

Circuit Documentation

Summary

This circuit is designed to automate a watering system using a soil moisture sensor, light-dependent resistors (LDRs), a servo motor, and a water pump. The system is powered by a 6V solar panel and a rechargeable 18650 Li-ion battery pack. The Arduino Uno microcontroller is the central unit that processes sensor data and controls the servo motor and water pump via a relay module. The system is designed to maintain optimal soil moisture levels and adjust the position of the solar panel based on light intensity.

Component List

1. **Arduino Uno**
 - **Description:** A microcontroller board based on the ATmega328P.
 - **Pins:** AREF, GND, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, TX->1, 0->RX, A5, A4, A3, A2, A1, A0, Vin, 5V, 3.3V, RESET, IOREF.
2. **Module LDR (x2)**
 - **Description:** Light-dependent resistor module used to detect light intensity.
 - **Pins:** VCC, GND, DO, AO.
3. **Soil Moisture Sensor Module**
 - **Description:** Sensor module to measure soil moisture levels.
 - **Pins:** VCC, GND, DO, AO.
4. **6V Solar Panel**
 - **Description:** Solar panel used to charge the battery.
 - **Pins:** +, -.
5. **18650 Li-ion Battery x 2**
 - **Description:** Rechargeable battery pack for power storage.
 - **Pins:** +, -.
6. **Servo**
 - **Description:** Servo motor for adjusting the position of the solar panel.
 - **Pins:** GND, VCC, PWM.
7. **Water Pump**
 - **Description:** Pump used to water plants.
 - **Pins:** Positive, Negative.
8. **1 Channel 5V Relay Module**
 - **Description:** Relay module to control the water pump.
 - **Pins:** VCC+, VCC- (GND), IN, N.O., COM, N.C.
9. **Rocker Switch**
 - **Description:** Switch to control the power flow.
 - **Pins:** 1, 2.
10. **TP4056**
 - **Description:** Lithium battery charger module.
 - **Pins:** OUT-, B-, B+, OUT+, IN-, IN+.

Wiring Details

Arduino Uno

- **5V** connected to VCC of Soil Moisture Sensor, both LDR Modules, Servo, and Relay Module.
- **GND** connected to GND of Soil Moisture Sensor, both LDR Modules, Servo, and Relay Module.
- **Pin 12** connected to IN of Relay Module.
- **Pin 9** connected to PWM of Servo.
- **Pin A0** connected to AO of Soil Moisture Sensor.
- **Pin 2** connected to DO of the first LDR Module.
- **Pin 3** connected to DO of the second LDR Module.

Module LDR (x2)

- **VCC** connected to 5V from Arduino.
- **GND** connected to GND from Arduino.
- **DO** of the first LDR connected to Pin 2 of Arduino.
- **DO** of the second LDR connected to Pin 3 of Arduino.

Soil Moisture Sensor Module

- **VCC** connected to 5V from Arduino.
- **GND** connected to GND from Arduino.
- **AO** connected to Pin A0 of Arduino.

6V Solar Panel

- **+** connected to IN+ of TP4056.
- **-** connected to IN- of TP4056.

18650 Li-ion Battery x 2

- **+** connected to B+ of TP4056 and Pin 1 of Rocker Switch.
- **-** connected to B- of TP4056 and negative of Water Pump.

Servo

- **VCC** connected to 5V from Arduino.
- **GND** connected to GND from Arduino.
- **PWM** connected to Pin 9 of Arduino.

Water Pump

- **Positive** connected to COM of Relay Module.

- **Negative** connected to - of Battery.

1 Channel 5V Relay Module

- **VCC+** connected to 5V from Arduino.
- **VCC- (GND)** connected to GND from Arduino.
- **IN** connected to Pin 12 of Arduino.
- **N.C.** connected to Pin 2 of Rocker Switch.
- **COM** connected to Positive of Water Pump.

Rocker Switch

- **Pin 1** connected to + of Battery.
- **Pin 2** connected to N.C. of Relay Module.

TP4056

- **B+** connected to + of Battery.
- **B-** connected to - of Battery.
- **IN+** connected to + of Solar Panel.
- **IN-** connected to - of Solar Panel.

Documented Code

```
#include <Servo.h>
#define SOIL_PIN A0
#define RELAY_PIN 12
#define LEFT_LDR 2
#define RIGHT_LDR 3
int threshold = 50.00;

Servo servo;
int pos = 90;

void setup() {
  servo.attach(9);
  pinMode(LEFT_LDR, INPUT);
  pinMode(RIGHT_LDR, INPUT);
  servo.write(pos);
  pinMode(SOIL_PIN, INPUT);
  pinMode(RELAY_PIN, OUTPUT);
  digitalWrite(RELAY_PIN, HIGH);
  Serial.begin(9600);
  Serial.println("Started");
```

```

}

void loop() {
    int value = analogRead(SOIL_PIN);
    float percent = 100 - (value * 0.0714);

    if (percent > threshold) {
        digitalWrite(RELAY_PIN, HIGH);
        Serial.println("Motor ON");
        Serial.println(percent);
    } else {
        digitalWrite(RELAY_PIN, LOW);
        Serial.println("Motor OFF");
        Serial.println(percent);
    }

    delay(50);

    if (digitalRead(LEFT_LDR) == LOW && pos < 135) pos++;
    if (digitalRead(RIGHT_LDR) == LOW && pos > 45) pos--;
    servo.write(pos);
    delay(20);
}

```

Code Explanation

- **Libraries and Definitions:** The code includes the Servo library and defines pin numbers for the soil moisture sensor, relay, and LDRs.
- **Setup Function:** Initializes the servo, sets pin modes, and starts serial communication.
- **Loop Function:** Continuously reads the soil moisture level and controls the relay to turn the water pump on or off based on the moisture threshold. It also adjusts the servo position based on the LDR readings to optimize solar panel orientation.