

Wi-Fi Based Home Automation

A COURSE PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this mini project report "**Wi-fi Based Home Automation**" is the bonafide work of **BUCHINGARI VASU(RA2011003010412), KASANUR JYOTHIRADHITHYA(RA2011003010416),SHUBHAM DUDHADE(RA2011003010431),K.B.CHANDRASHEKHAR(RA2011003010435),SHAIK HUSSAIN AHAMED(RA2011003010439)** who carried out the project work under my supervision.

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TABLE OF CONTENTS

CHAPTERS	CONTENTS
1.	ABSTRACT
2.	INTRODUCTION
3.	LITERATURE SURVEY
4.	REQUIREMENT ANALYSIS
5.	ARCHITECTURE & DESIGN
6.	IMPLEMENTATION
7.	EXPERIMENT RESULTS & ANALYSIS
	7.1. RESULTS
	7.2. RESULT ANALYSIS
8.	CONCLUSION & FUTURE ENHANCEMENT
9.	REFERENCES

1. ABSTRACT

Secure Wi-Fi technology is used by server, and hardware interface module to communicate with each other. User may use the same technology to log in to the server web-based application. If server is connected to the internet, so remote users can access server web-based application through the internet using a compatible web browser. For example, The home automation system can control the following appliances:

- 1) Lights on/off/dim
- 2) HVAC on/off
- 3) Door lock
- 4) Window shutdown
- 5) On/off different appliance and etc.

2. INTRODUCTION

2.1 Scenario Description

In today's technologically growing world technological development without becoming a requirement that is frequently used in today's human life. Living home that includes smart objects with specific functions is called smart home. i.e aimed to improve safety, comfort and efficiency. Which can be used to automate home activities without users using various sensors (Temperature, Humidity, Smoke, Wind, Sound) to monitor the home environment. And there are usually monitoring tools, and the devices that are controllable and automatic this can be accessed via an internet-connected computer or smart mobile device. Instead of providing security that is safe, smart home can provide different features to provide automatic security using various alarm systems, as LCD display and siren sound and by sending email to valid users if sensor detects security issues. Home automation states handling and monitoring home items using microcontroller or computer technology. Automation is common because it makes the process simple, productive and secure. All smart devices are registered at the home gateway in this paper and operated by a legitimate person. By including different sensors in home automation, Smart Home eliminates user engagement in tracking home settings and operating home appliances. IOT (Internet of Things) is a system in which people, objects with a specific identity and moving capacity information without needing a dual human-to-human origin, i.e destination or contact between people and computers IoT and IoE are a well versed technology which optimizes the life based on smart sensors and smart devices which operate together on the internet. All (IoE) web is a theory that extends machine-to machine communication (M2M) emphasis of the Internet of Things (IoT) to describe a more complex system that also includes people and processes. IoE is a smart people, method, information and stuff relation. The Internet of All (IoE) describes a system in which billions of entities have sensors for measuring and determining their status; all linked by common or proprietary protocols over public or private networks. This paper describes the implementation of smart home with the use of latest version of cisco packet tracer as this version includes different sensors, actuators and smart devices used for home automation. Chic lights, chic windows, chic fans, chic doors with different detectors and sensors are some of the devices. Latest version the simulation program for cisco packet tracer modeling and configuration of IOE systems with conventional networking system to implement smart home.

3. LITERATURE SURVEY

There are several researches related to home Automation Platform using IOT device. Along with this in the past, the research on the IOT has been made along with the study on various applications of internet of things. The growth of Internet of Things (IOT) in future is totally depending upon us.

Ahmed ElShafee(2012)

This paper has presented a design and prototype implementation of new home automation system that uses WiFi technology as a network infrastructure connecting its parts.

Hence they concluded that the required goals and objectives of home automation system have been achieved. The system design and architecture were discussed, and prototype presents the basic level of home appliance control. and remote monitoring has been implemented. Finally, their system is better from the scalability and flexibility point of view than the commercially available home automation system

Vinay sagar K (2015)

This system is designed to be low cost and expandable allowing a variety of devices to be controlled. The home automation using Internet of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet.

Neha Malik(2017)

The author discusses the various intelligent home automation system and technologies. The effort targeted on home automation concept where the controlling and monitoring operations are expediting through smart devices.

Shaikh Amreen(2017)

They have discussed about architecture of home automation system. Also explained how internet of things are used for monitoring regular domestic conditions by sensing systems.

Anurag Tiwari et al.(2017)

The authors reviewed the Challenges and Ongoing Researches for IOT. The IOT systems are very common and are widespread. Therefore chances of security and privacy problems have become regular. Due to this all the things which are associated with internet may face safety issues. Due to the issue which is related to security and privacy IOT could not set himself as a reliable technology.

