

AIR BAND SCANNER WITH RETRANSMISSION TO LOCAL FM RADIO USING A SOFTWARE DEFINED RADIO

Final Report
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Outline

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- Background
- Development
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Project Goal

Project Goal

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- The goal of this project is to receive air band transmissions with the TVRX daughter board and then retransmit the received transmissions, using a BasicTX daughter, over an FM frequency that can be received using a standard FM radio
- Essentially this is an AM to FM repeater

Hardware and Software

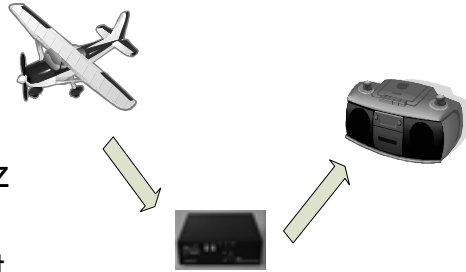
- Hardware
 - USRP
 - TVRX Daughterboard
 - BasicTX Daughterboard
 - FM Transmitting Antenna
 - AM Receiving Antenna
- Software
 - GNU Radio



Airband

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- Used for Aircraft Communications
 - Multiple frequencies for one airport (CLE uses at least 14)
- 108 MHz – 137 MHz
- Amplitude Modulation (AM) not Frequency Modulation (FM)



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Development

Phase 1: Airband Reception

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- Used usrp_am_mw_rcv.py demo program as starting point and simple “rabbit-ear” antenna
- Program worked but signal strength was very low
- Determined that the antenna was the easiest thing to upgrade
- Built a quarter wave ground plane antenna
 - ▣ \$15 worth of parts from Radio Shack and Home Depot

Quarter Wave Ground Plane Antenna

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- Vertical – 23”, 10 AWG Copper House Wire
- Legs – 24”, 10 AWG Copper Wire.
 - ▣ Bent at 45° from the base
- Base – SO239 Bulkhead Connector
- Tuned to 120 MHz
- Built for portability



FM Transmission

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- Started with MP3 to FM transmitter
 - ▣ Found in GNU Radio mailing list archives online
 - ▣ Required installation of latest version of Sox
- Used a SMA703 antenna
 - ▣ Again, weak signal strength
- Tried a standard FM radio antenna from a home stereo
 - ▣ Works very well

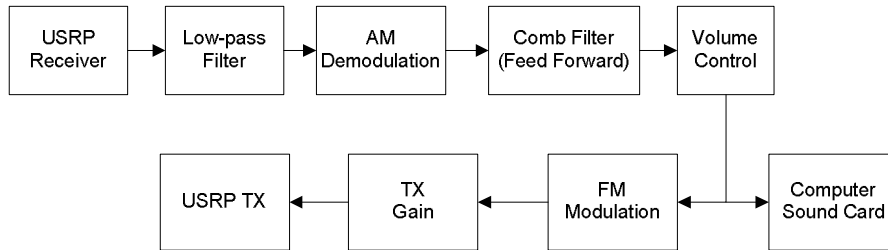
Reception and Transmission Integration

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- Used AM example program as starting point
- Heavily modified code to add in the USRP as a sink for the demodulated AM reception
- Left in ability to sink the receptions to the computer soundcard as well
- Added several options to command line parameters for full functionality

Repeater Function Block Flow Diagram

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GUI Development

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- wxPython Graphical User Interface (GUI)
- Developed within GNU Radio framework



Software Tools Used for Development

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Software Package	Version	Use
Eclipse	3.4.2	Python code development
PyDev	1.4.5	Plug-in for Eclipse to enable Python development in an IDE
Python	2.5.4	Scripting language used to access GNU Radio Libraries
GNU Radio	3.1.3	Libraries used to interface with the USRP and do signal processing
Sox	14.2.0	Used in getting MP3 to FM player working
Ubuntu Linux	8.04	Main OS used for development

Future Improvements

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- Investigate filtering more aggressively
- Add squelch capability
- Automatic variable gain for strong vs. weak signals strengths
- Antenna rebuild with welding rods
 - ▣ Mount antenna in a higher location

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Demo

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Questions and Answers