Python APIs for Battery Testing Instruments

Aashutosh MISTRY[1,2,*]

[1] Department of Mechanical Engineering, Colorado School of Mines, Golden, Colorado 80401, United States
[2] Payne Institute of Public Policy, Colorado School of Mines, Golden, Colorado 80401, United States

Company Background

Prof. Mistry's research is about building next-generation batteries and other futuristic electrochemical energy systems. The development of such devices is limited by an incomplete understanding of how material behavior translates to device-scale performance. To address this key scientific knowledge gap, his research group synergistically combines controlled experiments, physics-based theory, and machine learning techniques.

Description of the Work to be Done

Prof. Mistry's research group uses various battery testing equipment as shown in Figure 1. Such machines are typically controlled by proprietary software offering standard functionalities. The proprietary software does not take full advantage of the hardware's capabilities. For example, the BioLogic SP-50e can offer 50 [kS/s] sampling rate, i.e., one sample every 20 [μs], but its proprietary software (EC lab) at best offers a sample every 200 [μs].

For critical testing needs, it is desired to directly communicate with the device without using the proprietary software. Thankfully, these equipment manufacturers do allow direct handling of the equipment via TCP/IP protocols.

The goal of this field session project is *to develop python APIs to control battery testing equipment* in Prof. Mistry's lab.

(a) BioLogic SP-50e tester

(b) Arbin LBT tester

Figure 1. Representative battery testing instruments used by Prof. Mistry's research group.

* E-mail: aashutosh.mistry@mines.edu

API Design for User Experience

The field session team will *develop higher level python functions* (along with the necessary documentation) that researchers with standard python proficiency can use to communicate with the battery testing equipment.

Ideally, these functions will be *similar to standard file handling operations*, e.g., a function to initiate communication with a battery tester similar to the `file = open(filename, mode)` function, sending operational instructions to the machine similar to `file.write()`, retrieving data from the machine similar to `file.read()`, and closing out the communication similar to `file.close()`. Error handling will be a critical aspect of the API design.

Any Desired Skills for the Students

- python programming,
- instrumentation, and
- GUI development.

Preferred Team Size

3 – 4 students

Potential Internship at the End of the Course

Please reach out to Prof. Mistry if you are interested in using your computer science skills to solve problems relevant to battery and electrochemistry research.

Some of the potential opportunities are independent study, SURF (Summer Undergraduate Research Fellowship), and a CS project-based Masters (https://cs.mines.edu/msdegree/).

If the APIs built for this project do the intended task, they will contribute to a future research publication from the group, and the students from this team will be invited to be co-authors for the study.

Location

Anywhere except for the regular in-person check-ins @Mines

Non-disclosure Agreement (NDA)

Depending on the end result, there may be a scope of marketable software. While any information revealed to other Mines students or professors is not considered public disclosure, please refrain from discussing the specific details of the project with anyone outside Mines.

Intellectual Property Rights

We will jointly hold the Intellectual Property Rights.