

# IoT Herb Garden



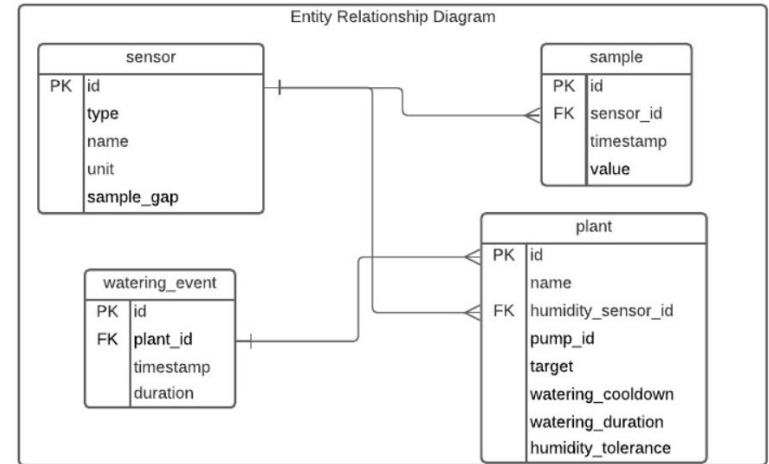
IOT Course Project - Team 11

# Project Goals

- Automate watering of plants
- Log the environment attributes and soil watering
- Use these logs to display graphs in a web server
- Allow the web server to edit configuration of plants, send manual pumps

