



A Cross-Band Repeater System Using a Raspberry Pi And BaoFeng Radios

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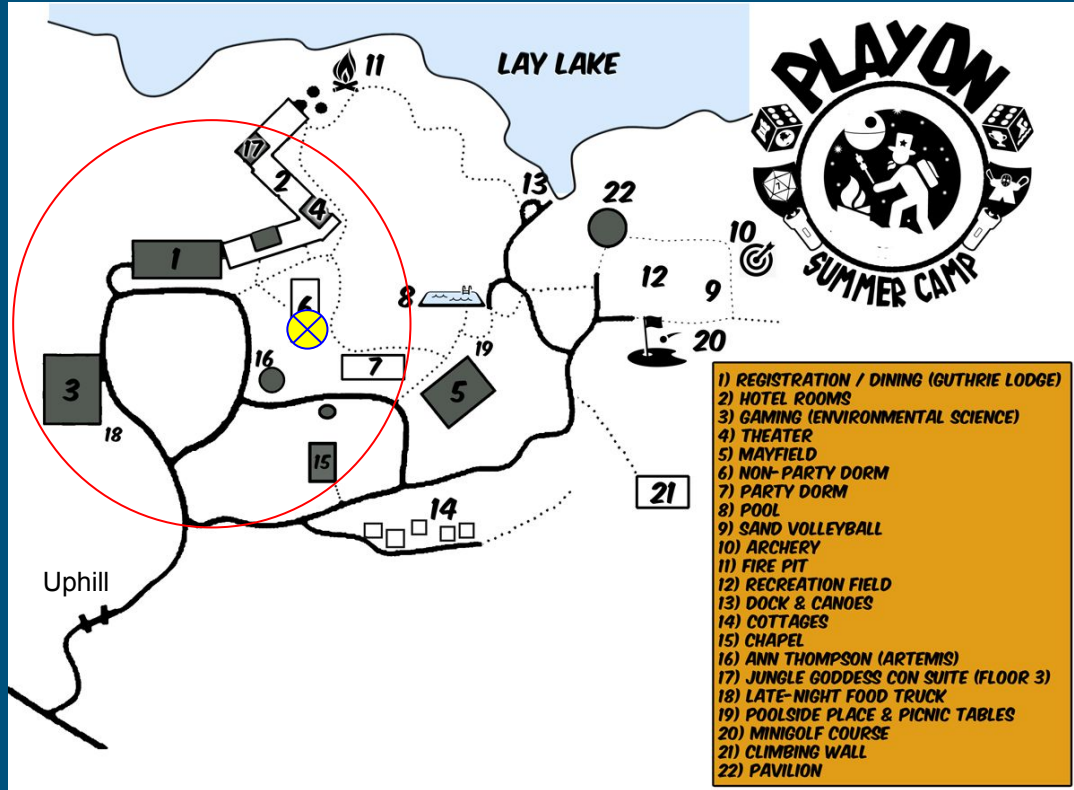
Outline

- The problem
- Our proposed solution
- Shopping list
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- Electronics work
- Programming work
- Real-world testing report
- Future improvements
- Q&A
- References

The Problem - Play On Con

- <https://www.playoncon.com> - Yearly board gaming and fandom convention in the Birmingham, AL area
- Currently located at a 4H campground with limited cell reception/internet
- Friend group of 12~24 people goes yearly
- How do we solve communication issues with no internet/cell? Radios!
- Four licensed so far, others eventually due to convenience
- Large footprint in a hilled region
- Several buildings are radio frequency secure
- Handheld radios aren't quite strong enough to reach everywhere
- Commercial repeaters are expensive for a weekend usage

The Problem - Play On Con



Our Proposed Solution

- Set up a temporary repeater in the most financially reasonable way
- This turns out to not be buying repeater equipment
- Instead a learning experience
- Cross-band Repeater using two Radios
- BaoFengs are cheap - however any radio with PTT+audio IO would work

