<div align="center">**Learning the Arduino Opta for PLC Education**
William Hall
Undergraduate Research Plan
Research Mentors: John Shovic, Mary Everett</div>

Project Goals:
- Learn the basics of PLC Programming with the Arduino Opta Starter Kit
- Create a basic (2-4 hours total) training program with the Arduino Opta that can be used to teach others the basics (can be the *very* basics of PLC programming)
- Integrate the Arduino Opta with the Ignition Front-End Software

Expectations:
- Weekly check in with Mary and/or John (can schedule based on your availability)
- Timesheets submitted every 2 weeks
- Emails answered within 48 hours of scheduled work day

Specific Project Plan:
1. Create an account with Arduino
2. Complete the Arduino PLC training "Hello, Arduino" found here: https://courses.arduino.cc/explore-plc/ (about 13.25 hours)
- First Steps (1 hour)
- A bit of Theory (2.25 hours)
- DIN Projects (5.5 hours)
- Extra Projects: use a Motor (4.5 hours) (When you arrive at this project, we can supply the motor)
3. Write a Teaching Plan to create a 2 or 4 hour workshop based on the Arduino Opta
- Should teach what a PLC program is
- Should have the students doing some ladder logic programming
- Should be able to program the PLC to do something physical (turn on a light, activate a heater, etc)
- If possible, would be great to integrate a HMI (Human Machine Interface – usually some sort of display or touch screen) into the workshop but that might be too ambitious for a workshop
- Make sure to include troubleshooting time into the time limit
4. Integrate Ignition with Arduino Opta
- You will need to get an Ignition license from John. He should also have the instructions for downloading it. Will update the plan with those resources when I get them
- You will most likely want to use Modbus TCP to do the integration
- Potential Resource: https://forum.arduino.cc/t/arduino-plc-to-ignition-via-modbus/1188911/2 (Seems straightforward)
- Potential Resource: https://youtu.be/Z_J0DVwZv2w?si=nKfT9aBksDrOnERc (Also straightforward)
5. Potentially help teach the PLC workshop during bootcamp week

Project Outcomes:
- Determine the feasibility of using the Arduino Opta for PLC skill training
- Determine the performance of the Opta in controlling industrial equipment

- Create a workshop PLC training plan and curriculum for use in summer and fall workshop sessions

Project Deliverables:
- Demonstration of Arduino Opta PLC working with DIN Celsius and DIN Simul8
- PLC Training Workshop Curriculum with Opta
- Demonstration of Opta reporting to Ignition
- Final project documentation (most likely on Github)
- Final presentation: ~15 minute report (to be scheduled at end of research plan)

Resources:
Arduino Opta Training Link: https://courses.arduino.cc/explore-plc/
Arduino Opta Downloadable Resources: https://docs.arduino.cc/hardware/opta/#tutorials
Ignition User Manual: https://www.docs.inductiveautomation.com/
Mary Everett email: meverett@uidaho.edu
John Shovic email: jshovic@uidaho.edu

Lab Resources:
- 3D printers available (with pre-training, subject to project demand schedule)
- High performance computer (with pre-training, subject to project demand schedule)
- Cobots and Robots (subject to use in class)
- Fridge & Microwave
- Nespresso Machine and coffee pods in cabinet below are available to all of our students. There is also a red carton of milk usually stocked in the fridge that is available to all of our students. Keurig also located by sink.
- All food on the black shelf by coffee maker is up for grabs for all students. Usually includes tea, microwave mac and cheese, cup noodles, etc).

Tips:
- As an NIC student in a UI program, you have access to UI Career Advising Resources. This includes resume help, mock interview practice, etc. These are great resources to take advantage of. See Tammy for details.
- Your research mentors are also more than happy to discuss your resume, cover letter, or any career prep/internship opportunity documents. Take advantage of help from the faculty and staff if you are pursuing an opportunity, they can also write you references.
- Bootcamp week is (tentatively) June 9-13th. Schedule of workshops to be published shortly. This is a great way to explore a variety of topics in automation, robotics, and AI, and will count as paid work time for attendance.