



CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s) Alisa Y. Hathaway	Project Number S1009
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Project Title
Increasing Wifi Signal Strength Using a Phased Array Helical Antenna System

Abstract

Objectives/Goals
This experiment was conducted to investigate the feasibility of utilizing a phased array that is able to focus its signal strength on a specific location. 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 5 GHz phased array with helical antennas was constructed, and a circuit board was designed. Many different physics formulas were applied to calculate dimensions. The board incorporated phase shifters, shift registers, 0.1 uF capacitors, 2 6-pin connectors and 1:2 Wilkinson dividers. An Arduino Uno was programmed to shift the beam to a specific location, and the time was delayed between each element.

Results
The phased array antenna system was tested and optimized using a Keysight Fieldfox Microwave Analyzer. The phased array antenna system was able to ameliorate the wifi signal strength significantly. The antenna gain of a phased array was calculated:
 $G_a = 4 \pi A_n \sin^2 \theta$
The phase shift between two elements:
 $\Delta \phi = 2 \pi (d \sin \theta) \cdot \sin \theta$

Conclusions/Discussion
The hypothesis, #A stationary array of helical antennas could be digitally controlled using phase shifters, in order to form a focused beam that could be steered to a specific target location.# was accepted. The phased array board was created to shift beams in certain locations to allow a higher concentration of energy to be placed within a smaller area. This also shows why an original router would not be as effective, considering the fact that the classic router sends out signal isotropically.

Summary Statement
In order to increase Wifi signal strength, a phased array helical antenna system was designed and implemented.

Help Received
Mr. Neil Yamamoto - Keysight Fieldfox Microwave Analyzer borrowing , Mr. Mike Herndon - understanding tuning (impedance matching), Mr. Ameesh Pandya - MATLAB understanding