

University of Idaho - College of Engineering
Undergraduate Research Proposal

Project Title:

Secure PLC-SCADA Integration and Educational Training Platform Using Arduino Opta

Student Researcher:

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Faculty Mentor:

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Acknowledgment:

This project is based on the foundational research and program development initiated by Dr. John Shovic and Dr. Mary Everett. Their vision for bringing practical ICS/SCADA education into the cybersecurity track at UI Coeur d’Alene made this research possible. I am honored to extend their work by implementing, documenting, and piloting the first instructional build of this system.

Project Summary:

This project will develop a reproducible and secure industrial control training platform utilizing the Arduino Opta micro-PLC integrated with Ignition SCADA software. The objective is to design an accessible, scalable demonstration system that models real-world operational technology (OT) and industrial control system (ICS) architectures, while simultaneously creating a student workshop curriculum to train future cybersecurity and engineering students in industrial automation principles.

The platform will replicate a standard sensor-actuator-controller loop and include secured Modbus TCP/IP communication to a SCADA dashboard built in Ignition. Emphasis will be placed not only on technical functionality but also on instructional clarity, modularity, and reproducibility. The final deliverables will include a live demo system, a detailed public GitHub repository, and a 2–4 hour instructional workshop designed for UI CDA Bootcamp Week and future classroom deployment.

Goals and Deliverables:

- Complete Arduino Opta PLC training and build an operational control loop.
- Develop a functioning Ignition SCADA dashboard with live system data.
- Create a 2–4 hour workshop curriculum for student training.
- Build a GitHub repository with clear instructions, diagrams, and documentation.
- Deliver a final demonstration and presentation to faculty.

Resources Required:

This project will require access to an Arduino Opta PLC kit and minor hardware accessories, the Ignition SCADA software with a lab license, and workspace in the UI CDA Robotics Research Lab. Two PLC kits and the SCADA software are already available.

Communication Plan:

I will meet weekly in-person with my mentor, Dr. Everett, to review progress and confirm milestone development. Additional updates will be shared with the Center for Intelligent Industrial Robotics as part of ongoing project integration. Deliverables include a public GitHub archive, a live demo, a recorded instructional workshop, and a final presentation to faculty. I also plan to submit this work to the UI Undergraduate Research Symposium in Spring 2026.

Timeline:

- Weeks 1–2: Complete training and build hardware sketch
- Weeks 3–4: Draft and revise workshop curriculum
- Weeks 5–7: Integrate Ignition SCADA and configure Modbus TCP
- Weeks 8–9: Develop GitHub documentation and polish materials
- Weeks 10–12: Final presentation, demo rehearsal, and submission

Evaluation and Assessment:

Project success will be evaluated based on two technical outcomes: 1) successful, stable Modbus TCP/IP communication between the Arduino Opta and Ignition SCADA dashboard, and 2) full delivery of the instructional workshop using the developed curriculum and training platform. Assessment will also include clarity and accessibility of the GitHub documentation and reproducibility of system setup.

This project serves a broader educational need in Idaho's industrial and cybersecurity sectors. There is currently no affordable, modular training solution that teaches PLC to SCADA integration from scratch. This project is designed to fill that gap. It also lays the foundation for long-term curriculum growth in ICS/SCADA security at UI CDA.

Personal Statement:

Before beginning my cybersecurity studies, I spent 20 years working in the aerospace and mechanical industries, building systems where precision, reliability, and hands-on skill were non-negotiable. Initially, I had no plan to continue beyond a bachelor's degree, but through a period of discernment and prayer, I realized I was being called to a deeper path. Mentorship from Dr. Everett and Dr. Shovic, combined with my technical background, opened a door I had not seen before: using my experience to strengthen the cybersecurity and operational technology fields, especially in critical infrastructure. This project is the first step toward my longer-term vision of combining real-world system knowledge with academic research to better protect the systems people rely on every day.

Budget Justification:

Funding will support a student researcher stipend at 20 hours per week for 12 weeks, covering project development, testing, documentation, and workshop delivery. Additional costs include one Arduino Opta PLC kit with hardware accessories, mileage reimbursement for travel to the UI CDA campus, and a small reserve for potential conference participation during the 2025–2026 academic year. Two of the required PLC kits and the Ignition SCADA license are already secured. (A detailed budget spreadsheet is attached.)