Shri Ramdeobaba College of Engineering and Management, Nagpur.

Electronics and Communication Department

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Programme: B.Tech. Third Year VI Semester (A / A3)

Mini Project Report

Course: Computer Networks Lab Course Code: ECP357

Course Coordinator:Prof. Puja Agrawal

TITLE:Sensor-Driven IoT System for Temperature Regulation and Carbon Monoxide Detection in Controlled Environments

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INTRODUCTION:

In this project, we explore the domain of sensor-driven IoT systems, focusing on the integration of temperature regulation and carbon monoxide detection within simulated environments. Our endeavor revolves around the creation of a smart solution that enhances both comfort and safety in indoor spaces. Through the utilization of advanced sensors and IoT devices, we aim to empower users with real-time monitoring and control capabilities, enabling them to optimize environmental conditions and mitigate potential hazards. With a user-friendly smartphone interface facilitating seamless interaction, our system not only ensures optimal temperature control but also provides early detection of carbon monoxide, offering peace of mind and enhanced security to occupants.

SCOPE:

The scope of this project encompasses the design, implementation, and evaluation of a sensor-driven IoT system tailored for temperature regulation and carbon monoxide detection. We aim to demonstrate the effectiveness and versatility of our solution within simulated environments, showcasing its potential for application in various settings such as residential dwellings, offices, and public spaces. Through a simplified yet robust architecture, our system promises ease of deployment and operation, making it accessible to a wide range of users. Furthermore, we endeavor to explore opportunities for future enhancements and scalability, paving the way for further advancements in smart environmental control and security systems.

OBJECTIVES:

This project aims to confront the critical challenge of optimizing environmental conditions and ensuring safety within indoor spaces through advanced monitoring and control systems.Traditional methods of temperature regulation and hazard detection often lack the efficiency and adaptability required for modern living standards. By leveraging sensor-driven IoT technologies, we aim to provide a comprehensive solution that optimizes comfort levels while swiftly detecting hazardous gasses such as carbon monoxide in real-time. This challenge is of paramount importance in the realm of computer networks, as it underscores the critical intersection between physical infrastructure and digital innovation. The seamless integration of sensors, IoT devices, and communication networks exemplifies the transformative potential of networked solutions in elevating both efficiency and safety standards within built environments.

COMPONENTS USED:

