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Design Simuation & Analysis of WiFi Signal Extender using Raspberry Pi 3

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Abstract: *Limited-cost extended wifi technology has been developed and its effectiveness has been evaluated at a low network coverage. The Raspberry Pi 3 is designed and programmed to serve as a wireless access point for a current infrastructure. The energy efficiency of the Raspberry Pi and the transmitted signal of the network are examined throughout the testing. It is feasible to use an Android cellphone's WiFi hotspot to increase the range of an available commercially WiFi enhancer, but only in the most expensive variants. Because the suggested device may be positioned at the point where the Wi-Fi transmission is strongest within the gate, the Wireless internet reach can be expanded while protecting the input signals. Raspberry Pi's ability to spread network signals up to 80 meters, particularly in a free-space setting, has been verified by the results of the tests. If you have a weak network signal, you may use this approach as a temporary replacement for the system..*
Keywords: *Raspberry Pi, WiFi Extender, Access Point, Portable.*

I. INTRODUCTION

The Raspberry Pi Foundation in the United Kingdom was responsible for creating the Raspberry Pi [1]. It is a single- board computer designed for use in underdeveloped nations to teach computer literacy. of a credit card-sized size

It's modest and inexpensive at $35. (based on the Pi3). While coding, documenting, and working on websites just need a TV and keyboard. To see Wu Jing's music videos on his desktop PC is possible. It is quite inexpensive to prototype your ideas on a Raspberry Pi. It's an open-source hardware that represents two mountain ranges at the same time.

The Internet of Things is powered by the Raspberry Pi microcontroller (IoT). A growing number of industries are using it as a platform for creating new goods. He utilized central heating in a residence, for example, by Mr. Gyu-ho Kim [2]. The temperature sensor's purpose is to lower the system's heating expenses. The temperature rises when a letter is attached to the Raspberry Pi. As a result, heating expenditures might be drastically reduced. Temperature and humidity conditions in greenhouses where crops are cultivated are important in agriculture. Automated water or ventilation monitoring and delivery A smart agricultural gadget that regulates the ideal conditions for development by turning the lights on and off. In fact, it is possible to achieve [3]. Dogs and cats are similar in this regard.

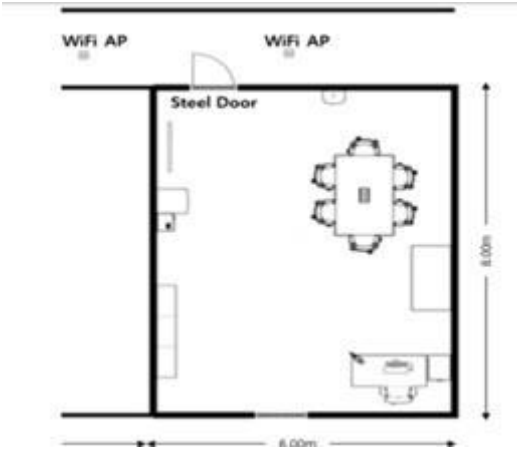

Figure 1: Plan of building area

Monitor animals or plants from afar and take the necessary measures. Alternatively, you may set up systems that can be taken either automatically or manually. The numbers 4, 5, and 6. Drones, printers, and cellphones are also on the rise. It's difficult to include all of the gadgets that react to smart mirrors, smart door locks, wireless access points (APs).

Additionally, the following problems with everyday living are addressed in this research: Recognize it and utilize the Raspberry Pi to construct the system it desires. As shown by Fig. 1's center, There are a number of offices to the left and right of the hallway, as well as a single office to the center. Consider constructing a building with this in mind. Here for the benefit of the general public on the ceiling of the hallway, a Wi-Fi AP that can do this is a particular length. It has been set up, and the office no longer has a distinct AP. The real structure of the author's office is shown here. Within the framework of a larger corporation, pray. The use of public APs in corridors is a typical occurrence in many places. The entryway is the single point of entry for all public Wi-Fi signals.

To reduce the signal, the door must always be open in the suggested building construction. When used for business, it is possible to lower Internet quality without sacrificing usability.

