattern Readings

Angle (degree)	Copole	Cross pole	Angle (degree)	Copole	Cross pole
0	-42.6	-39.1	180	-45.0	-45.2
5	-43.6	-42.2	185	-51.3	-44.6
10	-38.2	-34.4	190	-53.2	-44.3
15	-34.4	-33.8	195	-51.6	-43.8
20	-31.8	-30.7	200	-49.7	-44.4
25	-31.0	-29.8	205	-47.5	-45.3
30	-31.4	-29.3	210	-46.4	-45.2
35	-32.0	-29.6	215	-46.7	-45.7
40	-33.2	-30.4	220	-47.2	-46.1
45	-34.4	-31.5	225	-46.4	-47.2
50	-36.6	-32.6	230	-46.3	-45.8
55	-39.5	-35.2	235	-46.2	-48.2
60	-41.3	-37.8	240	-47.0	-49.7
65	-43.0	-39.9	245	-49.3	-50.9
70	-43.8	-41.8	250	-50.1	-52.9
75	-44.3	-44.5	255	-50.1	-56.3
80	-45.6	-46.8	260	-49.9	-57.7
85	-45.2	-47.8	265	-48.0	-56.7
90	-44.7	-48.1	270	-48.3	-52.4
95	-44.3	-48.0	275	-50.9	-50.5
100	-43.6	-48.7	280	-51.7	-49.8
105	-42.3	-50.0	285	-50.6	-47.2
110	-42.4	-51.6	290	-50.5	-45.2
115	-42.8	-52.7	295	-48.5	-43.9
120	-44.6	-50.6	300	-46.3	-39.6
125	-46.1	-47.8	305	-42.3	-37.6
130	-47.0	-45.2	310	-39.8	-35.6
135	-45.6	-44.3	315	-36.2	-33.7
140	-43.3	-43.9	320	-34.9	-31.1
145	-41.4	-44.2	325	-31.4	-29.7
150	-40.1	-45.5	330	-30.8	-28.8
155	-39.8	-48.5	335	-30.9	-28.2
160	-40.3	-49.8	340	-29.1	-28.3
165	-41.1	-49.2	345	-28.1	29.1
170	-42.7	-48.6	350	-29.8	-30.4
175	-45.7	-47.0	355	-30.5	-33.4

Above results are best for the 2GHz frequency. To connect it to the household Wi-Fi which operate on 2.4GHz, there is requirement of fine tuning between distances of each antenna plate.

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VII. FUTURE SCOPE

We can implement this module on the base station extending the range of the Wi-Fi.
We can use this module in low network areas.
This module can be carried along for the adventure activities (trekking, wildlife photography, off road racing/biking, etc.) where network percentage is very low.
This module can be installed in the Institutes, Corporate offices which cover large campus areas where it becomes difficult to provide a long range network.

VIII. CONCLUSION

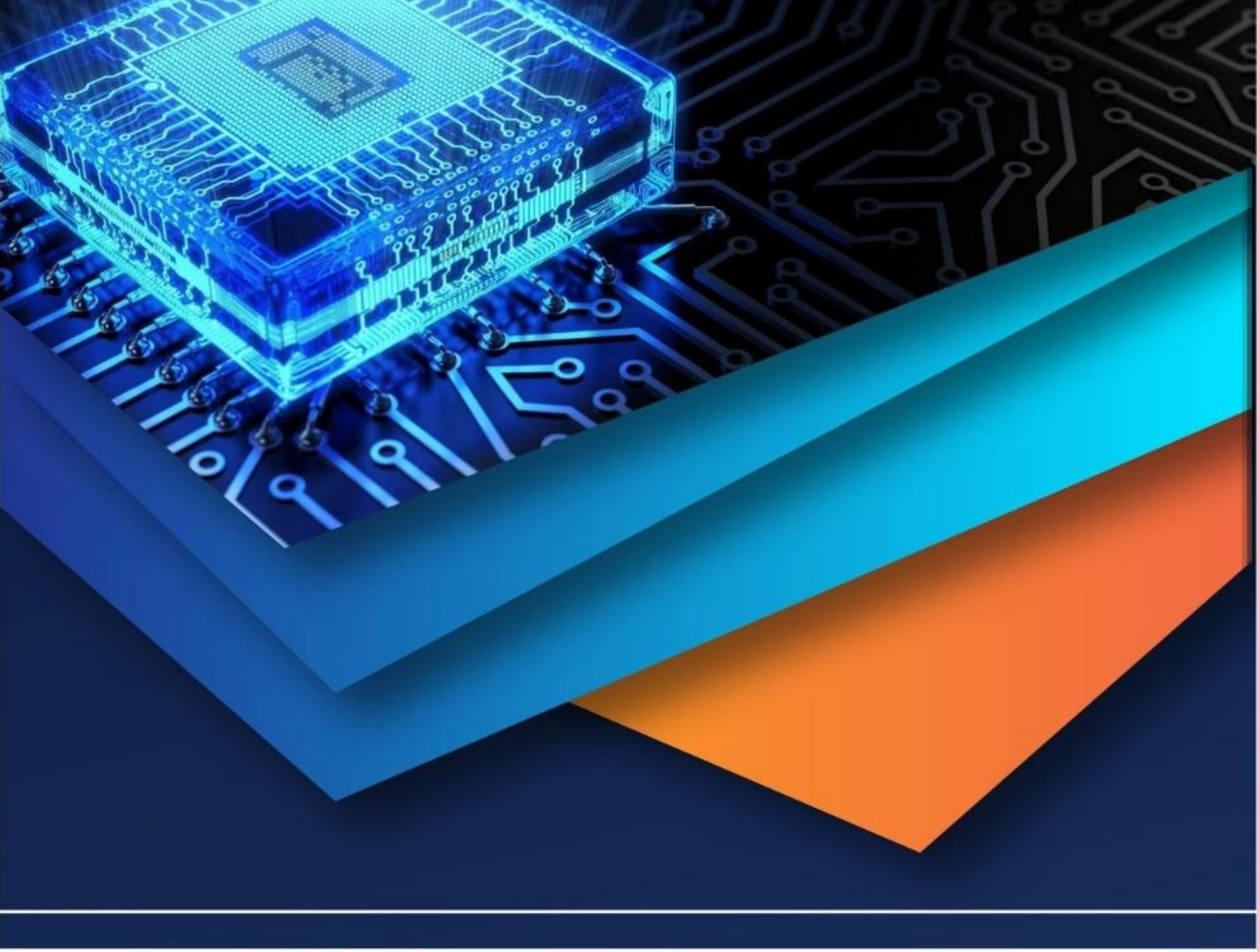
"Wi-Fi Gun" antenna incorporates feature like long distance (500 m – 1 Km) better quality network provider that are lacked in the conventional Wi-Fi routers which is restricted to 150 to 200 m. Especially the Wi-Fi gun is an antenna which power ups the signal strength due which it provides a long distance (500 m – 1 Km) good quality network.

The design of Wi-Fi gun has shown the satisfactory results and works well by providing a long distance range network. It works well to provide a long distance delivery of Wi-Fi network.

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