1. LCD Display: Shows information like temperature and warnings for easy user understanding.

2. Temperature Sensor: Measures the temperature of the environment, providing data from -100°C to 100°C.

3. Heating Element: Increases room temperature by 10°C per hour, while also reducing humidity by 2% per hour.

4. Air Cooler: Lowers room temperature by 10°C per hour and decreases humidity by 2% per hour.

5. Smartphone: Used for remote monitoring and control of the IoT system.

6. Cars: Emit carbon dioxide, carbon monoxide, and smoke, posing potential environmental hazards.

7. Windows: Allow ventilation to release carbon dioxide and carbon monoxide from indoor spaces.

8. Siren Alarm: Activates when carbon monoxide levels exceed a safe threshold, alerting occupants.

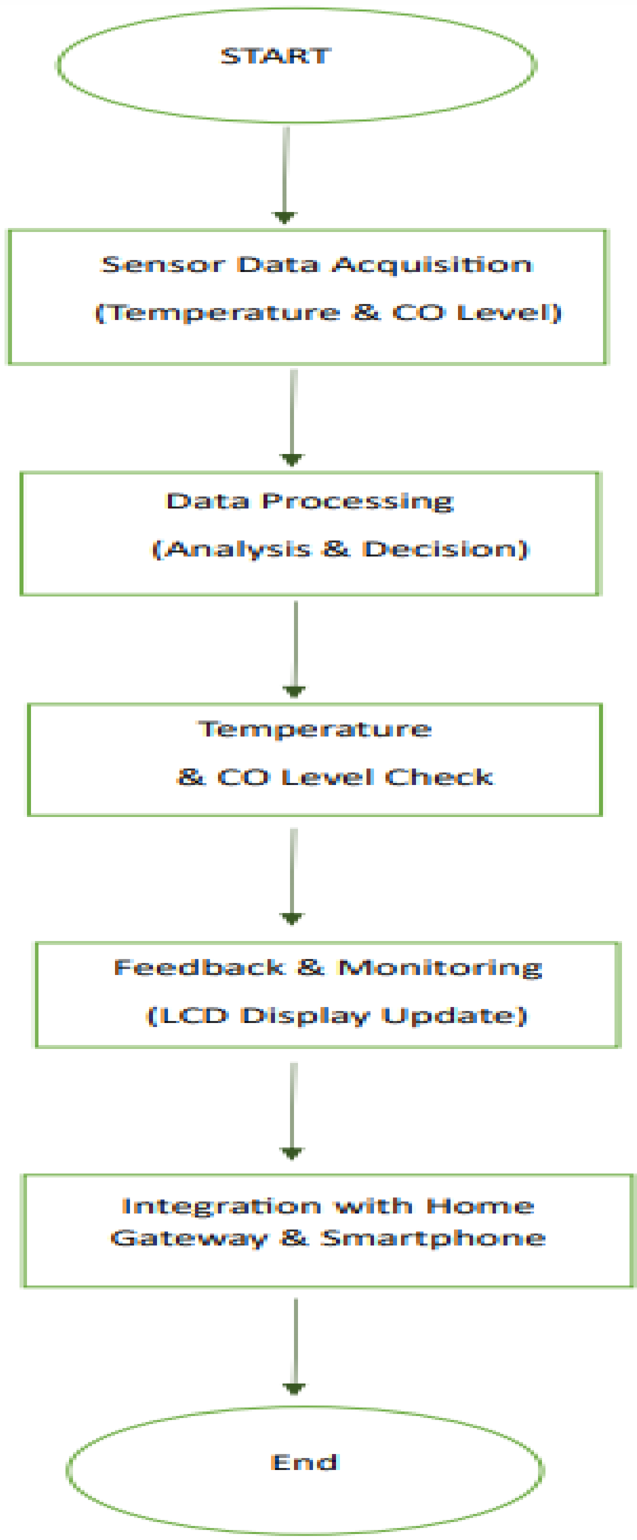
9. Temperature Monitor: Collects environmental temperature data and presents it in an understandable format.

10. Home Gateway: Establishes an internet connection for the IoT system's communication.

11. SBC Board: Central hub managing operations and processing data for the IoT setup.Common examples of SBCs include the Raspberry Pi and Arduino.

12. Carbon Monoxide Alarm: Detects dangerous levels of carbon monoxide in the air, ensuring safety.

BLOCK DIAGRAM :



WORKING: A brief overview of the working of our project:

1. Temperature Monitoring and Control:

The project continuously monitors the temperature of the surrounding environment using a temperature sensor.

Based on the temperature readings, the Single-Board Computer (SBC) board determines whether the temperature is too low or too high.

If the temperature is too low, the SBC board activates the heating element to increase the temperature.

If the temperature is too high, the SBC board activates both the air cooler and the air conditioner to cool the environment.

Additionally, if the temperature is within the normal range, the system maintains status quo without activating any temperature control devices.

The LCD display provides real-time feedback on temperature readings and the current state of the system.

2. Carbon Monoxide Detection and Response:

The project involves carbon monoxide detection facilitated by the IoT monitor server.

The smartphone, acting as the IoT monitor, continuously receives data from the carbon monoxide detector.

Based on the received data and predefined conditions set in the IoT monitor server, appropriate actions are triggered to respond to the carbon monoxide levels.

These actions ensure the safety of occupants by activating alarms, ventilation mechanisms, or other necessary measures as dictated by the severity of the carbon monoxide level detected.

3. Integration with Home Gateway and Smartphone:

The project is integrated with a home gateway, which serves as a central hub for communication between the various components of the system.

The home gateway is connected to the SBC board, LCD display, temperature monitor, carbon monoxide detector, and smartphone.

This integration allows for remote monitoring and control of the system via the smartphone application.

Users can view real-time temperature and carbon monoxide readings, receive alerts and notifications, and control the system's operation from anywhere with an internet connection.

