SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR.

Mini Project Report

(6TH SEM, SESSION 2023-2024, ECP357)

"Smart Greenhouse Monitoring"

Submitted By

Batch: B4

Tanya Pandey (Roll No.-68, Sec-B)
Ruchi Dumbhare (Roll No.-104, Sec-B)

Course Coordinator: Prof. Puja Agarwal

Department of Electronics and Communication Engineering

Contents

1. Introduction

Greenhouse is used to protect plants from extreme environmental conditions and also growing plants in controlled environments. Greenhouse monitors the extreme environmental conditions in favor of plant growth. Greenhouses can be made smarter by using different techniques. IoT is basically connecting the surrounding environment to the network. Greenhouses have to be monitored manually whereas by making it a smart greenhouse that is by using IoT technique it can be monitored from faraway places also. Different sensors as per the requirement are used to monitor greenhouse and perform the actions according to the parameters sensed. The conditions are predefined by the maintainer so that the growth of the plant is not affected by environmental conditions. Operators predefine parameters to ensure consistent plant growth, mitigating the impact of fluctuating environmental conditions.

2. Block Diagram

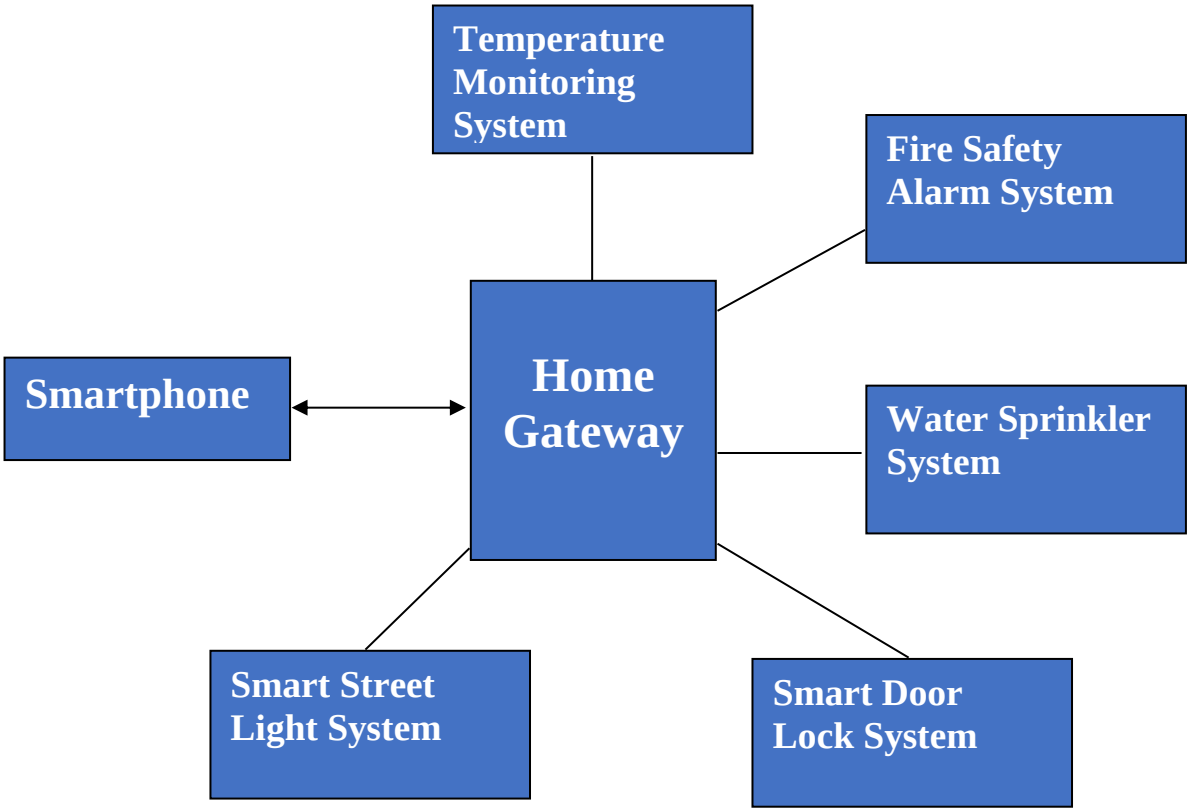


Fig 1: Block Diagram of system

3. Objectives

