



St. Stephen's Community House

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Understanding Radio Technology St. Stephen's Community House Summer Program for Middle School Students

This document describes a three-phase project for the middle school children at St. Stephen's Community House, Columbus, Ohio. This project will be offered during Summer 2014, with a potential pilot program in Fall 2013. The whole project will be offered 1-8 times every summer.

Goal: There is much evidence that children decide NOT to have a career in Engineering when they go to middle school. The goal of this project is to expose them a special topic in Engineering in order to encourage them to consider a career in Engineering. The government of United States has identified wireless technology as key to meeting the ever-growing demand on data. In fact, the government will be opening up 200MHz of spectrum in the next 10 years to address this demand. This demand also means that there is will be a need for Engineers who can work with this technology. Thus, the futuristic goal of this project is to encourage the students of today to consider a career in wireless in the future. Therefore, this project will be focused on wireless/radio technology.

The Project: The project will introduce students to basic radio operations. The students will have hands-on experience building a simple FM radio receiver and then building a walkie-talkie. We will be using laptops connected to USRP software-defined radios for this project. Every group of 2-3 students will be given a laptop, a USRP radio and a WBX daughterboard. Prof. Kannan Srinivasan and his research group (CoSyNe) will provide these hardware components and any documentation to build this project.

This project has three phases or sub-projects. The first sub-project will introduce the students to the concept of frequency. In this phase, the students will be looking at the spectrum observed by our software-defined radios. We will use a spectrum analyzer tool in our platform to show the different transmissions going on at different frequencies. Figure 1 shows the tool that we have developed that shows the first phase of the project. It also shows the spectrum output. The students can record the spectrum and identify different radio stations (FM 90.8, NPR, etc.).

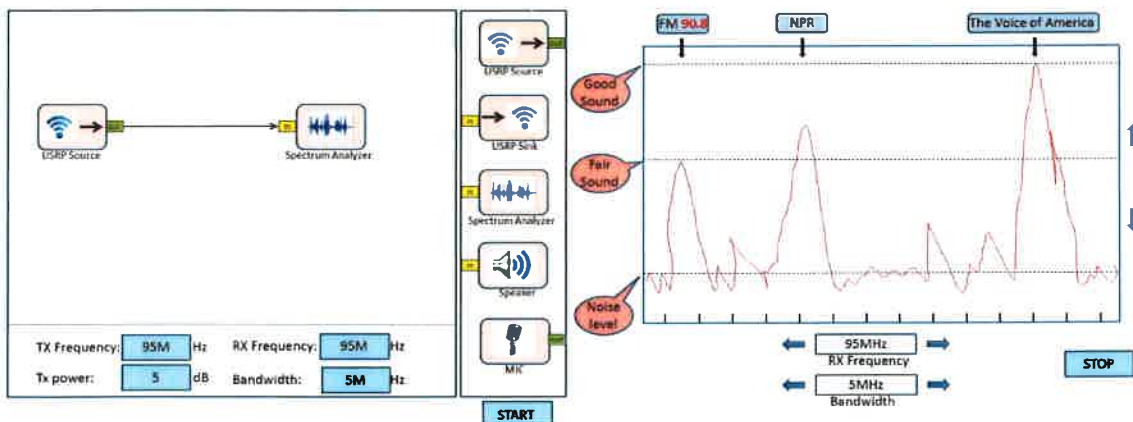


Figure 1. The basic radio tool with the USRP source connected to a spectrum analyzer. It also shows the output of the spectrum analyzer.

In the second phase of the project, the students will choose a frequency from phase 1 and tune to the radio station by directing the output of the USRP source to a speaker. Figure 2 shows these components.

