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Design and Implementation of Smart Home System using Packet Tracer

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ABSTRACT

Smart home automation is a technology to make things happen at home automatically. When we say home automation, the first thing that comes to mind is robots, lighting, complex electronics, and a general feeling that it is a controlled warm, or cold condition of the home. However, some simple forms of automation such as Garage door opener, Remote controls, Irrigation/sprinkler control systems, Motion-activated lights, security systems. The home automation will have become important roles t in the human's environment because it provides the users with comfortable and calm for applying the home automation device. The design and implementation of smart home automation control uses three methods; Power Electrical system, fire alarm system, and home automation system to control of selective and security of the home device that protects the home. All of the systems are controlled by a server that also called a registration server. Some devices are used WIFI or WLAN and some of the devices that were used are wired (RJ45) or fiber optic.

Key words: RFID, Motion detector, Fire alarm, Sprinkler control systems.

1. INTRODUCTION

The home automation is controlled the home appliance by using a central control point or registration servers. All devices are completed automatically every day that can use on or off definitely devices and control remotely. The concept of the communication cable system is to use the wire IEEE 802.3, Wifi IEEE802.11 b/g/n [1,2]. The celebrity of wireless networks has expanded day by day and advanced computer technology has the facility to connect via the wireless network [3]. But, Wifi or RF has limited that it is avoided or not penetrated ceiling, concrete, steel frame, and wood. However, the RF device in a home environment is transmitted with high data rate transmission and to avoid cable complexity.

Home automation is used to imagine equipped CCTV (Close Circuit TV) with motion, streetlight with motion, Aircon with control room temperature, fire alarm and actuators for opening the door in the home automation. The automation is means 'intelligent' that can support a secure, more appropriate, and more security. Soon, most electronic appliances will include network card and home automation in as PCs, mobile, IoT, refrigerator, electrical generator, heating, and air condition and controlled PC, tablet by using web-based user interface by using http (hypertext transport protocol). In this paper has been designed a smart home automation control system by using four rooms of fire alarm control that it is control fire alarm using a server-based system, air condition system, and lighting system [4].

2. METHODOLOGY AND INFRASTRUCTURE OF SMART HOME AUTOMATION

This paper is divided in three sections. They are electricity sources, fire alarm, and home security automation. In the first section, the electricity sources that they are AC source (LV power line 220V 60Hz), electrical generator source, solar, and wind turbine are automatically selected [5,6]. A second section, fire alarm system that it is used smoking detectors. And then, in the third section, home security automation is controlled by the garage door, home door, and motion detector. Figure 1 shows the Network Infrastructure of Smart Home Automation.

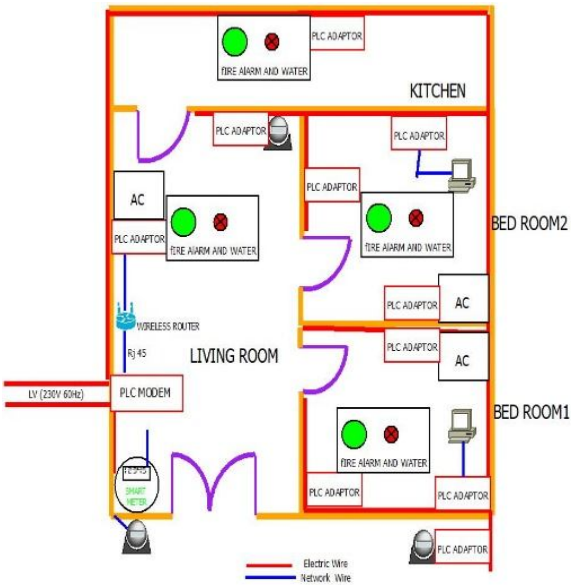


Figure 1: Network Infrastructure of Smart Home Automation

2.1. Automation System of Electricity Sources

There are four sources of electricity for smart home automation. They are AC source (LV power line 220V 60Hz), electrical generator source, solar, and wind turbineare automatically selected by using the registration server. The home that it is used four sources are used hybrid electricity smart electricity system. There is no problem with electrical power interrupting. Figure 2 shows the AC power on of home automation network.