4. REQUIREMENTS

4.1 Requirement Analysis

From the given scenario, we draw the following requirements:

1. Identifying the appropriate hardware which would be used (Cisco Packet Tracer)
2. Users on the internet should be able to access only https on the e-commerce server.
3. Users on the internet should have access only to the public IP address of the server and not the private IP address.
4. The users in the organization should have full access to the server.
5. TCP/IP Network design with IP addressing
6. Features and configuration required on the hardware with explanation

We need to configure a network design keeping the following requirements in mind.

4.2 Hardware Requirement

Server
Router WRT-300N
Switch
Laptop
IOT Smart Fan,
Window
Air Conditioner
Siren Web Cam
Motion Sensor
Smoke Detector
Humiture Monitor
Lawn Sprinkler

5. ARCHITECTURE AND DESIGN

The below figure shows the overall design of our system. There is a server setup which is connected to a switch and router. The IoT devices are connected to the server and can be accessed from anywhere within range. The devices can be accessed using a laptop or mobile which is also connected to the network. IOMoARcPSD|16423996

The design shows how different devices can be connected inside a smart home through the internet of things. The different devices used for design are as follows -

1.IoT and Radius server - Remote Authentication Dial-In User Service is a networking protocol that provides centralized authentication, authorization, and accounting management for users who connect and use a network service. This server is to monitor intelligent things that are recorded on it and to have specific database features .

2.Router(WRT300N) - Used to link different devices to the network of cellular.

3.Laptop - Link to your home destination to access intelligent objects.

4.Smartphone - To access the IoT devices from anywhere.

5.Fan - Used for ventilating the home environment on the basis of certain circumstances.

6.Webcam - For security to see who is coming in the house it gets activated only when the motion detector detects any movement and the webcam takes pictures and sends it to the server.

7.Siren - Provide sound at home for some cases for example if fire breaks out.

8.Motion detector - Link to your home getaway and detect motion.

9.Smart door - Link to your home getaway and detect motion to open or close automatically.

10.Lawn sprinkler - Used as a sprinkler based on environmental water level.

11.Smoke sensor - Used to sense the smoke level.

IOMoARcPSD|16423996

12.Older car - Used to model various home development scenarios as it affects the amount of oil, co2 and smoke. At a level of 1 percent an hour, this absorbs carbon monoxide. At a level of 2 percent an hour, this absorbs carbon dioxide Affects Smoke at an hourly rate of 3%.

13.AC - Used at a level of -2 percent an hour to cool the home affects humidity.

14.Smart window - Used to remotely control the window impacts Argon, CarbonMonoxide, Carbon Dioxide, Hydrogen, Helium, Methane, Nitrogen, O2,Propane, and Smoke.

6. IMPLEMENTATION

Including various smart objects which are used for implementing home automation such as windows, fans, lights, doors, lawn sprinklers, webcams and various sensors. The router and server are used for controlling the objects and sensors, which provide a programming environment for controlling objects that are connected and provide control mechanisms through the registration of Home Gateway smart devices.

ROUTER(WRT300N)

The router is set up with an IP address and default gateway. Then we change the network SSID name to “Home”. In the wireless security section the network mode is selected to WPA2 Enterprise. Then the encryption is selected which we set to AES here. We set the radius server option here to what we registered our server with. Here we also provide the shared password for the router. The figure below show the different configurations of the router.

Wireless Router0

Physical Config **GUI** Attributes

Internet Setup

Internet Connection type: Automatic Configuration - DHCP

Optional Settings (required by some internet service providers)

Host Name:

Domain Name:

MTU: Size: 1500

Network Setup

Router IP

IP Address: . . .

Subnet Mask:

DHCP Server Settings

DHCP Server: ☒ Enabled ☐ Disabled

DHCP Reservation

Start IP Address: 192.168.0.

Physical Config **GUI** Attributes

Wireless-N Broadband Router

Firmware Version: v0.93.3

Wireless Setup Wireless Security Access Restrictions Applications & Gaming Administration Status

Basic Wireless Settings

Network Mode:

Network Name (SSID):

Radio Band:

Wide Channel:

Standard Channel:

SSID Broadcast: ☒ Enabled ☐ Disabled

Wireless Router0

PhysicalConfigGUIAttributes

Wireless-N Broadband Router

Firmware Version: v0.93.3

Wireless

Setup

Wireless

Security

Access Restrictions

Applications & Gaming

Administration

Status

Basic Wireless Settings

Wireless Security

Guest Network

Wireless MAC Filter

Advanced Wireless Settings

Wireless Security

Help...