4. Safety Measures:

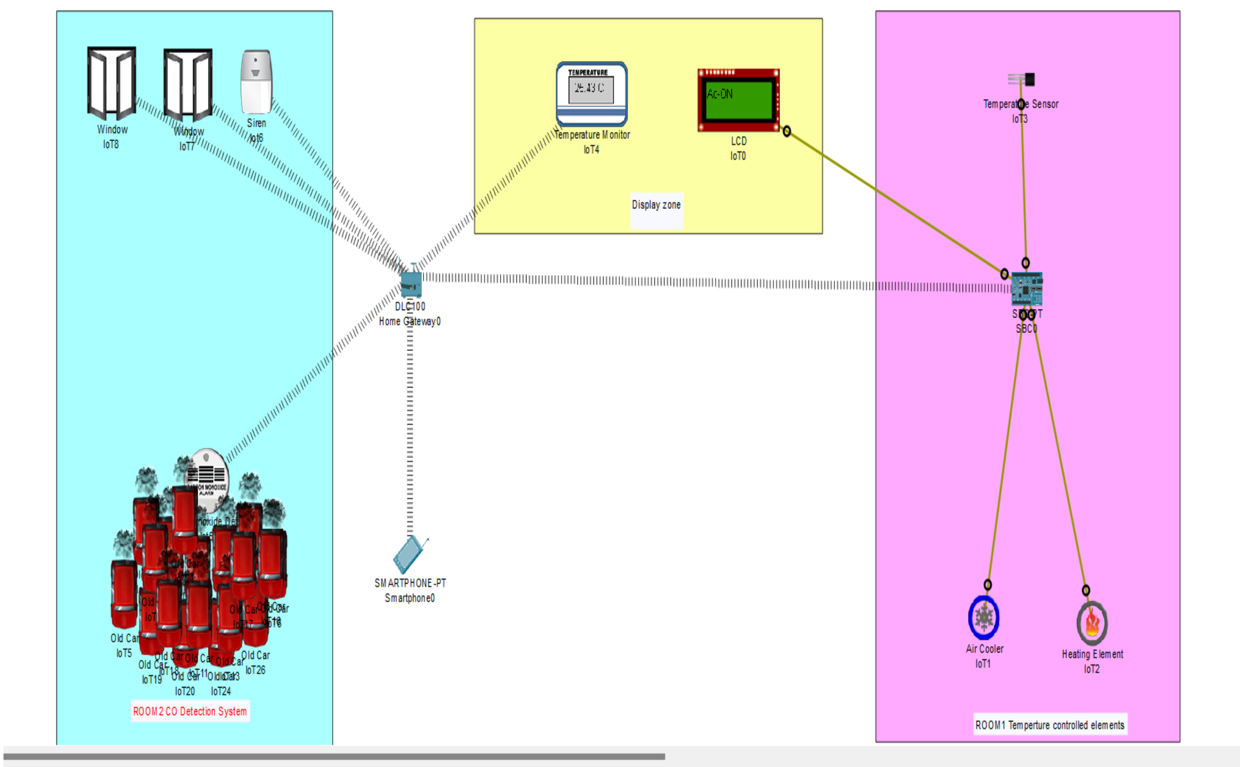
The project prioritizes safety by swiftly detecting and responding to hazardous conditions such as high temperature and elevated carbon monoxide levels.

By activating the appropriate response mechanisms (heating element, air cooler, air conditioner, siren alarm, window opener), the system ensures the safety and well-being of occupants within the indoor environment.