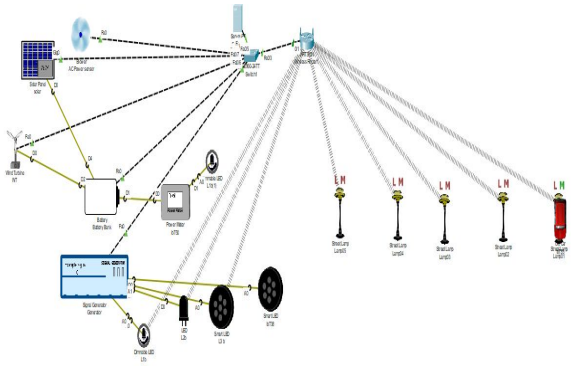


Figure 2: AC power on of home automation network

This system is four sources of the electrical system. The AC power is sensed by the blower fan [7,8]. The electricity of the AC power line is on the electrical generator off. However, solar and wind turbine is charging. The electricity power off, electrical generator on. In this situation, the solar and wind turbine sense. Solar power is an irradiation sensor that it is a sense of environment weather of packet tracer [9,10,11]. Figure 3 shows the Generator on while AC power supplies off.

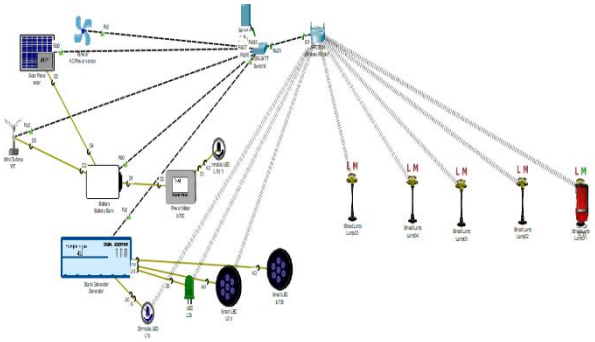


Figure 3: Generator on while AC power supply off

The registration server is setting in the condition of the home automation network. All of the devices are remote to the registration server. Figure 4 shows the Registration server at conditions.

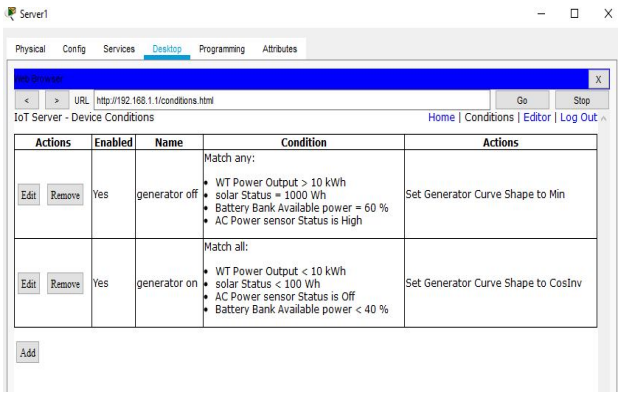


Figure 4: Registration server at conditions

This research a streetlamp that is controlled motion detect. The motion detector is sensed the objects that there is object, the streetlamp is on. There is no object, the streetlamp off. The object moves behind streetlamps, the street lamps off. Figure 5 and 6 shows the streetlamp of detect motion object and streetlamp off condition of detect motion object

