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Project: IOT based smart home with smart security and fire prevention system using Cisco Packet Tracer

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Lab Project Status

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Comments: ..... **Date: .....**

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IOT based smart home

Chapter 1

Introduction

1 Introduction

Smart home is a living home that include smart object to improve home activities in advance, that can be automating activities of home without users' involvement such monitoring home environment condition by various sensor (Temperature, Humidity, smoke, wind, sound) then ventilate the environment based on sensor information. Smart home can provide different function rather than providing safety that is security by providing more automate security using different alarm system such siren sound, LCD display and sending email to legitimate user if security issue is detected by sensor. Home automation states managing and controlling home objects by using micro-controller or computer technology. Automation is popular because it provides ease, efficiency and secure environment. In this paper all smart appliance is registered to home gateway and controlled by legitimate person. Smart Home reduces user's involvement in monitoring home settings and controlling home appliances by including different sensor in home automation. This paper presents if smoke is detected the fire sprinkler automatically on to ventilate the environment and window is open. While the term "Internet of Things" (IoT) was first announced, the primary question might be what is considered as "Things". Till current years, groups of scholars and organizations tried to make clear the definition of IoT. Haller et Al. proposed a definition of IoT with "A world where physical objects are seamlessly integrated into the information network, and where the physical objects can become active participants in business process. IOT is an abbreviation of Internet of Things which refers to uniquely identifiable objects (things) and their virtual representations in an Internet-like structure. Internet of Things (IoT) is currently released technology to automate communication by connecting different objects around us as part of internet. IoT objects integrated with networking technology to control from remote and local.

This project deals about implementing smart home using new released cisco packet tracer because this feature includes different sensor, actuator and different smart device used for home automation. Some of the devices are smart window, smart light, smart door, smart fan with different detector and sensor. To implement smart home, I used new released cisco packet tracer simulation software to design and configure IOT device with classically networking device.

IOT

1.1 Internet of things (IOT)

IOT as a term has evolved long way as a result of convergence of multiple technologies, machine learning, embedded systems and commodity sensors. IOT is a system of interconnected devices assigned a UIDS, enabling data transfer and control of devices over a network. It reduced the necessity of actual interaction in order to control a device. IOT is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system.

1.1.1 Features of IOT

Intelligence IOT comes with the combination of algorithms and computation, software & hardware that makes it smart. Ambient intelligence in IOT enhances its capabilities which facilitate the things to respond in an intelligent way to a particular situation and supports them in carrying out specific tasks. Inspire of all the popularity of smart technologies, intelligence in IOT is only concerned as a means of interaction between devices, while user and device interaction are achieved by standard input methods and graphical user interface

Connectivity

Connectivity empowers the Internet of Things by bringing together everyday objects. Connectivity of these objects is pivotal because simple object level interactions contribute towards collective intelligence in the IOT network. It enables network accessibility and compatibility in the things. With this connectivity, new market opportunities for the Internet of things can be created by the networking of smart things and applications

Dynamic Nature

The primary activity of Internet of Things is to collect data from its environment, this is achieved with the dynamic changes that take place around the devices. The state of these devices changes dynamically, example sleeping and waking up, connected and/or disconnected as well as the context of devices including temperature, location and speed. In addition to the state of the device, the number of devices also changes dynamically with a person, place and time

Enormous Scale

The number of devices that need to be managed and that communicate with each other will be much larger than the devices connected to the current Internet. The management of data generated from these devices and their interpretation for application purposes becomes more critical. Gartner (2015) confirms the enormous scale of IOT in the estimated report where it stated that 5.5 million new things will get connected every day and 6.4 billion connected things will be in use worldwide in 2016, which is up by 30 percent from 2015. The report also forecasts that the number of connected devices will reach 20.8 billion by 2020

Sensing

IOT wouldn’t be possible without sensors that will detect or measure any changes in the environment to generate data that can report on their status or even interact with the environment. Sensing technologies provide the means to create capabilities that reflect a true awareness of the physical world and the people in it. The sensing information is simply the

analogy input from the physical world, but it can provide a rich understanding of our complex world

Heterogeneity

Heterogeneity in Internet of Things as one of the key characteristics. Devices in IOT are based on different hardware platforms and networks and can interact with other devices or service platforms through different networks. IOT architecture should support direct network connectivity between heterogeneous networks. The key design requirements for heterogeneous things and their environments in IOT are scalabilities, modularity, extensibility and interoperability.

Security

IOT devices are naturally vulnerable to security threats. As we gain efficiencies, novel experiences, and other benefits from the IOT, it would be a mistake to forget about security concerns associated with it. There is a high level of transparency and privacy issues with IOT. It is important to secure the endpoints, the networks, and the data that is transferred across all of it means creating a security paradigm.

1.1.2 Advantages of IOT

Communication

IOT encourages the communication between devices, also famously known as Machine-to-Machine (M2M) communication. Because of this, the physical devices are able to stay connected and hence the total transparency is available with lesser inefficiencies and greater quality.

Automation and Control

Due to physical objects getting connected and controlled digitally and centrally with wireless infrastructure, there is a large amount of automation and control in the workings. Without human intervention, the machines are able to communicate with each other leading to faster and timely output.

Information

It is obvious that having more information helps making better decisions. Whether it is mundane decisions as needing to know what to buy at the grocery store or if your company has enough widgets and supplies, knowledge is power and more knowledge is better.

Monitor

The second most obvious advantage of IOT is monitoring. Knowing the exact quantity of supplies or the air quality in your home, can further provide more information that could not have previously been collected easily. For instance, knowing that you are low on milk or printer ink could save you another trip to the store in the near future. Furthermore, monitoring the expiration of products can and will improve safety.

Time

As hinted in the previous examples, the amount of time saved because of IOT could be quite large. And in today's modern life, we all could use more time. Money The biggest advantage of IOT is saving money. If the price of the tagging and monitoring equipment is less than the amount of money saved, then the Internet of Things will be very widely adopted fundamentally proves to be very helpful to people in their daily routines by making the appliances communicate to each other in an effective manner thereby saving and conserving energy and cost. Allowing the data to be communicated and shared between devices and then translating it into our required way, it makes our systems efficient. Automation of daily tasks leads to better monitoring of devices The IOT allows you to automate and control the tasks that are done on a daily basis, avoiding human intervention. Machine-to-machine communication helps to maintain transparency in the processes. It also leads to uniformity in

the tasks. It can also maintain the quality of service. We can also take necessary action in case of emergencies.

Efficient and Saves Time

The machine-to-machine interaction provides better efficiency, hence; accurate results can be obtained fast. This results in saving valuable time. Instead of repeating the same tasks every day, it enables people to do other creative jobs.

Saves Money

Optimum utilization of energy and resources can be achieved by adopting this technology and keeping the devices under surveillance. We can be alerted in case of possible bottlenecks, breakdowns, and damages to the system. Hence, we can save money by using this technology.

Better Quality of Life

All the applications of this technology culminate in increased comfort, convenience, and better management, thereby improving the quality of life.

1.1.3 Disadvantages of IOT

Compatibility

Currently, there is no international standard of compatibility for the tagging and monitoring equipment. I believe this disadvantage is the easiest to overcome. The manufacturing companies of this equipment just need to agree to a standard, such as Bluetooth, USB, etc. This is nothing new or innovative needed.

Complexity

As with all complex systems, there are more opportunities of failure. With the Internet of Things, failures could sky rocket. For instance, let's say that both you and your spouse each get a message saying that your milk has expired, and both of you stop at a store on your way home, and you both purchase milk. As a result, you and your spouse have purchased twice the amount that you both need. Or maybe a bug in the software ends up automatically ordering a new ink cartridge for your printer each and every hour for a few days, or at least after each power failure, when you only need a single replacement.

Privacy/Security

With all of this IOT data being transmitted, the risk of losing privacy increases. For instance, how well encrypted will the data be kept and transmitted with? Do you want your neighbours or employers to know what medications that you are taking or your financial situation?

Safety

Imagine if a notorious hacker changes your prescription. Or if a store automatically ships you an equivalent product that you are allergic to, or a flavour that you do not like, or a product that is already expired. As a result, safety is ultimately in the hands of the consumer to verify any and all automation. As all the household appliances, industrial machinery, public sector services like water supply and transport, and many other devices all are connected to the Internet, a lot of information is available on it. This information is prone to attack by hackers. It would be very disastrous if private and confidential information is accessed by unauthorized intruders. Lesser Employment of Menial Staff The unskilled workers and helpers may end up losing their jobs in the effect of automation of daily activities. This can lead to unemployment issues in the society. This is a problem with the advent of any technology and can be overcome with education. With daily activities getting automated, naturally, there will be fewer requirements of human resources, primarily, workers and less educated staff. This may create Unemployment issue in the society.

1.2 Objective

Through the simulation framework based on cisco packet tracer (version 8.1), smart home system can be implemented. Cisco Packet Tracer is a tough Cisco system Academy network modelling application that can simulate/create a network without a physical network. It has a drag and drop interface that, while configuring complex networks, is simple to use yet highly effective. Additionally, Cisco Packet Tracer can operate as a hybrid network that combines real networks with virtual networks. This latest version of cisco packet tracer is also added to MCU-PT board single boarded computers, offering programming environment to power connected devices.

Newly released Packet Tracer advantages are:

- Provides the practical IOT machine simulations and visualizations.
- Allows users to plan, create, customize smart homes, smart cities by supplying them with various smart objects.
- Provide board for the control of intelligent objects.
- Allow students to explore the concepts of IOT principles.
- Provide sensor detector

Chapter 2

Implementation of the Project

2 Methodology

2.1 Implementation

Including various smart objects which are used for implementing home automation such as windows, fans, lights, doors, garbage doors, lawn, sprinklers, fire sprinklers, cell towers, web cams and various, sensors. The Home Gateway is used for controlling the objects and sensors, which are providing programming environment for controlling objects that are connected and provide control mechanisms through the registration of Home Gateway smart devices.