Security Mode:

WPA2 Enterprise

Encryption:

AES

RADIUS Server:

192

168

0

10

RADIUS Port:

1645

Shared Secret:

mypass

Key Renewal:

3600

seconds

Top

The router is connected to switch and different devices and the server.

IoT AND RADIUS SERVER

Remote Authentication Dial-In User Service is a networking protocol that provides centralized authentication, authorization, and accounting management for users who connect and use a network service. The device reads the username and password. The device creates a message called an Access-Request message and sends it to the RADIUS server. The device uses the RADIUS shared secret in the message. This server is used to monitor intelligent things that are recorded on it and to have specific database features .Firstly the IP configurations of the server is set up as shown below -

The screenshot shows a web-based configuration interface for an "IoT and radius Server". The interface has a top navigation bar with tabs: Physical, Config, Services, Desktop (selected), Programming, and Attributes. Below the navigation bar, the "IP Configuration" section is active. It contains two main configuration areas: "IP Configuration" and "IPv6 Configuration".

IP Configuration:

- ☐ DHCP
- ☒ Static
- IPv4 Address: 192.168.0.10
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.0.1
- DNS Server: 0.0.0.0

IPv6 Configuration:

- ☐ Automatic
- ☒ Static
- IPv6 Address: [Empty field] / [Empty field]
- Link Local Address: FE80::260:47FF:FE21:B51E
- Default Gateway: [Empty field]
- DNS Server: [Empty field]

802.1X:

- ☐ Use 802.1X Security
- Authentication: MD5 (selected from a dropdown menu)

At the bottom left of the configuration area, there is a "Top" link.

After that we use the AAA framework. AAA is a standard-based framework used to control who is permitted to use network resources (through authentication), what they are authorized to do (through authorization), and capture the actions performed while accessing the network (through accounting). Inside AAA service we set the client name, IP (IP address of the router), secret (which is the same as password set for router) and select the server type which is radius here.

The screenshot shows a web-based configuration interface titled "IoT and radius Server". The "Services" tab is selected, displaying a list of services on the left and the AAA configuration on the right.

SERVICES

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA**
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

AAA Configuration

Service: ☒ On ☐ Off Radius Port: 1645

Network Configuration

Client Name: Client IP:

Secret: ServerType: Radius

	Client Name	Client IP	Server Type	Key	
1	Home	192.168...	Radius	mypass	<input type="button" value="Add"/> <input type="button" value="Save"/> <input type="button" value="Remove"/>

User Setup

Username: Password:

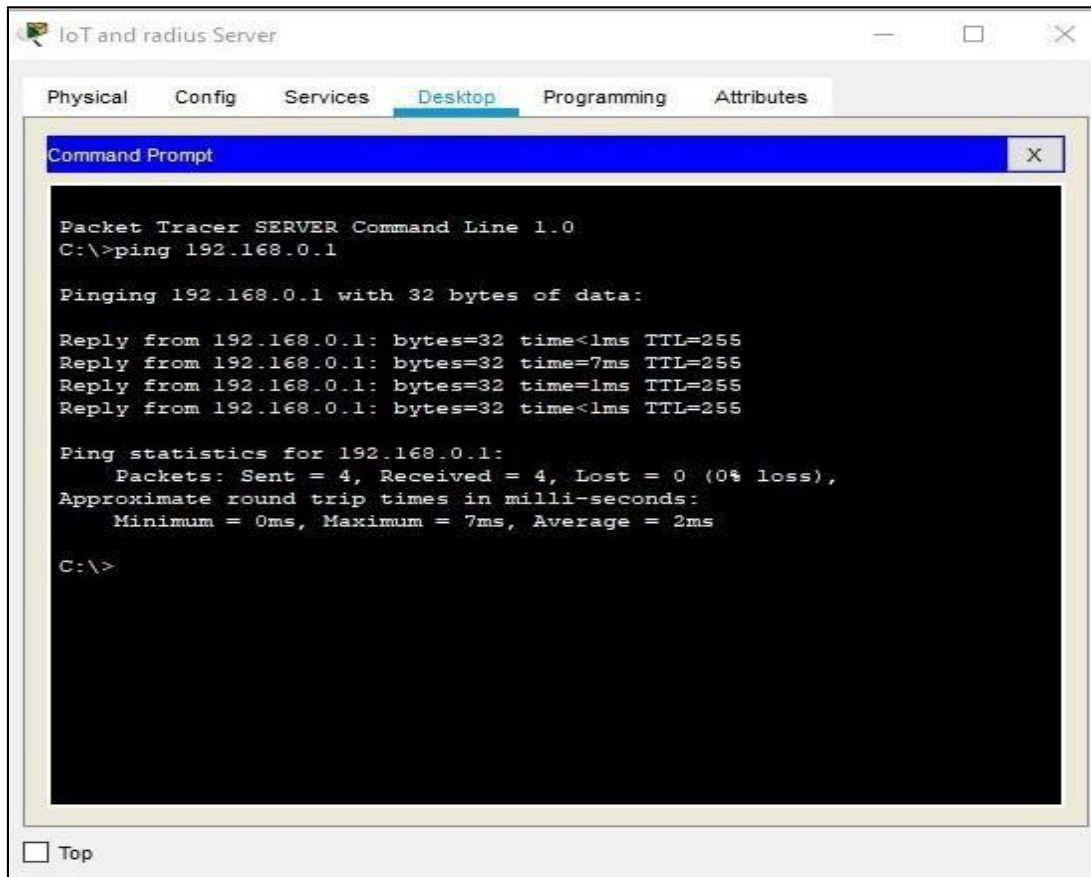
Then the IoT devices to be connected are registered by giving a username and password for the associated device as follows-