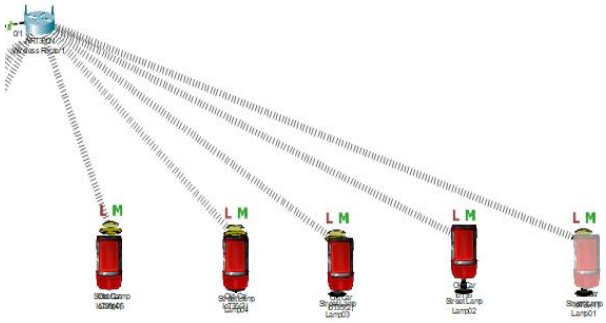


Figure 5: The streetlamp of detect motion object

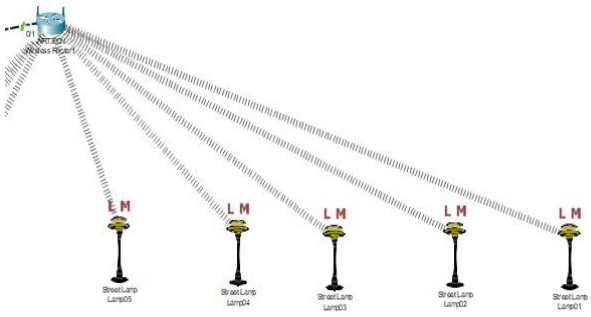


Figure 6: The streetlamp off condition of detect motion object

2.2. Fire Alarm and Sprinkler System

The fire alarm is very important at home automation stations [12,13]. This system is controlled by the smoking detector of CO2. The kitchen, living room, and bedrooms are used in the fire alarm system. If the CO2 of smoking from the kitchen or other rooms is detected, the smoking alarm and sprinkler will

be opened. Figures 7,8,9,10,11 show the fire alarm network infrastructure design, registration server setting by using DNS, registration server condition setting, registration server CO2 condition setting of alarm, and Operation of CO2 or fire detection respectively.

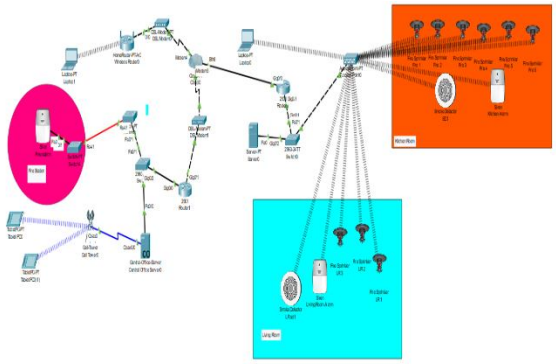


Figure 7: The fire alarm network infrastructure design

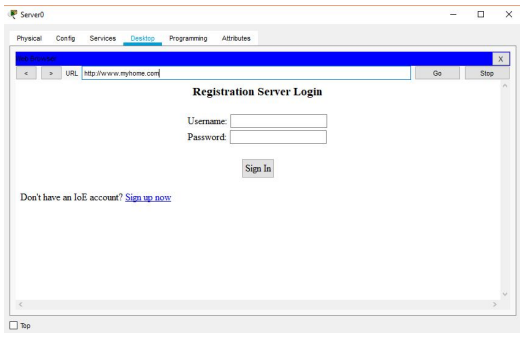


Figure 8: The registration server setting by using DNS

The registration server is used dns, webserver and registration server that it is used IoT (Internet of Thing).

