IoT-Based Smart Irrigation System Using Cisco Packet Tracer

Aim

Design and simulate a smart irrigation system that automates the process of watering agricultural fields.
The system uses real-time soil moisture monitoring via IoT components to activate a water pump when moisture falls below a set threshold, thereby optimizing water usage and enhancing crop health.

Problem Statement

Agriculture is a critical sector requiring significant water resources for irrigation. However, traditional methods face multiple challenges:

- **Overwatering** causes water wastage, soil erosion, and nutrient leaching.
- **Under-watering** leads to poor crop yield and plant health.
- Manual irrigation requires labor and is inefficient.
- Lack of real-time monitoring prevents timely actions.

This project aims to resolve these challenges by designing an automated system using IoT sensors and actuators simulated in Cisco Packet Tracer to intelligently manage irrigation without human intervention.

Scope of the Solution

The project covers:

- Soil moisture monitoring using simulated sensors.
- Automatic control of irrigation based on sensor data.
- Data communication between sensor, microcontroller (Arduino), IoT Cloud, and actuator (water pump).
- Visualization of data and system status in real-time.
- Complete system simulation using Cisco Packet Tracer.

Future extensions could include multi-zone control, weather-based scheduling, mobile app integration, and cloud-based data logging.

System Design

➤ Block Diagram

➤ Data Flow Process

1. Soil Moisture Sensor reads analog moisture levels in the soil.
2. Arduino receives the sensor data and processes it.
3. Data is transmitted to the IoT Cloud using MQTT protocol in Packet Tracer.
4. The Cloud dashboard monitors the sensor values in real time.
5. If the moisture level is below a predefined threshold (e.g., 300), the Cloud triggers the water pump actuator.
6. The system sends back the pump status for visualization.

Circuit Simulation in Cisco Packet Tracer

- Designed a simple circuit in Cisco Packet Tracer integrating:
  - IoT devices: Soil Moisture Sensor, Arduino, and Water Pump.
  - Network hardware: Switch and Router to simulate data communication.
  - IoT Cloud as the central monitoring and control platform.
- Simulation Scenario:
  - Varying the soil moisture sensor values between low and high ranges.
  - Demonstrated that the water pump activates automatically when moisture is low.

Arduino Code Logic Example

```
int moistureSensorPin = A0;

int pumpPin = 8;

int threshold = 300;


void setup() {
  Serial.begin(9600);
  pinMode(pumpPin, OUTPUT);
}
```

```
void loop() {
  int sensorValue = analogRead(moistureSensorPin);
  Serial.print("Soil Moisture: ");
  Serial.println(sensorValue);

  if (sensorValue < threshold) {
    digitalWrite(pumpPin, HIGH);  // Pump ON
  } else {
    digitalWrite(pumpPin, LOW);   // Pump OFF
  }

  delay(2000);
}
```

Results & Observations

Observation Step	Outcome
Sensor detects low moisture	Arduino sends value to IoT Cloud
Threshold check triggers pump	Water pump actuator switches ON automatically
Data displayed on cloud	Real-time status of moisture and pump is visible
Moisture returns to adequate	Water pump switches OFF automatically

- The system successfully automates irrigation.
- Real-time monitoring enables dynamic response.
- Reduces human effort and optimizes water usage.

Conclusion

This project demonstrates an effective implementation of an IoT-based smart irrigation system using Cisco Packet Tracer.
Benefits include:

- Automation and real-time decision-making.
- Improved efficiency of water usage.
- Prevention of crop damage caused by inconsistent irrigation.

Future work may include integrating advanced machine learning for predictive irrigation or adding multiple zones for large farms.