User Setup

Username Password

	Username	Password	
1	AC	AC	<input type="button" value="Add"/> <input type="button" value="Save"/> <input type="button" value="Remove"/>
2	Car	Car	
3	Door_1	Door_1	
4	Fan	Fan	

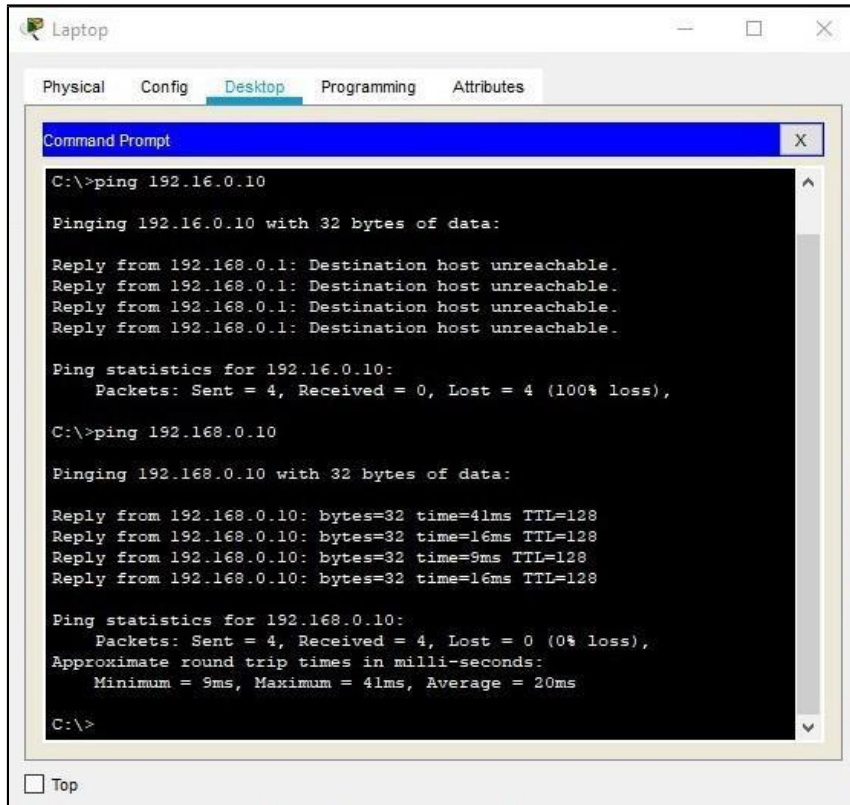
Then we ping the router from the server to check everything is working properly



REGISTERING TO THE SERVER

We connect a laptop to the router by setting up the IP configurations and then register to the server by providing a username and a password. After registering we can login with same credentials to view the devices which have been connected to our network and access them.





The screenshot shows a Windows Command Prompt window titled "Command Prompt" with a blue title bar. The window is open on a laptop, as indicated by the "Laptop" label in the top-left corner of the window's frame. The window has tabs for "Physical", "Config", "Desktop", "Programming", and "Attributes", with "Desktop" currently selected. The command prompt shows the following output:

```
C:\>ping 192.16.0.10

Pinging 192.16.0.10 with 32 bytes of data:

Reply from 192.168.0.1: Destination host unreachable.
Reply from 192.168.0.1: Destination host unreachable.
Reply from 192.168.0.1: Destination host unreachable.
Reply from 192.168.0.1: Destination host unreachable.

Ping statistics for 192.16.0.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.0.10

Pinging 192.168.0.10 with 32 bytes of data:

Reply from 192.168.0.10: bytes=32 time=41ms TTL=128
Reply from 192.168.0.10: bytes=32 time=16ms TTL=128
Reply from 192.168.0.10: bytes=32 time=9ms TTL=128
Reply from 192.168.0.10: bytes=32 time=16ms TTL=128

Ping statistics for 192.168.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 9ms, Maximum = 41ms, Average = 20ms

C:\>
```

At the bottom left of the window, there is a checkbox labeled "Top" which is currently unchecked.

