DEVELOPING A SMART UNIVERSITY NETWORK DESIGN

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February 6, 2023 -
February 12, 2023

TABLE OF CONTENTS

1. Introduction

Internet access in universities is essential for students to stay connected and informed. It allows students to access online resources, such as research databases, library catalogs, and online journals. It also provides a platform for students to collaborate with each other on projects and assignments. Additionally, internet access in universities enables students to stay connected with their peers and faculty members through social media platforms. This helps foster a sense of community among the student body and encourages collaboration between different departments and classes. Furthermore, internet access in universities allows students to stay up to date on current events and news from around the world. This helps them become more informed citizens and better prepare them for their future careers.

The Smart University project, was created using Cisco Packet Tracer, showcases a technologically advanced educational facility. The ground floor of the university features multiple rooms including a

1-Cafeteria

2-Chairman's Office

3-Library

4-Lecturer Room

Providing students with all the resources necessary for a comprehensive learning experience. The first floor consists of four classrooms designed for an optimal learning environment. Outside the university, there is a garage that uses advanced technology to detect the arrival of a car and opens to lead the way to a beautiful garden. In addition to this, there are two service rooms outside the university - an Internet Service Provider Room, equipped with multiple servers for DNS and email use, and a Television Service Provider Room, providing students and staff with additional amenities. This report will provide an overview of the Smart University project, highlighting its features, capabilities and the use of cutting-edge technology to create a modern and efficient learning environment.

2. Equipment

Image	Type	Justification	Quantity
	Server	Provides central interface to manage users, implement security and other administrative processes Manages and monitors client computers and/or operating systems	**12**
	Switch	Cisco 2960 Series Switches provide a range of security features to limit access to the network and mitigate threats	**10**
	Router	Cisco 2811 routers are an excellent choice for organizations looking for a versatile, reliable, and feature-rich solution for their WAN link capability.	**2**
	Router	Cisco 1841 router were used because it can allow two WAN connections using serial port and because it can hold a lot of traffic that is why we used it as main router.	**1**

	PC	The use of PCs is essential for facilitating communication, managing data, and promoting flexibility and cost-effectiveness. PCs are used.	**22**
	Laptop	It functions as a device that uses wireless connectivity	**4**
	Printer	It provides office workers the ability to copy documents, it's essential in every office.	**4**
	TV	It functions as a device that uses wireless connectivity	**1**
	Motion detector	An electrical device that utilizes a sensor to detect nearby motion. Form a vital component of security, automated lighting control.	**2**
	Motion sensor	An electrical device that utilizes a sensor to detect nearby motion. Form a vital component of security, automated lighting control.	**3**
	Webcam	It is used either for video calls or for security with the help of motion detector	**4**
	Smoke detector	It's used alongside with fire sprinkler and siren to detect if fire lit up	**1**
	Alarm motion sensor	This allows to monitor the activity in a specific area and respond quickly to potential security threats with the help of motion sensor	**2**
	Access point PT	Access points play an important role by providing wireless connectivity, improved coverage, and bandwidth management.	**2**
	SBC BOARD	SBC boards used as embedded systems to control IoE devices automatically.	**4**
	Fire sprinkle	fire sprinklers are important for life safety, property protection, business continuity, and insurance savings.	**1**
	Solar panel	solar panels are a smart investment that can provide cost savings, energy efficiency, and long-term returns. By harnessing the power of the sun, organizations can reduce their energy consumption, lower their utility bills, and make a positive impact on the environment.	**1**
	Smart phone / Tablet	It functions as a device that uses wireless connectivity	**5**
	Power meter	Used alongside of solar panel to monitor the power for energy consumption.	**1**
	Battery	Used to power the LED light for demonstration alongside of Solar panel and power meter	**1**
	Wind detector	For weather monitoring if the window is opened.	**1**

	Smart Window	it's used alongside of co2 detector to open when co2 is detected in the room.	**1**
	Led	For demonstration of the usage of battery and solar panel	**1**
	Carbon monoxide detector	It's used alongside with window to detect if co2 is detected the server opens the windows.	**1**
	Potentiometer	Used to modify sound level for home speaker	**1**
	Home speaker	Used for demonstration alongside with potentiometer	**1**
	Air conditioner	Air conditioner provides comfortable working environment, it's used with temperature monitor to adjust the temperature based on how hot/cold the room	**1**
	Temperature monitor	Temperature monitor used to adjust room temperature and monitor the temperature inside the room `	**1**
	Rocker switch	Used as on and off switch for fan and lawn sprinkler with the help of SBC	**2**
	Fan	Ceiling fan provides comfortable working environment, it's used with rocket switch to be turned on and off as well as controlled using IOE server	**1**
	Lawn sprinkler	Used in garden to control the plants moisture. Can be either turned on and off using rocket switch or with IOE server.	**1**
	Cell tower	They provide a cell connection for all phones and tablets inside the university provided by ptCellular	**1**
	copper straight through	a type of twisted pair copper wire cable for local area network (LAN) uses for which the RJ-45 connectors at each end have the same pinout.	**61**
	Serial DTE Cable	to connect a Data Terminal Equipment (DTE) device (for example, a computer) to a Data Communications Equipment (DCE) device (for example, a modem).	**2**
	Coaxial Cable	the use of coaxial cable is essential for television to provide connect for the university	**1**
	IoT custom Cable	They ensure that their IoT network is optimized for their specific needs and requirements.	**12**
	Cloud PT	They are used to provide content for TV from TV service provider using coaxial cable	**1**
	Garage door with sensor	The use of a garage door equipped with a sensor provides several benefits, including improved security, convenience, safety, and energy efficiency.	**1**

	Wireless Router	Cisco WRT-300N is used for wireless connectivity, wireless speed ideal for interruption sensitive applications like HD video streaming. provides separate access for guests while securing network.	**1**

3. Design Requirements

1. Internet Service Provider Room: It will serve as Server room, it has three servers (DCHP, DNS/Web, Email) also, a PC to connect monitor IoT devices and a TV. Then, there is a webcam to monitor and a fan that is connected to an SBC to use a rocket switch to turn it on and off. All devices are connected to a switch and to the main router. Also, a garden with lawn sprinkler that can be either turned of and on via rocket switch or automated from ISP room.

2. Television Service Provider Room: will have a monitor pc, a printer, and a server that stores TV information, and a cloud that uses coaxial cable to provide TV content to the TV. Also there is a garage door for the room that works with a motion sensor. All devices relate to one switch as hub.

3. University building: the building must have two floors one for classes and another one for library, lecturer room, cafeteria, and chairman office.

4. Routers and Switches: All routers and switches must be protected by passwords and encryption

5. End Devices: All end devices must be configured accordingly and can access each other and can access the server room but can only allow 3 protocols to access DNS/Web server (ICMP, UDP, TCP).

6. Wi-Fi devices: Each floor must have at least one access point that are connected to WRT-300N router, also all Wi-Fi devices must be secured by a password.

7. Automation: Preferably IoE devices must have the ability to be controlled using the servers inside each room.

8. Conditions: Some devices can have a way to work together using IoE server conditions. Like Smoke detector can turn on Fire Sprinkler and Siren if smoke is detected.

4. Topology

The topology we used with the Smart University Network was Star Topology, because it provides a centralized and easily manageable network structure. In a star topology, all nodes connect to a central hub, which makes it easy to add, remove or troubleshoot individual nodes without affecting the rest of the network. Additionally, the use of a hub or switch in a star topology helps to reduce the likelihood of network congestion or collisions, resulting in a more reliable and efficient network. Some additional benefits of using a star topology in computer networks are:

Scalability: The star topology is highly scalable, and new nodes can be easily added to the network by connecting them to the central hub.

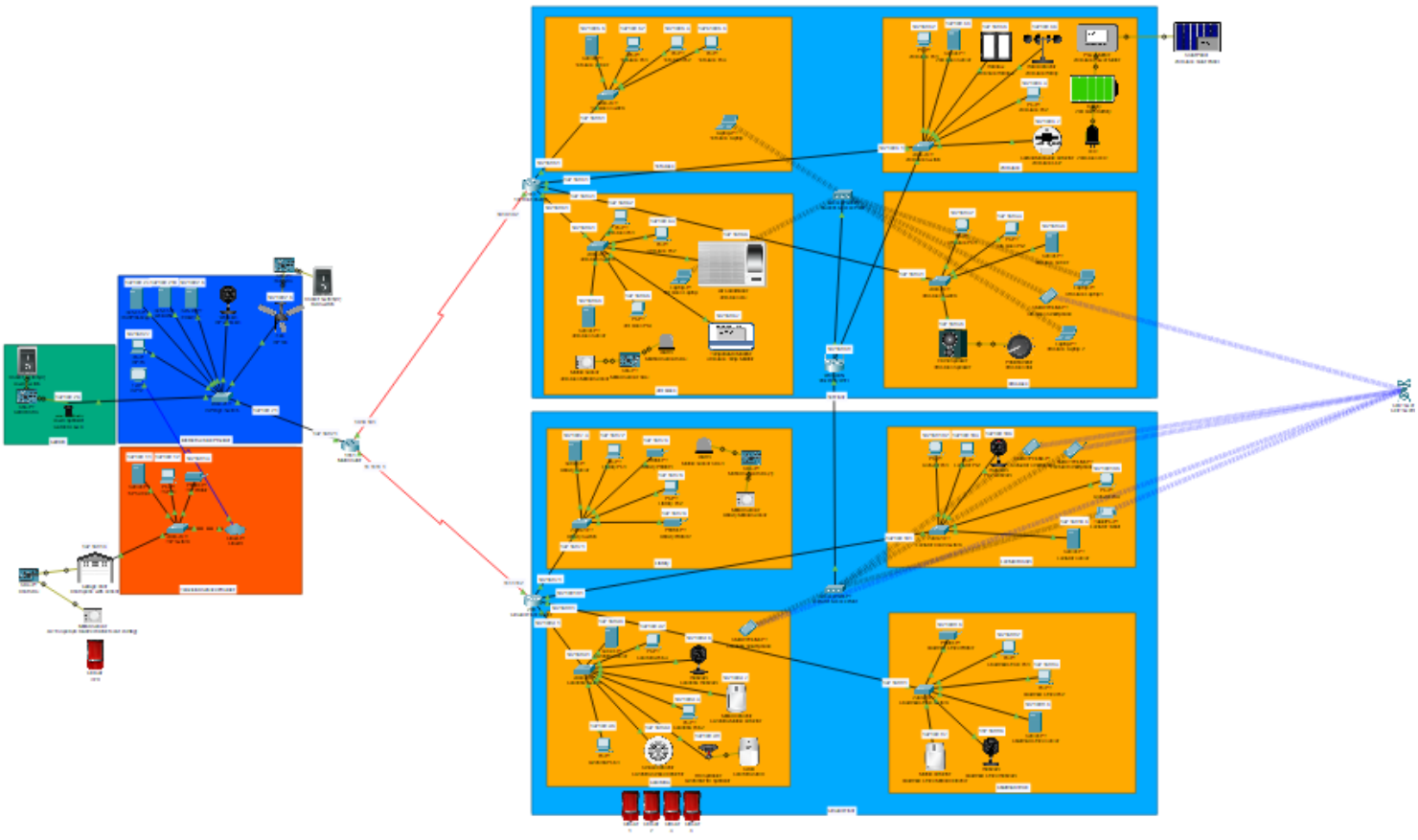
Fault-tolerance: In case a node fails or there is a cable break, only the affected node is impacted while the rest of the network continues to function.