- **Internet Exchange Point**

There is an internet exchange point that connects the IOT Service Provider with the mobile internet provider and the local internet provider. The home gateway is connected to the local internet provider. This allows IoT users to control their gadgets via afar. The IP setup part has done with the use of CLI. Both static and DHCP ip protocol are used to complete the project.
FOR PORT G0/0 ip 8.0.0.1 subnetmask 255.0.0.0
FOR PORT G0/1 ip 9.0.0.1 subnetmask 255.0.0.0
FOR PORT G0/2 ip 10.0.0.1 subnetmask 255.0.0.0

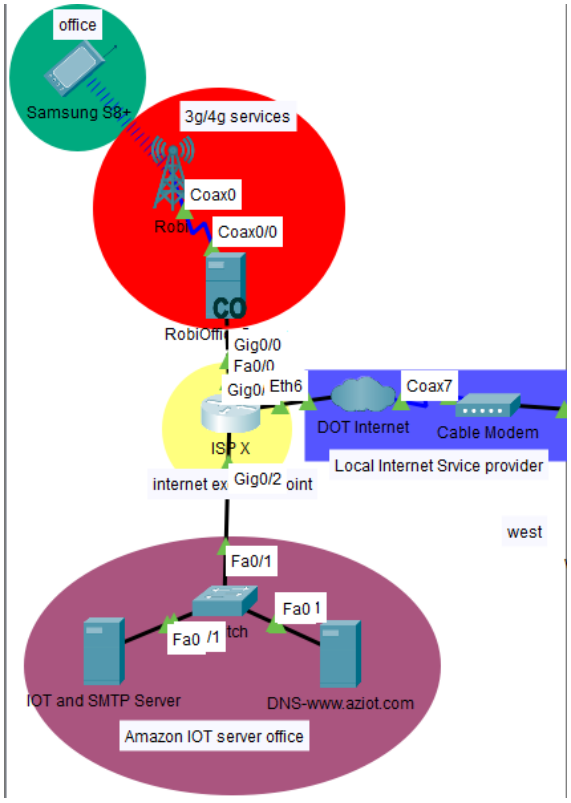


Figure 1: Connection with internet exchange point

- **Home gateway**

The IOT Things can register directly with the IOT service on a home gateway or network database. The Home Gateway offers 4 Ethernet ports and a wireless contact point on channel 6 equipped with the SSID "IOTvilla." It is possible to configure WEP / WPA-PSK / WPA2 companies to wireless links are safe for connections. Figure 2 displays IOT items connected to a Home Gateway. The home gateway is connected via the WAN Ethernet port on the internet. A home gateway and a web interface it is easy to manage the IOT system. The internal IP address of the Home Gateway (LAN) is 9.0.0.2 and default getaway is 9.0.0.1, but it can be too reached via its IP address in front of the Internet.

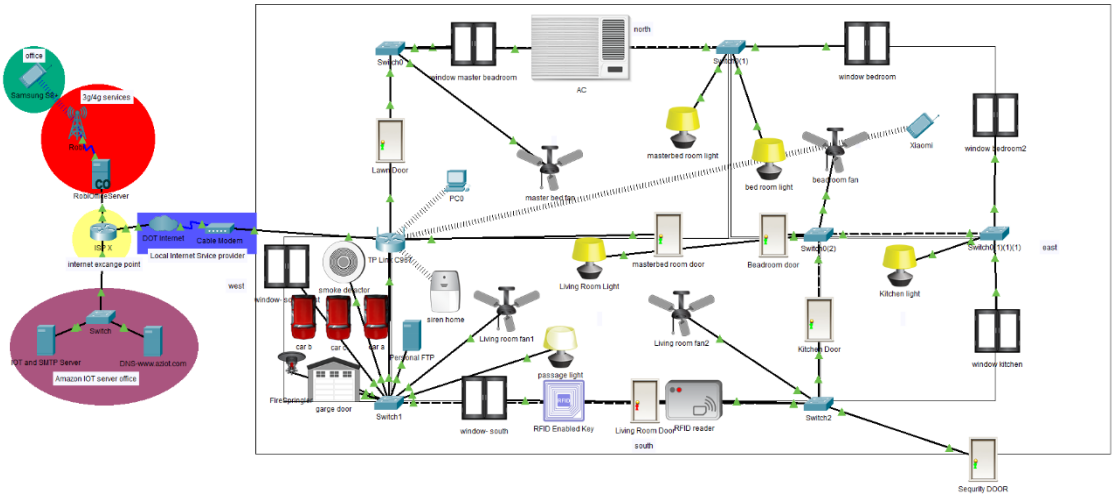


Figure 2: Home portal with several linked smart things

- **Server setup**

There are two servers, one is for IOT and SMTP of a IOT service provider company and a DNS server. These servers are under the 10.0.0.1 network.

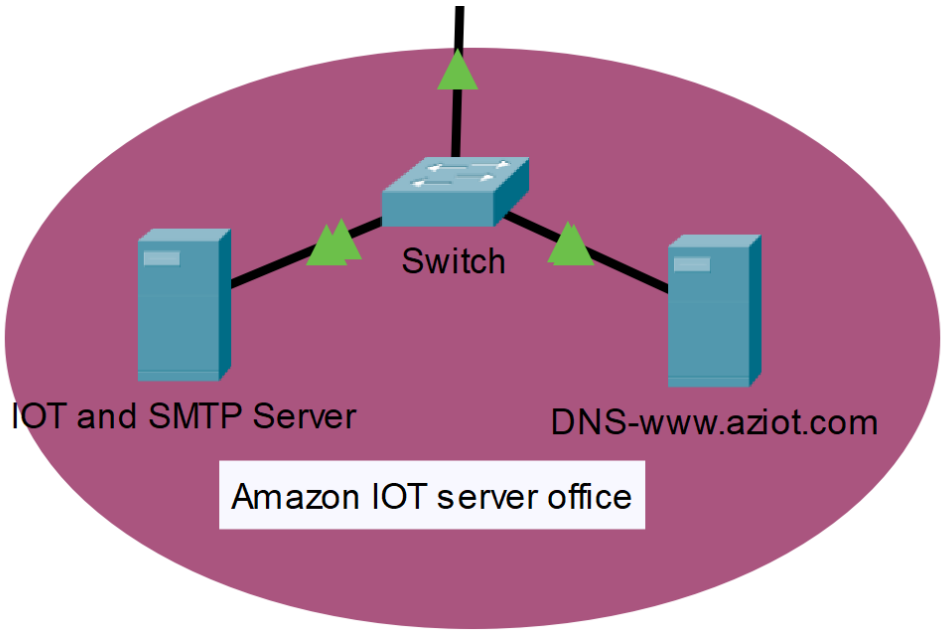


Figure 3: Amazon IOT servers

IOT Server:

IP configuration done with Static ip protocol
IPv4 Address: 10.0.0.2
Subnetmask: 255.0.0.0
Default Getaway: 10.0.0.1
DNS: 10.0.0.9

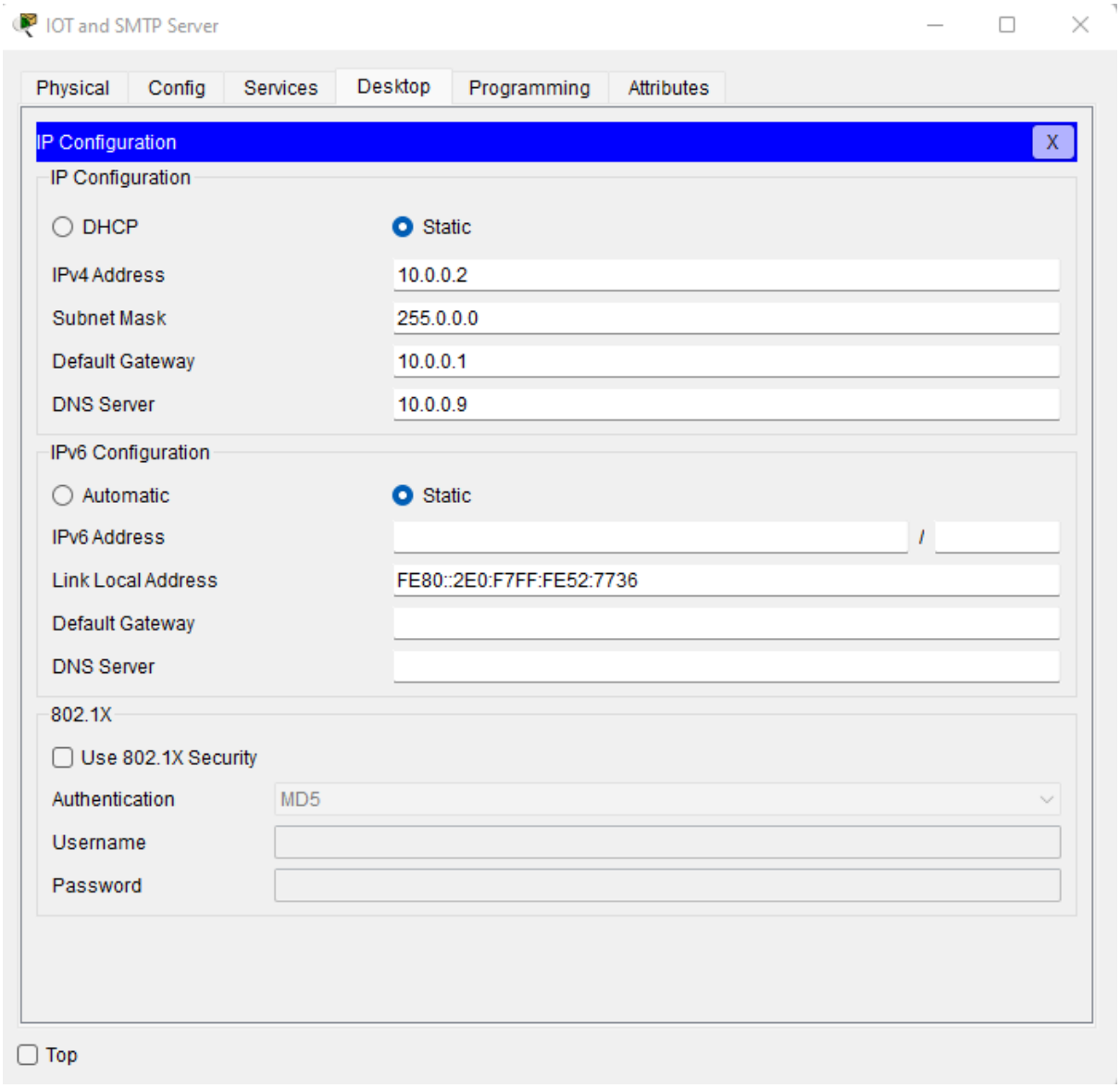


Figure 4: IOT server ip configuration

IOT Registration

In IOT section under the services tab, turned ON the registration server.

