

Project Summary

The goal of this project is to design a probe that is able to be either buried or placed into soil to measure a variety of different parameters and then display those parameters onto a monitor, .txt file or remote server. Some of the parameters to be measured by the probe include but are not yet limited to: soil moisture content, soil temperature, surface temperature and soil pH levels. Once the data has been collected it is sent over a wireless channel to the receiver where the user can use our designed software to view all the sensor data the probe has collected. Using capacitive measuring the project aims to measure the moisture content of the soil at certain times when there is a large amount of change in the moisture content such as after rainfall has occurred.

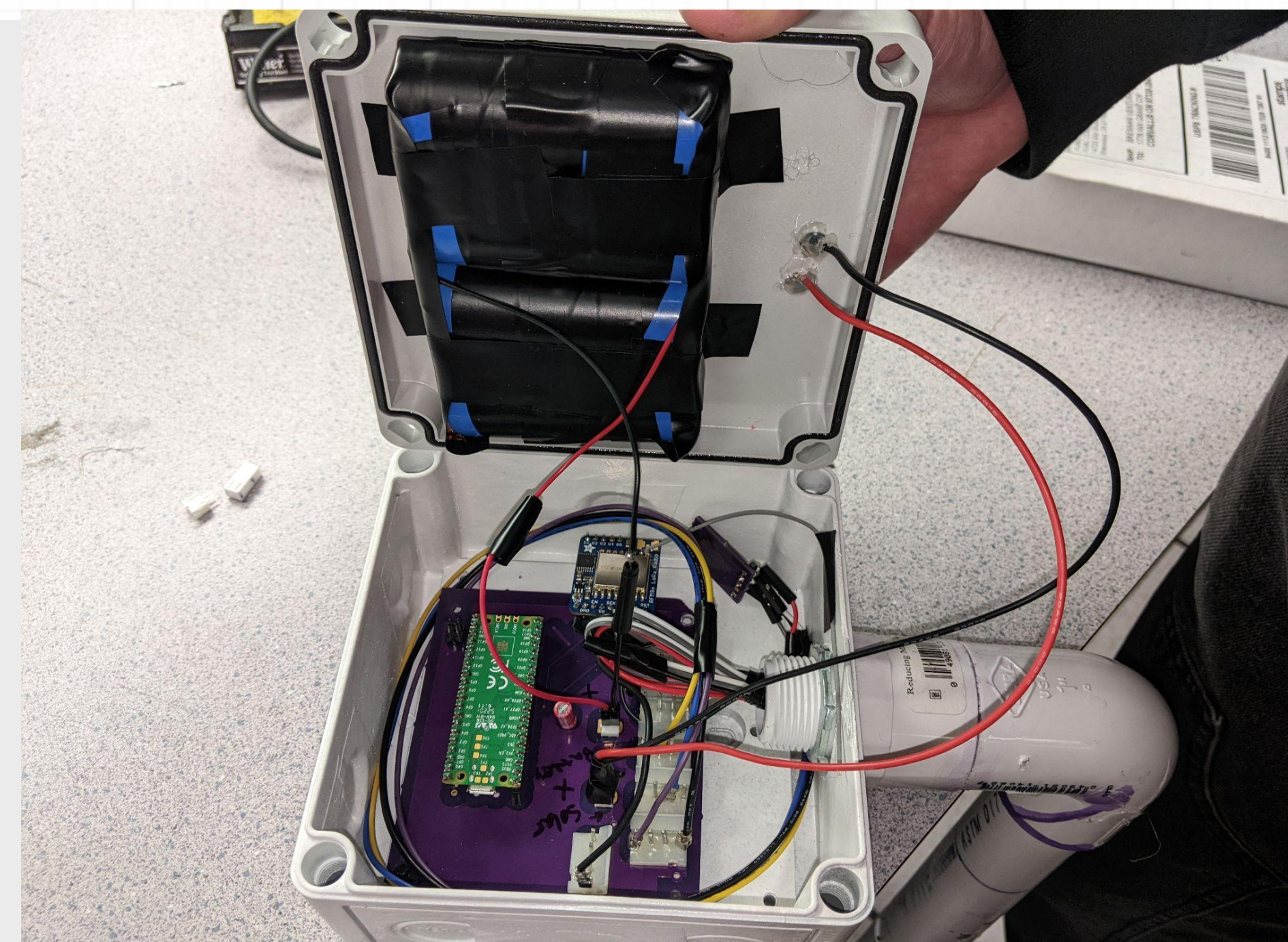
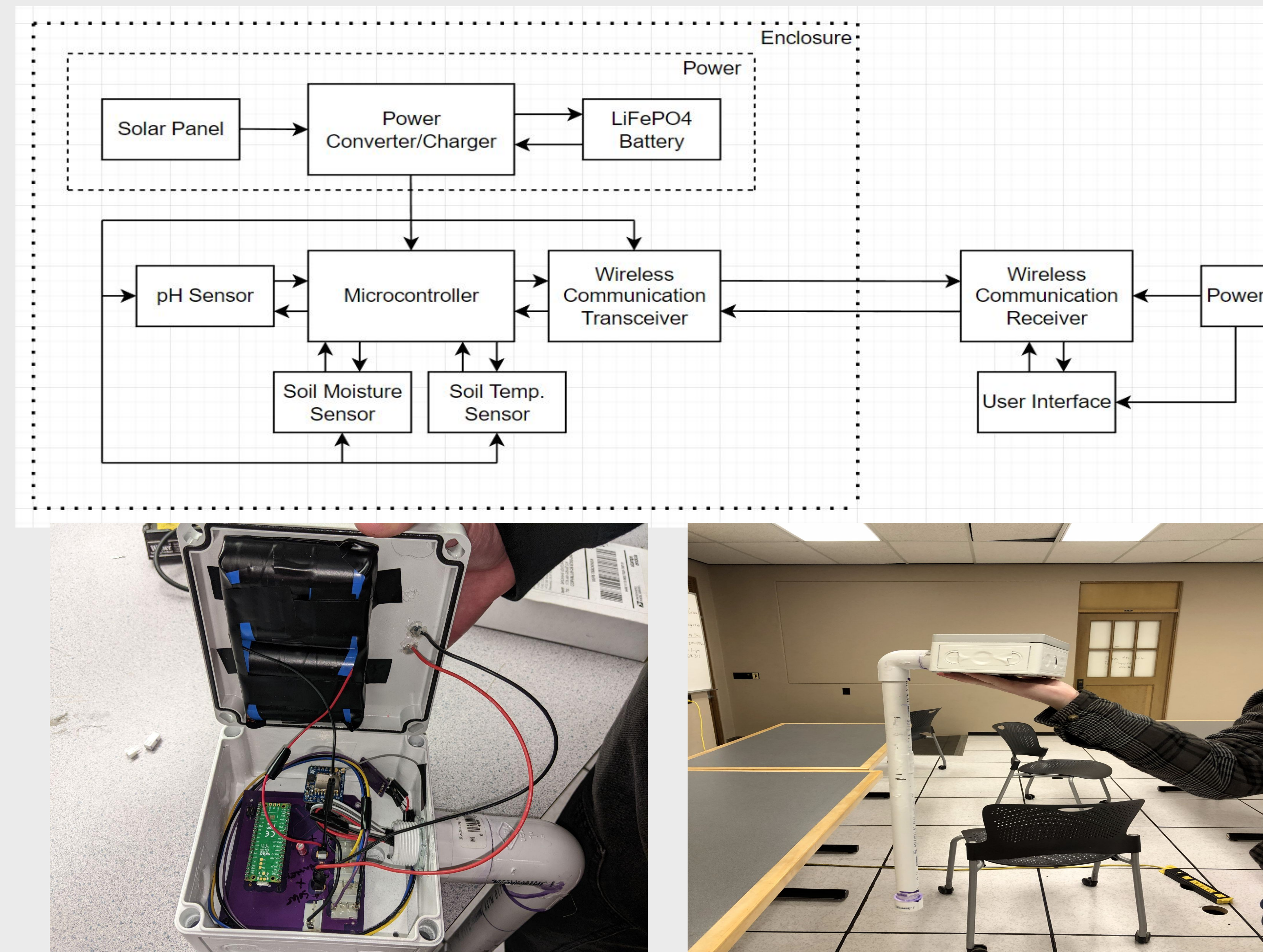
ENGINEERING REQUIREMENTS