Easy to diagnose issues: Troubleshooting a star topology network is straightforward as the central hub acts as a single point of control for the network, making it easy to locate and fix problems.

Security: A star topology can be secured by placing a firewall or other security devices at the central hub to prevent unauthorized access to the network.

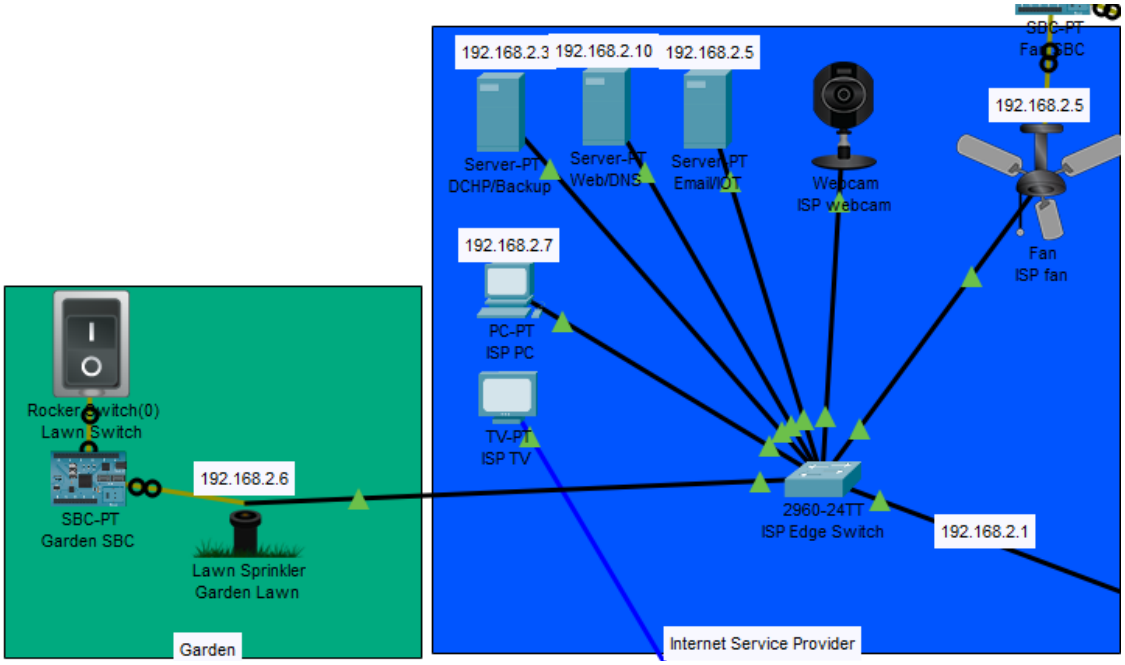
Flexibility: Star topology can support different types of network connections, including wired and wireless connections, making it versatile and adaptable to changing network needs

Full Topology:

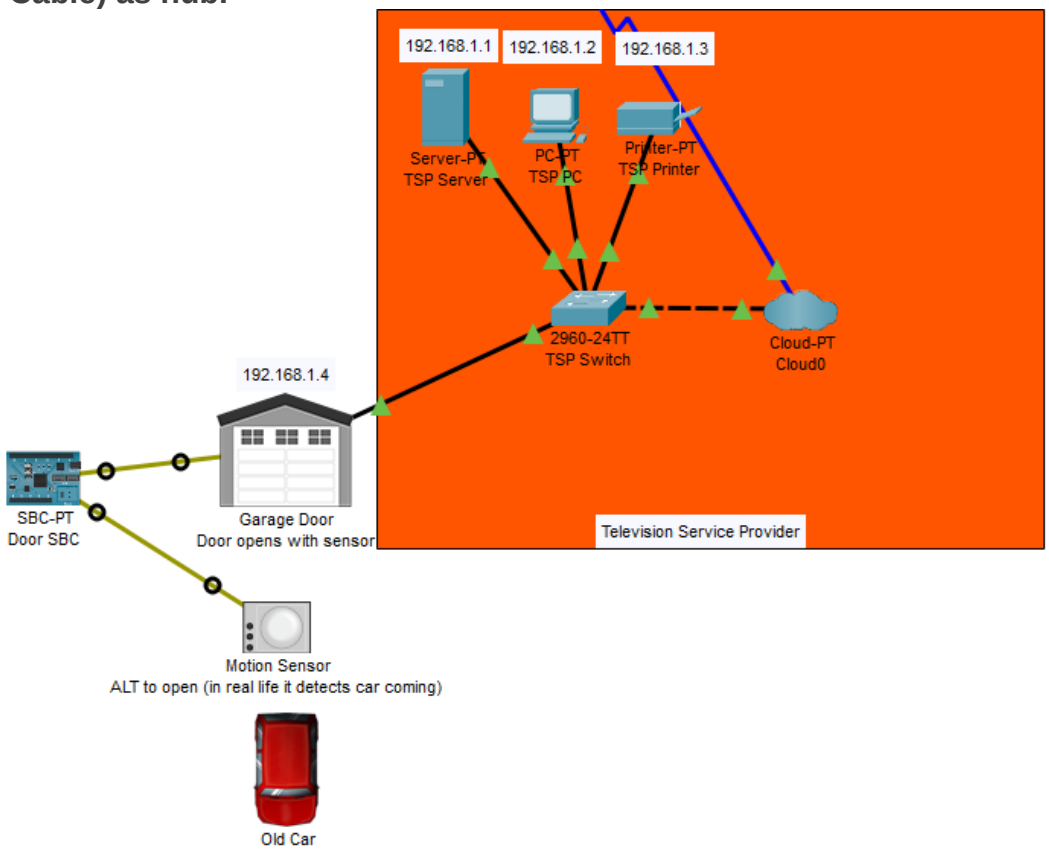


1- Each room are connected with Star topology.

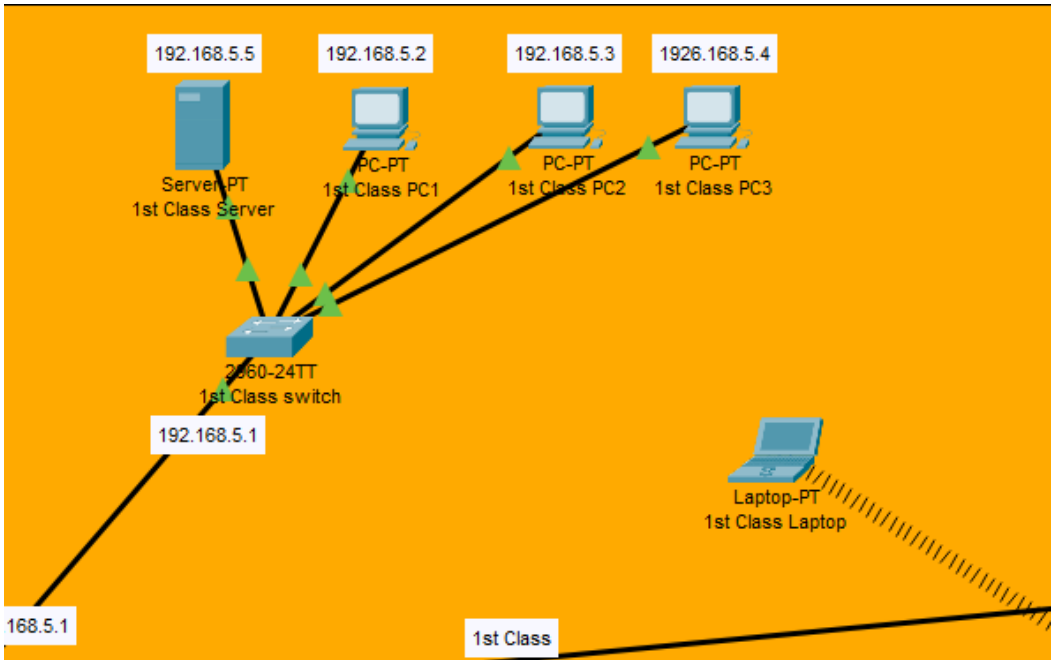
1- Internet Service Provider Room: All devices that includes servers, PC, Webcam, a Fan, as well as a Lawn Sprinkler are connected to Cisco 2960-24TT switch via (Copper Straight-Through Cable) as hub. The IOE devices are connected to SBC using (IoT custom cable). Also, the TV is provided from Television service provider room via Coaxial cable



