SUSHANT UNIVERSITY ORGANIZED INTERNATIONAL CONFERENCE ON
"ADVANCES IN MULTIDISCIPLINARY RESEARCH AND INNVOATION" ICAMRI-2023
ON 28-29TH OCTOBER 2023
INTERNATIONAL ADVANCE JOURNAL OF ENGINEERING, SCIENCE AND MANAGEMENT (IAJESM)
July-December 2023, Submitted in October 2023, iajesm2014@gmail.com, ISSN -2393-8048
Multidisciplinary Indexed/Peer Reviewed Journal. SJIF Impact Factor 2023 =6.753

Design and Simulation of a Smart Irrigation System Using Cisco Packet Tracer

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ABSTRACT

Many economies around the world are based on agriculture, and effective irrigation systems are essential to ensure successful crop growth. Traditional irrigation methods, however, can be ineffective, resulting in water waste and higher expenditures. Smart irrigation systems that utilise technology to maximise water use and boost agricultural productivity have gained popularity in recent years. This study uses Cisco Packet Tracer, a network simulation tool, to develop and simulate a smart irrigation system. The simulation depicts the design and implementation of a smart irrigation system employing a variety of technologies, including sensors, controllers, and actuators, and the interconnection of these components using a range of network protocols and technologies.The end result is an effective and economical irrigation system that may be utilised to increase agricultural productivity while preserving water supplies.

Key Words: Cisco Packet Tracer, Smart irrigation System, Sensors, Agriculture Productivity

INTRODUCTION

Computer networks refer to the systems of interconnected devices that can communicate with each other and share resources. These devices can include computers, servers, printers, routers, switches, and other networking devices. Computer networks are essential in modern society as they enable communication and the sharing of information and resources between people and organizations. They have revolutionized the way we live and work, enabling us to connect and collaborate with others in different parts of the world.Computer networks can be classified as either local area networks (LANs), wide area networks (WANs), metropolitan area networks (MANs), or wireless networks. While WANs can connect computers and devices over great distances, connecting them across cities, nations, or even continents, LANs typically cover a local geographic region, such as an office or a building.Ethernet, Wi-Fi, Bluetooth, and TCP/IP are only a few examples of the communication protocols and technologies used by computer networks to convey data between devices. Data is transported across the network swiftly, safely, and effectively thanks to these protocols and technologies.Computer networks enable the development of several network-based applications and services, including email, web surfing, online gaming, and video conferencing, in addition to supporting communication and resource sharing. The way we engage with one another has changed as a result of these services and programmes, which have made it simpler and more comfortable to connect with people around the globe [5].

A robust network simulation tool that enables users to model network topologies and configurations is Cisco Packet Tracer. Cisco Systems created a free, cross-platform network simulation tool that enables teachers, network administrators, and students to design, configure, and troubleshoot computer networks without the use of actual hardware. In order to support learning and experimentation, Cisco Packet Tracer simulates complicated networks and offers users a complete simulation and visualisation environment.Users may design, develop, and test networks utilising virtual network components like routers, switches, servers, PCs, and wireless devices with Cisco Packet Tracer [1] [3]. Access control lists, VLAN trunks, virtual local area networks, and dynamic routing protocols can all be created and configured by users.Users can model network topologies and configurations using Cisco Packet Tracer, a potent network simulation tool.

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It is a free, cross- platform network simulation programme created by Cisco Systems that enables network administrators, educators, and students to design, install, and troubleshoot computer networks without using actual hardware. With the help of Cisco Packet Tracer, users can learn and experiment with complicated networks in a thorough simulation and visualisation environment. Utilising virtual network components including routers, switches, servers, PCs, and wireless devices, users of Cisco Packet Tracer may design, construct, and test networks. Additionally, users can set up and customise dynamic routing protocols, control lists, virtual LANs, and VLAN trunks [7].

A smart irrigation system is an innovative solution to address the water scarcity issue that is becoming more prevalent in many parts of the world [9]. This system utilizes various technologies, including sensors, controllers, and actuators, to optimize the water usage for plants and crops. By monitoring the environmental conditions and plant water requirements, the system can provide the precise amount of water necessary for growth, resulting in more efficient use of water resources [4]. Cisco Packet Tracer is a powerful network simulation tool that can be used to design and simulate smart irrigation system. By utilizing the features and capabilities of Cisco Packet Tracer, it is possible to create a realistic simulation of a smart irrigation system and test its performance under different scenarios. The simulation can help identify potential issues and allow for adjustments before deploying the actual system, which can save time and resources [11].

