

Motivation

To improve conventional wireless communication and allow better usage of the electromagnetic spectrum by sensing the frequency content in the environment and avoiding interference between users.

Objectives

Project Goal:

- To be able to detect a (randomly generated) signal from a transmitter using multiple receivers (Fig. 1).

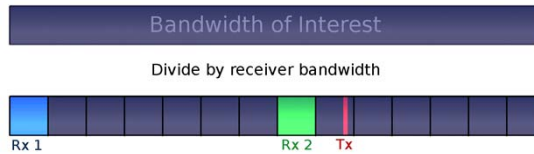


Fig. 1 – Diagram for spectrum sensing.

USRPD

USRPD (*Universal Software Radio Peripheral Daemon*) [1] is a software package, created by Dragoslav Stojadinovic, designed to work with spectrum sensing using multiple transmitters and receivers (Fig 2).

- Receivers are able to communicate with a central controller and perform various functions.
- USRPD is used to obtain and process data acquired by energy calculations performed on the spectrum.

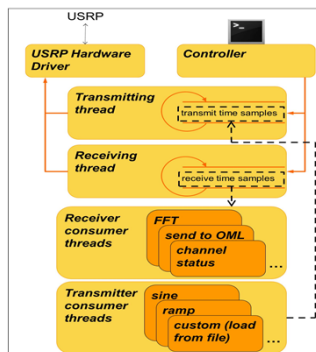


Fig. 2 – Logic diagram for USRPD [1].

Spectrum Sensing via Energy Detection

- Energy detection was used to locate the signal, as seen in the block diagram below (Fig. 3);
- The USRP hardware performs initial filtering and converts the signal into digital samples [3];
- A Fast Fourier Transform is performed on the samples in the USRPD program

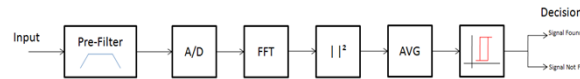


Fig. 3 – Energy detection block diagram [2],[3].

Results

Graphical User Interface Design

- Designed a MATLAB Graphical User Interface to create a spectrogram for visualization (Fig. 3);

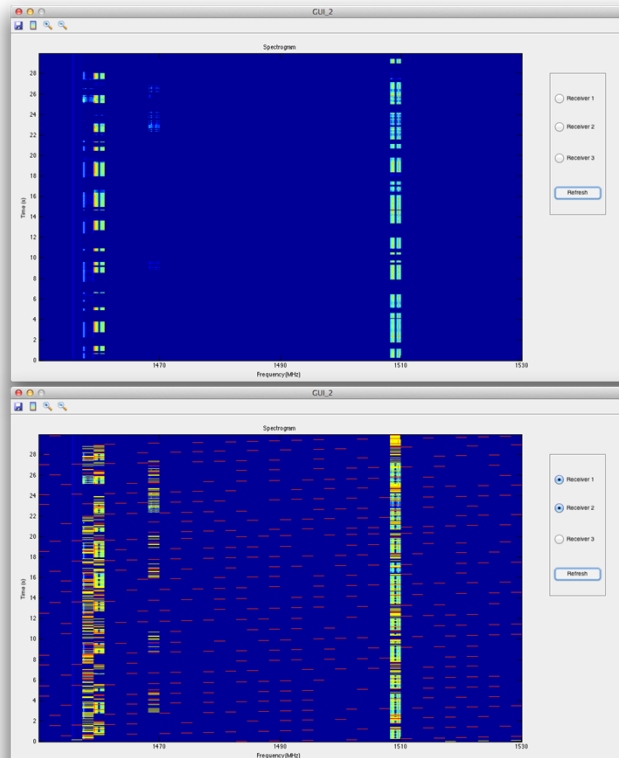


Fig. 4 – Spectrogram Results

Results (continued)

USRPD Controller Program

- Designed and implemented a controller program to send commands and get data from multiple nodes using USRPD (Fig. 5);

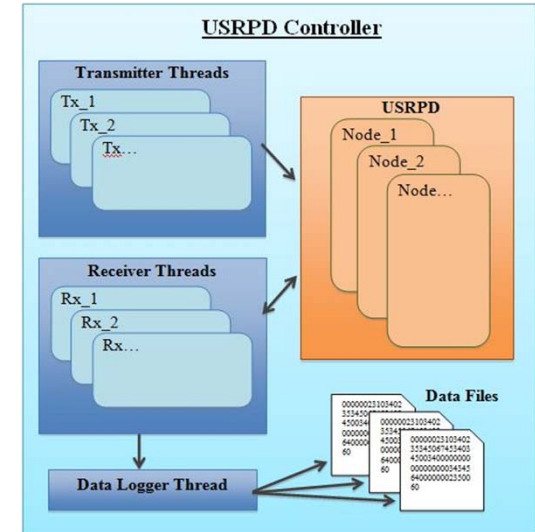


Fig. 5 – USRPD Controller diagram

Future Work

- Develop a method to compare different sensing algorithms
- Configure our control program to display results in real time.
- Allow for user-inputted sensing algorithms.

References

[1] Dragoslav Stojadinovic. USRPD user guide available at <http://wiser.orbit-lab.org/wiki/wiser/mSoftware/aWiser#wiser>.

[2] Sun, Hongjian, et al. "Wideband Spectrum Sensing for Cognitive Radio Networks: A Survey." *IEEE Wireless Communications* (April 2013): 74-81. Web.

[3] Department of Electrical and Computer Engineering, "ECE4305: Software-Defined Radio Systems and Analysis, Laboratory 4". Lab handbook. Worcester Polytechnic Institute. Worcester, MA. 2011. Web.