UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Plant Irrigation and Monitoring System

Team 8: Carlos Toledo, John Burns, Kevin Le

12/4/2023

Problem Statement

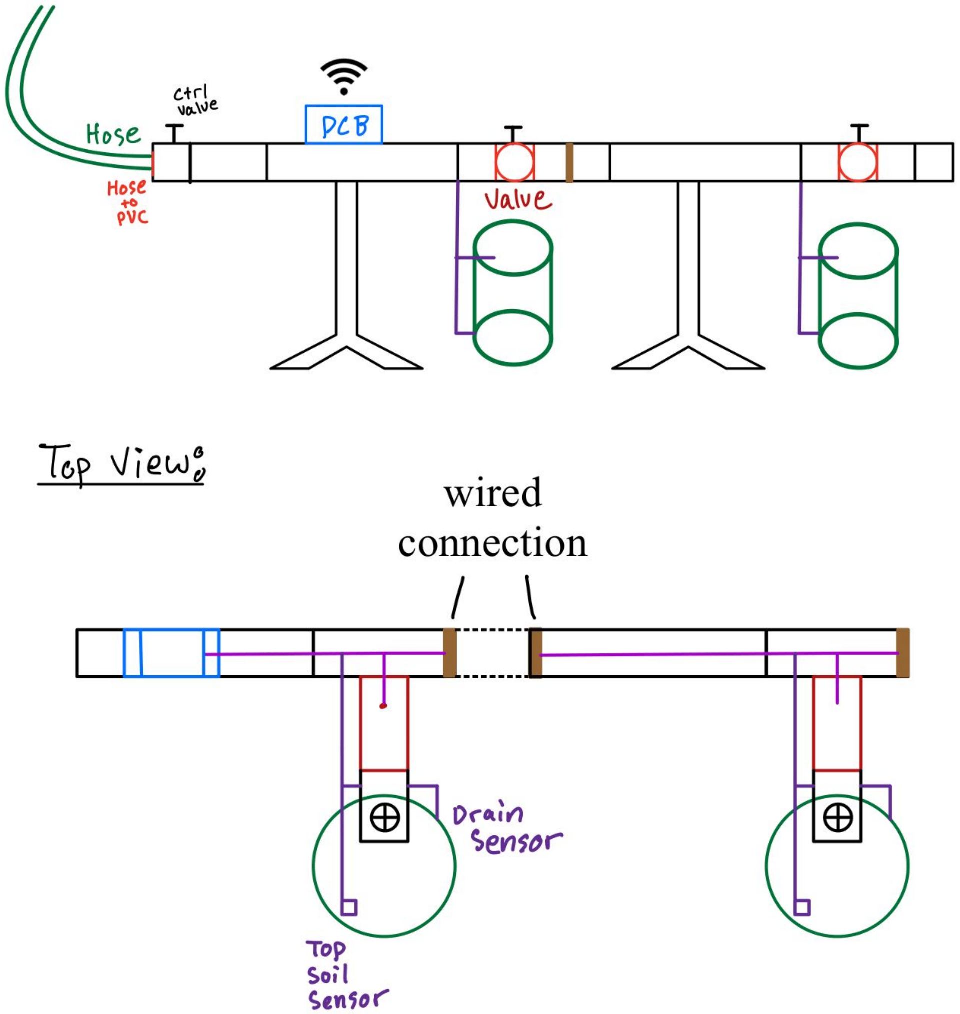
- Gardening requires intensive care and effort.
- Conditions and Needs vary between plants.
- Busy lives or lack of skill can hinder proper care.
- Watering outdoor plants is a tedious and often forgotten task.

We seek to alleviate some of the burden on gardeners.