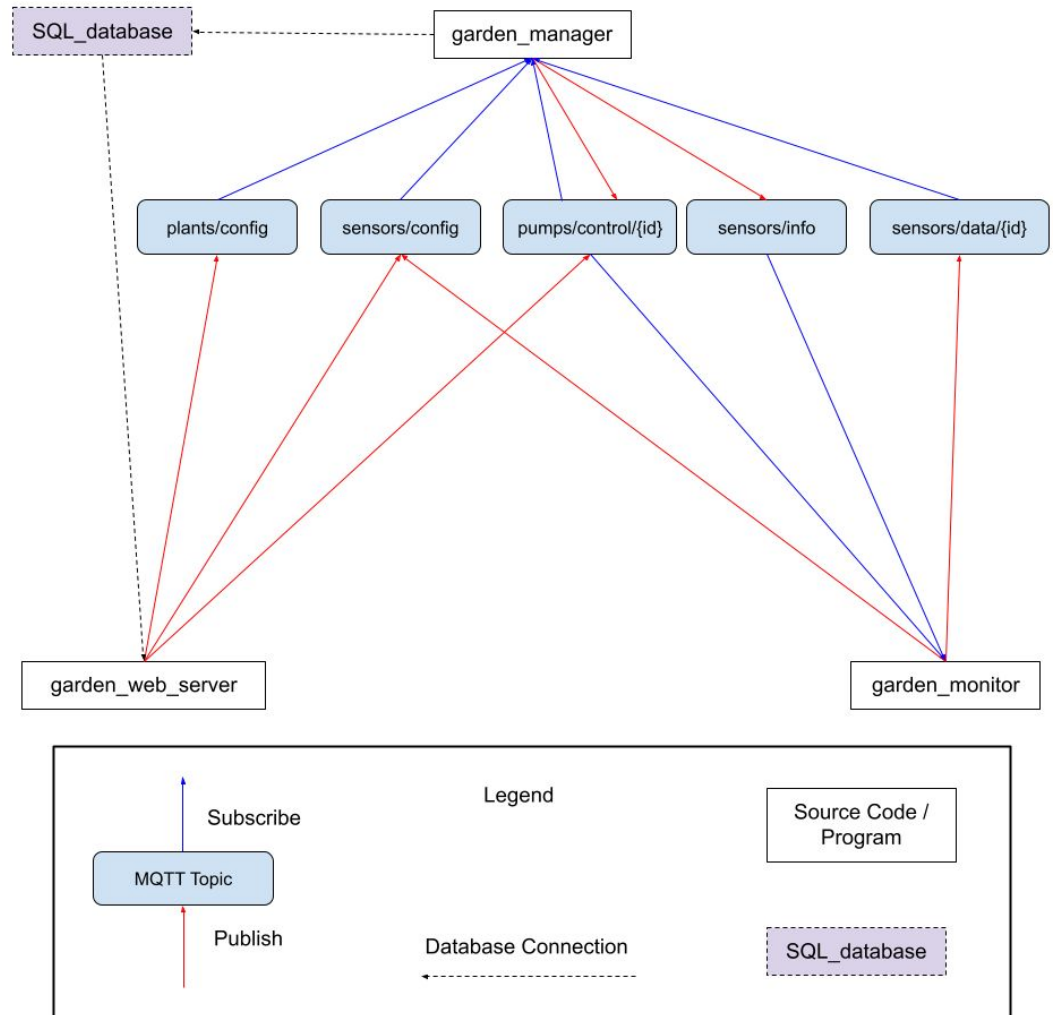
# Database Structure

- Sensor
  - Stores information of each sensor in the system
- Plant
  - Stores information about each plant in the system
  - Connects plants to their sensor and pump
  - Controls when to water the plant
- Sample
  - Stores data from individual samples from the sensors
- Watering\_event
  - Stores a record of pump operations