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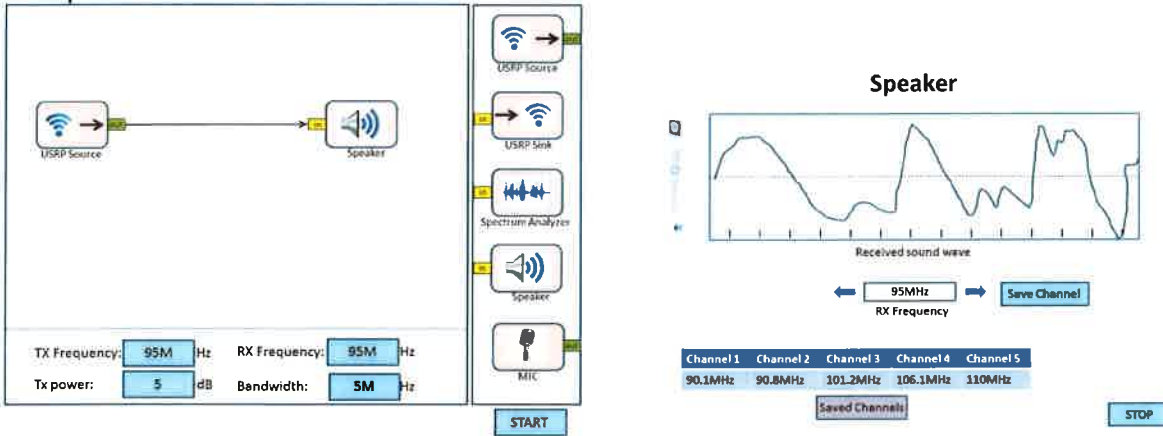


Figure 2. Listening to a radio station. A speaker is connected to a USRP source which is tuned to

a radio station. The speaker output is plotted and can also be heard by the students.

In the third phase of the project, the students will build a walkie-talkie. In this phase, they will design a system that transmit their voice signal and a system that can receive a voice signal. The students can choose from different frequencies so that they can communicate with different groups. The students will also adjust the transmit power to understand how the transmit power is related to the distance of communication. Figure 3 shows these components.

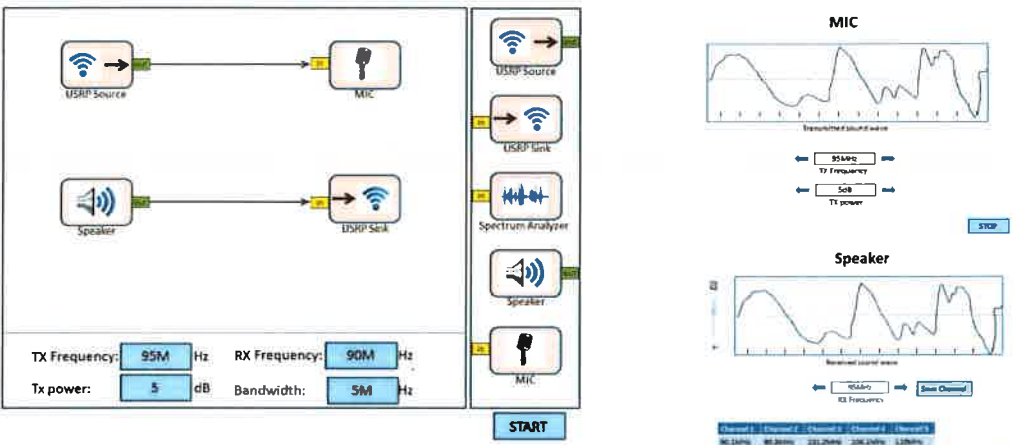
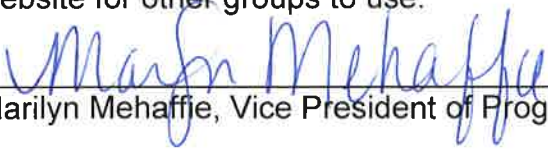


Figure 3. A Walkie-Talkie. It has both a microphone connected to a USRP sink and a speaker connected to a USRP source.

The students can tune their transmit and receive frequencies and communicate with each other.

Responsibilities: Prof. Kannan Srinivasan and his group members will be responsible for providing the hardware, software and documentation related to this project. St. Stephen's will be responsible for providing staff to help with monitoring the students.

Availability: The entire project and any tools developed will be made available online on CoSyNe's website for other groups to use.



Marilyn Mehaffie, Vice President of Programs & Services



Date

