Developing Python Programs for Data Collection and Analyzation

Kevin Li
College Park Scholars – Science & Global Change Program
Computer Engineering
k3vinli@umd.edu
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Introduction
During the fall and spring semester, I worked at the Joint Quantum Institute with graduate researcher Jonathan Vannucci. I worked to develop Python data collection programs to collect data from cameras that measured light from a laser being shone on a 2D material at cryogenic temperatures.

Activities:
I developed a Python program that could take scripts for a variety of instruments in order to collect and display the data that was collected. I needed to develop the program so that it displayed the data being collected in real time. This was done using multithreading with the GUI running in the main thread and the data collection being ran in another. I also learned more about Python and its libraries like NumPy and PyQtGraph for displaying data and PyQt5 to develop GUIs for the program.

Impact:
The program that I have developed will help make it easier to collect data in the lab since I have improved on a previous programs features. Also, the program that I have created is modular so in theory, it will work with any new modules that are developed to collect data from new machines. This project helped me get better at coding and developing programs in Python and helped me understand more about how Python works.

Discussion:
In the beginning, I knew very little about developing programs in Python and I started out making a simple program to collect data from an oscilloscope. However, the program that I had developed freezes whenever data was being collected. This was an obvious problem since the instruments that I develop programs for will sometimes be running for long periods of time, where the data needed to be monitored as it was collected. This meant that I needed to learn how to use threading in Python in order to keep the GUI running and display the data being collected in real time. After I finished the simple program, I created a main program that could take another Python script that collects data, send instructions to the instruments, plot the data being collected in real time, and be able to save the data after it was finished. I eventually finished the program and it can collect thousands of datapoints a second without slowing down or freezing.

Site Information:
Joint Quantum Institute
Address: 4296 Stadium Dr, College Park, MD, 20742
Site Supervisor: Mohammad Hafezi
Site Mission: Designs, fabricates, and collect measurements of 2D material device structures that exhibit unique electrical and optical responses at cryogenic temperatures.

Issues Confronting Site:
The lab needed to develop a new program in Python that could collect data for their instruments since the old program they were using was not able to be updated. Also, I would need to redevelop existing data collection modules to work with the new program.

Future Work:
As of now, the main program is functional and is able to collect data from some instruments. In the future, I will continue to update and refine the program and develop more modules for the instruments in the lab.

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