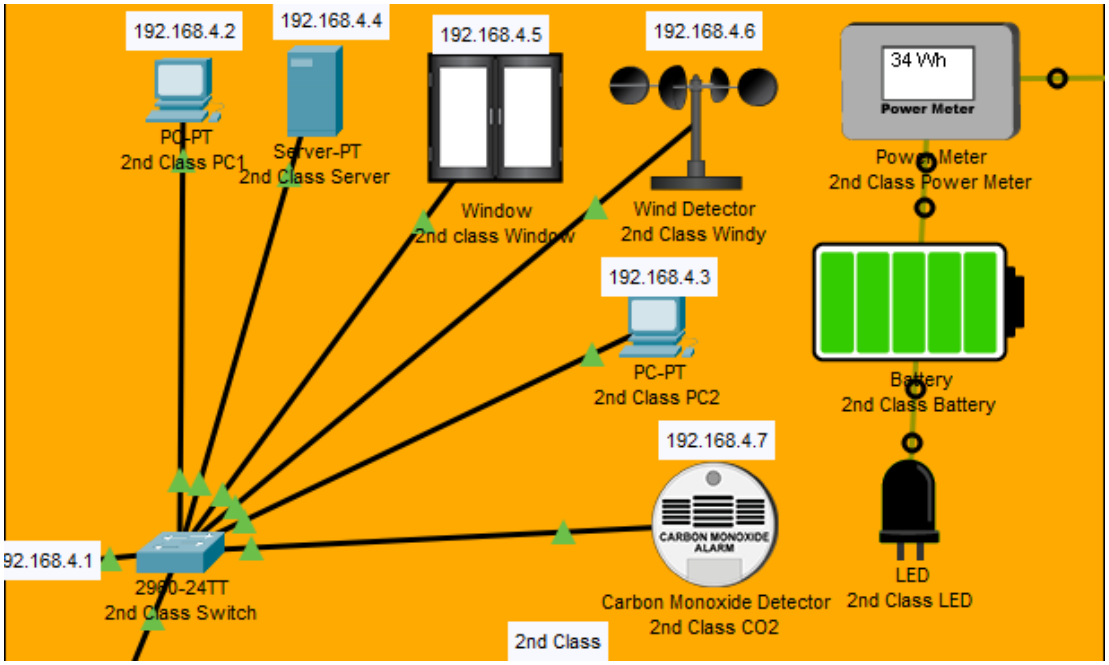
2- Television Service Provider Room: All devices that includes servers, PC, Printer, a Cloud that provide TV content that links with the TV in internet service provider room using coaxial cable, and a smart garage door that works with a motion sensor using IoT custom cable. The devices are connected to Cisco 2960-24TT switch via (Copper Straight-Through Cable) as hub.



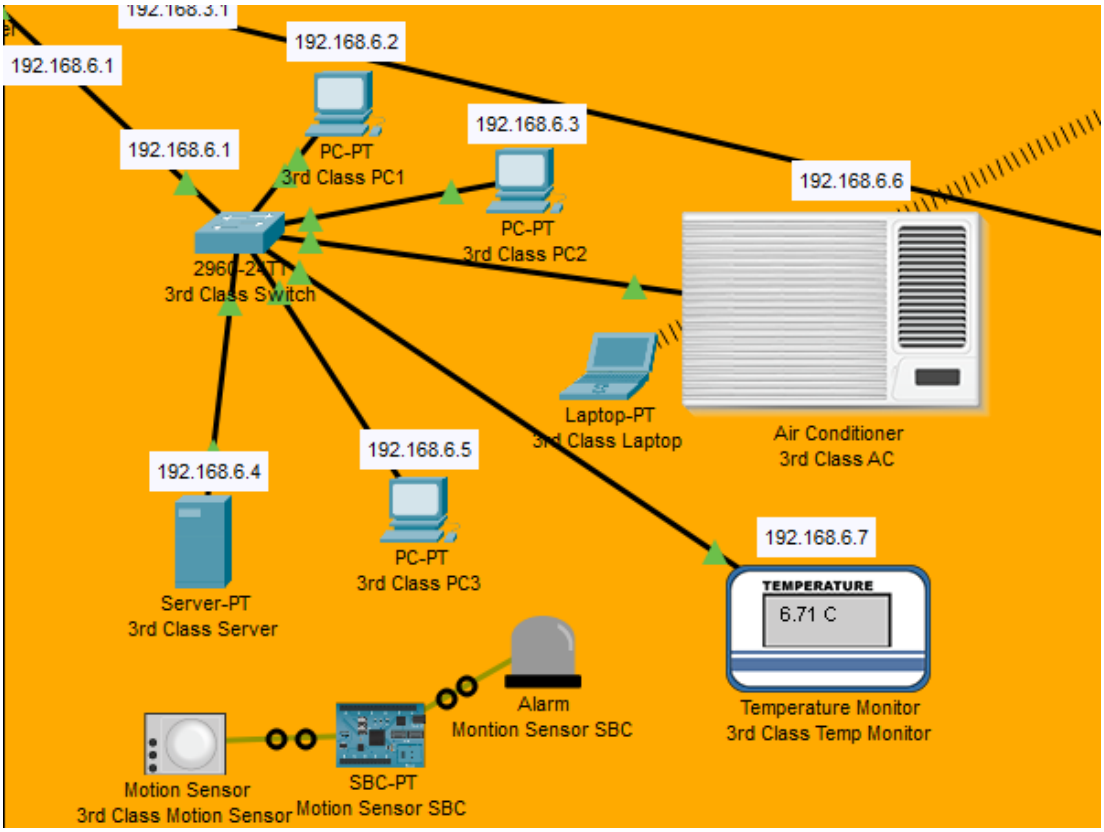
Eight Rooms in the university building each have a server, pc, IoE devices that connected as Star Topology using a Cisco 2960-24TT as hub.



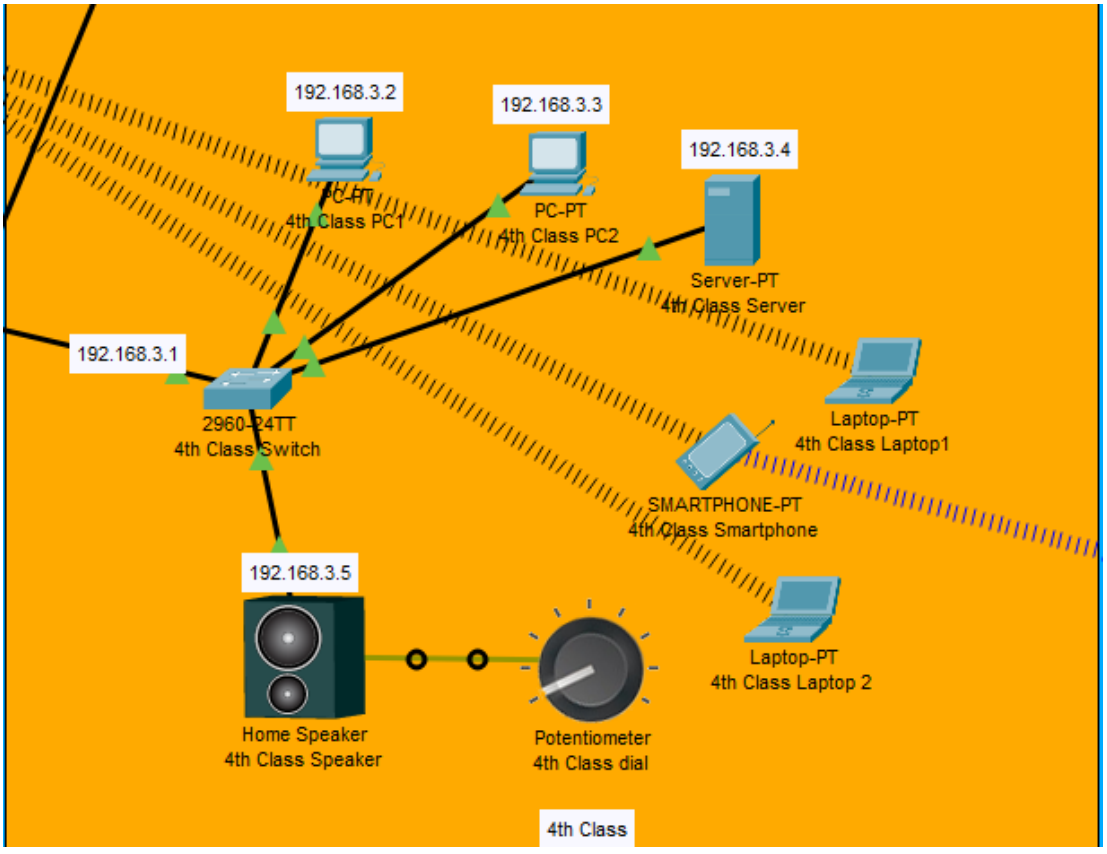
*All devices are connected with (Copper Straight-Through Cable) except the laptop is connecting wirelessly (we will talk about that later)