Implement IoT Features: Develop and integrate IoT technologies into greenhouse management systems to enable real-time monitoring and control.
Develop User-friendly Interfaces: Design intuitive smartphone interfaces for remote monitoring and control, prioritizing ease of use and accessibility for greenhouse operators.
Optimize Resource Management: Utilize IoT sensors and actuators to efficiently manage resources such as water and energy, aiming to reduce waste and enhance sustainability.

4. Working of the project

In this project, we are implementing the greenhouse setup using cisco packet tracer. A network is formed by connecting the sensors. Temperature sensor to sense the environment temperature, soil moisture sensor to detect the amount of water present in soil. Solar cell is used as the energy generator in the designed system and a smart door system is implemented to control the access.

Fig1 shows the block diagram of Smart greenhouse based on IoT in Cisco packet tracer. The block diagram contains temperature monitoring system, fire detection system, smart lighting system, moisture monitoring system, smart door system. All the devices are connected using the internet. A smart phone is used to monitor the devices in the greenhouse. Wireless devices are used to implement the designed system.

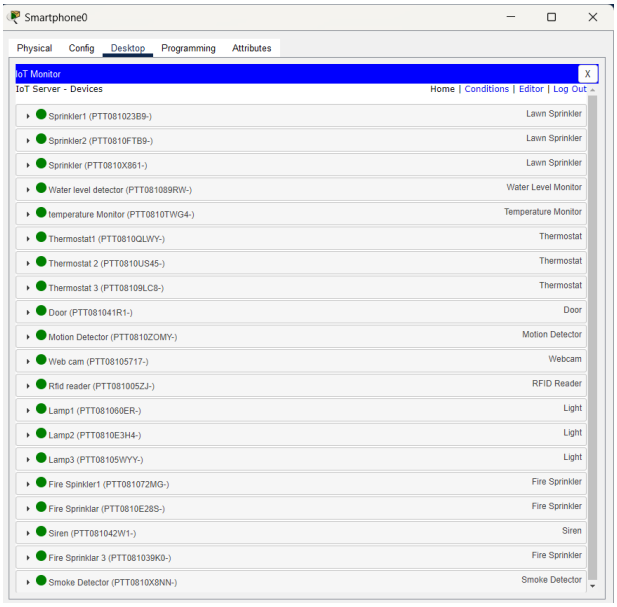
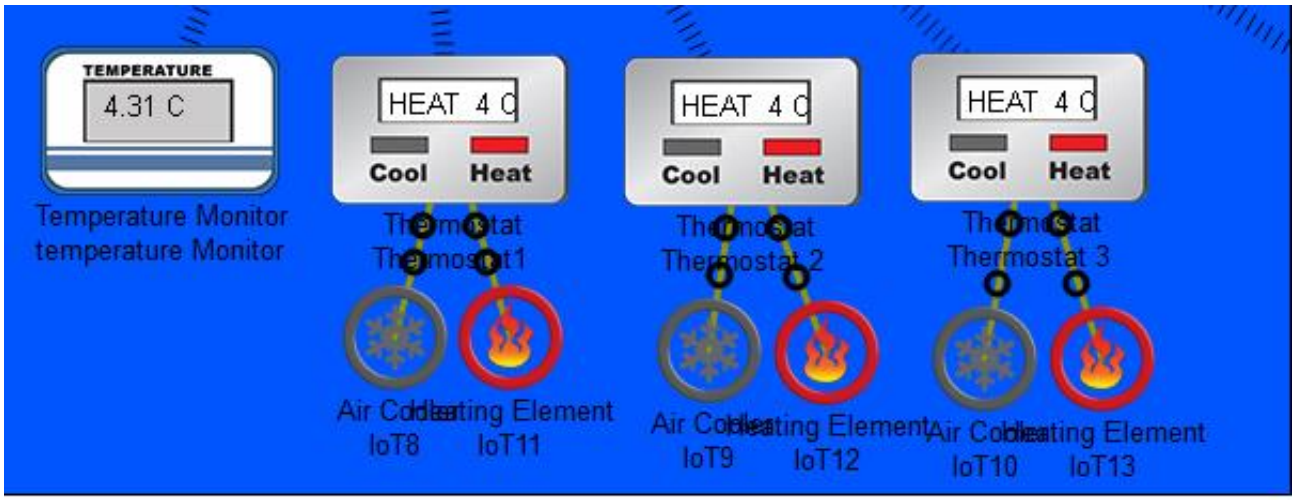


