CONSTRUCTION OF SMART IRRIGATION SYSTEM USING CISCO PACKET TRACER

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Abstract - Water is given to plants via irrigation systems in a single direction. Devices and sensors that are connected to the Internet allow users to operate and monitor remotely in the Internet of Things (IoT) domain. In order to achieve this goal, this research article will employ the most recent version of Cisco Packet Tracer 7.3.0 (64-bit), a simulation programme for Cisco packet tracers. Here, temperature, humidity, and lawn sprinkler sensors are just a few examples of the study technology. In order to develop a smart water system with numerous components, including Together, these instruments monitor the surroundings to enhance the drainage system and encourage robust development. Because each of the aforementioned gadgets is linked to the home gateway, users can control and keep an eye on them from a tablet, computer, or smartphone. Simulation findings demonstrate the successful integration of smart devices into building portals, such as environmental monitoring sensors and sprinkler systems. Farmers and homeowners have benefited from the technology as it made it simple for them to grow and nurture plants while also remotely protecting the environment.

Keywords - IoT, Network Simulation Tool, Intelligent Irrigation Solution

I. INTRODUCTION

Kevin Ashton first used the acronym IoT, which stands for "Internet of Things," in 1999 [1]. It is a new kind of technology that arranges for devices to be connected to one other over the internet so that data may be exchanged easily [2].

In the context of precision agriculture and residential plant care, the integration of IoT technology becomes paramount. The implementation of a Smart Irrigation system emerges as a pivotal solution, leveraging a network of intelligent devices interconnected through the internet. This interconnected network allows for automated and remotely controlled irrigation processes, providing real-time data exchange on environmental conditions.

Within this framework, the Smart Irrigation system comprises diverse sensors and actuators, including a water level monitor for precise irrigation control. Users can remotely manipulate the irrigation system based on data received from the water level monitor, optimizing water usage. Additionally, the inclusion of a humidity sensor adjusts the humidity of the plants and activates or deactivates the humidifiers based on the preset.

In today's living environment, the ease of remote monitoring and control through IoT-based smart irrigation systems solves the problems faced by farmers and homeowners, ensuring good plant care and resource utilization. The integration of IoT shows that it has the potential to transform the development of agriculture and housing management, offering effective solutions for water use and environmental management. Integration of various sensors is essential to ensure strong and lush plant growth. In the field of smart water, simple sensors such as temperature, humidity, carbon dioxide, carbon monoxide, wind and temperature and humidity sensors play an important role in monitoring the environment. These smart devices connect seamlessly to the home gateway, allowing users to operate and monitor them remotely using a tablet, PC or smartphone. In addition, the electronic alarm works as a deterrent against threats from animals by notifying the owner when the microcontroller detects movement in the water.

Simulation results confirm that the smart device is connected to the home gateway, which can not only perform the remote operation but also perform the automation that needs to be done. This study is made more sophisticated by the use of Cisco Packet Tracer, a visual simulation tool created by Cisco. This tool aids in the design and simulation of intricate network topologies, including routers and switches.

This article has been edited for clarity. While the first part introduces the concept of IoT and its application in smart water, the second part provides an in-depth examination of related studies. The strategy for smart water management is described in detail in Section 3, and the findings and discussion are shown in Section 4. Chapter 5 offers recommendations for future avenues for this field's research and development, bringing the study to a close.

II. RELATED WORK

In a reference work [3] IoT-based greenhouse monitoring is described in detail using packet tracking simulation software. This new system includes information analyzed by sensors and uses data stored in the cloud to improve performance. Going back to the paper [4], an automatic irrigation system based on a good analysis of soil moisture was proposed. This application uses Raspberry Pi and Arduino, two microcontrollers that allow efficient operation. The search continues with [5], which introduces smart home systems that use Cisco packet tracking and IoT technology to enable various home functions. Instead of focusing on [6], the main focus is on high-level monitoring and management of agricultural monitoring. This includes the integration of Raspberry Pi and cloud-based IoT systems to provide rapid insights into farm data. In [7] demonstrates the advantages of wireless automation systems compared to wired alternatives. The report highlights benefits such as reduced installation costs, scalability, and the ability to connect managed devices over the network. In the meanwhile, the plan in [8] suggests a home gateway and microcontroller (MCU-PT)-based control system that offers a workspace for devices linked to the home gateway. When taken as a whole, these studies show how versatile and widely applicable IoT technology is for creating sophisticated automation systems, ranging from home automation to agriculture.

III. METHODOLOGY

The design of the smart irrigation system was prepared using Cisco Packet Tracer simulation software, an advanced network simulator used to create networks containing routers, switches, wireless components and more. The tool supports experiments with network behavior, device configuration and design. The system includes a tablet and a home gateway that connects to a variety of devices such as thermometers, lawn sprinklers, water meters and other sensors. The home gateway acts as a central hub connecting all smart devices, while the tablet supports communication with these devices, providing a solution for efficient water management.

