



Green University of Bangladesh

*Department of Computer Science and Engineering (CSE)
Semester: (Fall, Year: 2023), B.Sc in CSE (Day)*

Smart Home Using IoT Simulation in Cisco Packet Tracer

*Course Title: Cloud Computing Lab
Course Code: CSE 446
Section: 201 D1*

Students Details

Name	ID
Sahin Alam	201002015

*Submission Date: 29 December 2023
Course Teacher's Name: Mr. Dipta*

[For teachers use only: **Don't write anything inside this box**]

<u>Project Report Status</u>	
Marks:	Signature:
Comments:	Date:

Contents

1 Project Proposal	3
1.1 Title of the Project Proposal:	3
1.2 Why I Selected this Project:	3
1.3 Problem Domain Motivations:	3
1.4 Objective/Aims:	4
1.5 Tools and Technology:	4
1.6 Gantt Chart:	5
1.7 Demo of the Project:	6
1.8 Complex Engineering Problems:	7
1.9 Conclusion:	7
1.10 Project Progress:	8
2 Project Final Report	9
2.1 Overview	9
2.2 Motivation	9
2.3 Design Goals/Objectives	10
3 Design/Development/Implementation of the Project	11
3.1 Introduction	11
3.1.1 Features	11
3.1.2 Tools and Technologies	12
3.2 Environments:	13
3.3 Implementation	13
4 Performance Evaluation	29
4.1 Simulation Environment/ Simulation Procedure	29
4.2 Results Analysis and Discussions	31
4.3 Test Case Output:	36

5 Conclusion	37
5.1 Discussion	37
5.2 Limitations	37
5.3 Practical Implications:	38
5.4 Scope of Future Work	38
5.5 Conclusion	39
5.6 References	39

Chapter 1

Project Proposal

1.1 Title of the Project Proposal:

Smart Home using IoT simulation in Cisco Packet Tracer.

1.2 Why I Selected this Project:

In our house, many times the light, fan, or AC is on or the house door is open. With this project, I can control the above problems from the office or outside my home with a smart device very easily, with the help of any cell tower network. The main objective of this project plan is that cell towers, routers, switches, and IoT devices will be controlled through cloud servers. If I can complete all the knowledge and practical configuration of this project, in the future I can do smart home configuration in my home in real life, which will be easy for me as an engineer.

1.3 Problem Domain Motivations:

- Manage Internet of Things (IoT) devices, cell towers, routers, and switches from off-premises cloud servers.
- Control smart home devices from anywhere through cell towers.
- Being able to keep all the technology in your home connected through one interface is a huge step forward for technology and home management.
- You can't remotely control all the devices in your home when you're away, but you can easily control them from wherever you are with a smart home system.
- For returning home from the office, you cannot turn on your air cooler at home, but if you use a smart home system, you can turn on/off the air conditioner on the road or from the office.

- Maybe if you are in the office now your room door will be closed when a guest comes to your room, but if you are using the smart home system then you can open the room door sitting in the office and you can monitor it through a cc camera.

1.4 Objective/Aims:

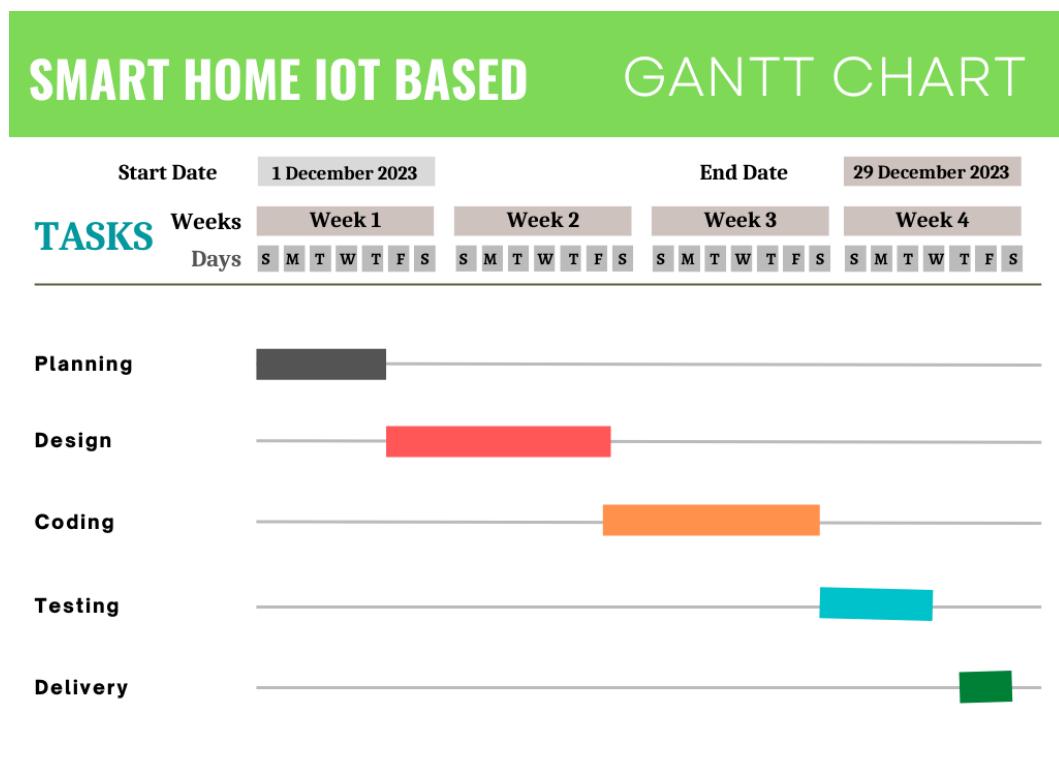
- The main objective is to manage cellular towers, routers, switches, and Internet of Things (IoT) devices through cloud servers.
- To be controlling IoT devices through cell towers.
- To be Controlled through a Cell tower by creating communication between smart home devices using a closerver and router.
- To be the possibilities are huge movement alarms, surveillance cameras, automatic door locks, and other practical security systems that can be integrated into a home control system so you can activate them from a mobile device before you go to bed.
- To integrate Cloud WAN and wireless routers with ISP server systems.
- To be depending on the time of day an alarm goes off, you can still choose to receive security alerts on different gadgets and view events in real-time, whether you're at home or halfway around the world.

1.5 Tools and Technology:

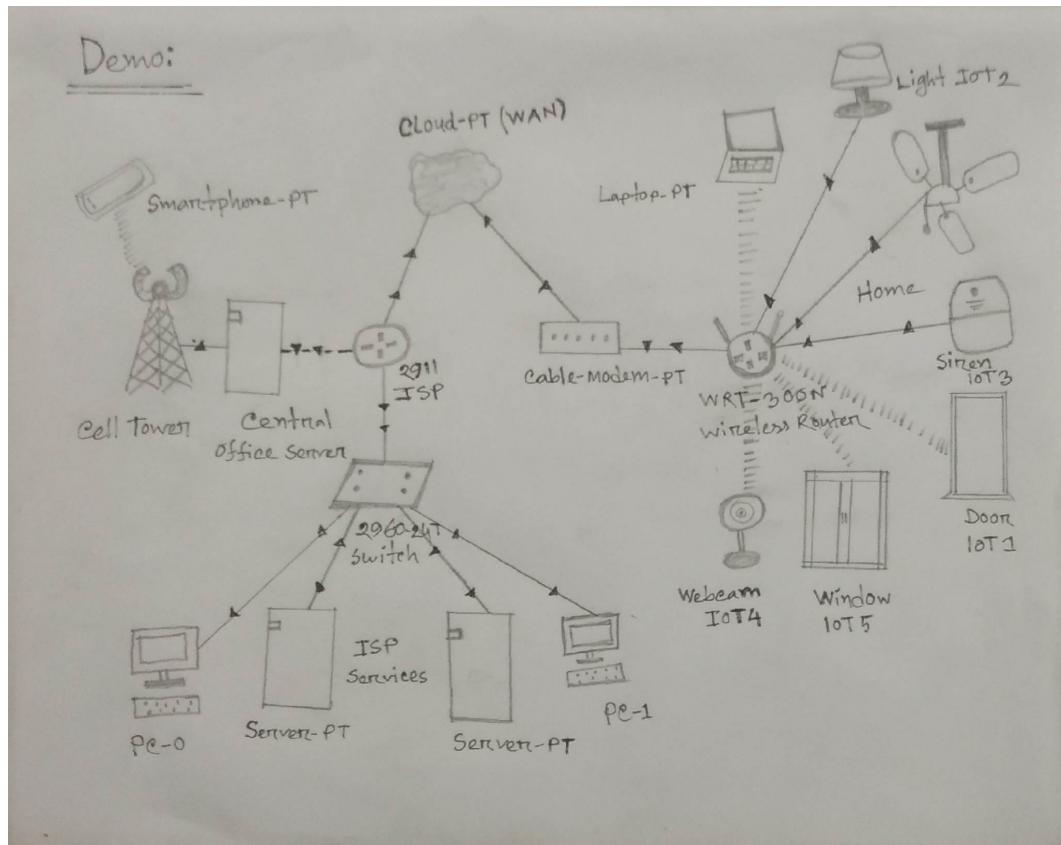
- Cloud Server
- IoE Server
- Central Office Server
- Cell Tower
- Cloud WAN
- Cable Modem
- Home Gateway
- Router
- Switch
- Laptop
- Smartphone
- Camera

- Fan
- Light
- Door
- Window
- Siren
- Cable
- Air Cooler
- IP

1.6 Gantt Chart:



1.7 Demo of the Project:



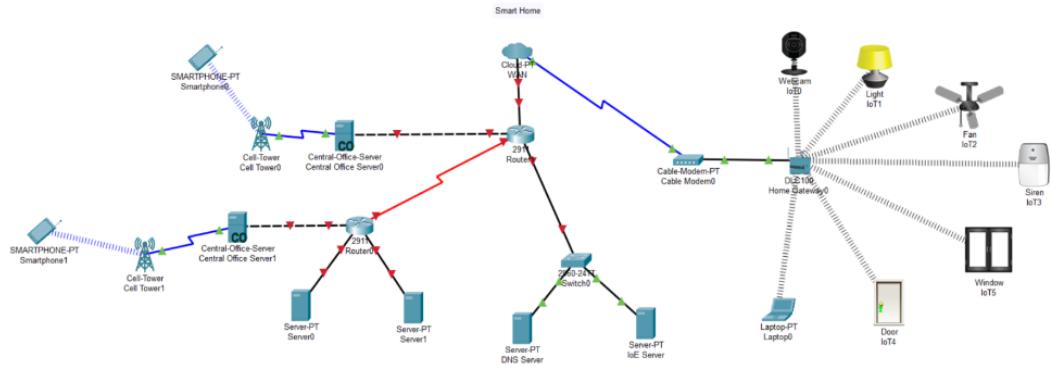
1.8 Complex Engineering Problems:

Name of the P Attributes	Explain how you addressed this attribute
P1: Depth of knowledge required	Required knowledge depth Advanced knowledge of smart home IoT hardware configuration, including cloud servers, cellphones, cell towers, routers, etc.
P2: The range of conflicting requirements	To fix difficulties like inadequate WiFi coverage and low battery charging capacity and coordinate amongst devices, you must balance opposing requirements.
P3: Depth of analysis required	Includes IoT device sensors, hardware, software, communication protocol, security, privacy, user experience, and maintenance and support in project system design.
P4: Familiarity with issues	Knowledge of wireless router IP settings and IoT server communication difficulties.
P5: Extent of applicable codes	The National Electrical Code, International Building Code, IEEE 802.11, Bluetooth Low Energy, and standards can benefit IoT smart homes' electrical, fire, cybersecurity, privacy, and data protection. These regulations and standards help manufacturers and consumers make IoT smart homes safe, secure, and reliable.
P6: Extent of stakeholder involvement and conflicting requirements	IoT smart home systems' main stakeholders and users are homeowners. They have unique system functionality, usability, and performance preferences. Technology companies make IoT smart home products, software, and platforms. Installation, maintenance, and support are offered by service providers.
P7: Interdependence	By monitoring the camera, a smart house will open the door when a guest arrives, open the room door if it's closed, turn on the light if it's off, and turn on the AC if it's off. These devices operate together.

1.9 Conclusion:

In this project, we will try to see how to use a cloud server and how to use an IoT-based Cisco packet tracer to control all your devices from the office or any other location via a cell tower. It solves many of your security and time-wasting problems and makes life easier.

1.10 Project Progress:



About Overview Project Progress: During the project's progress, we connected the required devices and various cables between them, connected the IOT devices to the home gateway, and used the cloud server. As well, we connected the smartphones to the cell tower, but our router configuration remained to be done, which we were able to complete in the final project. The second chapter has been described in detail.

Chapter 2

Project Final Report

2.1 Overview

Smart IoT home automation is the ability to control home appliances through electronically controlled, internet-connected systems. This can include presenting complex heating and lighting systems and setting alarms and home security controls. Internet-connected IoE computer or device uses IoT technology for remote monitoring and control of various home appliances. Here we have done all the work using a cloud server. I used the recently released Cisco Packet Tracer simulation tool to build and customize an IOE system with classical networking devices for smart home deployment.

2.2 Motivation

There are several reasons why we have selected this project as follows:

- Control homes easily from different locations using cloud servers through cell towers.
- Being able to keep all the technology in your home connected through one interface is a huge step forward for technology and home management.
- You can't remotely control all the devices in your home when you're away, but you can easily control them from wherever you are with a smart home system.
- For returning home from the office or University, you cannot turn on your air cooler at home, but if you use a smart home system, you can turn on/off the air conditioner on the road or from the office.
- Maybe if you are in the office now your room door will be closed when a guest comes to your room, but if you are using the smart home system then you can open the room door sitting in the office and you can monitor it through a cc camera.

