UNIVERSITY of GREENWICH
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BTEC

Higher Nationals in Computing

Unit 43: Internet of Things

ASSIGNMENT 2

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Subject code: 1690

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ASSIGNMENT 2 FRONT SHEET

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Unit number and title	**Unit 43: Internet of Things**		
Submission date	June 25, 2020	**Date Received 1st submission**	June 25, 2020
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Student declaration I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.			
		Student's signature	

Grading grid

P5	P6	P7	M5	M6	D2	D3

❒ Summative Feedback:	❒ Resubmission Feedback:

Grade:	Assessor Signature:	Date:

Internal Verifier's Comments:

Signature & Date:

ASSIGNMENT 2 BRIEF

Qualification	**BTEC Level 5 HND Diploma in Computing**		
Unit number	Unit 43: Internet of Things		
Assignment title			
Academic Year	2020		
Unit Tutor	Ho Hai Van		
Issue date		**Submission date**	June 25, 2020
IV name and date	Ta Thai Bao		

Submission Format:

Format: This assignment is an Individual assignment and specifically including 1 document:

You must use font *Calibri size 12, set number of the pages and use multiple line spacing at 1.3. Margins must be: left: 1.25 cm; right: 1 cm; top: 1 cm and bottom: 1 cm.* The reference follows Harvard referencing system. The recommended word limit is *2.000-2.500 words*. You will not be penalized for exceeding the total word limit. The cover page of the report has to be the Assignment front sheet 2.

Submission Students are compulsory to submit the assignment in due date and in a way requested by the Tutors. The form of submission will be a soft copy posted on http://cms.greenwich.edu.vn/

Note: The Assignment *must* be your own work, and not copied by or from another student or from books etc. If you use ideas, quotes or data (such as diagrams) from books, journals or other sources, you must reference your sources, using the Harvard style. Make sure that you know how to reference properly, and that understand the guidelines on plagiarism. *If you do not, you definitely get fail*

Unit Learning Outcomes:

LO1 Analyse what aspects of IoT are necessary and appropriate when designing software applications

LO2 Outline a plan for an appropriate IoT application using common architecture, frameworks, tools, hardware and APIs

LO3 Develop an IoT application using any combination of hardware, software, data, platforms and services.

LO4 Evaluate your IoT application and detail the problem your IoT application solves, the potential impact on people, business, society and the end user and the problems it might encounter when integrating into the wider IoT ecosystem

Assignment Brief and Guidance:

You currently work as a product developer for a new startup where you design IoT products for the consumer, corporate, government and defence clients. As part of your role your manager has tasked you to plan and develop a new IoT product, service or application for a potential client. You are required to identify a target user and conduct tests with this user and include this feedback into multiple iterative versions of your product.

Part 1 (Assignment 1):: For the first part, you must:

- Plan an IoT application for a specific target end user and the tests you intend to conduct with this user. This plan will be in the form of a document and will include supporting evidence and material, such as user personas and customer journey maps.
- Create multiple iterations of your application and modify each iteration with enhancements gathered from user feedback and experimentation. This will follow the pathway outlined in your plan.(log book,)

Part 2 (Assignment 2): For the second part, you must produce a report to prove that:

- Show evidence about Developed IoT application using any combination of hardware, software, data, platforms and services (video or images of your IoT system with code snippet)
- Evaluate your IoT application and detail the problem your IoT application solves, the potential impact on people, business, society and the end user and the problems it might encounter when integrating into the wider IoT ecosystem

Learning Outcomes and Assessment Criteria		
Pass	**Merit**	**Distinction**
LO3 Develop an IoT application using any combination of hardware, software, data, platforms and services.		
P5 Employ an appropriate set of tools to develop your plan into an IoT application. **P6** Run end user experiments and examines feedback.	**M5** Reconcile and evaluate end user feedback and determine advantages and disadvantages of your chosen IoT techniques.	
LO4 Evaluate your IoT application and detail the problem your IoT application solves, the potential impact on people, business, society and the end user and the problems it might encounter when integrating into the wider IoT ecosystem		
P7 Evaluate end user feedback from your IoT application.	**M6** Undertake a critical review and compare your final application with the original plan.	**D3** Critique the overall success of your application. Did it solve your problem? What is the potential impact on people, business, society and the end user? What problems might it encounter when integrating into the wider IoT ecosystem?

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LO3 Develop an IoT application using any combination of hardware, software, data, platforms and services.

P5 Employ an appropriate set of tools to develop your plan into an IoT application.

After planning in P4, from checking the spending after completing the model to checking the connection of devices in the model. Now I will start developing Smart Home based on Packet Tracer tool.

5.1 Step 1:

Open the **Packet Tracer** icon on the **Desktop** and Start screen

Figure 1:Cisco Packet Tracer

5. 2 Step 2:

After opening Packet Tracer, we see the program's work screen includes the following parts:

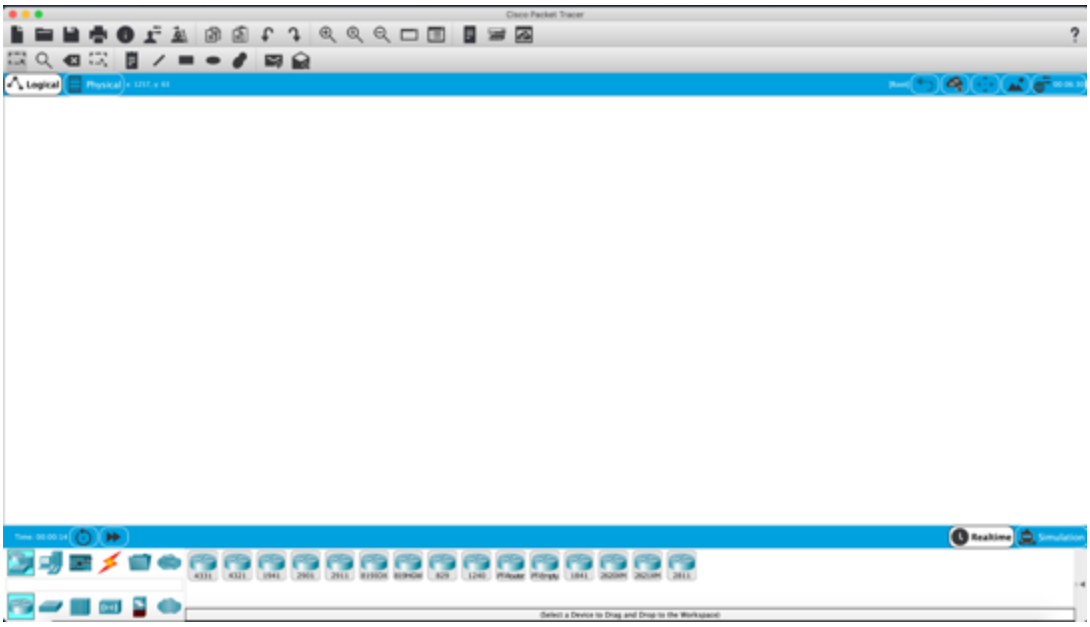


Figure 2: Program's work screen of Cisco Packet Tracer

- Frame work
- The equipment
- Toolbar

5.3 Step 3:

After planning, the model we need to develop needs a lot of equipment, including:

1) **Control device**: Smartphone, PC, tablet, Laptop.
2) **Sensor**: Smoke Detector, Temperature monitor IoT.
3) **Output device**: Ceilling fan, light, Garage Door, Fire Sprinkler, Air Conditioner, Door, Lawn Sprinkler, Appliance.
4) **Central equipment**: Home Gateway
5) **Connection types**: Copper Straight-Through, Wi-Fi

Now I will choose the device and bring up the working screen.

5.4 Step 4: Device Drivers

Figure 3: Toolbar of Cisco Packet Tracer

Based on the image above, we can search for the devices planned in the model in the **End Divices** section

5.4.1 Smartphone:

Figure 4: Smart phone

Packet Tracer supports virtualization of smart phones, helping us to use virtualized and compatible phones with IoT devices as usual.

5.4.2 Computer:

Figure 5: PC

In each house, at least one computer is required, so that users can do anything with computers as well as use computers to access IoT devices in smart home.

5.4.3 Tablet:

Figure 6: Tablet

Like using a phone, each of us must have at least one tablet so I can test and interact with tablet devices IoT devices in Smart home.

5.4.4 Laptop:

Figure 7: Laptop

Laptop is also an indispensable device in smart home, it is more convenient than pc because it is compact and can be used anywhere in the house.

5.5 Step 5: Sensor

Figure 8: Sensor

Based on the image above, we can see that the sensors for smart home are located at **End Devices => Home**. From there we can drag and drop the sensors that have been planned into the working screen.

5.5.1 Smoke Detector:

Figure 9: Smoke detector

Smoke Detector is a smoke sensing device, it helps identify the air with smoke or components similar to smoke. The main application of Smoke Detector is a fire or fire alarm device.

5.5.2 Temperature monitor:

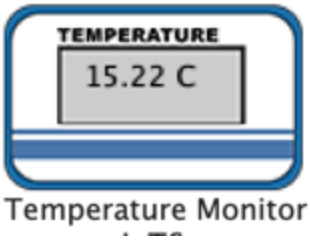


Figure 10: Temperature Monitor

Temperature Monitor is a temperature sensor, which measures the temperature from the surrounding environment and returns the temperature results to the central system. Temperature value can be C or F depending on the device we set.

5.6 Step 6 Output device:

5.6.1 Ceilling fan:

Figure 11: Fan

Every floor in the smart home has a fan, for when the weather is hot and high temperatures, users can control the device remotely by phone or computer as long as they can access the network.

5.6.2 Light:

Figure 12: Light

Every floor in smart home has light devices for users who need light to work or anything, they can turn on and off the light by remote devices.

5.6.3 Garage Door:

Figure 13: Garage door

As shown above, it is the Garage Door that has been configured so that when users need to open or close the door, they can use the phone or other control devices to access the network to control the **Garage door**.

5.6.4 Fire Sprinkler:

Figure 14: Fire Sprinkler

Fire sprinkler is a fire extinguishing device when a fire occurs. After the central system has confirmed whether the house is on fire or is on fire, the Fire sprinkler will automatically operate to extinguish the fire.

5.6.5 Air Conditioner:

Figure 15: Air conditioner

When the indoor temperature is too high, users have to use the remote control devices to control the **Air Conditioner** on / off to adjust the indoor temperature.

5.6.6 Door:

Figure 16: Door

In smart home, **Door** has also been equipped with devices to be able to open or close doors with remote control devices.

5.6.7 Lawn Sprinkler:

Figure 17: Lawn sprikler

When outside the garden is too hot, users can control Lawn Sprinkler to have to supply water to the garden plants or we can configure Lawn Sprinkler to automatically turn on when the temperature is too high.

5.6.8 Appliance:

Figure 18: Appliance

Appliance can also be remotely controlled so that when the user needs to use it but at a distance too far from the Appliance. Users can use the device remotely and then slowly close it.

5.7 Step 7 Central equipment:

Central devices are devices that connect devices in the home. Receiving data from sensors, processing and outputting results to output devices.

5.7.1 Home Gateway

Figure 19: Home gateway

As shown above, the Home Gateway is the central system, whose main task is to allocate the internet to help connect devices in the house together. From there take values from the sensors, process and execute them based on the given conditions.

5.8 Step 8 Types of connections:

Figure 20: Types of connections

As shown above, we see Packet Tracer has a toolbox that supports different types of wires connecting devices. Such as: copper wire, optical cable, usb, ..

5.8.1: Copper Straight-Through

Figure 21: Copper Straight-Through

In the smart home model, I use copper wire to connect the PC to the Home Gateway together. To be able to control devices in the house with a PC through the processing center is the Home Gateway.

5.8.2: Wi-Fi

Figure 22: Wi-Fi

The next type of connection I use in the smart home model is the wireless connection (Wifi) to connect the remote devices together without having to use copper wires, which helps streamline and save connection costs. cord.

5.9 Step 9: Arrange the position of the devices in the model

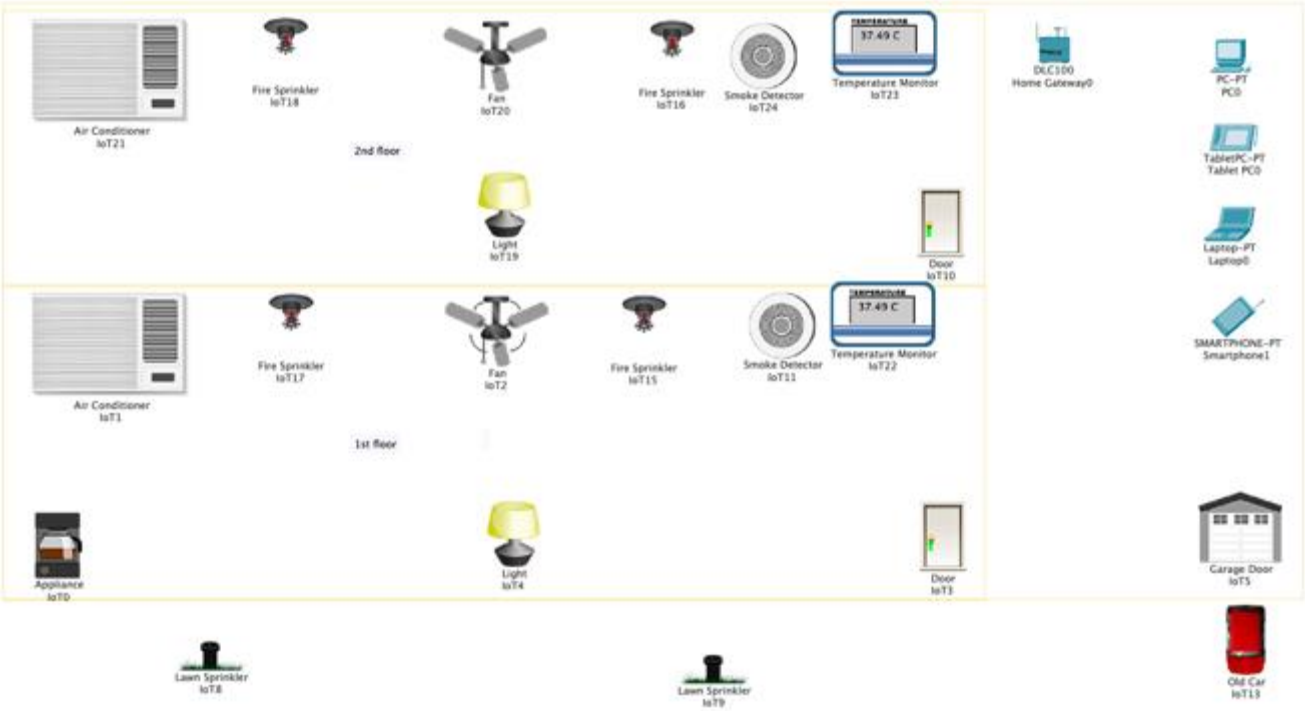


Figure 23: Home

As the picture above, is the result of I have arranged the equipment in the model into the appropriate position in the house:

- **In the graden**

  + Lawn Sprinkler

  + Old car

- **Ground floor**

  + Appliance

+ Door

+ Light

+ Air Conditioner

+ Fire Sprinkler

+ Temperature monitor

+ Smoke detector

- **1st Floor**

+ Door

+ Light

+ Air Conditioner

+ Fire Sprinkler

+ Temperature monitor

+ Smoke detector

5.10 Step 10: Configure and connect devices to home network.

5.10.1 Home Gateway:

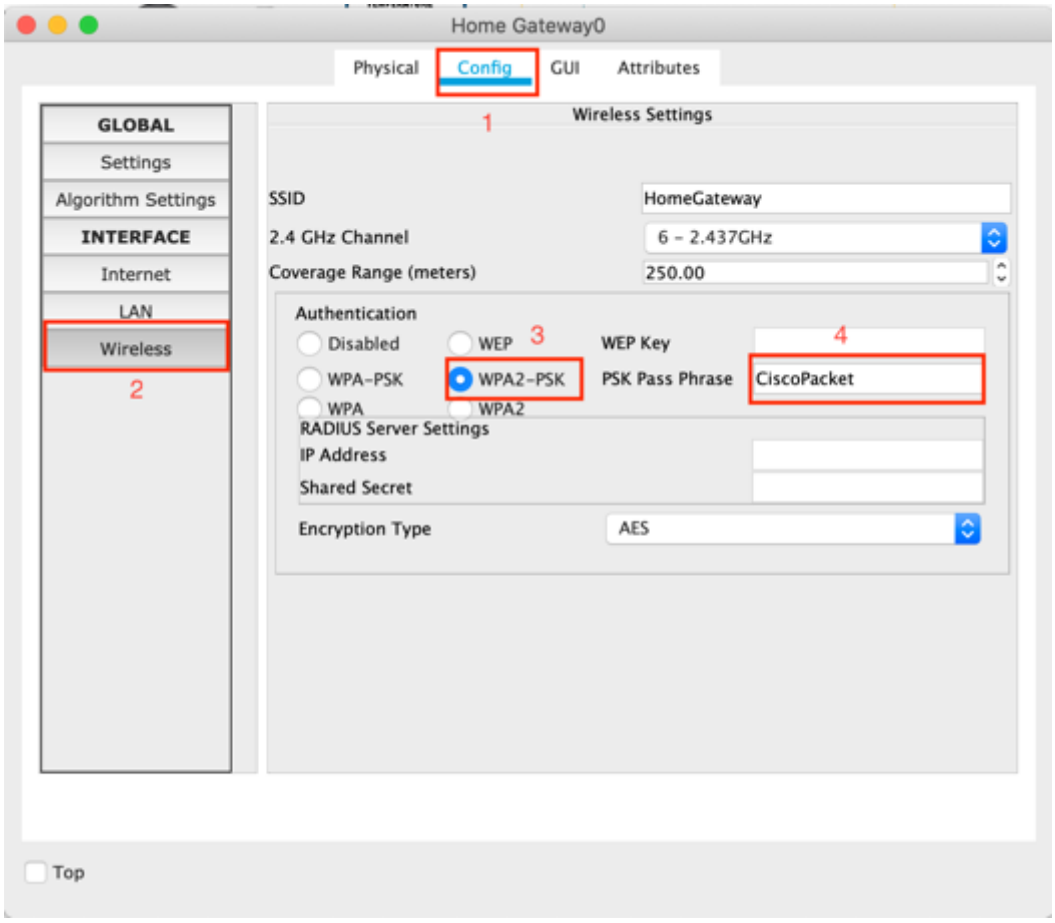


Figure 24: Config of Home Gateway

As shown above, I configured the wireless connection for the Home Gateway to create a connection with devices in the smart home based on the following steps:

1) Click config button
2) Click the Wireless button on the left side
3) Select the security I want to use, I use WPA-PSK here
4) I entered the password for the smart home network, to avoid unauthorized access. I need to create a password to ensure that only I can use it.