For the time being, however, the entry door of the exhibit will be constructed of steel. When set up, on a workstation with the necessary equipment. Failure of WiFi occurs within the building if the signal strength goes below 90 dBm. Adding insult to injury, it's either summer or winter now. It is difficult to leave the door open for lengthy periods of time in iron because of the fluctuating temperatures.

To maximize Wi-Fi reception, a mechanism has been suggested that allows for free installation in the greatest possible place to receive the signal of the result. In an office with closed doors and 720p online surfing and video streaming, remove radio wave shadows. An experiment shown that it is possible to watch.

II. ATTENUATION OF WIFI SIGNAL

Wi-Fi operates at frequencies of 2.5 GHz and 5 GHz, which are quite high. Since the straightness is so great, the signal loss varies based on the kind of cable. Wi-Fi attenuation in water is shown in Table 1 according to the quality category. The illustration on the table depicts a solid cone. The most attenuating materials are crete and iron, whereas the least attenuating materials are high transmittance glass and low transmittance glass.

Table 1: Attenuation table for different objects in home

Material	5GHz	2.4GHz
Steel Door	30dBm	20dBm
Concrete Wall	30dBm	20dBm
Wooden Door	7dBm	4dBm
Normal Glass Window	8dBm	3dBm

Attenuation of around 10dBm is seen at 5 GHz, where the frequency is more than twice as high, compared to 2.4 GHz, which penetrates the material at 2 dBm less. According to the statistics, this research has substantial signal attenuation iron gates.

Table 2: Connection Available for WiFi Strength of signals

Available Connections	Strength of Signal
Best(Nearest to WiFi area)	-30dBm
Excellent	-50dBm
Impossible	-90dBm
Not Strong	-70dBm

In other words, the Wi-Fi signal is – when the door is shut. It's safe to assume that the loss is much above 20 dBm. Perceptible Internet speed is the fastest possible connection speed. Table 2 shows how to make certain that. There shouldn't be any problems with this Wi-Fi signal intensity being within the acceptable range [10].

The Wi-Fi AP and the measurer are both on the table (or router). When standing, you should expect to obtain a signal intensity of between -80 dBm and -90 dBm. if you're lucky. Connections in the are more likely to have frequent disconnections because of the instability of the network. In the case of a smartphone, if the signal dips below –90 dBm, the AP and connection cannot be established. The antenna symbol, on the other hand, is gone. When the iron door of this study is shut, a Wi-Fi signal may be picked up at the desk location. –90 dBm call strength means that your internet connection will ultimately be affected.

III. THE PROPOSED SYSTEM IMPLEMENTATION

Even when the iron door is shut, a minor signal of roughly -67dBm was detected via the glass. This signal was replicated and amplified on an office desk for the purposes of this investigation. Sleep on the internet by building a wifi extension. Using the manual process released by Gus in the [11] handbook, the Raspberry Pi project community shows how to apply it.

Proposal system adjustments or additions may be necessary if these things are included. It's important to remember to connect to neighboring Wi-Fi.

A. Hardware

- Raspberry Pi 3: Raspberry Pi 3 Model B and Raid Raspberry Pi 4 Model B (4GB DRAM) are the primary hardware platforms for implementing the suggested system. Each and every one of them in order to take use of the Wi-Fi extension feature. For both models, the team used the program and environment parameters that worked. In [12], you will find a complete hardware specification.
- Wi-Fi Dongle: The suggested system requires two WLANs to function. Although an adapter is required, the Raspberry Pi comes equipped with one. So, if you have a spare Wi-Fi dongle on hand, do so. In the instructions, WLAN0 is used for ease of use. WLAN1 was configured to do many tasks at once. Wireless LAN1 (dongle). Transmits Shinhan packets to WLAN0 (built-in) adapter functioning as AP forward and may connect to the internet through the hallway wifi IEEE 802.11b/g/n Protocol and 2.4GHz single band are supported by the dongle used in production [13].
- Auxillary Battery: Terry was linked to an auxiliary ship that would provide mobility for the wifi extender. A 10,000 mAh extra battery was employed. 5V/2A output capacity is supported.