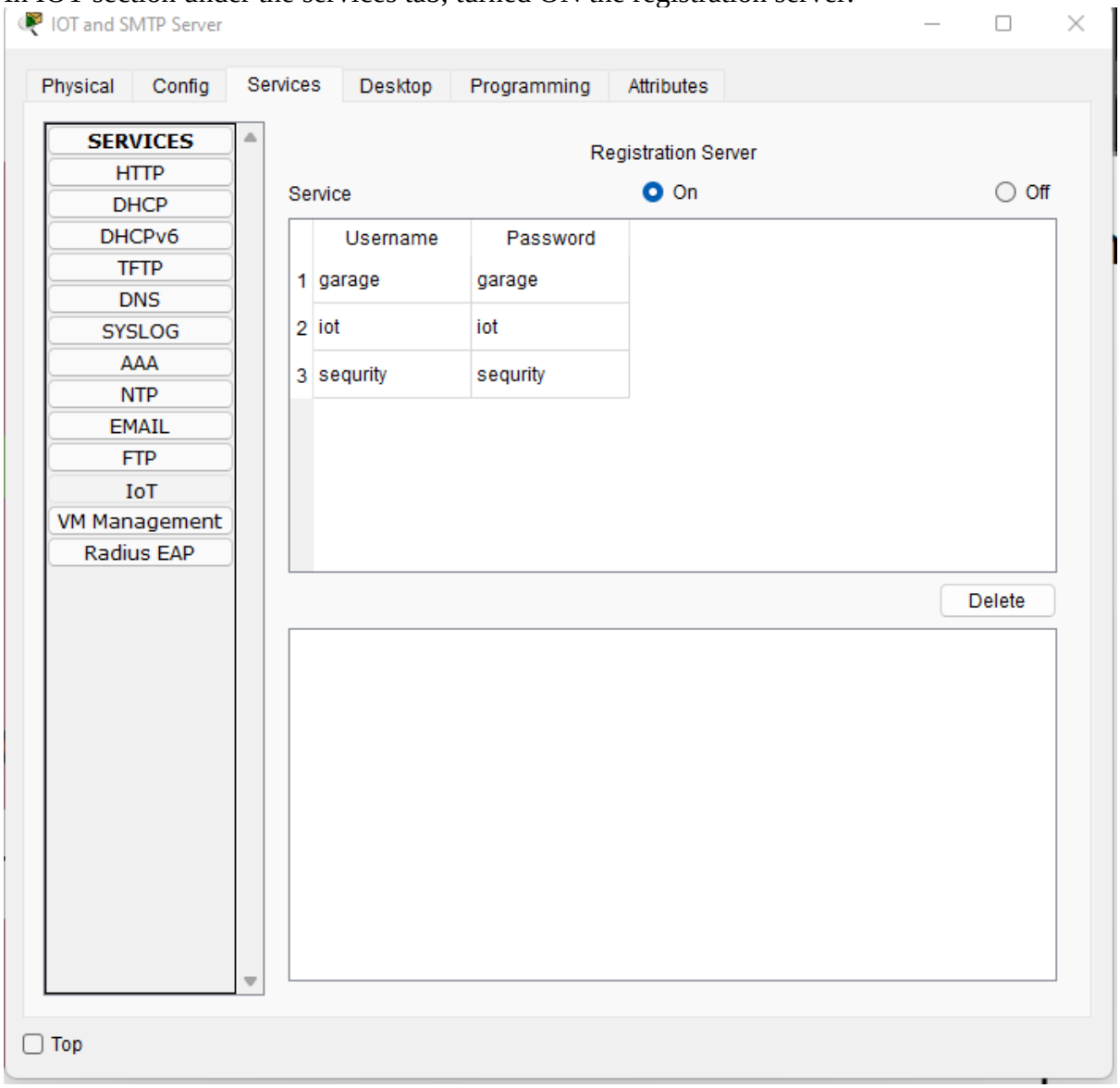


Figure 5: Registration server setup

SMTP Server

In E-MAIL section under the services tab, turned on the SMTP and POP3 server.
Set domain name as: aziot.com
Manually added two users, office and home.

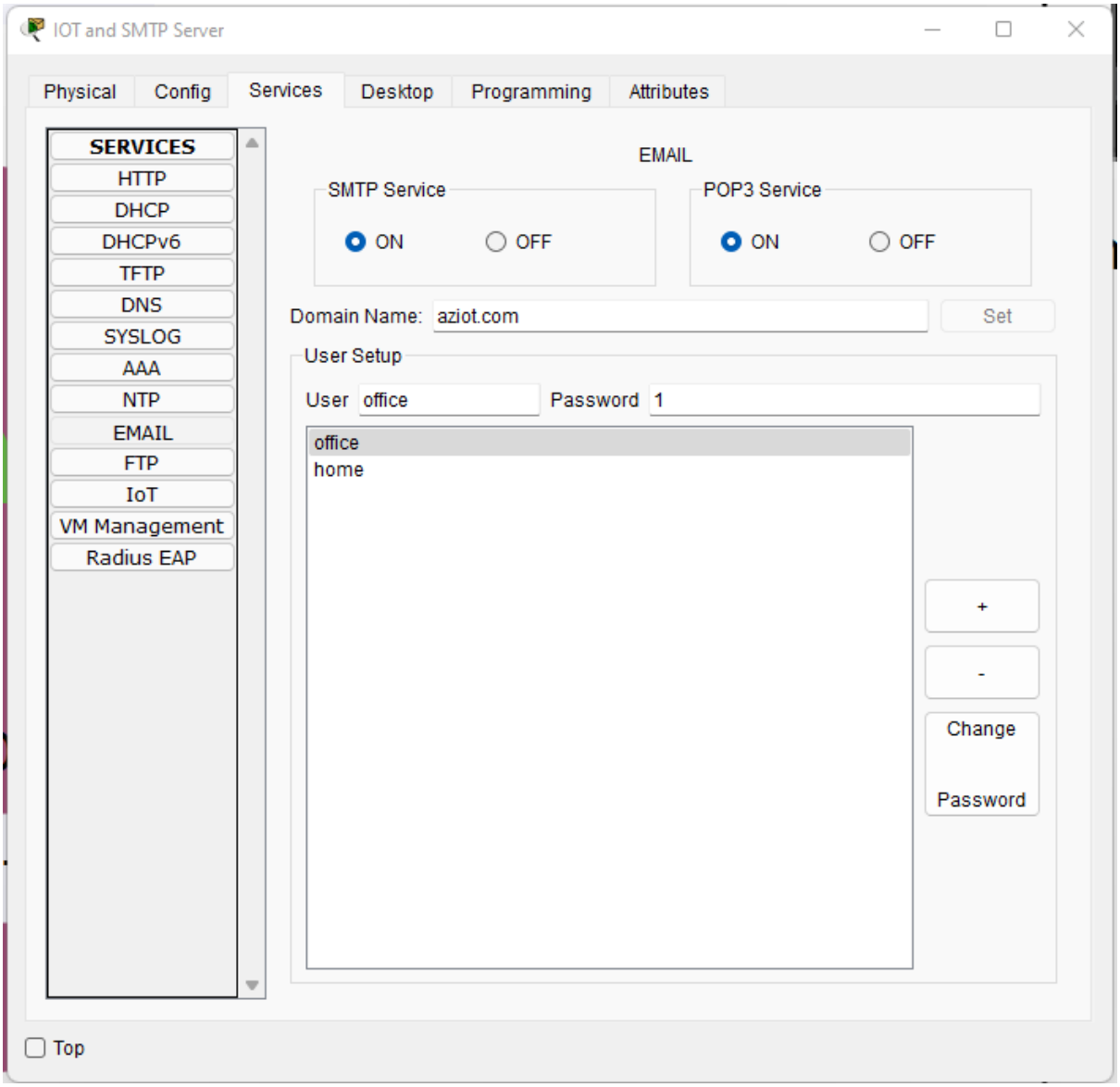


Figure 6: SMTP server setup

FTP Server

A personal FTP server is added into the home. Any one connected to the home router can access the FTP sever
IP configuration done with Static ip protocol
IPv4 Address: 192.168.0.69
Subnetmask: 255.0.0.0
Default Getaway: 192.168.0.1