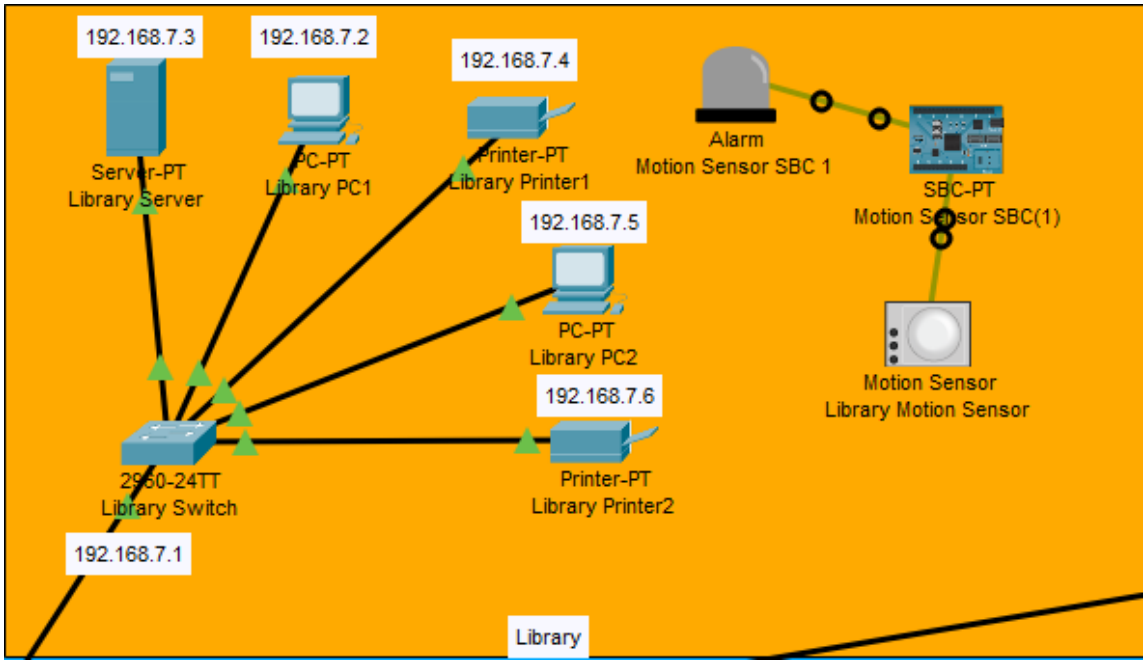
*This room also have an LED that works using a solar panel via IoT custom cable but other devices are connected to the switch using (Copper Straight-Through Cable), Also a Carbon monoxide detector that if it detects a gas in the air it the server opens the window in order to reduce gas level.



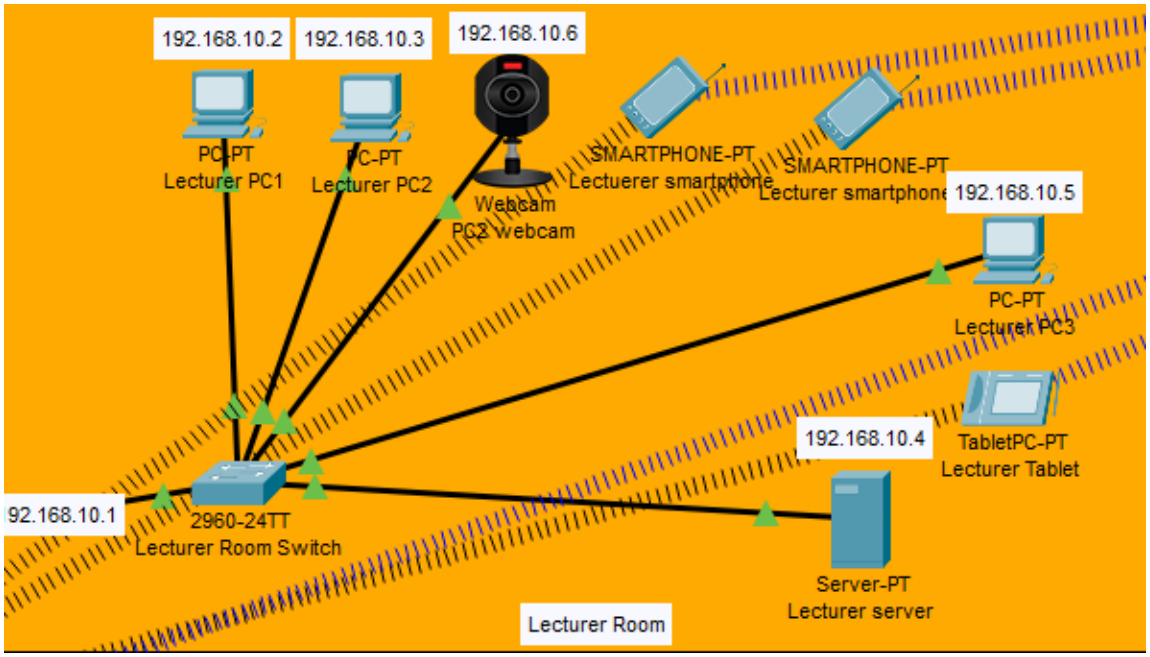
*This room have an Air conditioner that turns on when Temperature is more than 20C and turns off when Temperature is less than 5C. Also have a motion sensor that turns an alarm if someone came close to server.



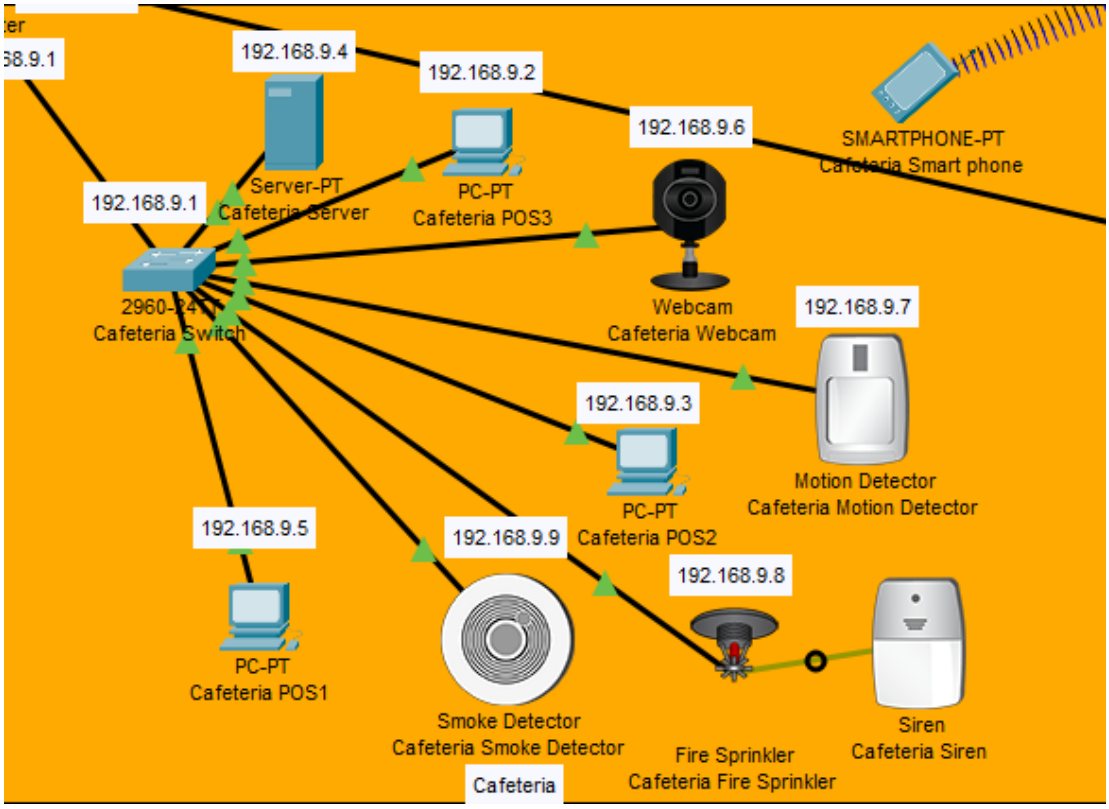
*This room have a Home Speaker that have a potentiometer to control sound level, both are connected via IoT custom cable, The two laptops and smartphones are connected wirelessly with wireless router (we will talk about that later) other devices are connected to 2960-24TT switch with star topology using the switch as a hub, the cable used is (Copper straight-through cable)



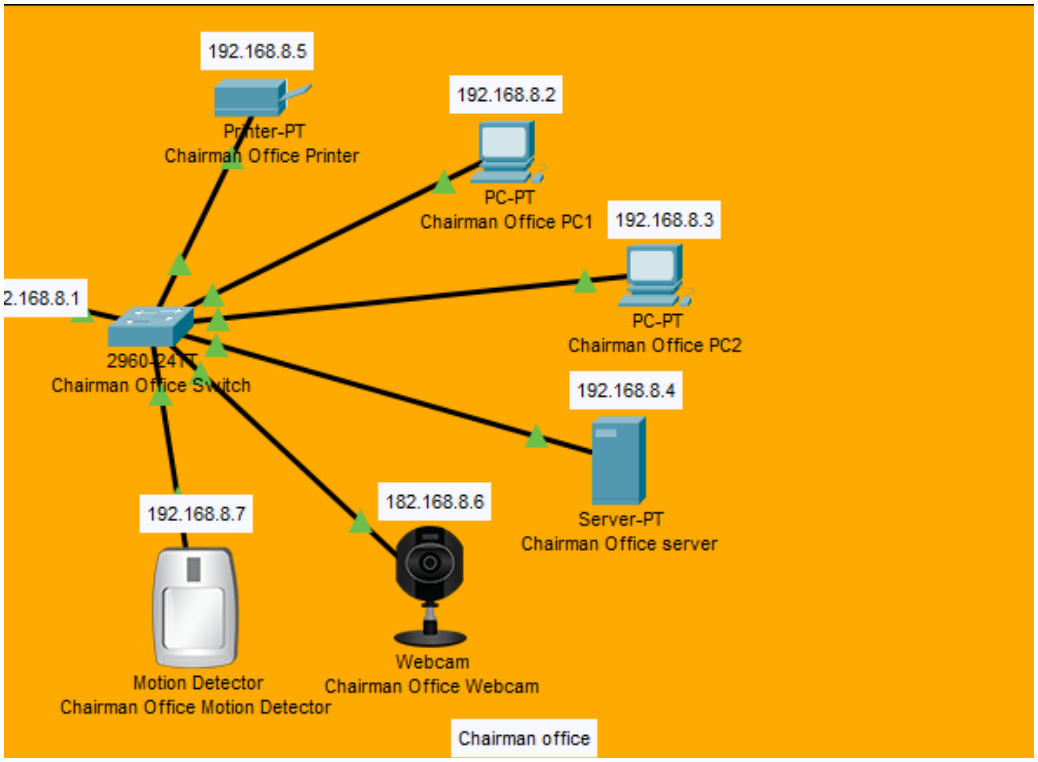
*All devices (server, pc client, printers) are connected to the switch using(Copper Straight-Through Cable) Also have a motion sensor that turns an alarm if someone came close to server.