5.10.2 Connect devices to the Wi-Fi network

Because the connection of devices is the same, such as: Fan, Appliance, Door, Light, Air Conditioner, Fire Sprinkler, Temperature monitor, Smoke detector, Lawn Sprinkler.

I will configure for Fan as well for all devices listed above. Because the configuration is the same for all listed devices.

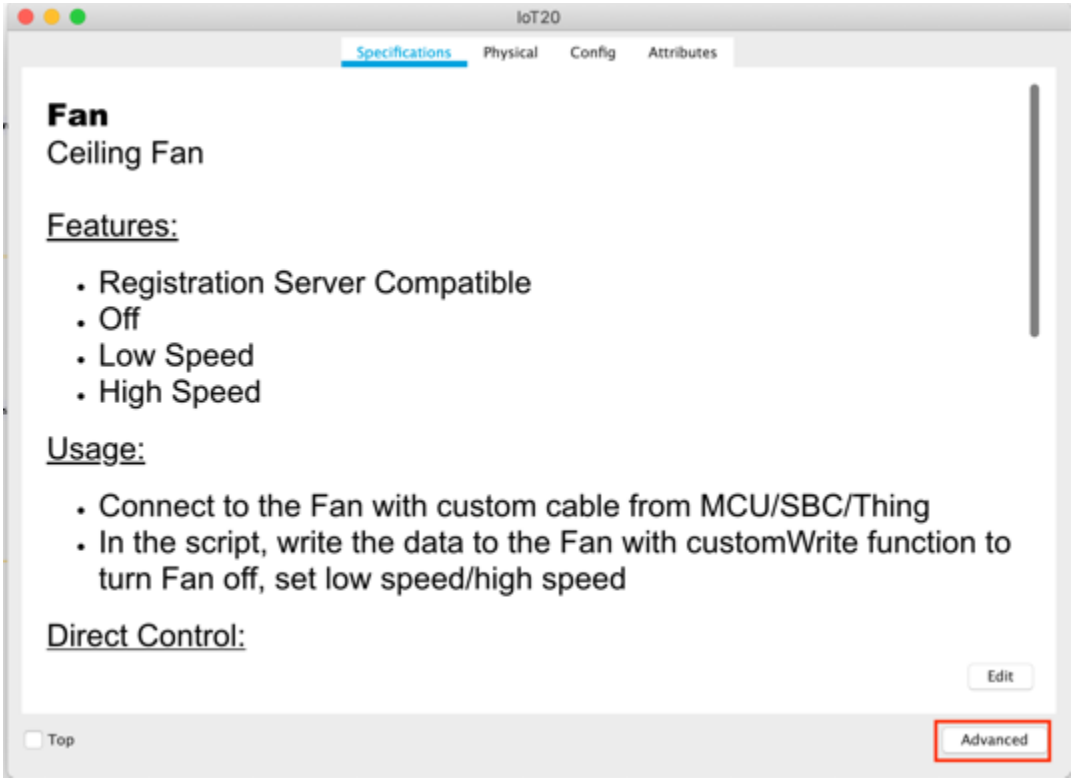


Figure 25: Config of Fan(1)

First, I will click on Fan to appear the configuration table as shown above, then click the **Advanced** button for advanced configuration for Fan.

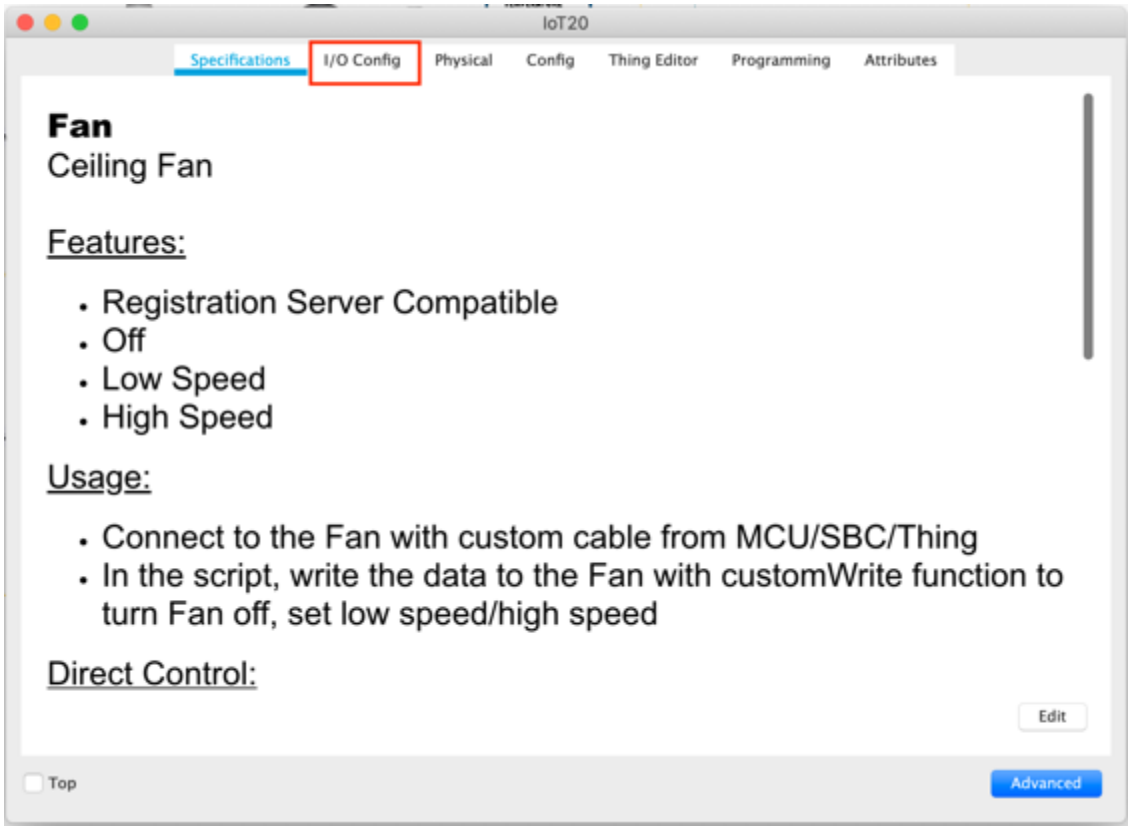


Figure 26: Config of Fan(2)

After I went into the advanced configuration, I chose the **I / O Config** button to configure the connection types for Fan.

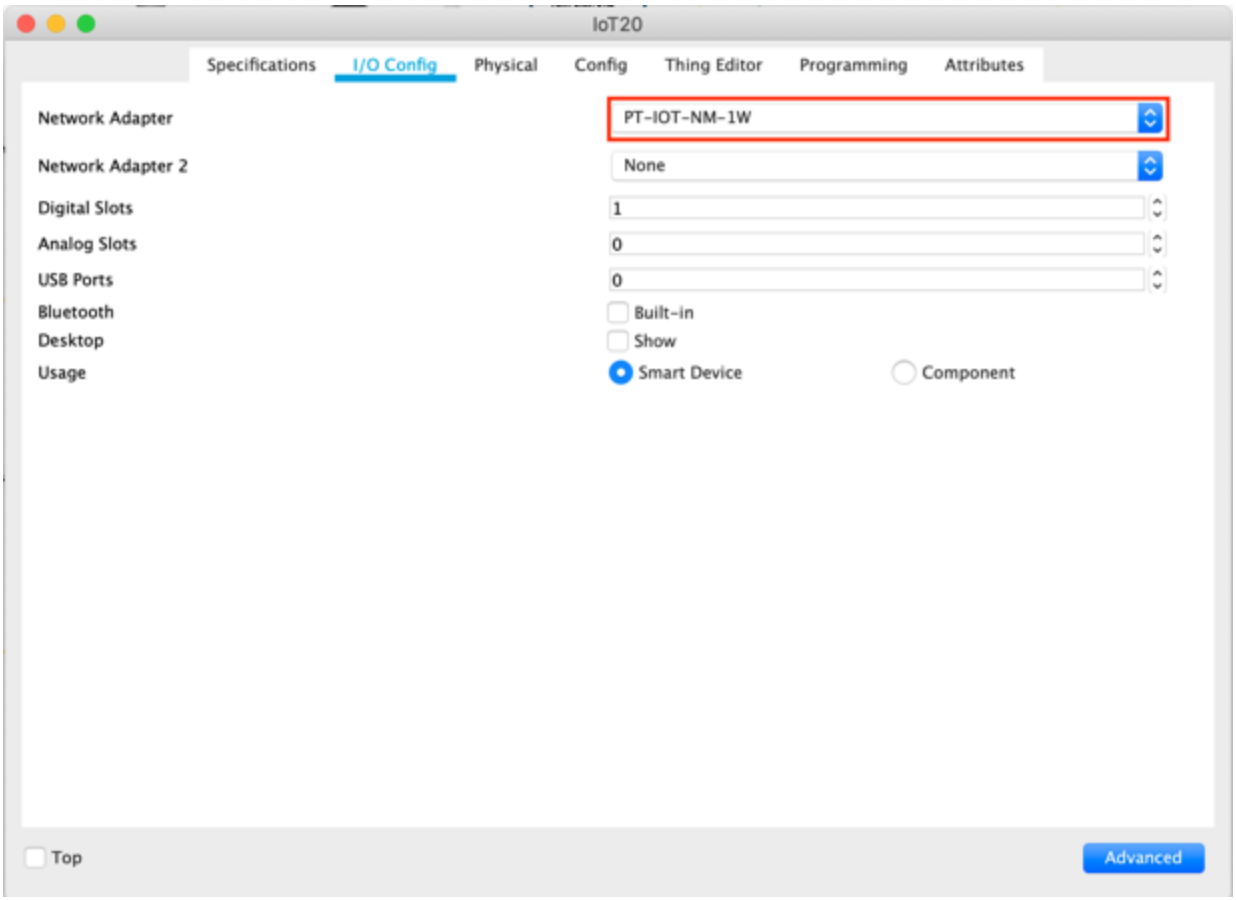


Figure 27: Config of Fan(3)

As shown above, I searched for **Network Adapter** and selected **PT-IOT-NM-1W**. In the absence of **PT-IOT-NM-1W** I will click on the item to select:

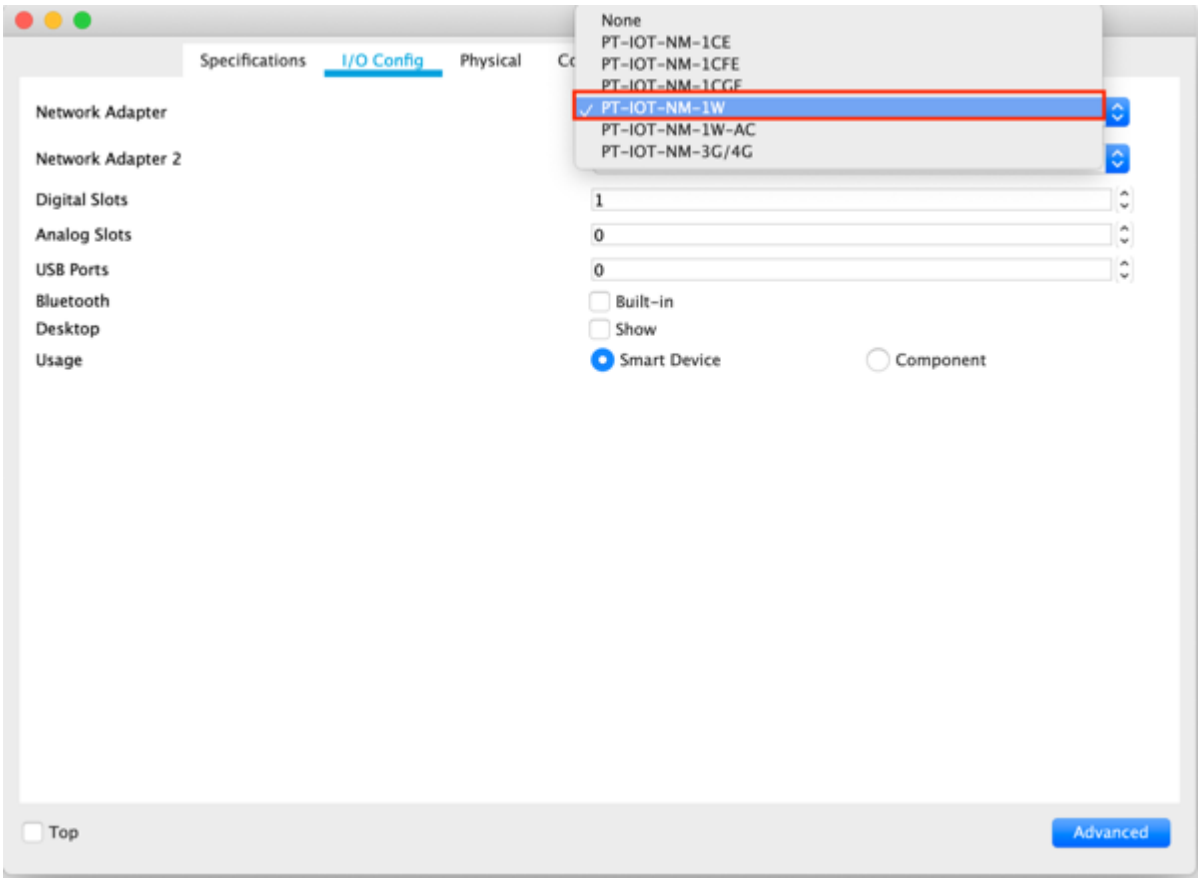


Figure 28: Config of Fan(4)

As shown above, I have chosen **PT-IOT-NM-1W** so that Fan device can have wireless connection and can be connected to Home Gateway network.