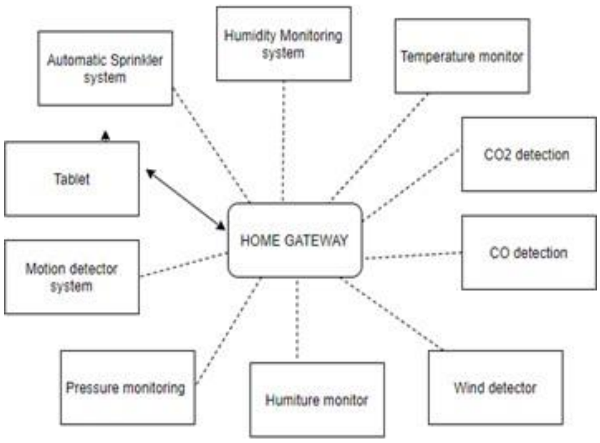

Fig 1. Block Representation of Advanced Irrigation Setup

The Cisco Packet Tracer's smart water flow is depicted in Fig. 1's block representation. Components include automatic sprinkler systems, humidity monitors, temperature gauges, pressure gauges, humidity gauges, air gauges, carbon monoxide detectors, and carbon dioxide detectors. Through a home gateway, all of these Internet of Things technologies and gadgets are linked to the internet and are tablet-controlled. An overview of the instruments utilized and their purposes is given in Table 1.

Table 1. Devices used

Sr. No.	Device	Function
1	Server	The home system is connected to a cellular network via a server
2	Cable Modem	It is used to provide internet connection
3	Home gateway	Provides internet access and local connection to the IoT network
4	Virtual Server	Data is stored on virtual cloud servers
5	Switch	Switches enable communication between various networked devices
6	Lawn Sprinkler	A sprinkler for Lawn
7	Water level monitor	Used for water level detection
8	Water Drain	Removes water at a pace of 0.50 centimeters per hour
9	Light indicator	It's used to indicate via a light whether the system is on
10	Temperature Monitor	A temperature monitor is a device that collects environmental temperature data and transforms it into usable format
11	Pressure monitor	Sensing barometric pressure
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	MCU board	A microcontroller board for device networking
15	Humidifier	It serves to raise the relative humidity.
16	Motion sensor	It is employed to identify movement.
17	Alarm	It is activated upon detection of motion
18	CO2 Detector	Measures the carbon dioxide content
19	CO Detector	Determines the carbon monoxide level
20	Wind Detector	Senses wind in the surrounding air

a) The Home-Gateway

Users can establish a network connection with the help of a recording server or a home gateway. Users may effortlessly manage the power state of connected devices, like tablets or PCs, using the gateway. The physical layout of the home gateway is depicted in Fig. 2, which also highlights its key features and capabilities for effective device control and user interaction.

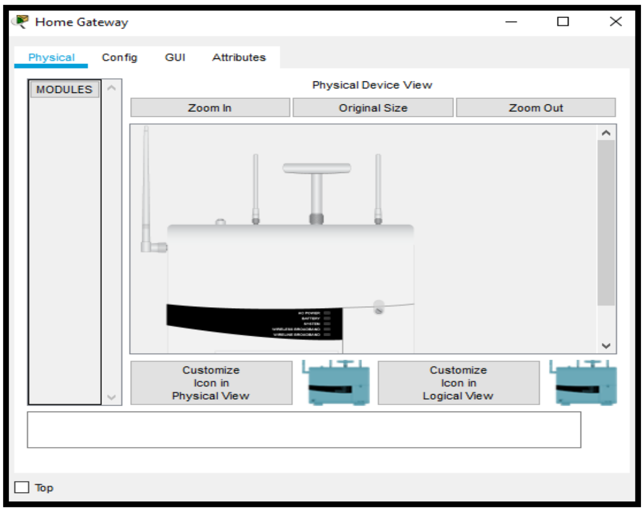

Fig 2. Physical structure of the home gateway

In addition to acting as wireless network connections and Internet access points, home gateways can also act as local connections for Internet of Things smart devices. Its connectivity is provided by four LAN ports, an Internet port, and numerous antennae. The Configuration tab will provide access to the configuration after the home gateway is connected to the current network. The bottom tab contains the IP address information and other internet options. Setting the network authentication password, WPA2-PSK PSK password, and home gateway SSID are necessary for wireless setup. The home gateway can be linked to smart IoT devices.