*All devices (server, pc client, printers, webcam) are connected to cisco 2960-24TT switch using (Copper Straight-Through Cable) except the tablets and smartphones are connecting wirelessly to a wireless router (we will talk about that later)

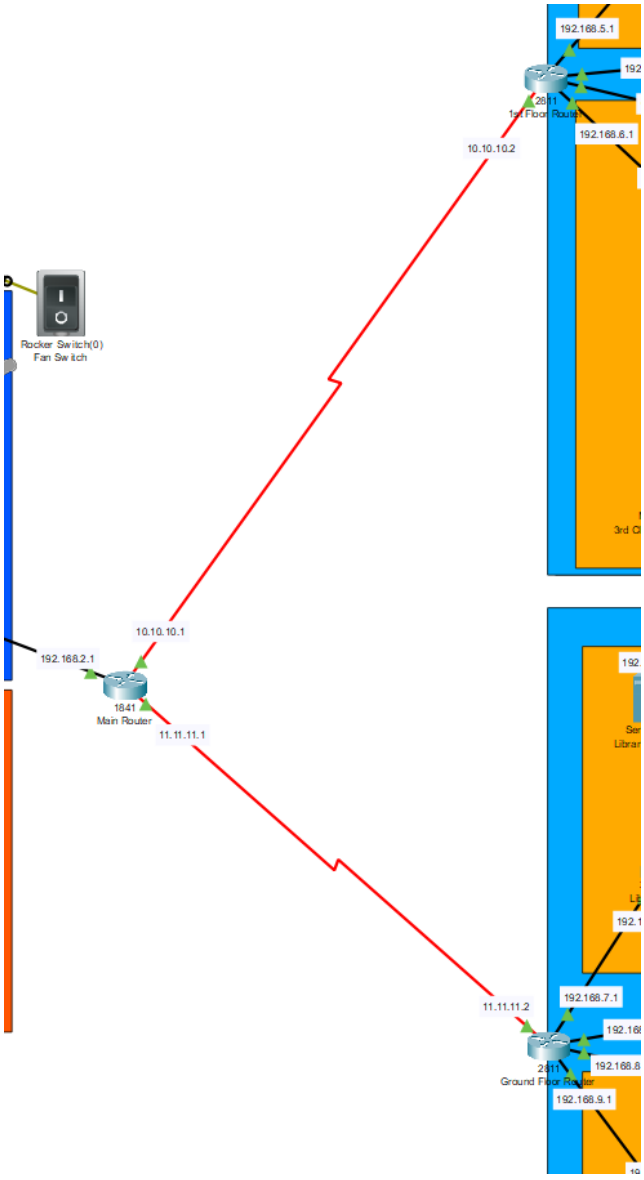


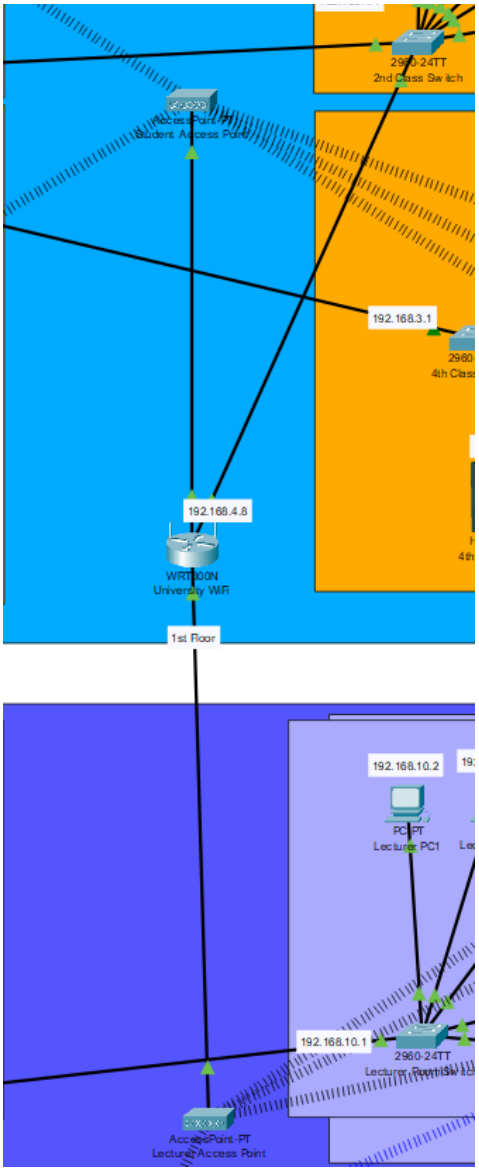
*All devices (server, pc client, IoE) are connected to the switch using(Copper Straight-Through Cable) Also have a motion detector that makes the server turns on the webcam when a motion is detected, also a smoke detector that makes the server turns on the fire sprinkler and siren if smoke is detected, there is also a smartphone are connecting wirelessly to a wireless router (we will talk about that later).



*All devices (server, pc client, printers, IoE) are connected to the switch using(Copper Straight-Through Cable) Also have a motion detector that makes the server turns on the webcam when a motion is detected.

2- We have a star topology for connect each floor's router to a main router, and a Wi-Fi Router that have two access points connected to it





*The main router has 3 cables connected to it, a (copper straight-through cable) that connects to ISP switch, and two Serial DTE cables each of them are connected to a router simulating a WAN connection.

*The wireless router (WRT-300N) is connected to 2nd class switch (as the researchers used) mostly because it's usually have no traffic and can handle the other Wi-Fi devices connected to it easily. The wireless routers connects to Two Access points to provide two Wi-Fi connections (Students Wi-Fi which is restricted, and Lecturer Wi-Fi which is less restricted) they both connect with copper straight through cable

5. Device configuration

Outside The University:

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
Main Router	FastEthernet 0/0	192.168.2.1	255.255.255.0	N/A
	Serial 0/0/0	10.10.10.1	255.0.0.0	N/A
	Serial 0/1/0	11.11.11.1	255.0.0.0	N/A
ISP Edge Switch	VLAN 1	192.168.2.20	255.255.255.0	192.168.2.1
ISP Webcam	FastEthernet 0	192.168.2.4	255.255.255.0	192.168.2.1
ISP Fan	FastEthernet 0	192.168.2.5	255.255.255.0	192.168.2.1
ISP Email Server	FastEthernet 0	192.168.2.2	255.255.255.0	192.168.2.1
ISP DNS/Web Server	FastEthernet 0	192.168.2.10	255.255.255.0	192.168.2.1
ISP DCHP/Backup Server	FastEthernet 0	192.168.2.3	255.255.255.0	192.168.2.1
ISP PC	FastEthernet 0	192.168.2.7	255.255.255.0	192.168.2.1
Garden Lawn Sprinkler	FastEthernet 0	192.168.2.6	255.255.255.0	192.168.2.1
TSP Switch	VLAN 1	192.168.1.10	255.255.255.0	192.168.1.1
TSP Server	FastEthernet 0	192.168.1.1	255.255.255.0	192.168.1.1
TSP PC	FastEthernet 0	192.168.1.2	255.255.255.0	192.168.1.1
TSP Printer	FastEthernet 0	192.168.1.3	255.255.255.0	192.168.1.1
TSP Garage Door	FastEthernet 0	192.168.1.3	255.255.255.0	192.168.1.1

Inside university:

Ground Floor

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
Ground Floor Router	FastEthernet 0/0	192.168.7.1	255.255.255.0	N/A
	FastEthernet 0/1	192.168.8.1	255.255.255.0	N/A
	FastEthernet 1/0	192.168.9.1	255.255.255.0	N/A
	FastEthernet 1/1	192.168.10.1	255.255.255.0	N/A
	Serial 0/2/0	11.11.11.20	255.0.0.0	N/A

Cafeteria Room

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
Cafeteria Switch	VLAN 1	192.168.9.10	255.255.255.0	192.168.9.1
Cafeteria POS1	FastEthernet0	192.168.9.5	255.255.255.0	192.168.9.1
Cafeteria Smoke Detector	FastEthernet0	192.168.9.9	255.255.255.0	192.168.9.1
Cafeteria Fire Sprinkler	FastEthernet0	192.168.9.8	255.255.255.0	192.168.9.1
Cafeteria POS2	FastEthernet0	192.168.9.3	255.255.255.0	192.168.9.1
Cafeteria Motion Detector	FastEthernet0	192.168.9.7	255.255.255.0	192.168.9.1
Cafeteria Webcam	FastEthernet0	192.168.9.6	255.255.255.0	192.168.9.1
Cafeteria POS3	FastEthernet0	192.168.9.2	255.255.255.0	192.168.9.1
Cafeteria Server	FastEthernet0	192.168.9.4	255.255.255.0	192.168.9.1
Cafeteria Smartphone	Wireless0	192.168.0.100	255.255.255.0	192.168.0.1

