Week 10 Progress Report - Capacitive Soil Moisture

CENG 317 – 0NB

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As the final month of the project approaches I am focusing on completing the last few stages. The last couple weeks have consisted of: soldering parts onto my PCB, verifying the solder job, testing the PCB’s fit on the Raspberry Pi, powering it up for testing, and reading values from the sensor/activating the effector. Soldering went very well. There were no issues or shorts that needed fixing. When I test fit the PCB onto the Pi everything lined up as expected. I was able to find some risers for securing the PCB and analog-to-digital converter. Before the initial power up I double checked all traces, connections, and solder joints. This was to prevent any accidental failures or damage to the Pi. Everything went well during the initial power up. Finally, I tried reading values from my sensor while plugged in to the PCB. Using the same Adafruit sample code from my breadboarded milestone, I was able to pickup sensor values. I then made a simple modification to the program which turns on the motor/water pump when the readings fall outside a certain value. In the first version, I set it to turn the GPIO pin on, but forgot to turn the pin off at program close. This resulted in me having to go back in and change the program code in order to get it to turn off again. But overall, this feature works as well (just needs some fine tuning/coding work). Currently, the project is meeting and exceeding the requirements of the project proposal.

One of the main problems I encountered during this project was the need for an analog-to-digital converter. Originally, I didn’t realize that the Pi was missing analog inputs. I corrected this in a timely and cost effective manner by selecting the ADS1115 as a solution. I sourced this ADC for $5 from Universal Solder on Amazon.ca. Another modification I made was the addition of a DC jack to supply the motor/water pump with power. This came as the suggestion from Kelly Gray in order to isolate the motor from the Pi circuitry and supply if with the proper amount of power. Another issue I just recently encountered was with regards to 3D printing. I designed my .stl file using OpenSCAD and sliced it using Ultimaker Cura. After adjusting the detail and speed settings, Cura was giving me a slice time of 3 – 3.5 hours. The Humber Idea Lab has a printer time limit of 2 hours. I was left with two options: 3D print the case in smaller pieces/sections, or consider other options/materials. Luckily, a coworker offered to 3D print my case on his personal printer (with no time limit). All I had to do was pay for the cost of the filament. I took this opportunity because the filament charge was cheap, and it has the added benefit of 3D printing one solid piece (instead of multiple and having to glue them together).

As with previous reports, I am slightly over project budget. This is due to a few reasons. Firstly, I decided to purchase the Pi 4 instead of the 3B+, which cost $35 more. This was due to the better performance of the 4 and future expandability. Secondly, having to add the ADS1115 set me back another $5. Thirdly, having a case part 3D printed by a friend cost me $5 in printer filament. On the other hand, I recently found some clear acrylic in my supplies at home which saves me around $10. Overall, after factoring in taxes/shipping, I am around $40 over the original proposed budget. I feel like most of the decisions which have incurred extra cost were the right decisions/necessary at the time, and will result in a better final product.

This past week I completed my power up milestone, was able to successfully read my sensor, and manipulate my effector. I designed my 3D printed portion of the case, sliced it, and sent it off to be made. During Tuesday’s lab I will be designing the top and bottom case covers using Corel Draw. Once these designs are complete I will bring them to the prototype lab to be laser cut. As you can see by my current progress, I am on time with my project schedule.

In the coming week I will be testing my case for fitment, tapping the holes in the acrylic, and finish assembling my case. In the weeks following that I will be working on fine tuning the motor/water pump control code, compiling my final presentation in PowerPoint, and creating build instructions for the finished project.