NEHRU ARTS AND SCIENCE COLLEGE

BATCH : 2

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EXECUTION VIDEO OF THE DEMO :

GITHUB LINK :

SMART IRRIGATION SYSTEM USING CISCO PACKET TRACER

AIM & PROBLEM STATEMENT : To design and simulate a Smart Irrigation System using Cisco Packet Tracer that optimizes water usage in agricultural fields by monitoring soil moisture levels and automatically controlling irrigation. This system ensures efficient water management, reduces wastage, and enhances crop productivity through IoT-based automation.
Agricultural irrigation systems often lead to excessive water usage due to inefficient manual control, resulting in water wastage, increased costs, and soil degradation. Traditional irrigation methods do not adapt to varying soil moisture levels, leading to overwatering or underwatering, which affects crop growth and yield.To address this issue, a Smart Irrigation System is needed to automate irrigation based on real-time soil moisture data. This system should use IoT sensors to monitor moisture levels and trigger irrigation only when necessary, ensuring optimal water usage, reducing waste, and improving agricultural efficiency. Cisco Packet Tracer will be used to simulate and implement this IoT-based solution.

Keywords— Internet of Things, Cisco Packet Tracer, Smart Irrigation System

As mentioned in the reference paper [3], A monitoring system is developed based on IoT using the packet tracer simulation software. It uses the statistical data from the sensors and the information stored in a cloud. In Paper [4], an automated system for irrigation is developed by analyzing the moisture level of the ground. This system makes use of two microcontrollers, Raspberry pi and Arduino respectively. The system represented in [5] represents a smart home system using cisco packet tracer that uses the IoT technology to automate various activities of the house. The theme in [6] aims for a high-level monitoring and controlling of the data for agriculture monitoring system which monitors the real-time data from the crop-field using Raspberry pi and cloud-based IoT systems. As mentioned in this paper [7], The use of automation systems in wireless technology has several advantages that wired systems cannot provide. The wireless systems reduce the installation costs since the hardware requirement is low and no cabling is necessary. Wireless systems are scalable and expandable. Internet connectivity is another factor that plays crucial role in order to control devices from all around the world. As proposed in this paper [8], for controlling the sensors, a Microcontroller (MCU-PT) and Home Gateway is used which provides programming environment for controlling devices that are connected to the home gateway.

OVERVIEW ARCHITECTURE OF THE SOLUTION

The solution architecture consists of multiple layers working together for efficient and automated irrigation.The Sensing Layer collects real-time data using soil moisture, temperature, humidity, and rain sensors. The Communication Layer transmits data via Wi-Fi, LoRa, GSM, or IoT protocols like MQTT and HTTP. The Processing Layer analyzes data using microcontrollers, edge computing, and AI/ML algorithms to optimize irrigation schedules. The Cloud Layer stores data, enables remote access, and provides advanced analytics. Finally, the Actuation Layer controls pumps and valves for automated irrigation, ensuring efficient water usage and improved crop yield.

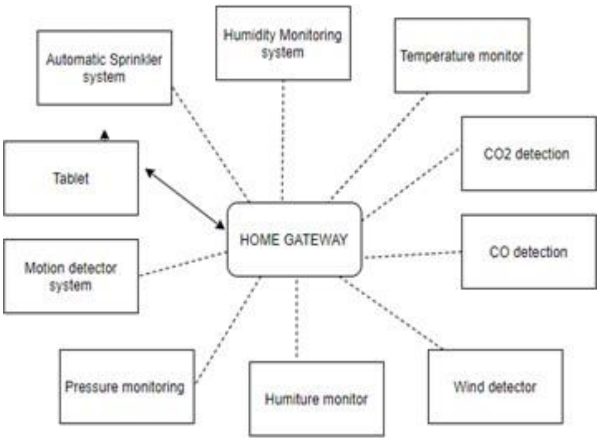


Figure 1. Block Diagram of Smart Irrigation System

Shows the block diagram of the Smart Irrigation system, which is implemented using the Cisco Packet Tracer. The block diagram contains an Automatic sprinkler system, humidity monitoring system, Temperature monitor, Pressure monitoring, Motion detector system, Humiture monitor, Wind detector, Carbon monoxide detector, and Carbon dioxide detector. All these smart IoT systems and devices are connected to the internet by using a home gateway and can be controlled using a Tablet. Table 1 shows the devices used and their function.