Chairman office Room

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
Chairman Office Switch	VLAN 1	192.168.8.10	255.255.255.0	192.168.8.1
Chairman Office Motion Detector	FastEthernet0	192.168.8.7	255.255.255.0	192.168.8.1
Chairman Office Webcam	FastEthernet0	192.168.8.8	255.255.255.0	192.168.8.1
Chairman Office server	FastEthernet0	192.168.8.4	255.255.255.0	192.168.8.1
Chairman Office PC2	FastEthernet0	192.168.8.3	255.255.255.0	192.168.8.1
Chairman Office PC1	FastEthernet0	192.168.8.2	255.255.255.0	192.168.8.1
Chairman Office Printer	FastEthernet0	192.168.8.1	255.255.255.0	192.168.8.1

Library Room

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
Library Switch	VLAN 1	192.168.7.10	255.255.255.0	192.168.7.1
Library Printer2	FastEthernet0	192.168.7.6	255.255.255.0	192.168.7.1
Library PC2	FastEthernet0	192.168.7.5	255.255.255.0	192.168.7.1
Library Printer1	FastEthernet0	192.168.7.4	255.255.255.0	192.168.7.1
Library PC1	FastEthernet0	192.168.7.2	255.255.255.0	192.168.7.1
Library Server	FastEthernet0	192.168.7.3	255.255.255.0	192.168.7.1

Lecturer Room

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
Lecturer Switch	VLAN 1	192.168.10.10	255.255.255.0	192.168.10.1
Lecturer PC1	FastEthernet0	192.168.10.2	255.255.255.0	192.168.10.1
Lecturer PC2	FastEthernet0	192.168.10.3	255.255.255.0	192.168.10.1
PC2 webcam	FastEthernet0	192.168.10.6	255.255.255.0	192.168.10.1
Lecturer server	FastEthernet0	192.168.10.4	255.255.255.0	192.168.10.1
Lecturer PC3	FastEthernet0	192.168.10.5	255.255.255.0	192.168.10.1
Lecturer Smartphone1	Wireless0	192.168.0.103	255.255.255.0	192.168.0.1
Lecturer Smartphone2	Wireless0	192.168.0.101	255.255.255.0	192.168.0.1
Lecturer Tablet	Wireless0	192.168.0.102	255.255.255.0	192.168.0.1

1ST Floor

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
1st Floor Router	FastEthernet 0/0	192.168.3.1	255.255.255.0	N/A
	FastEthernet 0/1	192.168.4.1	255.255.255.0	N/A
	FastEthernet 1/0	192.168.5.1	255.255.255.0	N/A
	FastEthernet 1/1	192.168.6.1	255.255.255.0	N/A
	Serial 0/2/0	10.10.10.20	255.0.0.0	N/A
University Wi-Fi	Internet	192.168.4.8	255.255.255.0	192.168.4.1

1st Class

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
1st Class Switch	VLAN 1	192.168.5.10	255.255.255.0	192.168.5.1
1st Class PC1	FastEthernet0	192.168.5.2	255.255.255.0	192.168.5.1
1st Class PC2	FastEthernet0	192.168.5.3	255.255.255.0	192.168.5.1
1st Class PC3	FastEthernet0	192.168.5.4	255.255.255.0	192.168.5.1
1st Class Server	FastEthernet0	192.168.5.5	255.255.255.0	192.168.5.1
1st Class Laptop	Wireless0	192.168.0.105	255.255.255.0	192.168.0.1

2nd Class

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
2nd Class Switch	VLAN 1	192.168.4.10	255.255.255.0	192.168.4.1
2nd Class PC1	FastEthernet0	192.168.4.2	255.255.255.0	192.168.4.1
2nd Class PC2	FastEthernet0	192.168.4.3	255.255.255.0	192.168.4.1
2nd Class Server	FastEthernet0	192.168.4.4	255.255.255.0	192.168.4.1
2nd class Window	FastEthernet0	192.168.4.5	255.255.255.0	192.168.4.1
2nd Class Wind detect	FastEthernet0	192.168.4.6	255.255.255.0	192.168.4.1
2nd Class CO2	FastEthernet0	192.168.4.7	255.255.255.0	192.168.4.1

3rd Class

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
3rd Class Switch	VLAN1	192.168.6.10	255.255.255.0	192.168.6.1
3rd Class PC1	FastEthernet0	192.168.6.2	255.255.255.0	192.168.6.1
3rd Class PC2	FastEthernet0	192.168.6.3	255.255.255.0	192.168.6.1
3rd Class PC3	FastEthernet0	192.168.6.5	255.255.255.0	192.168.6.1
3rd Class Server	FastEthernet0	192.168.6.4	255.255.255.0	192.168.6.1
3rdClass Temp Monitor	GigabitEthernet0	192.168.6.7	255.255.255.0	192.168.6.1
3rd Class AC	GigabitEthernet0	192.168.6.6	255.255.255.0	192.168.6.1
3rd Class Laptop	Wireless0	192.168.0.103	255.255.255.0	192.168.0.1

4th Class

Device Name	Interface	IP Address	Subnet-Mask	Default-Gateway
4th Class Switch	VLAN1	192.168.3.10	255.255.255.0	192.168.3.1
4th Class PC1	FastEthernet0	192.168.3.2	255.255.255.0	192.168.3.1
4th Class PC2	FastEthernet0	192.168.3.3	255.255.255.0	192.168.3.1
4th Class Server	FastEthernet0	192.168.3.4	255.255.255.0	192.168.3.1
4th Class Speaker	FastEthernet0	192.168.3.5	255.255.255.0	192.168.3.1
4th Class Smartphone	Wireless0	192.168.0.107	255.255.255.0	192.168.0.1
4th Class Laptop1	Wireless0	192.168.0.108	255.255.255.0	192.168.0.1
4th Class Laptop 2	Wireless0	192.168.0.104	255.255.255.0	192.168.0.1

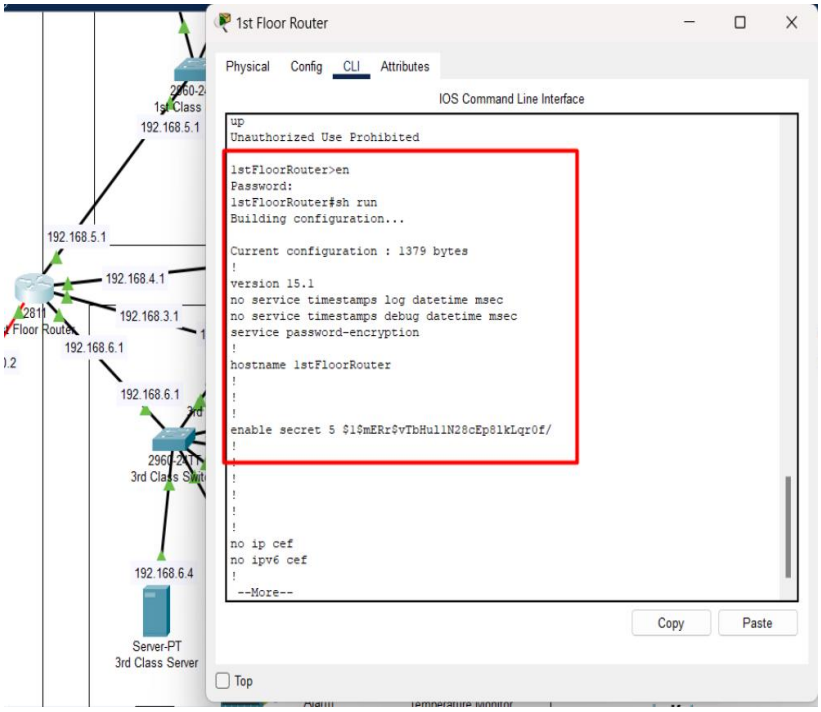
Wi-Fi information

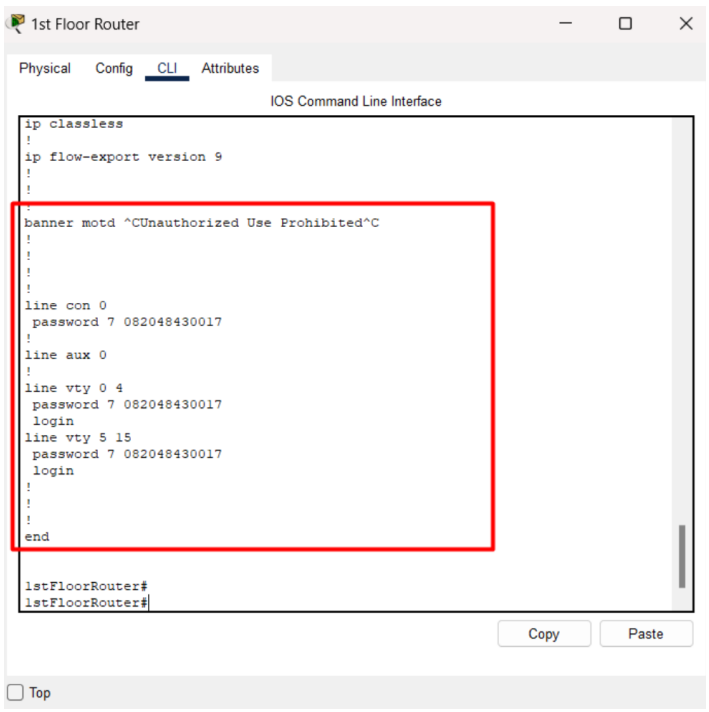
SSID	Authentication	Password	Channel	Coverage	Encryption
KAU	WPA2-PSK	12345678	2.412GHz	10 Meter	AES
Student	WPA2-PSK	Student123	2.412GHz	140 Meter	AES
Lecturer	WPA2-PSK	Lecturer123	2.412GHz	140 Meter	AES

