Topic	HOME AUTOMATION/ SMART IRRIGATION SYSTEM
Class Description	**Students will be introduced to IoT (Internet of Things) and they will learn how to perform automation with IoT on Cisco packet tracer.**
Class	**PRO C241**
Class time	**50 mins**
Goal	- Learn about IoT (Internet of Things) - Learn about HomeGateway - Create a smart home system - Create a smart irrigation system
Resources Required	- Teacher Resources: - Laptop with internet connectivity - Earphones with mic - Notebook and pen - Cisco Packet Tracer - Student Resources: - Laptop with internet connectivity - Earphones with mic - Notebook and pen - Cisco Packet Tracer

Class structure	**Warm-Up**	**5 mins**
	Teacher-led Activity	**20 mins**
	Student-led Activity	**20 mins**
	Wrap-Up	**5 mins**

WARM-UP SESSION - 5 mins
Teacher Starts Slideshow **Slide 1 to 5**

<Note: Only Applicable for Classes with VA> Refer to speaker notes and follow the instructions on each slide.

Teacher Action	Student Action
Hey <student's name>. How are you? It's great to see you! Are you excited to learn something new today?	**ESR**: Hi, thanks, yes I am excited about it!
Do you remember what we did in the last class?	**ESR:** Yes!
In the last class, we revised networking concepts. Do you have any queries related to it? *In case of any queries, the teacher will clarify those.*	**ESR:** Varied
So have you done or learned anything new today? *Listen to the student carefully and respond as required if he says anything new.*	**ESR:** Varied
Let's start the new session with a small change. Are you ready?	**ESR:** Yes!
I will pose a riddle to you, and you must answer it. If you win, then it will be your turn to ask the riddle in the next class, and if I win, then I will give you a new challenge. Are you ready? *Riddle: It belongs to you, but other people use it more than you do. What is it?* **Answer:** Your name! Great, that was fun!	**ESR:** Yes!

WARM-UP QUIZ Click on In-Class Quiz

Continue WARM-UP Session **Slide 6 to 10** <**Note**: Only Applicable for Classes with VA>

Activity Details

Following are the session deliverables:
- Appreciate the student.
- Narrate the story using hand gestures and voice modulation methods to make the student feel more interested.

Teacher Ends Slideshow

Teacher Initiates Screen Share

<u>ACTIVITY</u>

- **Introduction to IoT**
- **Creating a Smart Home Automation System**

Teacher Action	Student Action
Ok, so we just completed our networking session. How has your experience with the networking module been like, till now? Till now, we have created a video chat app, a text chat app, a file sharing app, and many other new things in the networking module. Today, we will start a new module, that is, the IoT (Internet of things) and the Robotics module. Are you excited?	**ESR** Varied **ESR**

|	Yes!
What do you know about IoT?	**ESR** Devices connected to the internet.
"IoT is an abbreviation for Internet of Things, which refers to uniquely identifiable objects (electronic appliances) and their virtual representations on the internet."	
The Internet of Things, or IoT, refers to the billions of devices around the world that are connected over the internet. It's a network on which we can connect electronic devices that can be accessed by anyone from anywhere in the world.	
Can you give some examples of IoT?	**ESR** Alexa, Google Assistant
Right! There are a lot of sectors in which IoT has already been implemented, and many others, where IoT is being adopted now or is planned to be adopted in the future. We can see a lot of examples around us, as follows.	
Smart watches: These devices look like your watch and are worn to detect, analyze, and transmit information. **Automated Guided Vehicles**: Vehicles which can be driven without drivers use IoT for navigation. **Smart Cities**: Prepaid energy meters and camera vision technology used in smart cities, also use IoT.	

Automation Irrigation System: An automated irrigation system uses IoT to measure the soil moisture and irrigate agricultural fields accordingly.	
Smart Home System: IoT can be used to switch various devices on and off, in a smart home	
When we talk about IoT, a lot of things need to be considered. We will learn about them now, one by one.	
Also, don't you think it would be great if we could see real or virtual live things on IoT? Do you think that's possible?	**ESR** Varied
Yes, of course, we can see them! In fact, you are actually familiar with this. Remember?	**ESR** Varied
I will give you a hint. You do network simulation on that. Can you guess what I'm talking about?	**ESR** Cisco Packet Tracer
Yes, it is the Cisco packet tracer. Today, we will use the Cisco packet tracer to design a simulation of a smart home.	
A smart home is a house that uses IoT technology to automate various activities around the home. IoT devices are connected to the internet, to allow the distant monitoring and controlling of home appliances such as the appliances used for lighting, heating, cooling, and setting alarms.	
How do you get the Internet network at your home?	**ESR** Modem, Router

Let's prepare the network first. The steps for this will be the same as we followed for networking.

Open Cisco Packet Tracer.

1. Go to **Network** devices.
2. Click on the **Cloud** symbol.
3. Select **Cloud-PT** first and then select **Cable-Modem-PT** in the same row.
4. Click on **Connections**, then click on **Co-axial** (blue) and select **coaxial Port 0** for **Cable-Modem-PT** Then drag it to **Cloud** and select **Co-axial**. After this, both will share connections.
5. Click on **network devices** and then click on **Wireless devices** and select **Home Gateway**.
   Home Gateway will provide wireless access or ethernet ports to facilitate smart devices.
6. Click on **connections**, select **Copper-Straight-Through** and then click on **Home Gateway**. After clicking on **Home Gateway**, select **internet** and drag it to **Cable-Modem-PT.** After clicking **Cable-Modem-PT**, select **Port 1**.

Now we have set up our network for IoT.
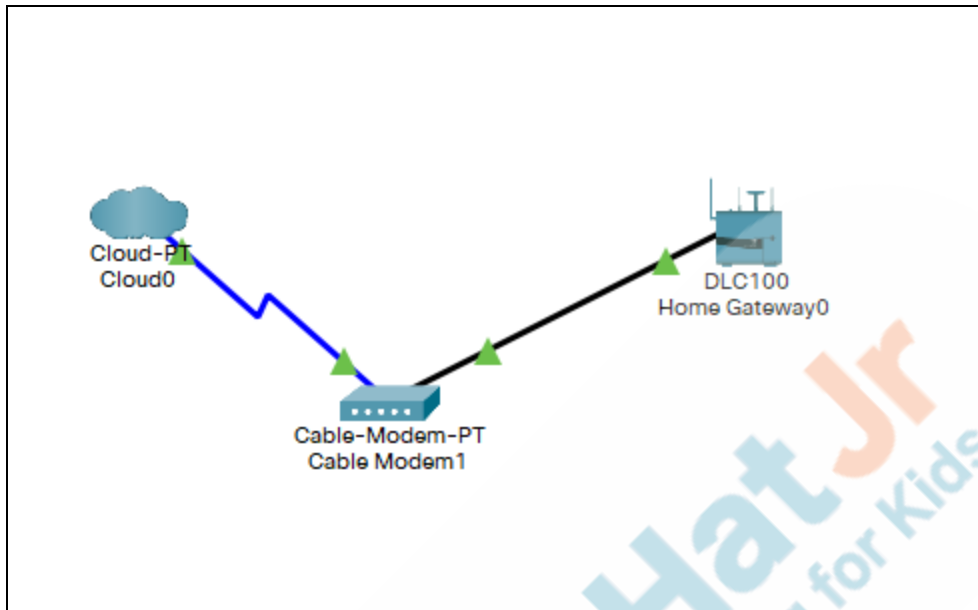
We have set up our network connection. Now, it's time to connect the smart devices. Smart devices are end devices like our fans, ACs, and lights.

1. Click on **End-Devices.**
2. Click on **Home.**
3. Select devices like **Fan, Door Lamp** one by one.
4. You will notice that the devices will automatically connect to **Home Gateway**.
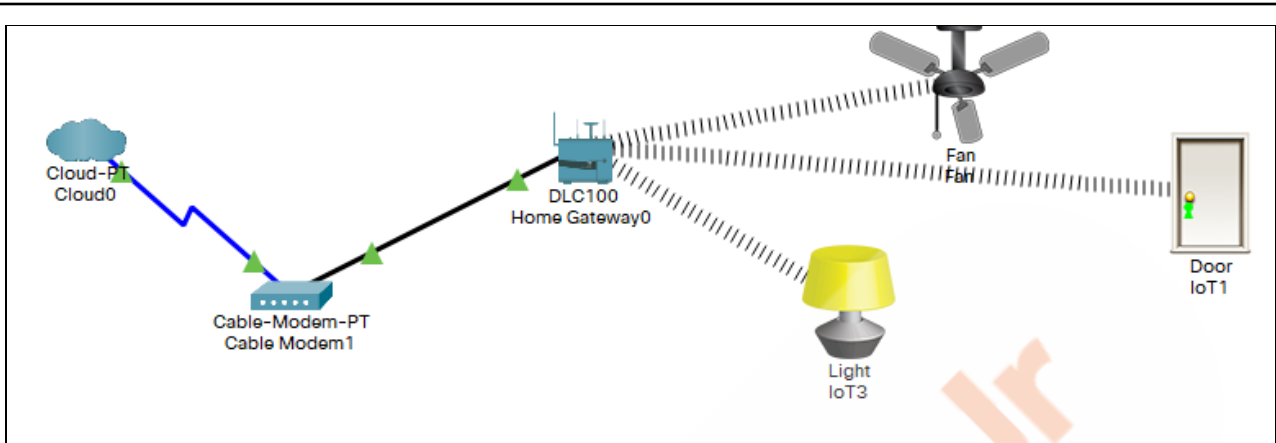
We can see that the home devices are visible, but we need to tweak some settings to make them smart devices and also make them available on remote or local servers.