Fig2: smartphone monitoring

In Figure 2, we observe the implementation of smartphone-based monitoring for greenhouse devices. This sophisticated system allows users to seamlessly track the sensed values from various sensors and stay informed about the current status of actuators. Through the interface provided on smartphones, individuals can conveniently access real-time data regarding the greenhouse environment and control the functionality of different devices as needed.

- TEMPERATURE MONITORING SYSTEM

The temperature monitoring system comprises temperature sensors, thermostats, heating elements, and cooling elements. These components work cohesively to regulate the temperature within a greenhouse environment. Initially, the temperature sensor detects the ambient temperature and presents this data on either an LED display or a monitor. Subsequently, the sensor's output, after undergoing suitable conversion, serves as input to the thermostat. The thermostat's primary function is to maintain the greenhouse temperature within a specified range. It achieves this by activating the heating element when the temperature dips below the predetermined threshold and engaging the cooling element when the temperature surpasses the set limit. The thermostat remains inactive, or in an "off" state, when the temperature within the greenhouse is conducive to optimal plant growth. This system ensures efficient temperature control, crucial for facilitating the healthy development of plants within the greenhouse.



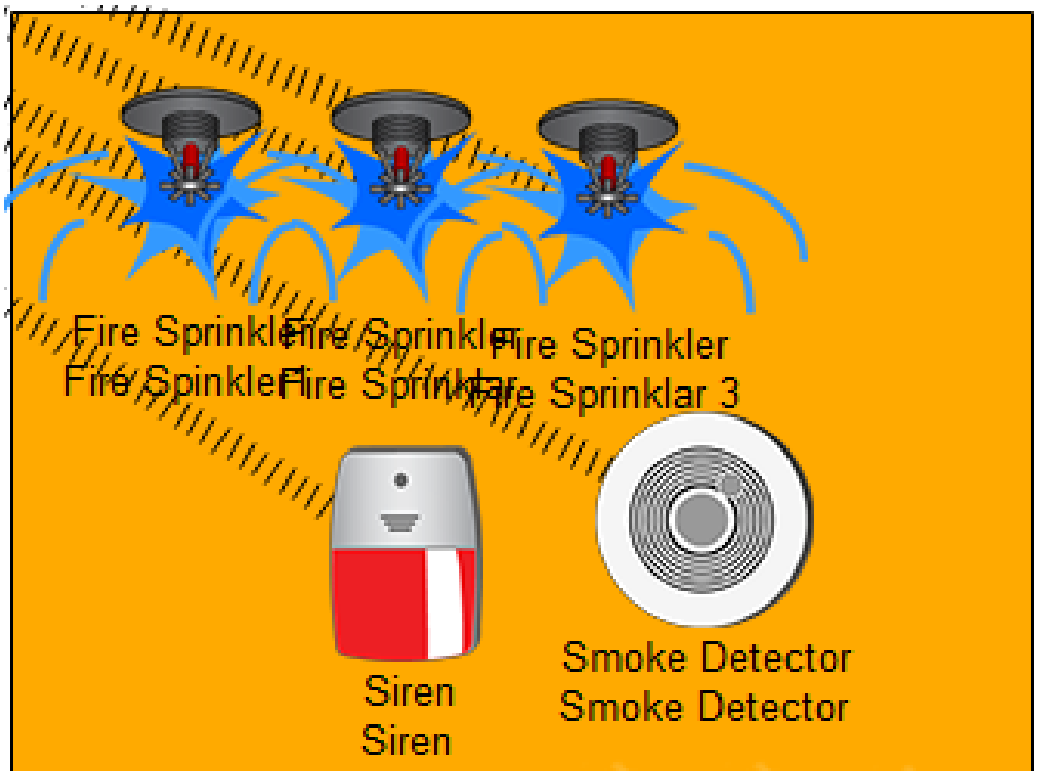
- FIRE SAFTEY

Within the smoke detection system, a comprehensive setup includes essential components such as a smoke detector, fire sprinkler, and siren. The primary

