Swift VISA Wrapper

1.   Company Background

Dr. Owen Hildreth is an Assistant Professor in the Department of Mechanical Engineering at the Colorado School of Mines. His primary research is on nanometer to centimeter-scale additive manufacturing technologies. He has written numerous MacOS applications for custom data-collection and visualization as part of his research.

2.   Project Description

A few years ago, we sponsored a field session for students to write a Swift wrapper around the popular NI-VISA framework (https://github.com/SwiftVISA/SwiftVISA) so that we could write applications to control our instruments using an Apple Computer.   This led to a larger project to write our own, pure-Swift VISA implementation (https://github.com/SwiftVISA/SwiftVISASwift) that has helped our group immensely. One challenge we've faced with SwiftVISASwift, is that communicating with USB devices is heavily restricted using Apple's API's. As a result, SwiftVISASwift currently only communicates with devices using Socket TCP/IP.

To bring full USB support to SwiftVISASwift, we are looking for a group of students to make a Swift wrapper for the libusb library (https://github.com/libusb/libusb). libusb is a powerful, cross-platform C-library for communicating with USB instruments that currently works with macOS (with some minor restrictions). This would allow us to bring USB support to SwiftVISASwift and expand the number of devices our applications control.

This project is an excellent opportunity for a student to directly contribute to an open-source project with broad, real-world applications. It will expose students to writing dll's, controlling hardware, and object-oriented programming. Students will be able to use this as a concrete demonstration of their skills when applying to future jobs or internships.

2.1   Deliverables

1. Final design report (mandatory for all teams)
2. Working prototype SwiftlibUSB wrapper
3. Demonstrate the SwiftlibUSB works by controlling a USB connected power supplies (set voltage, read voltage, read current)

2.2   Proposed Process

Since the students probably won't have experience with controlling instruments, the project will follow a simple progression to get the students familiar with the libUSB, Swift's protocols for serial communication, and wrapping libUSB commands using Swift. The goal at each stage is to: set a power supply's voltage, read a voltage, read a current, and calculate the resistance across a resistor.

1. Write a small, command-line utility in libUSB C to control a power supply
    a. goals: become familiar with the libUSB, how to detect, connet, write-to, and read-from a USB device using VISA-compatible strings (I'll give those strings to you)
2. Write a small, command-line utility wrapping the above C-code in a Swift function
    a. goals: identify the correct Swift storage elements that map the underlying NI-VISA C-code unto Swift-compatible storage elements for serial communication
3. Start translating the pyUSB structure to a SwiftlibUSB wrapper for libUSB

2.3   Summary

Develop the communication protocol that will be used on next-generation scientific and manufacturing equipment.

3. Desired Skill Set

Curious, self-motivated, interested in making an impact that will define how research equipment and machines a controlled for the next decade

4. Preferred Team Size

3-4 students

5. Internship Opportunity

Lab research opportunities continuing to support the libUSB wrapper

6. Location for Work

Off-site and on-site at Colorado School of Mines.