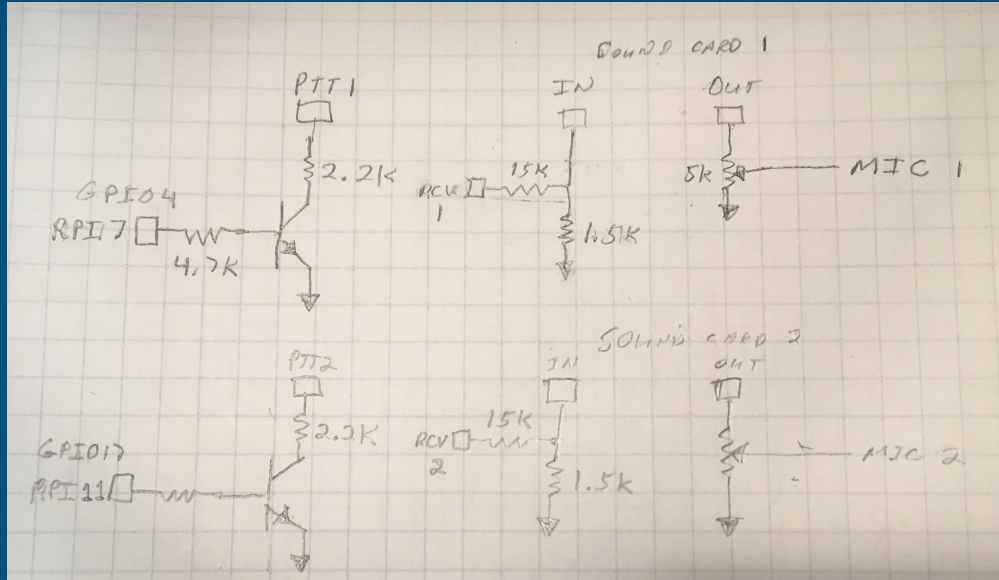
Shopping List (Example)

- [Raspberry Pi](#) - Price varies based on requirements... \$35~\$70
- [MakerSpot Prototyping Board](#) - 3 pack for \$8
- [Plugable USB Audio Adapters](#) - 2 for \$8/ea
- [BaoFeng UV-5R](#) (or equivalent) - 2 for \$25/ea
- [Magnetic-mount Mobile Antenna](#) (2 meter/70cm) - 2 for ~\$25/ea
- [Power Strip with USB power](#) - \$13
- Antenna Mount - Price varies based on build quality and purpose
- Total: ~\$165-200
- Cheaper than a lot of repeaters on eBay, but the journey is half the fun