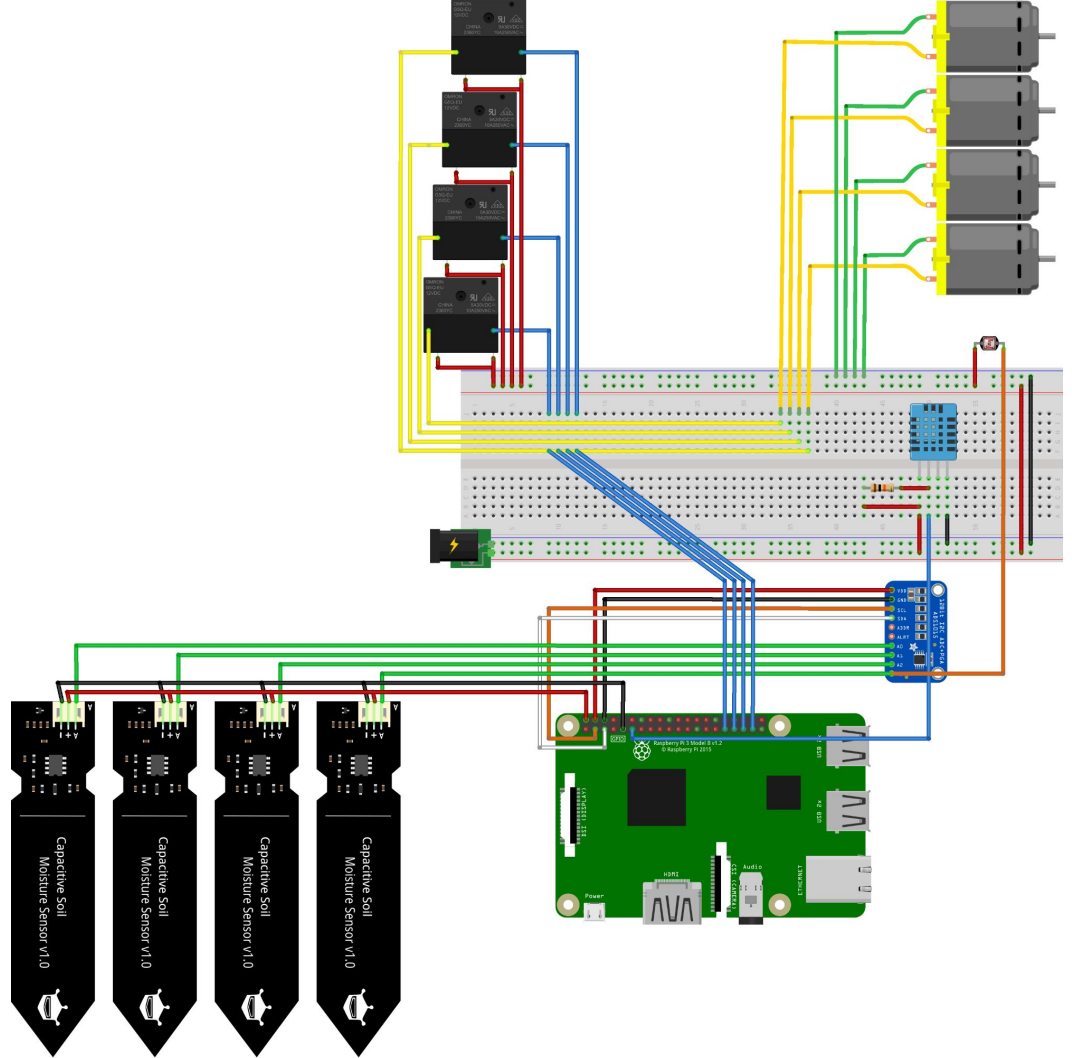
# MQTT Topics

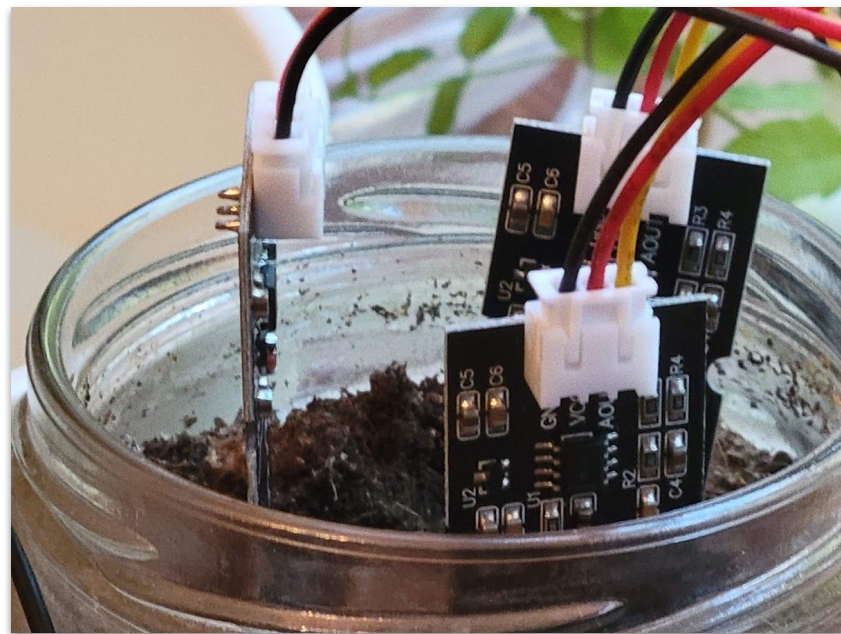
Configuration information, sensors data, and pump controls are sent over MQTT to communicate between the system components. Data not sent over MQTT is stored and accessed through an SQL database.