Devices used in this research paper -

1. **Home gateway**

A home gateway is an essential part of a smart home system. It functions fundamentally as a router that gives devices in a home or small business environment connectivity [6]. It is intended to serve as an interface between the internet and LAN-connected devices.Home gateways offer a number of features, including:

- Wireless access: The vast majority of home gateways offer wireless connectivity for connecting devices to the internet.
- Firewall security: To protect devices from external threats, home gateways frequently feature a firewall.
- Network administration capabilities: By offering features like device prioritisation and parental controls, home gateways enable users to manage their local network.

Home gateways have developed to integrate smart home integration as a result of the development of smart home technologies. This indicates that a home gateway can communicate with and control smart home appliances like humidity and water level monitors.

2. **Water level monitor**

A water level monitor is an instrument that gauges the amount of water in a tank or reservoir. Usually, a sensor is positioned inside the tank or reservoir and wirelessly transmits data to a monitoring device. A home gateway or other smart home system, such as a standalone unit, can be integrated with the monitoring device.

A water level monitor is helpful for a number of tasks, such as:

- Checking the water levels in a pool or spa;
- Measuring the water levels in a rainwater tank;
- Checking the water levels in a well or borehole.

Users can remotely check the water levels in their tanks and get notifications when the level is low by connecting a water level monitor with a home gateway [9].

3. **Humidity Monitor:**

A humidity monitor is a piece of equipment that measures the humidity and temperature levels in a space. In most cases, a sensor is positioned in the space or environment and wirelessly transmits data to a monitoring device. A home gateway or other smart home

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system, such as a standalone unit, can be integrated with the monitoring device.

Applications for a humidity monitor include:

- Tracking the temperature and humidity in a greenhouse or garden shed
- Keeping an eye on a baby's room's humidity and temperature
- Keeping an eye on the humidity and temperature in a wine cellar

Users can remotely monitor the temperature and humidity levels in their rooms and receive notifications when they are outside of the specified range by connecting a humidity monitor with a home gateway.

Overall, these components can be combined to build a smart home system that allows users to remotely monitor and adjust environmental factors like water levels. The home gateway serves as a hub that connects, controls, and offers a platform for remote monitoring and control of these devices.

LITERATURE REVIEW

Ankur Utsav et.al. (2022) had proposed a smart irrigation system using Cisco packet tracer software for Indian climatic conditions. We had used different sensors, webcams, and different electronic devices for smart control and security of the farms. Different analyses for different crops (Kharif and Rabi) are discussed so that effective use of water and resources are maintained. For each case, proper simulation is done on the software [3].

Norman Gwangwava et. Al. (2021)conducted a study on Platforms with intelligent objects and parts are needed for the design and implementation of Internet of Things (IoT) systems. Mashup-based and model-based techniques are the two most popular architectural strategies for creating IoT systems. Mashup strategies make advantage of already-existing services and are best suited for less important, individualised applications. In mashup strategies, web development technologies are frequently employed. By describing a system at a higher degree of abstraction, model-based techniques enable extremely expressive modelling of systems. The article designs an Internet of Things-based control system for a fertiliser manufacturing plant using Cisco packet tracer 7.2, which includes four subcategories of smart things: household, smart city, industrial, and power grid. Additionally, the packet tracer is made up of boards, including microcontrollers (MCU-PT), single- board computers (SBC-PT), actuators, and sensors. The concept makes it possible for things, including robots, databases, and Human Machine Interfaces (HMIs), to communicate in a flexible way. The IoT system's implementation leads to tighter process control because operating conditions are tracked online and broadcast in real-time to all stakeholders for faster response to deviations. The three process plants that are the centre of the developed model are the steam raising, nitric acid, and ammonium nitrate plants. Saturated steam temperature, fuel flowrates, CO and SOx emissions, converter head temperature, NOx emissions, neutralisation temperature, solution temperature, and evaporator steam pressure are important process parameters. Monitoring the parameters is necessary to guarantee the effectiveness, safety, and calibre of the process. A use case, physical layout, network layout, IoT layout, setup, and simulation interface were all designed using the Cisco packet tracer platform [1].

