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MID- TERM REPORT

Smoke detection system with fire prevention using Cisco Packet Tracer tool

Submitted By

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Description

In this project, we will be using Cisco Packet Tracer to detect smoke/fire in a residential one-story smart home. The Cisco Packet Tracer will emit different sets of virtual wireless networks using Internet of Things devices. When the smoke detector detects a level of smoke that exceeds a certain threshold, a smoke operation is performed. Smart-objects are used according to requirements based on various conditions. Users will be able to keep track of these devices and work on them.

The technologies that will be used to perform this project:

- Cisco Packet Tracer
- A Home Gateway
- IoT devices (four smoke detectors, four fire sprinklers, one siren, three windows, four doors)
- An old car
- Smart device such as a smart phone.

Key words: Siren, Fire sprinkler, Switches, Smart device, Windows, Doors.

Objective

- The main goal of this project is to generate a virtual environment using Cisco Packet Tracer such that we can interact with IoT devices and other devices. All devices appear as they are in reality.
- We would like to show that our model is reliable when smoke is induced and demonstrate the behavior of IoT devices.

Packet Tracer is a multi-task network simulation software that model different network actions like topology implementation, choice of the best path based on several routing algorithms, server configuration, IP sub-netting, and investigation of network troubleshooting. (Flife, 2019) To establish the communication between end user devices inside a network, it is important to select the suitable core networking devices like routers, switches, hubs and create a physical connection by connecting the appropriate cables to the ports from the tool list of packet tracer. (Flife, 2019)

Procedures

1. Our model consists of a one-story smart home that includes four different rooms including a garage. In each room, a smoke detector as well as a fire sprinkler system is placed. The fire sprinkler is an effective tool for fire prevention as it has a fast reaction time, discharging water when smoke is detected. The alarm in the smoke detector will go off when it detects the environment variable smoke at a certain level.
2. The garage has only a door and the other rooms have both a door and a window. All doors and windows are Registration Server Compatible and can vent Carbon Dioxide and Carbon Monoxide.
3. A siren (Siren1) and a smart phone (Device1) are used in the system.
4. A Home Gateway1 is used to connect all the devices linked by Copper Straight Through and Copper Cross-Over connections through the respective 2960-24TT switches (Swith1, Switch 2, Switch 3, and Switch 4) as shown in Figure 1. All IoT devices and switches are configured using the Home Gateway1, using an IP Address of 192.168.25.1 and a Subnet Mask of 255.255.255.0

   Dynamic Host Configuration Protocol (DHCP) is used to manage the IP Address. Device 1 is connected to the Home Gateway1; a user can monitor and write conditions to manage all the IoT devices through Device 1.

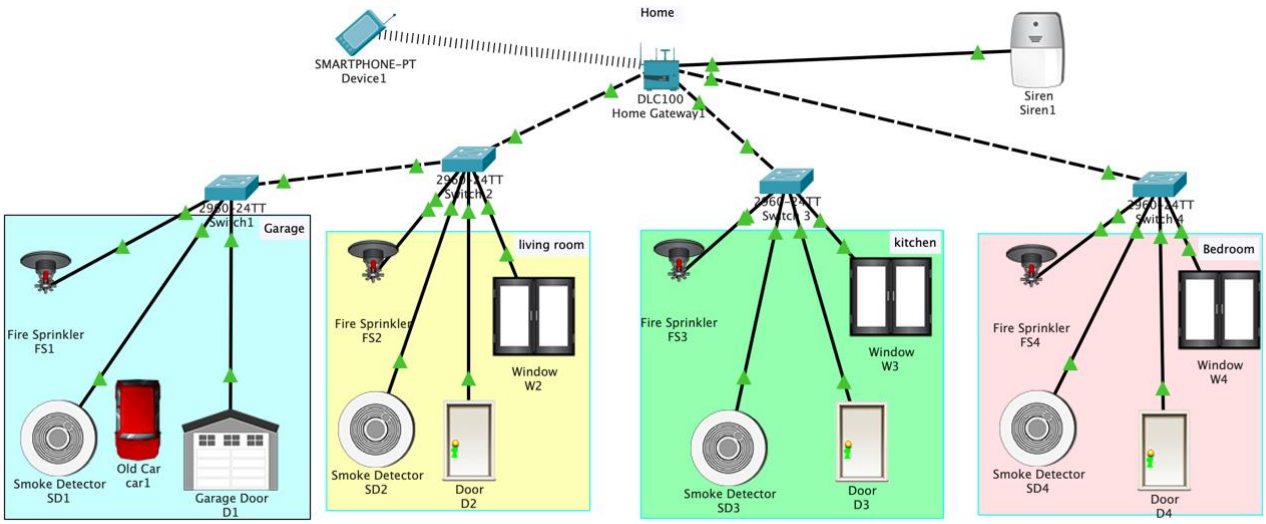

Figure 1.