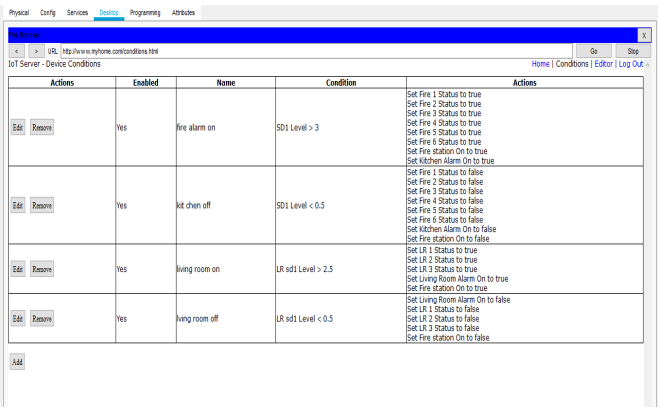


Figure 9: The registration server condition setting

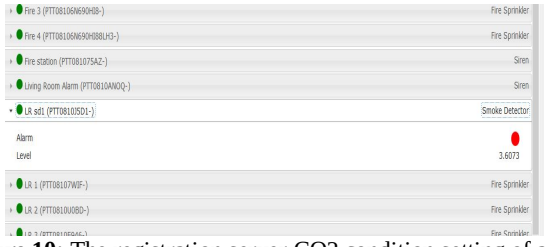


Figure 10: The registration server CO2 condition setting of alarm

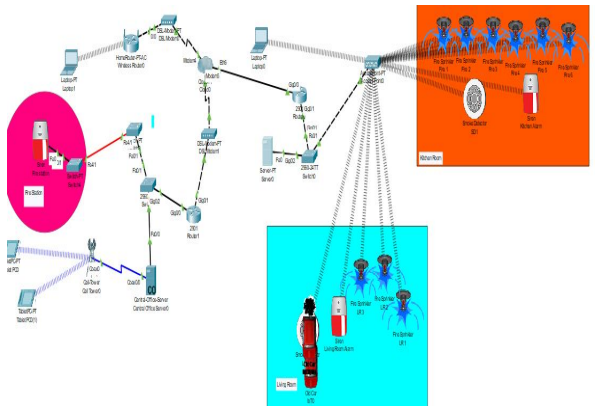


Figure 11: The Operation of CO2 or fire detection

This paper is used as a fire alarm system that it is detected CO2 or fire. If the fire or CO2 is detected, the fire alarm or sprinkle will be operated. This system is connected to the fired station via the network by using a fiber optic. If the fire or CO2 is not detected, the fire alarm or sprinkle will be stopped.

When the smoking detector in the kitchen is detected CO2 from extremely above of the cooking smoke, the fire alarm and water sprinkler is operated and then fire alarm at the fire station is alert that the fireman will know where the fire is burned. Moreover, the Living room is the same process as the kitchen.

2.3. Security System of Smart Home Automation

Figure 12 shows the smart automation systems.

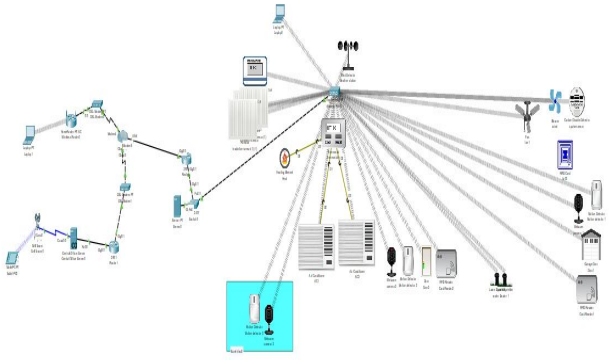
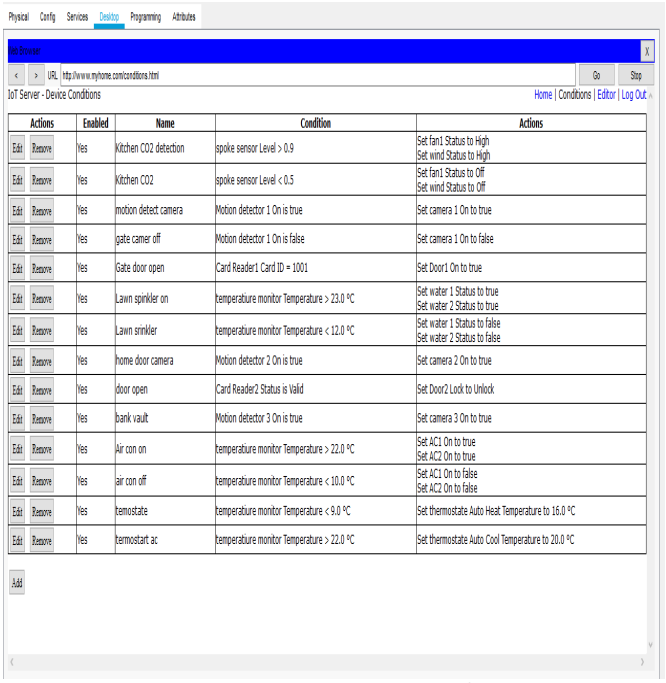


Figure 12: The smart home automation systems

There are five separates operations in smart home automation. Firstly, Gate door that it is the main gate of the home is controlled by the RFID card and motion sensor. The motion sensor that is connected to CCTV has detected motion activities. If the moving objects are be detected from the motion sensor, CCTV camera would be taken a photo of moving objects which it is captured the video another time. RFID (Radio Frequency ID) card is shown the match ID or not and then this card is identified from the storage ID system. If the corrected valid ID card detected, the gate would be

open. If no valid ID card detected, the gate is never open the gate. The second operation is the door of a home that is the same operation as the main gate system. The third operation is the money vault room. This room is prevented from thieves and other unnecessary issues. This room is installed on the motion sensor and camera. Moving everybody or every object in this room would take the photo by the system. Forth operation is the kitchen room. This room is sensed the CO2 from the cooking and another smoke. When either over the normal cook smoking or below firing smoking was detected, the fan and air blower fan are operated to release internal smoke to the outside. The fifth operation is the AirCon, Heat, and Water sprinkler of grasses field. The temperature sensor is sensing the outside weather heat. If the temperature is above 23, the water sprinkler of grasses field will be a spray of water, and all AC open. If the temperature is below 20, all AirCon is close and the water sprinkler is stopped.

