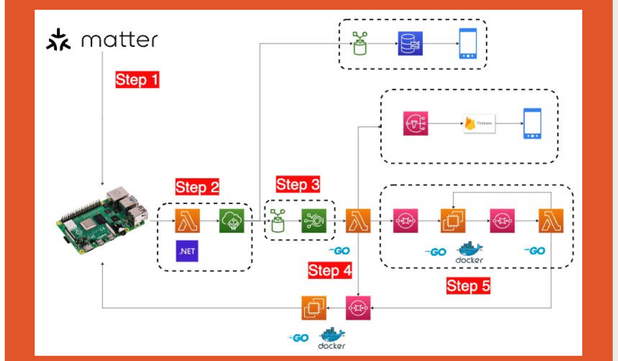
Engineering Requirements

- **Air Pressure Sensor** - The system will report pressure to within 25 inHg to 30 inHg.
- **Solar powered** - The EcoSense sub-system will operate off of solar power and battery.
- **Humidity Sensor** - The system will report relative humidity from 20-80% with a 5% tolerance.
- **Soil Moisture Sensor** - The system will report the difference between dry soil and fully saturated soil
- **Temperature Sensor** - The system will report the temperature from 32-120 °F within 2 °F
- **User Experience** - The system will report information such that 9 out of 10 people find it easy to understand.
- **Weather Resistant** - The garden system will be able to function under a spray of 1 gallon of water per minute.
- **Wireless Communication** - The subsystems will communicate using the Matter Protocol.

How Automations Work

1. Sensor data is sent to the hub via Matter protocol
2. Hub sends sensor data to cloud for analysis
3. The cloud determines if any sensors cross a threshold
4. The cloud notifies the hub which actuators should be turned off
5. After the user configured expiration is met, the cloud notifies the hub which automated systems should resume normal operations



Oregon State University

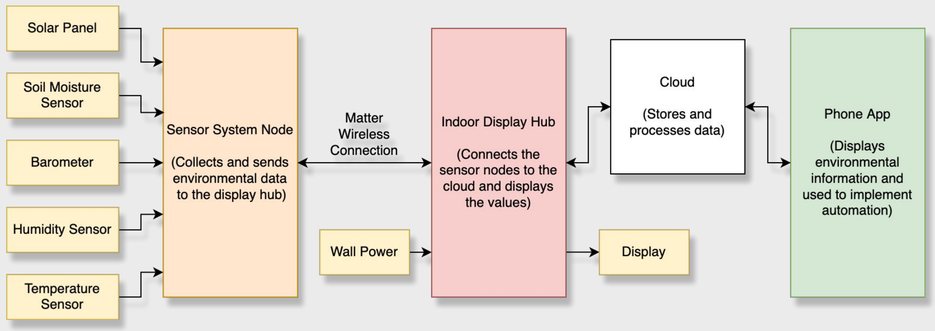
EcoSense

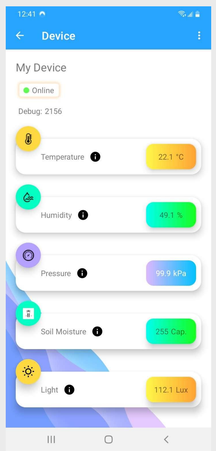
A universal smart product that collects environmental data which can be integrated into existing systems to automate tasks such as watering plants and HVAC.

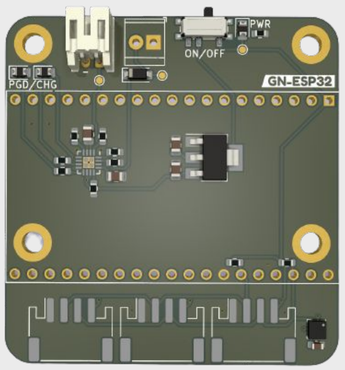
Overview

The system is a node-based environmental monitoring solution comprising a central hub and a Garden Node that connects to an App. The Garden Node is powered by **solar energy** and measures environmental parameters such as air temperature, humidity, pressure, soil saturation, and light intensity. The central hub node gathers data from each node and sends it to the cloud.

The communication between the nodes done is through **Matter**, an IP-based protocol that enables systems to communicate over wifi. The Android app enables users to configure the device and process data. Additionally, users can set thresholds to **automate systems**, such as turning on and off water valves.







Electronics

Sensor Measurements

- Collects the following measurements using the *I2C protocol*
- Uses an *ESP32* to relay the measured values to the hub over an internet connection, using *Matter*

Central Hub

- Uses a *Raspberry Pi Model 4 B* to collect data and sends it to the cloud
- Includes a *5-inch Capacitive Touch Screen* to display and navigate through the graphical user interface

Use case: Automatic agriculture watering

- Farms worldwide account for 70% of annual water consumption. 40% of the water used in farming is lost as a result of poor irrigation systems
- An improperly maintained household irrigation system can waste up to 25,000 gallons of water annually
- Irrigating only when plants need water can help reduce outdoor water use

The Team

We are all seniors graduating this June with degrees in Electrical and Computer Engineering

- **Alex Feng** (*fenga@oregonstate.edu*): I'll be graduating this year with a degree in ECE and a minor in CS. I worked on the Android app, Matter communication, and cloud automation processing.
- **Aiden Olsen** (*olsenai@oregonstate.edu*): I worked on schematic capture, part selection, PCB design, and software for the sensor measurement system.
- **Peter Thompson** (*thomppet@oregonstate.edu*): I will be graduating this year with a physics degree in addition to my ECE degree. For this project I worked on both of the enclosures and the Hub power supply.
- **Carson Ehlers** (*ehlersca@oregonstate.edu*): I worked on the Hub Electronics and its graphical user interface. I have a major interest in computer architecture, network security, and custom PC design.

Alex Feng, Aiden Olsen, Peter Thompson, Carson Ehlers