From our smart phone (Device1), we can use the web browser and insert the IP address to view a list of all the IoT devices that are connected to Home Gateway1. Figure 2 illustrates a screenshot of some of the IoT devices in the list. From that list, we can also determine the status of each IoT device. For example, we can see if Siren1 is on, verify the status of the fire sprinklers as well as check the alarm and smoke level from each smoke detector as shown in Figure 3.

We can also set up and write conditions to manage the IoT devices.

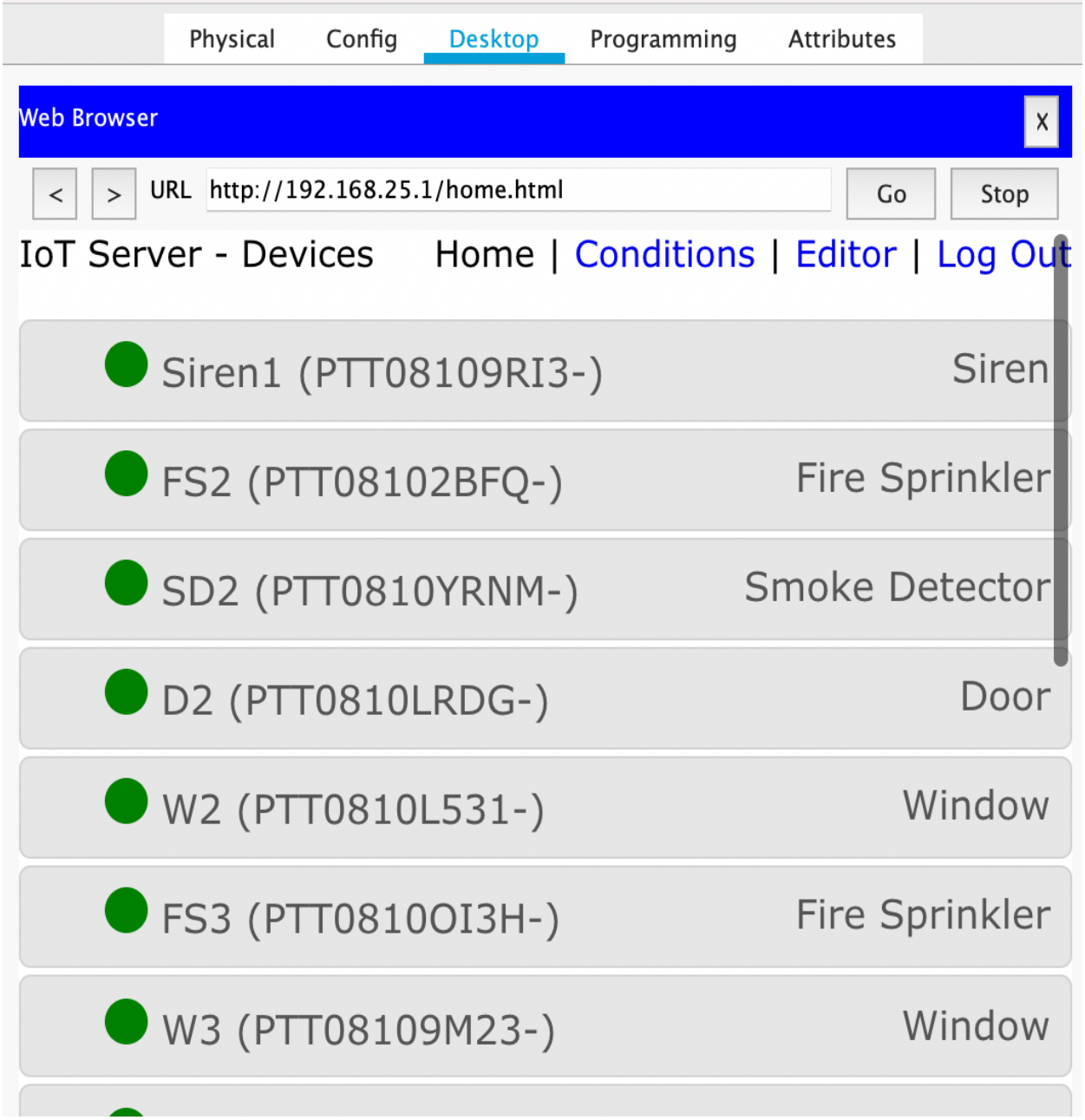

Figure 2

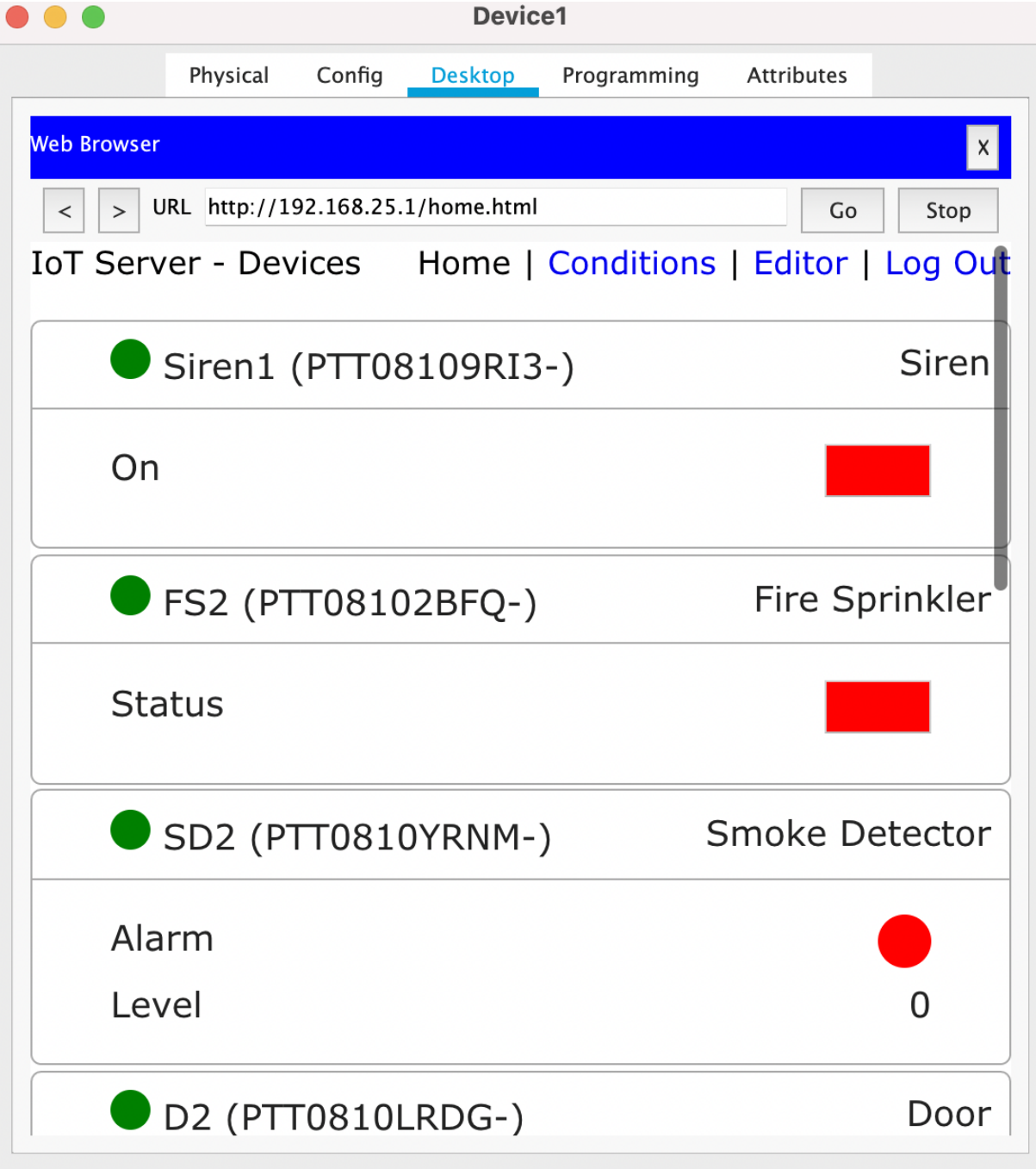

Figure 3.