The Cisco router is used with a remote server and is connected to the cloud. The office and mobile phone can be an interface to the home network or home automation service via the cloud. Figures 13,14,15,16 shows the registration sever condition of home automation, RFID controlled garage door, camera operation, and system diagram.



Actions	Enabled	Name	Condition	Actions
Edit Remove	Yes	Kitchen CO2 detection	spoke sensor Level > 0.9	Set fan1 Status to High Set wind Status to High
Edit Remove	Yes	Kitchen CO2	spoke sensor Level < 0.5	Set fan1 Status to Off Set wind Status to Off
Edit Remove	Yes	motion detect camera	Motion detector 1 On is true	Set camera 1 On to true
Edit Remove	Yes	gate camer off	Motion detector 1 On is false	Set camera 1 On to false
Edit Remove	Yes	Gate door open	Card Reader1 Card ID = 1001	Set Door1 On to true
Edit Remove	Yes	Lawn sprinkler on	temperature monitor Temperature > 23.0 °C	Set water 1 Status to true Set water 2 Status to true
Edit Remove	Yes	Lawn srinkler	temperature monitor Temperature < 12.0 °C	Set water 1 Status to false Set water 2 Status to false
Edit Remove	Yes	home door camera	Motion detector 2 On is true	Set camera 2 On to true
Edit Remove	Yes	door open	Card Reader2 Status is Valid	Set Door2 Lock to Unlock
Edit Remove	Yes	bank vault	Motion detector 3 On is true	Set camera 3 On to true
Edit Remove	Yes	Air con on	temperature monitor Temperature > 22.0 °C	Set AC1 On to true Set AC2 On to true
Edit Remove	Yes	air con off	temperature monitor Temperature < 10.0 °C	Set AC1 On to false Set AC2 On to false
Edit Remove	Yes	termostate	temperature monitor Temperature < 9.0 °C	Set thermostate Auto Heat Temperature to 16.0 °C
Edit Remove	Yes	termostart ac	temperature monitor Temperature > 22.0 °C	Set thermostate Auto Cool Temperature to 20.0 °C

Add

Figure 13: The registration severe condition of home automation

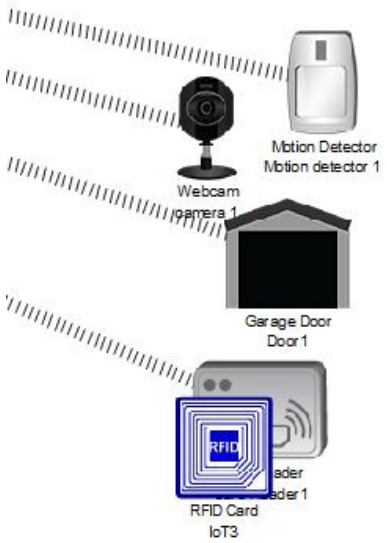


Figure 14: The RFID controlled garage door

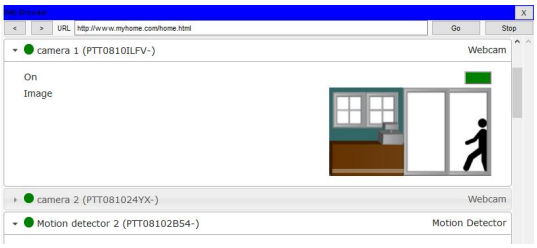


Figure 15: camera operation

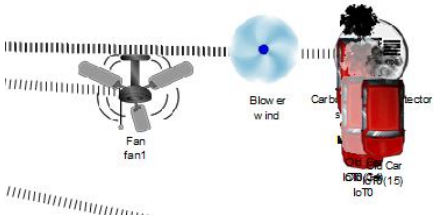


Figure 16: System diagram

The following command is the cisco command that it is DHCP (Dynamic Host Configuration Protocol) and routing Protocols. Figure 17 shows the screenshot of the code.