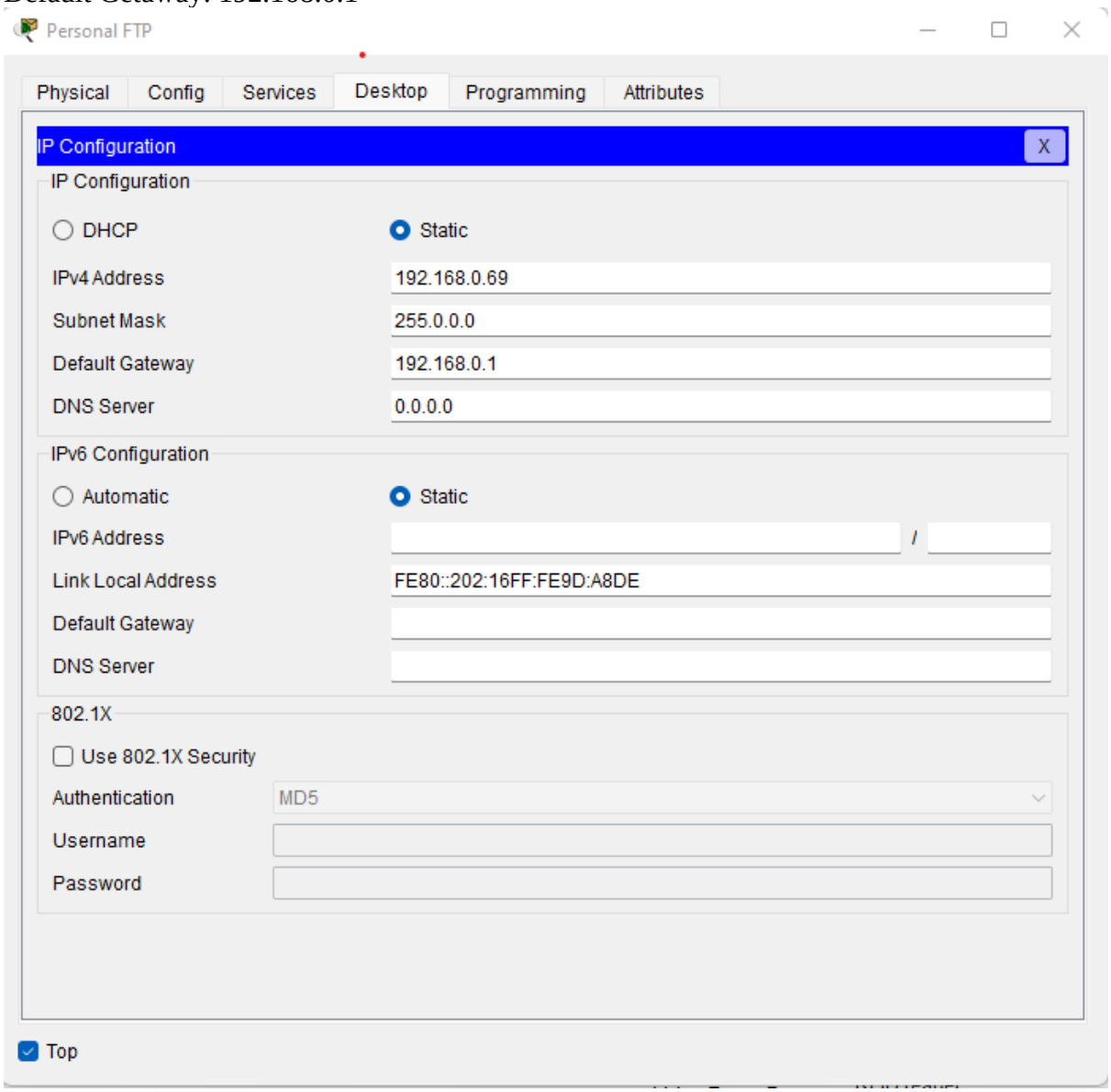


Figure 7: FTP server

In FTP section under Services tab, turned on the FTP server, created an account named home and set password as 1. Also give permission to read, write, download, rename, list.

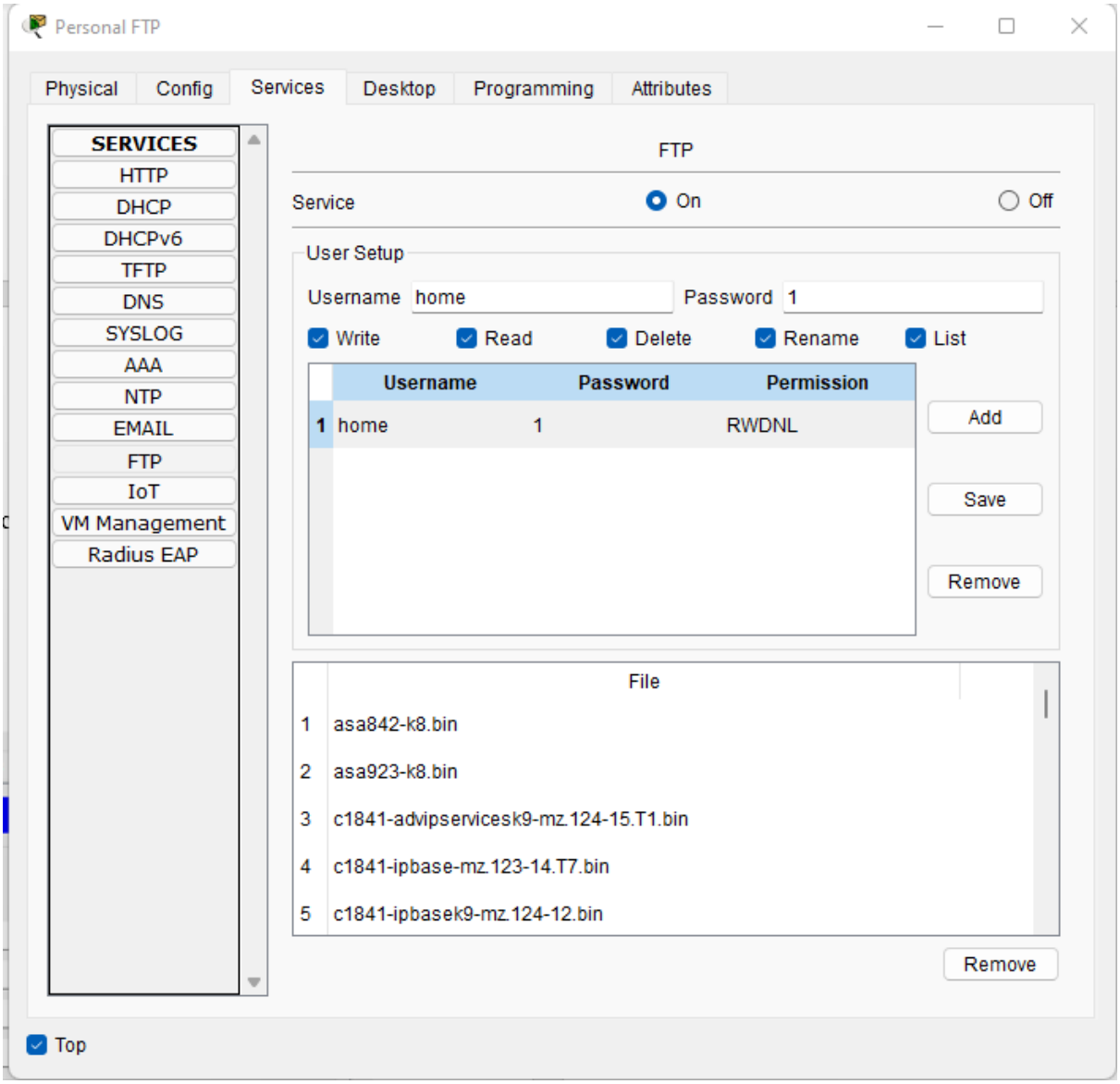


Figure 8: Creating FTP user account

DNS server:

IP configuration done with Static ip protocol
IPv4 Address: 10.0.0.8
Subnetmask: 255.0.0.0
Default Getaway: 10.0.0.1
DNS: 10.0.0.9

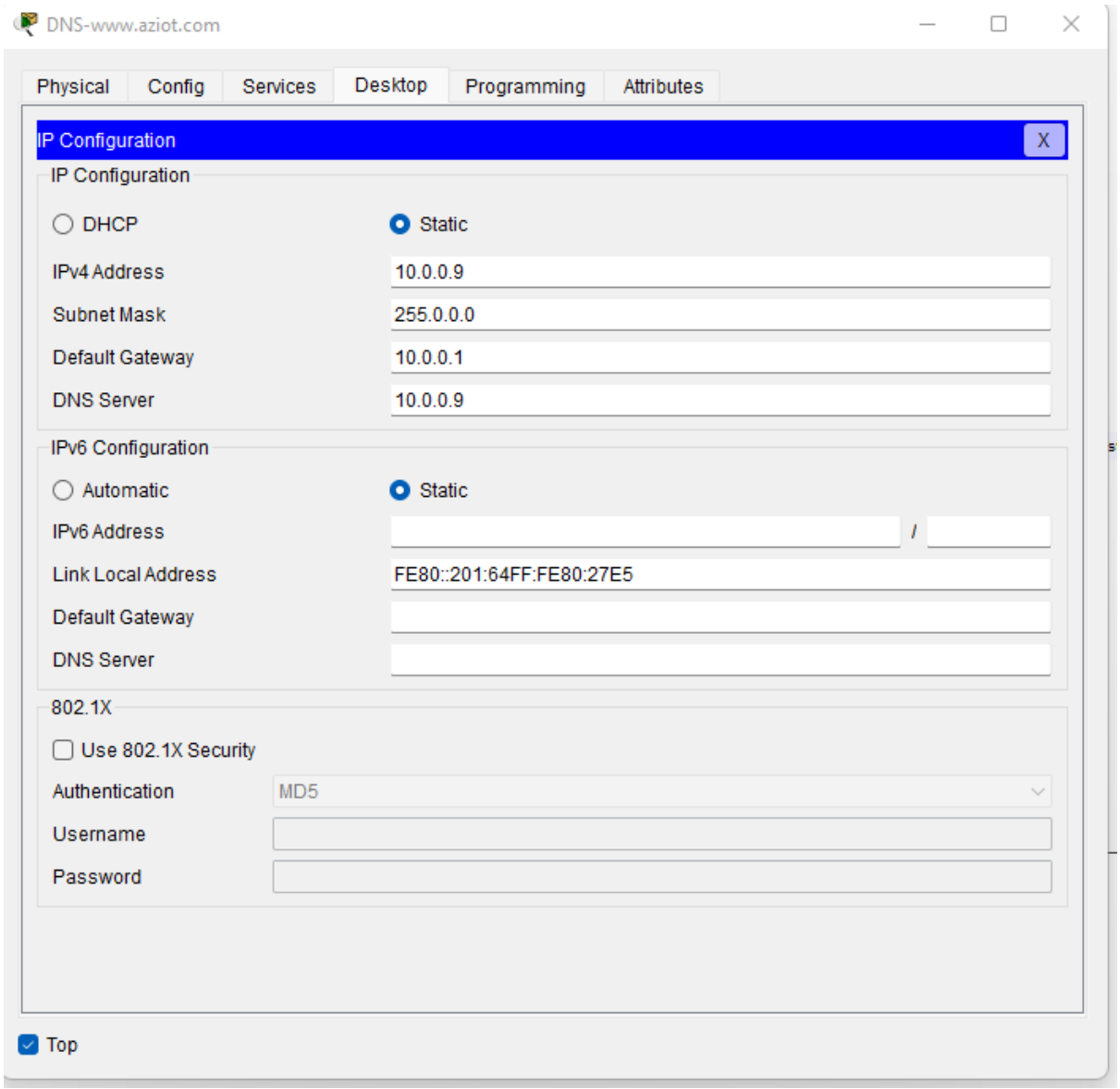


Figure 9: DNS Server IP configuration

In DNS section under Services tab, Turned ON the DNS service.
Set domain name as: www.aziot.com against ip address 10.0.0.2 which is the IOT server address.