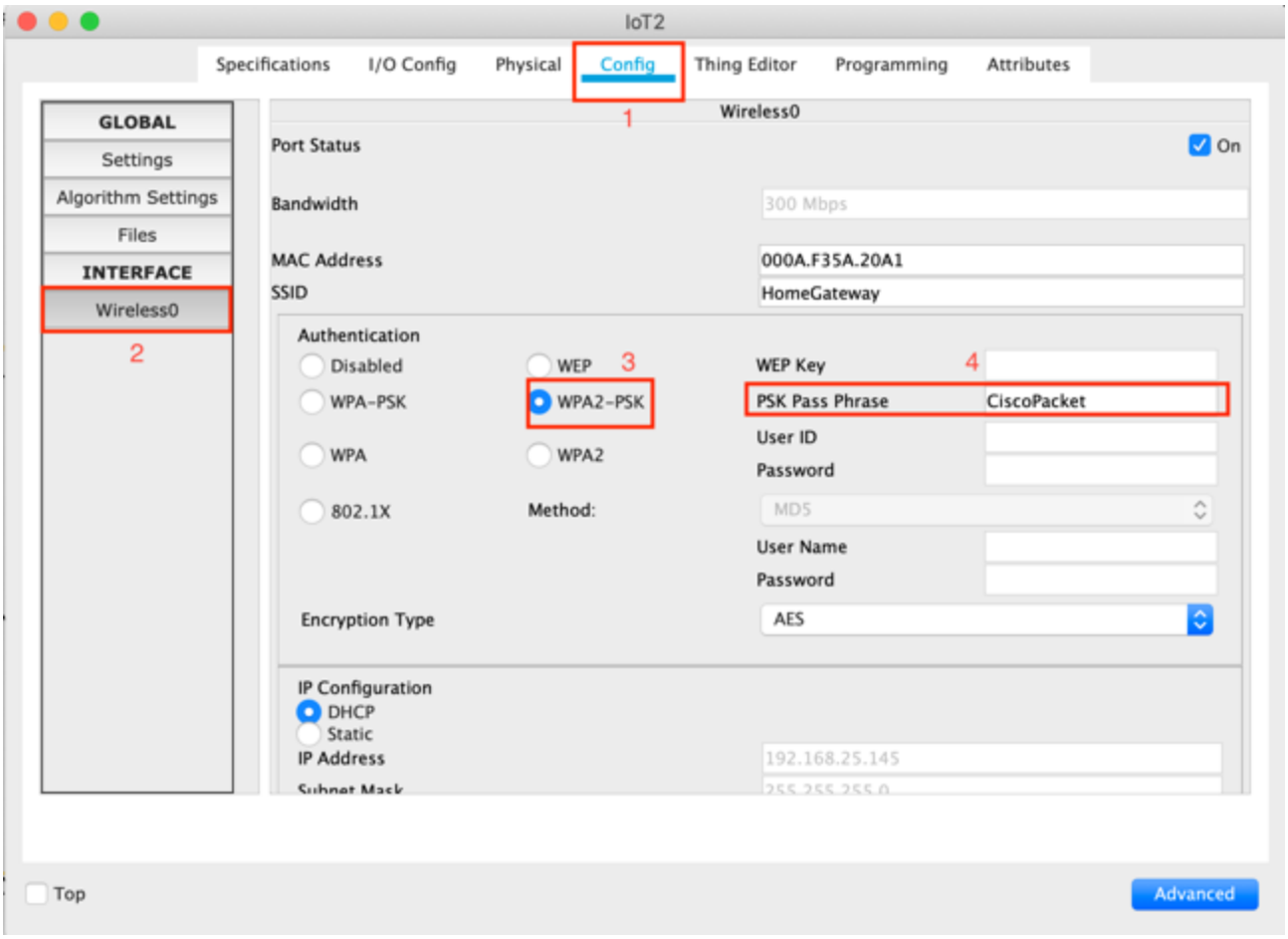


Figure 29: Config of Fan(5)

Once I have selected the Wi-Fi connection, I follow the steps below to get the device to access the Wi-Fi system:

1) Click config button
2) Click the Wireless button on the left side
3) Select the security issue I need to use to access Wi-Fi, here I use WPA-PSK
4) I imported a password for the smart home network, CiscoPacket

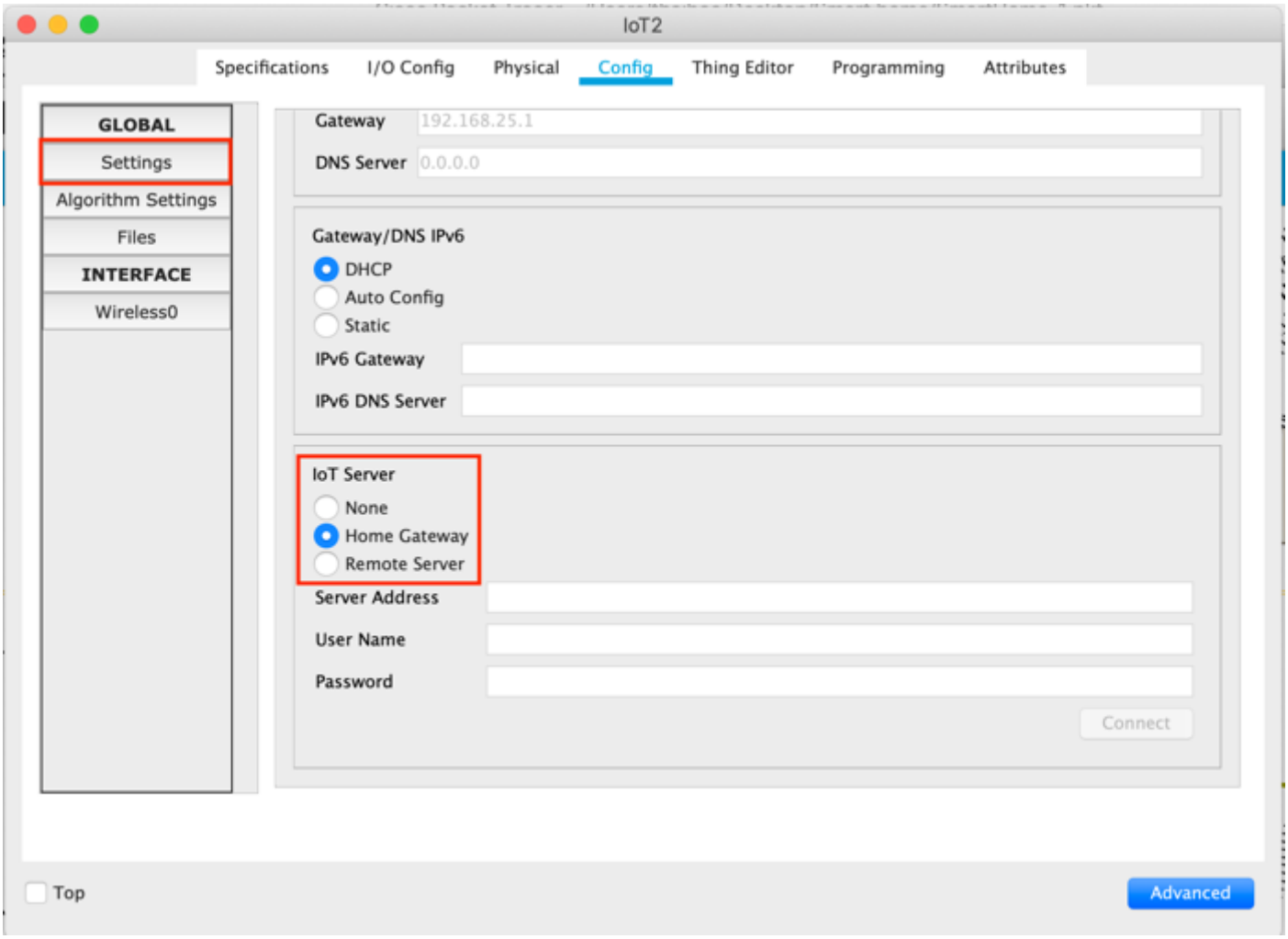


Figure 30: Config of Fan(6)

After you've connected to the **Wireless** network, go to Settings, select **Home Gateway** in the **IoT Server** so that the device recognizes that the **Home Gateway** is the control center.

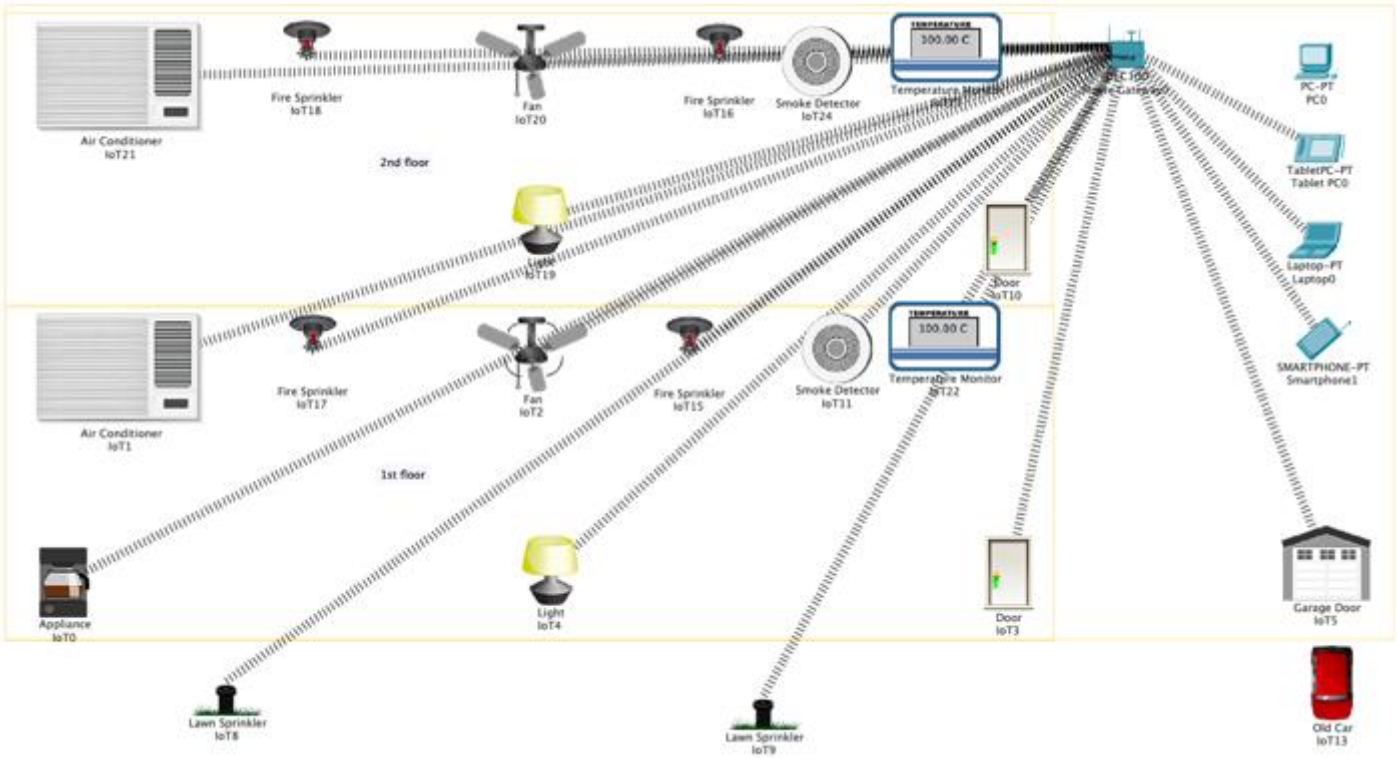


Figure 31: Smart home

And this is the result after I configured and connected the devices to the **Home Gateway** network.

5.10.3 Configure conditions for input and output devices.

In the smart home system, I have an automatic or dynamic configuration based on the conditions I have set.

Figure 32: Smart phone

I first used my phone to access the Home Gateway system.

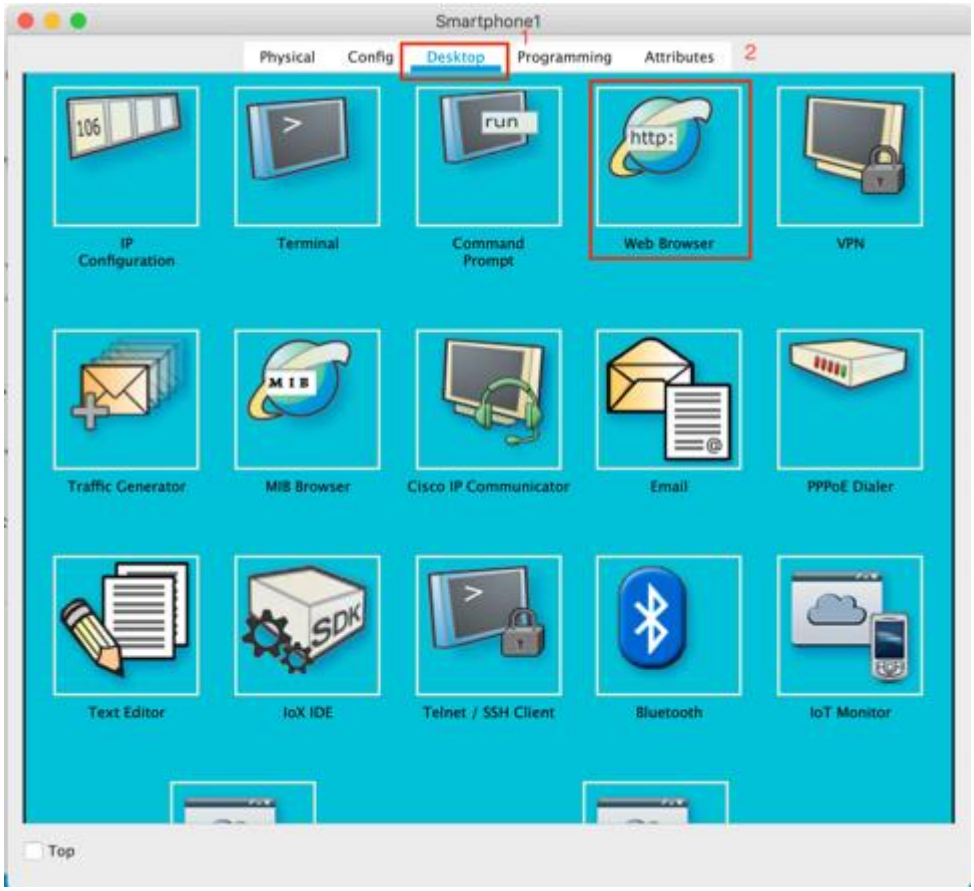


Figure 33: Config of Smart phone

Then, I went to the **Desktop** section to select the **Web browser**.

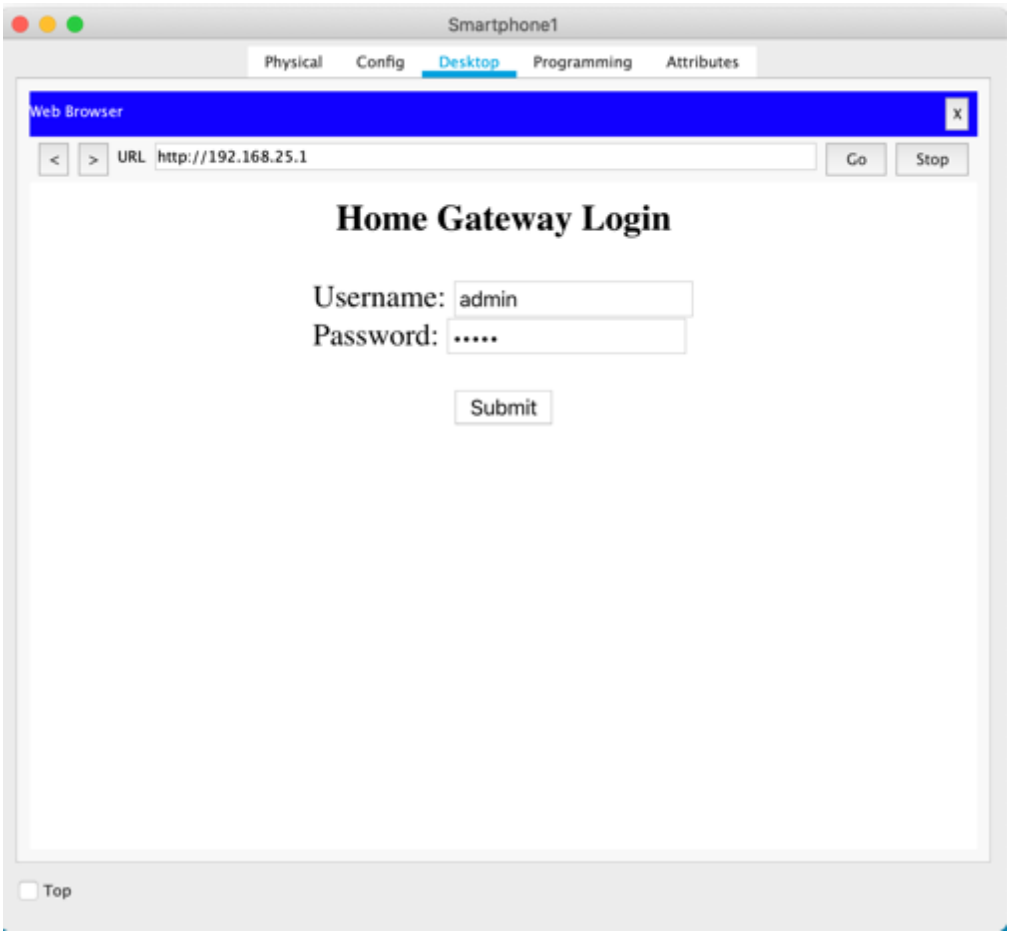


Figure 34: Config of Smart phone(2)

After accessing the **Web browser**, I accessed **IP**: 192.168.25.1 and entered:

Username: admin

Password: admin

To access the control system of smart home devices.