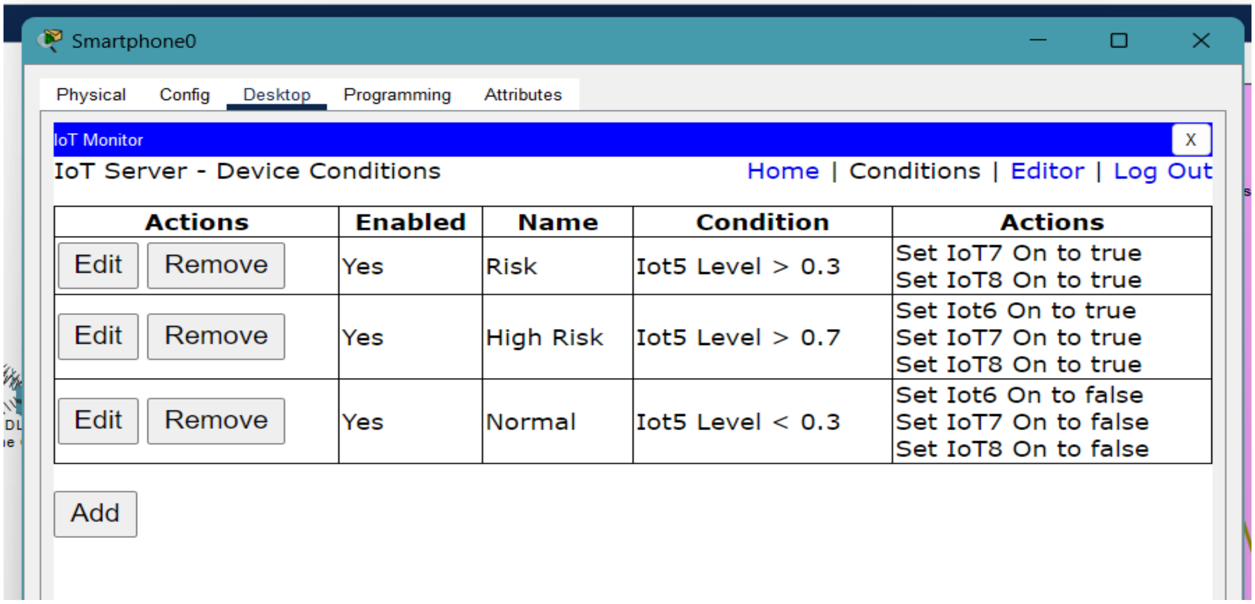
Overall, the project utilizes IoT technologies to create a smart monitoring and control system for indoor environmental conditions. It integrates temperature and carbon monoxide sensors, actuators, communication networks, and user interfaces to optimize comfort levels and ensure safety within indoor spaces.

SIMULATION DIAGRAM:

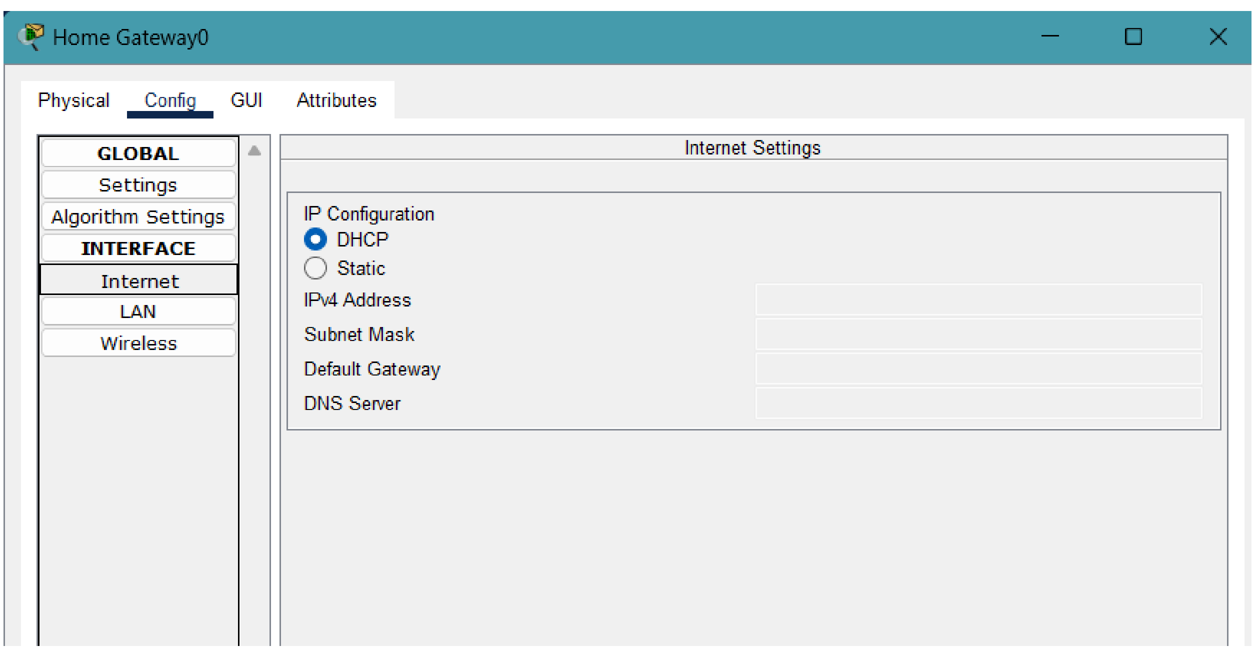
1.Circuit Diagram:

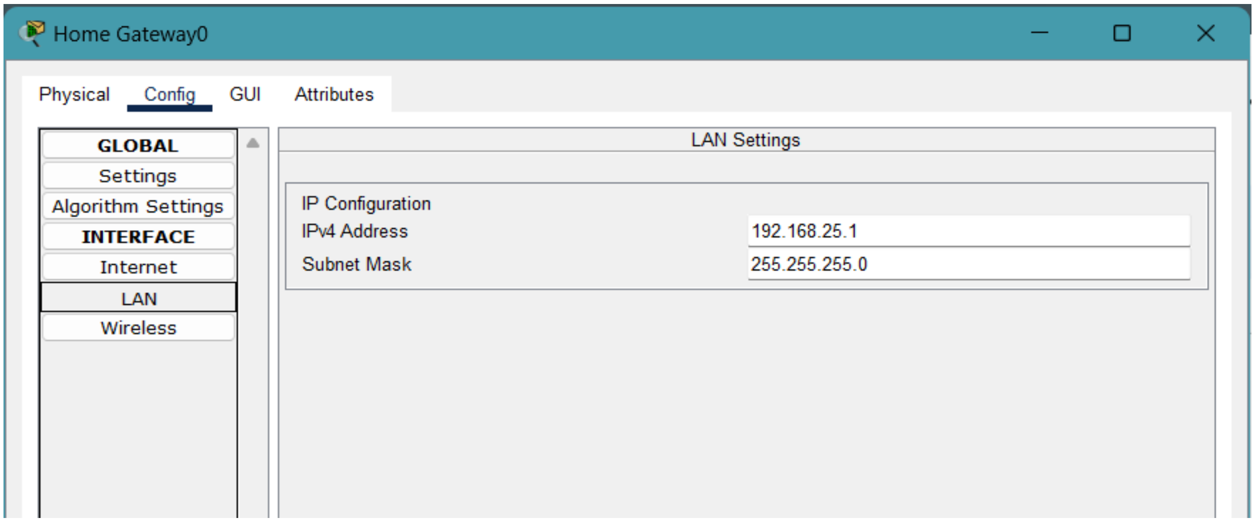


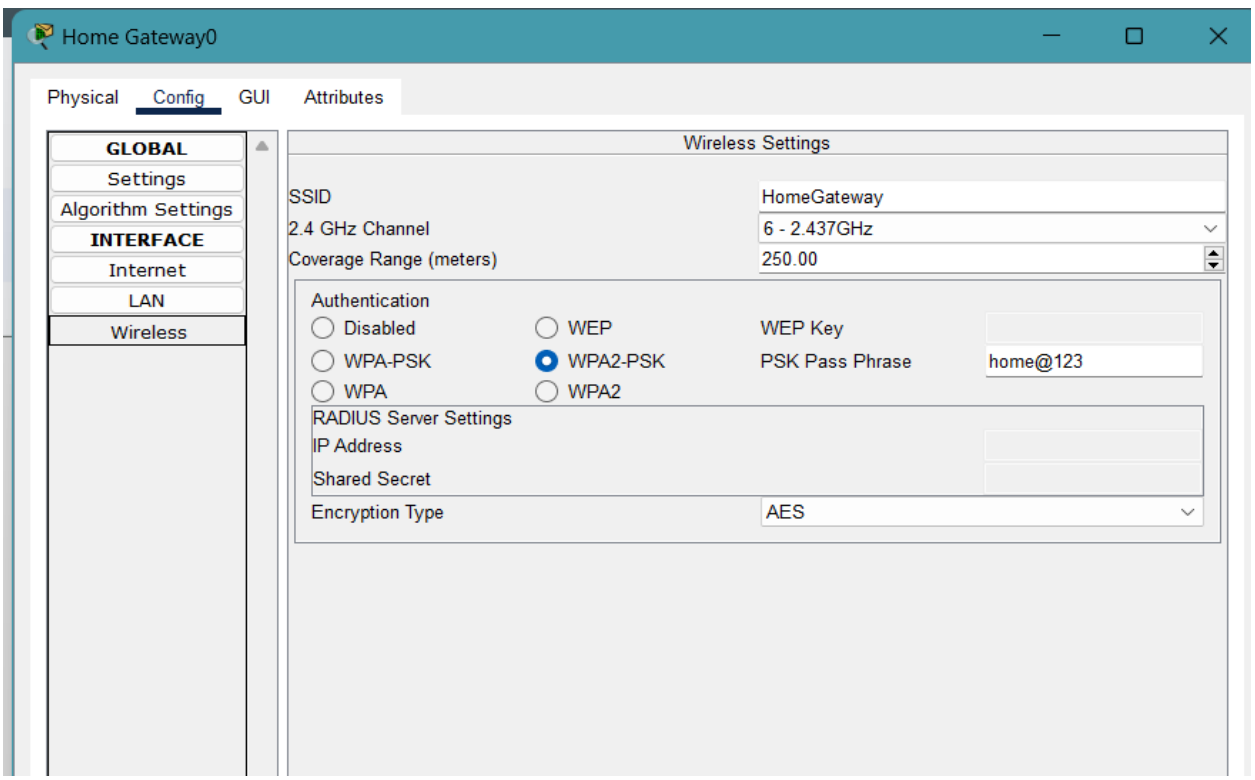
2.Conditions set for CO level in Smartphone:



3.Configuration of HomeGateway:




Home Gateway0
Physical
Config
GUI
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
Internet
LAN
Wireless
LAN Settings
IP Configuration
IPv4 Address
192.168.25.1
Subnet Mask
255.255.255.0


Home Gateway0
Physical
Config
GUI
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
Internet
LAN
Wireless
Wireless Settings
SSID
HomeGateway
2.4 GHz Channel
6 - 2.437GHz
Coverage Range (meters)
250.00
Authentication
Disabled
WEP
WEP Key
WPA-PSK
WPA2-PSK
PSK Pass Phrase
home@123
WPA
WPA2
RADIUS Server Settings
IP Address
Shared Secret
Encryption Type
AES

4.Code for Temperature Response of Devices like AC and Heater in SBC.

Specifications Physical Config Desktop Programming Attributes

Blink (Python) - main.py

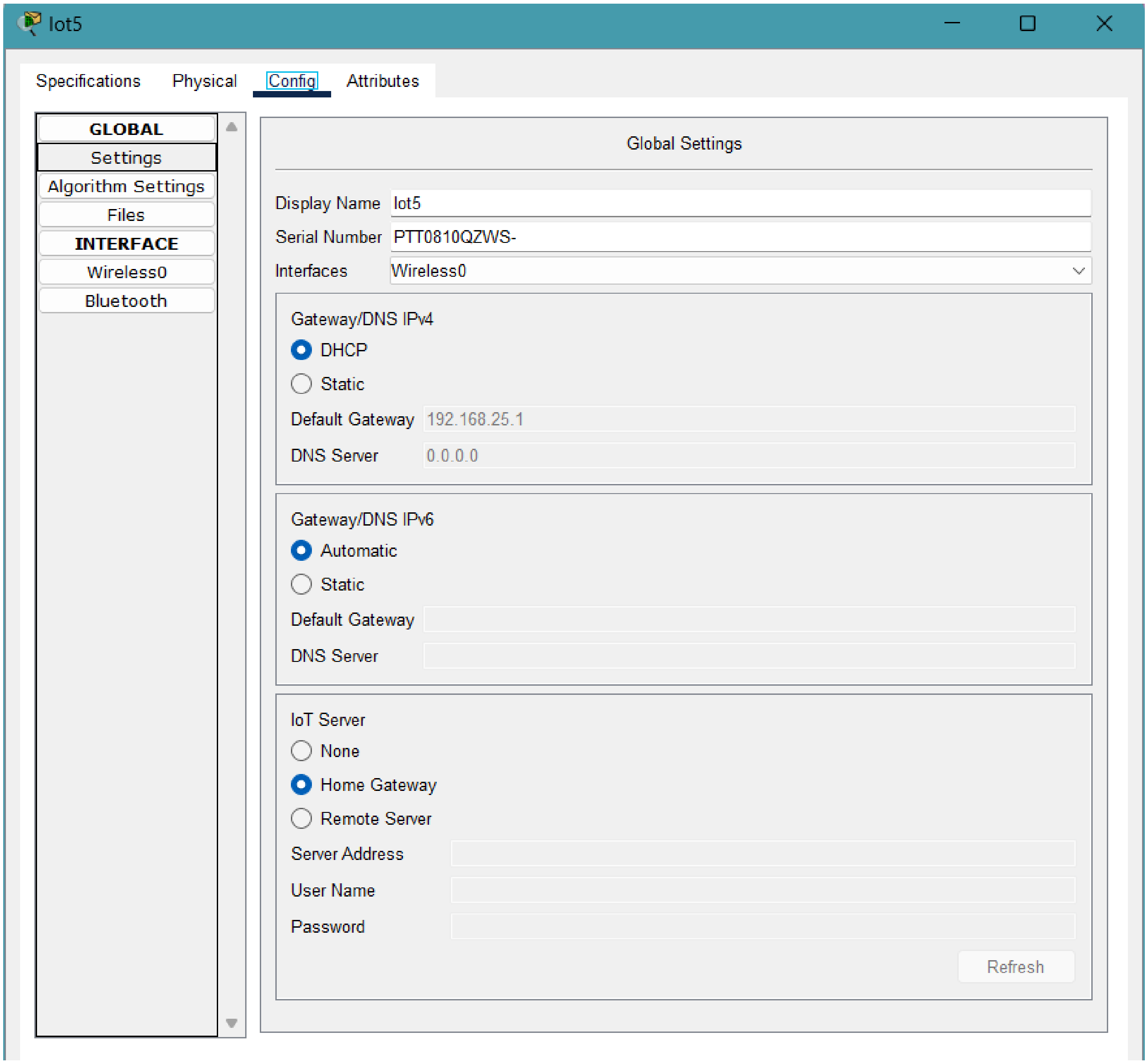
Open New Delete Rename Import

..
main.py

```python
from gpio import *
from time import *


def main():
	pinMode(0, INPUT)
	pinMode(1, OUT)
	pinMode(2, OUT)
	pinMode(3, OUT)
	print("Room Temperature")
	while True:
		temp = digitalRead(0);
		print("Temperature" ,temp)
		if(temp>=600):
			digitalWrite(1, HIGH);
			digitalWrite(2, LOW);
			customWrite (3,"Ac-ON");
		elif(temp<590):
			digitalWrite(2, HIGH);
			digitalWrite(1, LOW);
			customWrite (3,"Heater-ON");
		else:
			digitalWrite(2, LOW);
			digitalWrite(1, LOW);
			customWrite (3,"Normal-Temp");


		delay(1000);


if __name__ == "__main__":
	main()
```

```
('Temperature', 1023)
('Temperature', 1023)
```

5.Configuration of All IOT devices in HomeGateway network:



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RESULTS:

The project has successfully implemented an IoT-based monitoring and control system, aimed at optimizing indoor environmental conditions. By integrating sensors for temperature and carbon monoxide detection, the system ensures real-time monitoring of indoor air quality and safety. Through the utilization of actuators such as air conditioners, heaters, and window openers, the system dynamically adjusts environmental parameters to maintain comfort levels and mitigate potential hazards. Notably, the system's capability to detect hazardous gasses like carbon monoxide underscores its commitment to ensuring safety within indoor spaces, enhancing overall occupant well-being and comfort.

References:

Source:
(1) IoT-Based Environmental Monitoring: Types and Use Cases. https://www.digi.com/blog/post/iot-based-environmental-monitoring.
(2) environmental-monitoring · GitHub Topics · GitHub. https://github.com/topics/environmental-monitoring.
(3) IoT - Environmental Monitoring - Great Learning. https://www.mygreatlearning.com/iot/tutorials/iot-environmental-monitoring.
(4) Environmental Monitoring - GSMA. https://www.gsma.com/iot/wp-content/uploads/2018/02/iot_environ_sensors_02_18.pdf