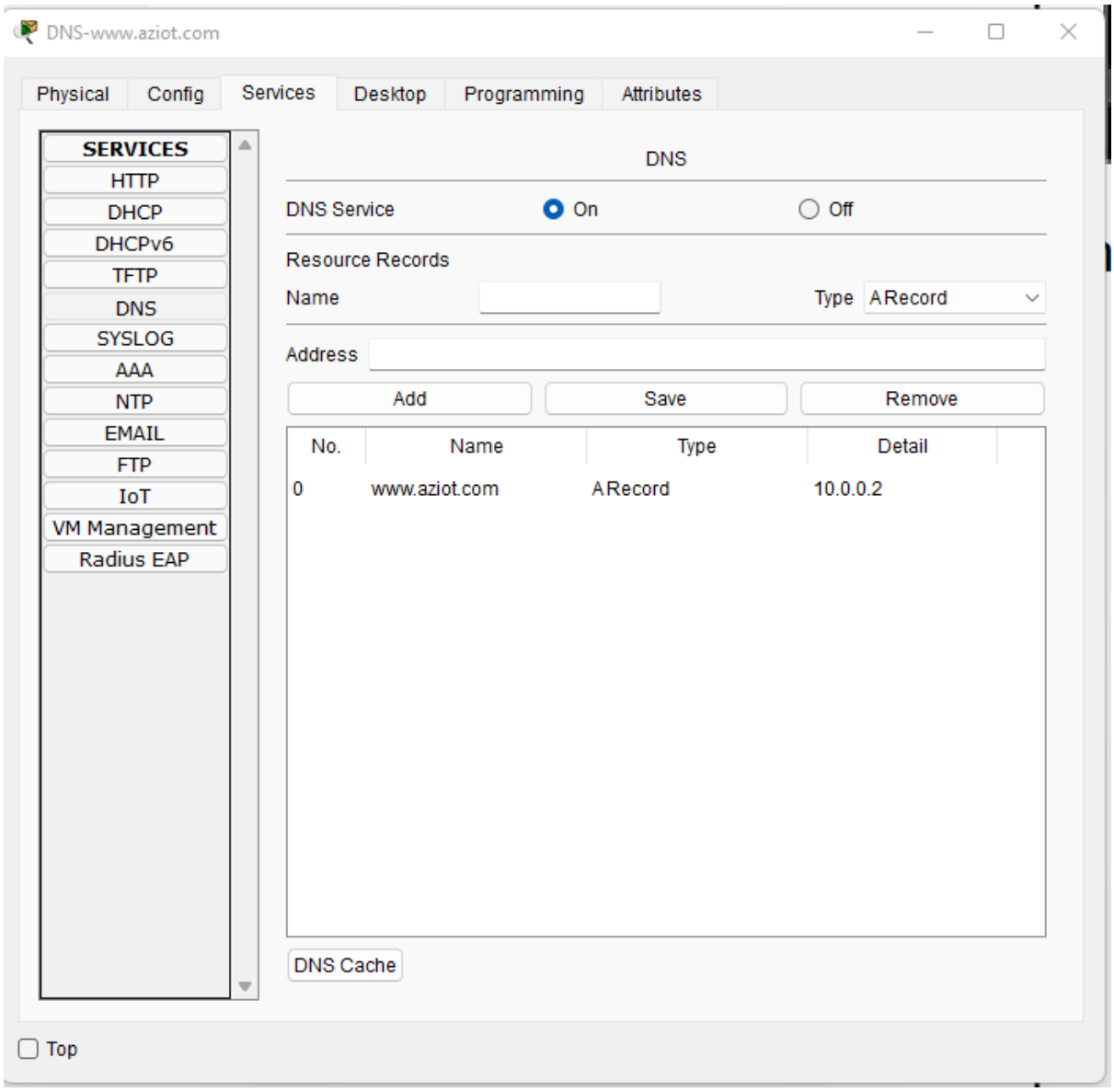


Figure 10: DNS server setup

- # IOT Devices setup

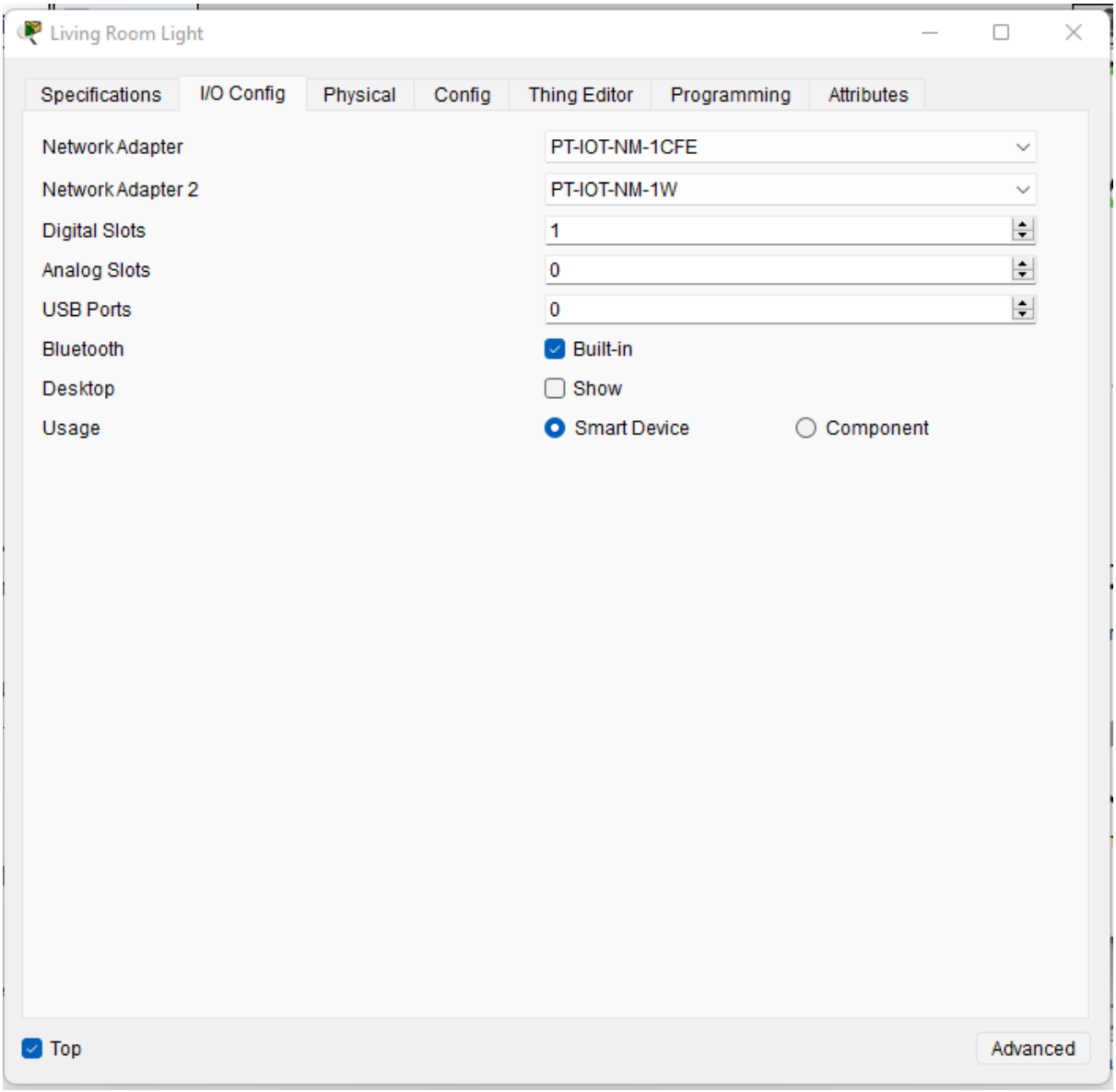
Through the home router all the IOT devices and end devices are connected with the IOT server. DOORs and WINDOWS are connected through the Ethernet cable. Other devices are connected with the wireless medium. I have added these two ports for all the IOT devices.

PT-IOT-NM-1CFE – Port is use for wired connection

PT-IOT-NM-1W – Port is use for wireless connection.

All the IOT devices are connect using the same method. Here the setup part for the “Living room light”

First added the necessary ports in advance > I/O Config section



In config tab ip are generated with DHCP protocol. Next enter the username, password and IOT ser address and successfully connected to the IOT server