SETTING UP DEVICES

For every device the network adapter is set to PT-IOT-NM-1W-AC. After that IoT server is selected as remote server and we provide the IP address of the router along with the password that we registered on the server with. In the wireless configuration part we provide the SSID along with authentication type, encryption type and username, password of the device with which it has been registered on the server.

Fan

Specifications I/O Config Physical Config Thing Editor Programming Attributes

Network Adapter PT-IOT-NM-1W-AC

Network Adapter 2 None

Digital Slots 1

Analog Slots 0

USB Ports 0

Bluetooth ☐ Built-in

Desktop ☐ Show

Usage ☒ Smart Device ☐ Component

INTERFACE

Wireless0

Default Gateway

DNS Server

IoT Server

☐ None

☐ Home Gateway

☒ Remote Server

Server Address 192.168.0.10

User Name Home

Password 123

Refresh

Specifications I/O Config Physical **Config** Thing Editor Programming Attributes

GLOBAL

Settings

Algorithm Settings

Files

INTERFACE

Wireless0

Wireless0

Port Status ☒ On

Bandwidth 300 Mbps

MAC Address 00E0.8FBB.5045

SSID Home

Authentication

☐ Disabled ☐ WEP WEP Key

☐ WPA-PSK ☐ WPA2-PSK PSK Pass Phrase

☐ WPA ☒ WPA2 User ID Fan

☐ 802.1X Method: MDS Password Fan

Encryption Type AES

IP Configuration

☒ DHCP

☐ Static

In the same way all the other devices are connected to the server that have been registered and they can now be accessed from the Laptop or Smartphone by logging in with username and password.

Laptop

Physical Config **Desktop** Programming Attributes

Web Browser X

< > URL http://192.168.0.10/index.php Go Stop

Registration Server Login

Username: Home

Password: ...

