

EE / CprE / SE 492 Weekly Report

September 20 - October 3

sddec24-16

Designing a Smart Plant Nurturing System Enabled by IoT Technology

Faculty Advisor / Client: Md Maruf Ahamed

Team Members:

- Tejal Devshetwar - Frontend
- Holden Brown - Frontend/backend
- Blake Hardy - Backend
- Cameron Jones - Backend
- Cayden Kelley - Hardware
- Chase O'Connell - Hardware

Summary of Work:

The primary focus of the past two weeks was exploring alternative approaches to our current problem of the lack of RS485 communication. We have explored different hardware options such as a hat board for the Pi Pico W as well as existing examples for this UART to RS485 converter. We have also determined that an Arduino MKR WiFi 1010 may be a good alternative as there is more library support in general for Modbus on Arduino platforms.

Additionally, we began setting up for data collection for the month of October. Specifically we have created an initial testing procedure to calibrate our pump watering system with our moisture sensor. The goal is to record the height of wheatgrass over the period of a week in relation to calibration variables between the pumps and sensor. This process should also work for our fertilization system once we have the NPK Modbus sensor communicating data correctly.

Work Period Accomplishments:

- Implemented code that allows pico to perform HTTP requests.
- Located possible code libraries for receiving and interpreting Modbus.
 - <https://www.waveshare.com/wiki/Pico-2CH-RS485?amazon>
- Identified alternative hardware options:
 - https://www.amazon.com/dp/B0989RQR16?ref=ppx_yo2ov_dt_b_fed_asin_title
 - https://www.amazon.com/Measuring-Logging-Moisture-Temperature-Humidity/dp/B0C9CDJJV3?ref=ast_sto_dp&th=1&psc=1
- Identified additional sensors:
 - https://www.amazon.com/stores/page/E30BF962-B347-4BB6-B2FF-F307D6BB862D?ingress=2&visitId=917c7528-82db-4f4d-b1fd-47dad2e47f94&ref=ast_bln
- Explored options for setting up Modbus libraries in Micropython:
 - <https://github.com/brainelectronics/python-modules?tab=readme-ov-file#modbus-wrapper>

- Obtained a working productized NPK sensor with a screen indicating collected data. We plan to use this device to test whether the original NPK sensor we bought is actually transmitting data or not.
- Began test setup and procedure for wheatgrass data collection for the month of October.
 - Primary focus on water system calibration.

Plans for Coming Week + Action Items:

- Holden Brown -
- Tejal Devshetwar - Discuss upcoming plans with Holden and get started on deciding next plans based on the progress made.
- Blake Hardy - determine viability of pico microcontroller, if not then order a replacement arduino. Hopefully get modbus communicating and relay that data up to the server. Will attempt to communicate with modbus the hard way, manual data frame building and interpreting.
- Cameron Jones - Research libraries to use with arduino to connect to the internet and interpret Modbus and I2C. Find some way to get around university network security to test ability to connect and communicate with the internet with a microcontroller. Test viability of arduino as a microcontroller. Attempt to work on a program which builds data frames.
- Cayden Kelley - I plan to work with the Raspberry Pi hat that I purchased to see if I can make any communication with the NPK sensor. I will also do preliminary testing with the pumps and moisture sensors to determine if we can take real-time measurements and water until the moisture sensor reads a certain value, or if we need to simply use timers to water for a certain amount of time.
- Chase O'Connell - Check if CT (current transformer), current sensor can be used to measure pump current. See if there is a difference in current when dry vs. pumping water to detect if empty. Start looking at enclosure selection. Look into error or status LEDs: communicating, idle, etc. Continue setting up for October data collection.

Pending Issues:

- Tejal Devshetwar
 - No issues
- Holden Brown
 - No issues
- Blake Hardy
 - School network security was impeding microcontroller, so far pico modbus libraries have been unhelpful. Will attempt to manually build dataframes and interpret responses.
- Cameron Jones
 - Checking if the microcontroller can communicate with the internet is difficult in the Iowa State network, we need to find an easy test network. Locate a test arduino

for better library support. All the libraries to process modbus with the Pico are inordinately difficult to work with so we should consider swapping to arduino.

- Cayden Kelley
 - No issues
- Chase O’Connell
 - Issue with water pipe gauge mismatch between the irrigation system and the pumps. Initial idea for solution is to use zip ties, but we will have to see if that actually works. Alternatively, we can look for adapters in pipe gauge size or even get smaller pumps if necessary.

Individual Contributions:

| Team Member | Contribution | Weekly Hours | Total Hours |
|------------------|--|--------------|-------------|
| Tejal Devshetwar | – | 0 | 27 |
| Holden Brown | – | 0 | 50.4 |
| Blake Hardy | Tried to get modbus working with the Pi, library turned out to be nonviable. Tested wifi communications, ran into issues with school network. Researched alternative arduino microcontroller, looked into enclosure options, found source of potential additional sensors. | 6 | 36 |
| Cameron Jones | Worked with Blake to implement and test code to connect pico to the internet. Discussed plans to swap to arduino. | 3 | 32.6 |
| Cayden Kelley | Worked with the Raspberry Pi to record data from the moisture sensor to a .txt for our October data collection. Researched the Raspberry Pi hat, and worked with another NPK sensor to begin to understand its functionality. | 5 | 53.6 |
| Chase O’Connell | Set up Altium student license for PCB development. Began setup and procedure for October data collection. | 4 | 35.5 |