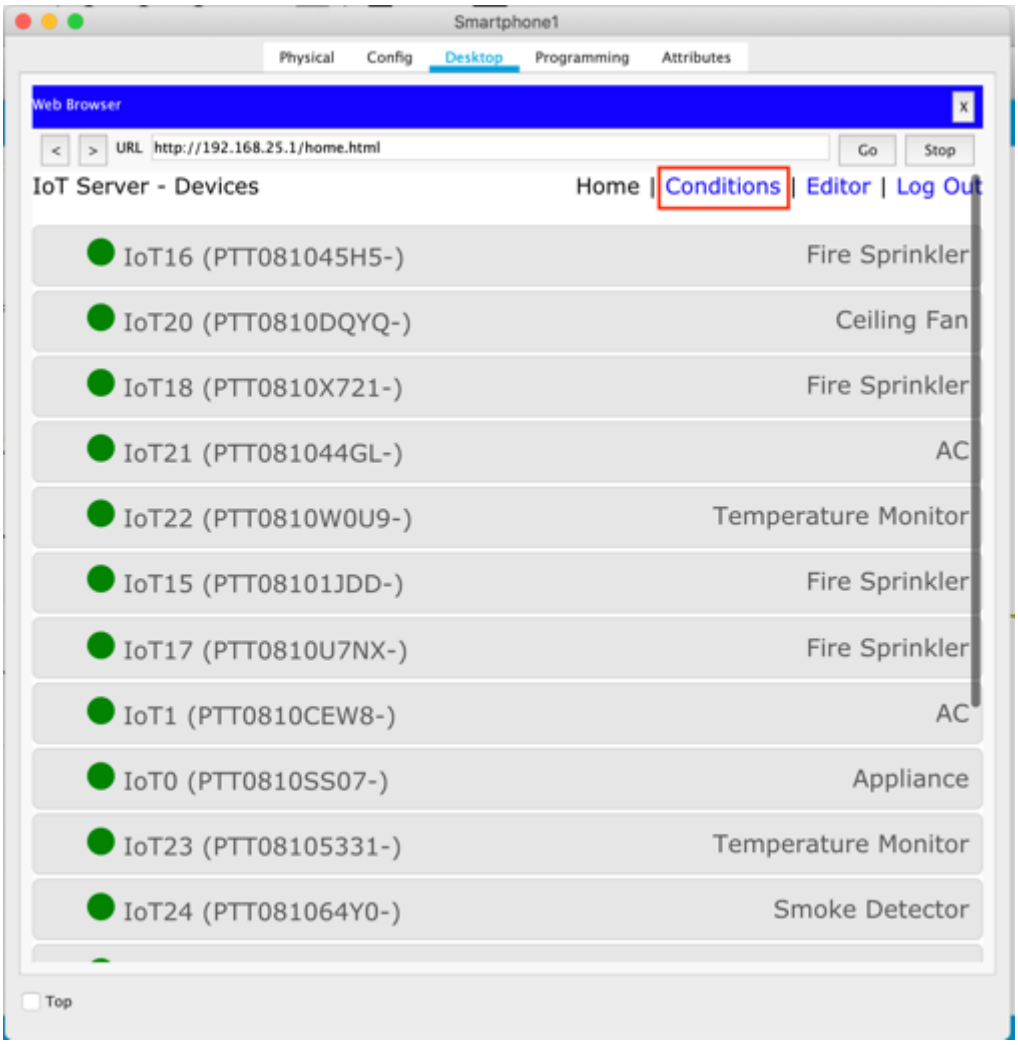


Figure 35: Config of Smart phone(3)

As you can see in the image above, this is the list of devices that are connected to the **Home Gateway** and we can control them remotely including turning on / off devices.

Then I went to the Conditions section to set the conditions for the device in the smart home.

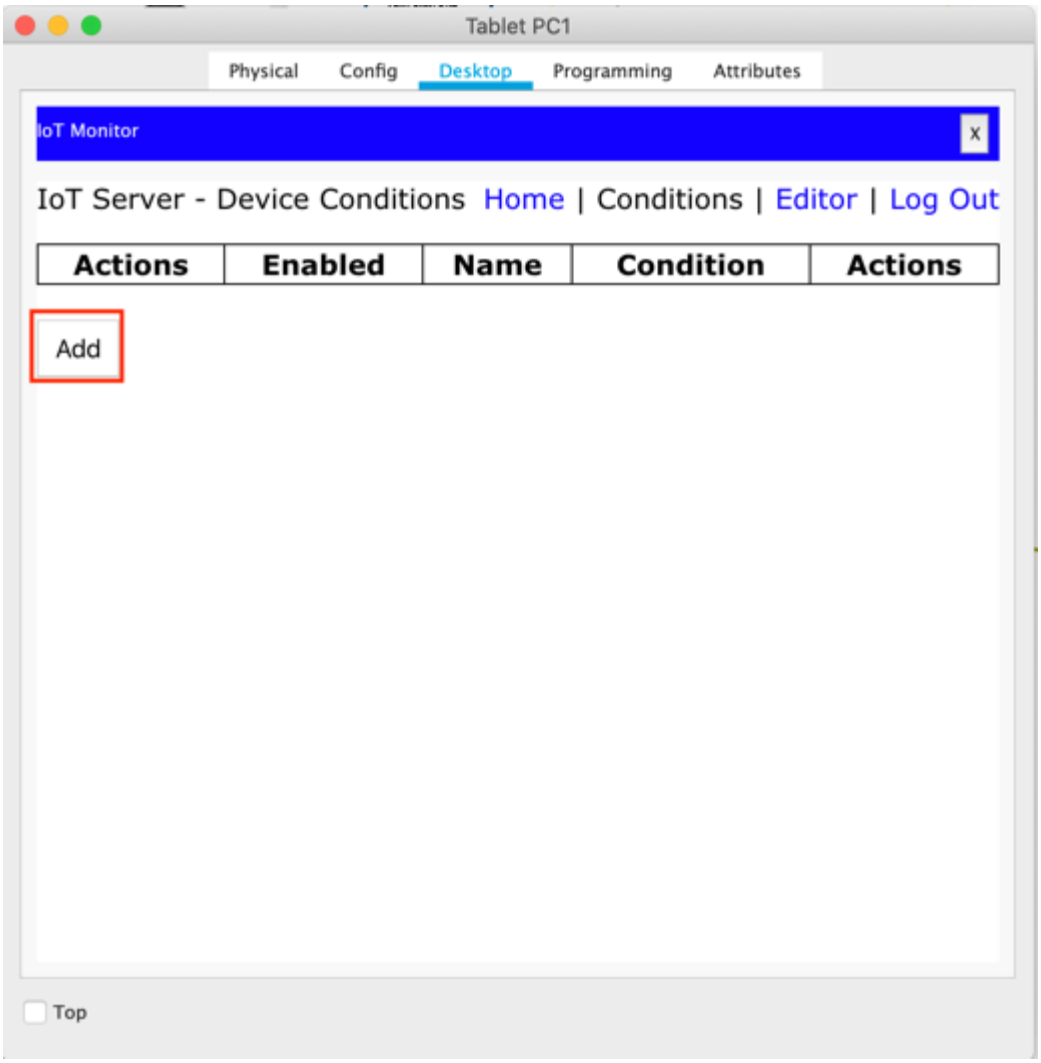


Figure 36: Config of Smart phone(4)

As shown above, it is a list of electrical types in the system. To create a new condition, click the **Add** button.

5.10.3.1 In the garden

For garden equipment, I have the following conditions:

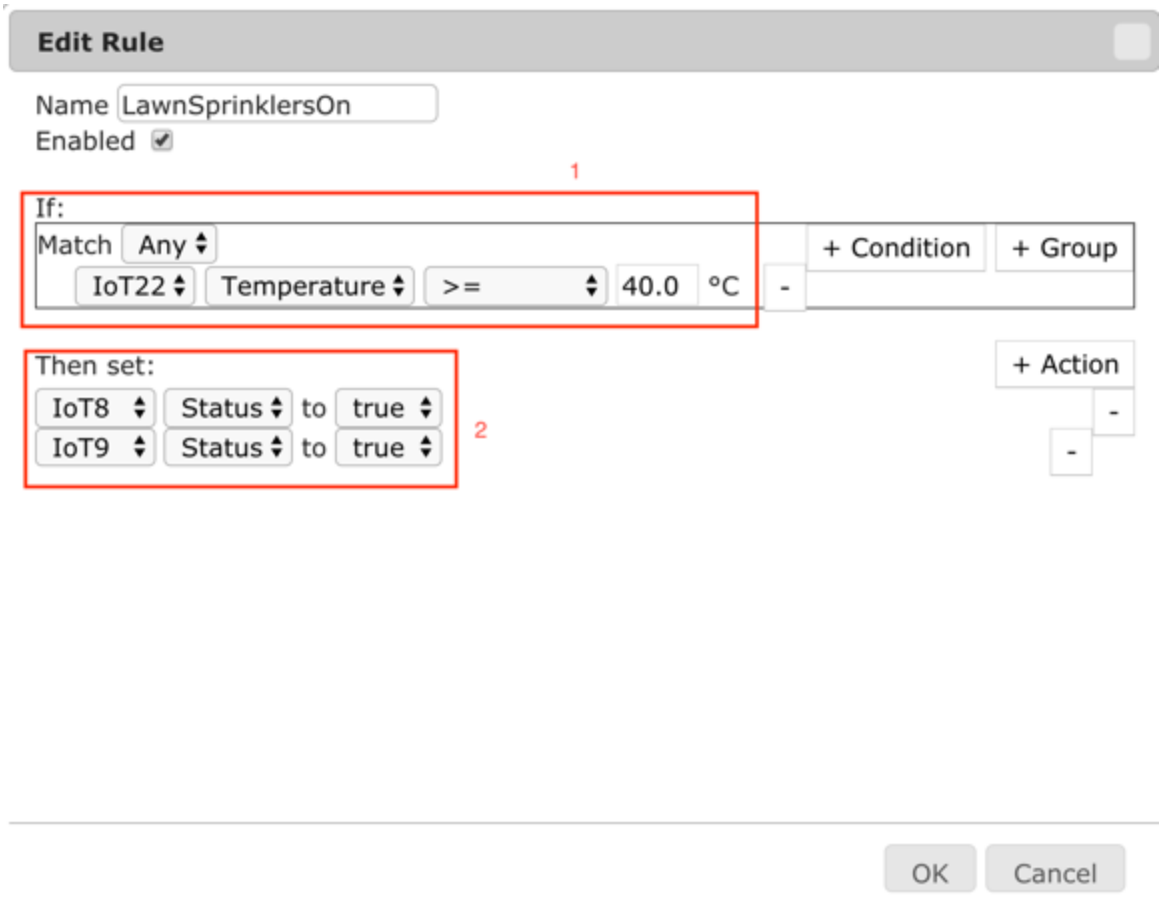


Figure 37: Condition in the graden

As the picture above, we see I named the condition is **LawnSprinklersOn** with the temperature of IoT22 device when> = 40C, 2 devices IoT8 and IoT9 will work.

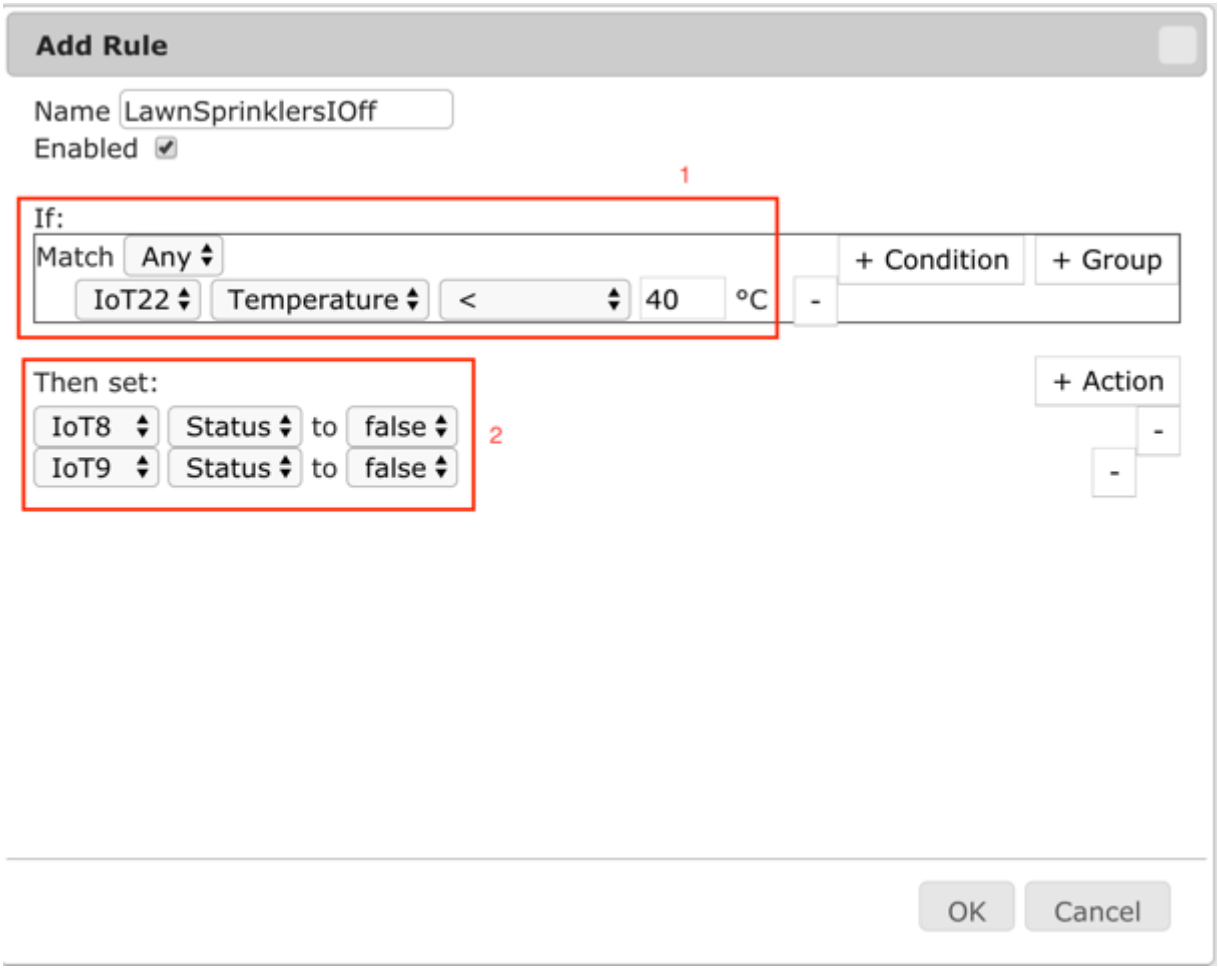


Figure 38: Condition in the graden(2)

When the temperature from IoT22 device returns <40C, then 2 devices IoT8 and IoT9 will turn off.

5.10.3.2 Ground floor

For devices on the ground floor, I will configure the following:

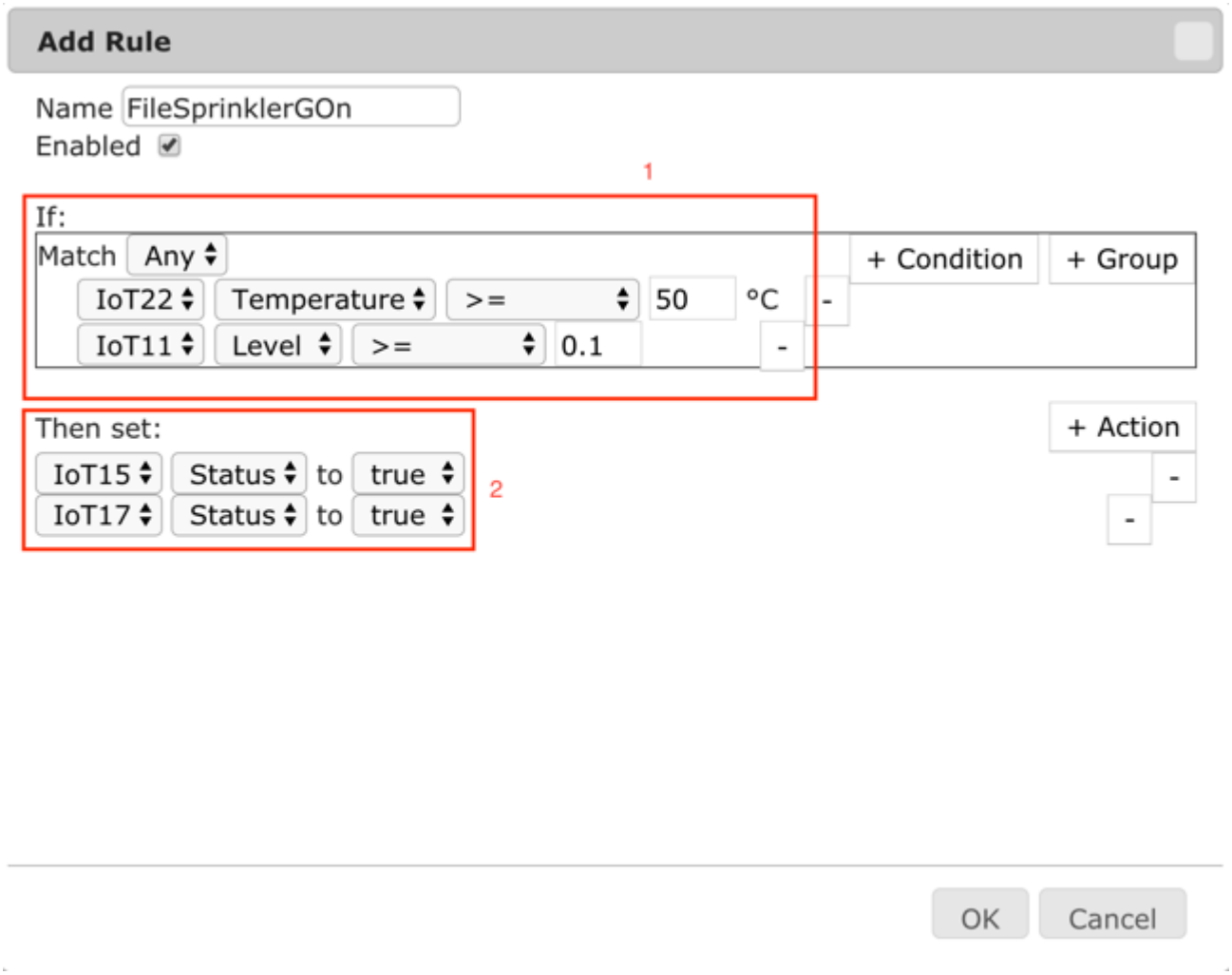


Figure 39: Conditon of Ground floor

As the picture above, I named the condition is **FileSprinklerGOn** with the temperature when returning from IoT device 22> = 50C and smoke concentration on return of IoT device 11> = 0.1, 2 devices IoT15 and IoT17 will be turned on.