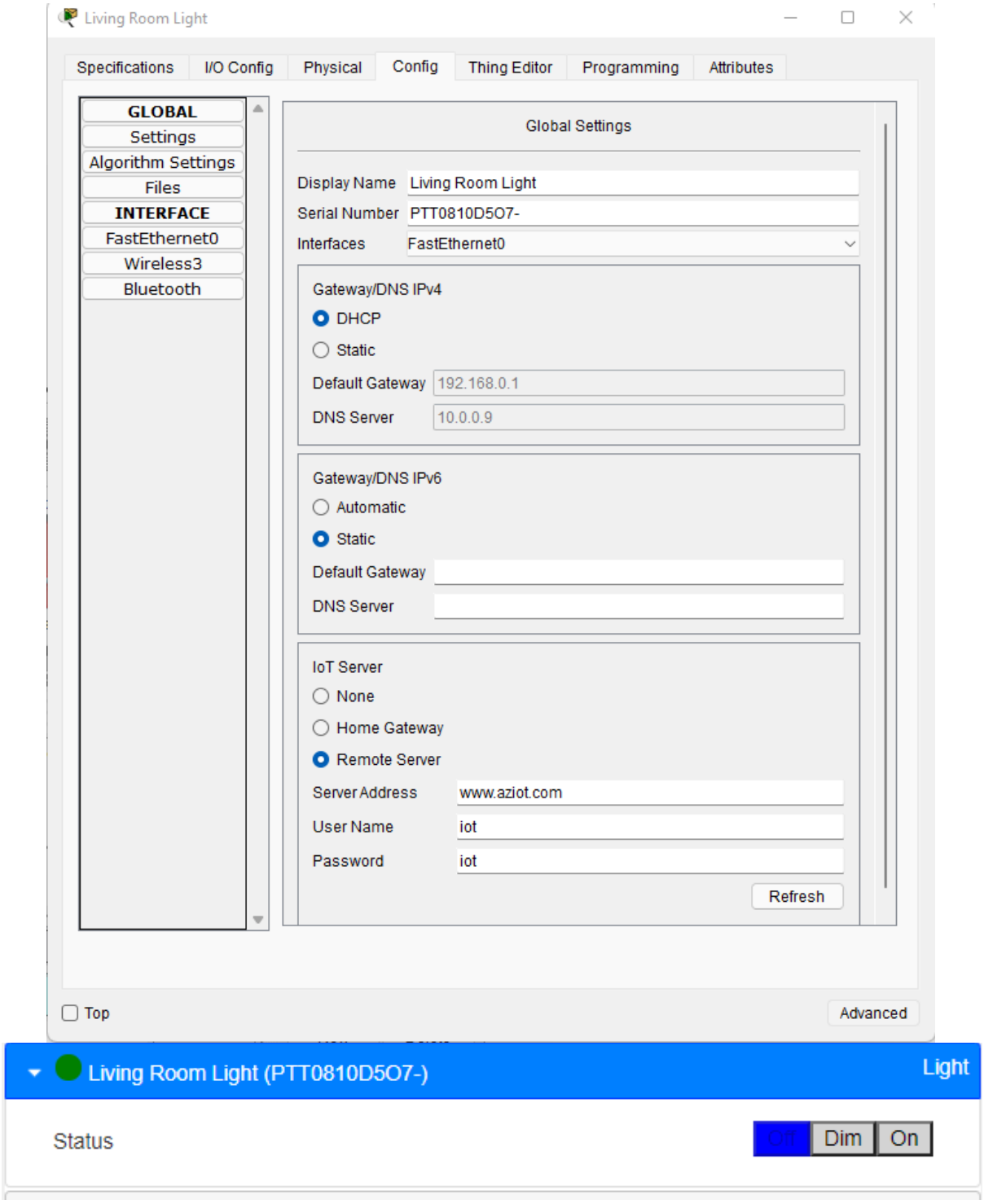
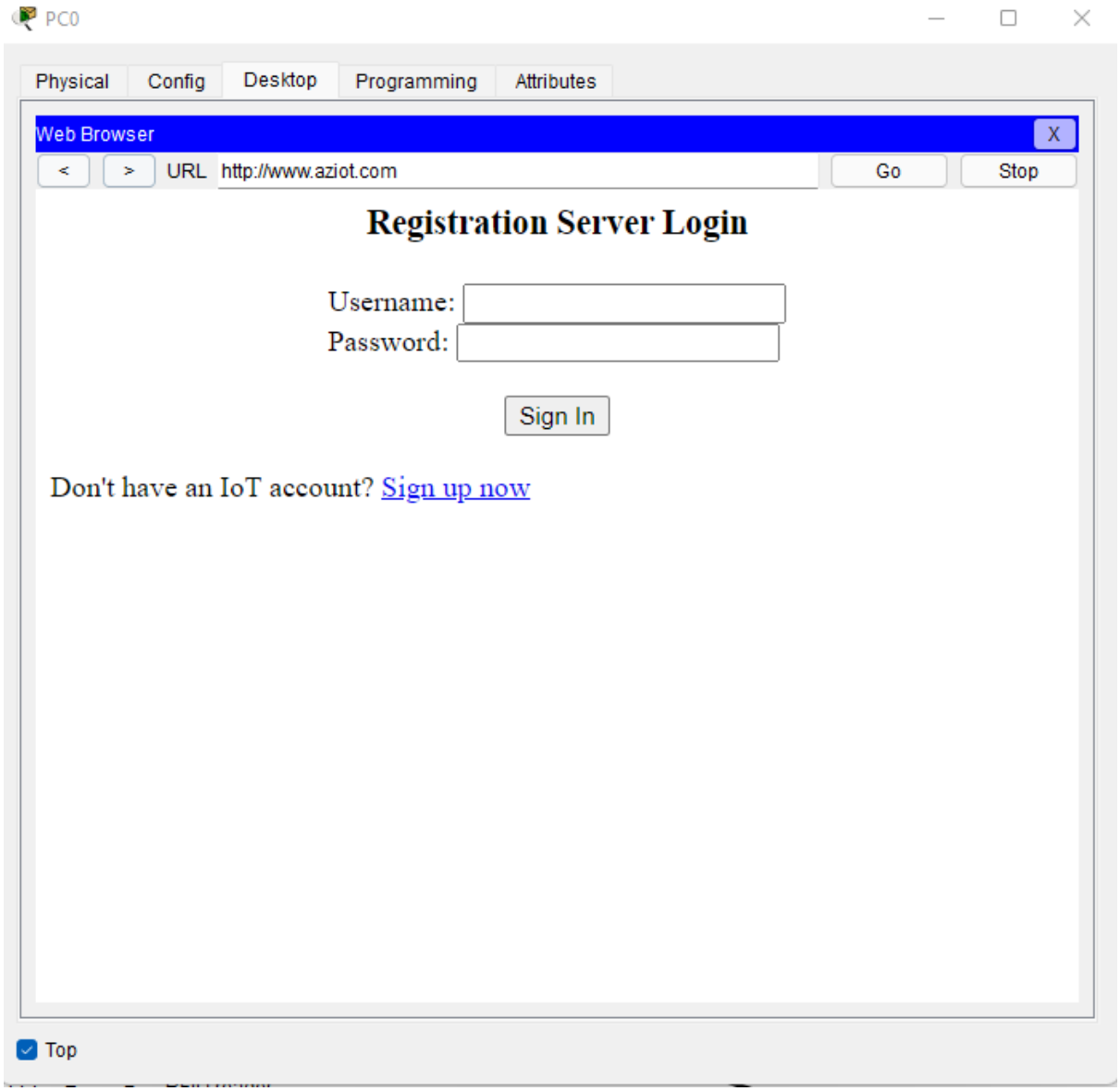


Figure 11: IOT device connection and logging to server

Using this method, I connected all the IOT devices.
To access and controls the IOT devices, User from any network under the same ISP in their web browser has to type this URL www.awiot.com .

In username and password section, I entered the required information to login. Also, I can create account from this page.



Clicking “Sign in” after giving the required information. All the connected devices are shown.

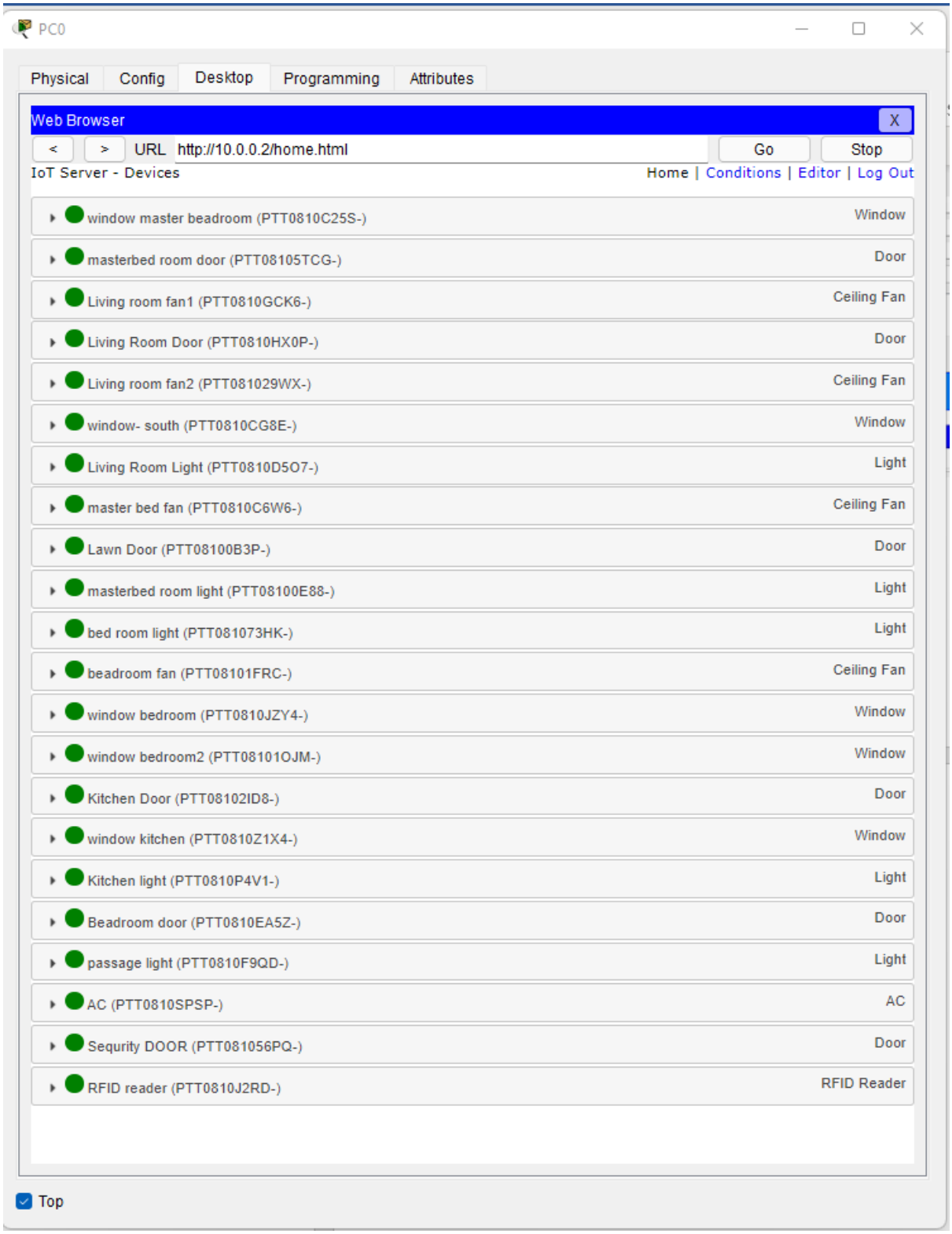


Figure 12: Registering IO devices to IOT server

2.2 Devices use for the design

NO	Devices	Function
1	Home Router PT AC	Used to interconnect home to cellular network.
2	Cable modem	Used to connect home to the internet
3	Home gateway	To control smart thing registered on it and provide difference server functionalities
4	Central office server	Used to connect cellular system to the router
5	Cell tower	Provide cellular system coverage for home user to control the home appliance form remote
6	Smoke sensor	Used to sense the smoke level
7	Old car	Used to simulate different scenario in home design since it affects, co, co2 and smoke level.
8	Smart door	Connect to home getaway and provide Function based event
9	Light	Provide light
10	Smart window	Used to control the window remotely Affects Argon, Carbon Monoxide, Carbon Dioxide, Hydrogen, Helium, Methane, Nitrogen, O2, Ozone, Propane, and Smoke. When the door is opened, those gases will decrease to a maximum of 1% in total change
11	AC	Used to cool the home Affects Humidity at a rate of -2% per hour
12	Smart Light	Used give light for home
13	PT Switch	This will enable you to restrict access to a given switch interface so that only the authorized devices can use it.