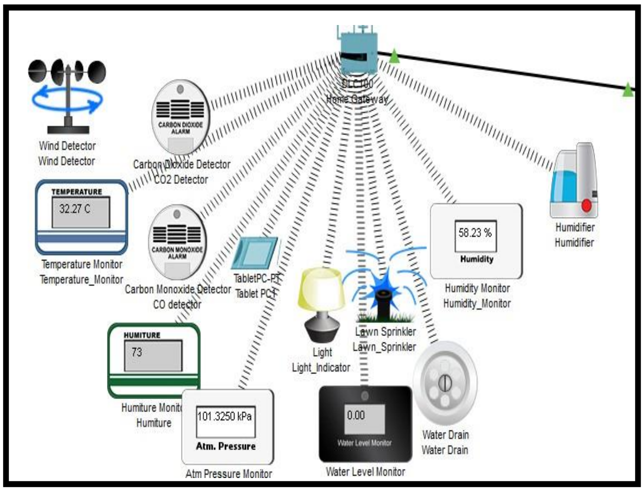

Fig 3. Device Integration with the home gateway

The connections that connect the gadget to the home gateway are depicted in Fig 3. Use these procedures to set up and register a smart IoT device from the home gateway: Select the device first, then choose the wireless adapter from the list bus network interface's I/O address. Check the correct SSID for the wireless connection by selecting Settings. Continue with "Location/Location" and specify the home gateway as the IoT server to access to complete the configuration and registration process. This approach enables the integration of smart IoT devices with the home gateway for efficient network operation.

b) Automatic Sprinkler System

Automatic sprinkler systems include lawn sprinklers, water level meters, water pipes and lighting systems. The water meter measures the water level and users can adjust accordingly. If the water reaches the required minimum level, the lawn sprinkler will turn off and open the drain. For example, if the water level is lower than required, sprinklers will activate. Indicators show the operating system. This feature reduces the disadvantages of manual irrigation controls. Lawn sprinklers and other system equipment can also be controlled manually, providing users with convenience and control over the irrigation process. This combination increases efficiency and ensures the quality of water according to the instantaneous water level.

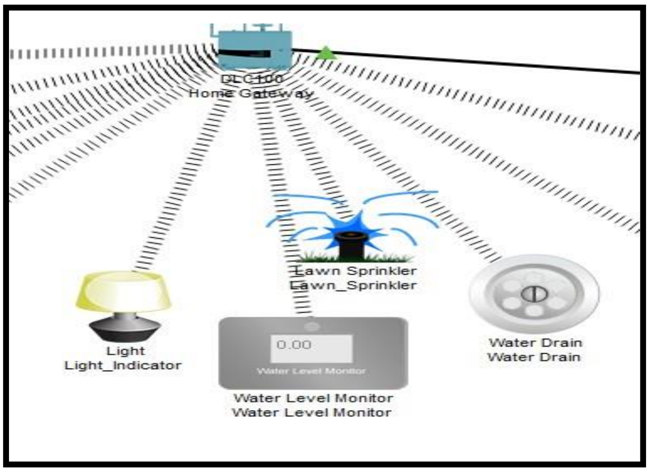

Fig 4. Autonomous Water Spraying System

c) Humidity Monitoring System

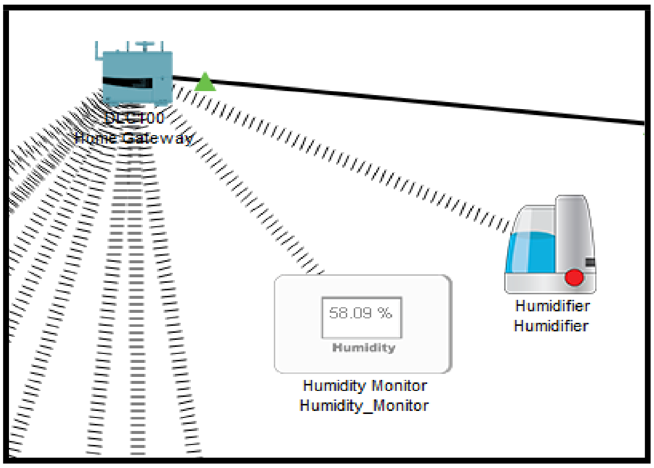

Fig 5. Atmospheric Humidity Tracker

Water quality management plays an important role in improving water quality. Monitoring water quality helps increase agricultural yield and water efficiency. As shown in Fig 5: A key component of the smart irrigation system is the moisture monitoring system. To precisely detect the ambient humidity, this device makes use of a humidity sensor. This sensor integrates seamlessly with the entrance door. After the network configuration is completed, users can easily monitor humidity sensor value via the tablet interface. A humidifier that can control ambient humidity is included to facilitate the process. Users have the flexibility to adjust conditions to their liking, making it possible to acquire skills and activities that promote good planting and agriculture.