Let's change the settings for the fan, first.

1. Click on **Fan**.
2. Click on **Advanced** at the right bottom corner.
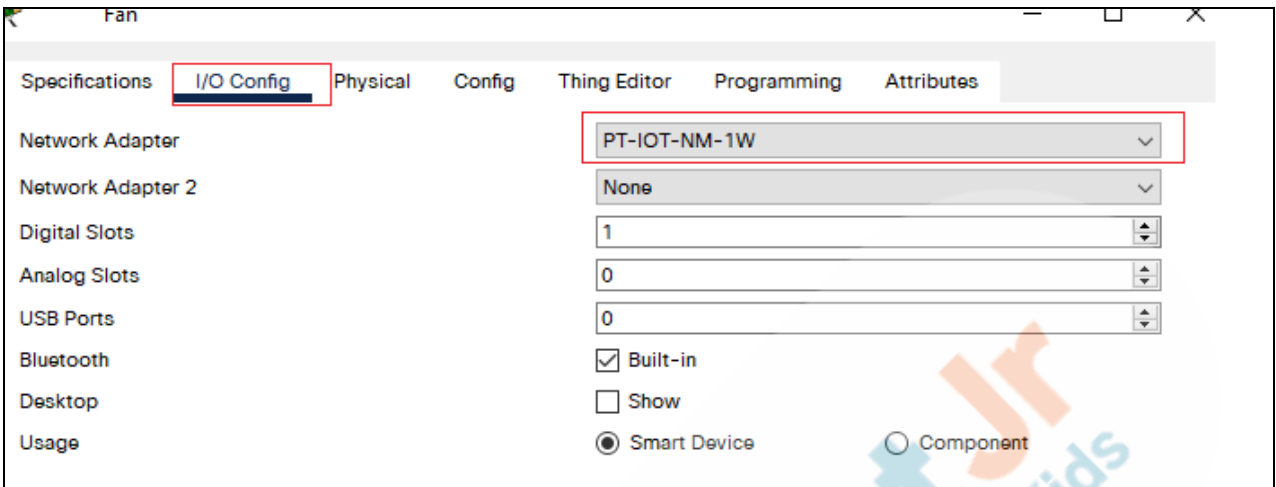
IoT0 — □ ×

Specifications   Physical   Config   Attributes

Fan
Ceiling Fan

Features:

- Registration Server Compatible
- Off
- Low Speed
- High Speed

Usage:

- Connect to the Fan with custom cable from MCU/SBC/Thing
- In the script, write the data to the Fan with customWrite function to turn Fan off, set low speed/high speed

Direct Control:

ALT click to interact

Edit

☐ Top   Advanced

3. Click on **I/O Config** and select **PT-IOT-NM-1W**.

Fan	— □ ×
Specifications I/O Config Physical Config Thing Editor Programming Attributes	
Network Adapter	PT-IOT-NM-1W ∨
Network Adapter 2	None ∨
Digital Slots	1
Analog Slots	0
USB Ports	0
Bluetooth	☑ Built-in
Desktop	☐ Show
Usage	⦿ Smart Device ◯ Component

Now that the network configuration is done, we need to adjust the **Fan** settings to make it a smart fan.

1. Click on **Config.**
2. Change the **Display Name** (any name can be used as preferred.)
3. Click on the **DHCP** setting.

Note: Don't change Default Gateway Value.

Thus, we have changed the settings for the fan. Let us do the same for other devices, that is, the door and the lamp. *Note: Repeat the same steps for the door and lamp too.*	
To control devices remotely we need portable devices like phones, tablets, and laptops. 1. Select **End Devices** at the bottom. 2. Select **Tablet**.	
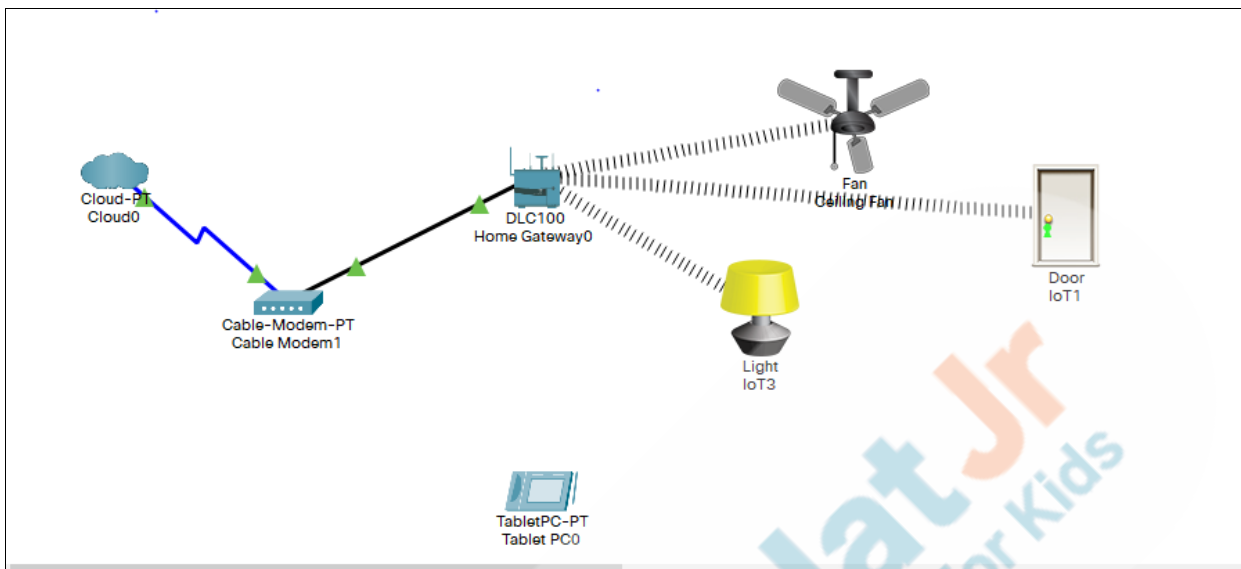
Now you will notice that the tablet is not connected with **Home Gateway**.

Let's adjust the setting for the same.
1. Click on **config.**
2. Click on **wireless.**
3. Go to **SSID** and write **Home Gateway.**

We are writing Home Gateway in SSID because SSID for both Tablet and Home Gateway should be the same to make a connection.
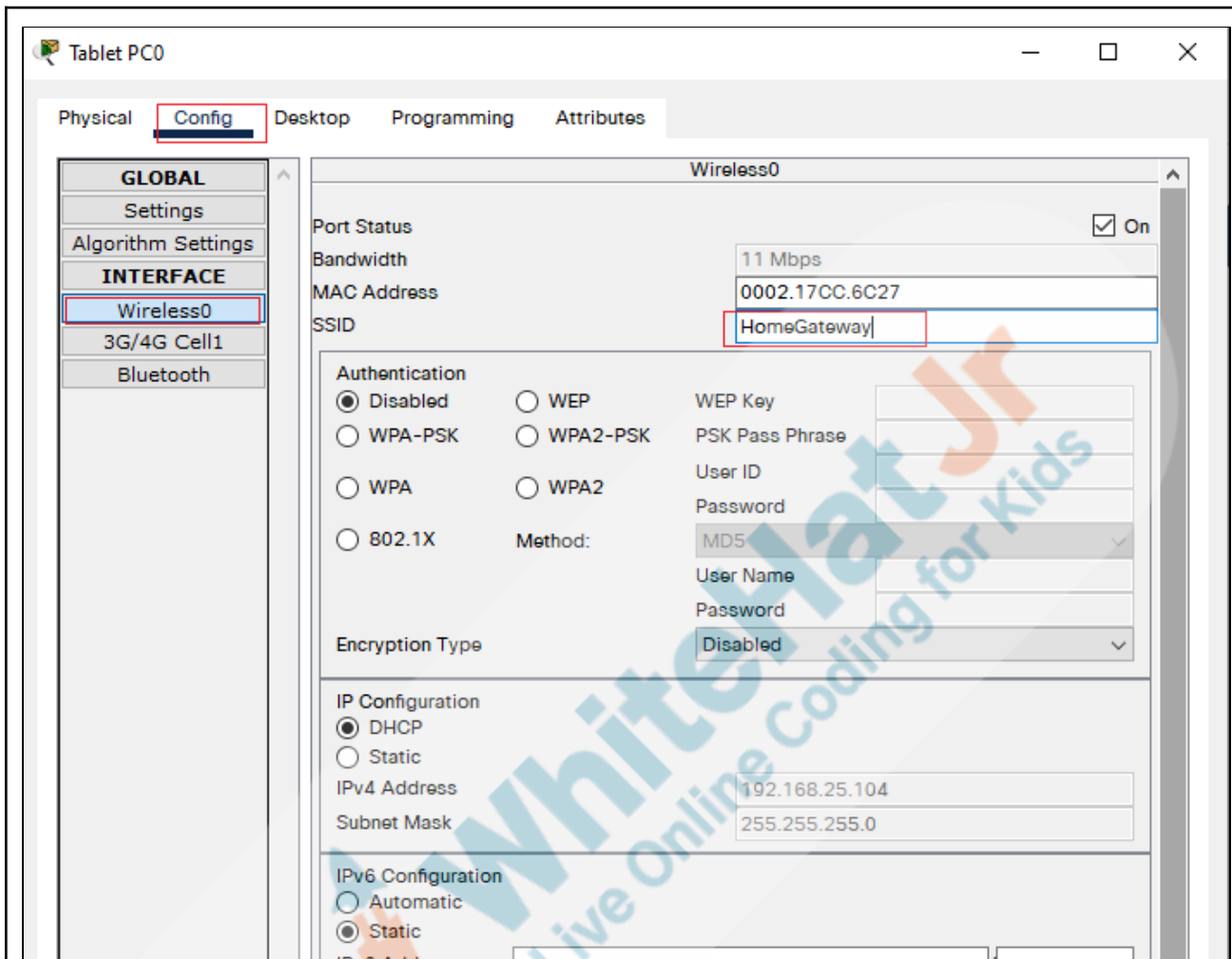
As of now, our tablet is connected with **HomeGateway** but we can't see any smart home interface on it.