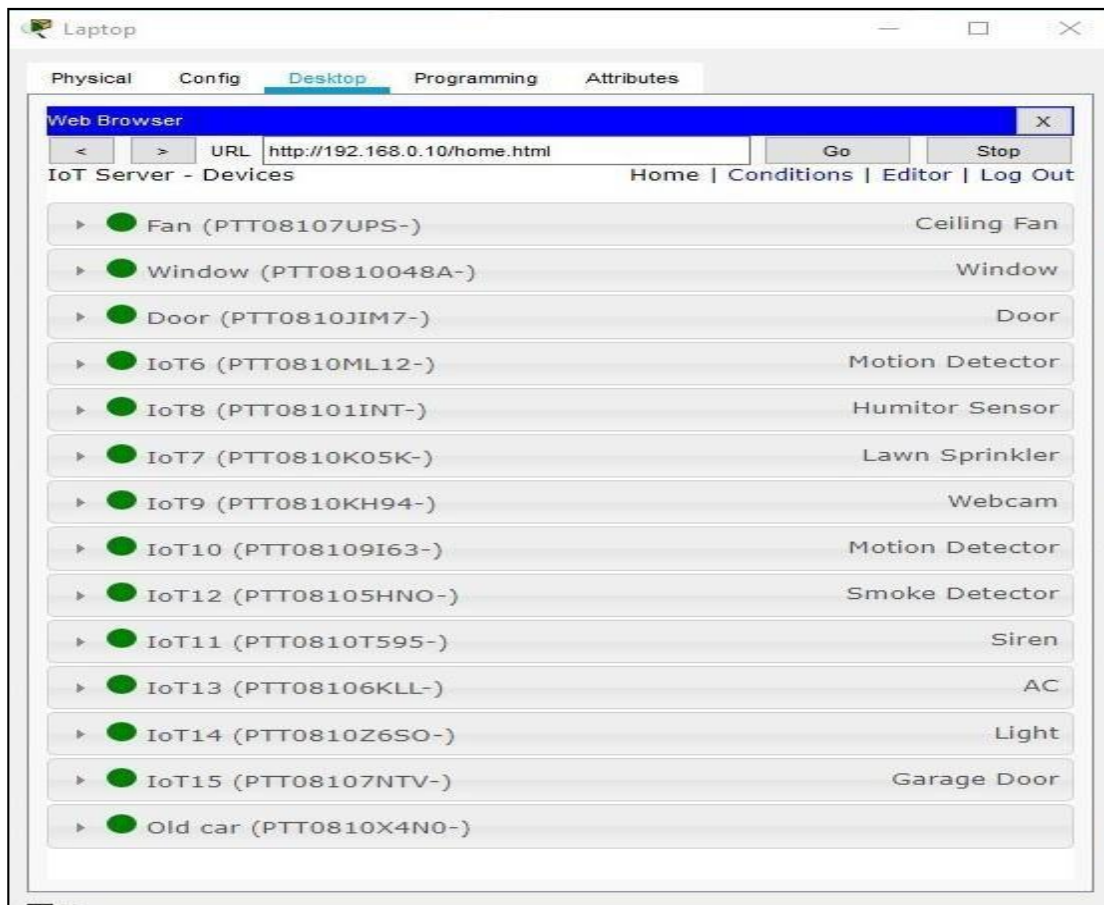
Sign In

Don't have an IoE account? [Sign up now](#)

7. EXPERIMENTS RESULTS AND ANALYSIS

7.1 RESULTS

After logging in from the web browser we get the following page from where we can access all the devices which have been connected.



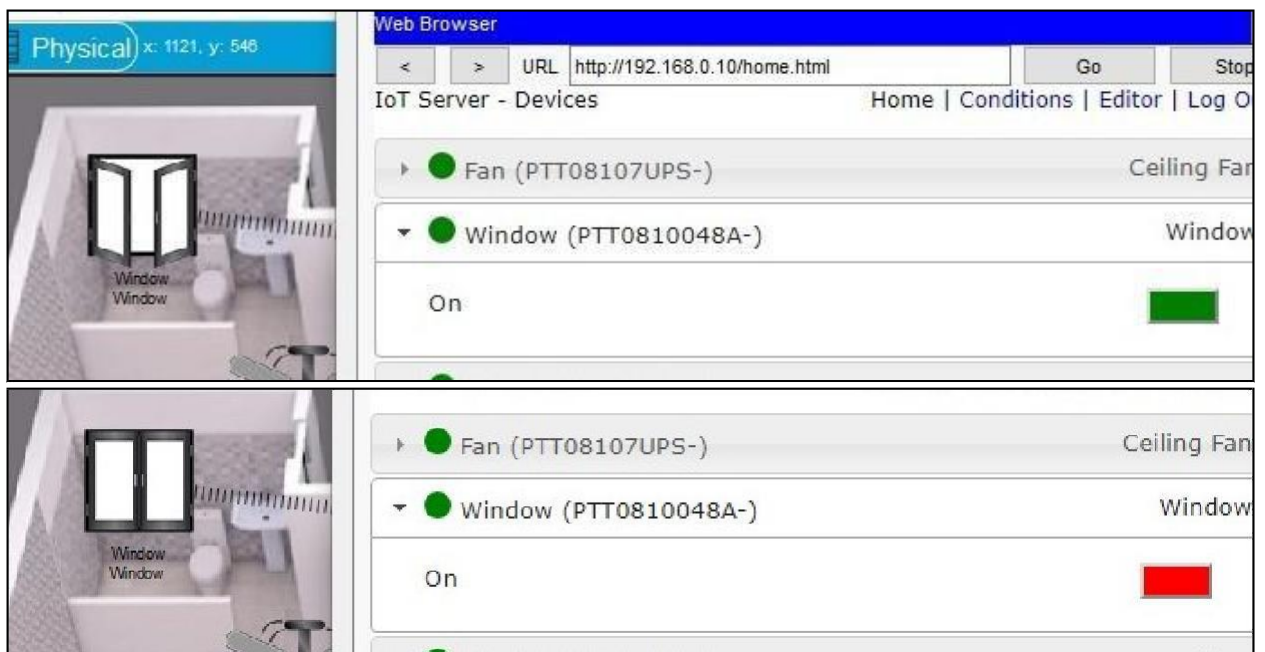
As an example, here we can control fan speed.