2.3 Design Goals/Objectives

- To be the main objective is to manage cellular towers, routers, switches, and Internet of Things (IoT) devices through cloud servers.
- To be controlling IoT devices through cell towers.
- The possibilities are huge movement alarms, surveillance cameras, automatic door locks, and other practical security systems that can be integrated into a home control system so you can activate them from a mobile device before you go to bed.
- To integrate Cloud WAN and wireless routers with ISP server systems.
- To set up static routing protocol between two routers.
- To be depending on the time of day an alarm goes off, you can still choose to receive security alerts on different gadgets and view events in real-time, whether you're at home or halfway around the world.

Chapter 3

Design/Development/Implementation of the Project

3.1 Introduction

This chapter will describe our smart home features, the tools and technologies used, and the implementation process of our project.

3.1.1 Features

- **Remote Control:** Smart home devices can be controlled from far away using a phone, tablet, or computer. This feature lets homeowners control their devices from anywhere, making things easier and more flexible.
- **Automation and Scheduling:** Smart home gadgets can be set up to do things automatically or at specific times. Some things, like lights, thermostats, and security cameras, can be programmed to work automatically at specific times or when certain things happen.
- **Energy Monitoring and Efficiency:** Smart home devices can watch how much energy you use and help you find ways to save energy. They give information right away about how much energy is being used. This helps people make smart choices to use energy better and pay less for their utilities.
- **Inter-connectivity:** Smart home gadgets can be connected together, so they can talk and work with each other. For example, when you move near a sensor, a light automatically turns on, or you can see who is at your door on a smart display or on your phone using a camera. This connection makes a smart home work better and does more things automatically.
- **Security and Safety:** Smart home devices help keep your home safe and protected. This means having locks, cameras, and detectors that can be controlled and watched from far away. They can tell if there is movement or if there is a fire or dangerous gas. The device then lets the homeowner know through their phone or computer.

- **Environmental Monitoring:** Some gadgets in a smart home can track the temperature, moisture, air quality, and noise levels around you. This information can help people who own a home make their living space more cozy and good for their health.
- **Integration with Third-Party Services:** Smart home devices can work with other services and platforms, like home security systems, streaming services, and weather services. This connection makes it easy to control and communicate between many different gadgets and services.
- **Expandability and Compatibility:** Smart home devices can work with many devices and technologies, and you can add more to them easily. This method lets people add new things to their smart home little by little, and combine them with their current system.

3.1.2 Tools and Technologies

Here are the names and items of devices and instruments used in our project:

- Cloud Server - 1
- IoE Server - 1
- Central Office Serve - 2
- Cell Tower -2
- Cloud WAN - 1
- Cable Modem - 1
- Home Gateway - 1
- Router - 2
- Switch - 1
- Laptop - 2
- Smartphone -2
- Camera - 1
- Fan - 1
- Light - 1
- Door - 1
- Window - 1
- Siren - 1

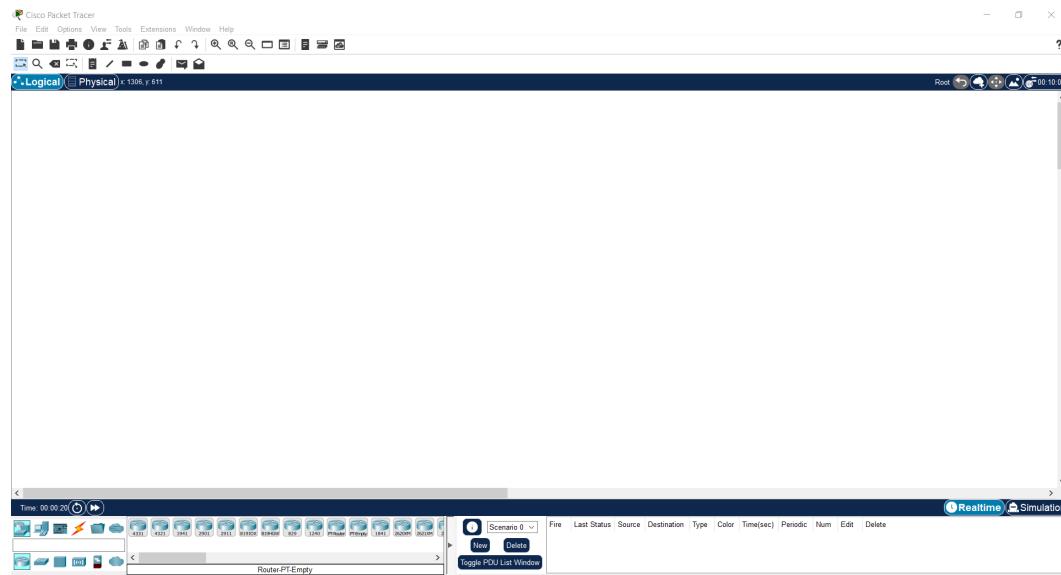
- Cable
- Air Cooler - 1
- IP

3.2 Environments:

It was not easy to get the environments of our project because the latest version of Cisco Packet Tracer was only the environment of our project, so we managed the latest version of Cisco Packet Tracer software and after installing it, opened it and started our project by using the above tools.

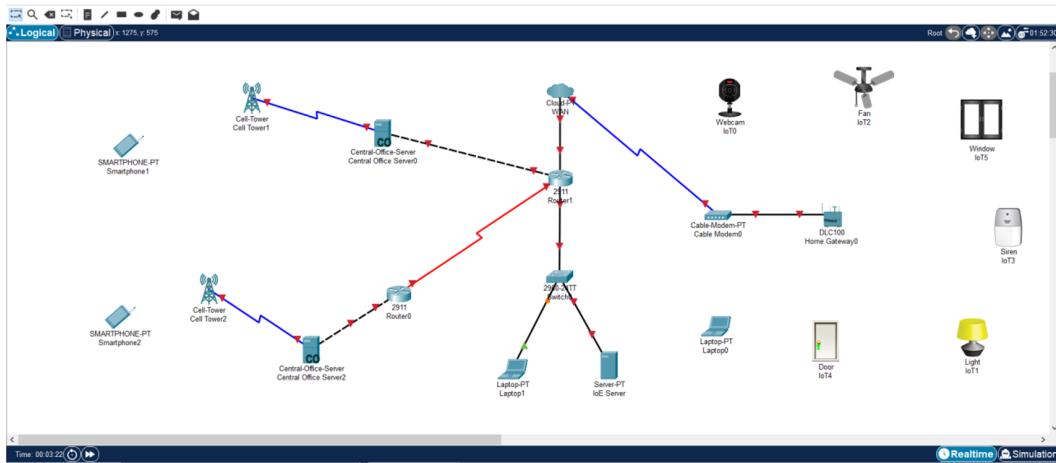
3.3 Implementation

Step - 1: First, we download the Cisco Packet Tracer latest version software and install Skill for All feature login and then open.



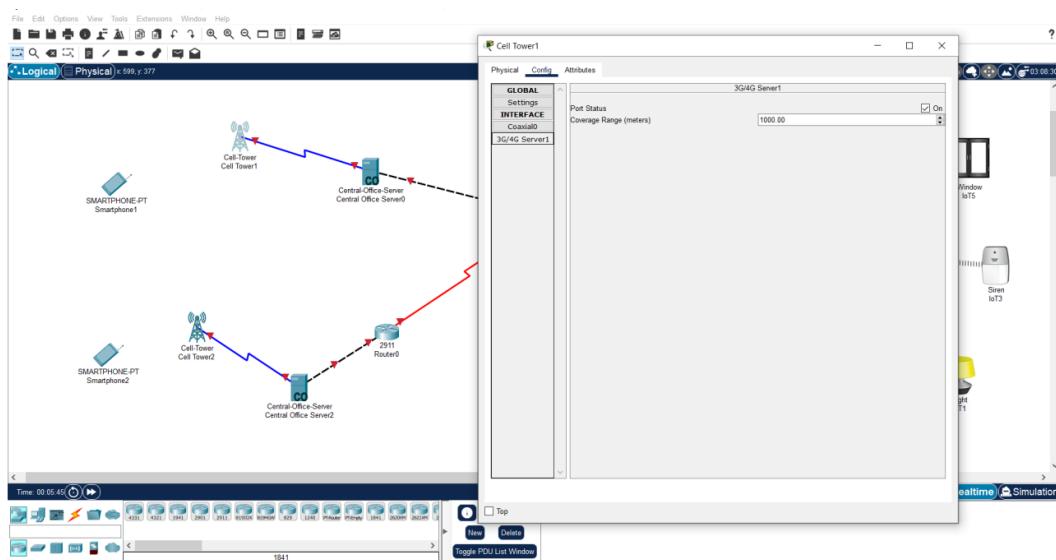
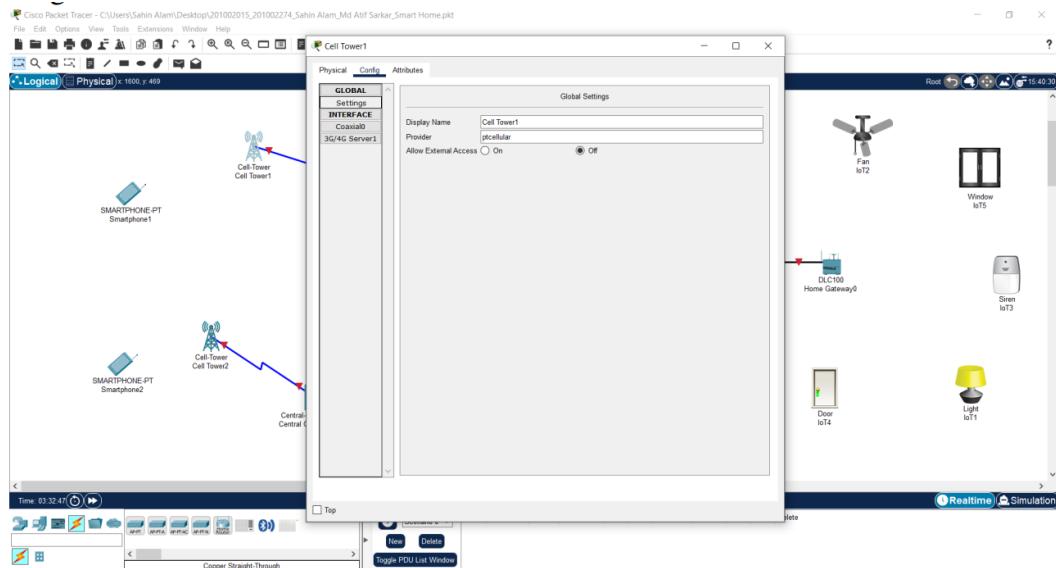
Step - 2:

In the second step we completed all the devices and connections needed for our project.



Step 3

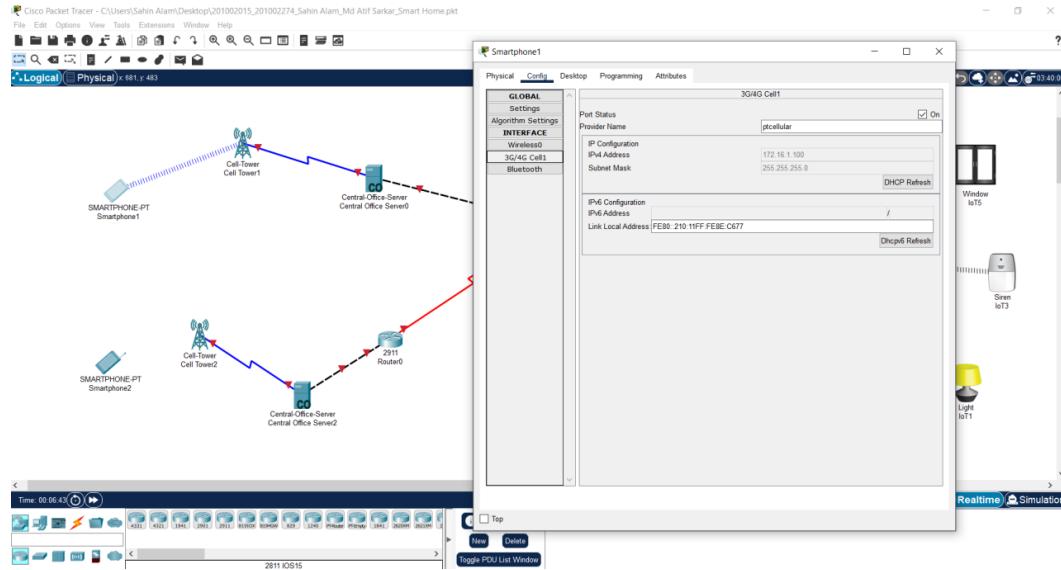
We then named Cell Tower 1 provider ptcellular and gave them a 1000-meter coverage range of 3G/4G service.



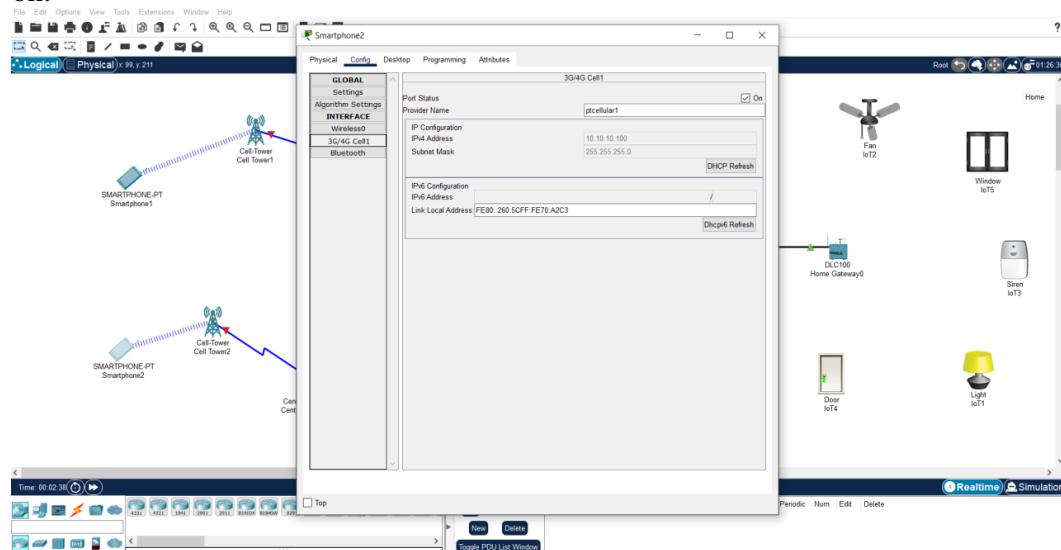
Note: Cell tower 2 we have configured in a similar method.