Let's make an interface for **IoT** products.
1. Click on **Tablet**.
2. Click on **Desktop**.
3. Click on **Web Browser**.
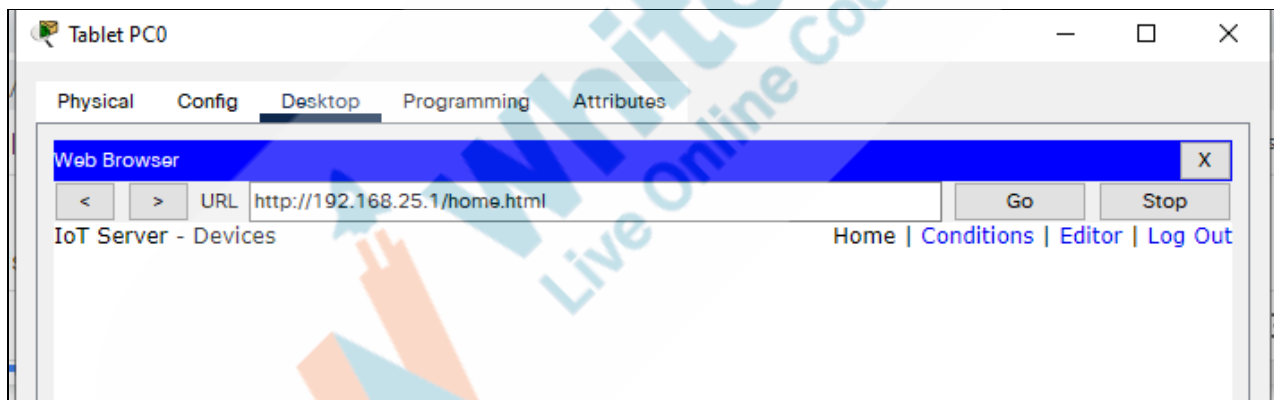
After clicking on **Web-Browser**, perform the following steps to make it available on the server.

1. Write **192.168.25.1** in the URL field. This is the IP of the gateway.
2. The **HomeGateway Login** window will appear.
3. Write down the username and password, as follows:
   Username = **admin**
   Password = **admin**
4. Click on **Submit**.
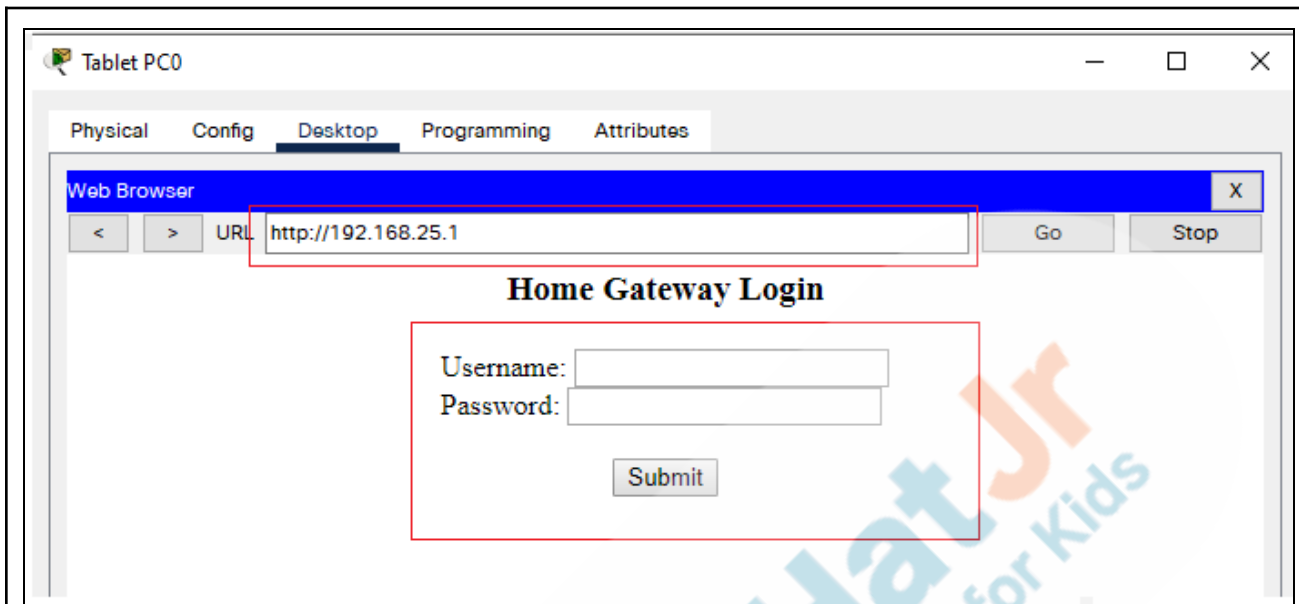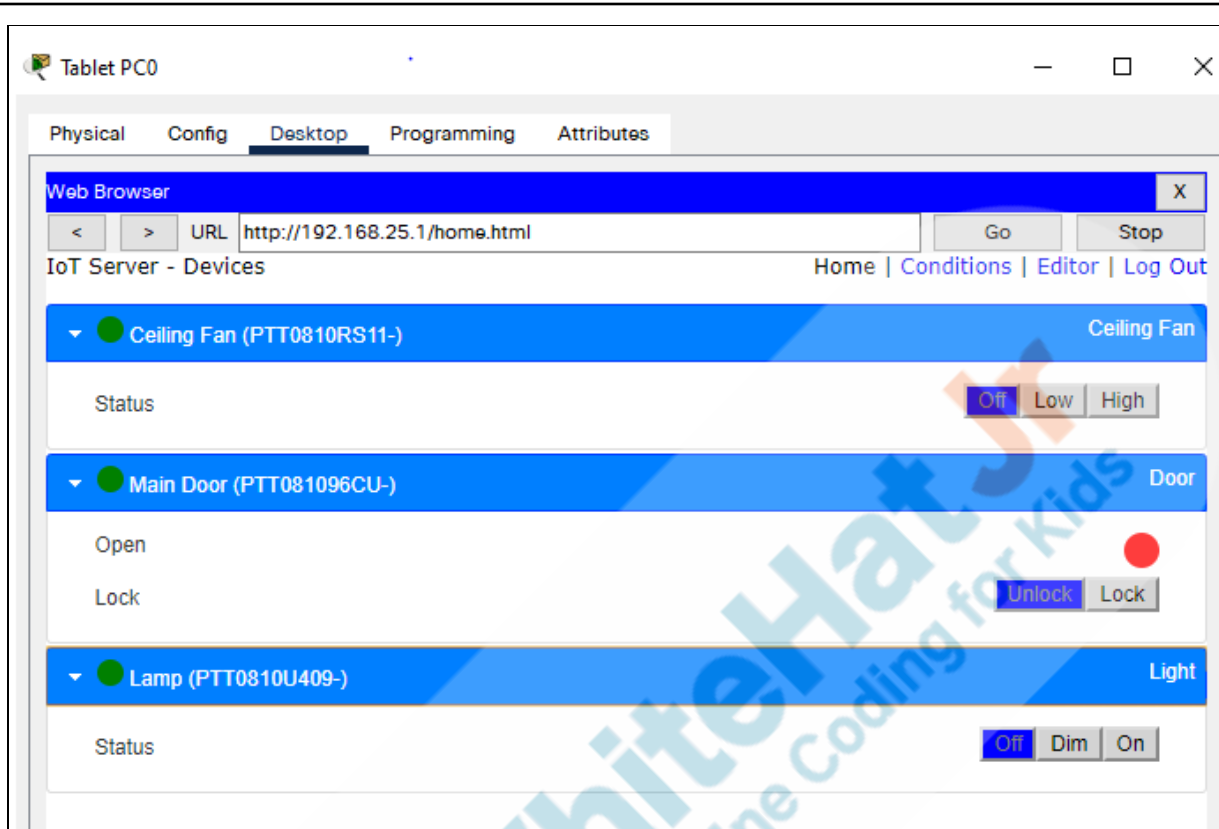
Now, the following window will appear:

But still, our home devices (**Fan**, **Lamp**, **Door**) are not visible. For that, we need to adjust some settings as follows:

1. Click on **Fan**.
2. Click on **Advance**.
3. Click on **Config**.
4. Under **IoT Server**, select **Home Gateway**.

| Let's see the smart home interface on Tablet. Go to **Tablet,** enter the **IP Address** (**192.168.0.1**), and then write down **admin** as both the **username** and **password**. | |

Operate the switches to turn the smart devices on and off Thus, we have our first smart home.

