

Smart Irrigation System Using IoT and Automation

Objective

The main objective of this project is to develop an efficient and automated Smart Irrigation System using IoT technology to monitor soil moisture levels and control water flow to crops automatically. This helps in water conservation, reduces manual labor, and improves irrigation accuracy in real time.

Importance

Water scarcity is a growing problem in agriculture. Traditional irrigation methods often waste water due to over-irrigation or poor timing. Our system addresses this issue by using soil moisture sensors and microcontroller-based decision-making to supply water only when needed, optimizing water usage and saving energy.

Components Used

- NodeMCU ESP8266 – Microcontroller with built-in WiFi for cloud connectivity
- Soil Moisture Sensor – Measures moisture content in soil
- DHT11 Sensor – Monitors temperature and humidity
- 0.96" OLED Display (SSD1306) – Displays live readings
- Relay Module – Controls the water pump automatically
- Mini Water Pump (5V/6V) – Delivers water to the plant
- Breadboard and jumper wires – For easy prototyping
- Power Supply (USB or 5V adapter) – Powers the NodeMCU

Software and Tools Used

- Arduino IDE – For programming the NodeMCU
- ThingSpeak (IoT Platform) – Used to send and view real-time data like soil moisture, humidity, temperature, and pump status from anywhere
- Libraries Used: ESP8266WiFi.h, DHT.h, Adafruit_SSD1306.h, Adafruit_GFX.h, Wire.h

How It Works

1. Soil moisture sensor reads the dryness level of soil.
2. If the moisture is below a set threshold, the NodeMCU activates the relay, turning on the pump.
3. The DHT11 sensor measures humidity and temperature.

4. All data is displayed on the OLED and uploaded to ThingSpeak.
5. The pump turns off automatically once the moisture level is sufficient.

Applications

- Smart agriculture & precision farming
- Greenhouses and gardens
- Remote irrigation in rural areas
- Urban terrace gardens and potted plants
- Sustainable water usage systems

Conclusion

This Smart Irrigation System is an effective, low-cost solution to modern agricultural challenges. It reduces human effort, saves water, and enables real-time environmental monitoring through IoT. It can be scaled and modified for larger farms, hydroponics, or smart city agriculture setups.