Step 4

We have turned on the service by writing the provider name ptcellular of the cell tower1 to connect with the smartphone cell tower and the smartphone connection with our cell tower is completed.

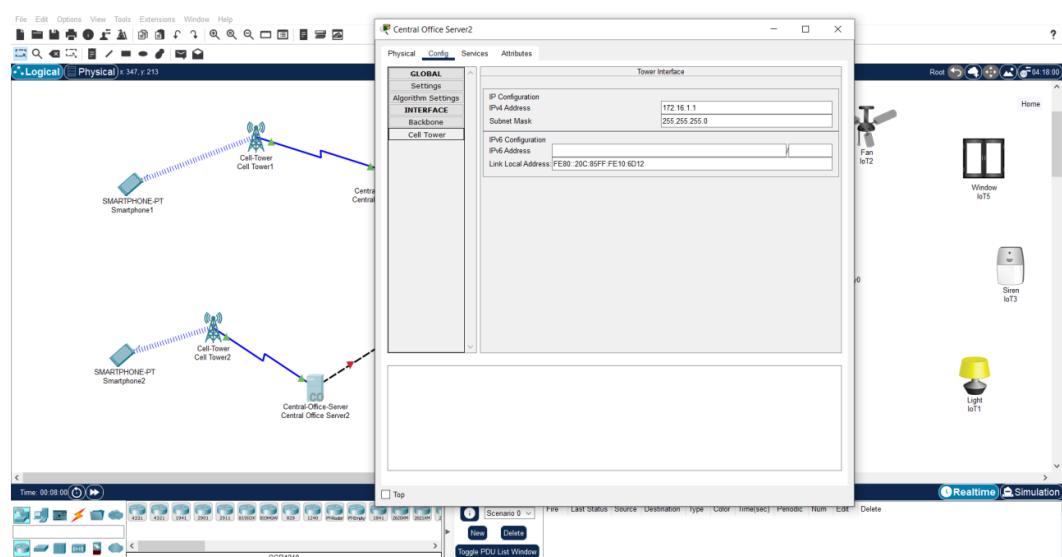
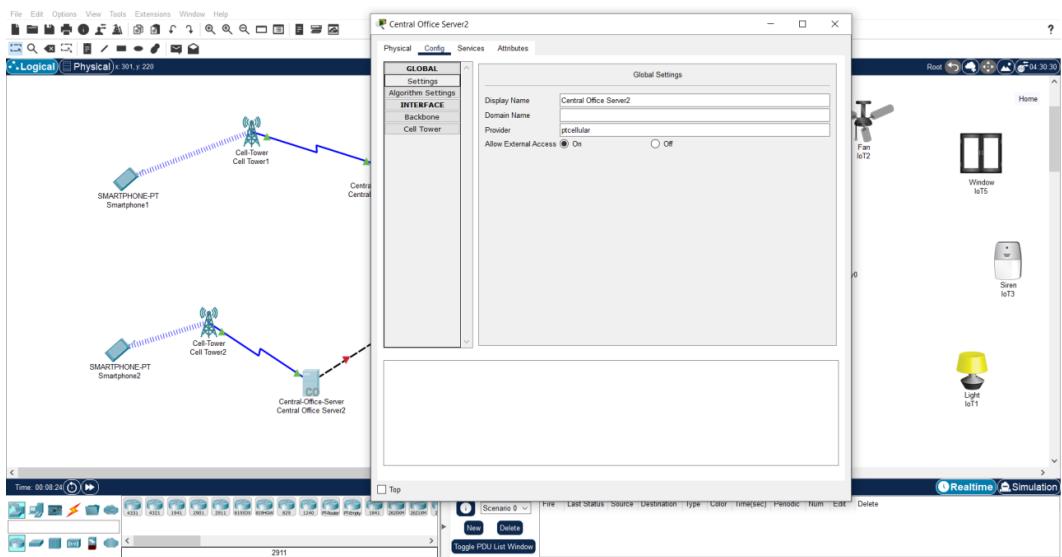


In the same way, we have made the connection between cell tower 2 by writing the name of the cell tower to a provider ptcellular1 to read this setting, we must come to the 3G/4G cell one option of our smartphone and write the name of the provider and turn it on.

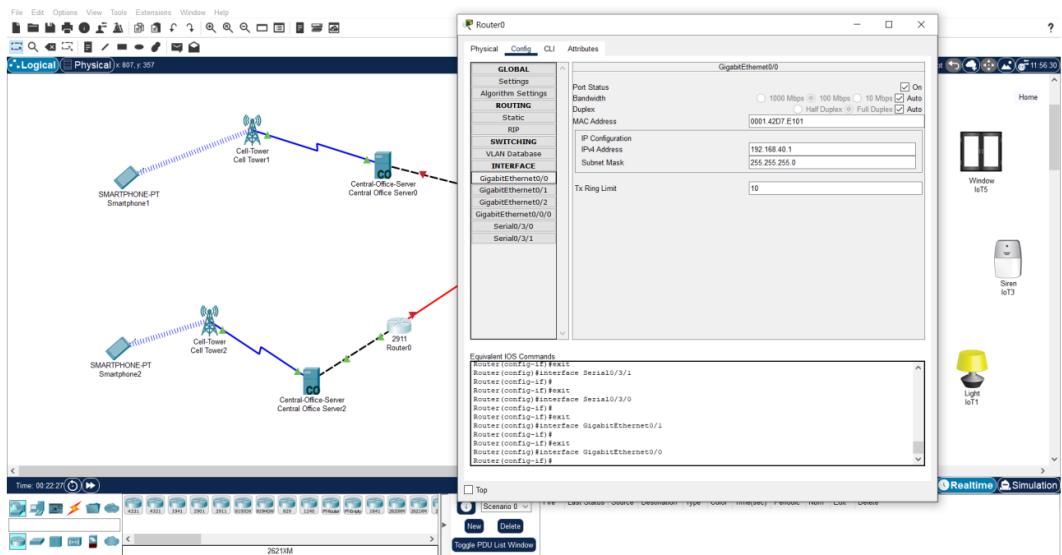


Step 5

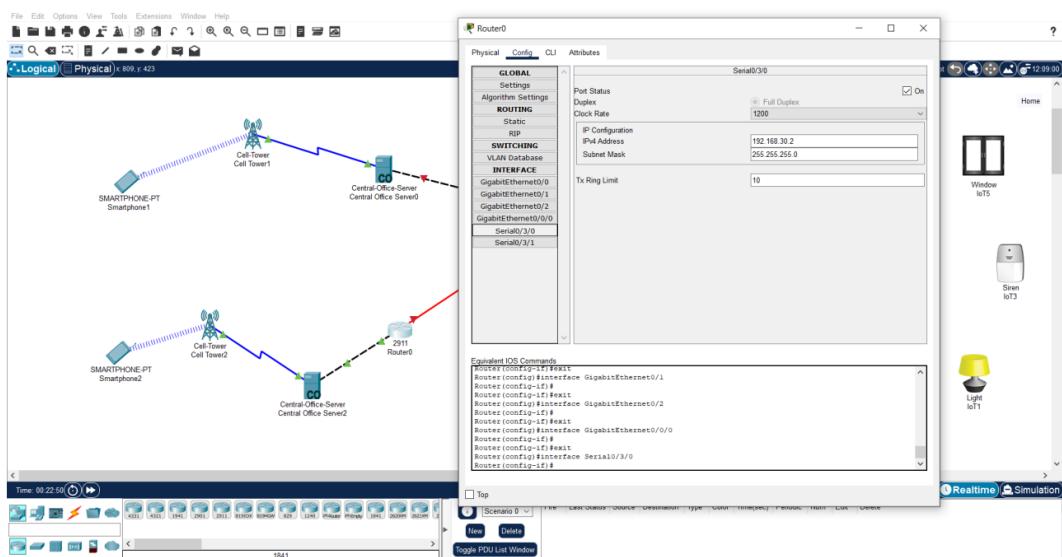
We must first set the central office server provider name and also select the cell tower option and set their IP address and Subnet mask It should be set in the same way on both servers..



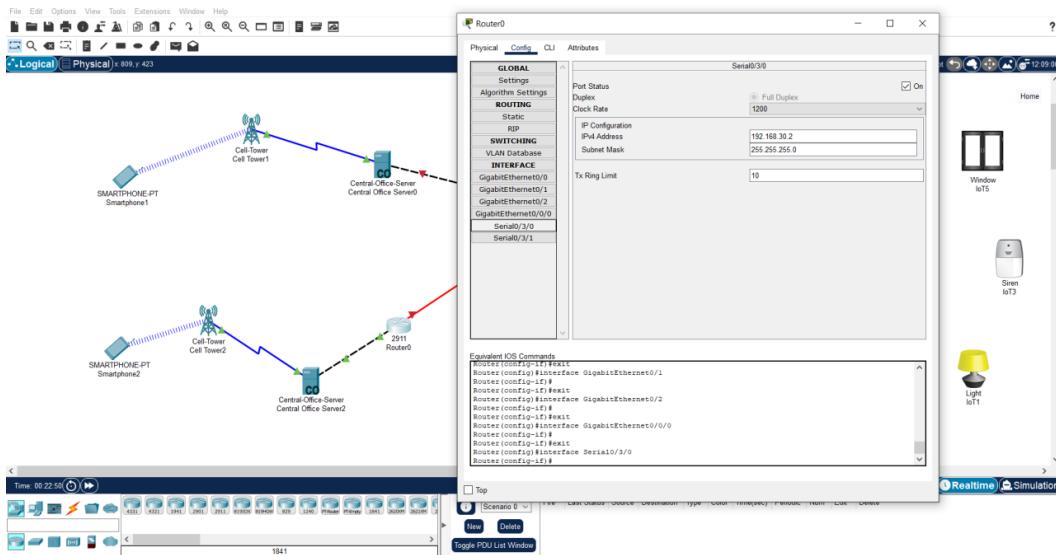
Now it's time to set up our router in that case we are configuring router 0 now here is the gigabit ethernet 0/0 port we have switched on the router with our IP 192.168.40.1 and Subnet mask 255.255.255.0.



turned on the router by setting serial port 0/3/0 IP address 192.168.30.2 subnet mask 255.255.255.0.

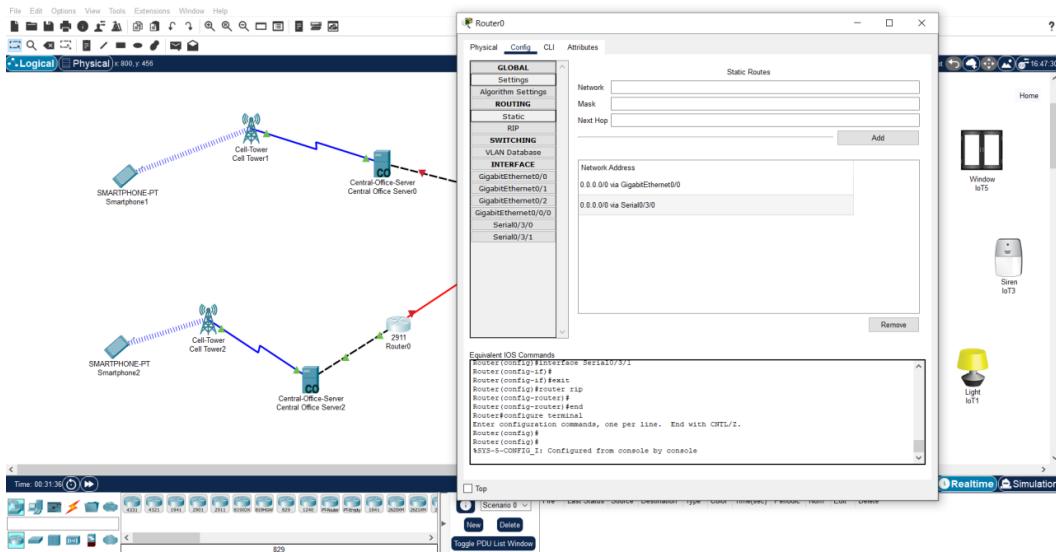


We have static routing configuration for gigabit Ethernet port 0/0 and serial 0/3/0.