We can add different products according to the smart home requirements. This is how we can design real-life smart home automation too.

Now it's your turn to design an automation system.
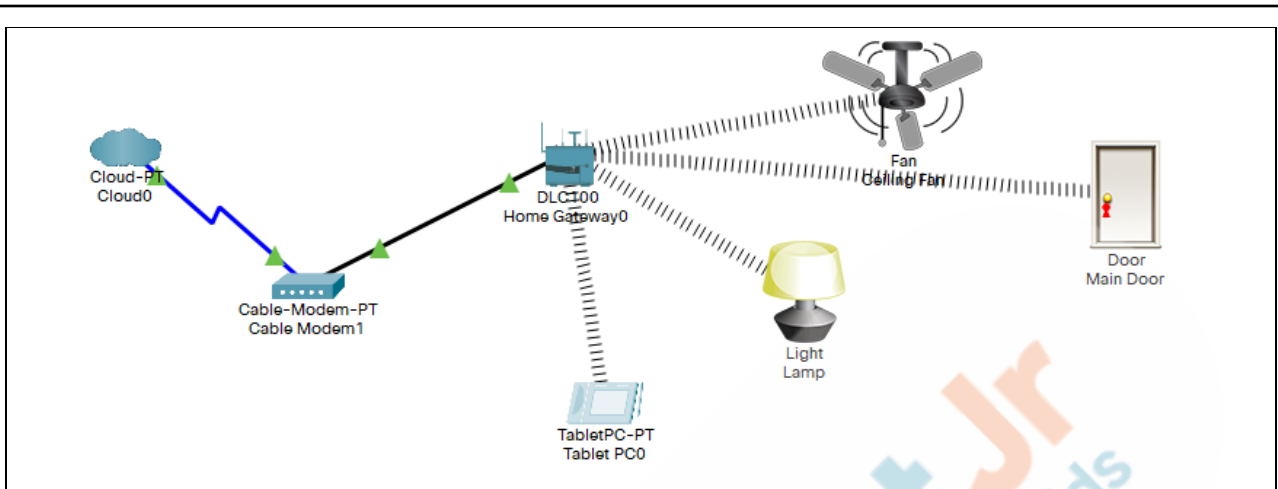
So now it's your turn. Please share your screen with me.

Teacher Starts Slideshow
Slide 11 to 15
<**Note**: Only Applicable for Classes with VA>
Refer to speaker notes and follow the instructions on each slide.

We have a class challenge for you. Can you do it?

Let's try. I will guide you through it.

Teacher Ends Slideshow

- **Ask the student to press the ESC key to come back to the panel.**
- **Guide the student to start Screen Share.**
- **The teacher gets into Fullscreen.**

ACTIVITY

- **Creating a Smart Irrigation System**

| Teacher Action	Student Action
You must be thinking that ma'am has made a smart home system. What should I do now? No worries, we have another smart system for you to implement. If you are able to design that system and if you get a chance to use it in real life, it would solve several problems that our farmers face. Do you know what type of design simulation I am talking about? Yes. So, we will follow the same procedure as we did for the smart home, to design a smart irrigation system. Let's start.	**ESR** Irrigation system
Let's prepare the network first. Open the Cisco Packet Tracer and follow these steps: 1. Go to **Network** devices. 2. Click on the **Cloud** symbol. 3. Select **Cloud-PT** first and then select **Cable-Modem-PT** in the same row 4. Click on **Connections**, then click on **Co-axial** (blue) and select **coaxial Port 0** for Modem. Drag it to **Cloud** and select **Co-axial**. After this, both will share connections. 5. Click on **network devices** and then click on **Wireless devices** and select **Home Gateway**. 6. Click on connections, select **Copper-Straight-Through** and then click on a home gateway. On clicking **Home Gateway** select internet and drag it to **Cable-Modem-PT**. On clicking **Cable-Modem-PT** select **Port 1**. Now we have set up our network for IoT.	
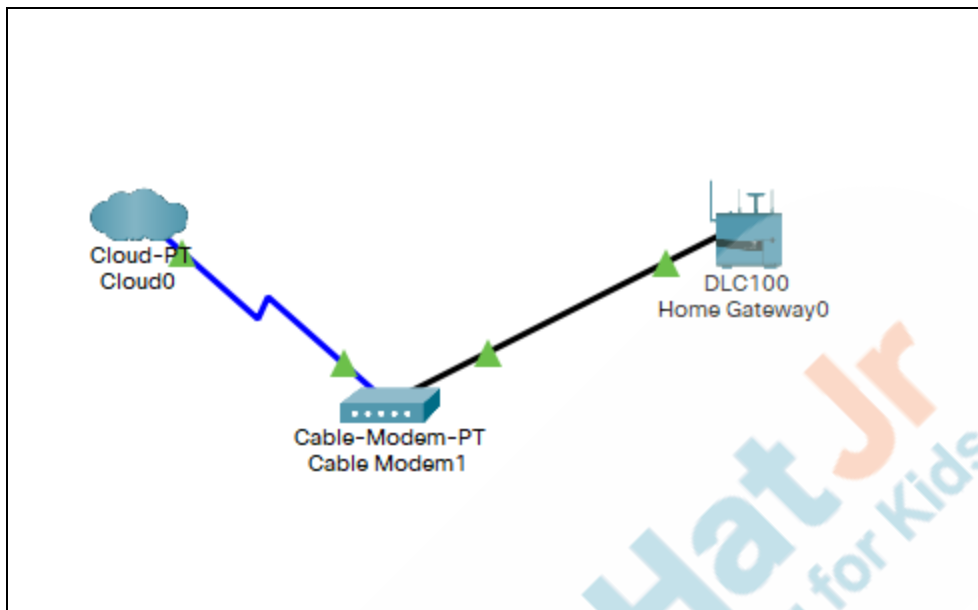
We have set up the network connections. Now, it's time to connect the smart devices. In this case, the smart devices are end devices like sprinklers, and water monitors.

A **sprinkler** is a device used to spray water. Sprinklers are used to water plants or crops or grass, or to put out fires in buildings.

Water monitors check the water levels and according to the water condition it will so output on monitor screen.

1. Click on **End-devices.**
2. Click on **Home**.
3. Select 4 **Lawn Sprinklers** and 2 **Water Level Monitors**.

You will notice that it will automatically be connected to **HomeGateway**.
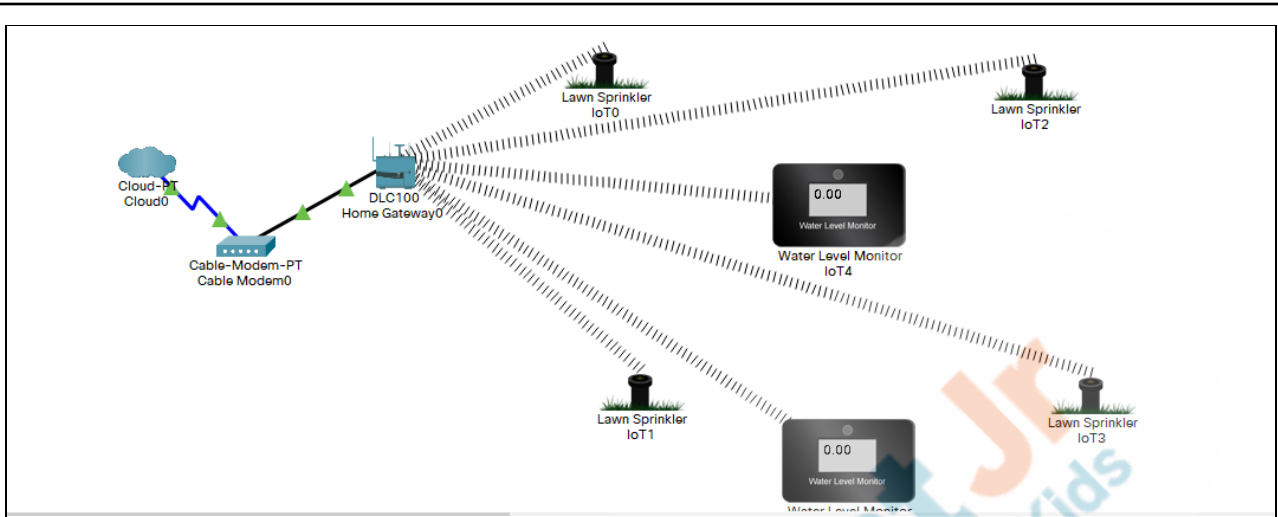
We can see the irrigation devices. However, we need to adjust some settings to make them smart devices and make them available on the remote and local servers.

