AUTOMATED IRRIGATION CONTROL SYSTEM BASED ON ENVIRONMENTAL SENSING

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AIM:

The aim of an automated irrigation control system based on environmental sensing is to automatically water crops by monitoring soil moisture and environmental conditions, ensuring water is used efficiently. It reduces manual labor and prevents overwatering, supporting sustainable agriculture. The system enhances crop growth while conserving water resources.

COMPONENTS REQUIRED:

- ESP8266 (Microcontroller)

SENSORS:

- Soil Moisture sensor
- DHT22
- Rain sensor
- Water level sensor
- Water flow sensor (YFS201)

ACTUATORS:

- Solenoid Valve
- Relay module

ESP8266 (MICROCONTROLLER):

- Controls the irrigation system by processing sensor data.
- Provides Wi-Fi connectivity for remote monitoring and control.
- Operates with 3.0-3.6V supply, CPU speed up to 160 MHz.
- Includes integrated WI-FI supporting 802.11b/g/n at 2.4 GHz.

SOIL MOISTURE SENSOR:

- Measures soil water content to determine irrigation needs.
- Provides analog output corresponding to moisture level.
- Effective sensing range covers dry to saturated soil conditions (0-100% moisture

DHT22:

- Measures ambient temperature and humidity.
- Temperature range: -40°C to 80°C; Humidity: 0-99.9% RH.
- Provides digital output for precise climate monitoring.

RAIN SENSOR:

- Detects rainfall to pause or adjust irrigation.
- Can measure rainfall rates as low as 0.1 mm.
- Operates in outdoor temperature ranges approximately -40°C to 60°C.

WATER LEVEL SENSOR:

- Monitors water reservoir or tank level.
- Typical measurement range from 0.1 m to 150 m depending on sensor.
- Outputs electrical signals for real-time water level tracking**.**

WATER FLOW SENSOR (YFS201):

- Measures water flow rate to regulate irrigation volume.
- Flow range: 1 to 30 liters per minute.
- Outputs pulses proportional to flow rate for measurement

SOLENOID VALVE:

- Controls water flow by opening/closing on electrical signal.
- Typically operates at 12V or 24V DC.
- Suitable for water temperature up to 82°C, normally closed type

RELAY MODULE:

- Acts as a switch to control high-power devices from ESP8266.
- Usually operates at 5V coil voltage.
- Can switch loads up to 10A at 250V AC or 30V DC

AVAILABLE COMPONENTS:

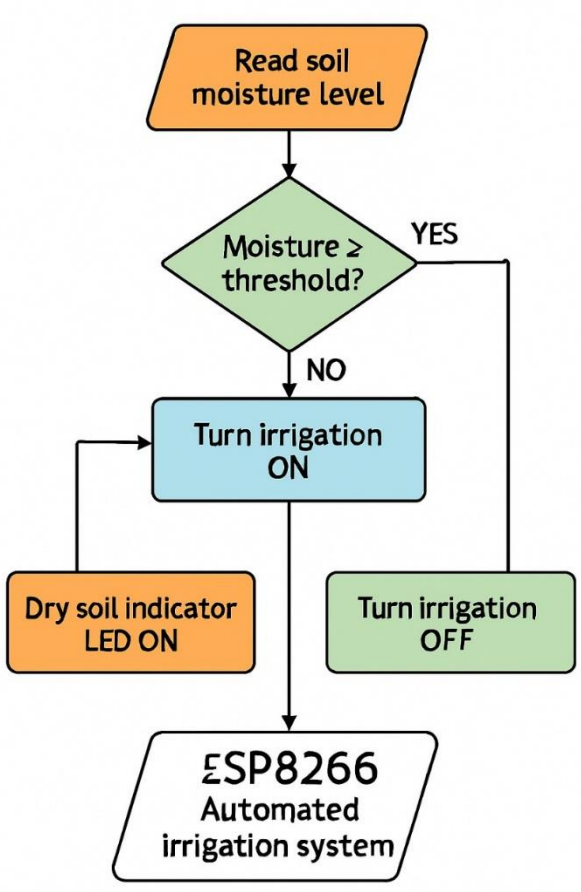
- ESP8266 (microcontroller)
- Capacitive Soil Moisture Sensor v1.2
- Submersible Water Pump (Mini DC 3-6V)
- 1-Channel Relay Module (Songle SRD-05VDC-SL-C)
- LED -3
- Resistor(1K)-3
- Connecting wires

PIN CONFIGURATION:

COMPONENT	**ESP8266**
SOIL MOISTURE SENSOR 1) VCC 2) GND 3) ANALOG OUTPUT	 3.3V GND A0
SUBMERSIBLE WATER PUMP-(CONNECT PUMP TO RELAY MODULE)	
RELAY MODULE: 1) IN 2) VCC 3) GND	D1(GPIO5) 5V (EXTERNAL) GND
LED1(ANODE) LED1(CATHODE)	D2(GPIO4) GND
LED2(ANODE) LED2(CATHODE)	D3(GPIO0) GND
LED3(ANODE) LED3(CATHODE)	D4(GPIO2) GND

.

