Wireless Modular Testbed

Hannah Caldwell-Meurer, Jack Garrard, Ryan Hitt & Cody Roberts

School of Informatics, Computing & Cyber Systems, Northern Arizona University

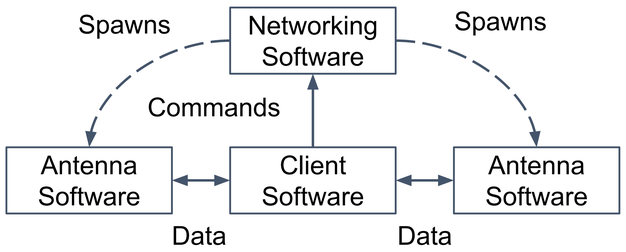
College of Engineering, Informatics, and Applied Sciences

WIRELESS MODULAR TESTBED Capstone

Introduction

Build a Wireless Modular Testbed that can use FM, Wi-Fi AP, Wi-Fi Mesh, Zigbee, Bluetooth, and LoRa. The goal of this project was to transfer data across multiple channels as well as allow the client to process the data. This project would use raspberry pi's as the nodes in which the antennas to communicate between. The project was given to us by Dr.Vigil-Hayes, a computer science professor at NAU, with the purpose to build a wireless testbed for future students. The development of this device would be used in research and a classroom setting to show network configurability of various wireless communications.

Software Concept Idea



The client software controls networking software through pipe commands. The networking software can then spawn antenna software to which the client software can attach with FIFO files.

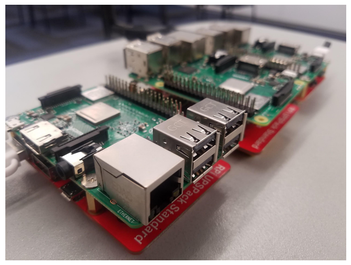
- Uses Pipes & FIFO files for interfacing
- Lightweight & robust
- Easy antenna addition
- Portable & modular design

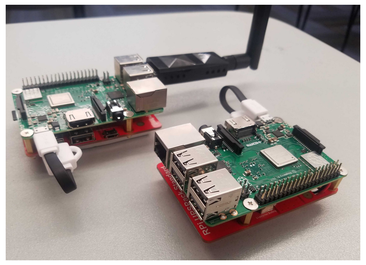
Hardware Requirements

- Battery Powered (lasting 10 hours)
- Easily switch between antennas
- Independent data processing
- Simple UX / Additional hardware load if required

zigbee Bluetooth WiFi LoRa

Results





We faced several challenges along the way:

- Hardware price, usability, speed
- Unknown data passing through software
- Creation of an interface similar to mininet

We were able to solve most of our challenges in the project with the software and hardware. For our final product, we were able to produce several raspberry pis that were able to connect to all antennas listed under the hardware requirements. The software that was produced allows for any type of client software to interact through the interface of pipes and files with unknown data being pass through them.

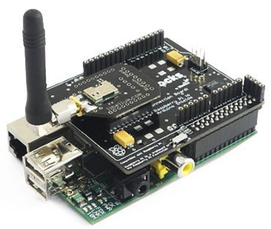
The additions of a future antenna can be achieved through the creation of a small program that pipes data from the files into antenna's protocols. The networking software also allows configuration through a JSON file or through configurations on other PIs. The team was able to meet the clients specifications because of this combination between hardware and software implementation.

Conclusion

The Wireless Modular Testbed has succeeded in fulfilling the Client's goals and requirements for the project. By developing a modular base that can be used to add on more antenna types we leave room for growth. The Network software that can control the antennas through the Pi's is a helpful tool in data distribution through the mesh network. We were able to concatenate different sources of information together and create a working project that will allow for easy signal processing simulations. Thought the team did face challenges during the prototyping process. Such as hardware constraints and passing in unknown data types to the software.

Future Work

The idea behind this project was to create a modular device, future implications and add-ons were built into the design. To accommodate for this we have left much of the devices open for three to four additional antenna types. The software developed is also open-ended. Acting as a hub between the different subsystems and passing data in between each of them. We hope what we have done represents a good starting point for the Wireless Modular Testbed. With more work, different antenna types can be added and the functionality can increase.



References

All project documentation available online

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