function of the smoke detector is to discern the presence of smoke particles in its environment. Upon detection of smoke, the system swiftly triggers a series of responses. Firstly, it promptly sends a notification to the security panel, alerting relevant authorities or personnel to the potential fire hazard. Simultaneously, the system activates the fire alarm, ensuring that occupants are promptly made aware of the emergency situation.

Moreover, in the event of a fire emergency, the fire sprinkler system plays a critical role in fire suppression. Once the smoke detector detects smoke, signalling the presence of fire, the sprinkler system automatically engages. It releases water or fire-retardant material to extinguish the flames, helping to contain the spread of fire and minimize damage to property and ensure the safety of occupants.

This integrated approach to smoke detection and fire suppression provides a robust safety mechanism, ensuring rapid response and effective mitigation of fire incidents.



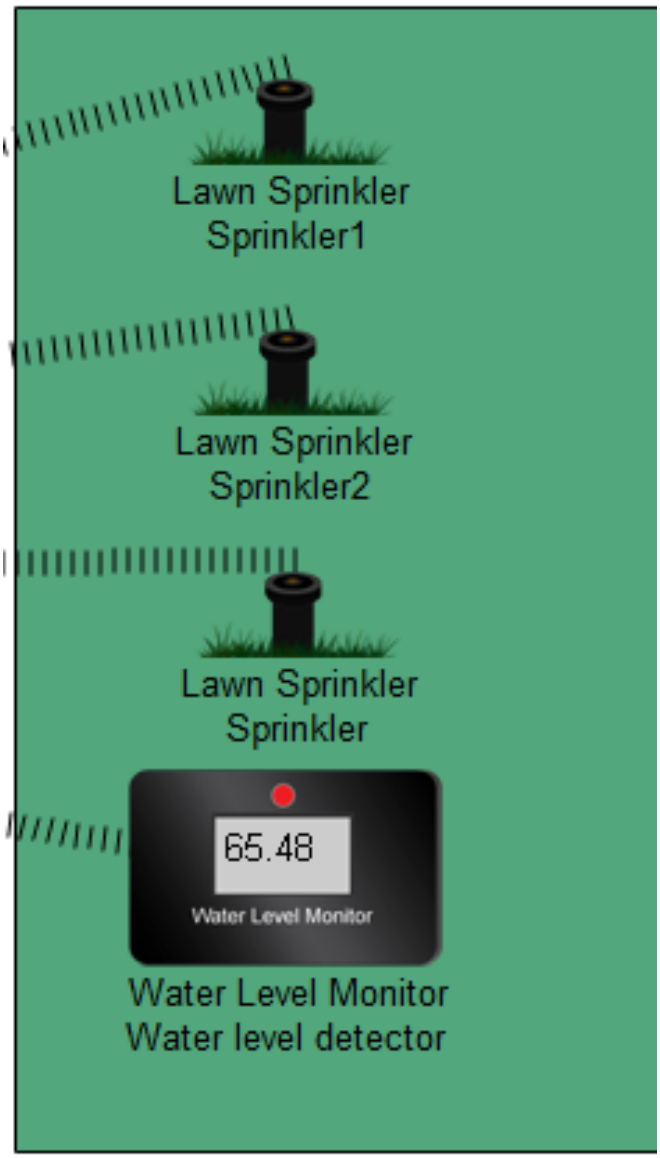
- WATER SPRINKLER SYSTEM

The soil moisture monitoring system is comprised of essential components including a water level monitor and a lawn sprinkler, each playing a vital role in maintaining optimal soil conditions for plant growth. The water level monitor serves as the cornerstone of this system, diligently measuring the water content within the soil, thus providing a direct indication of the soil's moisture levels. Given

the pivotal role of moisture in facilitating healthy plant growth, it becomes imperative to ensure that the soil maintains an adequate level of hydration.