Objective

- Help the user monitor a single plant or more.
- Connect to a garden hose and can be linked together to build a larger system.
- Water the plant till the whole pot is moist and fully watered.
- Any single plant can be configured to have a minimal moisture level

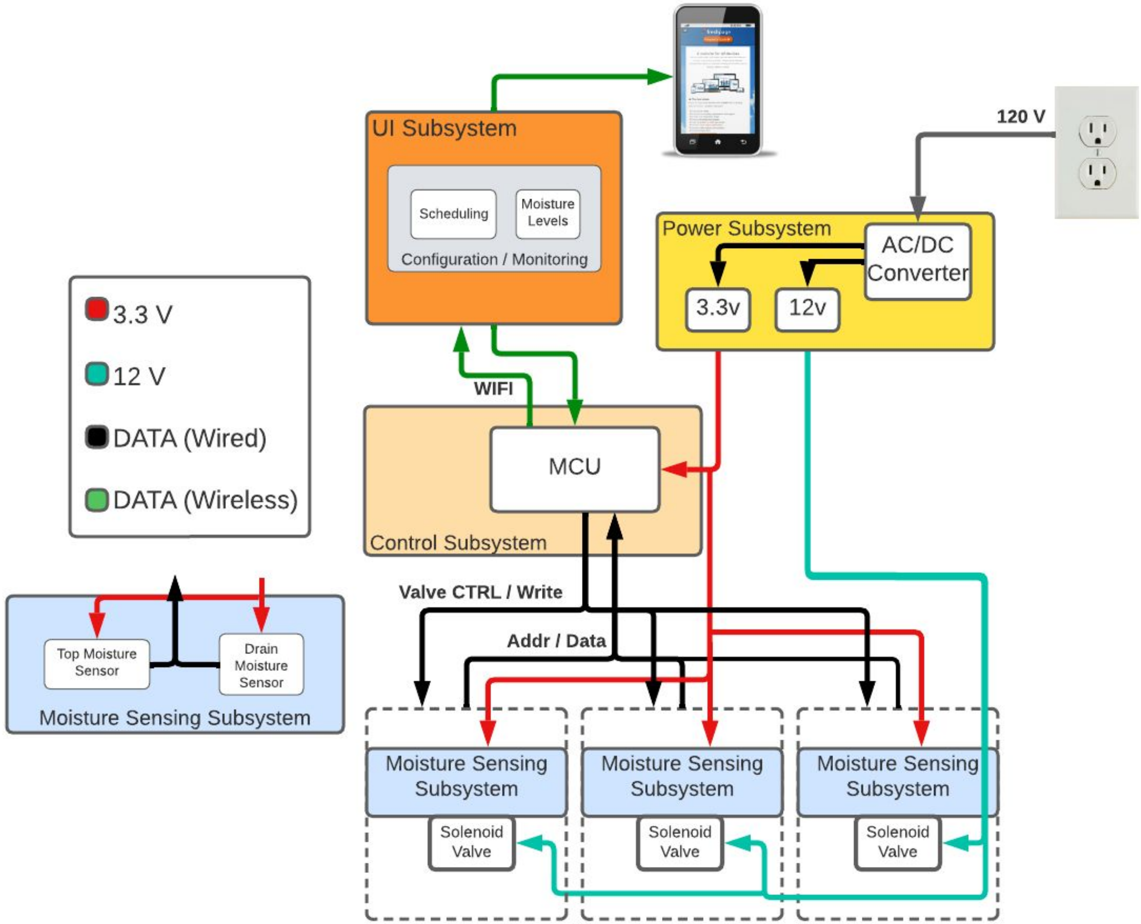
The gardener can automate watering and be sure that plants will be receiving the water they need.