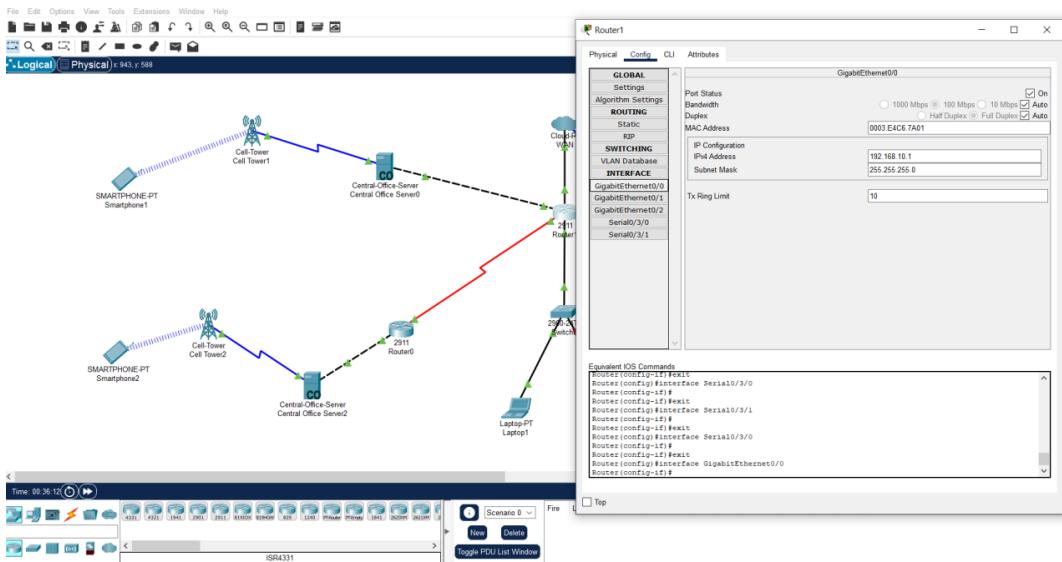


Step 6

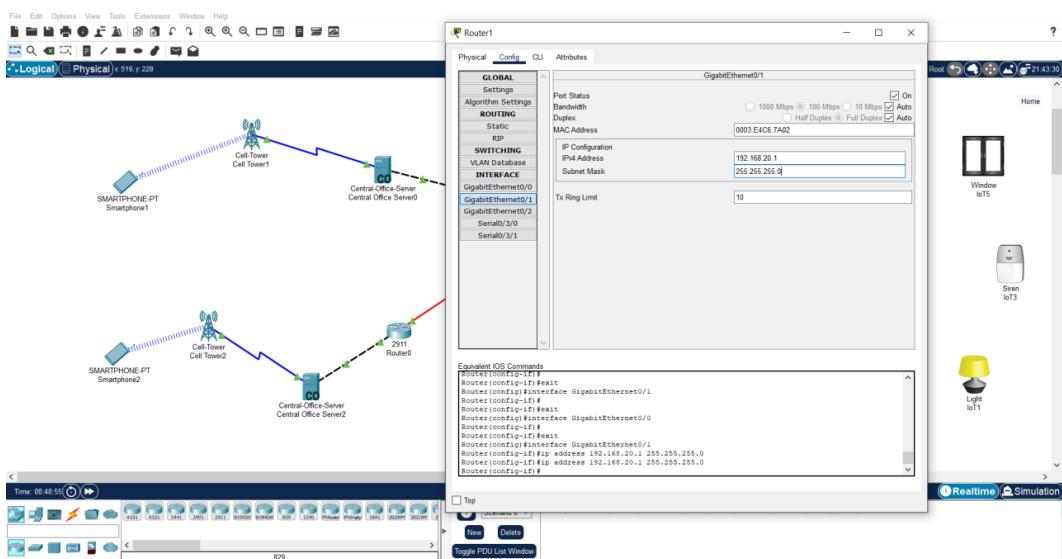
At this stage, we will configure router number 1. First, we selected the gigabit Ethernet 0/0 port from the config option and turned on the router with IP address 192.168.10.1 subnet marks 255.255.255.0.



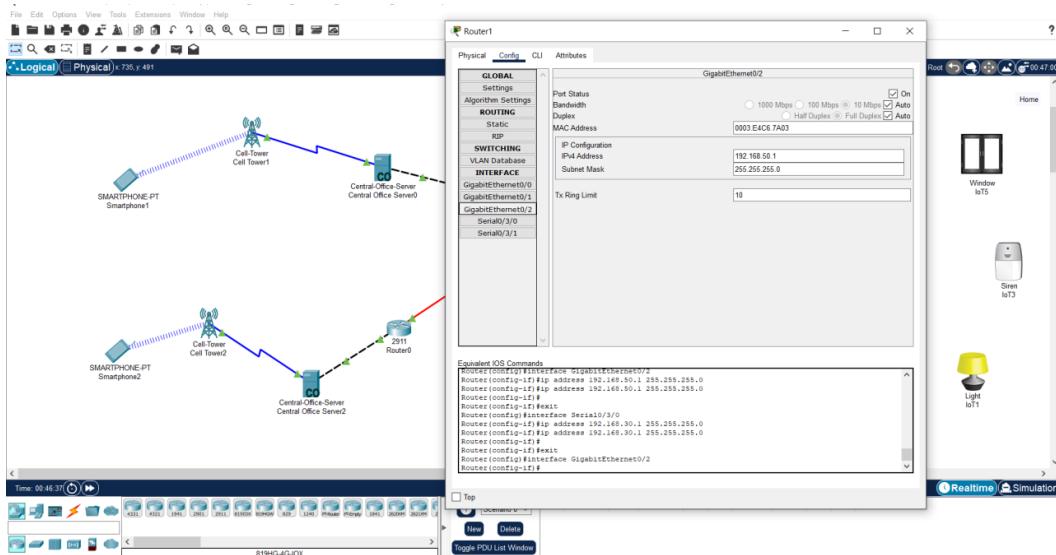
After that select gigabyte ethernet 0/1 and set the IP address 192.168.20.1 submit marks 255.255.255.0 and turn on the router.



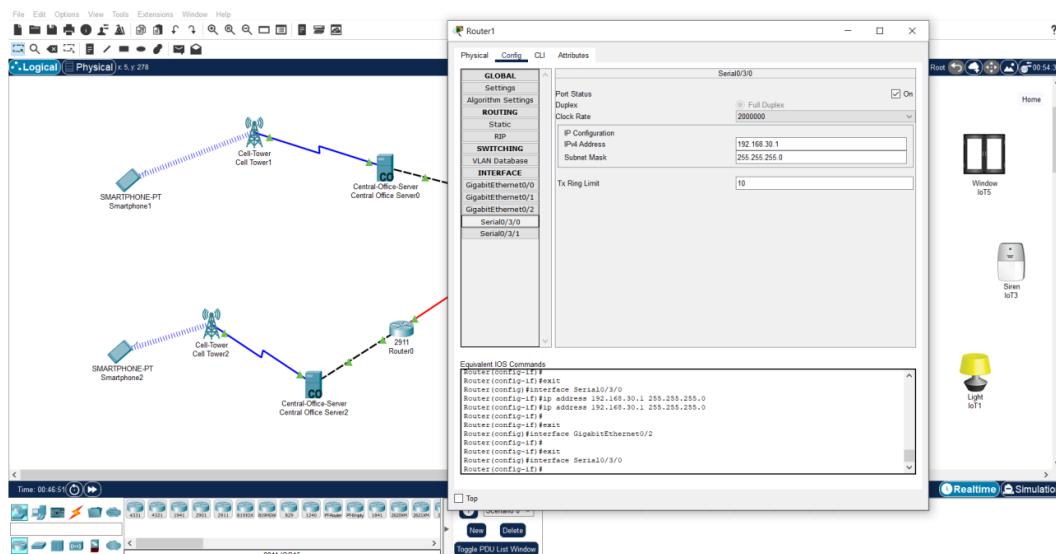
Now after that select gigabyte ethernet 0/2 and set the IP address 192.168.50.1 subnet marks 255.255.255.0 and turn on the router.



Next, we set the IP address 192.168.30.1 subnet mask 255.255.255.0 for the serial 0/3/0 port and turned on the port.

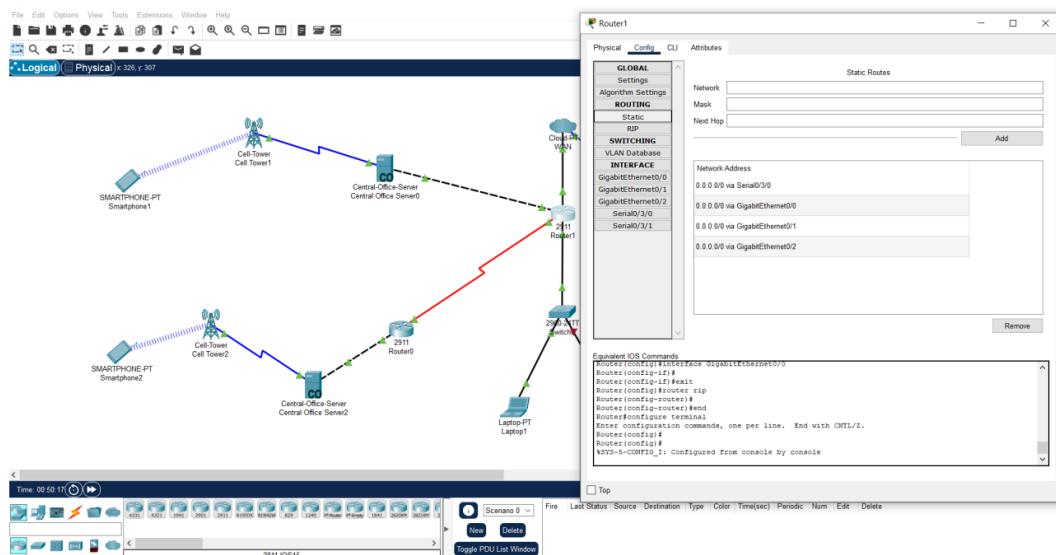


In the last stage of router configuration, we used the static routing configuration protocol for the post ports and the communication between the two routers as shown in the image screenshot.

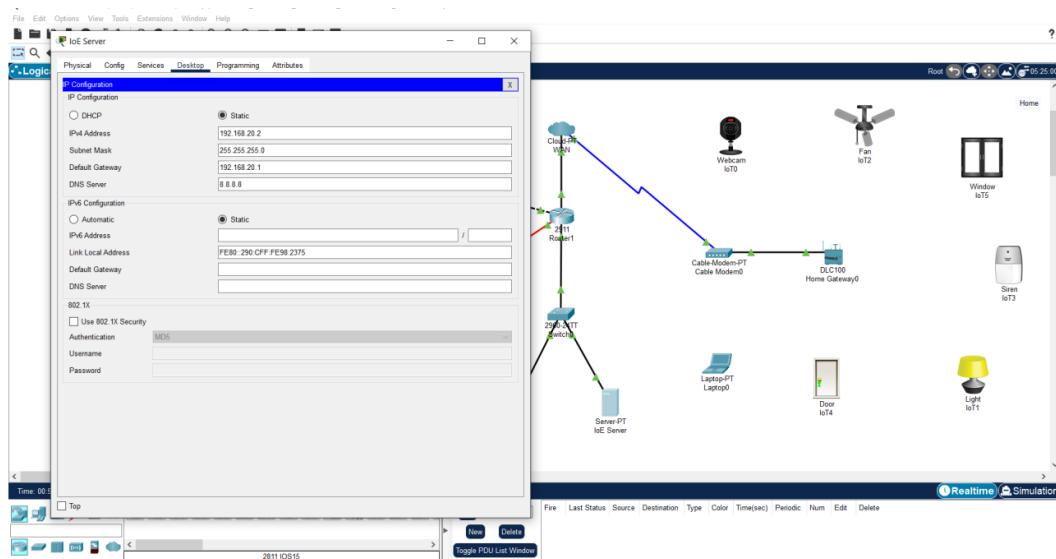


Step 7

In this step, we will set up the IOE server here we have added Server IP Address 192.168.20.2 Subnet Marks 255.255.255.0 Default gateway 192.168.20.1, and DNS Server 8.8.8.8.

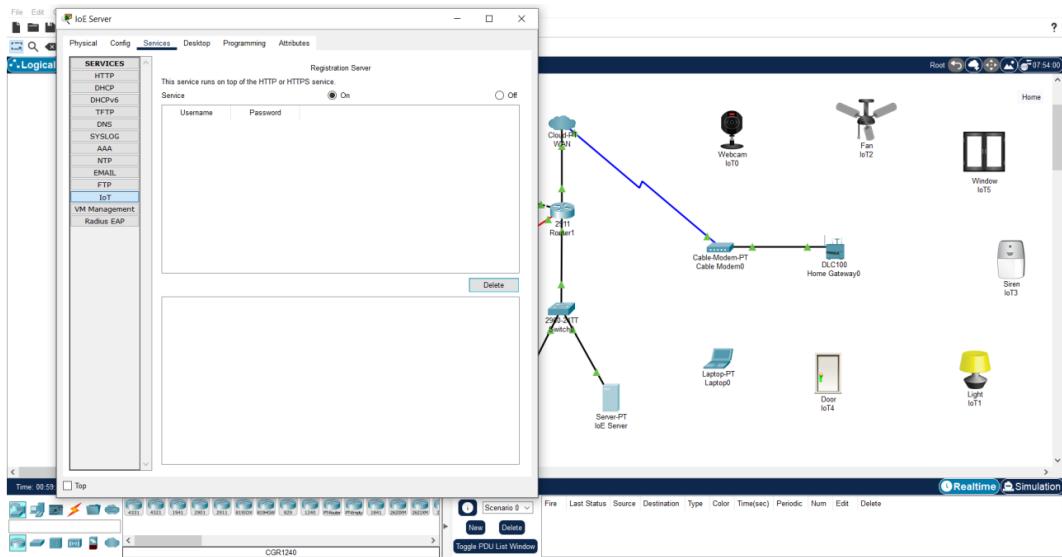


Now we have turned on the IoT server



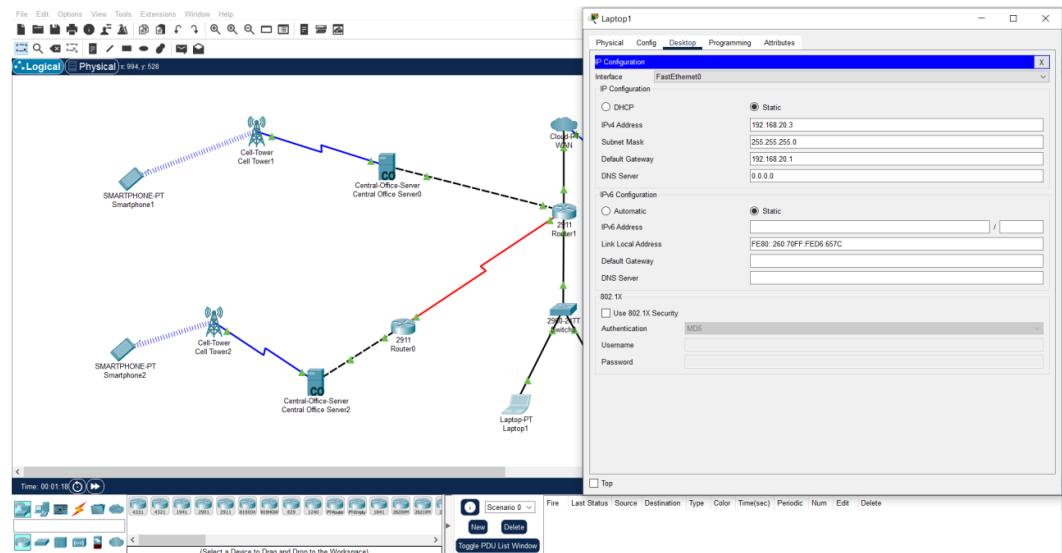
Step 8

We will configure Laptop 1 at this stage so that we can control our IoT devices over the wireless network as well as through cable. For this we set IP address 192.168.20.3 subnet marks 255.255.255.0 gate 192.168.20.1.