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with
CNTL/Z.
Router(config)#int gigabitEthernet 0/1
Router(config)#no shut
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config)#ip dhcp pool home
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#exit
Router(config)#ip dhcp excluded-address 192.168.1.1
192.168.1.20
Router(dhcp-config)#ip dhcp pool home
Router(dhcp-config)#dns-server 192.168.1.2
Router(dhcp-config)#exit
Router(config)#exit
```

```
Router>en
Router#config
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#no shut
Router(config-if)#ip address 10.10.0.1 255.0.0.0
Router(config-if)#exit
Router(config)#router rip

Router(config-router)#version 2
Router(config-router)#network 10.0.0.0
Router(config-router)#network 192.168.0.0
Router(config-router)#exit
Router(config)#exit
Router#
```

Figure 17: Screenshot of the code

3. DATA AND SIMULATION RESULT

The Data flow is set up the system of the network infrastructure of smart home automation. Firstly, the IoT devices that they are connected to the system are inquired Arp (Address Resolution Protocols) of layer 2 data links because IoT devices or network devices have differences MAC addresses. The whole over the world of network devices is not the same difference companies. Figures 18, 19,20,21,22 shows the various system setup output of this research.

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.206	--	Door2	IoT TCP
	0.496	--	Wireless Ro...	ICMP
	0.496	--	Wireless Ro...	ARP
	0.500	--	Motion detec...	TCP
	0.509	--	Door2	TCP
	0.614	--	Door1	IoT TCP
	0.851	--	Motion detec...	DHCP
	0.852	Motion detector 2	Access Point0	DHCP
	0.853	Access Point0	Switch0	DHCP
	0.854	Switch0	Router0	DHCP
	0.854	--	Access Point0	DHCP
	0.854	--	Router0	ICMP
	0.854	Switch0	Server0	DHCP
	0.854	--	Router0	ARP
	0.855	Access Point0	Weather stat...	DHCP
	0.855	Access Point0	Laptop0	DHCP
	0.855	Access Point0	temperatiure...	DHCP
	0.855	Access Point0	Motion detec...	DHCP
	0.855	Access Point0	thermostate	DHCP
	0.855	Access Point0	camera 1	DHCP
	0.855	Access Point0	camera 2	DHCP

Figure 18: The Data flow of Setup systems

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.855	Access Point0	Motion detec...	DHCP
	0.855	Access Point0	camera 3	DHCP
	0.855	Access Point0	Card Reader2	DHCP
	0.855	Access Point0	Motion detec...	DHCP
	0.855	Access Point0	Card Reader1	DHCP
	0.855	Access Point0	Door1	DHCP
	0.855	Access Point0	water 1	DHCP
	0.855	Access Point0	AC1	DHCP
	0.855	Access Point0	Door2	DHCP
	0.855	Access Point0	wind	DHCP
	0.855	Access Point0	irradiation se...	DHCP
	0.855	Access Point0	water 2	DHCP
	0.855	Access Point0	spoke sensor	DHCP
	0.855	Access Point0	irradiation se...	DHCP
	0.855	Access Point0	irradiation se...	DHCP
	0.855	Access Point0	Wireless Ro...	DHCP
	0.855	Access Point0	AC2	DHCP
	0.855	--	Wireless Ro...	ICMP
	0.855	--	Wireless Ro...	ARP
	0.855	Router0	Switch0	ARP
	0.855	Wireless Router0	Laptop1	ARP

Figure 19: The ARP flow of setup systems