wired connection

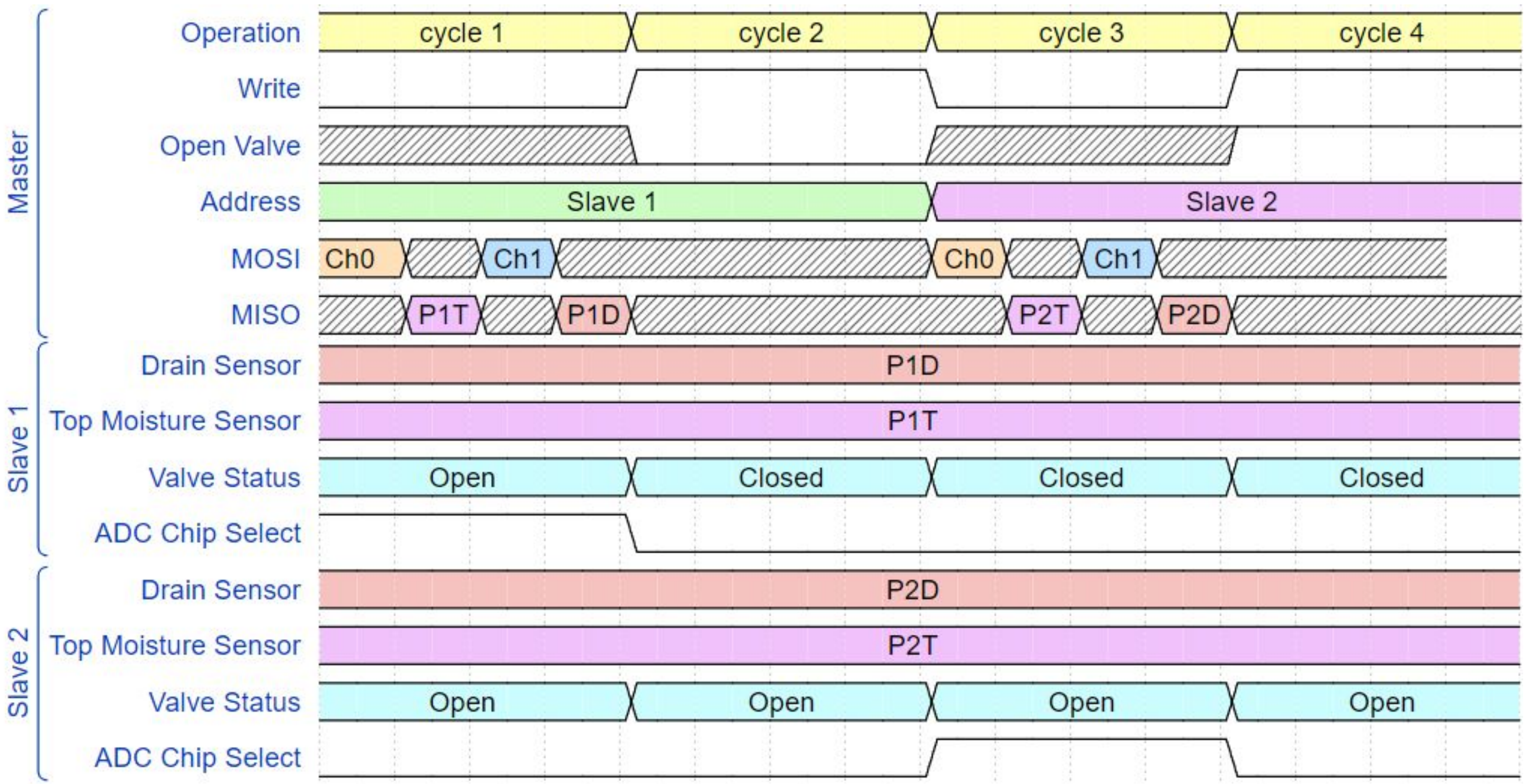
Initial Design/Project Build

Plant Irrigation and Monitoring System