Let's do this for the sprinklers first.

1. Click on **Sprinkler**.
2. Click on **Advanced** at the bottom right corner.
3. Click on **I/O Config**.
4. Select **PT-IOT-NM-1W**.
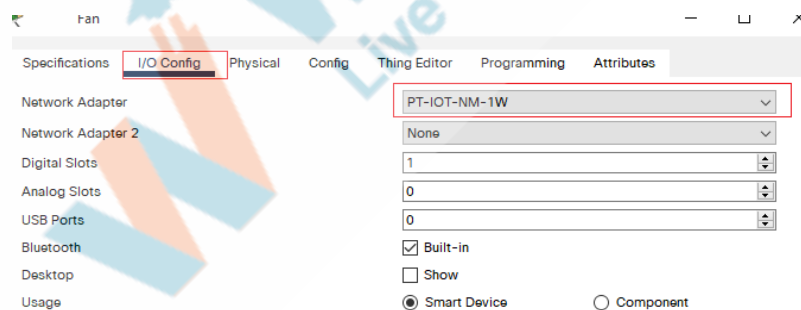
Still, we need to set more sprinkler settings.

1. Click on **Config**.
2. Change the **Display Name**.
3. Click on the **DHCP** setting.

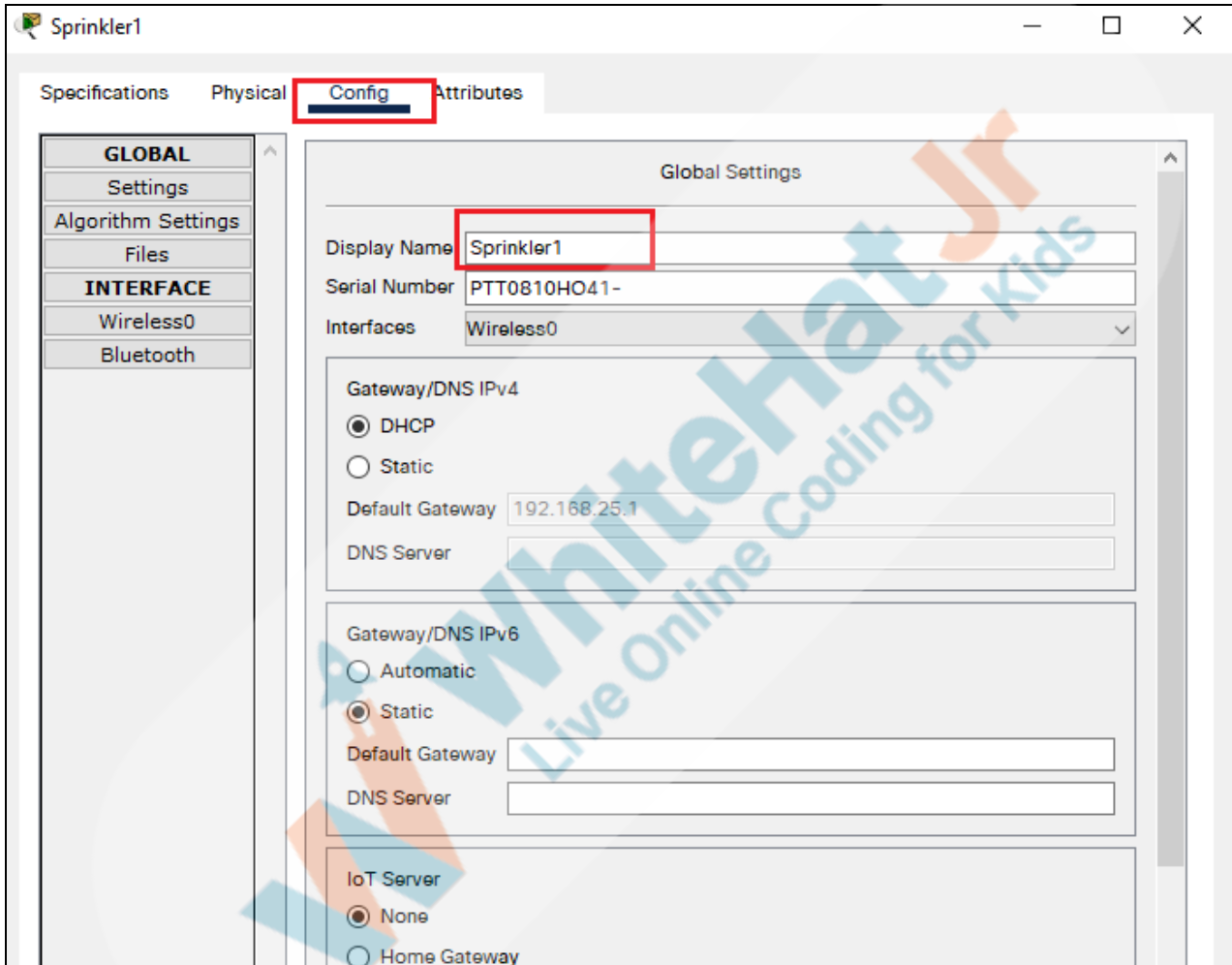|	
Note: Do not change the Default Gateway Value as this will be your IP address. Do the same settings for other sprinklers too and name them sprinkler 1, sprinkler 2, sprinkler 3, and so on	
We have adjusted the settings for the sprinklers. Let's do the same for the water level monitors. *Adjust the same settings for Water Level Monitor too.*	
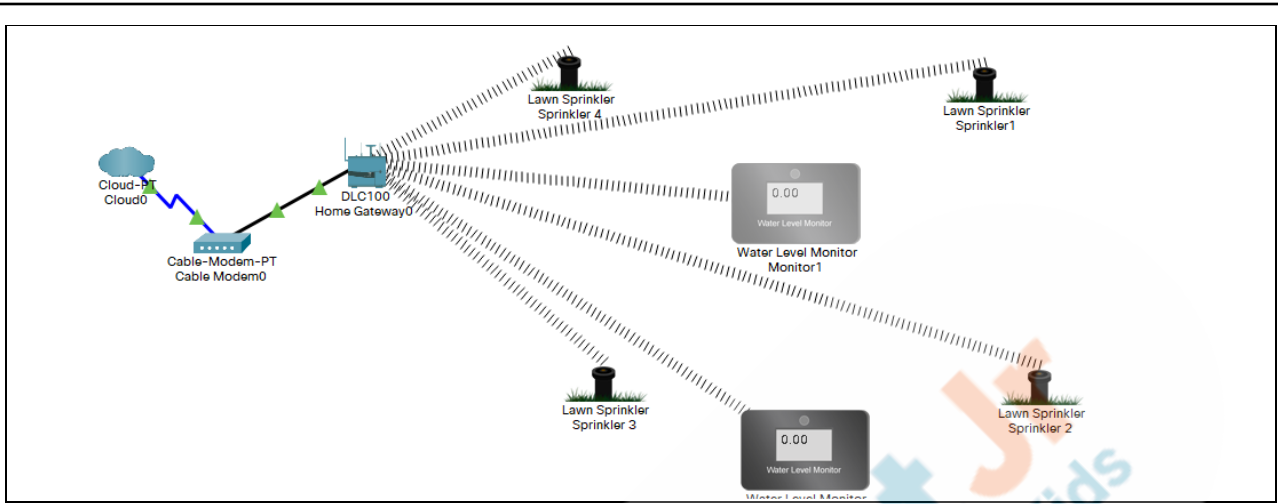
As mentioned earlier, to control devices remotely we need a laptop or a phone or a tablet.