- MicroSD: The suggested system is based on Raspbian, a Linux operating system. Install numerous required packages using this external storage device capacity was utilized up to 16 GB

B. Software

- Buster for Raspbian: The Raspberry Pi Foundation provides Debian-based software. A commercial version of the Linux operating system has been developed
- hostapd: The WLAN adapter in Linux serves as both an access point and an authentication server. It is operated by a daemon program.
- DNS caching and DHCP (Dynamic Host Configuration Protocol) server services are provided by dnsmasq.

Figure 2: The Implemented System image

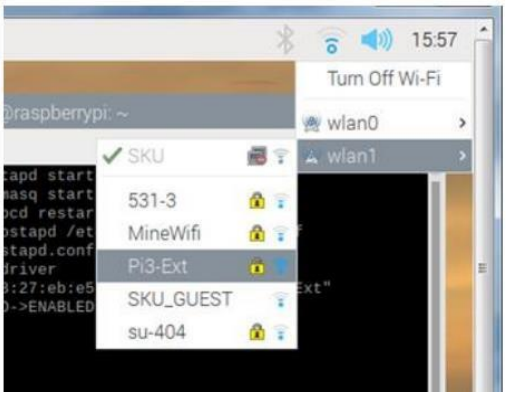

Figure 3: Creation of WiFi extension AP

For Raspberry Pi 3 Model B, there are instructions in the handbook. The Wi-Fi antenna in the top right corner of the Raspbian icon in Fig. should now be connected. An AP called 'Pi3 Ext' is generated as shown in figure 3.

As soon as the Wi-Fi signal from the hallway comes in, the door should be opened and activate it, connect your smartphone to the AP, and then attempt to whistle. Page displays properly after that. If this is the case, you may verify that the system is functioning properly. Afterwards, the spare battery. The integrated system's exterior appearance is seen in Fig. 2 on the left. In this situation, the Raspberry Pi 3 model comes with a protective case that covers the battery.

Battery is the form that overlaps. A micro 5 pin battery auxiliary is available. All power was provided to the Raspberry Pi through the USB connection used to connect it to the computer. There is a Wi-Fi dongle on top of the casing that serves as an AP. Using the USB port, it's connected. The finished Wi-Fi extension may be seen in the photo to the right of 4. Make your way over to the iron gate, which is near to the window with the finest reception, and pick up the antenna Wi-Fi signal of -67dBm size received via the window by wifi extender and recommended system. It is possible to make advantage of the signal replicated.

IV. RESULT OF THE EXPERIMENT

The Wi-Fi signal was used in this investigation to assess the performance of the suggested system. Using B to test the Raspberry 3 model's internet speed and strength (named Ext3). We'd want to be able to display it on all models, regardless of hardware kind. A Raspbian Buster operating system has been installed on the device.

The hostapd and dnsmasq packages were deployed as part of Samsung's Galaxy S8 performance test. In order to do this, the program mentioned above was installed. The WiFi Analyer app [14] was used to assess WiFi signal strength, and Internet speed was tuned for a home network. [15] The app BENCHBEE was utilized. Afternoon: time to take a fast reading. Average values are calculated by averaging data collected from 10 separate measurements.

5 and 8 meters away from the entrance. The Wi-Fi signal intensity was measured, and this was the observed result. When the door is opened, take Ext3, measure 3. Measured distance as predicted when the door was opened. Ext3's signal intensity was always greater than Ext3. When Ext3 and Ext4 were measured at 0.5m, Ext3 was -27dBm, while Ext4 was - 28dBm. A noticeable change in received signal power between 5m and 8m The teeth shrunk and finally vanished as they became smaller.

V. CONCLUSION

Experimentation using a Raspberry Pi and an external battery was documented in this publication. Utilize a Wi-Fi extender that is small, cheap, and convenient for on-the-go.

Set up the suggested system within a signal-attenuating iron office gate. It boosts the outdoor public Wi-Fi signal within the workplace or room. Experiments have shown that anybody can access the internet and view video streaming.

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