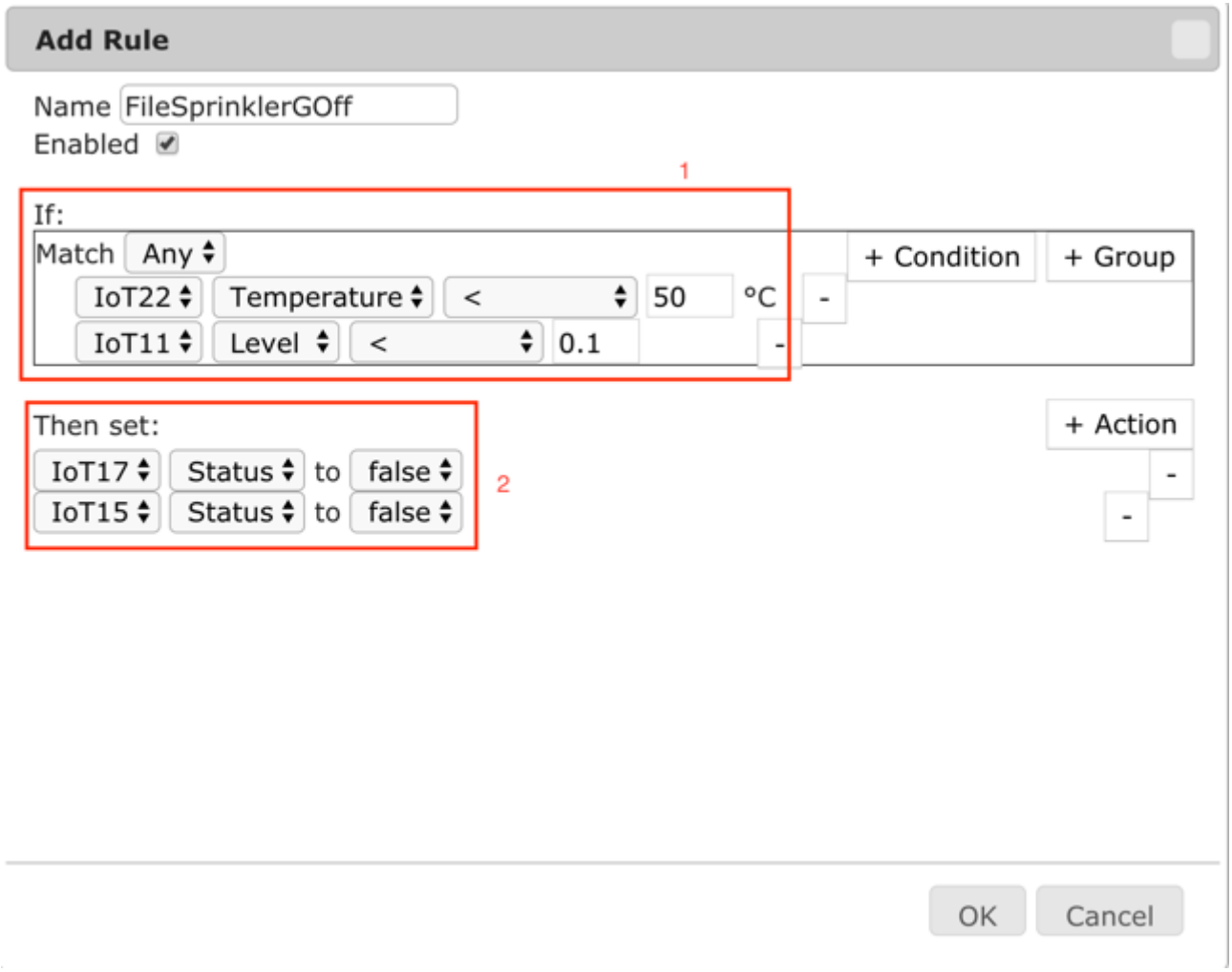


Figure 40: Condition of Ground floor(2)

When the temperature measured from IoT22 <50 and smoke concentration from IoT11> 0.1, the IoT17 and IoT15 devices will be turned off.

5.10.3.3 1st floor

For tier 1 devices, I would configure the following:

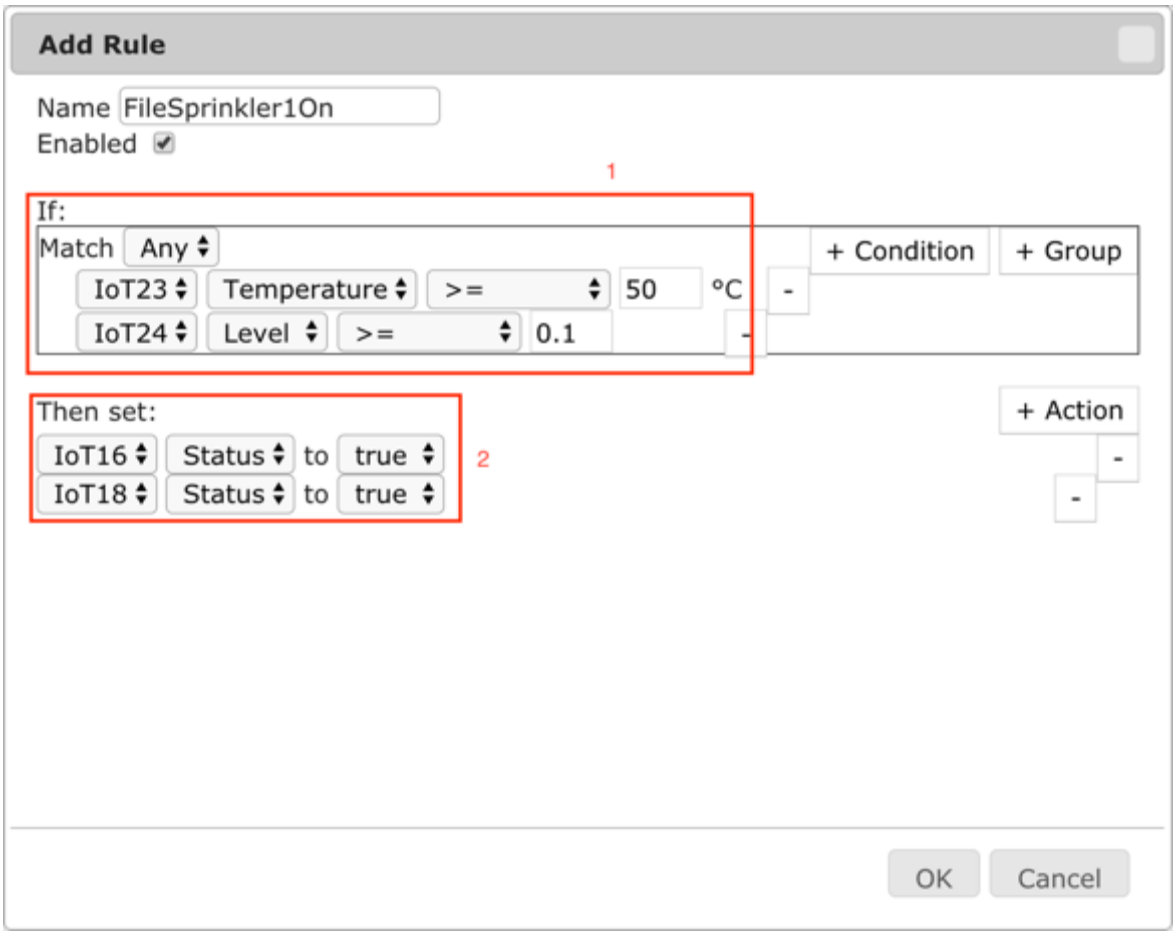


Figure 41: Condition of 1st floor

As the picture above, I named the condition is **FileSrinkler1On** with temperature measured from IoT23> = 50 and smoke concentration> = 0.1, the two devices IoT16 and IoT18 will be active.

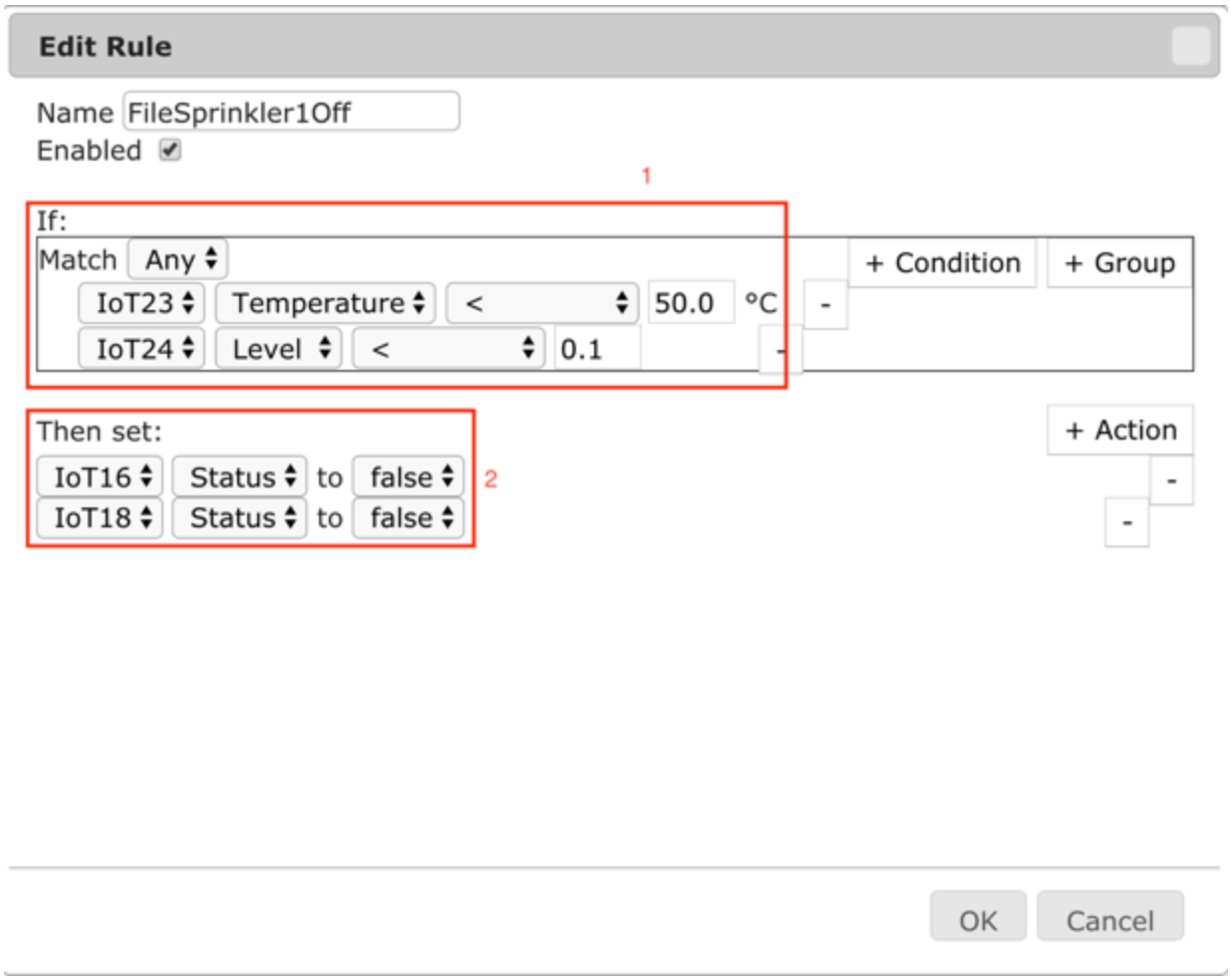


Figure 42: Condition of 1st floor(2)

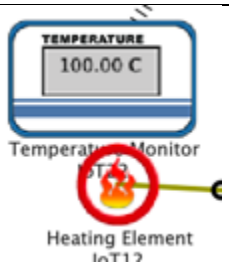
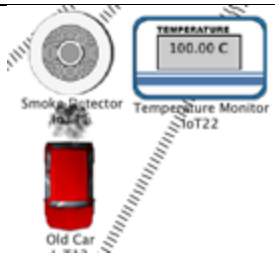
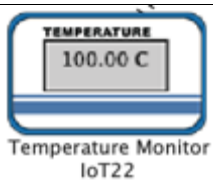
When the temperature measured from IoT23 <50 and smoke concentration from IoT24> 0.1, the two devices IoT16 and IoT18 will be turned off.

P6 Run end user experiments and examines feedback.

6.1 Run and test smart home:

Test case:

Type of test	Equipment to be tested	Desire	Input	Output	Result
Remote device control	Appliance	Can be used by phone			Works well

	Door	Can be used by phone			Works well
	Light	Can be used by phone			Works well
	Air Conditioner	Can be used by phone			Works well
Check the sensor	Temperature monitor	The sensor confirms accurate data from the outside			Works well
	Smoke detector	The sensor confirms accurate data from the outside			Works well
Automated system	Lawn Sprinkler	The system automatically activates when the conditions are set			Works well
	Fire Sprinkler	The system automatically activates when the conditions are set			Works well

Based on the test case table I have checked the smart home system, the main functions such as controlling remote devices with smart devices such as smartphones, computers, laptops, .. I Tested and commissioned indoor appliances and the results yielded. The device has run very well in the model. Next, I checked and tested the auto-activation device when certain conditions that I have given. The results from these devices have been implemented in accordance with my wishes.

6.2 User experiments and examines feedback:

After testing how it works and executes devices in the smart home. Next, I will ask 10 users to experience and ask them to help me evaluate the smart home model like?

I use 10 questions to ask them to feedback their ideas about smart home, including (5 interview questions + 5 survey questions)

Kind of question	Questions
Interview	How do you feel about the smart home?
	What do you like most about smart home?
	How do you think smart home should be developed in the future?
	What are some things you dislike about the current smart home?
	What in the smart home do you need to change or develop?
Survey	Which direction do you want smart home to develop?
	Which of the following do you need smart home for?
	What in the smart home you see is not good?
	Do you think smart home should be commercialized?
	How would you rate smart home on a scale?