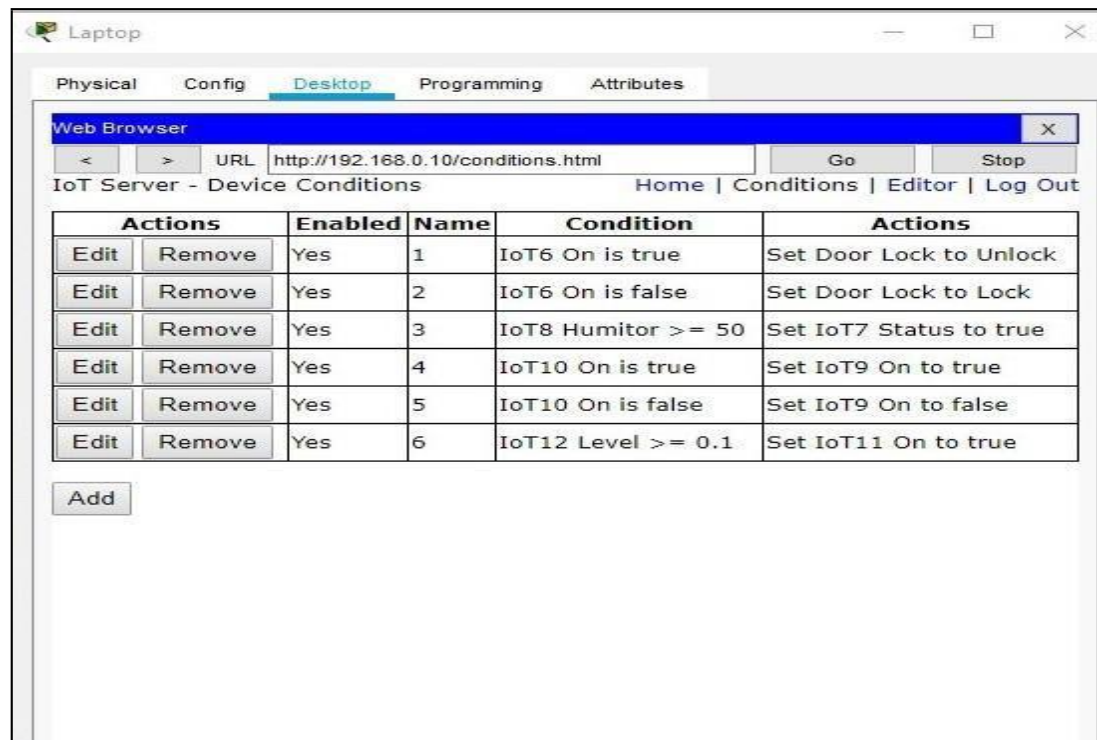
Or we can turn light on or off -



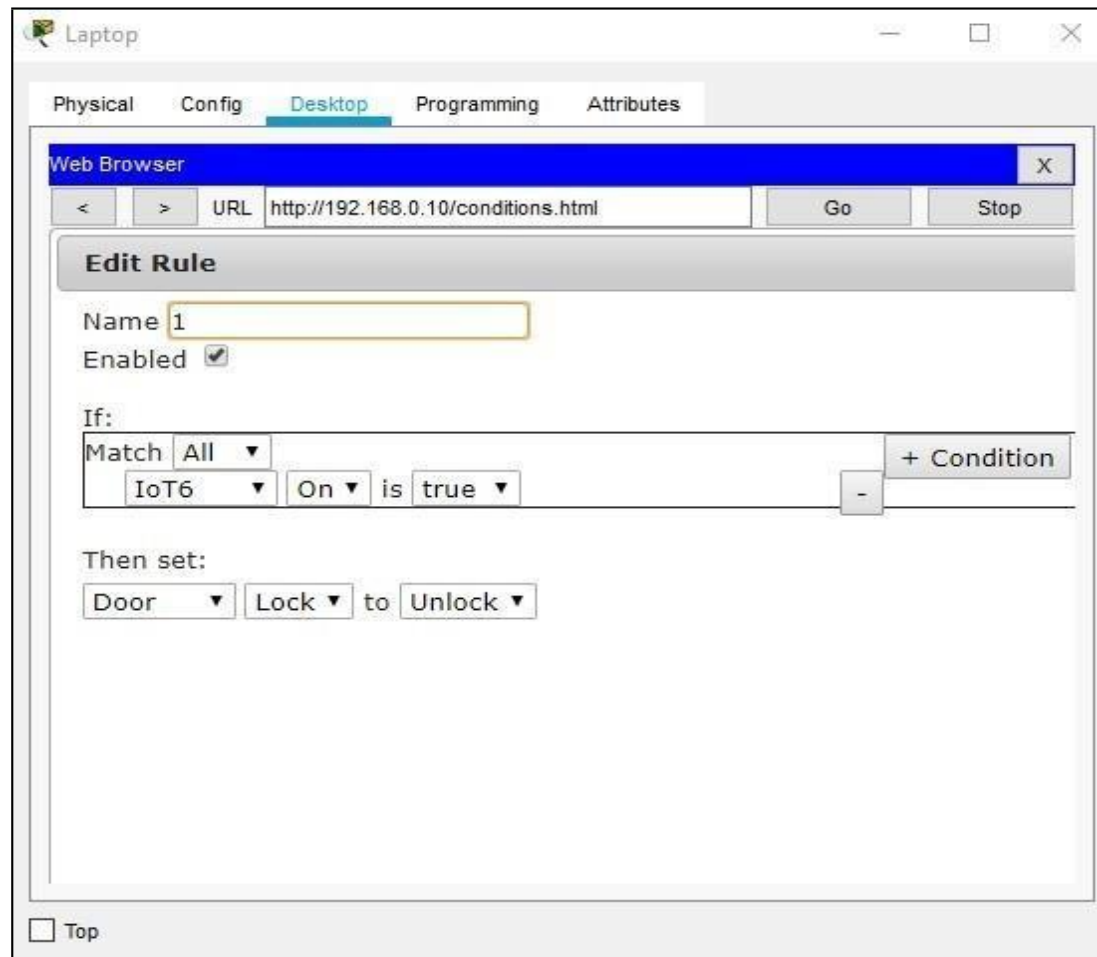
We can also control windows remotely.