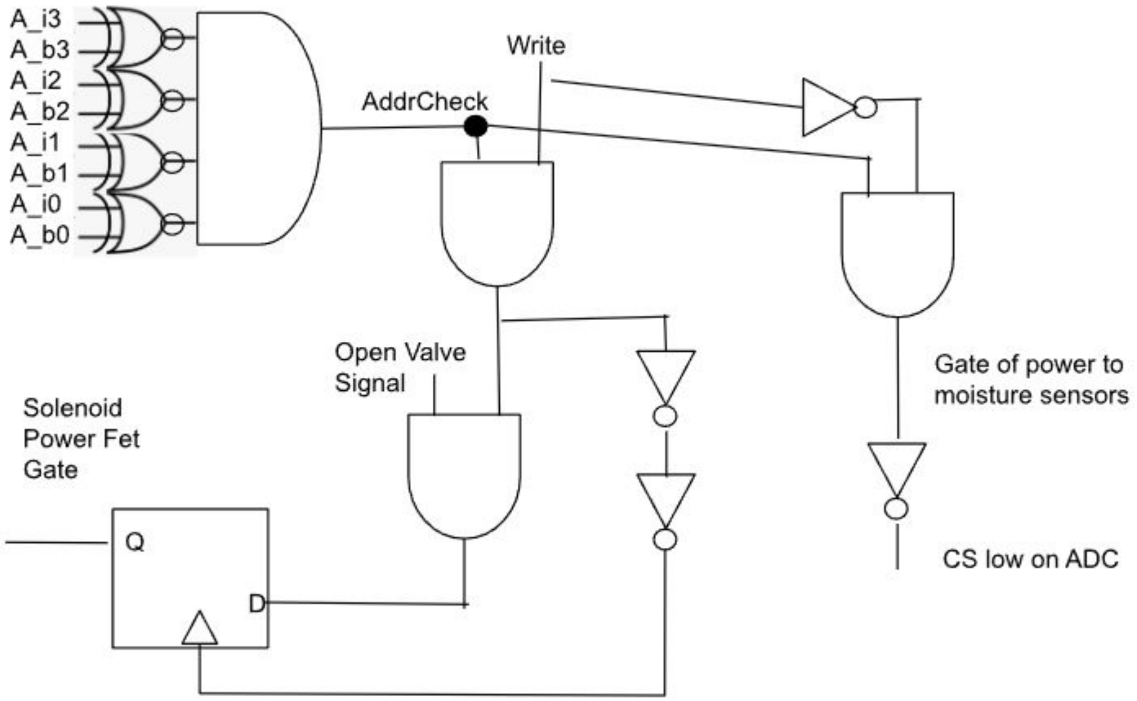


Block Diagram

- Subsystems:
- User Interface
- Control
- Moisture Sensing
- Power
  - Switched-Mode Power Supplies (SMPS)

