Hardware Details

The below table include the main hardware components to build the watering system:

#	Component	Role in the system	Integration Notes
1	Raspberry Pi 4 or 5	The system brain and control the IoT components / sensors.	The Raspberry Pi uses its GPIO pins for digital input/output and I2C communication. It is connected to the ADC module via I2C pins to read analog sensor in digital values. And connected to the relay input via a GPIO pin to control the pump.
2	Capacitive Soil Moisture Sensor	Detect the soil moisture level in analog voltage format.	Inserted into the plant pot's soil to provide continuous readings.
3	(1 or 4 Channel) 5V Relay Module	Switches the water pump on/off based on GPIO signal.	Connected to a GPIO pin and the pump.
4	Sunfounder PCF8591 or Adafruit ADS1115 ADC Module	Converts analog sensor signal to digital reading.	Connected via I2C bus.
5	Water Pump	Delivers the water to the plant's soil.	Connected to the relay.
6	Vinyl Tubing	Transports water.	Connected to pump's outlet and inserted into soil.

7	Two Power Supplies (any standard with USB-C)	Powers Raspberry Pi and relay/pump	One power supply connected to the Raspberry Pi, and another connected to the Relay.

The same Raspberry PI can control the watering and moisture level for multiple plants using the 4Channel 5V Relay Module:

*(Amazon for 4-channel watering kit: link)*

Adafruit chip to convert the analog signal from the capacitive moisture sensor to a digital signal for the Raspberry Pi ADS1115. Multiple soil moisture sensors can be connected through the same chip:

(Amazon for pre-soldered chip: link)

Below images show the Raspberry Pi connected to the relay and ADC module. In one setup, we repurposed a three slots gaming card box to accommodate all the required components for the watering system. One slot is used to host the Raspberry Pi after making a hole for the electrical wiring. Another slot used to host the analog-to-digital converter; it did not require an extra hole to connect the moisture sensor because the wire is small and goes through the cover gap. The last slot is dedicated to the relay that controls the motor, and we made a hole for the power wiring.:
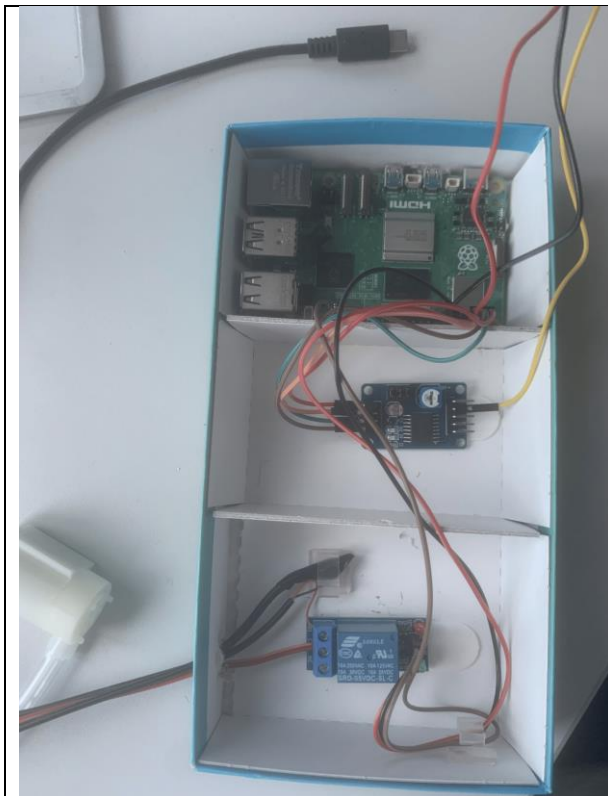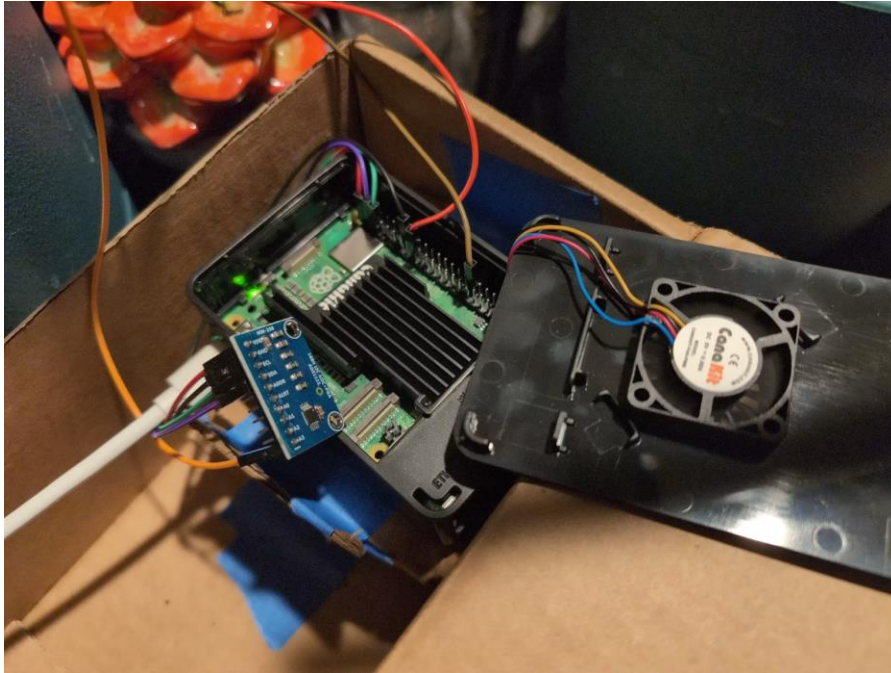

Caption: Cama-l Pack with Sunfounder Analog-Digital and pump configuration

Caption: Cama-l Pack with Sunfounder Analog-Digital and pump configuration, showing the water tank and pump

Below is another setup with Adafruit moisture monitoring and Raspberry PI with fan case:

Caption: Cama-l Pack with Adafruit Analog-Digital, CanaKit Raspberry Pi Case, and no pump

For more details check out Github repository:

https://github.com/Barqawiz/iot_watering_system