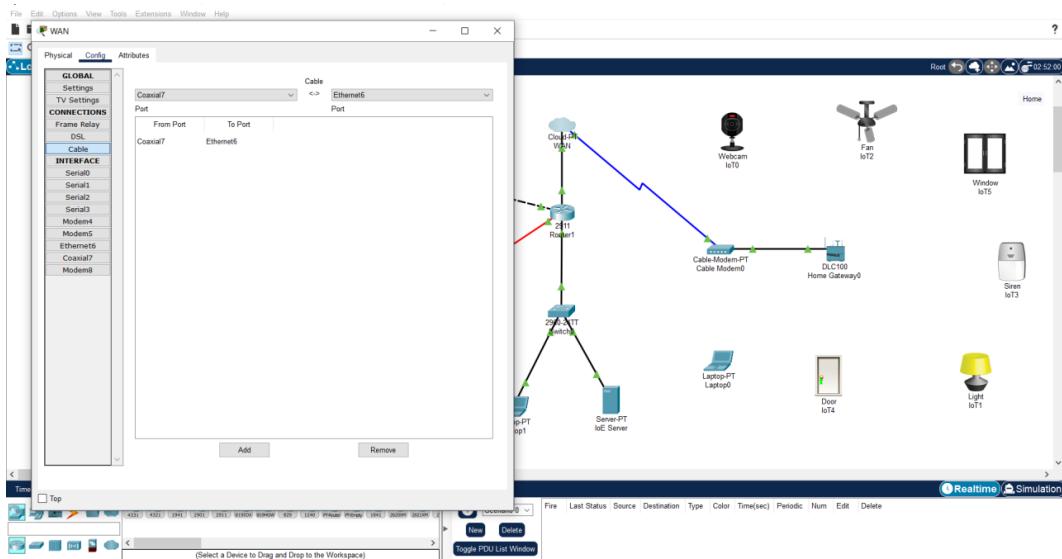
Step 9

Now we will set cloud one in this step in that case we have selected coaxial7 and internet port 6.

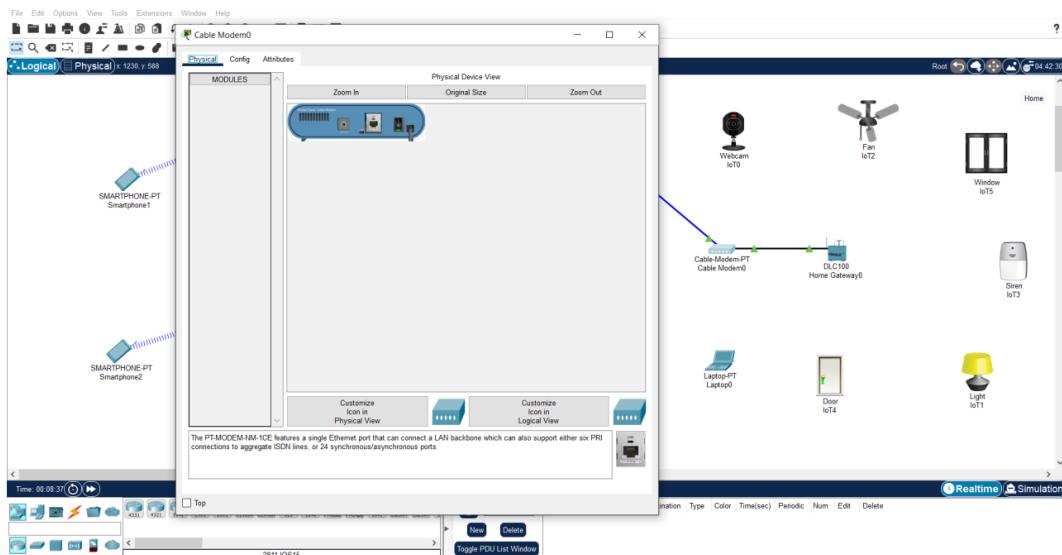


Step 10

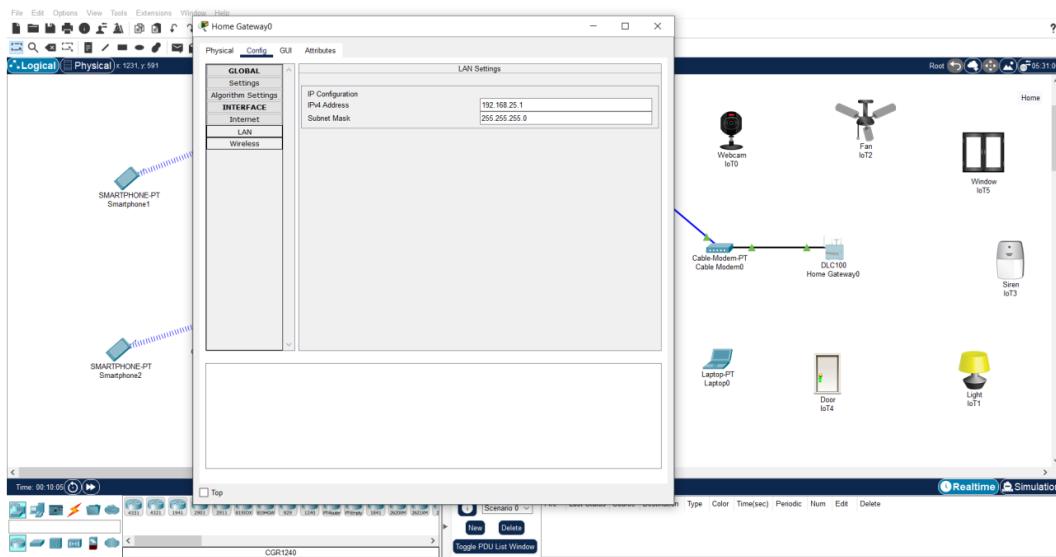
In the next step we took the modem cable



Now it's time to set up our latest IoT device and home grade now we will set up the home gateway for this we first entered LAN from the configure option and set the LAN IP address 192.168.25.1 and Subnet mark 255.255.255.0.

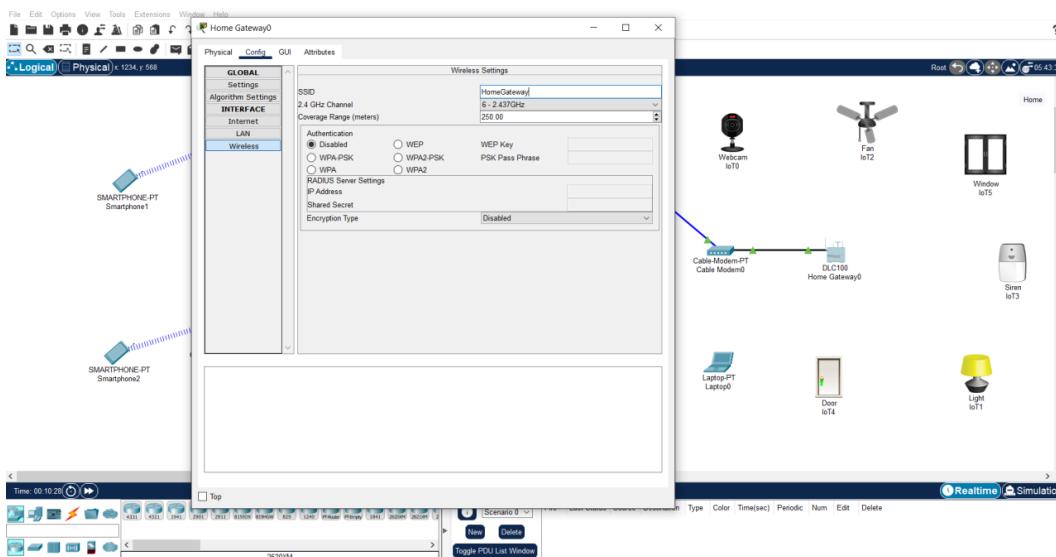


Now this step from the wireless network option we entered SSID Home HomeGateway and the coverage range is given 250.00 meters.

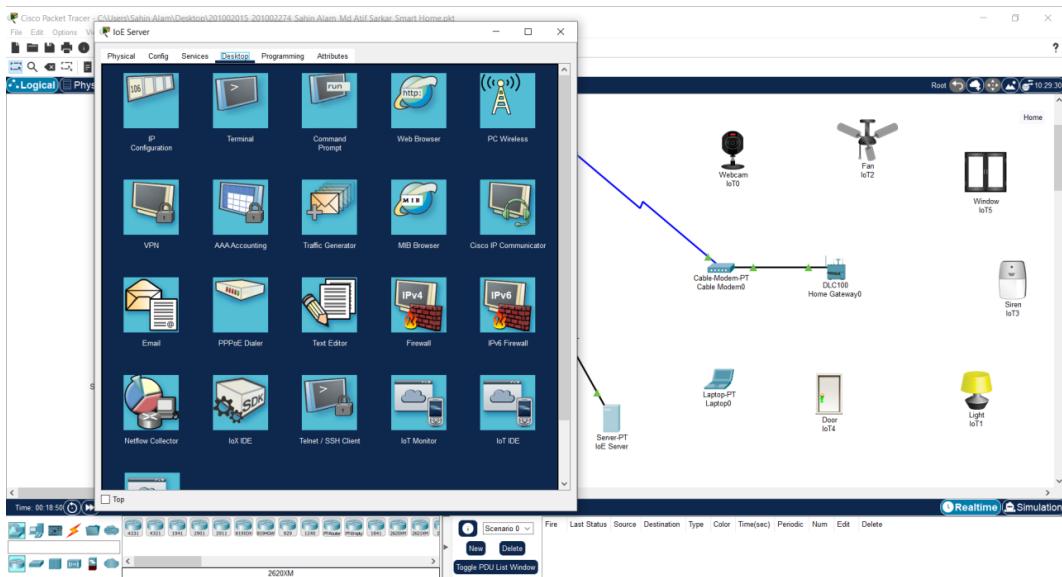


Step 11

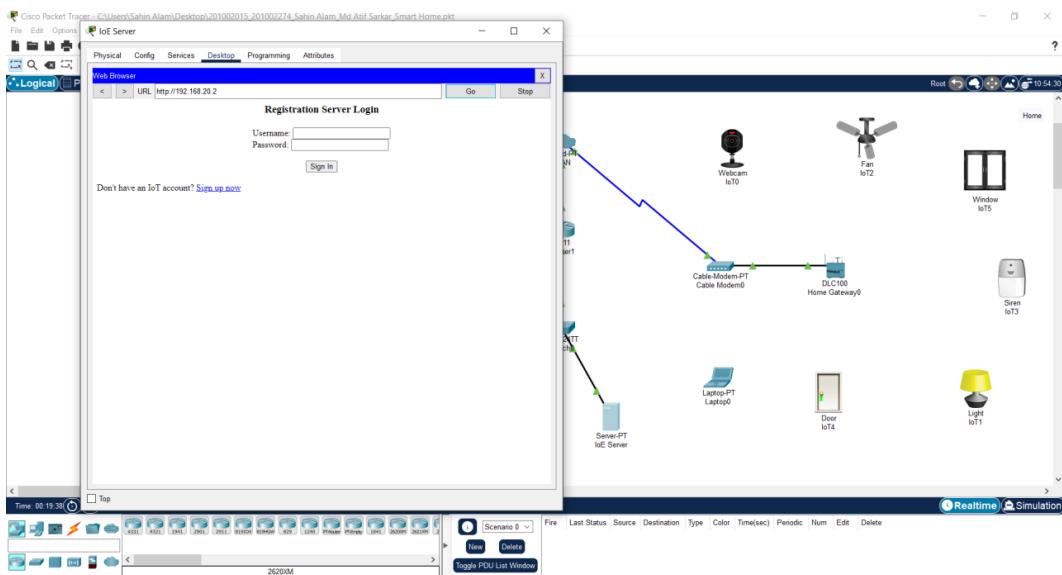
We will now register the IOE devices on the IOE server for which we need an admin username and password to do this we will click on the IOE server and go to the web browser option.