1. Select end devices at the bottom.
2. Select Tablet.
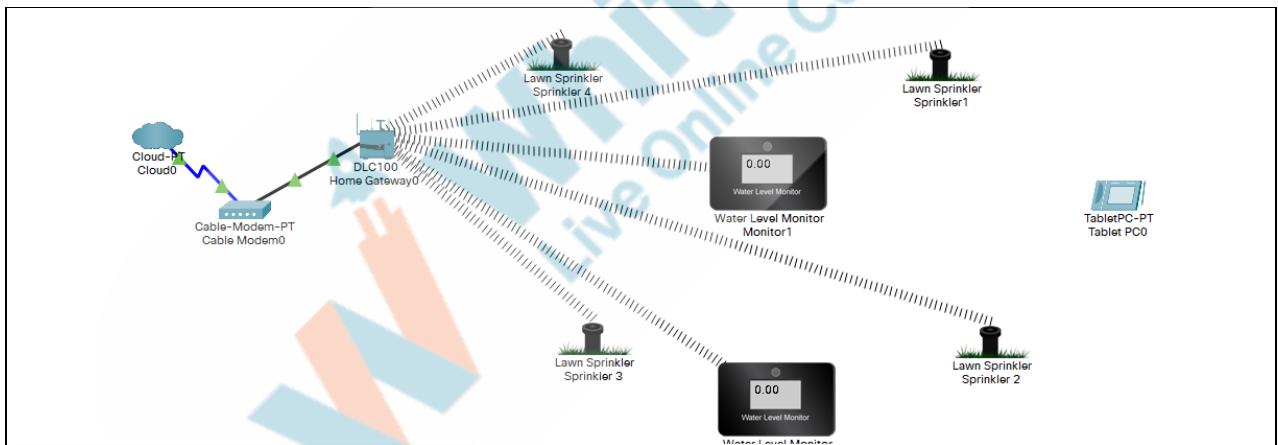
Now you will see your tablet is not connected with **Home Gateway**. Let's do this now:

1. Click on **Config**.
2. Click on **Wireless0**.
3. Go to **SSID** and write **HomeGateway**.

We are writing HomeGateway because SSID for both Tablet and HomeGateway should be the same to make a connection.
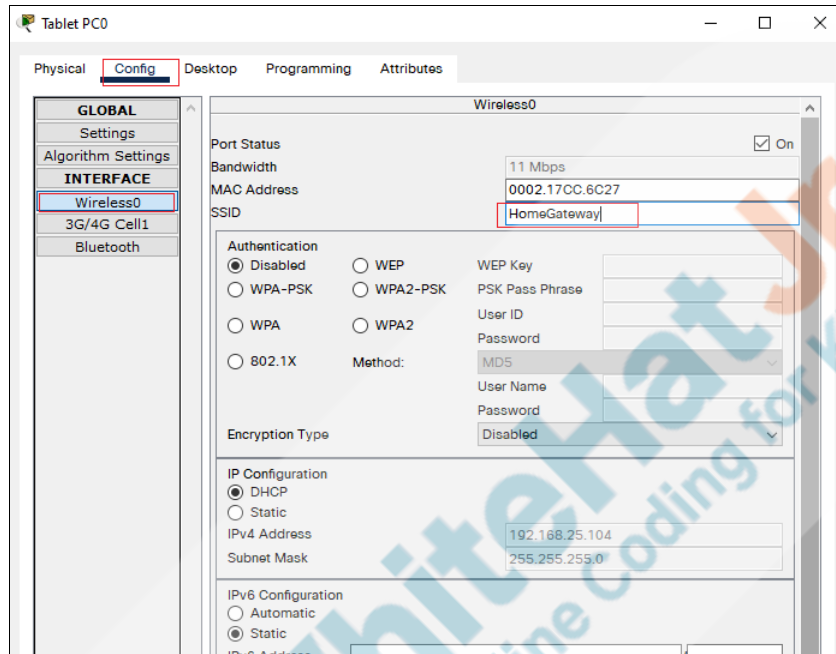
Now, our tablet is connected with **HomeGateway**, but we can't see any smart home interface in it.

Let's make an interface for IoT products.

1. Click on **Tablet**.
2. Click on **Desktop**.
3. Click on **Web Browser**.
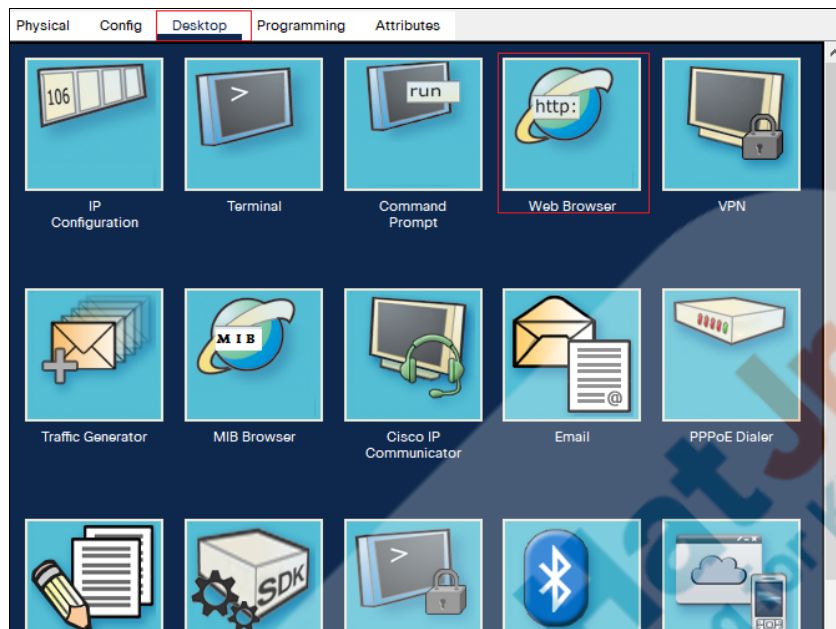
After clicking on **Web Browser**, perform the following steps:

1. Write **192.168.25.1** in the **URL** field. This is the IP of the Gateway.
2. The **Home Gateway Login** will appear.
3. Write down the username and password.
- **Username** = **admin**
- **Password** = **admin**
5. Click on **Submit**.
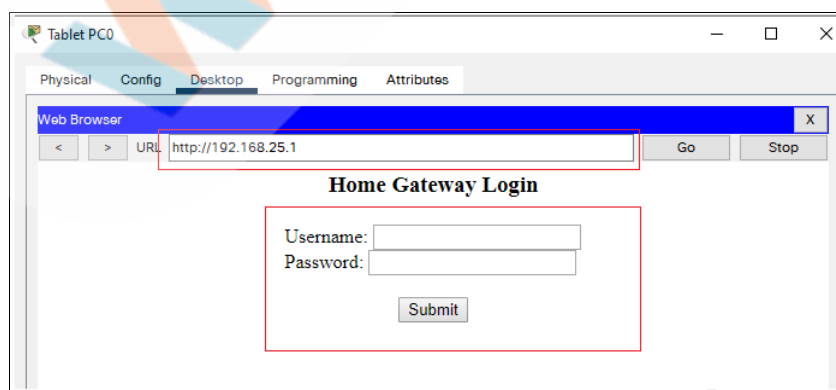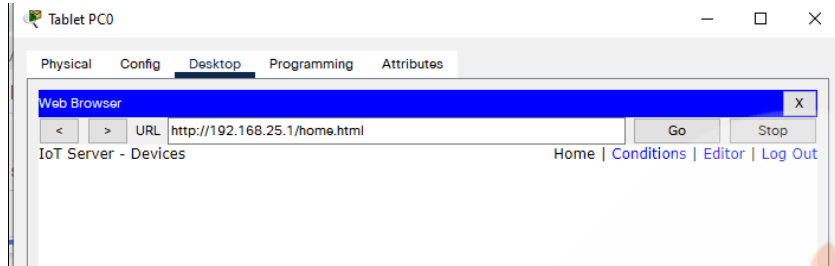
Now, the following window will appear:	
But still our irrigation devices (sprinklers and the water level monitors) are not visible. For that, we need to tweak the settings as follows: 1. Click on **Advanced**. 2. Click on **Config**. 3. Go to **Settings**. 4. Go to **IoT Server** and select **Home Gateway**.	
Let's see the smart irrigation interface on the tablet.	
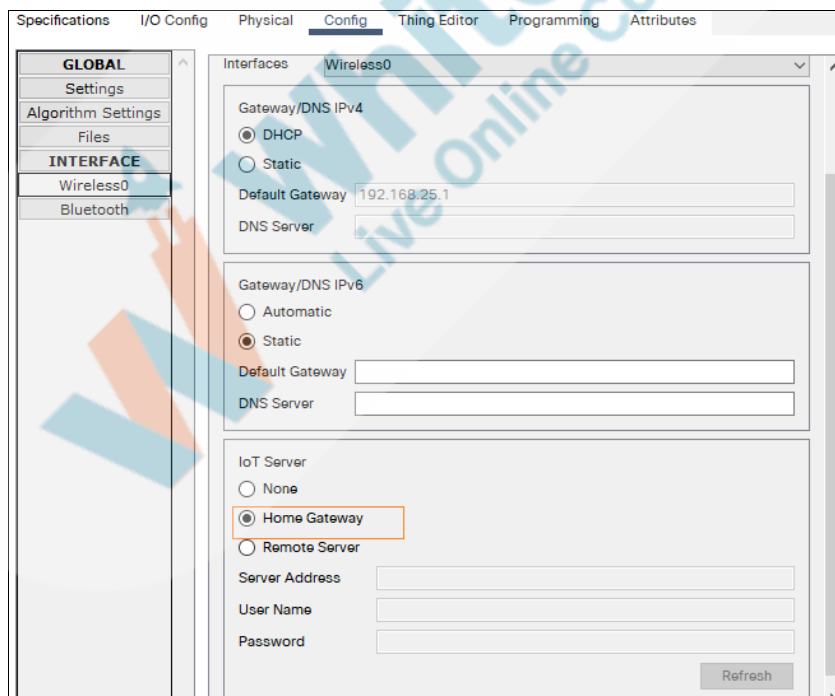
Go to **Tablet,** enter the **IP Address** (**192.168.0.1**), and then write **admin** as the **username** and **password** in both fields. You will see all devices on the interface.	
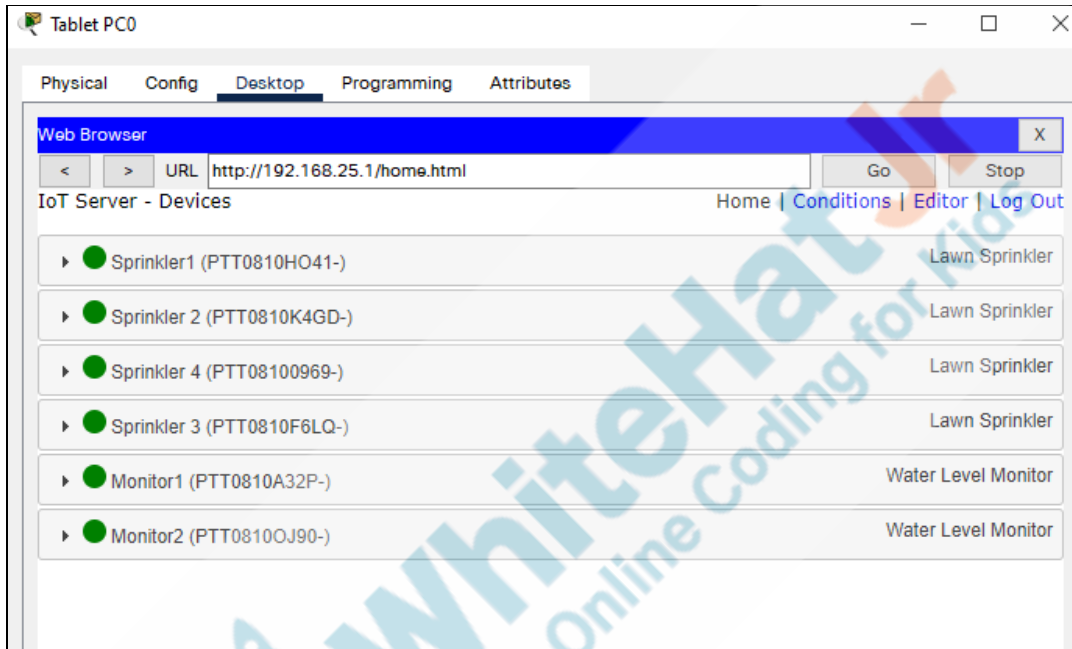
You will notice that your sprinklers are still not working, as you cannot see any water flow. For that you need to turn the sprinklers on.	
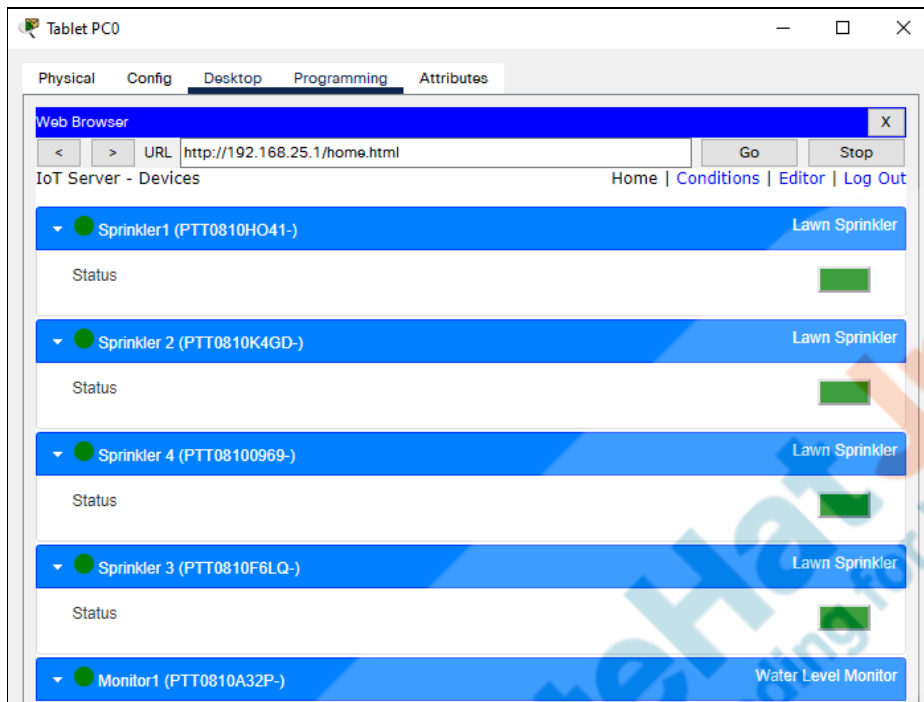
Output
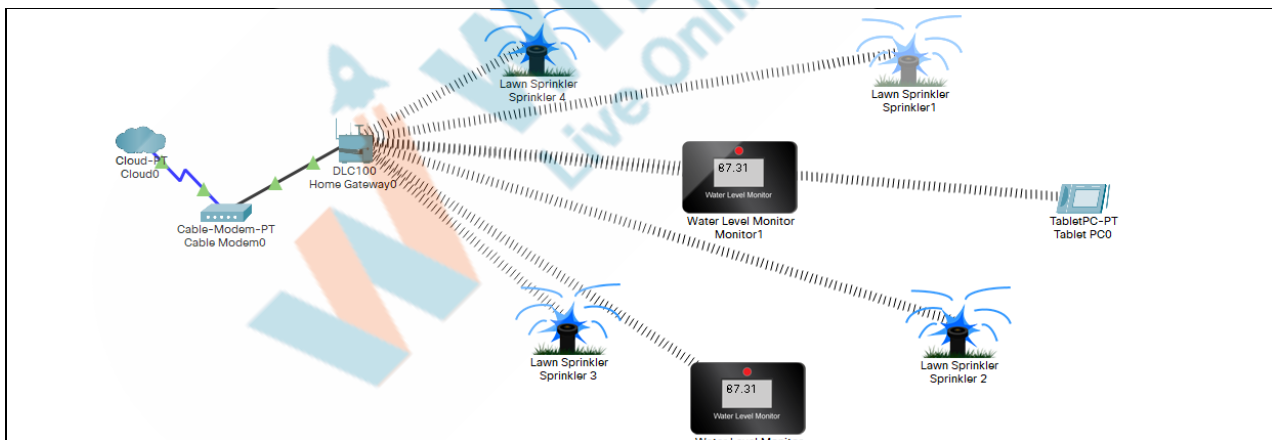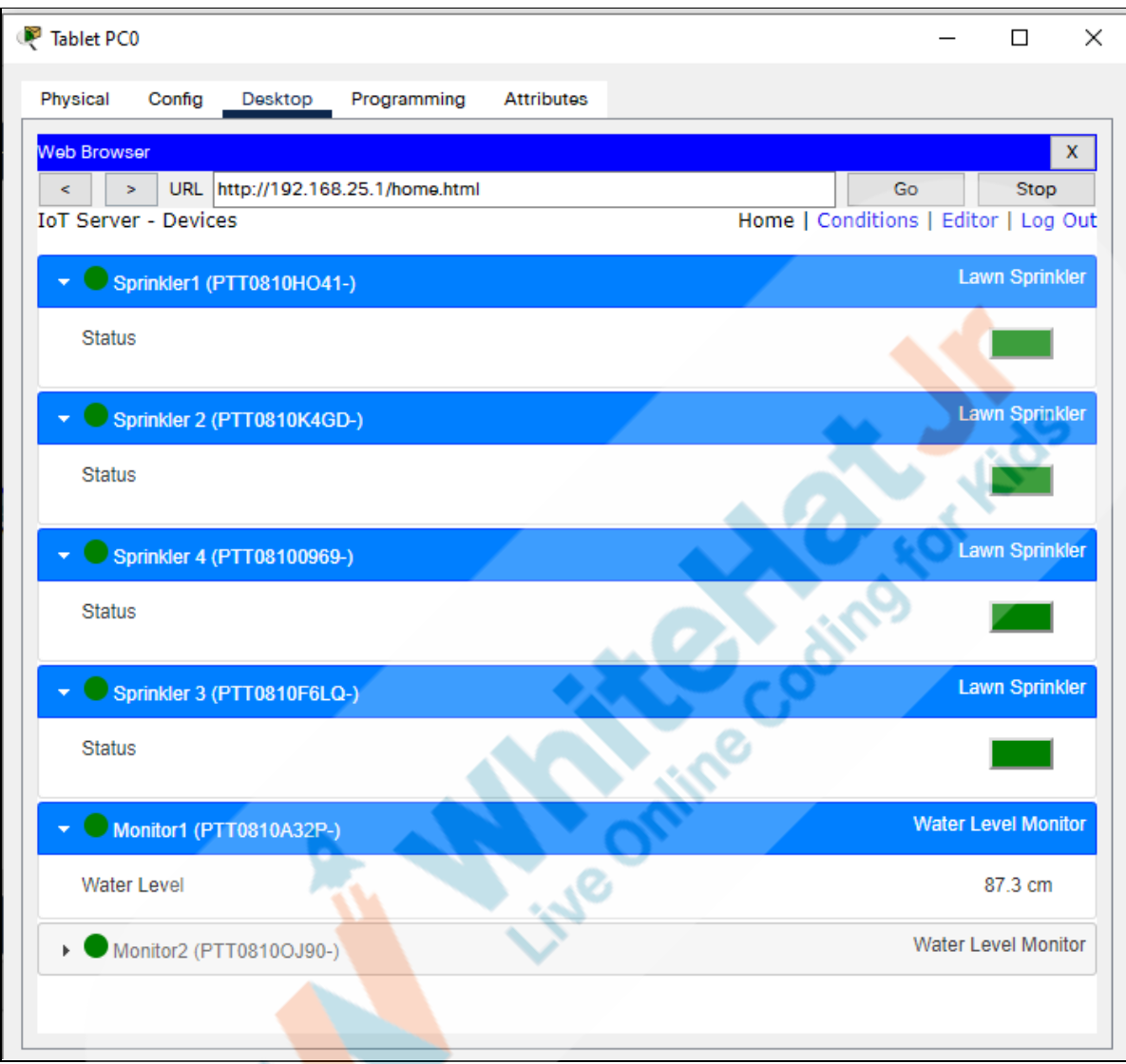
However, you will see the sprinklers are continually on, whereas we need to set conditions based on the level of water. For example, if the water level monitor shows a value less than 5 centimeters, the upper sprinklers