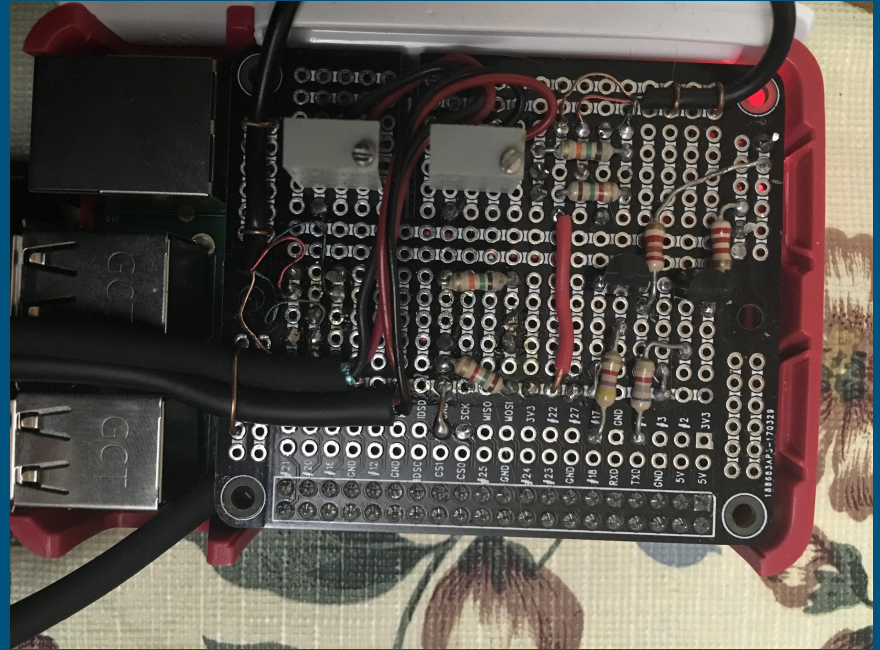
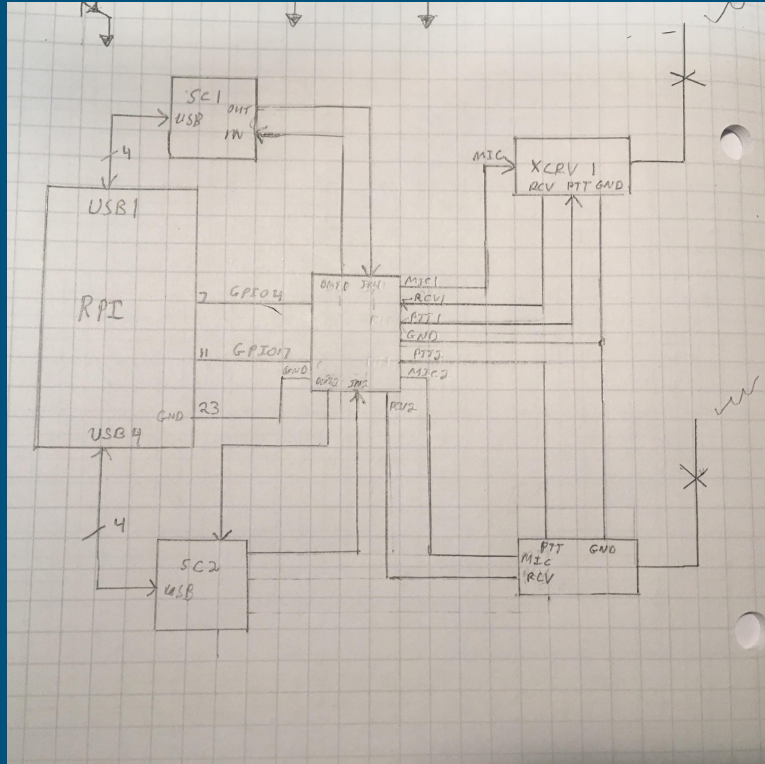
Demonstration

- Act impressed! Please. :(

Electronics Work



Electronics Work



Programming Work

- Extends [PeaterPyPer](#) - A simplex repeater that parrots communication
- Completely rebuilt his design to remove -ux security headaches
- Software link of the two physical devices
- Station ID every 10 minutes from prerecorded wav
- Turns out the RasPy uses GPIO pins in an unexpected way...
- Always use the most recent software libraries
 - Audio quality was horrible
 - Issues with cross-talk or the radios looping themselves
- Quick code overview
- Python files are abstracted from the config for any potential future users

Real World Testing Report

- Buy the programming cable for BaoFengs if you use them
- Suboptimal choice of location hampered efforts
- Hills are hard to broadcast through
- BaoFeng radios have the worst charging concept known to man
- Build a good mount, it helps!

Future Improvements

- Easier to transport design
- Better wire management
- Different radios with more functionality
- Solar power to drive the entire interface
 - Run off a Tesla's batteries locked in a trunk/frunk?
- Dynamically detect broadcast frequencies?
- (Dream) Tomcat WAR to allow for configuration if connected to network
- Web interface station ID recording

Q&A

Any questions?

Found while researching the presentation:

- [SainSonic RPT-2D Two-Way Radio Repeater Box for Two Ham Transceivers](#)

Resources/Cool links

Shopping list - [amazon.com](https://www.amazon.com)

BaoFeng pinout info - [Miklor.com](https://www.miklor.com)

Programming references - [PeaterPyPer](#) [Python 3](#) [PyAudio](#) [Python RPi GPIO](#)

[PlayOnCon](#)

[Alabama 4H Center](#)