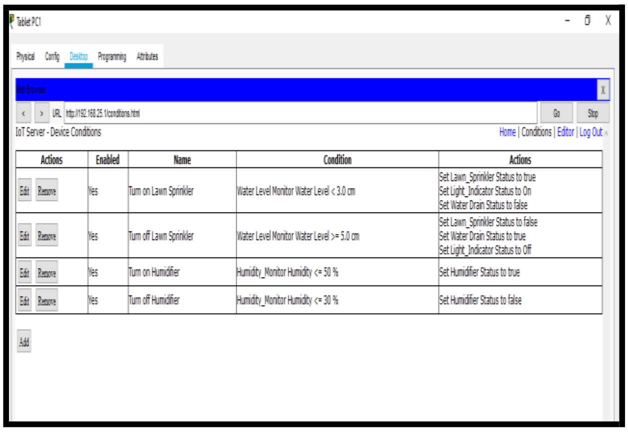
REQUIRED COMPONENTS TO DEVELOP SOLUTION

Sr. No.	Device	Function
1	Server	Server is used to interconnect the home system to a cellular network
2	Cable Modem	It is used to provide internet connection
3	Cloud	Cloud is used to store data
4	Home gateway	Provides internet access and local connection to the IoT network
5	Switch	Switches allow different devices on a network to communicate
6	Lawn Sprinkler	A sprinkler for Lawn
7	Water level monitor	Used for water level detection
8	Water Drain	Drains out water at a rate of 0.5cm per hour
9	Light indicator	It is used to give light indication if the system is on
10	Temperature monitor	Temperature monitor is a device that gathers data concerning temperature from the environment and converts it to a readable form of data
11	Pressure monitor	Atmospheric pressure detection
12	Humiture monitor	Humidity and Temperature monitor. Displays current humiture, which is (temperature+ humidity)/2 to the closest integer
13	Humidity monitor	Detects and displays humidity level
14	Humidifier	It is used to increase the humidity
15	MCU board	Microcontroller board for interconnecting devices
16	Alarm	It is triggered when motion is detected
17	Motion sensor	It is used for detecting motion
18	Carbon monoxide detector	Detects level of carbon monoxide
19	Carbon dioxide detector	Detects level of carbon dioxide
20	Wind detector	Detects wind in the environment

A. Home Gateway

To connect to the network, either a home gateway is required or a registration server. After connecting to the PC or a tablet to the home gateway, the devices can be turned on and off using the features of the home gateway. Fig 2 shows the physical configuration of the home gateway.

values of the humidity sensor can be viewed on the Tablet. Further, to make it more convenient, a humidifier is used. A humidifier is a device used for increasing the level of moisture in the environment. The users can set the conditions accordingly.



Actions	Enabled	Name	Condition	Actions
Edit Remove	Yes	Turn on Lawn Sprinkler	Water Level Monitor Water Level < 3.0 cm	Set Lawn_Sprinkler Status to true Set Light_Indicator Status to On Set Water Drain Status to false
Edit Remove	Yes	Turn off Lawn Sprinkler	Water Level Monitor Water Level >= 5.0 cm	Set Lawn_Sprinkler Status to false Set Water Drain Status to true Set Light_Indicator Status to Off
Edit Remove	Yes	Turn on Humidifier	Humidity_Monitor Humidity <= 50 %	Set Humidifier Status to true
Edit Remove	Yes	Turn off Humidifier	Humidity_Monitor Humidity <= 30 %	Set Humidifier Status to false

Add

Figure 6. Shows the conditions set for the automatic water sprinkler system and humidity monitoring system.

D. Other Monitoring Devices

The germination time of the seeds and plants may shorten due to frequent changes in the atmospheric pressure. This System has an Atmospheric Pressure level indicator for proper monitoring of atmospheric pressure levels and taking adequate measures that may help to increase the growth of plants and cause more massive and rapid root growth. Another aspect is the Humiture monitor, which helps in monitoring both temperature and humidity levels. The temperature monitor senses the temperature levels in the atmosphere. The Wind detector detects wind in the environment. The carbon monoxide and carbon dioxide detect the carbon monoxide and carbon dioxide levels, respectively.

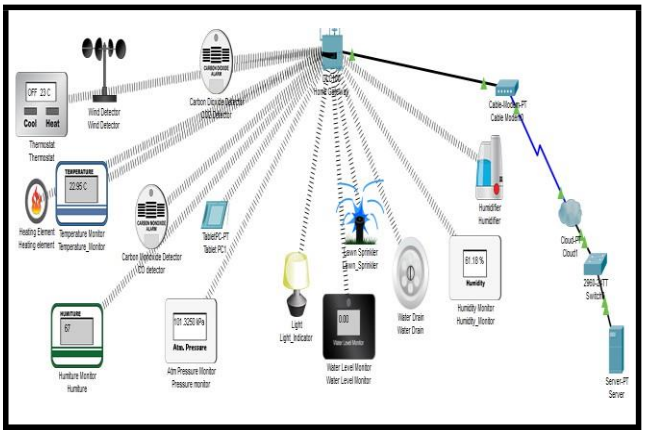


Figure 7. Overall Network

SIMULATED CIRCUIT

After registration of the devices with the home gateway, to control the IoT devices remotely using a tablet. The registered IoT devices can be viewed on the tablet. The devices can be manually operated as well as the values can

be viewed and monitored in real-time.