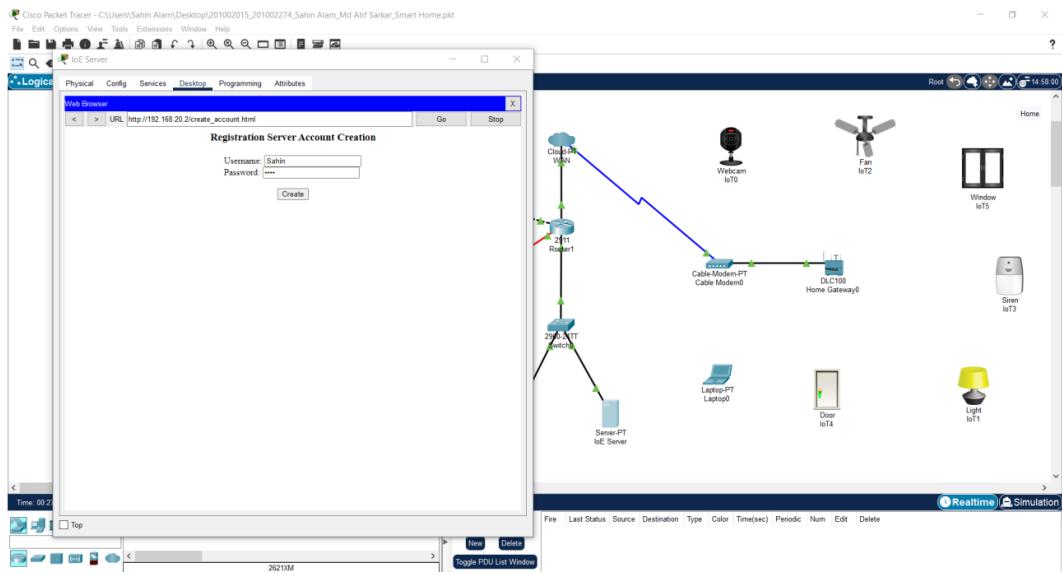
Now we will set the IP address of the URL IoE server as 192.168.20.2 and click the Go option then we will see a registration form in front of us.



We have done username sahin password Atif user registration form.



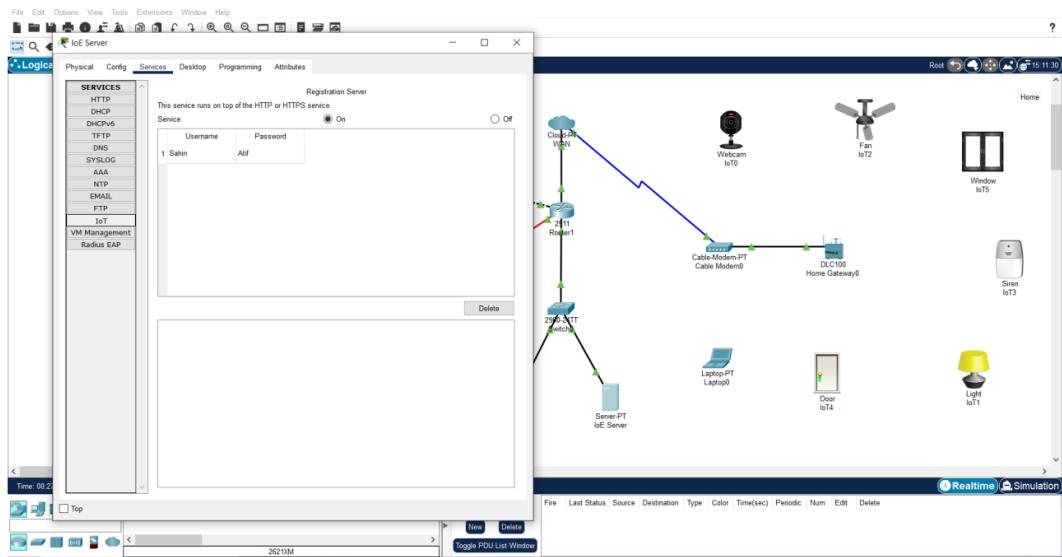
If we go to the IoT option of our IoE server, we will see the username and password as shown in the figure.



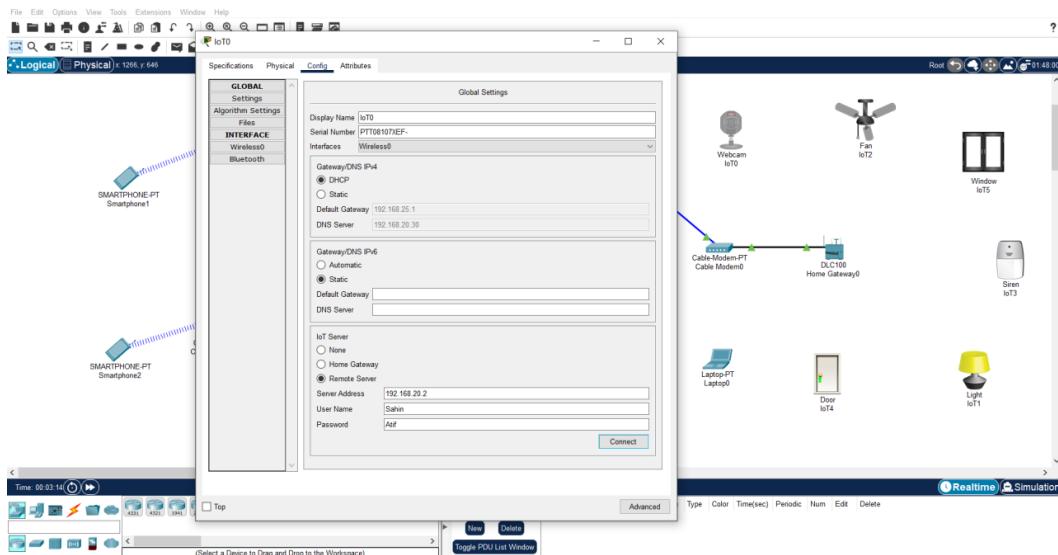
Step 12

For our IoT device configuration, only the devices need to be linked to the IoE server, that's all the setup work.

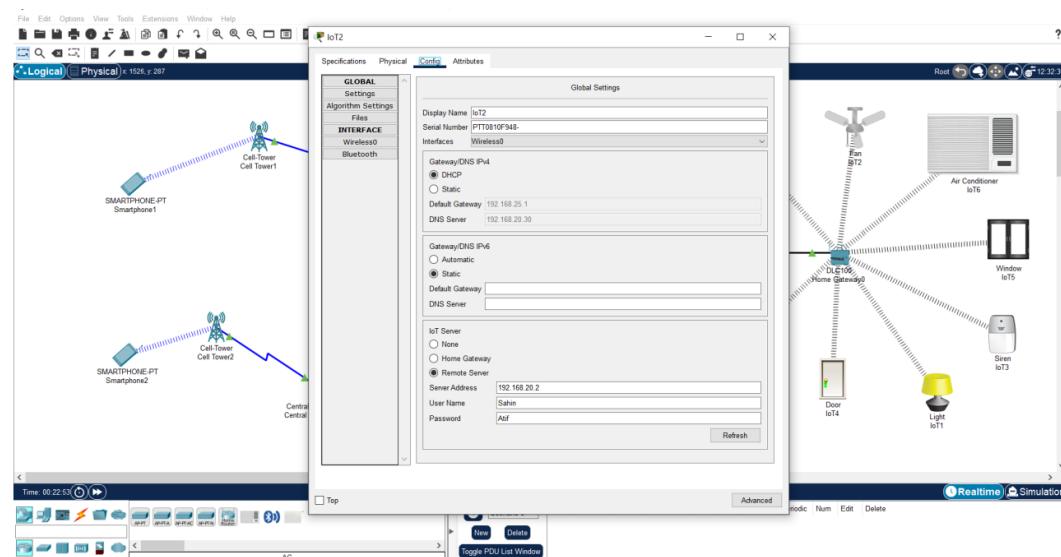
Now we will do wireless communication with our home gate example first we will set up a webcam in that case open the remote server option from the configure option server address i.e IoE server address will be set 192.168.20.2 username Sahin and password Atif click on the connect option Only then our Home Gateway will be connected with the device.



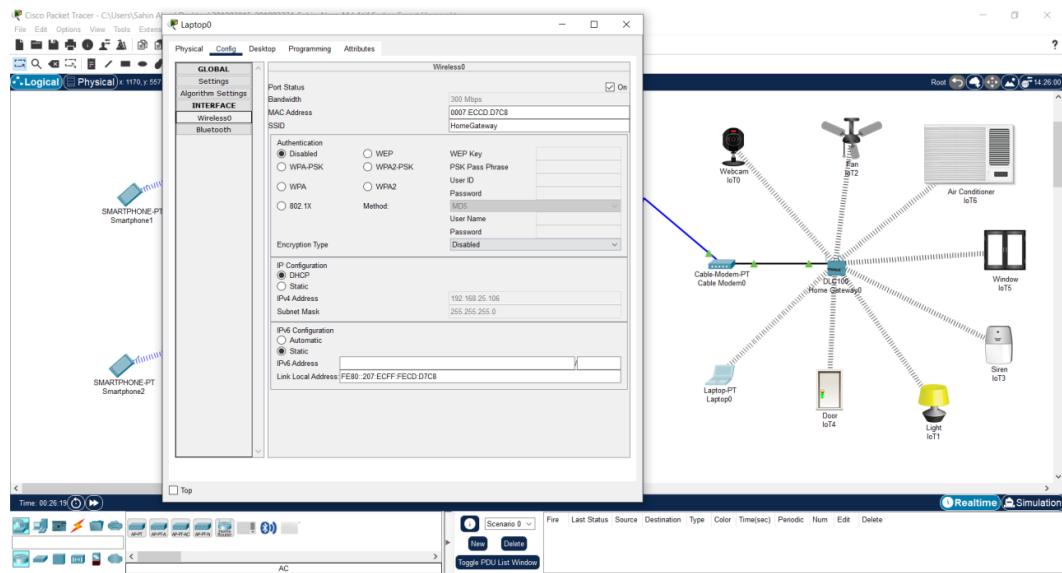
After that, if we want to connect to the fan, we have to connect in the same way, only if we connect with our server IP and username password, we will connect with the home gate.



Here the laptop is connected to the home gateway through wireless communication. To configure it, we have to go to any figure option of the laptop and from there go to the wireless0 option and connect if the SSID is HomeGateway.



Note: I have connected the IoT devices with the rest of the home grid in a similar manner.



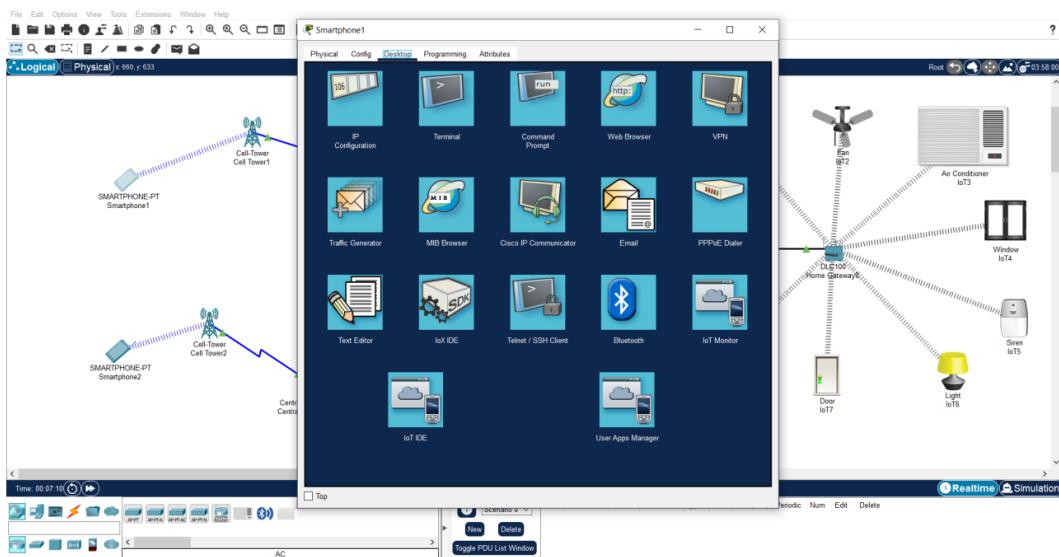
And through this, all configurations for our smart home have been completed successfully.

Chapter 4

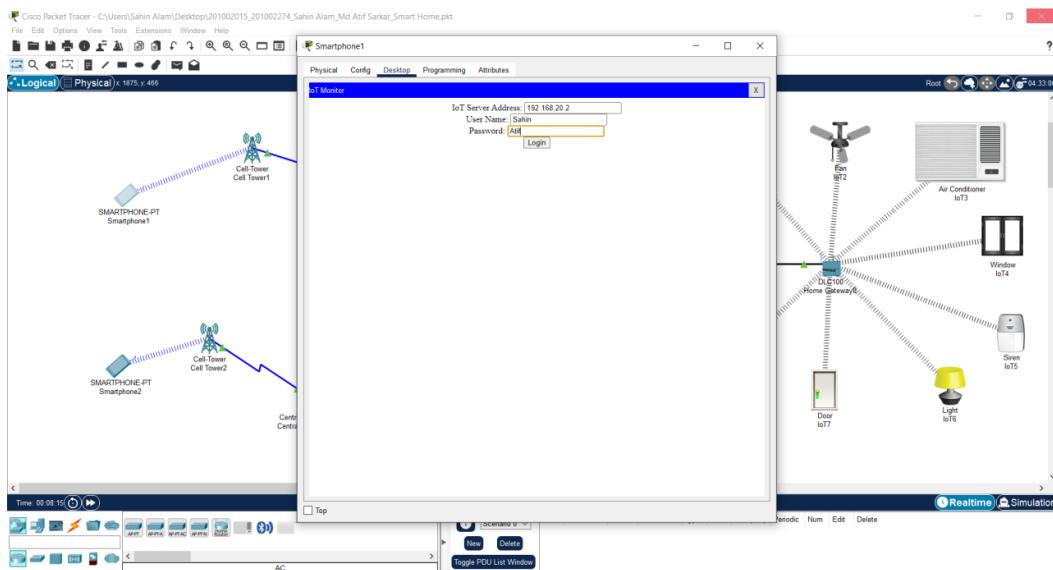
Performance Evaluation

4.1 Simulation Environment/ Simulation Procedure

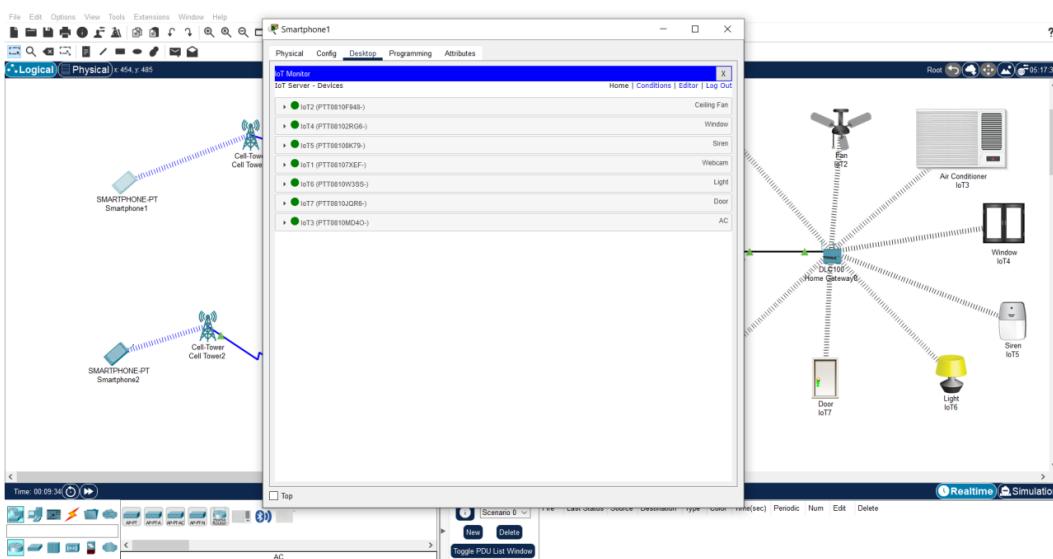
At this stage, we will see how our smartphone can be controlled through Cell Tower1, for this first we have to click on smartphone1 and then we have to click on the IoT monitor option.