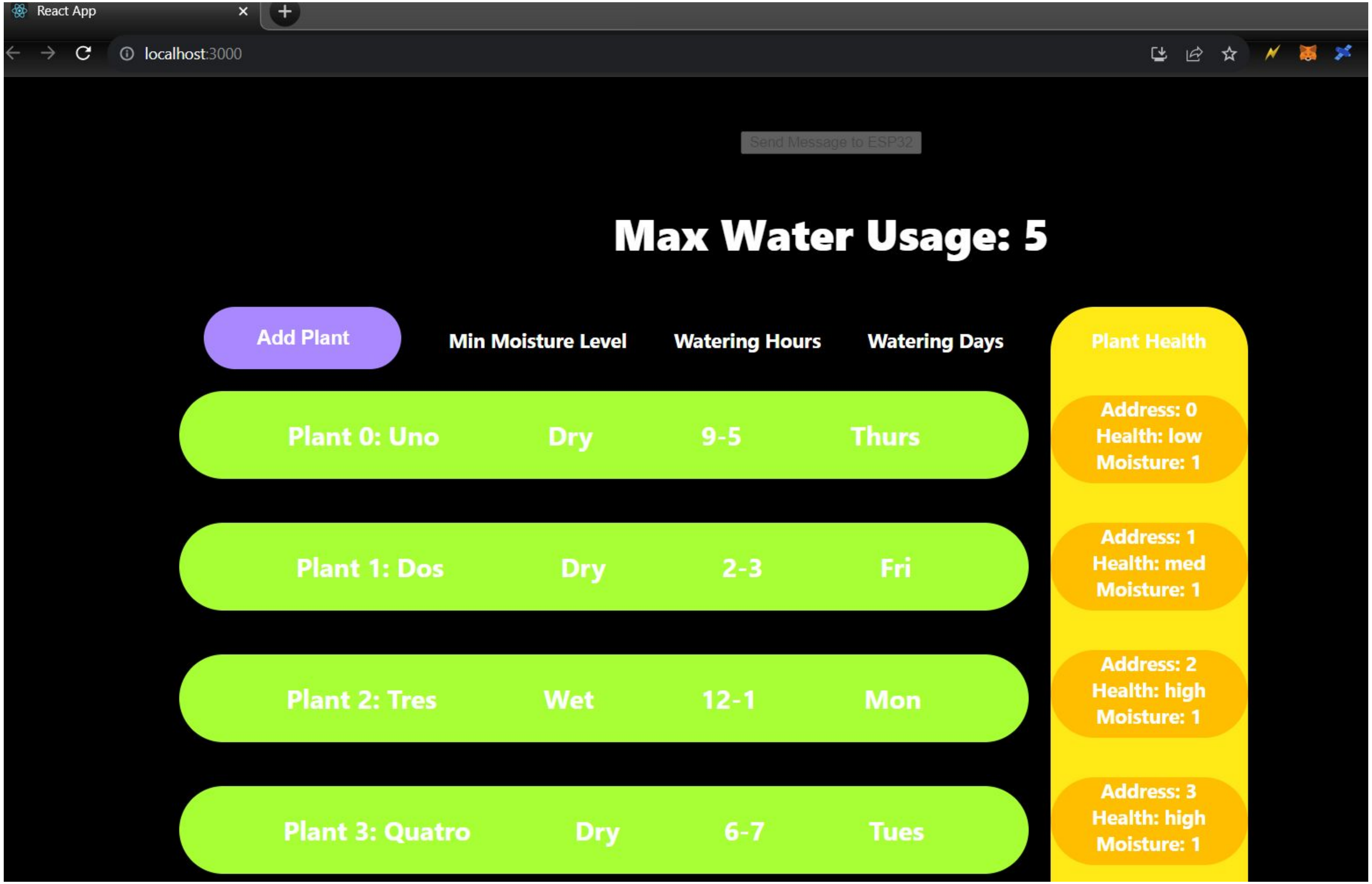


Custom Communication Protocol



All gates powered by 3.3V Vdd
A_i: internally saved address
A_b: address currently on the address outputs pins of the microcontroller

Moisture Sensing Subsystem Logic



Max Water Usage: 5

Add Plant	Min Moisture Level	Watering Hours	Watering Days	Plant Health
Plant 0: Uno	Dry	9-5	Thurs	Address: 0 Health: low Moisture: 1
Plant 1: Dos	Dry	2-3	Fri	Address: 1 Health: med Moisture: 1
Plant 2: Tres	Wet	12-1	Mon	Address: 2 Health: high Moisture: 1
Plant 3: Quatro	Dry	6-7	Tues	Address: 3 Health: high Moisture: 1

UI Snapshot

High Level Requirements

1. Requirement 1: The system controls moisture levels in individual plants, performing standard watering on schedule until drainage occurs, and continually monitors and waters plants if moisture deviates by more than 土 10% from user-defined values.

2. Requirement 2: The system starts watering within 土 2 minutes of the user-defined time, will only water within permissible windows to 土 2 minute accuracy, and stays within 土 5% of the user-defined daily water usage limit.

3. Requirement 3: The system can control multiple plants at once via master-slave communication. Each slave operates independently and is not influenced by the state of other slaves.

Test Results

1. User inputs parameters in UI-Subsystem
2. UI-Subsystem sends parameters as input to Control Subsystem
3. Control Subsystem opens/closes valve in Moisture Sensing Subsystem and receives plant Health Data
4. Moisture Sensing Subsystem sends plant health data to Control Subsystem and Control Subsystem send that data to UI-Subsystem to be displayed

Plant Irrigation and Monitoring System

Successes

- Individual subsystem implementations
- Stayed close to our budget of $150
- WIFI connection
- Data communication from slave boards

Challenges

- Water proofing
- Connecting subsystems
- Budget planning
- Physical design planning and execution

Conclusion

1. Technical design is only half the battle
2. Matching product specs, packaging, and integration were all major challenges
3. Software that works separately is not guaranteed to work together
4. What we would do differently: spend more time on software testing earlier in the process, put more forethought into the integration (both physical and design) of different submodules

Possible Ideas / Improvements

1. Completed Water Usage Tracking
2. Fully integrated scheduler
3. Fully integrated warning system for malfunctioning components
4. Auto detecting slave devices
5. improved wiring for slave connects

Thank You!

Questions?