With the measured data from the water level monitor, the system is equipped to make informed decisions regarding irrigation. Should the monitored moisture content fall below a predefined threshold, signalling insufficient hydration for the soil, the system promptly activates the lawn sprinkler. This automated response mechanism ensures that the soil receives the necessary replenishment of water to sustain optimal conditions for plant growth and vitality.

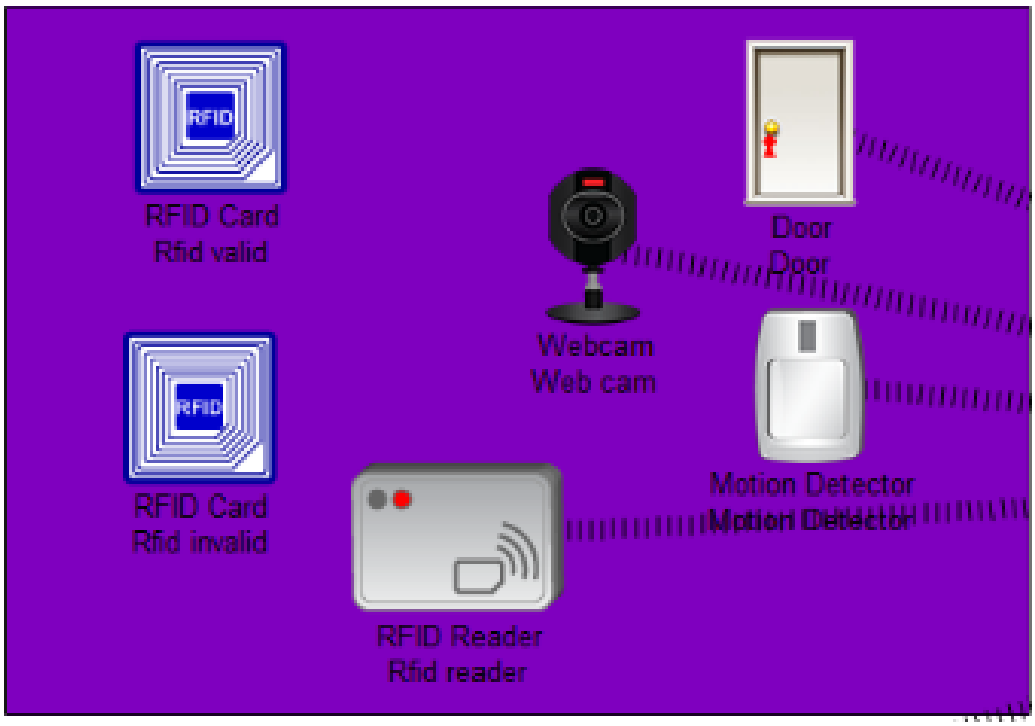
By seamlessly integrating the water level monitor and the lawn sprinkler, this system not only simplifies the task of maintaining soil moisture but also ensures that plants receive the precise amount of hydration they require for healthy development. This proactive approach to soil moisture management underscores the system's efficacy in promoting thriving plant life within agricultural or landscaping settings.



- SMART DOOR SYSTEM

The smart door system is comprised of key components including RFID valid cards, RFID invalid cards, an RFID reader, a motion detector, a siren, and a webcam. Its functionality revolves around the interaction between these elements. When the RFID reader successfully reads a valid card, it triggers the unlocking mechanism of the door while simultaneously deactivating the siren. Conversely, if the RFID reader detects an invalid card while the motion detector is active, indicating unauthorized access, the system responds by locking the door and activating the siren as a security measure.