Table 1: Device used for implementation

2.3 Cable use for connecting the devices

NO	Cable name	Usages
01	Console	Used for connecting your PC's serial port to the RJ45 console port on most Cisco equipment
02	Copper Straight Through & Cross-over	Straight-through cable is the standard config of NW cable Crossover is the same, but with a connector at one end wired differently.
03	Fibre Optic	NW cable that contains strands of glass fibres inside an insulated casing Designed for long distance and very high bandwidth NW comms
04	Coaxial Cable	Used by TV and that is common for data combusting a round cross-section of the cable you would find a single centre solid wire symmetrically surrounded by a braided or foil conductor

Table 2: Cable used for the device connection

Chapter 3

Performance Evaluation

3 Simulation Environment

3.1 Results and Discussions

Garage

The Figure 13 shows the fire sprinkler, siren, window and garage is opened this can be based on the condition made on, that is if smoke level is more than 0.5 the fire sprinkler, siren, window and garage is open to ventilate the place. To simulate the scenario, I used 3 old car as old car increases the smoke level.

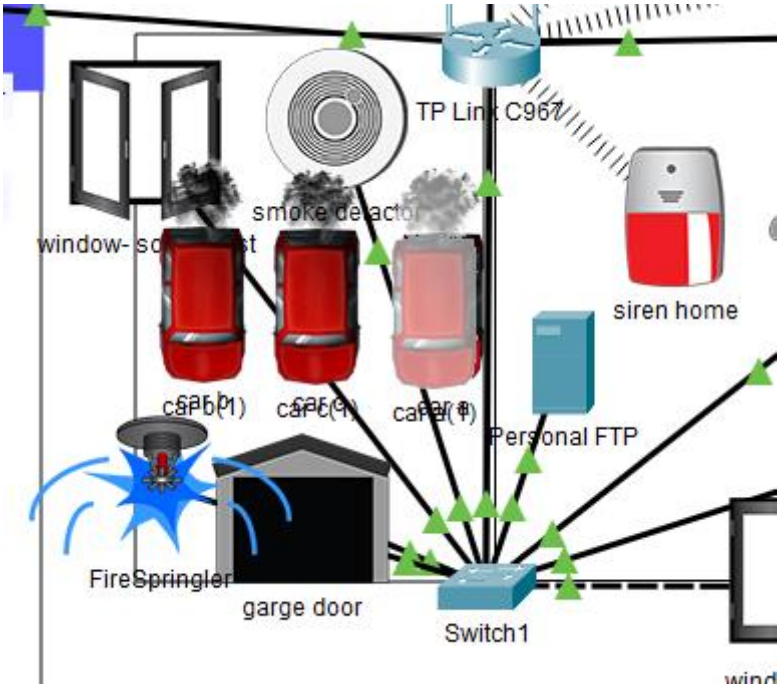
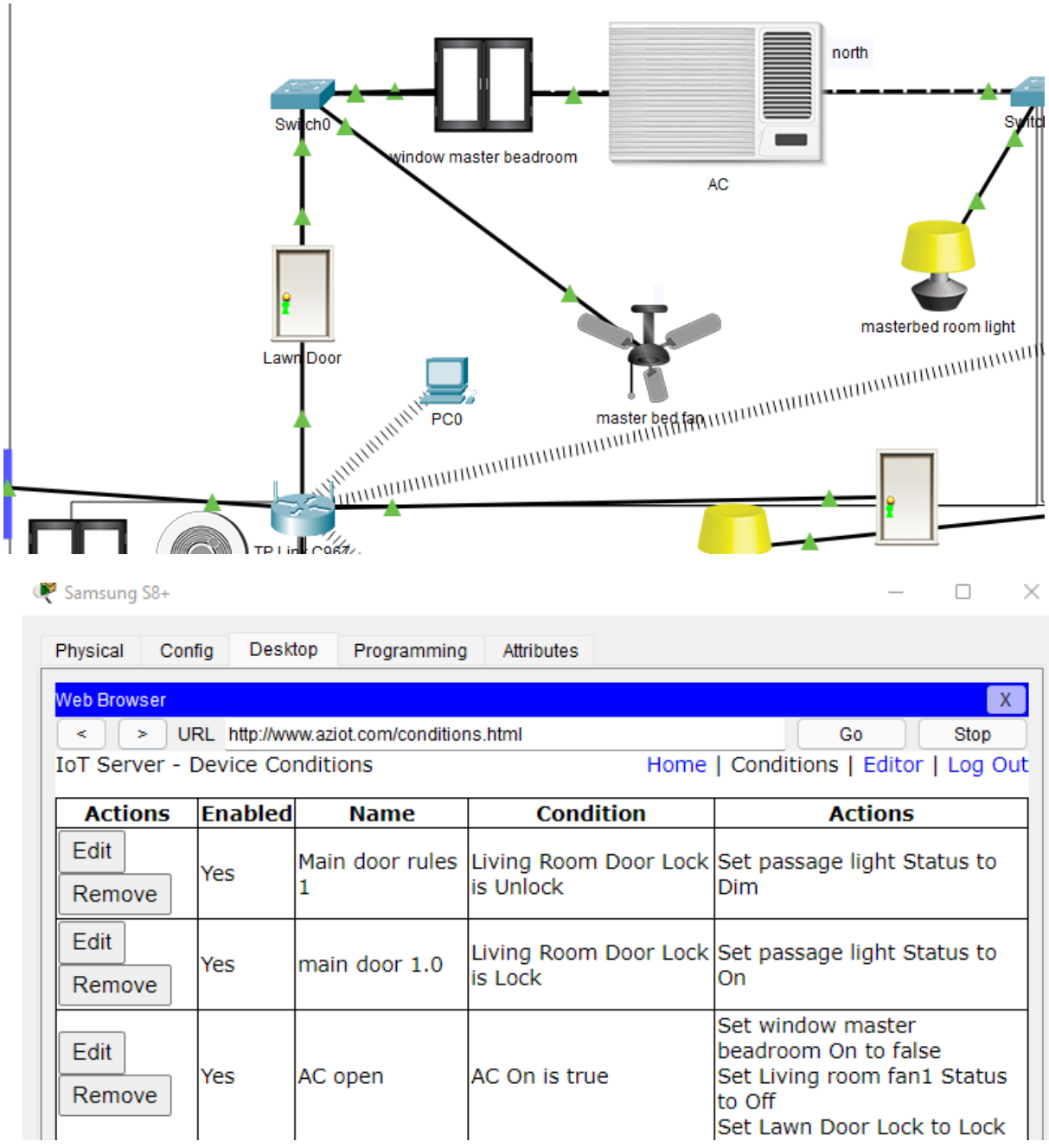


Figure 13: Fire Prevention System

Master-bed Room

Figure 14 some conditions are added. When the AC is on the lawn door, window, fan will be turned off.



Actions	Enabled	Name	Condition	Actions
Edit Remove	Yes	Main door rules 1	Living Room Door Lock is Unlock	Set passage light Status to Dim
Edit Remove	Yes	main door 1.0	Living Room Door Lock is Lock	Set passage light Status to On
Edit Remove	Yes	AC open	AC On is true	Set window master beadroom On to false Set Living room fan1 Status to Off Set Lawn Door Lock to Lock

Figure 14: Conditions for Master-bed room

RFID Card

Using a RFID card user can easily open the door and lock the door.

