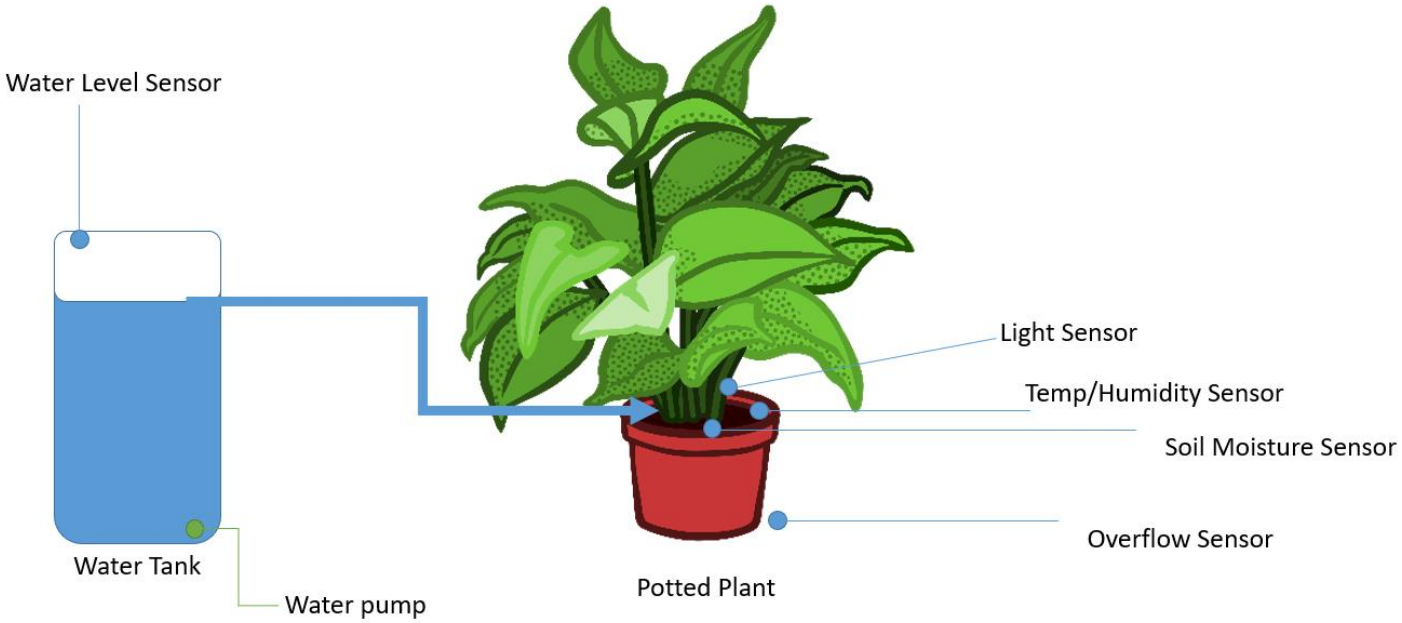
Software Requirements

Overview Block Diagram



Sensor Overview

Soil Moisture Sensor:
A capacitive soil moisture sensor. Output of sensor is an analog value. To calculate Moisture percentage:
*Soil Moisture % = [(580 – Raw Value)/280] * 100%*

Temp/Humidity Sensor:
DHT11 Temperature and humidity sensor.
Temperature = dht.temperature; (℃)
Humidity = dht.humidity
This sensor is used to monitor the atmospheric temperature and humidity.

Light Sensor:
A 12mm photoresistor to detect level of light exposure to the plant.

Overflow Sensor:
A resistive soil moisture sensor to detect when water has overflowed from the plant to the surface the plant is sitting on. There will be a piece of foam circling the pot at the surface with this sensor inserted to detect wetness.
*Moisture % = [(1023 – Raw Value)/800] * 100%*

Water Level Sensor:
An HC-SR04 Sonar sensor sitting on top of the water tank to detect water level. Output value is in centimeters.

Water Pump:
A small water pump powered by a dc motor. Turns on and off water flow.

Functions

Setup
The purpose of this function is to allow the user to set up desired soil moisture level. There are 2 options:

1. Specific Soil Moisture level: For example, 35%
    - Always keep soil moisture at this level.
2. Range of Soil Moisture level: For example, 20 – 80 %
    - Water once Soil moisture is below 20%, water it until it is 80%.

The user should be given two variables to set up: Moisture Minimum, Moisture Maximum.

For option 1, the user can enter same value for Min and Max.

The user should also be allowed to have an option to enter how often a plant should be watered. This should only be applicable to option 1.
For example: Min = 35%, Max = 35%, # of days = 3.
This means that check the soil moisture every 3 days, and water only if below 35%. Once 35% is achieved, check again 3 days later. If # of days = 0, then always check and water according to the soil moisture.

For option 2, # of days can be ignored.

Note: A toleration level of +/- 5% should be given for hysteresis. For example. If user desires 35%. The water pump should only be activated after 30% (35 – 5). And should stop watering after 40% (35 + 5).

Learning
This is the first function that will run after setup. The purpose of this function is to learn the size of the pot the plant is in to set up appropriate watering amount.

Note: User must set soil moisture sensor and water pump on opposite ends of the pot
Procedure:

1. Measure soil moisture
2. Turn on water pump for 3 seconds.
3. Wait for 1 minute and measure soil moisture.
4. Measure soil moisture and check if the moisture sensor has increased.
5. If soil moisture has not increased, repeat steps 2 – 4, storing the amount of time in took.
6. If soil moisture has increased, stop the learning process and store the time.

For example:

If it took 3 cycles to detect soil moisture increase, that means the plant needed to be watered for 3 x 3 Seconds = 9 seconds intervals.

This time (9 seconds) will be the interval to be used in the future, let's call it Watering_Time.

Watering the plant:

Based on the condition's setup by the users, the plant will need to be watered. To water the plant:

1. Turn on the pump for Watering_Time.
2. Wait for 1 minute
3. Measure soil moisture
4. If required moisture has been achieved, stop function
5. Else Repeat Steps 1 to 4.

Water level detection:

Report water level in color codes.

1. If water level > 10cm, GREEN
2. If 5 cm < water level > 10cm, YELLOW
3. If water level < 5cm, RED and send message to refill water. Do not pump water if below 5cm.

Overflow detection:

If moisture is greater than 15%, report overflow. Do not water the plant at any condition until the user has addressed the situation and we can detect less than 10% moisture.

Ambient Monitoring:
Record and store ambient Temperature, Humidity, and Light values every 15 minutes. Report an average value of every 24 hours.

Avg Temperature in 24 Hours
Avg Humidity in 24 Hours

For Light: Value will range from 0 to 1023.

Report how long every 24 hours the light was greater than 500.

Graphic User Interface

User should be allowed to input Minimum Moisture, Maximum Moisture, # of days.

After Learning function, Display Watering_Time

Report:

- Watering_Time
- Soil Moisture Value, Ambient Temperature Value, Ambient Humidity Value, Ambient Light Value
- Average Temperature, Humidity, Light (24 Hours)
- Water level indicator (Green, Yellow, or Red)
- Watering Indicator (Pump on or Pump off)
- Overflow indicator (Only when wet)