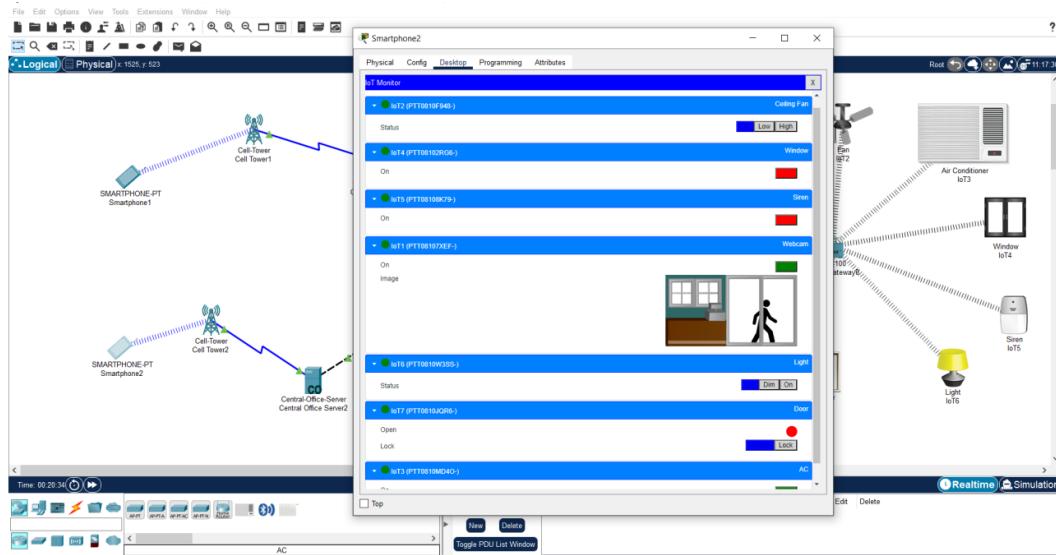
After clicking on the IoT Monitor option here we can see the IoT server address, user name, and password option here our IoE server address: is 192.168.20.2 Username: Sahin Password: Atif clicked login.



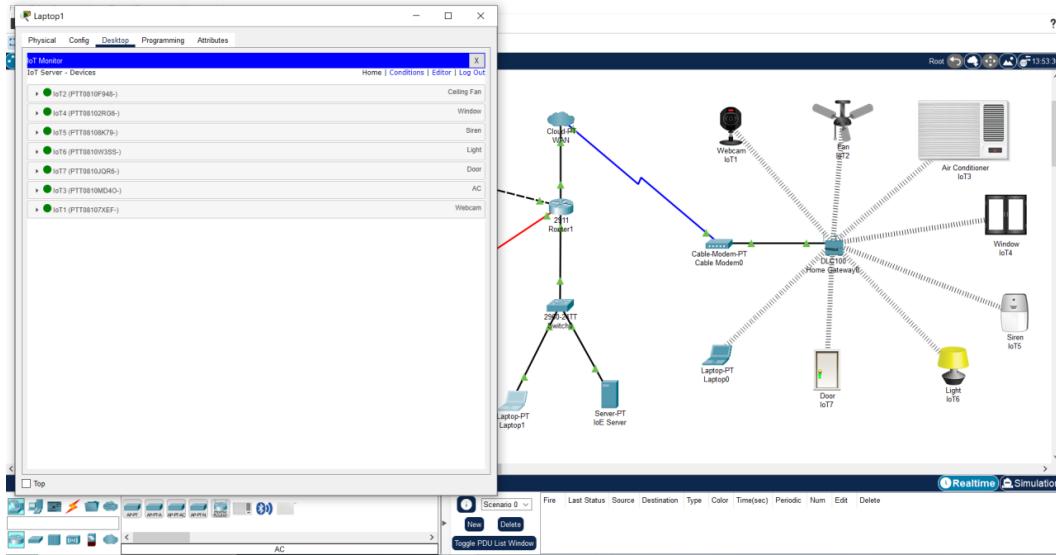
After giving our IoE server address and username password, as many IoT devices as there are in our home, the features of each device are displayed here.



Similarly, if we want to control smartphone2 devices from cell tower 2, we can control it from cell tower 2 in the same way by setting the user name password with the registration server.

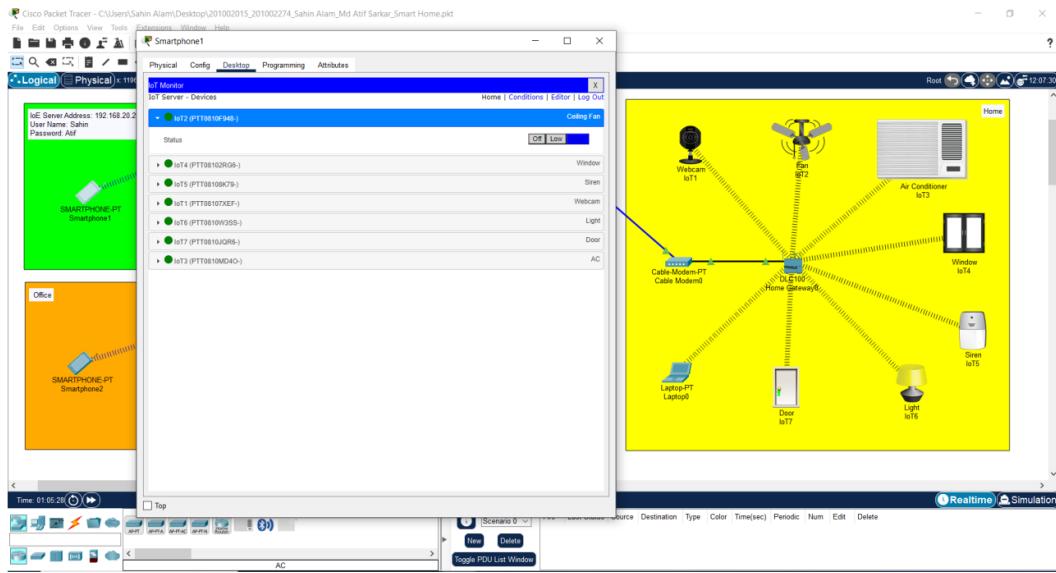


We have tried wireless communication as well as wire communication from laptop1 through the router to the home gateway in the same way. We have set IoE server address: 192.168.20.2 username: Sahin password: Atif and we can see the feature of controlling our smartphone.

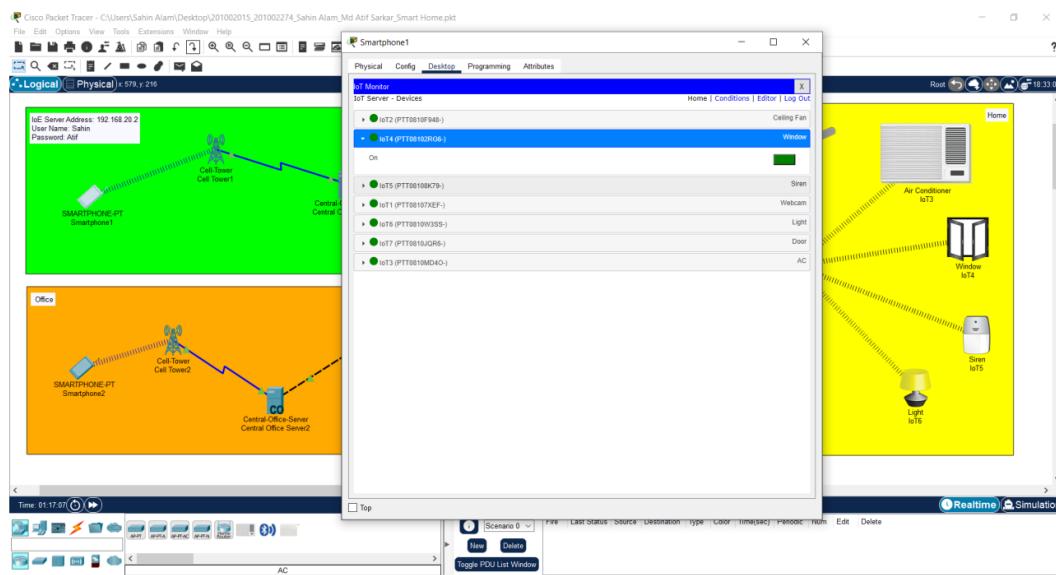


4.2 Results Analysis and Discussions

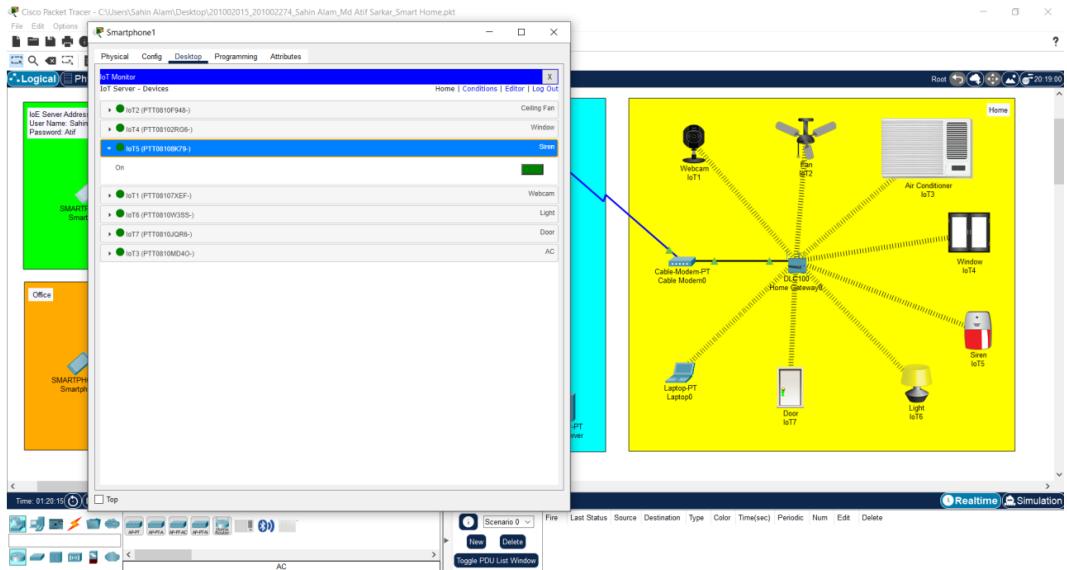
Ceiling fan: If we log in from any cell tower or laptop using Server Address: 192.168.20.2 Username: Sahin Password: Atif then the first feature we will see is the ceiling fan. The ceiling fan has three buttons, the first is the off button and the second is the low button. Through the third high button, we can control our ceiling fan.



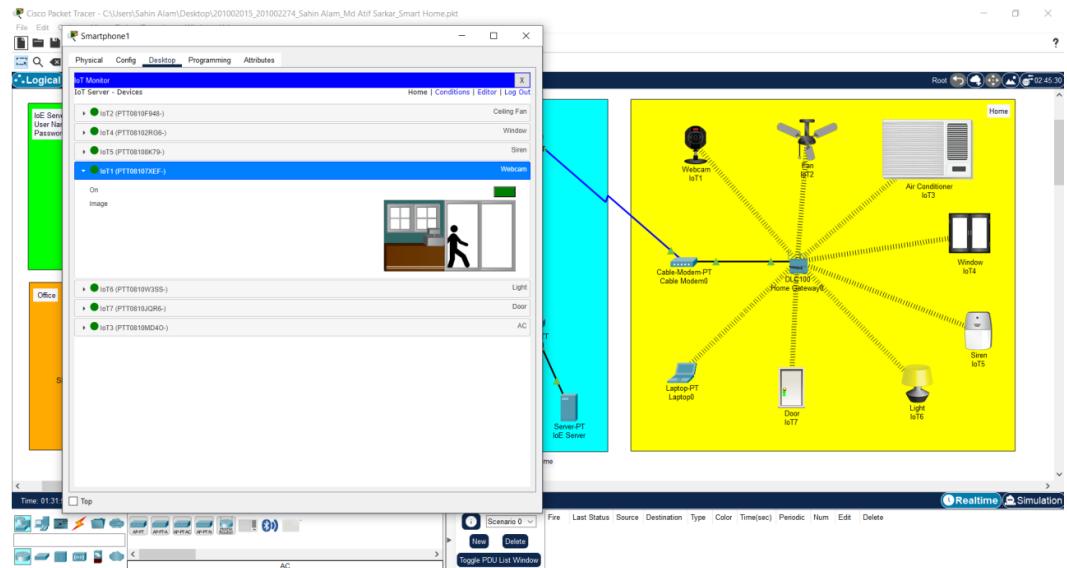
Window: The 2nd IoT device is a Window. A button is set for this, one part of the button is green and the other part is red. Press the red part to close the window and press the green part to open the window.