6.2.1 Question and answer 1

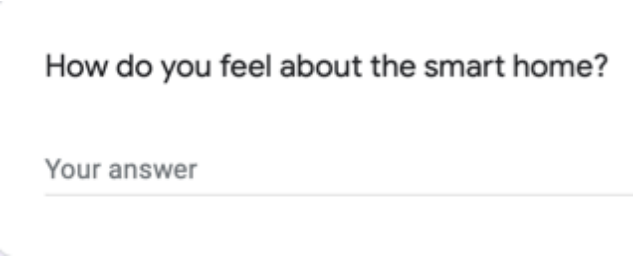


Figure 43: Question 1

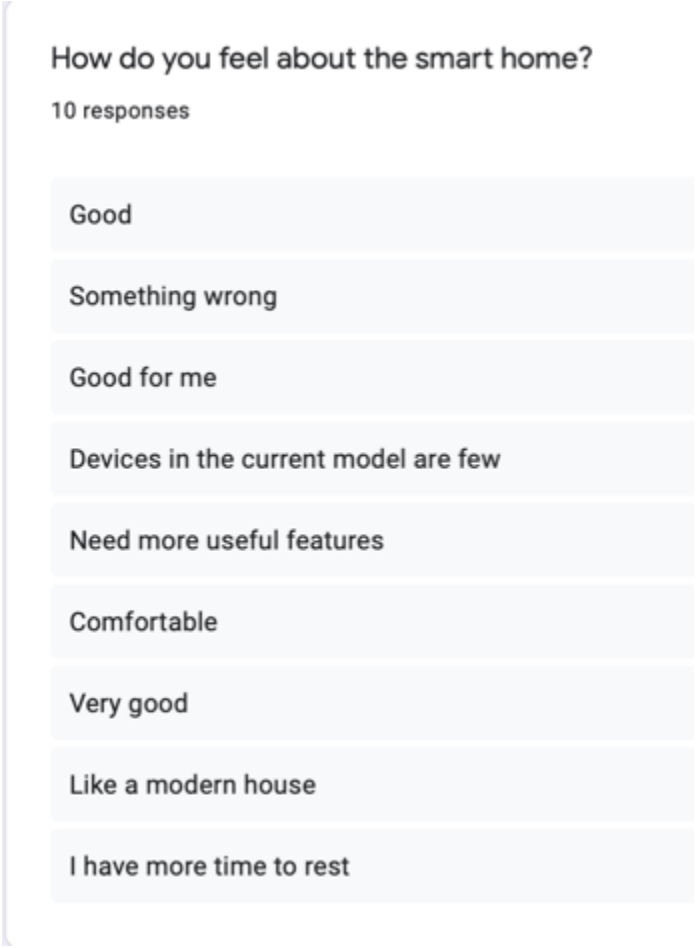


Figure 44: Answer 1

6.2.2 Question and answer 2

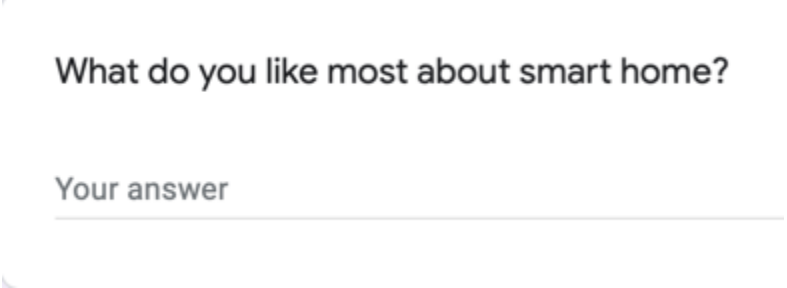


Figure 45: Question 2

Figure 46: Answer 2

6.2.3 Question and answer 3

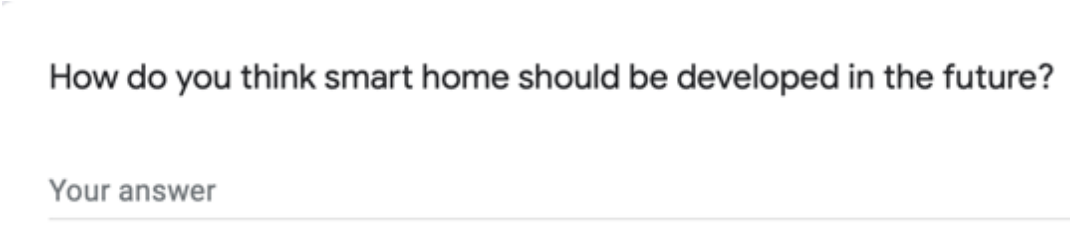


Figure 47: Question 3

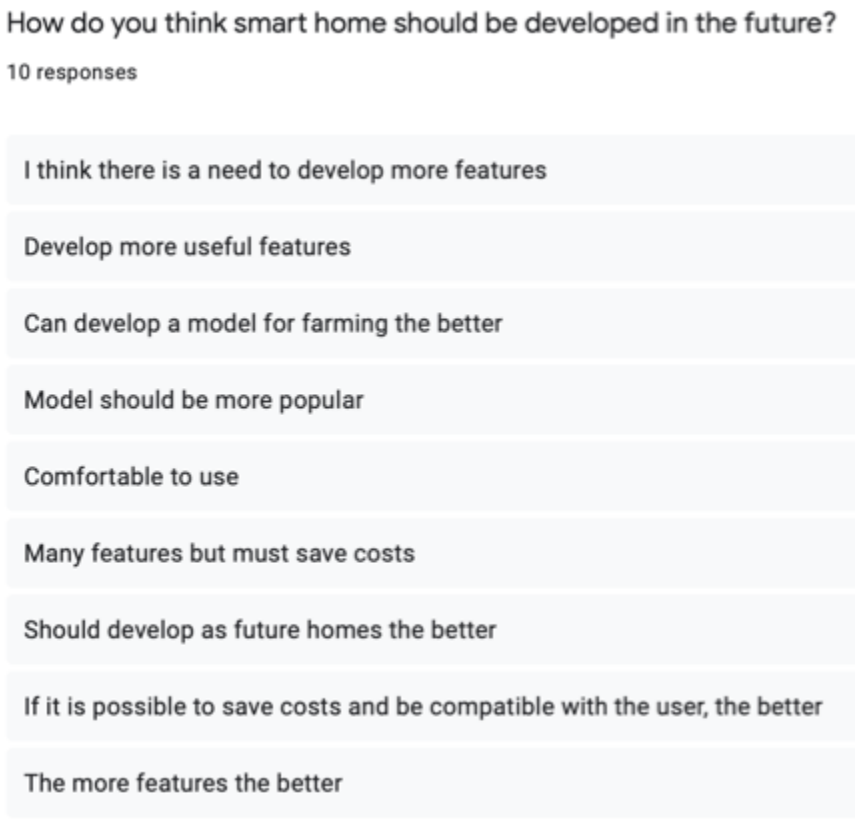


Figure 48: Answer 3

6.2.4 Question and answer 4

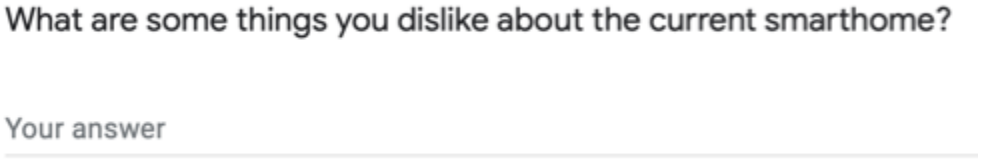


Figure 49: Question 4

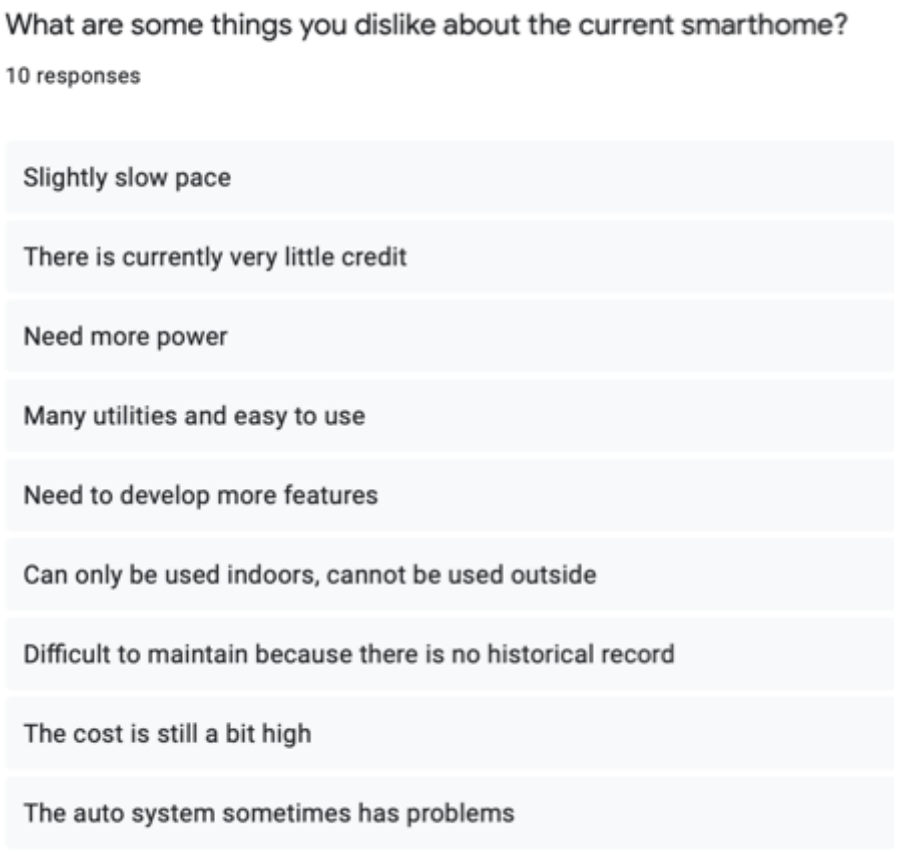


Figure 50: Answer 4

6.2.5 Question and answer 5

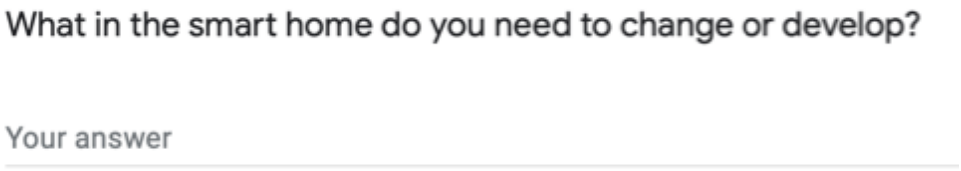


Figure 51: Question 5

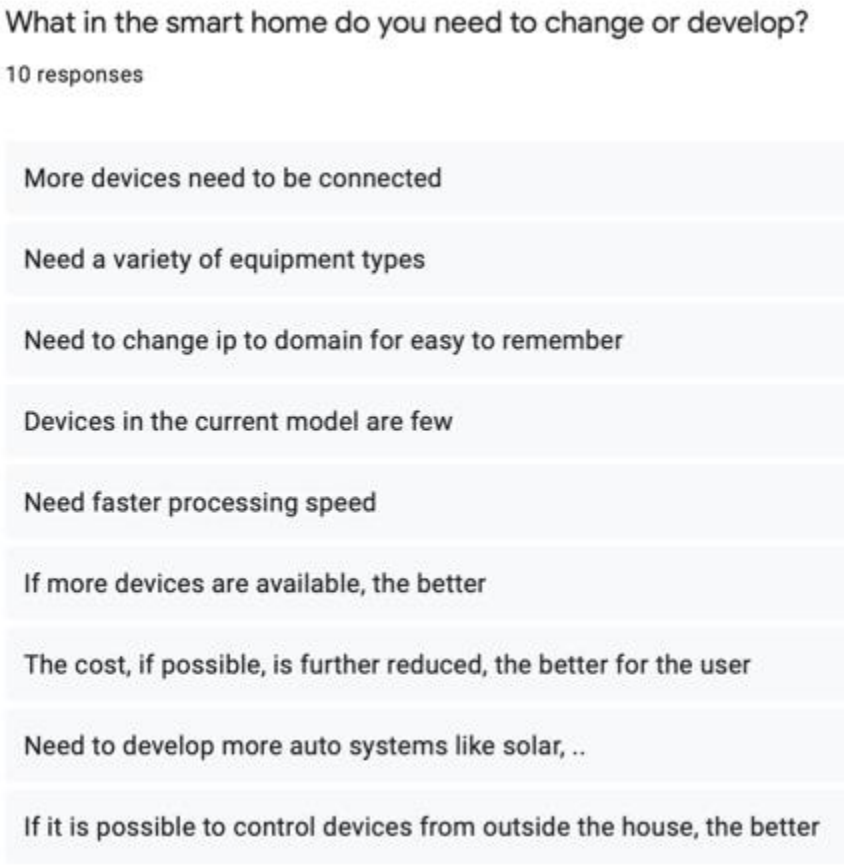


Figure 52: Answer 5

6.2.6 Question and answer 6

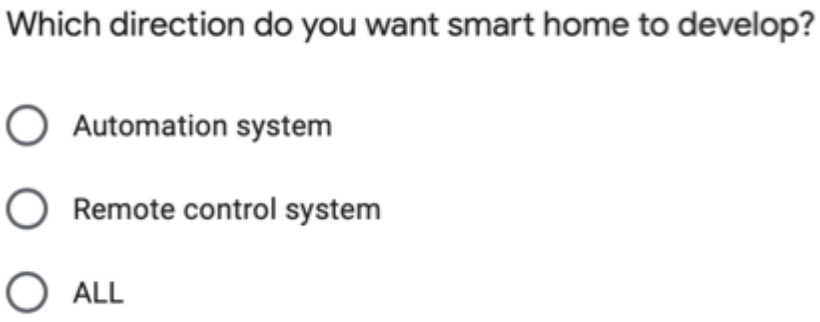


Figure 53: Question 6

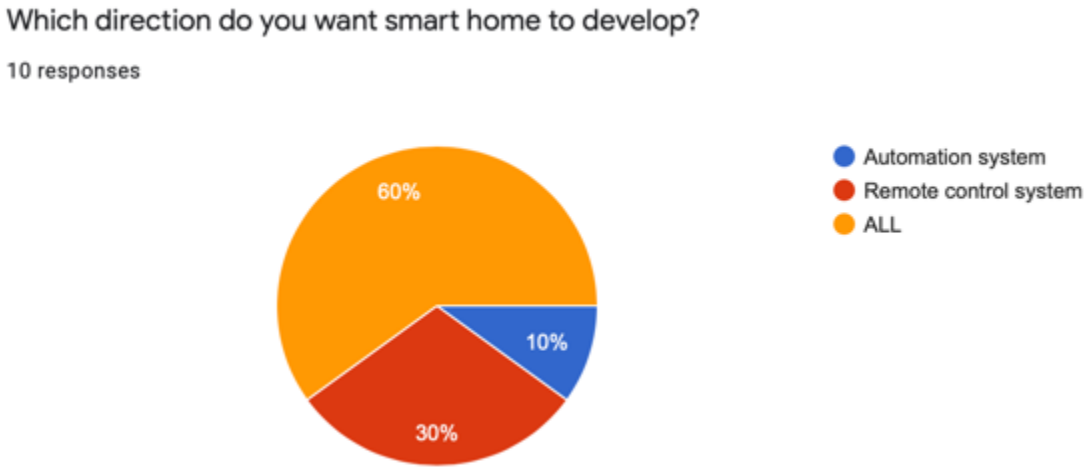


Figure 54: Answer 6

6.2.7 Question and answer 7

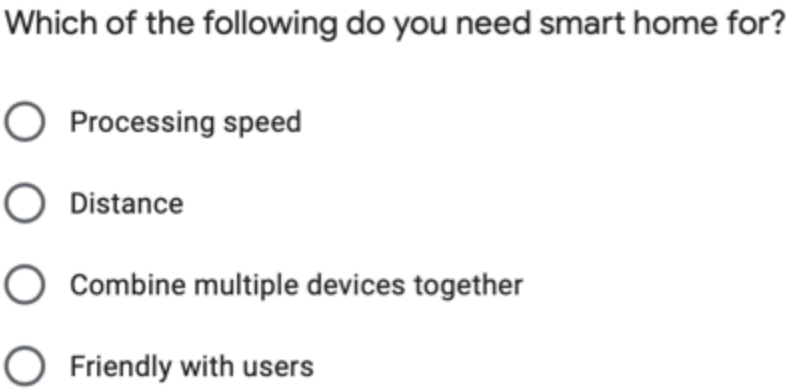


Figure 55: Question 7

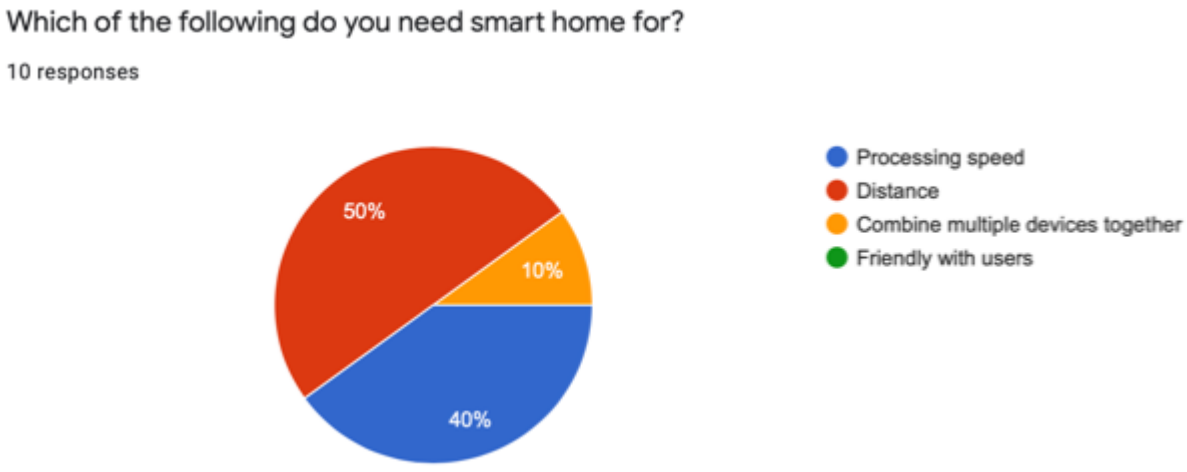


Figure 56: Answer 7

6.2.8 Question and answer 8

Figure 57: Question 8

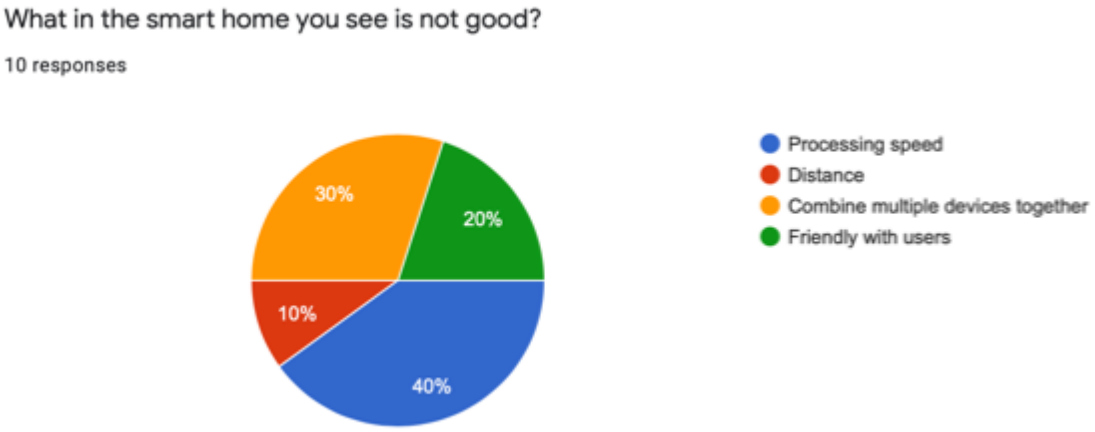


Figure 58: Answer 8

6.2.9 Question and answer 9

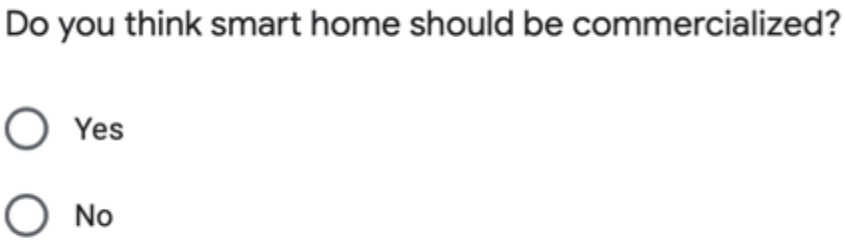


Figure 59: Question 9

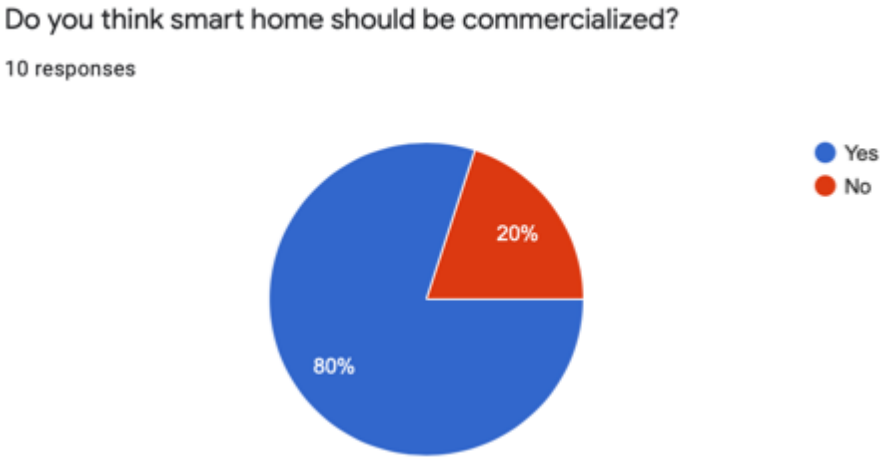


Figure 60: Answer 9

6.2.10 Question and answer 10

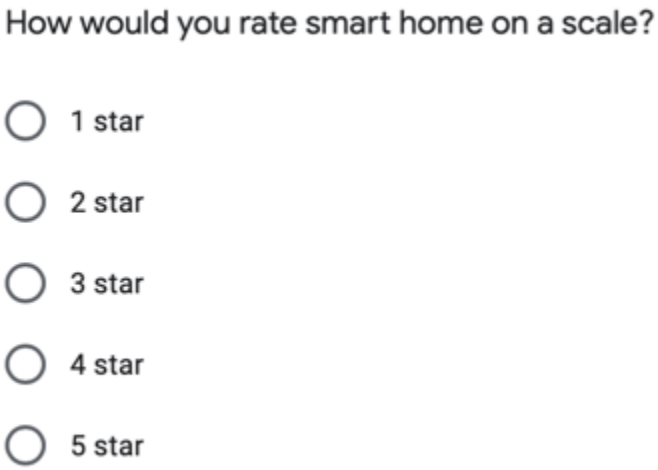


Figure 61: Question 10

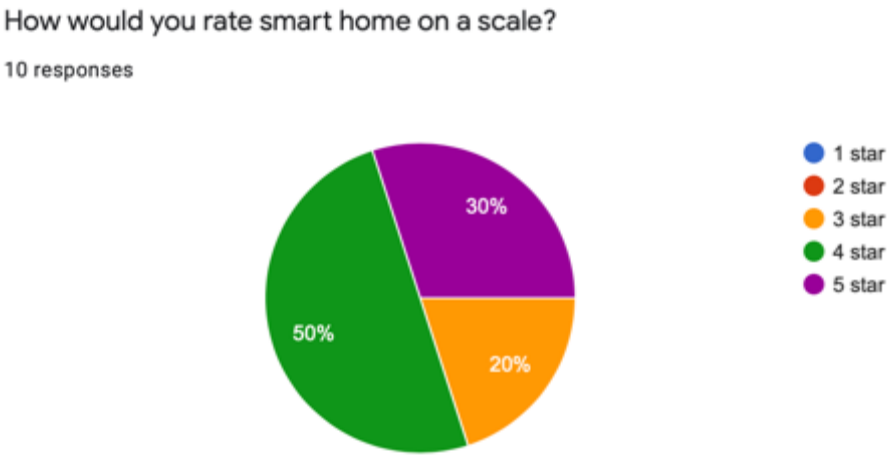


Figure 62: Answer 10

LO4 Evaluate your IoT application and detail the problem your IoT application solves, the potential impact on people, business, society and the end user and the problems it might encounter when integrating into the wider IoT ecosystem

P7 Evaluate end user feedback from your IoT application.

After surveying 10 users about smart home model issues, here I will start analyzing user feedback and making the most appropriate choice for the smart home model.

7.1 Question 1

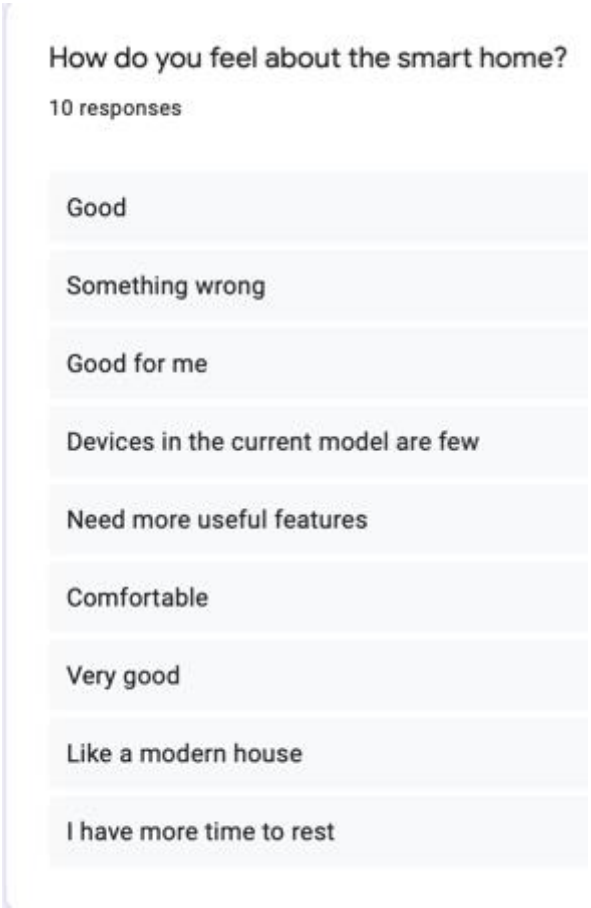


Figure 63: Answer 1