- The system will report moisture, temperature, and pH that is 90% accurate.
- The system will have clear documentation and instructions that at least 9/10 people report as 'easy to understand'.
- The system will function when the probe sub-system is at least 100m from the receiver sub-system.
- The system will save the sensor data and present as csv files.
- The system will report data more frequently when a change greater than 5% is detected from the previous sensor data.
- The system will operate for at least six months without any external power.
- The system will be able to be deployed in the soil and have a tensile strength to support a load of fifty pounds before breaking.
- The system will function normally after being submerged in water up to 12 inches.



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The all-in-one soil parameters measuring solution.
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Operating Principles

The majority of the focus of the project is on the probe unit: all of the hardware and software directly involved in taking measurements from the soil. Six sensors: three temperature, two soil moisture, and one pH sensor, are managed by a control system. The purpose of the control system is to take raw measurements from sensors and to convert them into human readable values which are then broadcast via LoRa radio.

The probe is designed to work in tandem with a receiver unit; with the receiver being left powered on to accept data from the probe as measurements are taken. When a user wants to collect the data, the receiver is connected via USB to a desktop/laptop computer running the included SoilSense Gateway GUI, which provides a clickable interface to retrieve data in a CSV file format.



Project Difficulties

- Low Power Design: The probe needs to last for a period of 6 months meaning it needs to be thrifty with its power usage. With this in mind, choosing low power devices became very important especially for the wireless communication. Moreover, choosing batteries with enough capacity and a solar panel that could provide enough energy throughout the year became essential for success.
- Soil Moisture: Designing our own device to measure the moisture content of soil was very important. Using a capacitive soil moisture sensor gave us a good challenge and was fun to implement.
- Easy to understand: Taking information from the soil and providing it to the user is not an easy task. Giving it to the user in a way that is easy to understand and requires little technical know-how.

SOILSENSE TEAM MEMBERS

- Brennan Ventura – wireless communication transceiver, wireless communication receiver, enclosure
- Caleb Walker – Microcontroller unit, PCB, firmware, power converter/charger
- Jeremiah Goddard – sensors bocks, solar panel charging, treasurer, project partner liaison



Business Potential

As time has progressed, water has become a scarce resource along with an increasing price to use it for farming and agriculture. This has been dramatized in areas where there may not be as much rainfall, or it is harder for water to be transported to that location. California in the recent years has experiences terrible droughts and it has significantly hurt farming communities which make up a large portion of the state. Because of this, a product that helps to show the water usage of crops can be extremely useful for farmers. Many farmers already pay hundreds of dollars each year to learn more about their soil. Our product can help reduce the cost for farmer while providing the same services year round instead of only at certain points of the year. Because of this, it can help farmers to learn their water usage year round and how their various crops respond to watering across seasons rather than only a couple times during the year. Our product can help farmers to not only grow better crops but to save money on watering and monitoring services.