Figure 8. IoT devices displayed on the Tablet

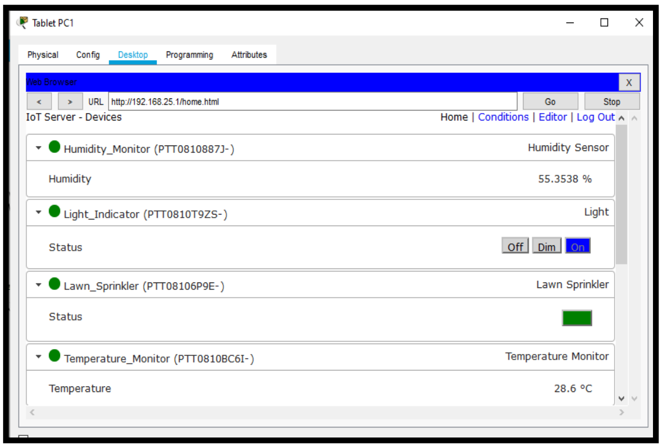


Figure 9. The numerical values of the sensors

Fig 9. shows the numerical values of the sensors that are displayed on the Tablet. It shows the status of the IoT devices registered with the home gateway. These devices can be manually as well as automatically monitored.

Irrigation in short:

A smart irrigation system is implemented using the Cisco packet tracer. A home gateway to register the devices and control them using a tablet. All the IoT devices connected to the home gateway can be monitored manually as well as remotely by the user. The results prove that there is an opportunity of applying this model in real life. The implementation of the automatic irrigation system can be used to reduce the use of water. The system can be manually monitored, it can increase the energy efficiency and savings. It also makes it convenient for the user to access all the devices through the smartphone. In the field of IoT, ensuring security should be a priority. Since the IoT devices are interconnected to each other, the network should be secured. In this system, an authentication gateway is designed that requires password to check authenticity of the home user for security purpose. To extend this system to be more robust and efficient in the future, modifications can be made to make the system more secure. If abnormalities in the system are detected, the system should send an SMS or an Email to alert the user.

RequiredComponentsforDevelopingtheSmartIrrigationSystem in Cisco Packet Tracer:

To build a Smart Irrigation System in Cisco Packet Tracer, the following hardware and software components are required:

1. Hardware Components (Simulated in Cisco Packet Tracer)

   A. Input Devices (Sensors)

1. IoT Soil Moisture Sensor – Monitors soil moisture levels in real-time.
2. IoT Temperature & Humidity Sensor (Optional) – Enhances system efficiency by factoring in environmental conditions.
3. IoT Water Level Sensor (Optional) – Ensures an adequate water supply for irrigation.

   B. Processing Unit

4. IoT Microcontroller (MCU-PT or SBC-PT) – Processes sensor data and controls the water pump based on moisture levels.

   C. Output Devices (Actuators)

5. IoT Water Pump – Activates when the moisture level is below the threshold and deactivates when moisture is sufficient.
6. IoT Sprinklers (Optional) – Alternative to the water pump for large-scale irrigation.

   D. Networking Devices

7. Wireless Router – Provides network connectivity between IoT components.

8. Switch (Optional) – Used if multiple microcontrollers are connected via wired communication.

   E. End-User Devices

9. PC, Tablet, or Smartphone – Allows farmers to monitor and control the system remotely via a web interface or Cisco Packet Tracer's IoT dashboard.

2. Software Components

   A. Cisco Packet Tracer (IoT Mode)

Used to design, configure, and simulate the Smart Irrigation System.

Supports IoT device configuration, programming, and networking.

   B. IoT Firmware/Operating System

Built-in Cisco Packet Tracer firmware for IoT components.

Provides configuration options for sensors, actuators, and microcontrollers.

   C. Programming Environment

JavaScript or Python (Cisco Packet Tracer IoT scripting) – Used to program automation logic for controlling irrigation based on soil moisture levels.

3. Communication Protocols Used

1. MQTT (Optional) – For cloud-based IoT communication.
2. HTTP/HTTPS – Enables web-based monitoringcoming
3. Wi-Fi (802.11) – Wireless communication between IoT devices and the router.

4. Additional Resources (For Future Enhancements)

Cloud Server (Optional) – For remote data storage and monitoring.

Database (MySQL, Firebase, etc.) – To store historical moisture and irrigation data.

Mobile App/Web Interface – For real-time control and alerts.

CONCLUSION:

The smart irrigation system designed using Cisco Packet Tracer successfully optimizes water usage in agricultural fields by integrating IoT-based monitoring and automation. The system continuously tracks soil moisture levels through sensors and triggers irrigation only when necessary, reducing water wastage and improving crop health. By leveraging Cisco Packet Tracer's network simulation capabilities, the system effectively demonstrates real-time data collection, decision-making, and automated control of irrigation mechanisms.This project highlights the potential of IoT in precision agriculture, enabling resource efficiency, cost savings, and sustainable farming practices. Future enhancements could include weather-based predictive analytics, remote user control, and AI-driven irrigation scheduling to further improve system performance.