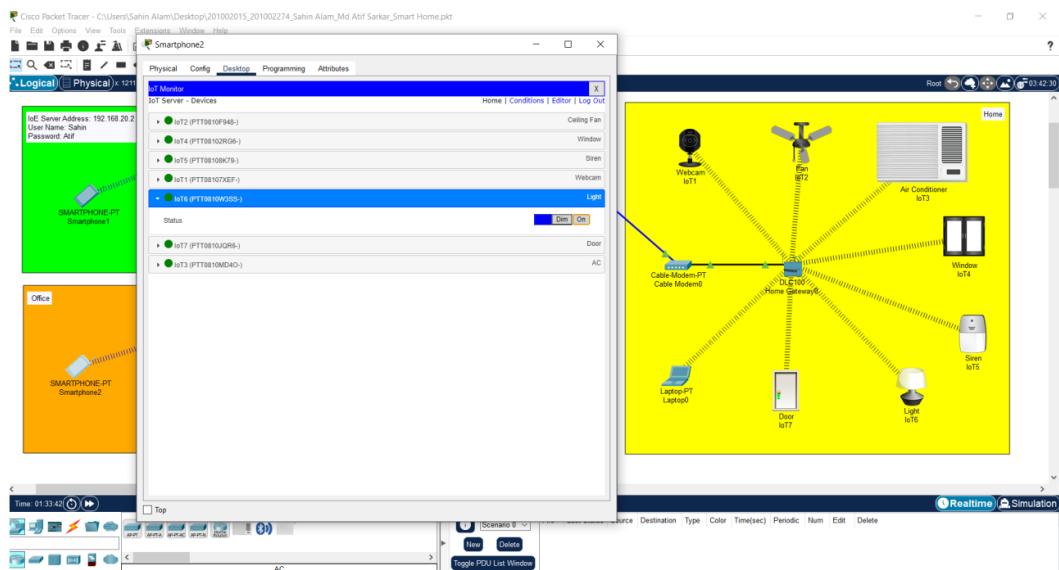
Siren: The third feature that appears here is the Siren. It has two buttons, a Read and a Green button.



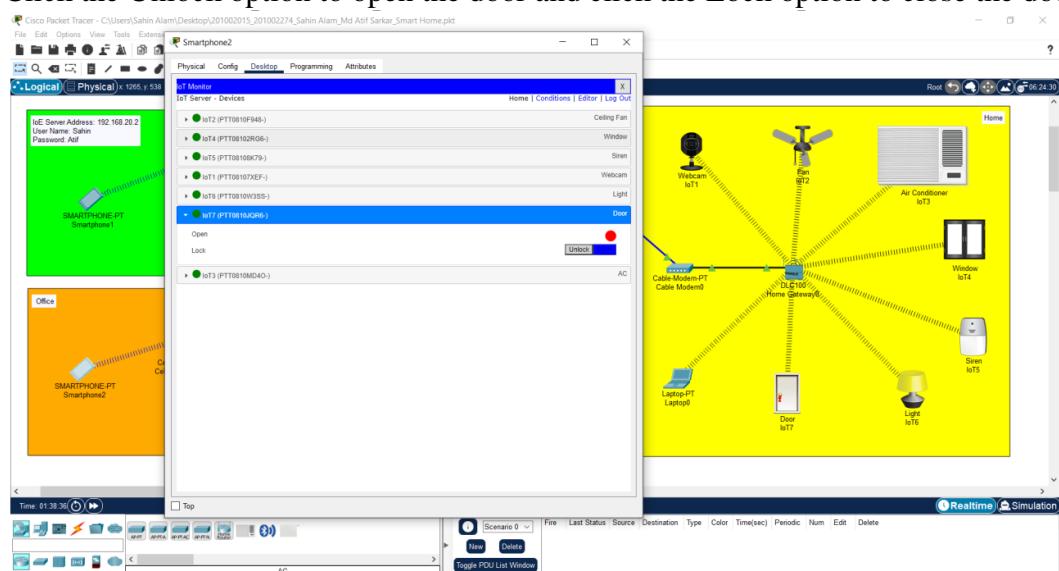
Webcam: Webcam: The 4th IOT device added Webcam. There is a button with one part red and the other green. Click on the green part to Open the Webcam and click on the red part to Close the Webcam.



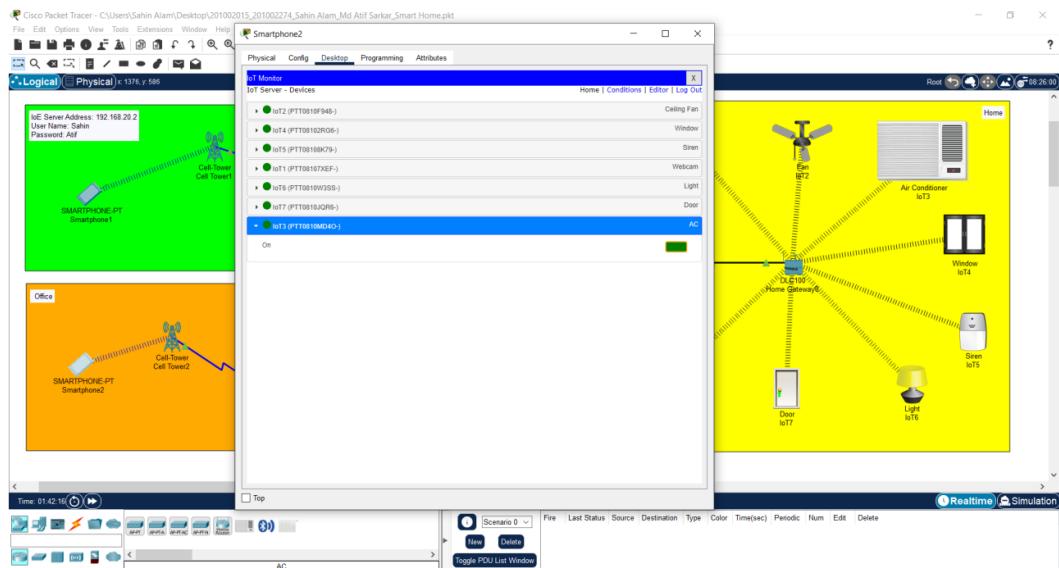
Light: Here is another IoT device that is for lights. Three buttons have been added for the lights OFF Button, Dim Button, and ON Button. Press the off button to turn off the light. If you want to reduce the voltage of the light or use it as a dim light, click on the Dim option and click on the button to use it as a light.



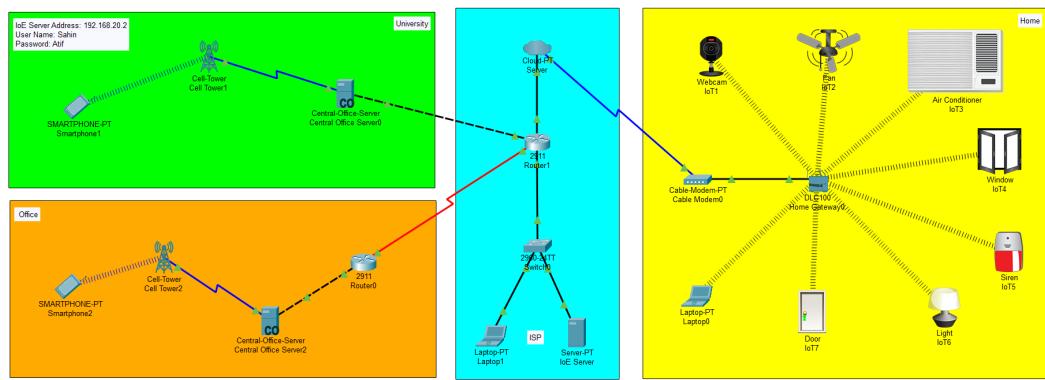
Door: The 5th IoT device that we can see is the unlock and lock option on the door. Click the Unlock option to open the door and click the Lock option to close the door.



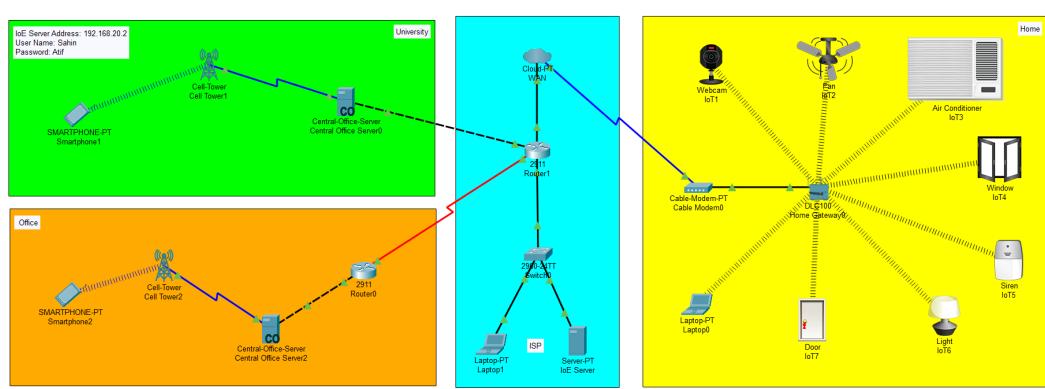
AC: The latest IoT device is an Air Cooler. There are two buttons here, one is red and the other is green. AC is turned on and off with these two buttons.



The final result is all IoT devices Off mood:



The final result is all IoT devices On mood



4.3 Test Case Output:

Finally, we controlled our smartphone through two cell towers and a cloud server. Since it is a wireless network, we encountered a problem while controlling the IoT device from our smartphone. We saw a latency of 5–6 seconds, and we retested the wired device, and there was no latency.

Chapter 5

Conclusion

5.1 Discussion

In this chapter, we have tried to conclude our project limitations future work opportunities, and advantages and disadvantages overall project.

5.2 Limitations

Smart home technology makes life easier and brings many advantages. But, some things make it difficult or not ideal. Some of the main problems with smart home technology are:

- 1. Cost:** Smart gadgets for an automated home can be costly, particularly if you need many devices to make a complete smart home setup. Smart home technology might not be available to many people because it can be too expensive.
- 2. Interoperability:** A big problem is that smart home devices and platforms don't work well together. Different devices work in different ways, which can make it hard to make them all work together smoothly. This may cause problems with making all your smart home devices work together smoothly.
- 3. Security and Privacy Concerns:** Smart home devices can easily be hacked or accessed by people who shouldn't be able to, which could lead to a violation of your privacy. Using weak and simple passwords, not updating the software, and not having good security can make your smart home network less safe. Keeping private information safe and making sure smart home gadgets are secure are still difficult things to do.
- 4. Reliability and Stability:** Smart homes need good internet and networks to work properly. If the network is not good, some things might not work. If the internet or electricity stops working, it can stop smart home devices from working properly, which makes them less trustworthy.
- 5. Lack of Standards and Regulations:** The use of technology in everyday things is

still changing and there are no set rules, laws, or common ways of doing things across the industry. This can cause confusion and disorder in the market, which makes it hard for customers to choose devices that work well together.

6. Power Consumption: Using smart home devices, which are always connected to the internet, can use a lot of electricity. This can lead to more expensive bills for electricity and harm to the environment, especially if the machines use a lot of energy.

5.3 Practical Implications:

- Light Control
- Lock system
- Kitchen Appliances
- Security systems
- Water level
- Composition of air
- Surveillance video
- Humidity
- Stress
- Accelerometer
- Computers and advanced speakers etc.

5.4 Scope of Future Work

Advanced Security and Privacy Measures: In the future, people will try to make smart homes more secure from hackers by making better ways to keep information secret, making sure only authorized people can access the system, and making sure people's privacy is respected.

Enhanced Interoperability: One big problem in the Smart Home Internet of Things (IoT) area is that different devices and platforms cannot easily work together. In the future, people can work on making sure that all types of smart devices can talk to each other better by creating some rules they all follow.

Artificial Intelligence and Machine Learning: Using artificial intelligence and machine learning can make smart homes work even better. In the future, people can use AI to make their homes smarter. This can help with things like automatically turning things on or off, making sure everything is working well, saving electricity, and creating

a customized experience for each person living there.

Energy Efficiency and Sustainability: Smart homes can help save energy and preserve the environment. In the future, people can work on making better computer programs and systems that help people use energy more wisely. This will also help people use renewable energy sources like solar and wind power. These systems will help homeowners know more about how they are using energy and make better choices.

Lack of Standards and Regulations: The use of technology in everyday things is still changing and there are no set rules, laws, or common ways of doing things across the industry. This can cause confusion and disorder in the market, which makes it hard for customers to choose devices that work well together.

Power Consumption: Using smart home devices, which are always connected to the internet, can use a lot of electricity. This can lead to more expensive bills for electricity and harm to the environment, especially if the machines use a lot of energy.

5.5 Conclusion

- ✓ Finally, we were able to successfully complete our smart home IoT-based project through a cloud server, but this task was not easy for us as we encountered various problems and solved them after many efforts, especially since two cell towers became one smart home. Control was new to us, so we ran into various complications and finally managed to solve them.
- ✓ Through this project, we tried to get a complete idea about controlling our home smart devices through a cloud server and cell tower, which will be useful in any IT sector in the future.
- ✓ By doing this project, we will be able to set up IoT devices in our own homes and take people's quality of life a step further as they use smart home technology.

5.6 References

1. <https://www.intechopen.com/chapters/65877>
2. <https://www.youtube.com/watch?v=KwhrRyWPv64>
3. <https://www.youtube.com/watch?v=EdYOZbX3r7s>