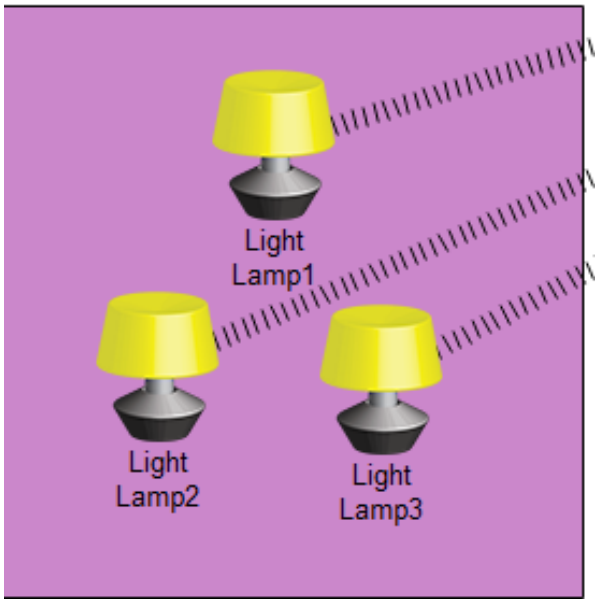
Additionally, a webcam remains operational at all times, providing continuous surveillance to complement the system's security features. This comprehensive setup ensures robust access control and intrusion detection capabilities, enhancing the overall security of the premises.



- SMART LIGHT SYSTEM

This project incorporates a sophisticated smart lighting system to manage illumination within the designated area. Upon successful authentication of a valid RFID card by the RFID ID reader, the door unlocks and activates one of the lamps. As a person enters the greenhouse, another lamp illuminates automatically, providing adequate lighting. Moreover, the system offers further control over additional lamps via smartphone, allowing users to adjust lighting levels based on specific requirements. This integrated approach ensures efficient lighting

management, enhancing both convenience and energy efficiency within the environment.



5. Flow Chart

Figure 3 illustrates the overarching flowchart depicting the methodology employed in this project, which remains consistent across all systems incorporated in the design. The procedure begins with sensors detecting their designated parameters, with the sensed values subsequently converted into the requisite format. These converted values are then transmitted to the actuators. Activation of the actuators occurs in accordance with predefined conditions established based on the input received. This standardized process ensures uniformity and efficiency in the operation of all systems within the design, facilitating seamless functionality and reliable performance.

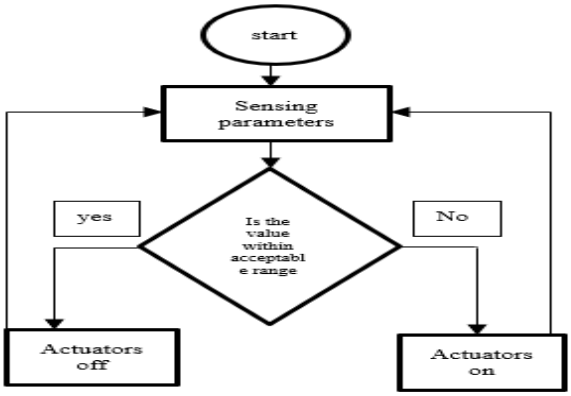
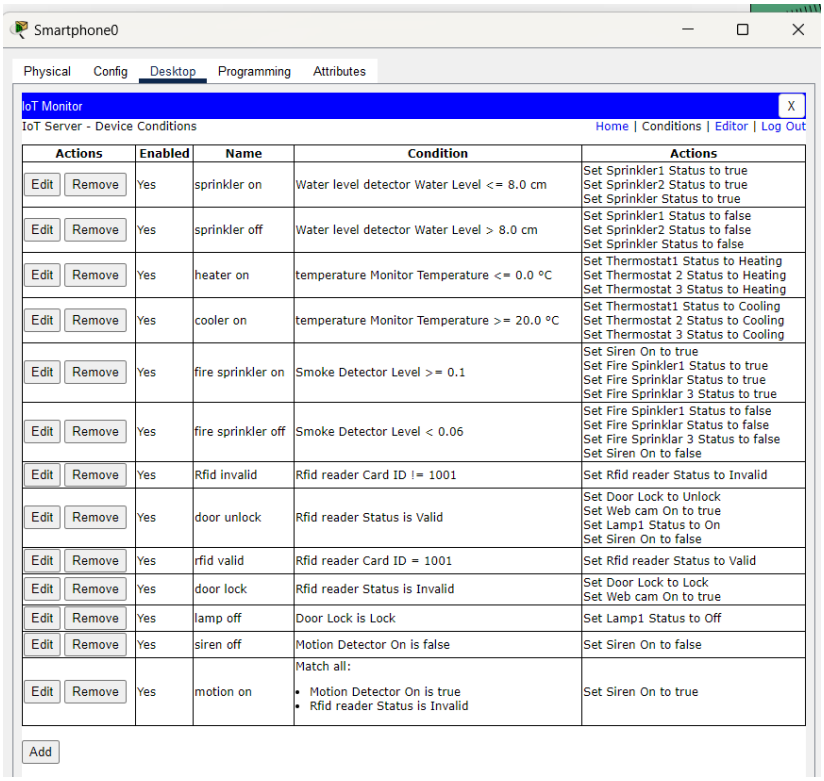


