2023

7. Gardening system

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Experiment 7: Gardening system

Short Description

Create a Gardening System that notified the gardener when the plans need water with Raspberry Pi Pico, RGB LED 5mm, Soil hygrometer / moisture detection Sensor and capacitor

Extended Description

The Raspberry Pi Pico-based system with a Soil Hygrometer/Moisture Detection Sensor and a capacitor is designed to monitor water levels in plants. It incorporates an efficient and cost-effective approach to ensure the watering of plants. The system consists of several components working together to provide accurate and real-time data on the moisture content in the soil. The Raspberry Pi Pico, a microcontroller board, serves as the central processing unit, handling data acquisition and signal processing tasks.

The Soil Hygrometer/Moisture Detection Sensor is embedded in the soil, constantly measuring the moisture level. This sensor utilizes electrical conductivity to determine the amount of water present in the soil. The moisture data is collected and transmitted to the Raspberry Pi Pico for analysis. To stabilize the sensor readings, a capacitor is employed to filter out noise and fluctuations in the electrical signal. This helps ensure consistent and reliable moisture measurements.

Once the Raspberry Pi Pico processes the moisture data, it compares it against pre-defined thresholds or desired moisture levels for different plant species. Based on these comparisons, the system determines whether the plant requires watering or if the moisture level is within the desired range. To provide visual feedback, an LED is connected to the Raspberry Pi Pico. When the system determines that the plant needs watering, the LED is illuminated, indicating that it's time to provide water. Conversely, if the moisture level is sufficient, the LED remains off.

Objectives:

Through this activity, the user will experiment with building a gardening system using the Raspberry Pi Pico board, Resistor, Soil hygrometer/moisture detection sensor, and capacitor. The user will acquire knowledge on:

- The ability of a capacitor to store energy in the system.
- The ability of a Soil hygrometer/ moisture detection sensor to detect water.
- The basics of programming in Python and how to write code to control the Raspberry Pi Pico board.
- The principles of circuit design and how to wire components together on a rapid prototyping board to create a functional reversing radar system.

By completing this project, the user will better understand electronics, engineering, and programming. They will also have a practical and useful device that they can use to water their plants when they need it.

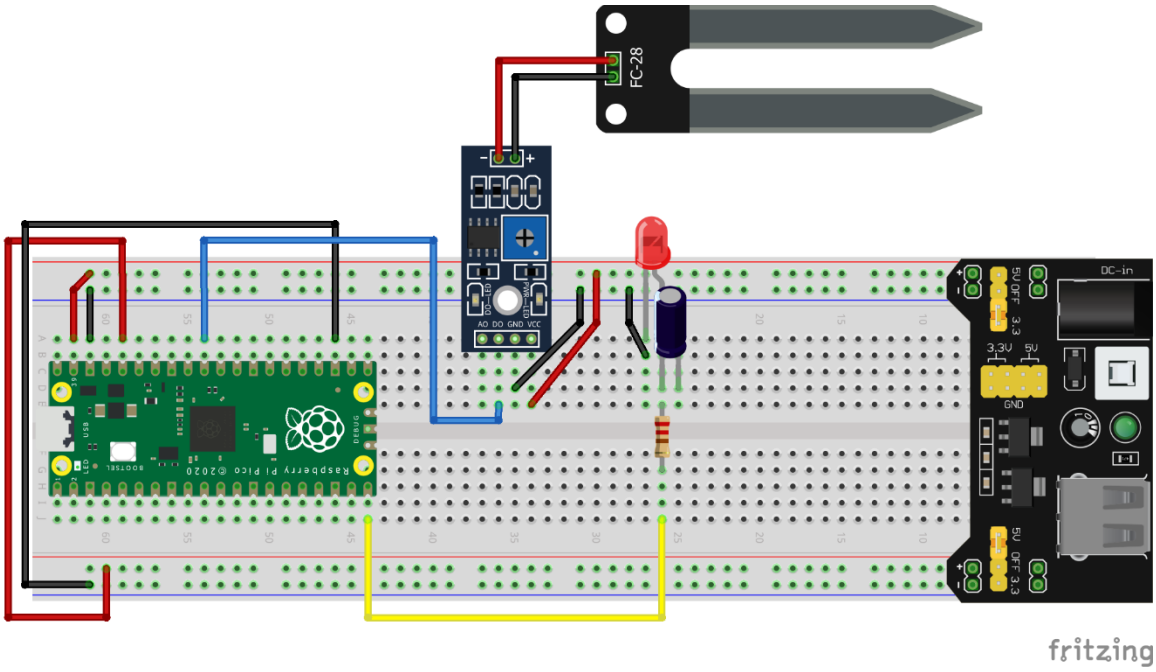
Materials to be used:

- 1 x Raspberry Pi Pico
- 1 x Pico breadboard kit
- 1 x Full-size breadboard
- 1 x Soil hygrometer/moisture detection sensor
- 1 x Capacitor
- 1 x 220 Ohm resistor
- 1 x LED
- Jumper wires

Steps to be followed:

1. Connect the Soil Hygrometer/Moisture Detection Sensor and the LED to the Raspberry Pi Pico as follows:
   - Connect the VCC pin of the soil moisture sensor to the 3.3V pin on the Raspberry Pi Pico.
   - Connect the GND pin of the soil moisture sensor to the GND pin on the Raspberry Pi Pico.
   - Connect the AO pin of the soil moisture sensor to an analog input pin (e.g. GP26) on the Raspberry Pi Pico.
   - Connect the anode (+) of the LED to a GPIO output pin (e.g. GP15) on the Raspberry Pi Pico, via the resistor (220 ohm).
   - Connect the cathode (-) of the LED to GND on the Raspberry Pi Pico.
   - Connect the capacitor in series with the LED and resistor to store energy while the LED is ON
2. Write a Blockly / MicroPython program to control the sensor and see if the LED is ON or OFF.
3. Put the sensor in a planter with water to see if the state of the LED is changed.

Wiring diagram



Code

```
import machine
import time

# Define the GPIO pins for LED and soil moisture sensor
led_pin = machine.Pin(15, machine.Pin.OUT)
sensor_pin = machine.ADC(26)

# Define the threshold for humidity
threshold = 40000  # Change this value according to your sensor
reading

while True:
    # Read the analog output pin of the soil moisture sensor
    humidity = sensor_pin.read_u16()
    print('electrical conductivity =', humidity)
    # If humidity is below the threshold, turn on the LED
    if humidity > threshold:
        led_pin.value(1)
    else:
        led_pin.value(0)
    # Wait for a moment before reading again
    time.sleep(0.5)
```

Conclusion

Overall, this Raspberry Pi Pico-based system with a Soil Hygrometer/Moisture Detection Sensor and an LED provides an automated and reliable solution for monitoring water levels in plants. It helps promote healthy plant growth by ensuring plants receive adequate hydration while preventing over-watering, which can be detrimental to their health.