NAVFAC Infrastructural ICS Networking Model

Elyssa Dietz, Kathleen Janiszewski, Ethan Nguyen, Enrique Ruiz, and Sean Salomon | Michael Virbia

NREIP
NAVAL RESEARCH ENTERPRISE INTERNSHIP PROGRAM

Project Objective and Intern Contribution:

Our aim was to create a NAVFAC control system test bed. The end goal of this project is to have a working system that can efficiently control the water temperatures of a water tank using multiple devices all controlled via an HMI. An operator would enter a temperature and the system will then use automated processing to get the tank of water to that temperature.

The methods we used to accomplish this aim were serial communication via RS485, Node Red, the Modbus protocol, various sensors and actuators, and custom programs to combine everything into one automated system.
Elyssa was assigned to RS485 communications and programming communications from the arduino to HMI.
Kathleen was assigned to RS485 communication and packaging the Pi and sensors.
Ethan was assigned to the Modbus Protocol and testing server and client responses.
Enrique was assigned to sensor and actuator schematics and programming.
Sean was assigned to the HMI programming and Node Red.

We have a system that works to communicate sensor readings to the HMI and receive commands from the HMI. The Arduino will then respond to those commands appropriately.
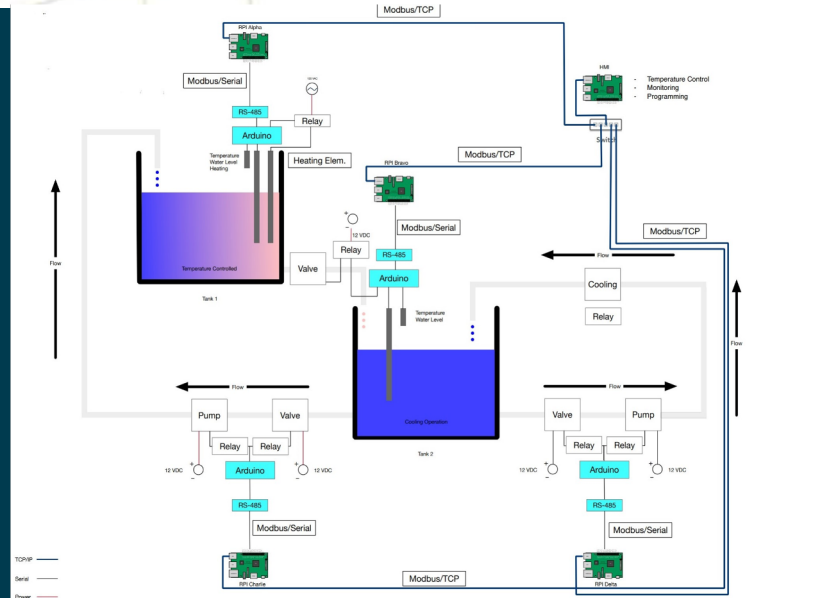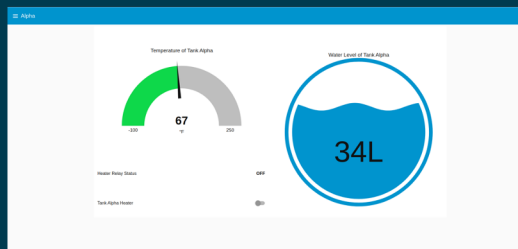
1. It was amazing that all of us were able to come together and create working devices, despite that most of us were not local, and all of us were working remotely most of the time.
2. We were able to learn many industry standard protocols and put them into practice. The people who were working around us were very knowledgeable and helped us to develop skills that will be applicable in a future career.
3. Stay on top of communicating with your team. The project runs much smoother if everyone is communicating well. Don't hesitate to reach out to other teammates and your mentor if you are stuck or have questions. You have the ability to learn a lot from your mentor as well as other team members. Take advantage of that.

Results / Accomplishments / Next Steps:

- We demonstrated that it's possible to build control devices using off the shelf components and software.
- The impact for the Navy is that they can replace the existing Purdue model industrial components with Industrial Internet-of-Things (IIoT) model to modernize their industrial systems.
- What's most important is that this model is scalable and cost-effective. The RS-485 communication works up to 4000 feet. Off-the-shelf parts such as Raspberry Pis and Arduinos are inexpensive.
- In the future this work will be able to be expanded to be used with cloud computing to monitor and control systems at any level.