5. For this experiment, we will use an old car (Car1) to generate smoke, by pressing (Alt + click) or (option + click).
6. The above system works when smoke is detected. If the smoke detectors' (SD1, SD2, SD3, SD4) level are more than zero, Siren1 will turn on which will induce the fire sprinklers (SF1, SF2, SF3 and SF4) to spray water while simultaneously opening all windows (W2, W3, and W4) and unlocking all doors (D1,D2,D3, and D4). The conditions are shown in Figure 4.

Web Browser

URL http://192.168.25.1/conditions.html

Go Stop

IoT Server - Device Conditions

Home | Conditions | Editor | Log Out

Actions	Enabled	Name	Condition	Actions
Edit Remove	Yes	On	Match any: • SD1 Level > 0 • SD2 Level > 0 • SD3 Level > 0 • SD4 Level > 0	Set D2 Lock to Unlock Set FS2 Status to true Set W2 On to true Set FS3 Status to true Set D3 Lock to Unlock Set W3 On to true Set W4 On to true Set D4 Lock to Unlock Set FS4 Status to true Set Siren1 On to true Set D1 On to true Set FS1 Status to true
Edit Remove	Yes	Off	Match all: • SD2 Level <= 0 • SD3 Level <= 0 • SD4 Level <= 0 • SD1 Level <= 0	Set Siren1 On to false Set FS2 Status to false Set FS3 Status to false Set FS4 Status to false Set W2 On to false Set W3 On to false Set W4 On to false Set FS1 Status to false Set D1 On to false

Add

Figure 4.

7. The outcome is shown in Figure 5.

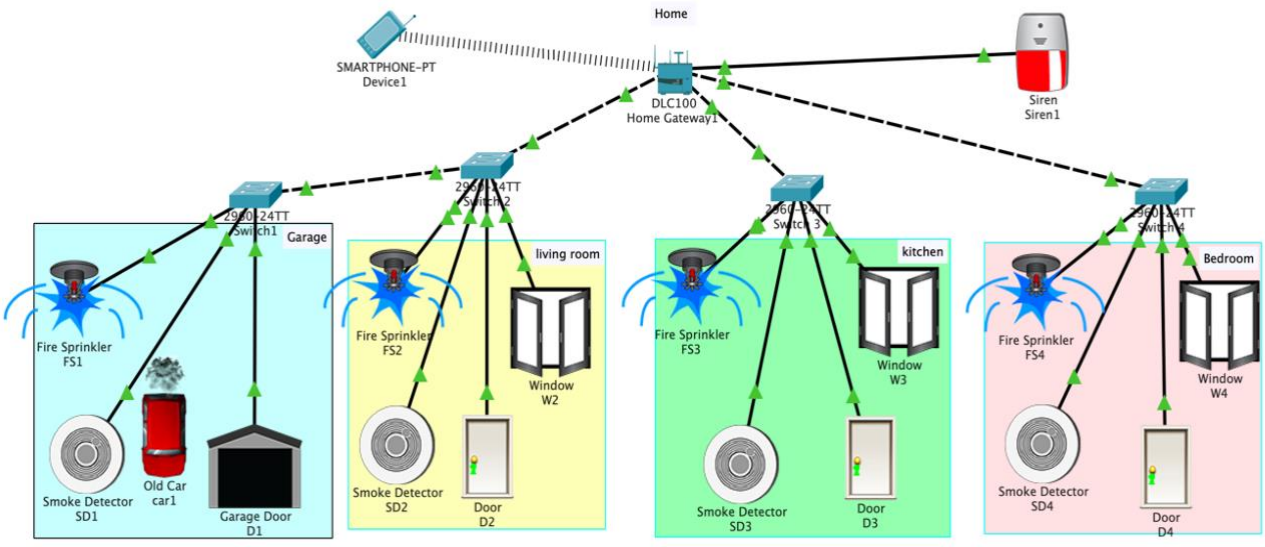

Figure 5.

From Figure 6, we can see the details of the outcome when smoke was created.

The siren is on.

The status of the fire sprinklers is on.

The alarm of the smoke detector is on, and the level of smoke is 0.027256.

The doors are unlocked, and the windows are open.