Sanskruti Raut et.al. created a smart irrigation system. The Cisco Packet Tracer simulation programme, latest version Cisco Packet Tracer 7.3.0 (64-bit), is used to simulate the implementation of a smart irrigation system. In order to automate the watering system and remotely monitor the environmental conditions for better plant growth, this technology can be used to construct a smart irrigation system, which includes of gadgets like a lawn sprinkler, temperature monitor, humidity monitor, etc. All of the connected devices can be controlled and monitored remotely using a tablet, computer, or smartphone. According to the simulation results, smart equipment for monitoring environmental conditions, such as watering systems, can be connected to the home portal and effectively monitored, making it

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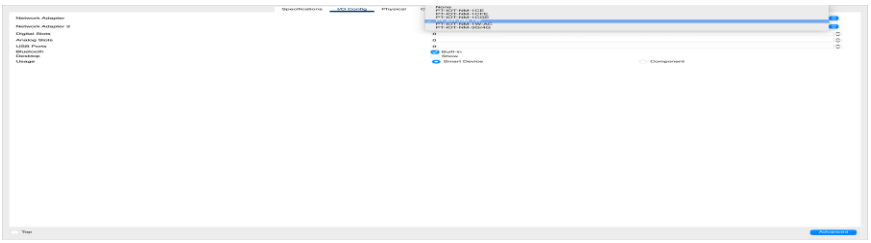
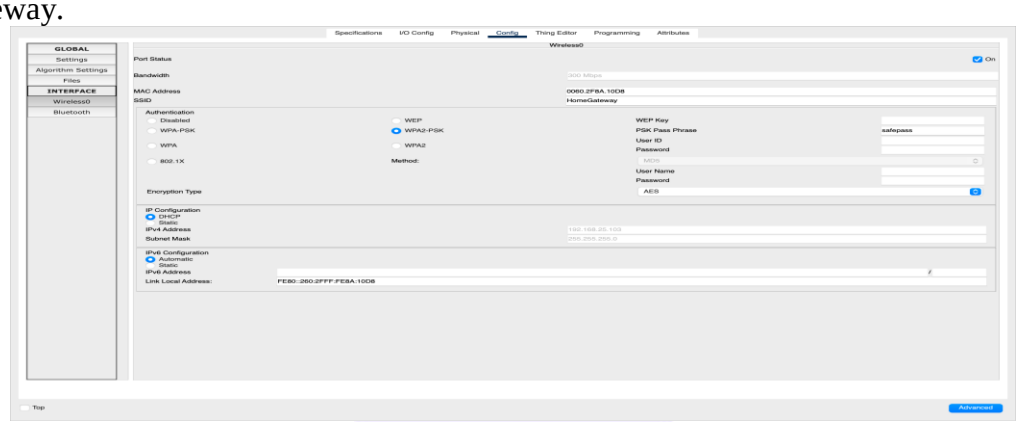
easier for farmers and homeowners to cultivate and manage their plants [7].

METHODOLOGY

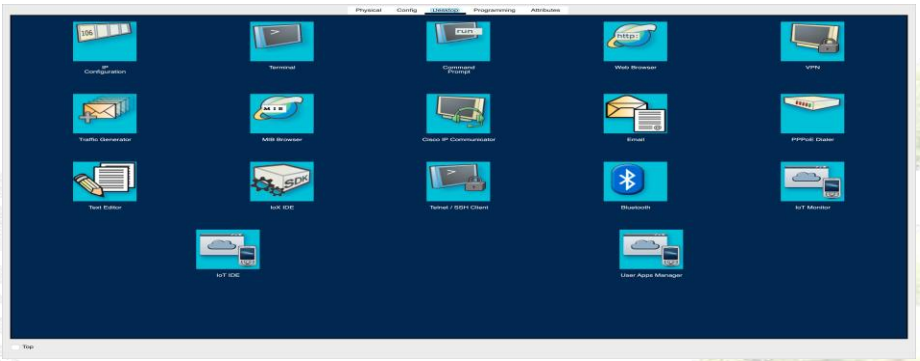
1. Conducted a review of the literature related to home gateways, IoT devices, wireless connectivity, and smart home systems, to identify relevant theories, concepts, and previous research findings.
2. Identified the components of the home gateway-based smart home system, including the devices, wireless protocols, IP addressing, and network management.
3. Used wireless adapters, specifically PT-IOT-NM-1W, to connect the lawn sprinklers, water level monitor, and humiture monitor to the home gateway, making all connections wireless.



