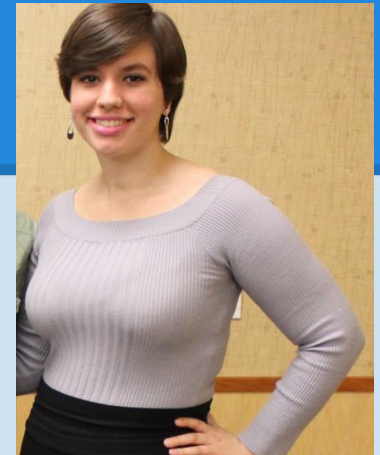
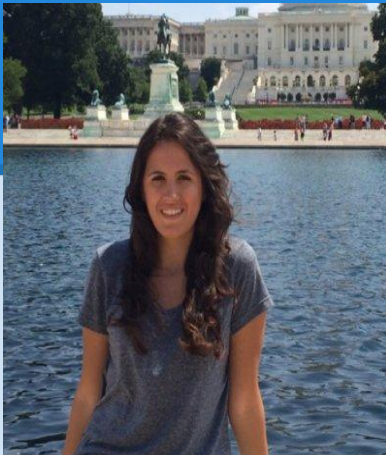


Find our project on GitHub!
<https://github.com/ThePomelo/Spectrum-Sensing>

SDR - Spectrum Sensing

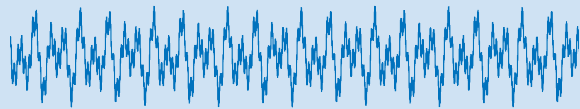
Christina Baaklini, Michael Collins, Nick Cooper, and Nicole DiLeo



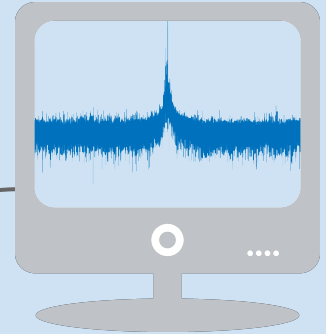
Project Overview

Project Goal

Develop a platform for visualizing the radio frequency spectrum using software-defined radio.



Time Domain
Radio Signals



Frequency Domain
Visualization

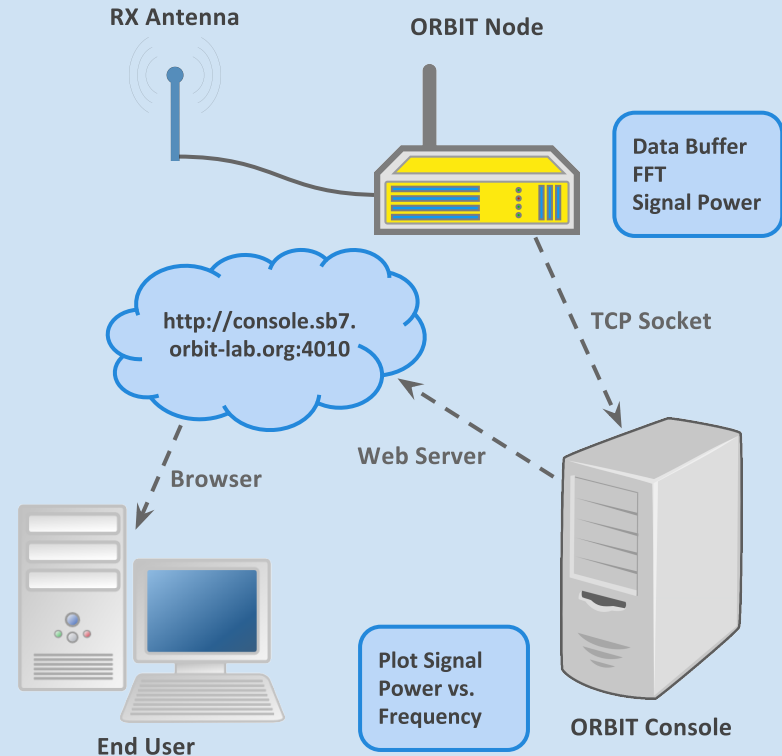
Project Objectives

- **Using ORBIT, configure radio receiver(s) to collect IQ time samples**
- **Process the samples to obtain frequency-domain data**
- **Analyze frequency data to identify any unknown signals**
- **Repeat with modified receiver carrier frequency, sampling rate, etc. to scan the available frequency spectrum for signals**
- **Implement methods above in real-time on CPU and FPGA**

Current Progress

CPU Implementation

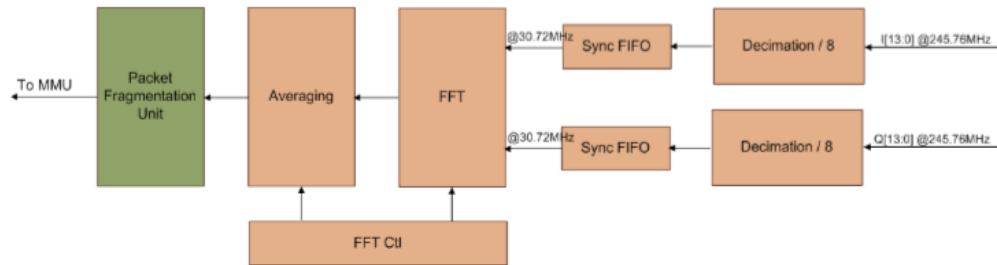
- **Browser-based visualization using Wt C++ library**
- **Configured Sandbox 7 and Grid consoles**
- **Plan to use TCP sockets to send FFT data from receiver node to console**
- **Console will display data in web browser**



Current Progress

FPGA Implementation

- **Spectrum Sensing Application (Sensing across a large bandwidth)**
- **Design of PFU (Packet Fragmentation Unit)**
- **Implementation of state machines in VHDL**
- **The final project goal is to use Octave in Linux to detect the spectrum**



```
WHEN ST_DATA =>
  o_busy <= '0';
  IF(sig_valid = '1') THEN
    IF(UNSIGNED(wrd_cnt) = 0) THEN
      o_sof <= '1';
    END IF;
    IF(i_eof = '1') THEN
      sig_busy <= '1';
      sig_last_pkt <= '1';
      current_state <= ST_LAST_WORD;
    ELSE
      IF(UNSIGNED(wrd_cnt) = X"FE") THEN
        sig_busy <= '1';
        current_state <= ST_LAST_WORD;
      END IF;
    END IF;
    o_data <= i_data;
    o_data_en <= i_data_en;
    wrd_cnt <= STD_LOGIC_VECTOR(UNSIGNED(wrd_cnt)+ 1);
  END IF;
```

Achievements

- **Design of ORBIT Grid Experiments using OEDL scripts**
- **Development of MATLAB Spectrogram Toolkit for post-processing signals**
- **Development of Real-Time Plotting Module in C++ for the Wiserd Framework**
- **Browser-based Visualization for plotting module**
- **Design of a Mealy finite-state machine of the PFU using VHDL code**

Acknowledgments

Special Thanks To Our Advisors

Ivan Seskar

Dola Saha

Wade Trappe

Also, thanks to Dragoslav Stojadinovic and Prasanthi Maddala for their assistance in our project.