As the picture above, out of 10 users responded. Most users responded that the system used very well but sometimes there were errors. Based on this feedback I will rediscover the smart home system, to find the error that the user has reflected.

7.2 Question 2

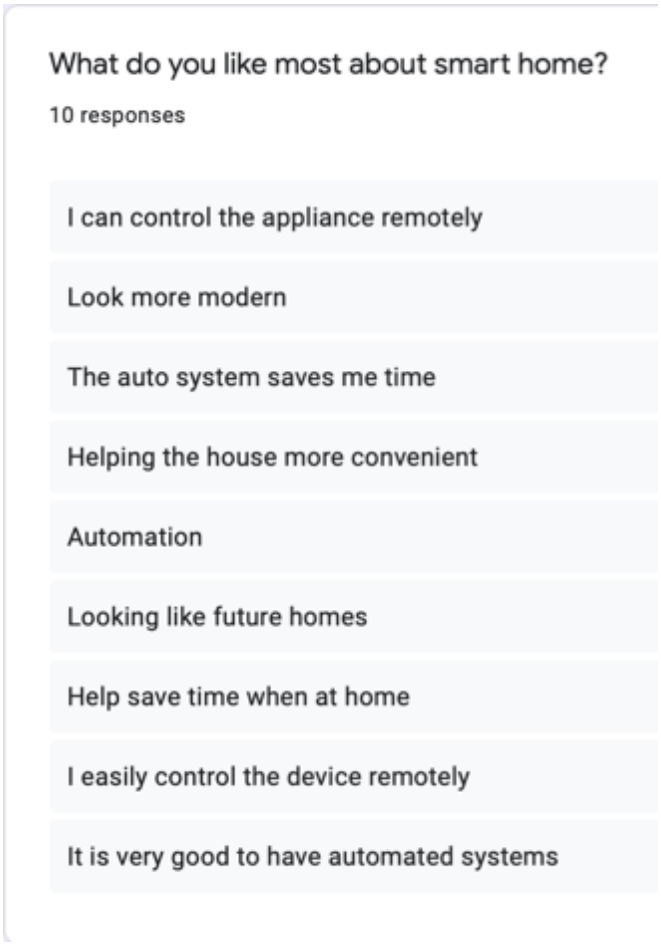


Figure 64: Answer 2

Based on the answers as the image above, I find that users are very interested in the smart home model as designed. Most of them responded that they were happy to be able to control the device remotely using an internet-connected phone. Remote control and automated systems have made them more comfortable in life, saving them time to do other things.

So I think, I need to develop smart homes that have many more features, which help users to be more comfortable in their lives and save time.

7.3 Question 3

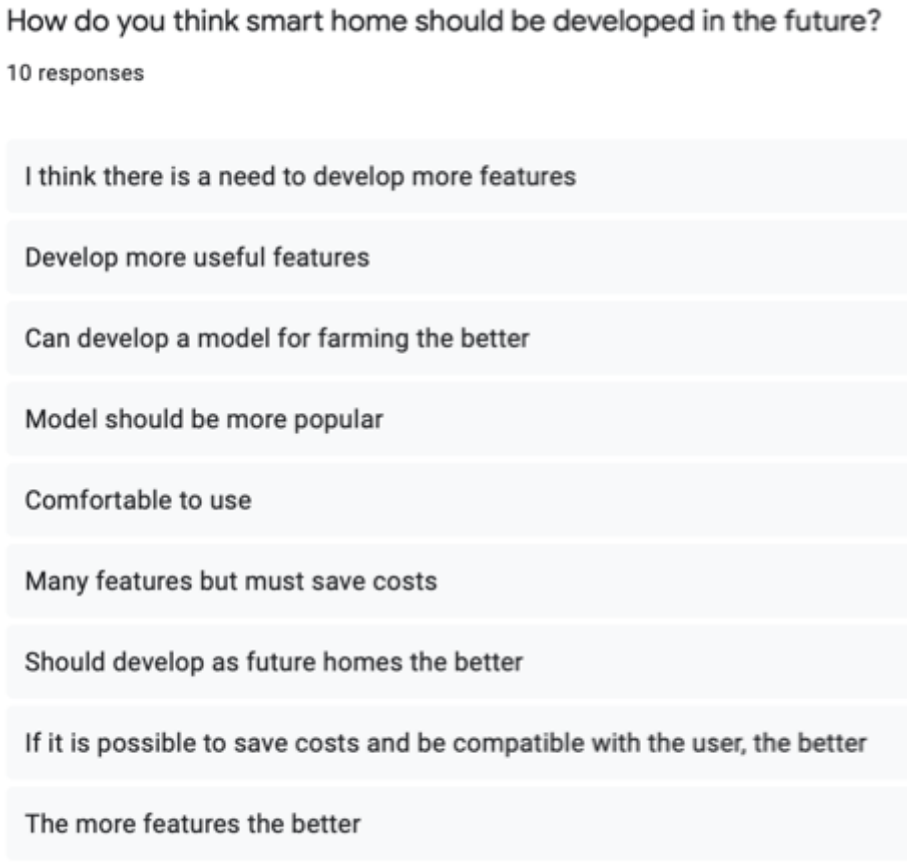


Figure 65: Answer 3

As the picture above, I have consulted many users' opinion about which direction I should develop smart home in the future. Most users responded that the smart home model should have many other good features, helping users to be comfortable in life. And this development must go along with the cost of products must be reduced slowly, helping fit the user's pocket.

7.4 Question 4

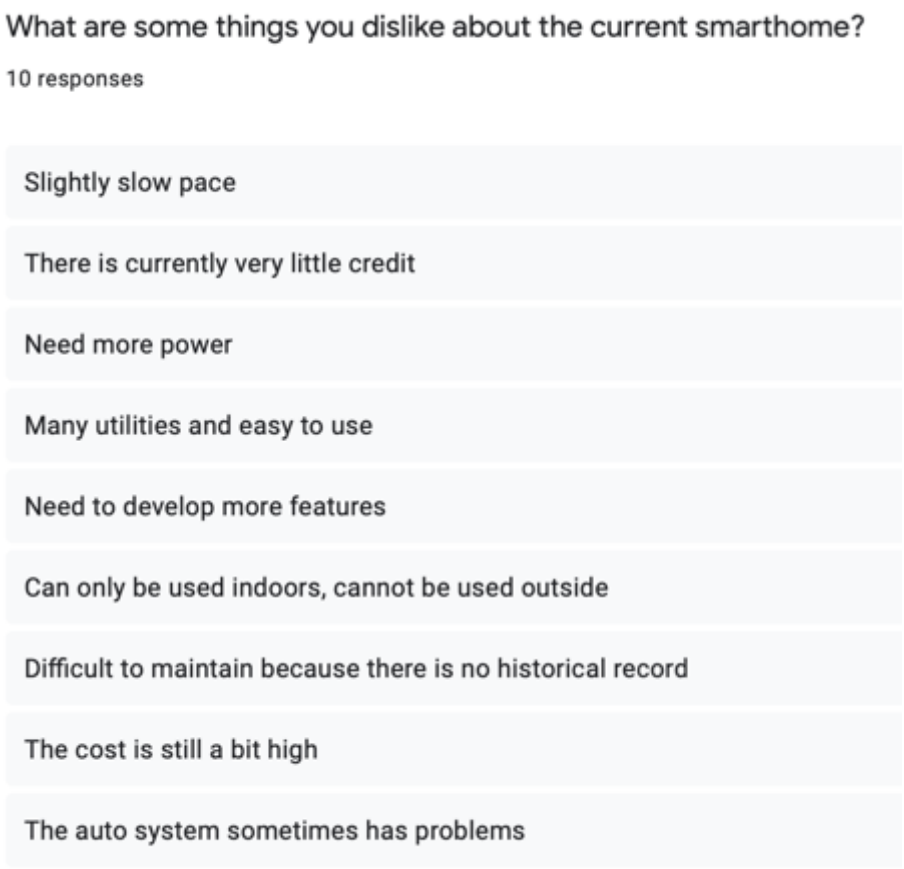


Figure 66: Answer 4

Besides the development of smart home in the future is like? Then I also survey users' opinions about what they do not like in the smart home model. Most users respond that the system has a slow processing speed, sometimes making them spend more time waiting for the system to process. Currently, the system has very few signals, they need a smart home that needs more power to make the house more modern.

7.5 Question 5

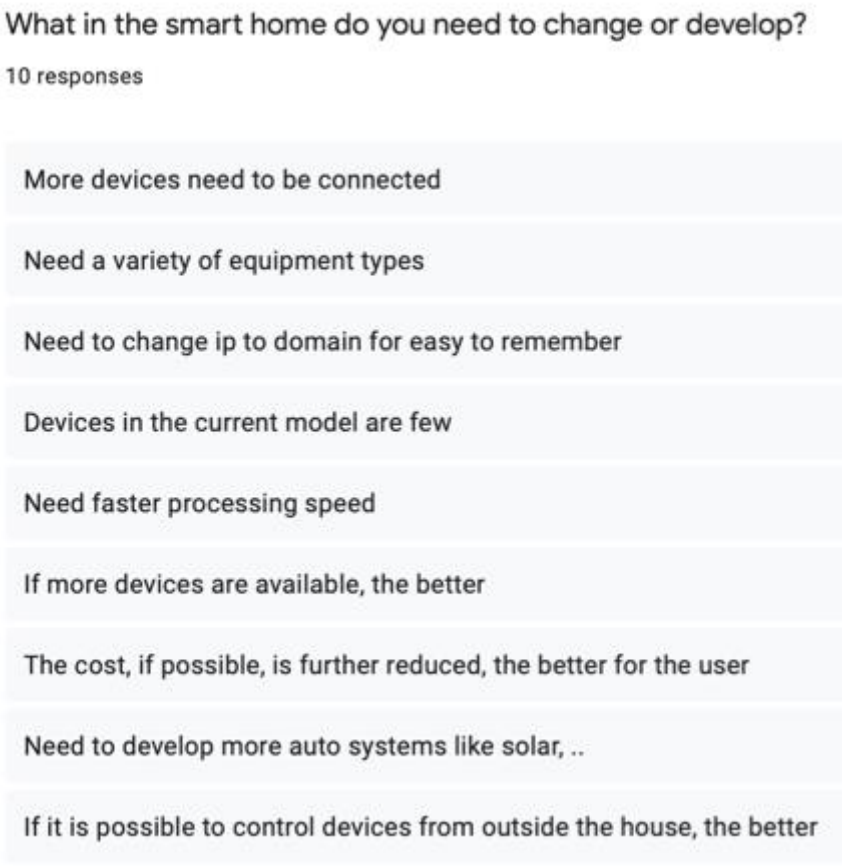


Figure 67: Answer 5

After studying the components that users do not like in the smart home system. I have surveyed what smart home system users need to change? Most users responded that the system needed more signals for smart home, they further responded that the system's processing speed needed to be further improved and the cost of the products needed to be reduced to suit. user's pocketbook.