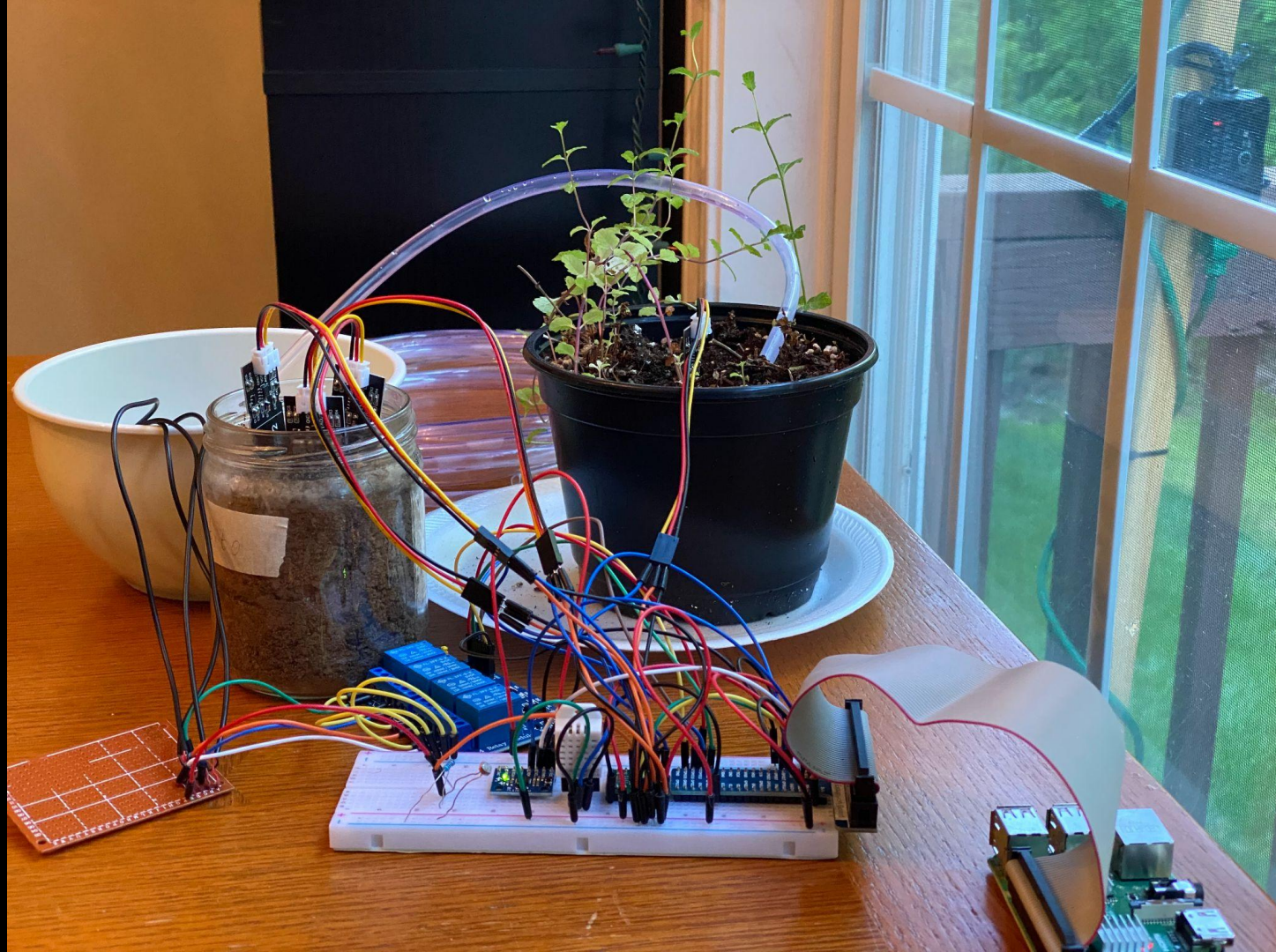
# Hardware

- Raspberry Pi 3b+
- A breadboard
- A prototyping board
- 4 capacitive soil humidity sensors
- 4 5V impeller water pumps
- 4 PCB-mounted 5V relays
- A DHT22 (thermistor / hygrometer combo)
- A photoresistor
- An 8 channel ADC
- 22 Awg wires



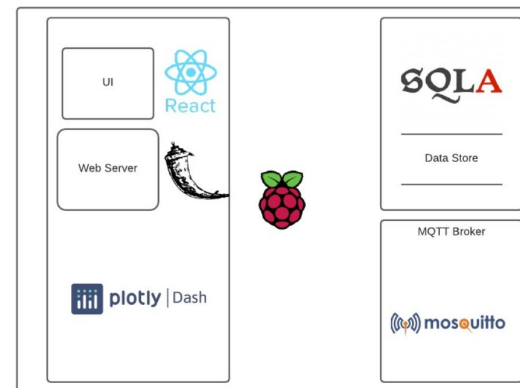






# Implementation

- Our project is built in Python using the libraries: Dash (web server), SQLAlchemy (database), Paho-MQTT, and GPIOZero
- Three programs to run:



## Garden Manager

- ❖ Create database schema objects.
- ❖ Log sensor and event data to the database when received from the MQTT broker.
- ❖ Provide auto-watering functionality.
- ❖ Inform other components of configuration info read from the database.

## Garden Monitor

- ❖ Configure defaults for sensors.
- ❖ Collect and publish sensor data.
- ❖ Activate water pumps when instructed to do so.