CONDITIONS:



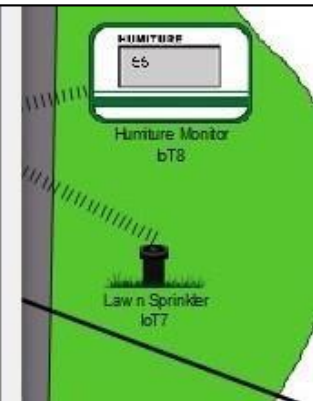
We can also apply conditions to the IoT devices to automatically take some actions if certain conditions are met. The below diagram shows how we can add conditions by selecting the target device and applying conditions on them. For example, in the below picture, there is an if condition. The if block allows us to set conditions we can go to + sign to add conditions. Here, we have selected if IoT6 is true then set Door Lock to Unlock. IoT6 is a motion detector here. As soon as the motion detector senses motion it unlocks the gate automatically.



Here as soon as the mouse cursor goes to the motion detector which is a function in the software for motion detector, the door unlocks which we can see.

Similarly many conditions are applied to other devices also be it lawn sprinkler which automatically becomes on by applying some conditions on humiture monitor and siren which starts making sound when smoke detector detects smoke. These devices are connected to each other.

Edit	Remove	Yes	1	IoT6 On is true	Set Door Lock to Unlock
Edit	Remove	Yes	2	IoT6 On is false	Set Door Lock to Lock
Edit	Remove	Yes	3	IoT8 Humitor ≥ 60	Set IoT7 Status to true
Edit	Remove	Yes	4	IoT10 On is true	Set IoT9 On to true
Edit	Remove	Yes	5	IoT10 On is false	Set IoT9 On to false
Edit	Remove	Yes	6	IoT12 Level ≥ 0.1	Set IoT11 On to true
Edit	Remove	Yes	7	IoT8 Humitor < 60	Set IoT7 Status to false



Here the condition is applied such as when the humiture is ≥ 60 , then the lawn sprinkler becomes on and when it becomes less than 60 it becomes off. Since, humidor meter is showing 56, the sprinkler is off for now.

Similarly we can apply conditions on smoke detector for siren to work



7.2 RESULT ANALYSIS

IoT systems are going to replace present day devices rapidly. The analysis which we can draw is that this is a swift and very easy to use system. Once set up people can easily control their home with their laptop or smartphone. The devices are working properly and devices respond according to the condition set.

Cost Analysis-

Cost of smart home systems can be categorized into two parts: installation cost and operating cost. Gesture controlled and Internet controlled systems have comparatively higher installation and operation cost compared to the other systems.

Speed, Range and Accuracy Analysis-

Performance of different smart home systems according to speed, range of operation and accuracy are different. The speed and connection strength varies with distance of the devices. This can also affect accuracy.

Reliability Analysis of Smart Home Systems-

Based on different issues such as cost, range, speed, accuracy, flexibility, GUI and many other things, it is important to determine whether a smart home system is reliable or not. Reliability of smart home systems is quite important to determine because consumers need to have a clear idea of the product before buying it. If a system fails from time to time then customers will not gain confidence in such a system, so it's very important to make these devices very accurate.

8. CONCLUSION AND FUTURE ENHANCEMENT

We used the latest cisco packet tracer version to introduce smart home, as this version includes numerous IOE devices. We used the home portal for home automation and record smart devices for monitoring them and microcontroller (MCU-PT) to connect various sensors as well as IOE devices. MCU moreover offers computing environment for different devices and different language of programming.

Future scope for the home automation systems involves making homes even smarter. Homes can be interfaced with sensors including motion sensors, light sensors and temperature sensors and provide automated toggling of devices based on conditions. More energy can be conserved by ensuring occupation of the house before turning on devices and checking brightness and turning off lights if not necessary. The system can be integrated closely with home security solutions to allow greater control and safety for home owners. The next step would be to extend this system to automate a large scale environment, such as offices and factories. Home Automation offers a global standard for interoperable products. Standardization enables smart homes that can control appliances, lighting, environment, energy management and security as well as the expandability to connect with other networks.

9. REFERENCES

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