

Required Components

1. Hardware Components

a. Raspberry Pi Pico W

- Main microcontroller used to read sensor data and connect to the internet.
- Pico W preferred because it has **built-in WiFi** for ThingSpeak and MQTT.

b. Ultrasonic Sensor (HC-SR04)

- Measures the distance between the sensor and water surface.
- Used to calculate water level percentage / height.

c. OLED Display (0.96" I2C – SSD1306)

- Displays:
 - Water level (cm / %)
 - System status (Safe / Warning / Critical)
 - Connectivity status (ThingSpeak / MQTT)

d. LEDs

- **Green LED** → Safe
- **Red LED (fast blink)** → Warning
- **Red LED (solid)** → Critical

e. Buzzer

- Audible alert for critical water levels.

f. Connecting Wires (Male–Male / Male–Female)

- For connecting Pico to sensors and modules.

g. Breadboard

- Easy circuit assembly and testing.

h. Power Supply

- USB cable / power bank / 5V adapter.
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2. Software Components

a. Thonny IDE

- Main IDE used to program Raspberry Pi Pico in **MicroPython**.
- Supports uploading code directly via USB.
- Easy to install and beginner-friendly.

b. MicroPython Firmware for Pico / Pico W

- Required to run MicroPython code on the microcontroller.

c. Required Python Libraries (installed in Thonny)

- machine
 - time
 - ssd1306
 - umqtt.simple (for MQTT)
 - urequests (for ThingSpeak – optional)
 - network (WiFi connection)
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3. IoT & Cloud Platforms

a. ThingSpeak

- For cloud dashboard
- Stores water level data and shows graphs

b. MQTT Broker (e.g., HiveMQ / EMQX / Mosquitto)

- For real-time alerts
- Pico publishes messages; MyMQTT app receives notifications

c. MyMQTT Mobile App

- Used to receive alerts:
 - Warning level
 - Critical level
 - Water level updates