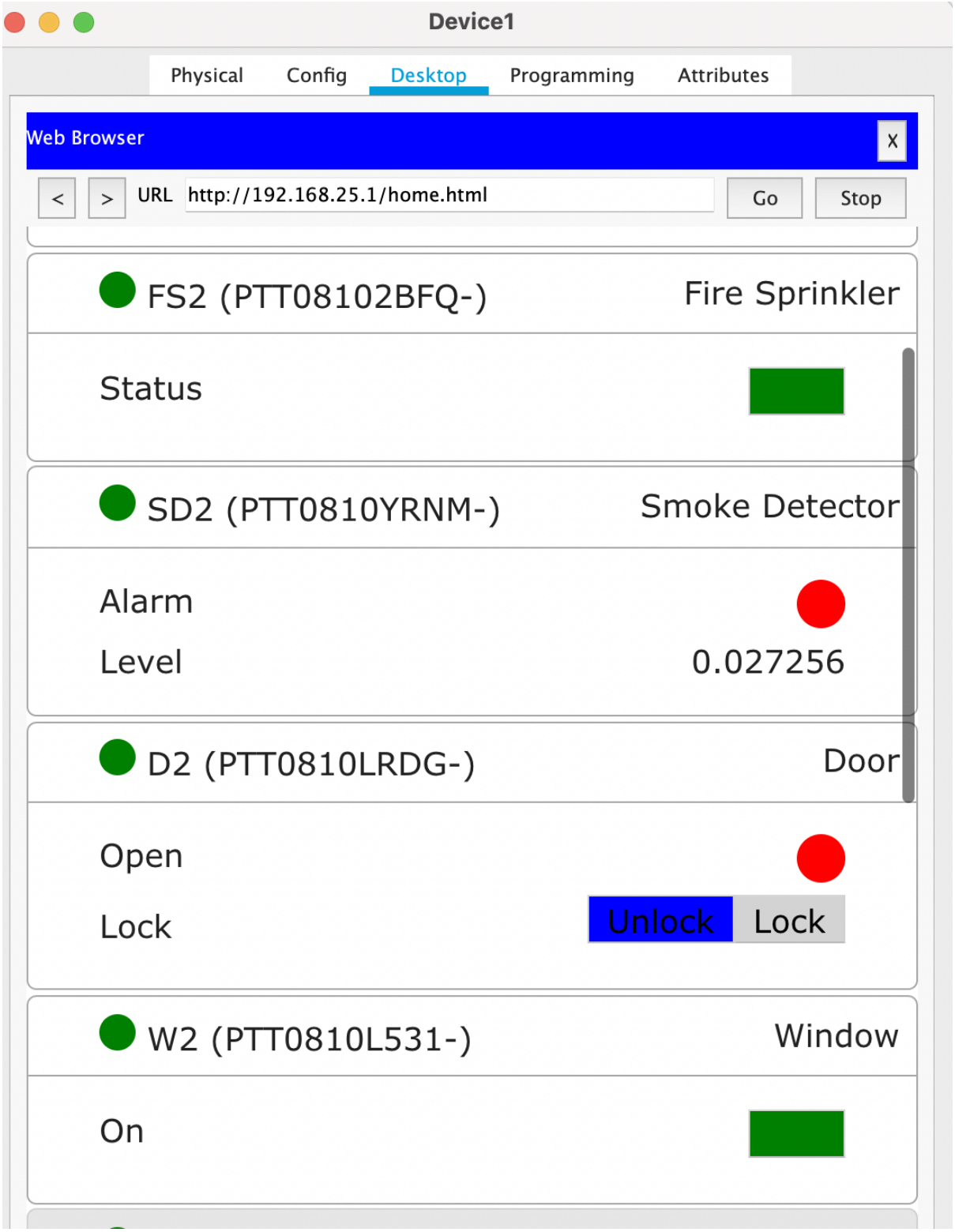

Figure 6.

8. When the level of SD1, SD2, SD3 and SD4 are less than or equal to zero, Siren 1 and the four fire sprinkles (FS1, FS2, FS3, and FS4) will turn off, closing all the windows.

Conclusion

In this project we used Cisco Packet Tracer to build a smart home and establish a wireless connection between a smart device and several IoT devices. The smart home simulation model we proposed includes a living room, a kitchen, a bedroom, and lastly a garage. All of these rooms have several wireless and IoT devices, all connected to the home gateway and controlled by the smartphone.

Finally, we can conclude that our model offers safety and simplicity in case smoke or fire is detected. We observed that our model is also lightweight, powerful thus, making it ideal for building smart homes using wireless and IoT technologies. For future work, we will compare our current model with other models by considering various variables such as simulation time, transmission delay and, we will try to improve the system security to ensure that data transmission is done securely.

References

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