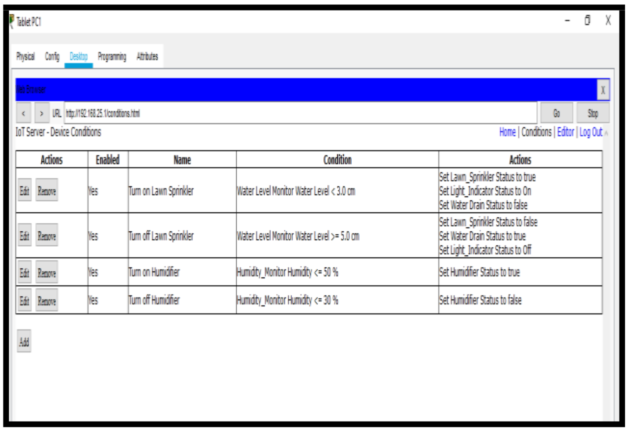

Fig 6. Displays the settings for the humidity monitoring system and the autonomous water sprinkler system.

d) Additional Surveillance Instruments

The rate at which seeds and plants germinate can be impacted by frequent changes in the weather. The system has an air pressure sensor for quality monitoring to address this issue. This increases operating time to promote good plant growth and encourage root development. Temperature and humidity measurement is another important tool used to monitor temperature and humidity. While a thermometer measures atmospheric temperature, a thermometer senses the pattern of ambient air. Additionally, the system features carbon monoxide and carbon dioxide detectors, each dedicated to monitoring fuel levels. This integration keeps the system alert and responsive, ensuring optimum plant growth and overall environmental health.

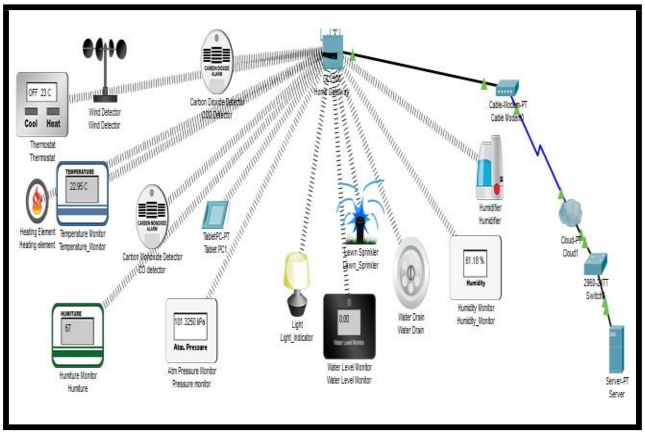

Fig 7. Unified Integrated Network

IV. RESULTS AND OUTCOMES

IoT devices can be remotely controlled using a tablet once they have registered with the home gateway. The tablet interface shows registered equipment, enables manual operation and tracks the price over time.

Fig 8. Tablet Visualization of IoT Devices

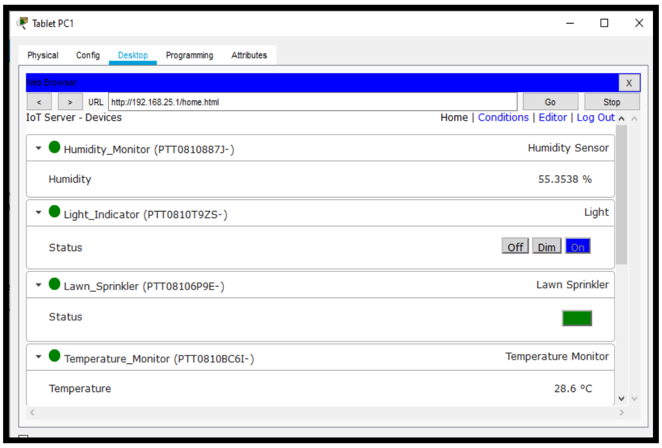

Fig 9. Numerical measurements recorded by sensors

The tablet displays digital sensor findings, as depicted in Figure 9, that describe the state of IoT devices registered to the home gateway. Quick and automatic maintenance of this device is made easier thanks to the tablet interface.

V. CONCLUSION AND FUTURE IDEA

Cisco Packet Tracer, which incorporates a gateway for tablet registration and management, is used to implement the smart water system. This comprehensive configuration allows manual and remote monitoring of all IoT devices connected to the home gateway. The results are demonstrated in real-life applications demonstrating the potential for water savings through automatic irrigation. Manual control helps improve energy efficiency and save energy. The accessibility of smartphones provides convenience to users. Security is the most important thing in the IoT space and this system solves this problem by integrating an authentication gateway that requires password to ensure users are correct. To increase future strength and physical performance, development may focus on strengthening safety measures. The system can be designed to send text or email alerts to users when suspicious activity is detected; thus, ensuring timely and fair responses. This versatile application not only increases water efficiency, but also highlights the importance of security and user-friendliness in IoT-based water management.

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