Outdoor Transmitter Localization

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Introduction

Outdoor transmitter location is the process of locating a signal in an outdoor environment without knowing the exact location of the transmitter. Transmitter location in an outdoor environment is useful in several situations: responding to emergencies, finding location without a GPS device at hand, and detecting the position of malicious attacks on a system. However, in any outdoor location, obstructions in the environment can result in multipath distortion which occurs as radio signals are warped when reflected off these obstructions.

Research Objective

Due to the vast nature of this problem, our research focused on laying a foundation for future researchers to use O-CORNET software as a means of looking at parameters and seeing their correlation to position.

Methodology

- Used rogue walkie talkie to transmit a signal to be detected from O-CORNET.
- Synchronized all O-CORNET nodes together using TCP Sink/Source in GNU-Radio (Figure 1).
- Reduced lag of O-CORNET by streaming data directly onto computer.
- Compiled the data onto one graph using the WX GUI Scope Sink in GNU-Radio.
- Used python to convert the files.
- Analyzed data in MATLAB.
- Plotted the amplitude against time and real vs. imaginary.

Results & Conclusion

This project was mostly successful in setting up O-CORNET for further use. The received signal shapes (Figure 2) were consistent with the signal that was transmitted. Since there was no major loss from the file conversion, the code can be easily modified to look at the potential correlation between signal shape and location. The results for the power levels were consistent with the expected outcome. The nodes closest to the transmitted had a higher relative power (Figure 3). When the real vs. imaginary were plotted, the graph (Figure 4) showed rough circles from each node. The diameter of which corresponds to the power level of each node. Since these transmissions were line of sight with a sinusoidal wave, the result was expected to resemble the unit circle. The code that was used to obtain the information was correct.

Future Work

- Obtain a more accurate, higher power, and programmable transmitter to control the shape, length, and power of the signal being transmitted.
- Enable GPS capabilities on nodes to obtain time stamps of received/sent data.
- Determine baseline power level inside nodes.
- Research the potential correlation between signal shape, signal length, and transmitter location.

Acknowledgements

We would like to acknowledge and thank Dr. Louis Beex (mentor), Ferdinando Romano, Jason Snyder and Dr. Vuk Marojevic for their assistance and guidance during this project. In addition, we would like to acknowledge the National Science Foundation for their support and funding for this project.