| (sprinklers 1 and 4) should be turned on, otherwise they should be off.

Similar conditions will apply for the bottom level monitor (sprinkler 2, sprinkler 3) - they will be turned on if the water level monitor is less than 5.

1. Go to **Tablet.**
2. Go to **Web Browser**.
3. Write down the IP address **192.165.25**.
4. Write **admin** as the username and password.
5. Go to **Conditions**. | |

Click on **Add Rule**
    1. Name them (you can choose any name).
    2. Go to **Match.**
    3. Set Condition for water level monitor i.e less than 5(If the water level is less than 5, then turn on upper sprinkler(Sprinkle 1 and Sprinkle 4)
    4. Turn on Sprinkler 1 and Sprinkle 4	

Add Rule   ✖

Name Upper Sprinkle
Enabled ☑

If:
Match All ▼   + Condition + Group
   Monitor1 ▼ Water Level ▼ < ▼ 5 cm   -

Then set: + Action
   Sprinkler1 ▼ Status ▼ to true ▼   -
   Sprinkler 4 ▼ Status ▼ to true ▼   -

If the **Water Level** detected by **Monitor1** is greater than **5**, then set the **Status** of **Sprinkler1** and **Sprinkler 4**, to **false**.

Add Rule   ✖

Name Upper Sprinkle
Enabled ☑

If:
Match All ▼   + Condition + Group
   Monitor1 ▼ Water Level ▼ > ▼ 5 cm   -

Then set: + Action
   Sprinkler1 ▼ Status ▼ to false ▼   -
   Sprinkler 4 ▼ Status ▼ to false ▼   -

Now do the same for bottom sprinklers and set the same conditions for **Monitor2**. Turn off the bottom sprinklers if the water level is greater than **5**, otherwise turn them on.

Add Rule ✖

Name Bottom Sprinkle

Enabled ☑

If:

Match [All ▼] [+ Condition] [+ Group]

[Monitor2 ▼] [Water Level ▼] [> ▼] [5] cm [-]

Then set: [+ Action]

[Sprinkler 2 ▼] [Status ▼] to [false ▼] [-]

[Sprinkler 3 ▼] [Status ▼] to [false ▼] [-]

Turn on the bottom sprinklers if the water level is less than 5 cm, otherwise turn them off.

Add Rule ✖

Name Bottom Sprinkle

Enabled ☑

If:

Match [All ▼] [+ Condition] [+ Group]

[Monitor2 ▼] [Water Level ▼] [< ▼] [5] cm [-]

Then set: [+ Action]

[Sprinkler 2 ▼] [Status ▼] to [true ▼] [-]

[Sprinkler 3 ▼] [Status ▼] to [true ▼] [-]

These conditions should look as follows:

Actions		Enabled	Name	Condition	Actions
Edit	Remove	Yes	Bottom Sprinkle	Monitor2 Water Level < 5.0 cm	Set Sprinkler 2 Status to true Set Sprinkler 3 Status to true
Edit	Remove	Yes	Bottom Sprinkler	Monitor2 Water Level > 5.0 cm	Set Sprinkler 2 Status to false Set Sprinkler 3 Status to false
Edit	Remove	Yes	Upper Sprinkler	Monitor1 Water Level < 5.0 cm	Set Sprinkler1 Status to true Set Sprinkler 4 Status to true
Edit	Remove	Yes	Upper Sprikler	Monitor1 Water Level > 5.0 cm	Set Sprinkler1 Status to false Set Sprinkler 4 Status to false

Now, let's check the output.
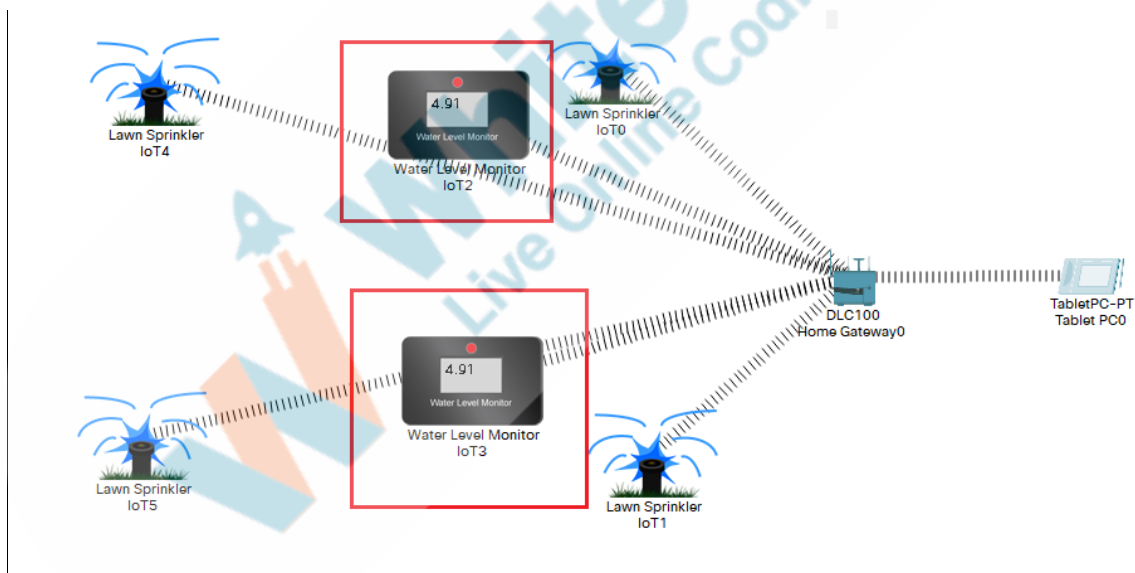
Today we designed our first IoT simulation. Using this simulation, we can see how the IoT works in real life too.

Teacher Guides Student to Stop Screen Share

WRAP-UP SESSION - 05 mins

- **Teacher Starts Slideshow**
- **Slide # to #**
- <**Note**: Only Applicable for Classes with VA>

Activity details

Following are the WRAP-UP session deliverables:
- Appreciate the student.
- Revise the current class activities.
- Discuss the quizzes.

WRAP-UP QUIZ   Click on In-Class Quiz

Continue WRAP-UP Session
Slide # to #
<**Note**: Only Applicable for Classes with VA>

Activity Details

Following are the session deliverables:
- Explain the facts and trivia
- Next class challenge
- Project for the day
- Additional Activity (Optional)

FEEDBACK
- **Appreciate and compliment the student for trying to learn a difficult concept.**
- **Get to know how they are feeling after the session.**
- **Review and check their understanding.**

Teacher Action	**Student Action**

You get hats-off for your excellent work! In the next class, _____	*Make sure you have given at least 2 hats-off during the class for:* Creatively Solved Activities +10 Great Question +10 Strong Concentration +10

ACTIVITY LINKS		
Activity Name	**Description**	**Link**
Teacher Activity 1	Teacher Reference Link-Smart Home Automation	https://s3-whjr-curriculum-uploads.whjr.online/78392c9a-d362-407c-b0b3-b518701f4257.pkt
Teacher Activity 2	Teacher reference Link-Smart Irrigation System	https://s3-whjr-curriculum-uploads.whjr.online/fcc8fc12-f66c-46fc-995c-d46aaed82df9.pkt

Teacher Reference 1	Project	https://s3-whjr-curriculum-uploads.whjr.online/0442fadc-4729-4e80-ba70-13fca043f0be.docx
Teacher Reference 2	Project Solution	https://s3-whjr-curriculum-uploads.whjr.online/98013c7e-41b4-43a1-94e1-bf999bf9bc7d.pkt
Teacher Reference 4	In-Class Quiz	https://s3-whjr-curriculum-uploads.whjr.online/adf3c1c7-ec89-4f2a-b051-f4361fe76c1c.docx