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GNU Radio Companion (GRC) On Software Defined Radio Platforms

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GNURadio Companion (GRC)
On Software Defined Radio Platforms

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Background

- Software defined radio (SDR) provides a more flexible and upgradeable radio platform compared to hardwired radio infrastructure
- Some SDR applications include amateur radio transmission, aircraft and ship tracking, satellite transmissions, RF communications, and radio astronomy
- The use of graphical “drag and drop” programming such as that in GNU Radio Companion (GRC), developers can create a working system and test it with limited knowledge and in a relatively short amount of time
- Developing a product with open source GRC blocks is less expensive than contemporary design of RF hardware. Libraries of these blocks are currently being developed at a rapid pace and are compatible with current SDR platforms
- The WBT is an all-in-one SDR solution that allows the user to record, transmit, and analyze on the go in the field
- The WBT has platform specific functions that are not a part of GRC’s native libraries. These functions include recording, transmitting, reading GPS sensors, sweeping, and calculating FFT data. Our goals all involve developing these capabilities for the WBT in GRC blocks
- A fundamental mathematical calculation performed by RF equipment is a fast Fourier transform (FFT). Acceleration and implementation of this function in hardware greatly increases the capabilities of any system using it

Goals

Completed Goals:
- WBT FFT Source Block: Access to processed FFT data from the WBT memory in GRC
- WBT FFT Sink Block: Playback data from a GRC dataflow graph
- WBT Sweeper Source Block: Sweep range to obtain fine tuned readings
- WBT GPS Source Block: Get valuable GPS metadata including latitude, longitude, altitude, current time, and more
- FFT GRC Block with Hardware Acceleration: Develop a hardware accelerator on a FPGA that enables accelerated processing of FFT calculations

Future Goals:
- Make the hardware accelerator faster
- Implement a more portable program for the FFT accelerator
- Increase the number of points that can be processed in one FFT accelerator cycle
- Add additional types of hardware accelerators to the FPGA

Outputs

Figure 1: Functional dataflow diagram of FPGA FFT accelerator

Figure 2: Example of a GRC dataflow graph which allows the user to easily modify parameters

Figure 3: WBT FFT Source showing FFT data preprocessed by the WBT with a large local oscillator spike in the center

Figure 4: WBT Sweeper Source showing data centered at 1,000 MHz with a 25MHz bin size

Figure 5: Shows Human readable GPS meta data that the WBT GPS Source block prints to the console. This debugging information is printed to the console when running via SSH