The Grainger College of Engineering

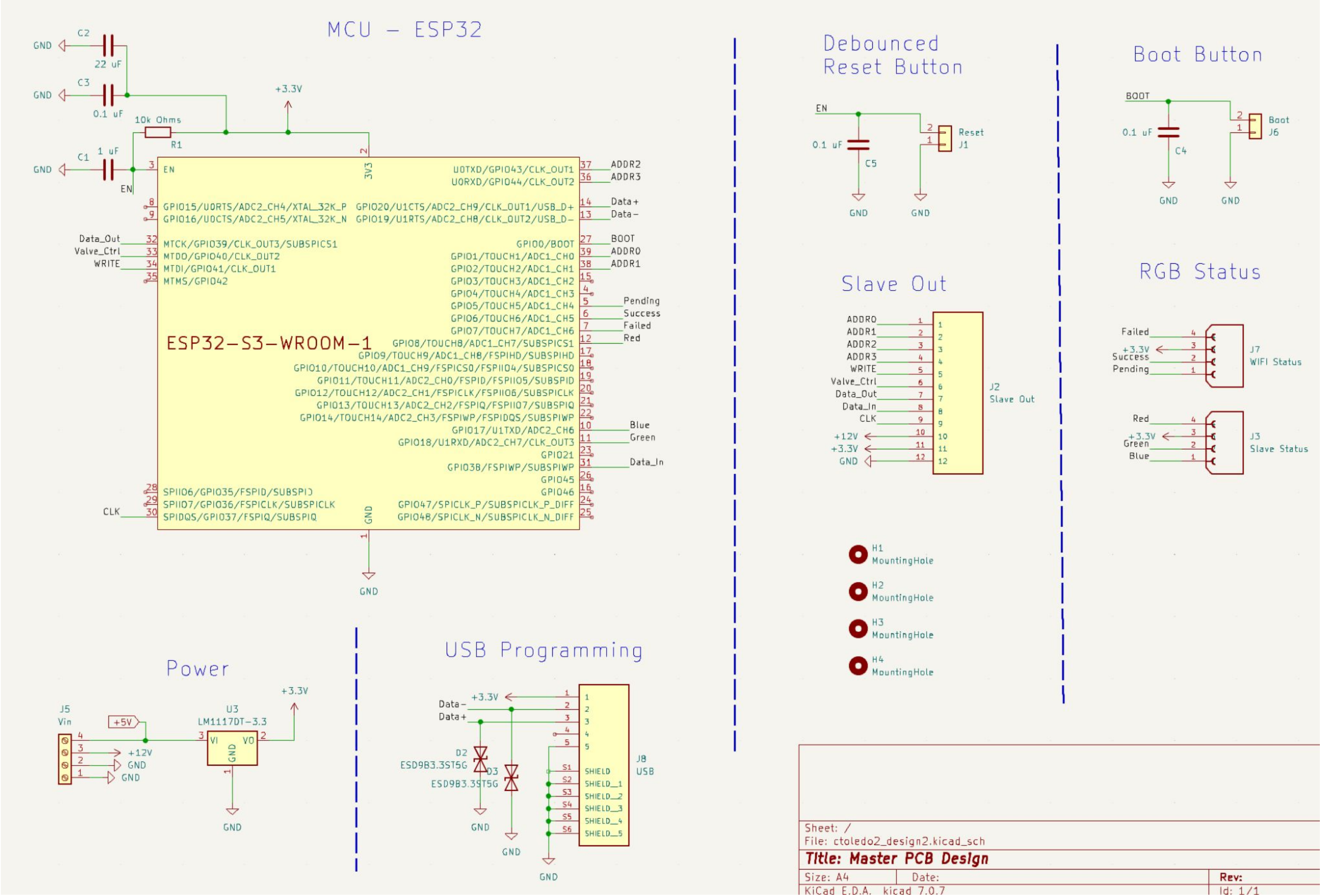
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Moisture Sensors and Solenoid Valves