Fig3: Flow Chart

6. Device Conditions

Each device within the system is allocated with distinct conditions that must be satisfied for its activation. These conditions are meticulously tailored to guarantee that each device operates solely when the requisite criteria are met; otherwise, they remain inert. By incorporating such specified conditions, the system ensures precise and reliable functionality of each device, thereby optimizing performance and adhering closely to the project's overarching requirements. This meticulous approach not only enhances the efficiency of individual devices but also contributes to the seamless integration and effective operation of the entire system.



Smartphone0

Physical | Config | Desktop | Programming | Attributes

IoT Monitor

IoT Server - Device Conditions

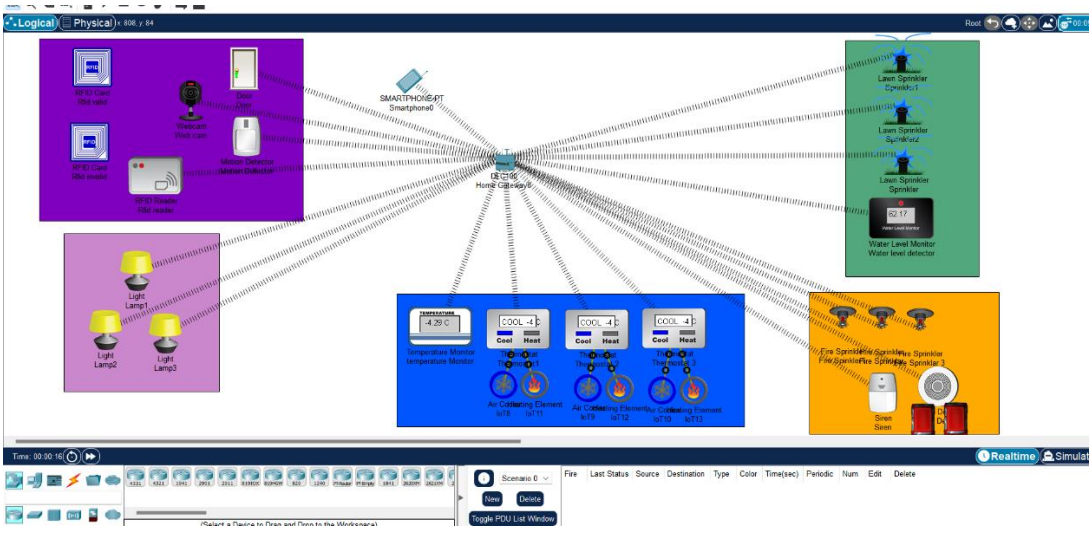
Home | Conditions | Editor | Log Out

Actions	Enabled	Name	Condition	Actions
Edit Remove	Yes	sprinkler on	Water level detector Water Level <= 8.0 cm	Set Sprinkler1 Status to true Set Sprinkler2 Status to true Set Sprinkler Status to true
Edit Remove	Yes	sprinkler off	Water level detector Water Level > 8.0 cm	Set Sprinkler1 Status to false Set Sprinkler2 Status to false Set Sprinkler Status to false
Edit Remove	Yes	heater on	temperature Monitor Temperature <= 0.0 °C	Set Thermostat1 Status to Heating Set Thermostat 2 Status to Heating Set Thermostat 3 Status to Heating
Edit Remove	Yes	cooler on	temperature Monitor Temperature >= 20.0 °C	Set Thermostat1 Status to Cooling Set Thermostat 2 Status to Cooling Set Thermostat 3 Status to Cooling
Edit Remove	Yes	fire sprinkler on	Smoke Detector Level >= 0.1	Set Siren On to true Set Fire Spinkler1 Status to true Set Fire Sprinklar Status to true Set Fire Sprinklar 3 Status to true
Edit Remove	Yes	fire sprinkler off	Smoke Detector Level < 0.06	Set Fire Spinkler1 Status to false Set Fire Sprinklar Status to false Set Fire Sprinklar 3 Status to false Set Siren On to false
Edit Remove	Yes	Rfid invalid	Rfid reader Card ID != 1001	Set Rfid reader Status to Invalid
Edit Remove	Yes	door unlock	Rfid reader Status is Valid	Set Door Lock to Unlock Set Web cam On to true Set Lamp1 Status to On Set Siren On to false
Edit Remove	Yes	rfid valid	Rfid reader Card ID = 1001	Set Rfid reader Status to Valid
Edit Remove	Yes	door lock	Rfid reader Status is Invalid	Set Door Lock to Lock Set Web cam On to true
Edit Remove	Yes	lamp off	Door Lock is Lock	Set Lamp1 Status to Off
Edit Remove	Yes	siren off	Motion Detector On is false	Set Siren On to false
