CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

36076

Project Title

A Customized Directional Antenna System to Focus WiFi Signals

Abstract

Objectives/Goals

This experiment was conducted to investigate the feasibility of utilizing a helical antenna and customized mechanism to optimize Wi-Fi strength at various locations. In the 21st century, where robust internet is a vital necessity, consumer requirements drive the need to investigate methods to enhance WiFi signal strength.

Methods/Materials

A 2.4 GHz helical antenna was constructed using physics formulas and household materials, and two pan-tilt brackets were purchased online. Two servo motors were connected to the brackets, and one of the motors was attached to a wooden base for stability. An Arduino Uno was utilized to drive the motors; it was programmed using code generated for Arduino Software. The Arduino was programmed to move +120 degrees in elevation and azimuth, depending on the location of the computer. Finally, an old WiFi router was modified to provide an internet signal to the helical antenna.

Results

Once the Helical Antenna was built, testing was possible. The Helical was measured for Return Loss in -dB using a machine called a Keysight Field Fox Microwave Analyzer. Furthermore, the Signal Analyzer was utilized to measure the far field performance of the antenna at various locations and distances. The signal strength was measure in dBm. The data showed that there was a significant increase in the power level of the Wi-Fi signal. The 15dBi output of the WiFi router was increased by the 13 dBi gain of the helical antenna, which focused the WiFi energy to a 47 degree beam. Once the antenna was functioning properly, it was integrated with the brackets and servo motors, Arduino, router, camera, and support structures. The finished #Customized Directional WI-FI Antenna System# (CDWAS) was able to be pointed directly at the target laptop computer and a focused beam of WiFi energy delivered to the user.

Conclusions/Discussion

Therefore, the hypothesis, #If a Wi-Fi router is altered to propagate beams using a customized directional antenna system aimed at specific locations, then the Wi-Fi signal strength to those locations will be enhanced.# was accepted. The CDWAS was able to focus the WiFi energy beam and point it towards the target, which resulted in an increase in the amount of signal power that a device received. In the future, it would be interesting to determine whether the design can be improved to use more than one helical antenna to allow for the tracking of more devices.

Summary Statement

The Customized Directional Wifi Antenna System was able to focus the WiFi energy beam and point it towards the target, which resulted in an increase in the amount of signal power that a device received.

Help Received

I designed, built, and performed the experiments myself.