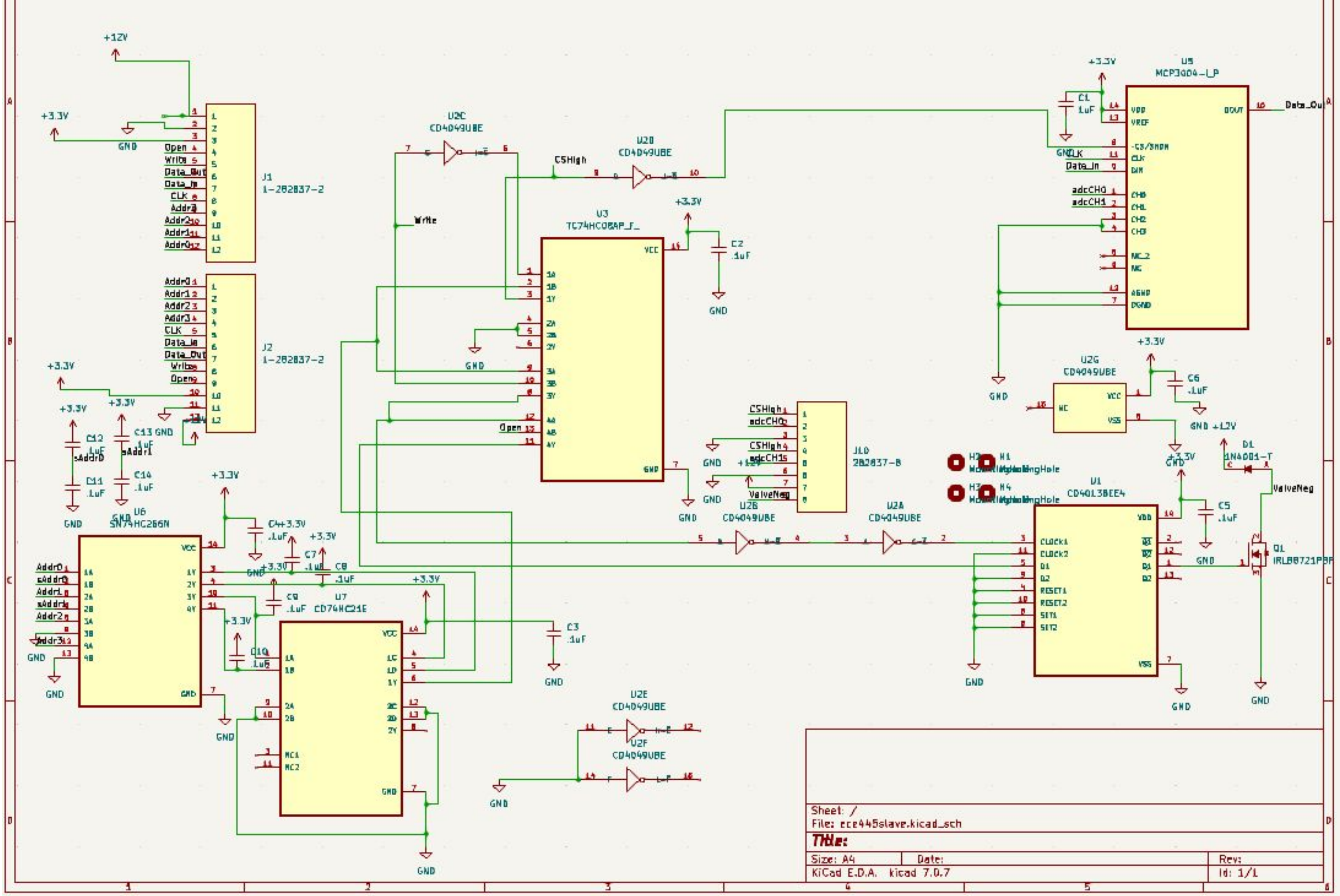
- Sparkfun SEN-13322
  - Resistance between two terminals varies based on conductivity between them
  - Moisture is conductive
- Adafruit Plastic Water Solenoid Valve
  - Electromagnetic coil with a plunger
  - Pilot operated valve: requires pressure to open

These are not failsafe parts

The sensor requires calibration and may degrade over time.
The valve will require cleaning.



Master Control Unit Schematic



Moisture Sensing Subsystem Schematic