Cell Tower

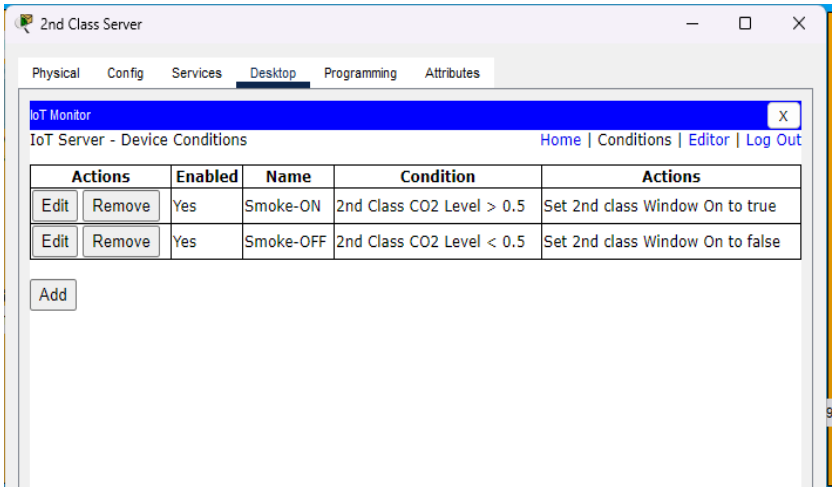
Provider	External Access	Cost	Range
ptcellular	Off	200000$	1000m

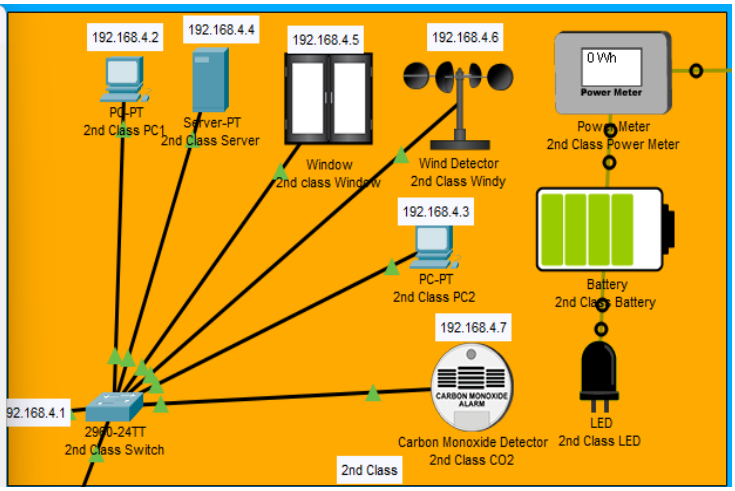
Switches and Routers configuration: All devices have passwords and encrypted.



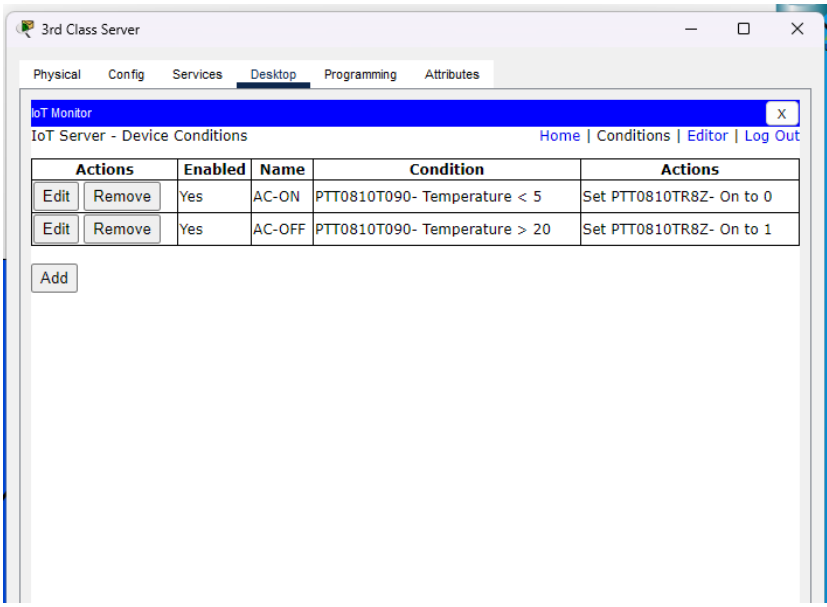


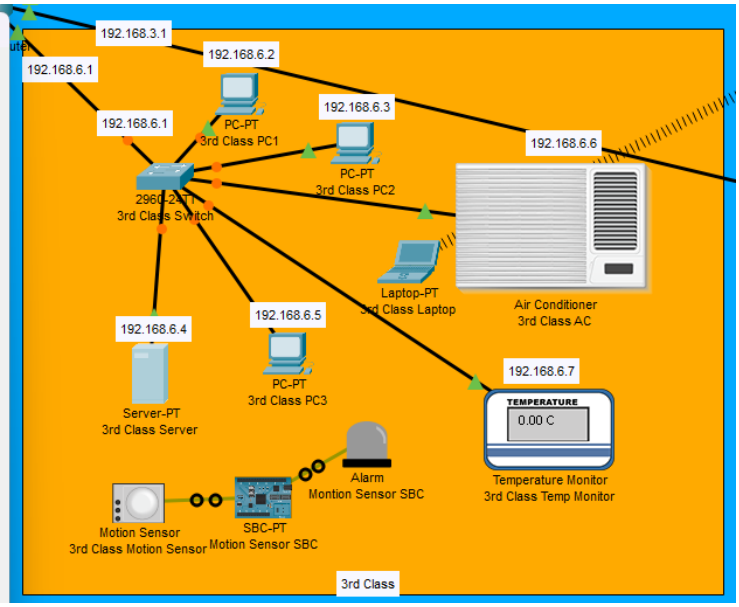
Window, CO2 detector condition: if CO2 level is higher than 0.5 open the window else close it.



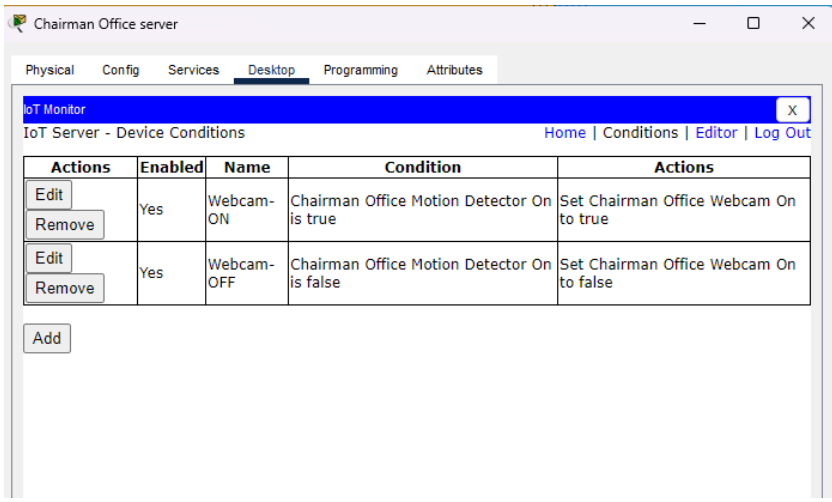


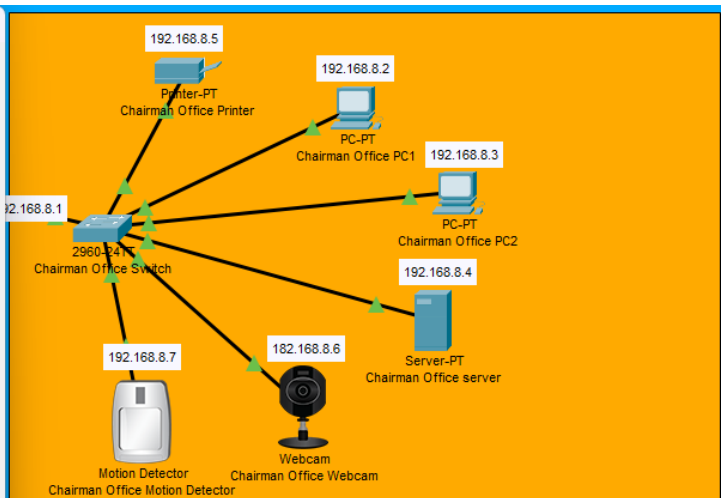
Air conditioner, temperature monitor condition: if temperature is higher than 20 degrees turn on the AC, if the temperature is less than 5 degrees close the AC.