Edit Remove	Yes	motion on	Match all: • Motion Detector On is true • Rfid reader Status is Invalid	Set Siren On to true

Add

Fig4 : Device Conditions

7. Overall Setup



8. Conclusion

Greenhouses have emerged as pivotal tools for enhancing agricultural productivity by facilitating controlled environments for plant growth. With the integration of smart technologies, the management of greenhouses becomes significantly streamlined, eliminating the need for manual monitoring of environmental conditions. This automation is achieved through the deployment of a diverse array of sensors capable of detecting various parameters, alongside the activation of actuators based on predefined conditions.

In the context of sustainability and efficiency, the implementation of solar energy generation stands out as a transformative feature within smart greenhouse systems. By harnessing solar power, these systems reduce reliance on conventional energy sources, thereby minimizing environmental impact and operational costs. Moreover, the integration of smart lighting systems further optimizes energy usage by dynamically adjusting illumination levels based on plant needs and ambient conditions.

Beyond energy management, smart greenhouse systems encompass comprehensive monitoring solutions to ensure optimal growing conditions. These monitoring systems encompass a wide range of sensors, including those for temperature, humidity, soil moisture, and CO2 levels, among others. By continuously monitoring these parameters, the system can precisely regulate environmental conditions to support optimal plant growth and development.

In essence, the convergence of sensors, actuators, renewable energy sources like solar power, and sophisticated monitoring systems epitomizes the evolution of smart greenhouse technology. This holistic approach not only enhances productivity but also promotes sustainability, efficiency, and precision in agricultural practices, heralding a new era of intelligent cultivation methods.

9. References

[1]International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Published by www.ijert.org, NCETESFT - 2020 Conference Proceedings

[2]https://youtu.be/Jw3H2PF-upg

[3]Nath, Shablu & Hossain, Mohammad & Akber Chowdhury(2021). Design and Implementation of an IoT Based Greenhouse Monitoring and Controlling System. Journal of Computer Science and Technology Studies. 3. 10.32996/jcsts.2021.3.1.1.

[4] International Research Journal of Modernization in Engineering Technology and Science, ISSN: 2582-5208, Published by www.irjmets.com