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.856	Switch0	Access Point0	ARP
	0.856	Switch0	Server0	ARP
	0.857	Access Point0	Weather stat...	ARP
	0.857	Access Point0	Laptop0	ARP
	0.857	Access Point0	temperatiure...	ARP
	0.857	Access Point0	Motion detec...	ARP
	0.857	Access Point0	thermostate	ARP
	0.857	Access Point0	camera 1	ARP
	0.857	Access Point0	camera 2	ARP
	0.857	Access Point0	Motion detec...	ARP
	0.857	Access Point0	camera 3	ARP
	0.857	Access Point0	Card Reader2	ARP
	0.857	Access Point0	Motion detec...	ARP
	0.857	Access Point0	Card Reader1	ARP
	0.857	Access Point0	Door1	ARP
	0.857	Access Point0	water 1	ARP
	0.857	Access Point0	AC1	ARP
	0.857	Access Point0	Door2	ARP
	0.857	Access Point0	wind	ARP
	0.857	Access Point0	irradiation se...	ARP
	0.857	Access Point0	water 2	ARP

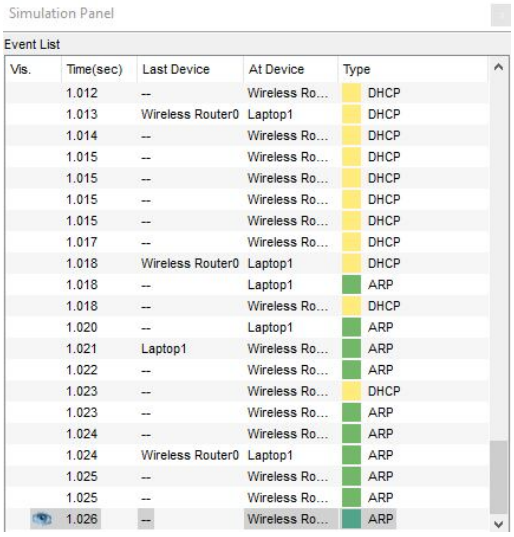
Figure 20: The ARP flows of setup systems

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.857	Access Point0	spoke sensor	ARP
	0.857	Access Point0	irradiation se...	ARP
	0.857	Access Point0	irradiation se...	ARP
	0.857	Access Point0	Wireless Ro...	ARP
	0.857	Access Point0	AC2	ARP
	0.858	--	Wireless Ro...	ARP
	0.859	--	Wireless Ro...	ARP
	0.860	--	Wireless Ro...	ARP
	0.860	--	Wireless Ro...	ARP
	0.861	--	Wireless Ro...	ARP
	0.861	--	Wireless Ro...	DHCP
	0.861	Wireless Router0	Laptop1	DHCP
	0.862	--	Wireless Ro...	ARP
	0.863	--	Wireless Ro...	DHCP
	0.863	--	Wireless Ro...	DHCP
	0.864	--	Wireless Ro...	DHCP
	0.864	--	Wireless Ro...	DHCP
	0.867	--	Wireless Ro...	ARP
	0.868	Wireless Router0	Laptop1	ARP
	0.869	--	Wireless Ro...	ARP
	0.869	--	Wireless Ro...	ARP

Figure 21: The ARP flows of setup systems


Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	1.012	--	Wireless Ro...	DHCP
	1.013	Wireless Router0	Laptop1	DHCP
	1.014	--	Wireless Ro...	DHCP
	1.015	--	Wireless Ro...	DHCP
	1.015	--	Wireless Ro...	DHCP
	1.015	--	Wireless Ro...	DHCP
	1.015	--	Wireless Ro...	DHCP
	1.017	--	Wireless Ro...	DHCP
	1.018	Wireless Router0	Laptop1	DHCP
	1.018	--	Laptop1	ARP
	1.018	--	Wireless Ro...	DHCP
	1.020	--	Laptop1	ARP
	1.021	Laptop1	Wireless Ro...	ARP
	1.022	--	Wireless Ro...	ARP
	1.023	--	Wireless Ro...	DHCP
	1.023	--	Wireless Ro...	ARP
	1.024	--	Wireless Ro...	ARP
	1.024	Wireless Router0	Laptop1	ARP
	1.025	--	Wireless Ro...	ARP
	1.025	--	Wireless Ro...	ARP
	1.026	--	Wireless Ro...	ARP

Figure 22: The ARP and DHCP of setup systems

4. CONCLUSION

This paper is used Cisco routing and switching technology. And then, the system can be controlled from the owner's office or any mobile network via mobile network or fiber optic communication.

The author's design tested with a real connection to install smart home devices and the registration that can get security and authentication process was including. The author's design can exam the wired and wireless network. When the wireless connection, the costs of wire will reduce, and some devices will obtain flexible by moving one place to another easily.

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