## Garden Web Server

- ❖ Provide a web UI to interact with the Herb Garden
- ❖ Display current metrics for sensors
- ❖ Display a historic view of sensor values
- ❖ Allow configuration of plant and sensor objects
- ❖ Manually control pumps



Manager: onlineMonitor: online

## Overview

### Ambient



### Sunlight



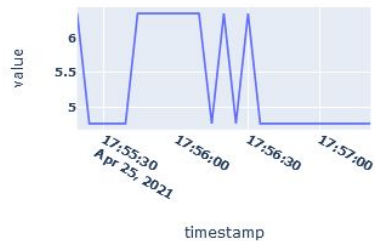
### Watering

#### plant\_1

Last Watered: 2021-04-25T17:57:21.123200

Soil Humidity: 4.76

Soil Humidity Target: 50

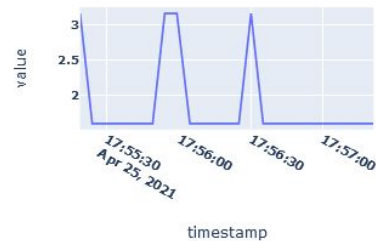


#### plant\_2

Last Watered: 2021-04-25T17:57:21.125874

Soil Humidity: 1.59

Soil Humidity Target: 50



Manager: onlineMonitor: online

# History

## Ambient

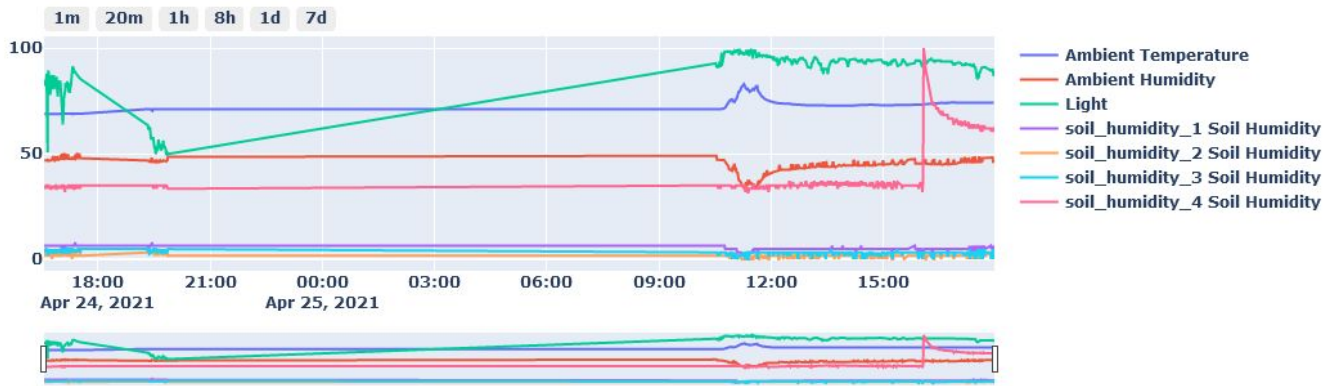
- ☒ Ambient Temperature
- ☒ Ambient Humidity
- ☒ Light

## Plants

- ☒ plant\_1
- ☒ plant\_2
- ☒ plant\_3
- ☒ plant\_4

## Fields

- ☒ Soil Humidity
- ☐ Humidity Target
- ☐ Pump Activated



Manager: onlineMonitor: online

## Controls

### Manual Water

Pump 1  SecondsPump 2  SecondsPump 3  SecondsPump 4  SecondsClearPerform Operation

Manager: onlineMonitor: online

# Configuration

Plants

Sensors

Mint

## Parameters

Name

plant\_4

Humidity Sensor

soil\_humidity\_4

Pump

pump\_4

Target Humidity

50

%

Watering Cooldown

30

Seconds

Watering Duration

1

Seconds

Humidity Tolerance

5

+/- %

Cancel

Save

Manager: online

Monitor: online

# Configuration

- Plants
- Sensors

Ambient Temperature ▾

## Parameters

Name

Ambient Temperature

Samples

1 ▾

per

minute ▾

Cancel

Save