Requirements

The requirements listed below appear in 3 different categories depending on the device's applied scenario. Although the system is intended for small home irrigation, it can be easily expanded, with little modification to the design, to other use cases as shown below.

Garden irrigation for plant parents away on holiday:

1. The device must be operational at all times to ensure that consistent watering is performed to the garden area.
2. User intervention must be minimized as much as possible besides the initial device setup to ensure a high level of fidelity to the upkeep of the garden.
3. Overwatering protection must be implemented. This may be inherently implemented through a normal shutoff system as long as there is continuous water moisture checking in place.

Plant-based scientific experiments by scientists/botanists/students:

1. The system must provide consistency in water delivery to ensure the experiment's main controlled variable, the water level, remains unchanged throughout.
2. The system must allow continuous monitoring and/or measurement taking while the system is in operation so as not to interrupt the experiments taking place.
3. Watering levels need to be controlled by the user of the system to give more flexibility in different research cases.

Optional: Pond/pool/pet water bowl top up application:

1. The system must be able to serve a variety of users if expanded to other cases and thus must have a modular design process to ensure that future engineers can adapt the design.
2. The water container must remain at a consistent water level to ensure the user of the system is satisfied or to not make the system redundant by requiring user intervention.
3. Full automation of the system is required so that user error is removed from the process altogether. Removal of user error is key as the system needs to provide a fair level of certainty that the system will not fail for many applications.
4. The system must have protections in place to prevent container overflow. Damage prevention and device safety should be ensured. Whether that is heat, water, or electrical damage.
5. An accurate trigger device is to be implemented to ensure a high level of consistency when filling the container.

Specifications

Electrical Specifications:

Requirement	Specification(s)	Acceptance Test Criteria
An analogue moisture sensor input signal	**Connected to and co** nstrained to the 0-3.3V range of an Op-Amp comparator circuit	Ensure voltage does not exceed 3.3V or go below 0V by lab-testing comparator's practical range
3 LED's indicating soil moisture levels, related to sensing/comms board	Red LED is ON when soil moisture levels are very low, and water is required to be released from valves. Orange LED is additionally ON when moisture levels are no longer critically low. Green LED is ON when soil moisture levels are adequate, and valves are closed.	LED internal bias tolerances are negligibly small
Switching power supply circuitry for sensing/comms board	Switching power regulator: 24V DC from Power Supply regulated to 12V DC for valves	12V DC does not exceed 13V or go below 12 V.

Mechanical Specifications:

Requirement	Specification(s)	Acceptance Test Criteria
Device meets standard µPiHAT mechanical specifications.	The width of the device is 30mm and the length of 65mm. The components SMD on the bottom must not exceed the height between the HAT and the PI board and need to have a clearance of at least 2mm.	Size tolerances of final PCB must be within 0.1mm of computer generated. Clearance tolerance must be minimal or the clearance must be bigger than 2mm.
User sets soil moisture level for which watering is required	Potentiometer and moisture sensor circuit act as voltage divider User able to access physically adjust potentiometer to set soil moisture level requirements	Potentiometer voltage divider accuracy is within 3% of the required values.
Float switch/ humidity sensor additional replacement option	Float switch triggered when water-level drops below user-specified amount.	Water level float switch is triggered by is within 3 cubic centimeters of the designated level.