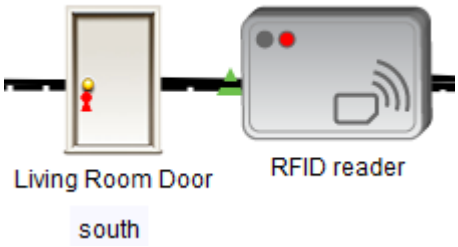


Figure 15: Door Lock when no card

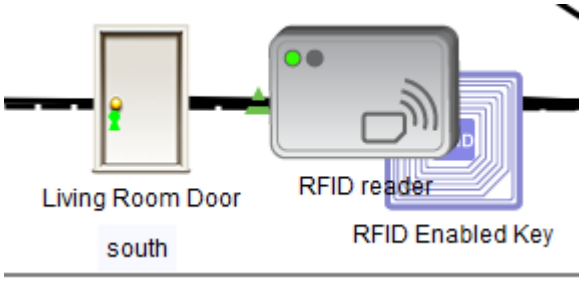


Figure 16: Door unlock when RFID card near RFID reader

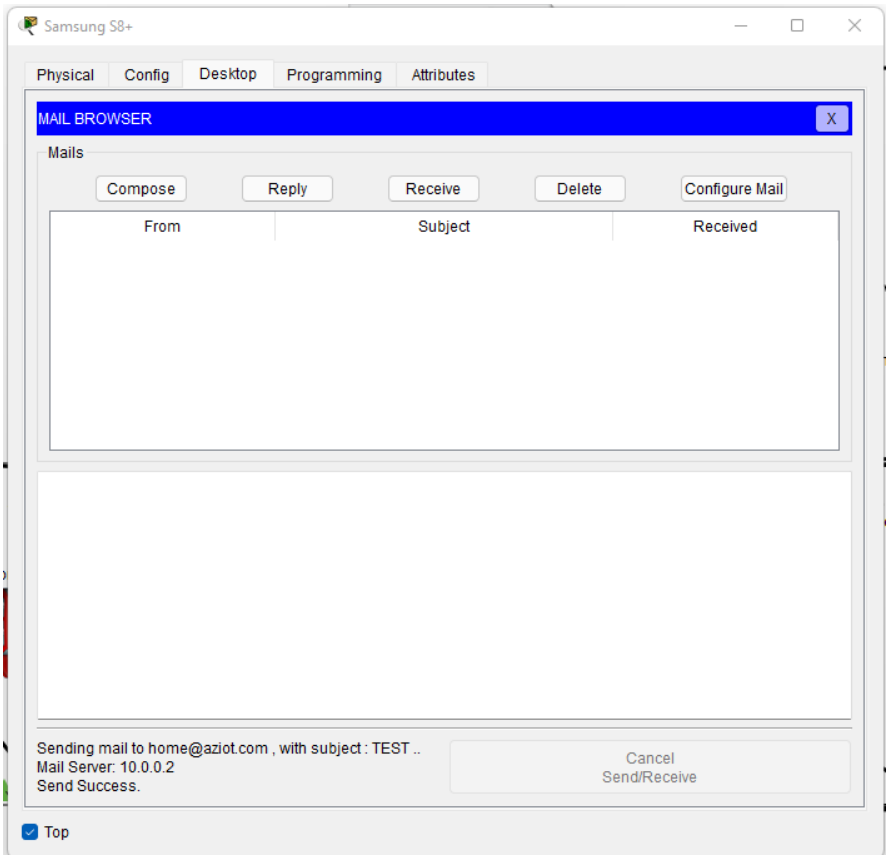
Edit Remove	Yes	RFID Card Valid	RFID reader Card ID = 1001	Set RFID reader Status to Valid
Edit Remove	Yes	RFID not valid	RFID reader Card ID != 1001	Set RFID reader Status to Invalid
Edit Remove	Yes	RFID Valid - door open	RFID reader Status is Valid	Set Living Room Door Lock to Unlock
Edit Remove	Yes	RFID invalid	RFID reader Status is Invalid	Set Living Room Door Lock to Lock

Figure 17: Conditions for RFID

And like this add all the IOT components and conditions are given. There are also SMTP and FTP server for my home network.

SMTP

Messages send from office network



Messages received from home network

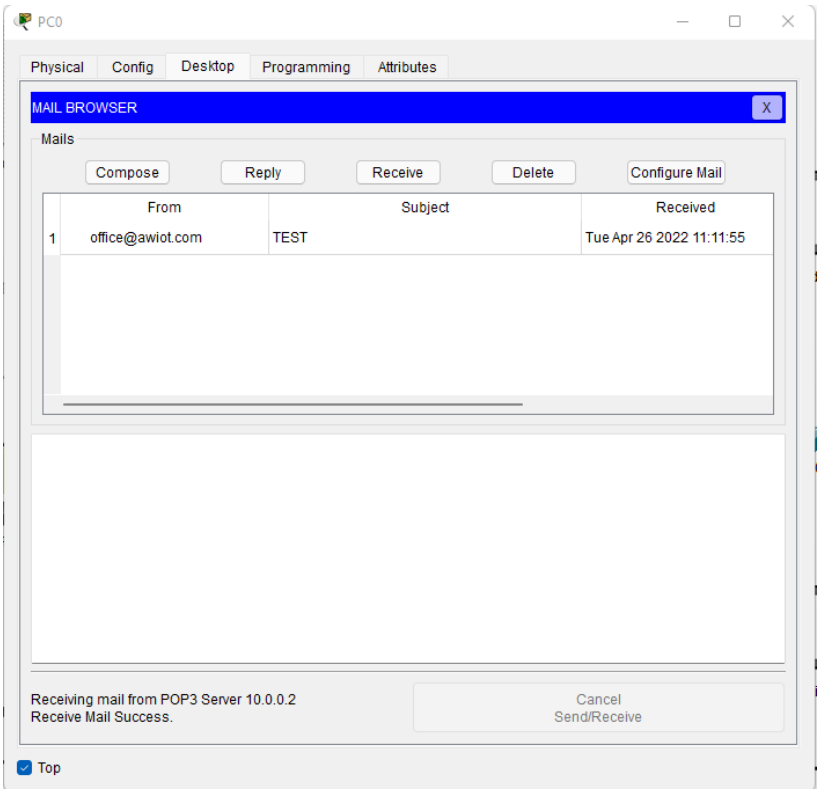


Figure 18: Working SMTP server

FTP

From any devices which is connected to the home network can access the FTP server. First open command prompt, then type: ftp 192.168.0.1

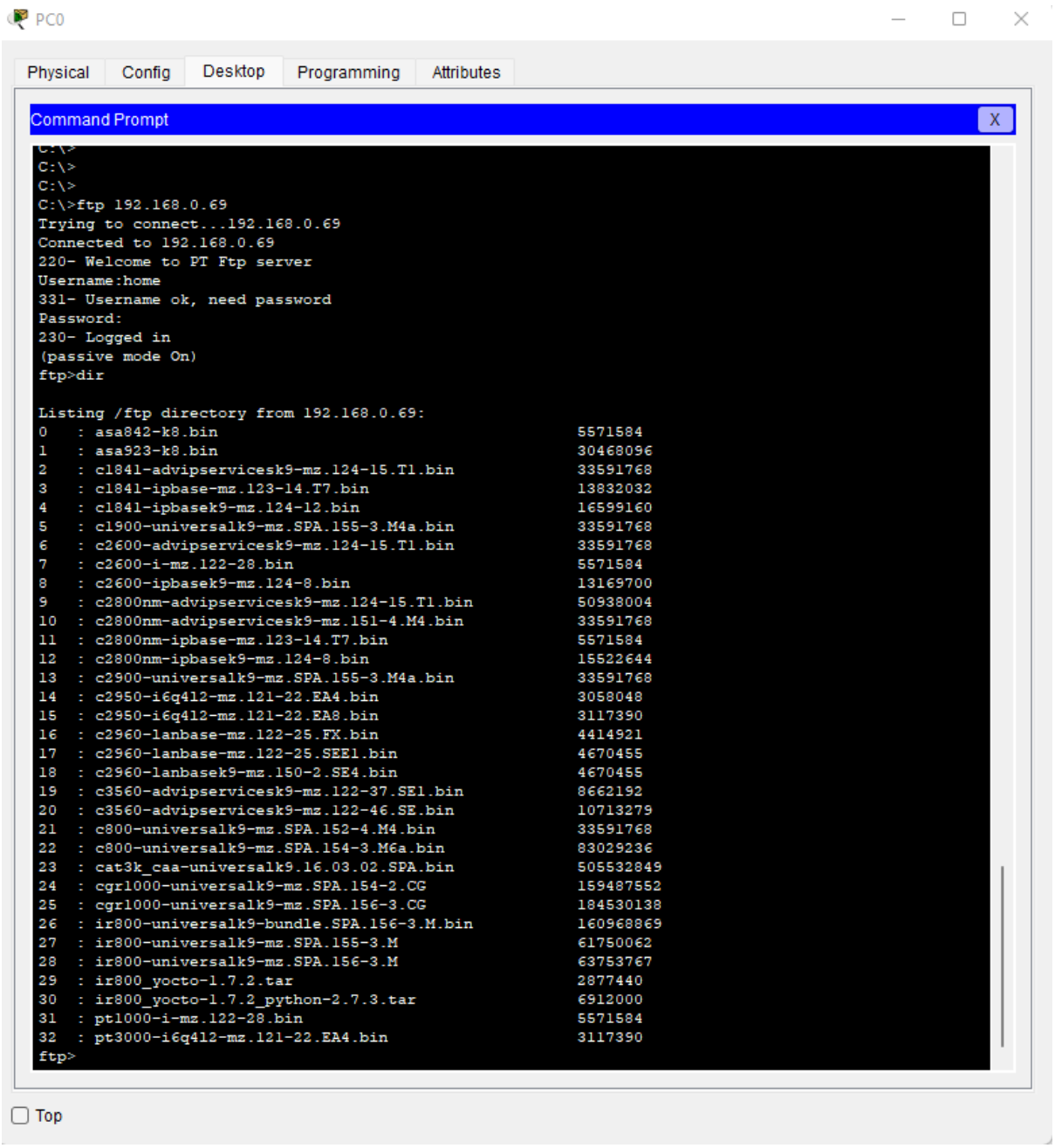


Figure 19: Working FTP server

3.2 Discussions

Basically, the movement in this project will be depending on the instruction that has been given. Insert the command either want to control the door or lamp by opening or closing the light or door if I want to control the light or door. There is only one command that can be executed at a time. After we issue a command, the server will issue us a notification based on the command we issued. The action executed once the command is issued is determined by the speed of our connection. If the connection is good, the server will respond quickly; but, if the connection is bad, I will have to wait a bit for the notification to appear on the server.

Chapter 4

Conclusion

4 Conclusion

4.1 Practical Implications

Nowadays, technology is continually evolving, and home automation is no exception. In terms of this project, it is highly recommended for everyone in the globe, particularly for disabled users and householders. This suggestion will lead to a greener environment, and it will help save money on electricity costs. Furthermore, it will assist and lead the disabled person to be able to function independently and manage their home safety in a more orderly manner. It will assist in preventing any loss or unfavorable scenarios for a user.

4.2 Scope of Future Work

There are numerous opportunities to improve in the project. The project will be subjected to comprehensive testing, and it is also suggested that the most of the sensors can be upgraded to a wireless mode, eliminating the need for a cable connection. This project will also expand its capabilities so that it may be used for purposes other than monitoring temperatures, such as monitoring server room temperatures or residential appliances.

Reference

5 References

1.Teymourzadeh, Rozita, et al. "Smart GSM Based Home Automation System." Systems, Process & Control (ICSPC), 2013 IEEE Conference on. IEEE, 2013.
2.Singh, Navab, et al. "Remotely controlled home automation system."Advances in Engineering and Technology Research (ICAETR), 2014 International Conference on. IEEE, 2014.