FLOWCHART:



PROCEDURE:

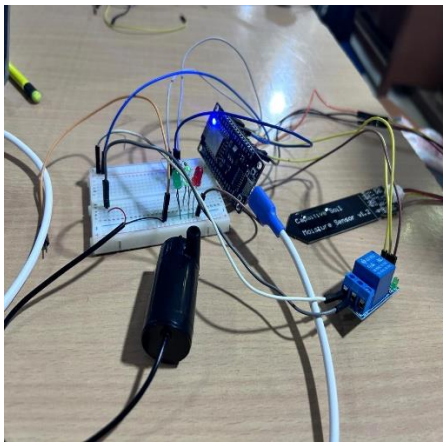
- Initialize pins for relay, LEDs, and soil moisture sensor on ESP8266.
- Continuously read soil moisture sensor analog value from A0 pin.
- Compare soil moisture reading with dry and wet thresholds.
- Turn on corresponding LED based on moisture level (dry, moderate, wet).
- Activate relay to switch ON water pump only when soil is dry; otherwise, keep it OFF.

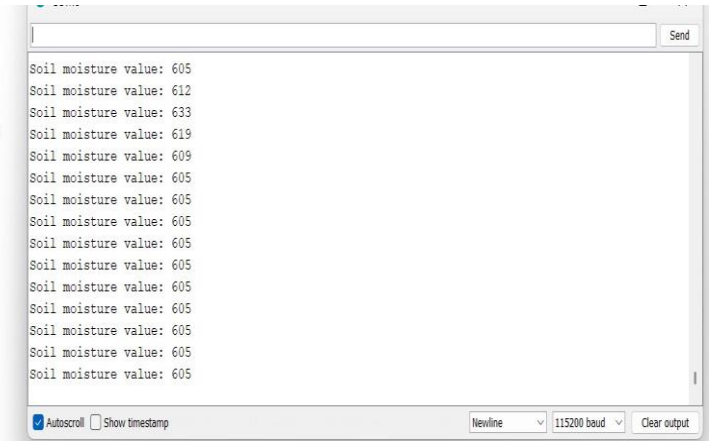
PROGRAM:

```
#define SOIL_MOISTURE_PIN A0
#define RELAY_PIN 5
#define LED1_PIN 4
#define LED2_PIN 0
#define LED3_PIN 2
int dryThreshold = 800;
int wetThreshold = 400;
void setup() {
  pinMode(RELAY_PIN, OUTPUT);
  pinMode(LED1_PIN, OUTPUT);
  pinMode(LED2_PIN, OUTPUT);
  pinMode(LED3_PIN, OUTPUT);
  Serial.begin(115200);
}
void loop() {
  int soilValue = analogRead(SOIL_MOISTURE_PIN);
  Serial.print("Soil moisture value: ");
  Serial.println(soilValue);
```

```
  // Control LEDs and relay based on soil moisture
  if (soilValue > dryThreshold) {
    digitalWrite(LED1_PIN, HIGH);
    digitalWrite(LED2_PIN, LOW);
    digitalWrite(LED3_PIN, LOW);
    digitalWrite(RELAY_PIN, HIGH);
  } else if (soilValue <= dryThreshold && soilValue > wetThreshold) {
    digitalWrite(LED1_PIN, LOW);
    digitalWrite(LED2_PIN, HIGH);
    digitalWrite(LED3_PIN, LOW);
    digitalWrite(RELAY_PIN, LOW);
  } else {
    digitalWrite(LED1_PIN, LOW);
    digitalWrite(LED2_PIN, LOW);
    digitalWrite(LED3_PIN, HIGH);
    digitalWrite(RELAY_PIN, LOW);
  }
  delay(1000); // Wait for 1 second
}
```

EXECUTION:





RESULT:

The project successfully implements an automated irrigation system using ESP8266 that efficiently monitors soil moisture and controls water supply, reducing water wastage and manual labor, while enhancing crop growth and allowing remote real-time monitoring for sustainable agriculture.