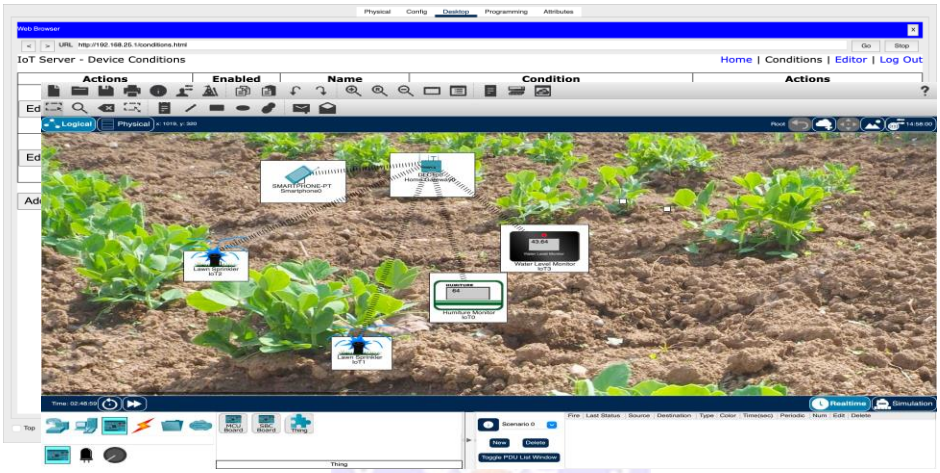
4. Assign the same IP address (192.168.25.1) to all connected devices and add the same SSID (HomeGateway) of the home gateway to connect all the devices to the home gateway.



5. Use a smartphone to open the desktop column and then the web browser. Enter the assigned IP address (192.168.25.1) in the URL section of the web browser, which will open the login page for the home gateway. Enter the username and password to log in and view the list of all devices connected to the home gateway.



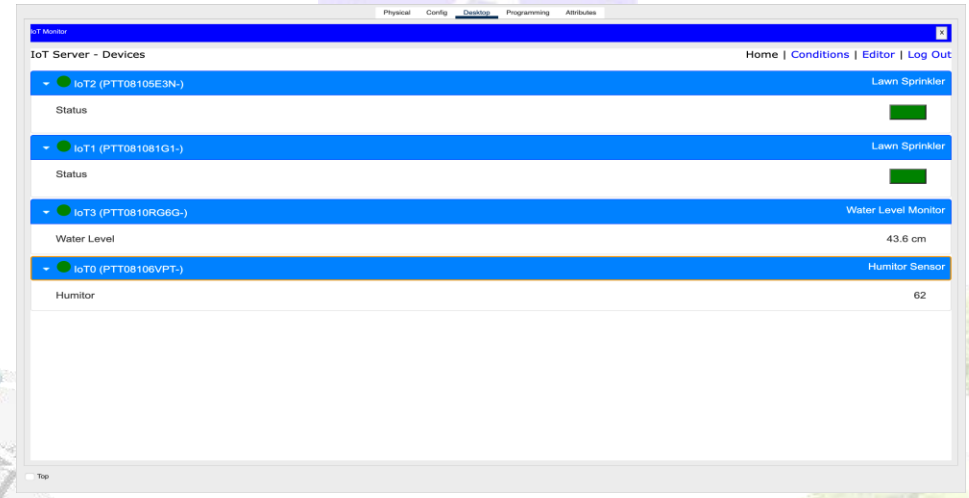
6. Define the conditions for the smart irrigation system, including when and how the sprinklers should be turned on and off based on the water level monitor and humiture monitor data.



7. Test the system by controlling the lawn sprinklers through the smartphone app and verifying that the system functions as intended.

RESULT

After registering the devices with the home gateway, a smartphone can be used to remotely operate the IoT devices. On the smartphone, you can see the registered IoT devices. The devices can be manually controlled, and real-time viewing and monitoring of the values is also possible.



CONCLUSION

Users can have an easy and effective way to remotely monitor and control their home environment by integrating smart home devices with a home gateway, such as a water level and humidity monitor. Users are able to access and manage their home environment from any location, at any time, by connecting these devices wirelessly to a home gateway and controlling them with a smartphone. It is simple to integrate different smart home gadgets into a home gateway, which also serves as a platform for managing and monitoring them remotely. In addition to convenience, this can result in increased energy efficiency and cost

savings. The combination of smart home appliances and a home gateway has the promise of radically altering the way we interact with and oversee our domestic spaces. It is anticipated that as technology advances, the integration of these gadgets will become even easier to use and seamless, increasing their adoption and use in smart homes.

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