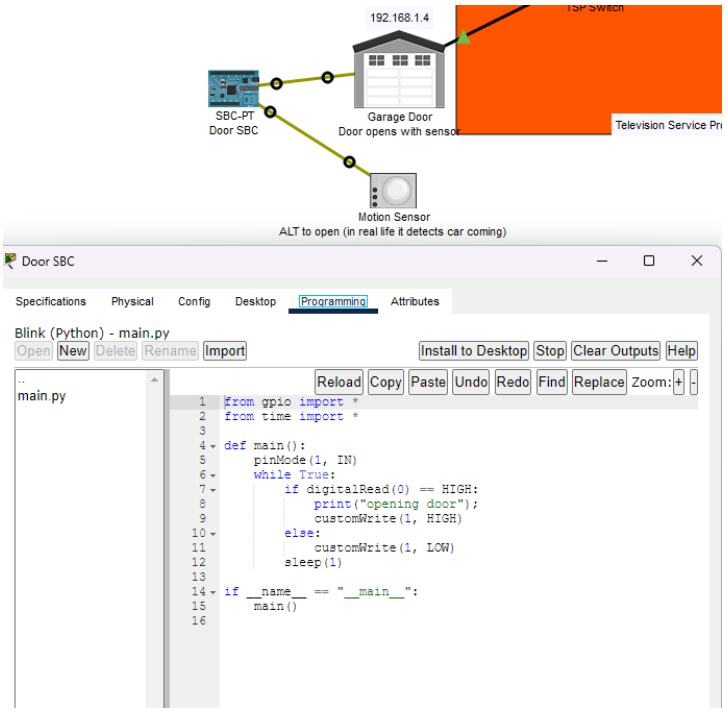


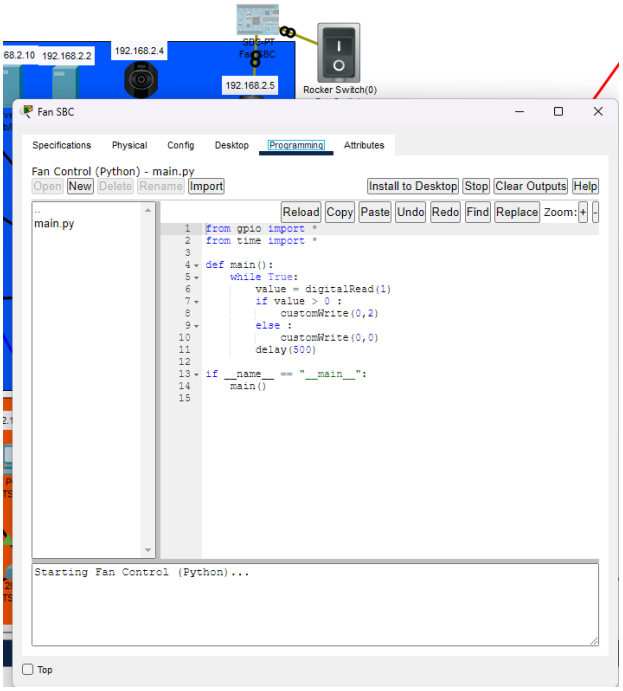
Webcam, motion detector condition: if motion detector is turned on turn on the web cam, if motion detector is off, turn off the webcam.





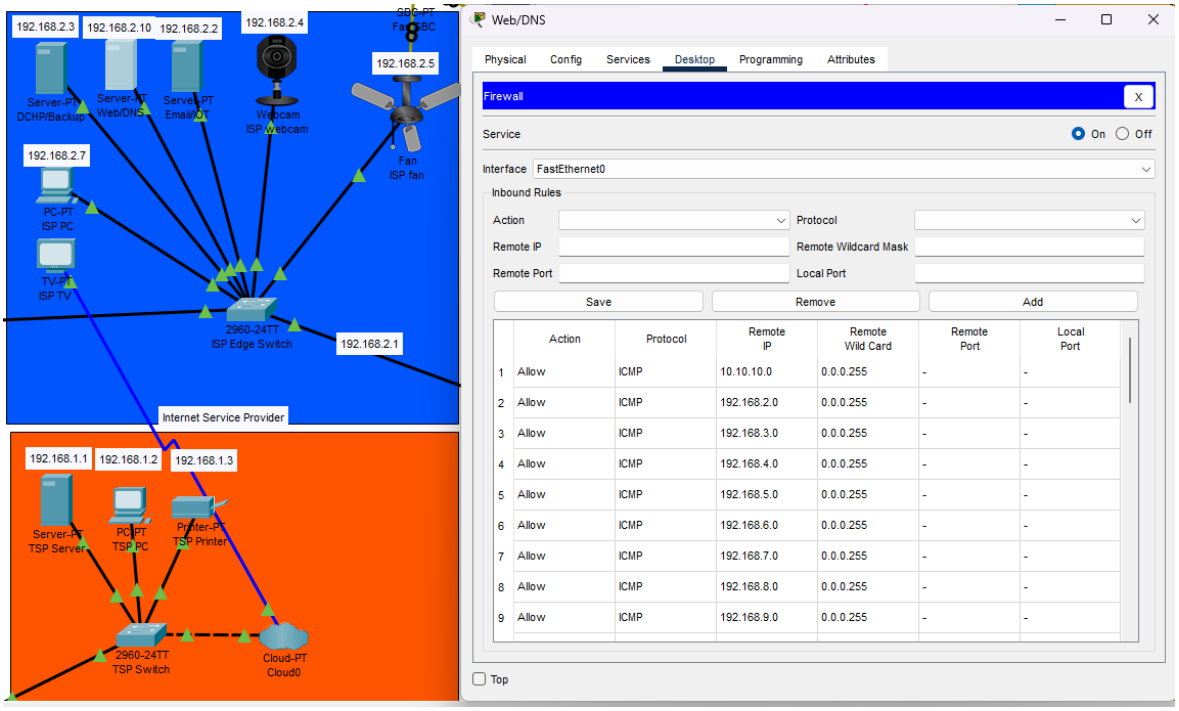
Automation using SBC:





*As we can see we used python to automate some tasks such as opening the garage door with motion sensor, and turning on a fan using rocket switch and SBC

Web/DNS server firewall configuration:



*As we configured the Web/DNS server to only accept ICMP,UDP,TCP protocols from every end host in the network for security.

*Other examples are in configuration file

6. Connectivity

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	1st Class PC1	2nd Class PC1	ICMP		0.000	N	0	(edit)	
	Successful	1st Class PC2	3rd Class PC1	ICMP		0.000	N	1	(edit)	
	Successful	1st Class PC3	4th Class PC1	ICMP		0.000	N	2	(edit)	
	Successful	1st Class PC1	Library PC1	ICMP		0.056	N	3	(edit)	
	Successful	1st Class PC2	Lecturer PC1	ICMP		0.056	N	4	(edit)	
	Successful	1st Class PC3	Cafeteria POS3	ICMP		0.060	N	5	(edit)	
	Successful	1st Class PC2	Chairman Office PC1	ICMP		0.065	N	6	(edit)	
	Successful	2nd Class PC2	3rd Class PC1	ICMP		0.469	N	7	(edit)	
	Successful	2nd Class PC1	Library PC1	ICMP		0.478	N	8	(edit)	
	Successful	2nd Class PC2	Lecturer PC2	ICMP		0.482	N	9	(edit)	
	Successful	2nd Class PC1	Cafeteria POS3	ICMP		0.488	N	10	(edit)	
	Successful	2nd Class PC1	4th Class PC1	ICMP		0.000	N	11	(edit)	
	Successful	2nd Class PC2	Chairman Office PC1	ICMP		0.067	N	12	(edit)	
	Successful	3rd Class PC1	4th Class PC1	ICMP		0.352	N	13	(edit)	
	Successful	3rd Class PC2	Library PC1	ICMP		0.352	N	14	(edit)	
	Successful	3rd Class PC3	Lecturer PC2	ICMP		0.352	N	15	(edit)	
	Successful	3rd Class PC2	Cafeteria POS3	ICMP		0.358	N	16	(edit)	
	Successful	3rd Class PC3	Chairman Office PC1	ICMP		0.364	N	17	(edit)	
	Successful	4th Class PC2	Library PC1	ICMP		0.473	N	18	(edit)	
	Successful	4th Class Laptop1	Lecturer PC2	ICMP		0.478	N	19	(edit)	
	Successful	4th Class PC1	Cafeteria POS3	ICMP		0.483	N	20	(edit)	
	Successful	4th Class PC2	Chairman Office PC1	ICMP		0.488	N	21	(edit)	
	Successful	Library PC1	Lecturer PC1	ICMP		0.068	N	22	(edit)	
	Successful	Library PC2	Cafeteria POS3	ICMP		0.073	N	23	(edit)	
	Successful	Library Printer2	Chairman Office PC1	ICMP		0.081	N	24	(edit)	
	Successful	Lecturer PC2	Cafeteria Motion Detector	ICMP		0.367	N	25	(edit)	
	Successful	Lecturer PC2	Chairman Office PC1	ICMP		0.375	N	26	(edit)	
	Successful	Cafeteria POS1	Chairman Office PC1	ICMP		0.379	N	27	(edit)	

*As we can see all Room can communicate with each other as we stated in the Design Requirement

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	1st Class PC1	Web/DNS	ICMP		0.000	N	0	(edit)	(delete)
	Successful	3rd Class PC1	Web/DNS	ICMP		0.000	N	1	(edit)	(delete)
	Successful	2nd Class PC1	Web/DNS	ICMP		0.000	N	2	(edit)	(delete)
	Successful	4th Class PC1	Web/DNS	ICMP		0.000	N	3	(edit)	(delete)
	Successful	Library Server	Web/DNS	ICMP		0.000	N	4	(edit)	(delete)
	Successful	Lecturer PC1	Web/DNS	ICMP		0.000	N	5	(edit)	(delete)
	Successful	Cafeteria Server	Web/DNS	ICMP		0.000	N	6	(edit)	(delete)
	Successful	Chairman Office PC1	Web/DNS	ICMP		0.000	N	7	(edit)	(delete)

*Here we can see that all rooms can access the Internet service provider room successfully.

7. Conclusion

To sum up, after checking the requirements we created ten rooms, including the ISP room and TSP room the other eight are (1st class, 2nd class, 3rd class, 4th class, cafeteria room, library room, chairman office, lecturer room) we set the equipment needed for each room with the addition of some extra IoE devices, after that we designed the topology needed for this design and connected all the equipment using that topology, finally, we configured all the devices used and tested the connectivity for the topology which turned in successfully.