7.6 Question 6

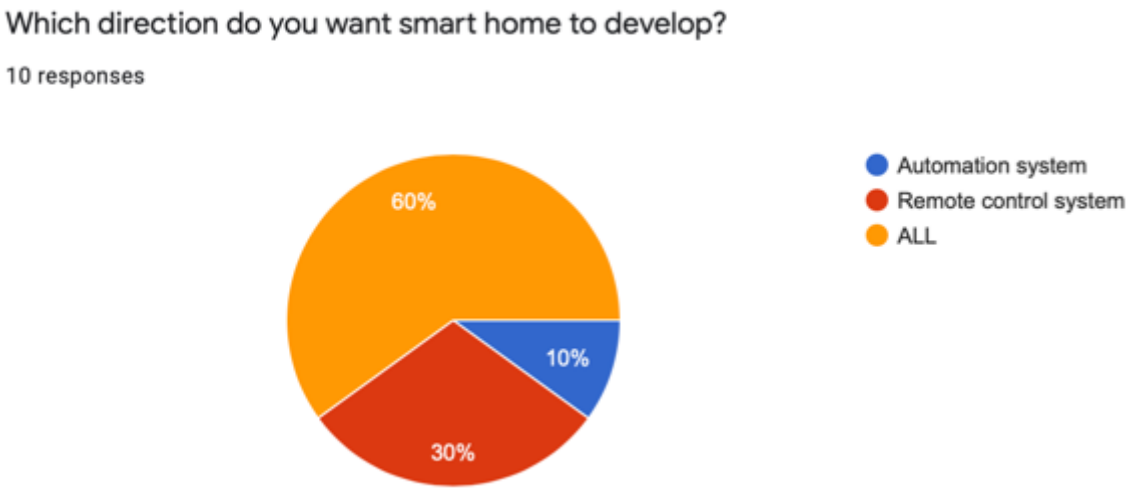


Figure 68: Answer 6

As shown in the statistics above, I found that 60% of users responded that the system needed to develop more about automation systems and remote device control systems. 30% of users responded that I should only focus on developing the system in the direction of remote device control, the remaining 10% of users want the system to focus on developing the system automatically. .

7.7 Question 7

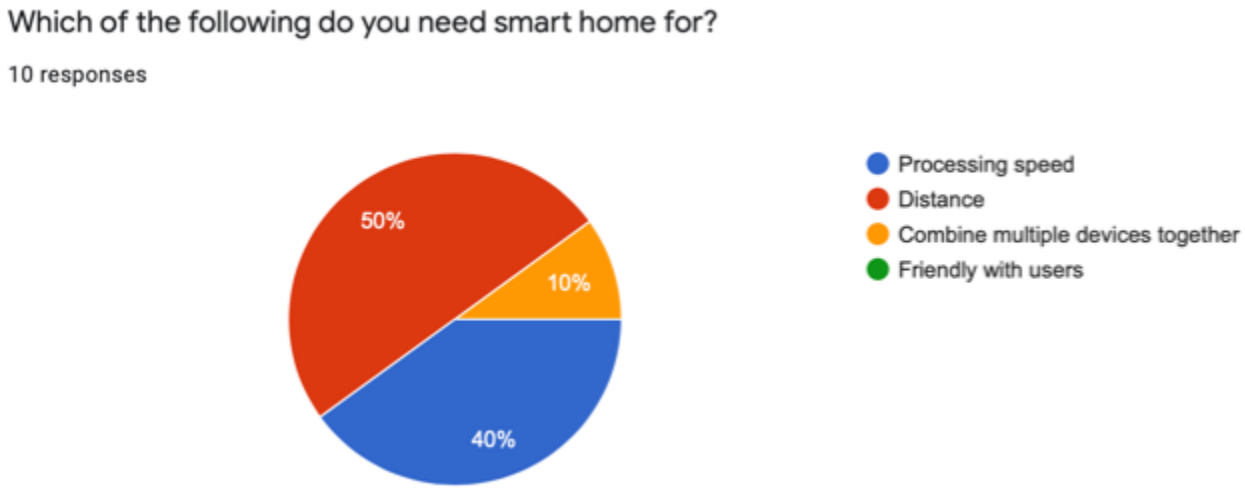


Figure 69: Answer 7

During execution I have 4 issues that require users to recover that we should develop one of these first. 50% of users responded that the system needs to develop more control distance of devices in the model. 40% of other users said that it should improve the speed of the system. 10% of other users want that the

system needs to develop many different devices to diversify the model. For the rest, none of the users wanted me to develop an app that would be more user friendly, maybe the version is already very user friendly so there's no need for further development.

7.8 Question 8

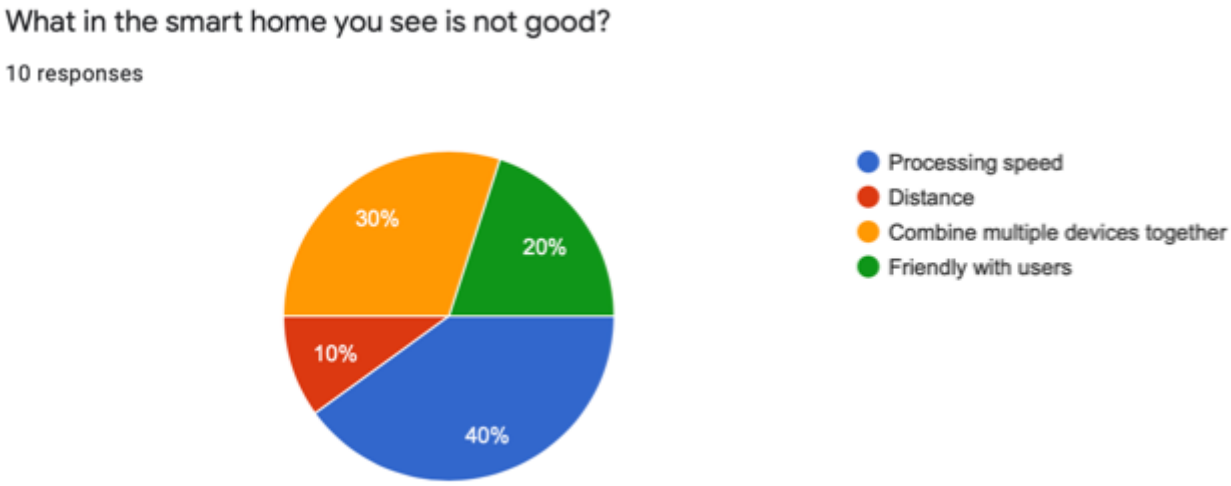


Figure 70: Answer 8

In the 4 issues above, I have surveyed users that my system currently not good in any way? 40% of users responded that the system was still not good on the issue of good processing. 30% of users responded that currently the system is too few devices need to have more devices. 20% of users responded that the level of user friendliness of the system was still not good. And 10% of other users found that the remote control distance of the system is not good.

From here I realize that I need to develop more devices for the system and also happy because the distance to control devices, users reflect at least.

7.9 Question 9

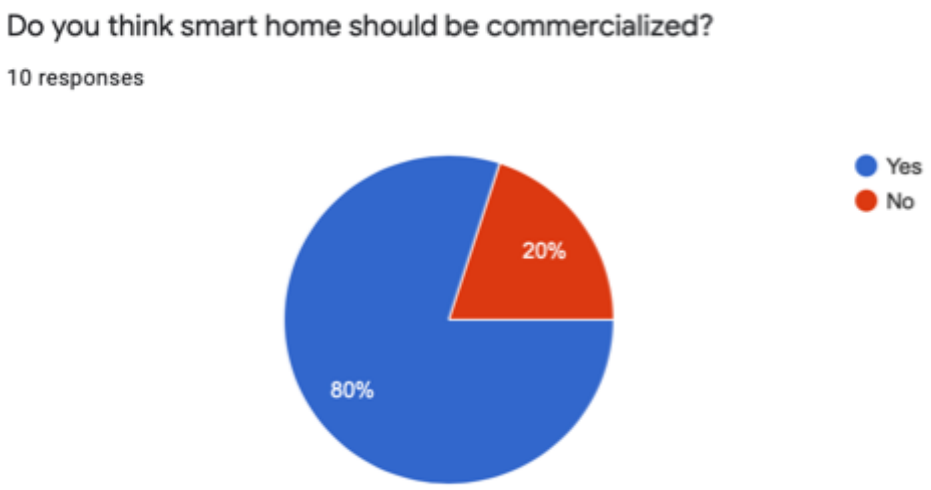


Figure 71: Answer 9

As the image above, I have surveyed whether users should commercialize my smart home products or not? 80% of users responded that smart needs to be commercialized and the remaining 20% reflects that the system should not be commercialized.

7.10 Question 10

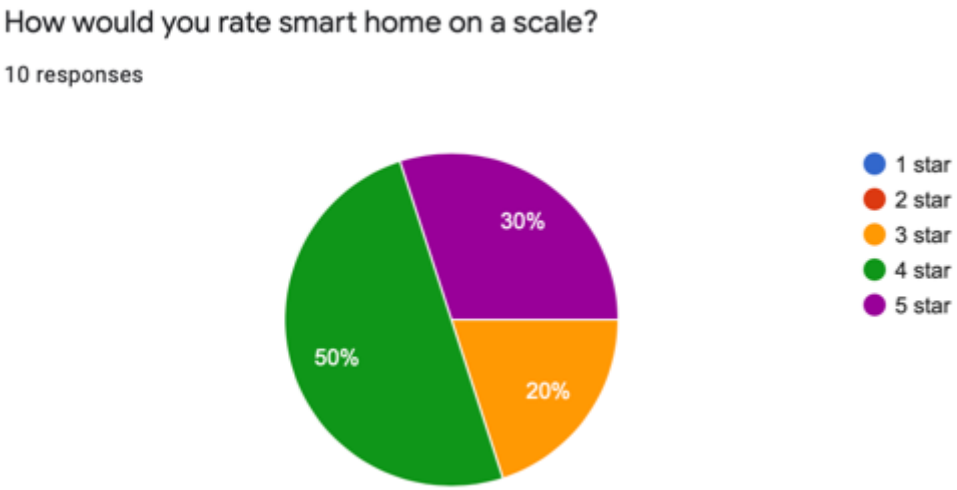


Figure 72: Answer 10

Based on the above survey, we received user reviews about smart home, 50% of users rated the system as 4 stars, 30% of other users rated the product as 5 stars, The remaining 20% of users have rated the product as 3 stars. I'm glad no other users rate our system 1 star and 2 stars.

7.11 what is solution for smart home?

Based on user feedback on system issues. I have analyzed the good and bad points of smart home. Since then, I have found that my smart home system is still very simple and the current processing speed is very slow, sometimes it takes the user to spend more time waiting. The current devices in the system and there are very few, I need to develop for the system to have more devices that can interact with each other, making smart home more and more diverse. The next problem is about the connections of the devices, currently my system can only be used indoors, but if I need to use the system while outside the house, it still cannot be controlled playable.

7.11.1 Solution 1

To solve the problem of too slow processing speed, the devices can interact with each other too slowly compared to the user's request. So I will increase the bandwidth of the Home Gateway device to increase the speed of connecting devices together.

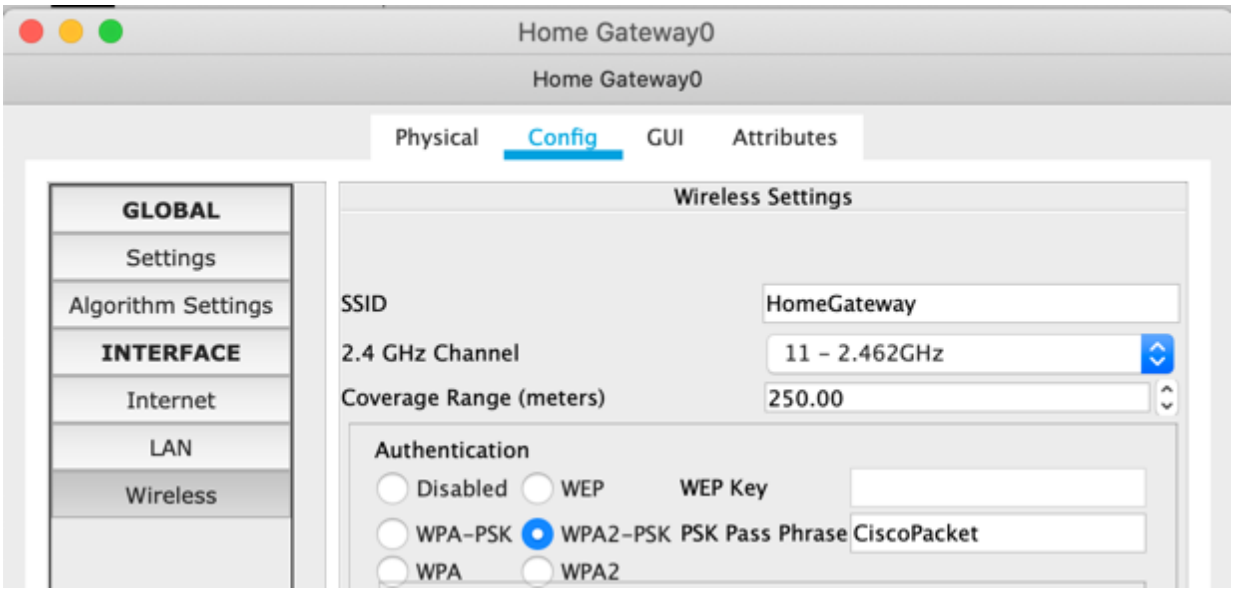


Figure 73: Solution 1

7.11.2 Solution 2

Due to the fact that the current models have too few devices, the control for smart home is not diversified.

So I designed a few more devices to suit the needs of the user.

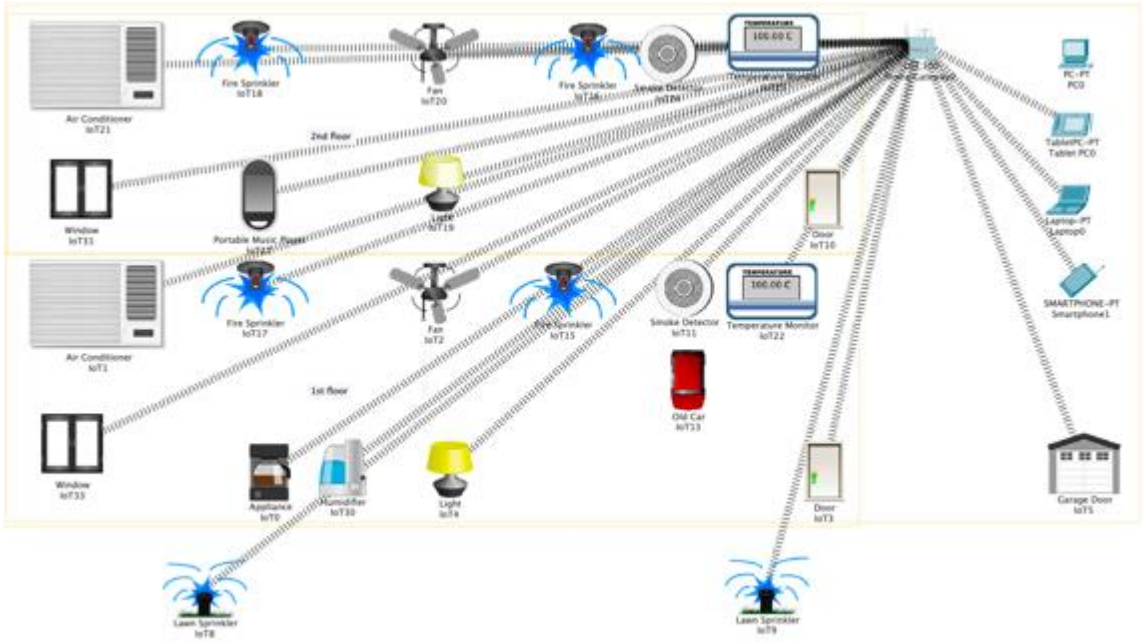


Figure 74: Solution 2

7.11.3 Solution 3

In addition to the automatic systems of the model are too few, so I will provide more watering systems based on the humidity of the environment.

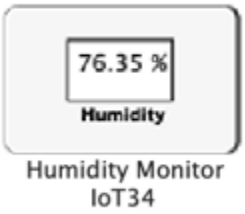


Figure 75: Solution 3

References:

[1] Unit 43 - Internet of Things 2019, *Session 1- Introduction to IOT*, University of Greenwich (Alliance with Vietnam FPT Education), United Kingdom.

[2] Unit 43 - Internet of Things 2019, *Session 2 - Design Framework for IOT system*, University of Greenwich (Alliance with Vietnam FPT Education), United Kingdom.

[3] Unit 43 - Internet of Things 2019, *Session 3 - Basic of IOT System*, University of Greenwich (Alliance with Vietnam FPT Education), United Kingdom.

[4] Unit 43 - Internet of Things 2019, *Session 4 - Sensors and Actuators - Introduction*, University of Greenwich (Alliance with Vietnam FPT Education), United Kingdom.

[5] Unit 43 - Internet of Things 2019, *Session 5 - Digital Sensors Practices*, University of Greenwich (Alliance with Vietnam FPT Education), United Kingdom.

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[7] Unit 43 - Internet of Things 2019, *Session 7- Communication Packet Tracer*, University of Greenwich (Alliance with Vietnam FPT Education), United Kingdom.

[8] Unit 43 - Internet of Things 2019, *Session 8 - Intermediate Devices - Microprocessors*, University of Greenwich (Alliance with Vietnam FPT Education), United Kingdom.

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