**IOT Smart Home Design in Packet Tracer**

Introduction

The aim of this task was to design and build an Internet of Things network based in Cisco Packet Tracer. This network would comprise of a minimum of and ISP called SHU-LTD a modem to the ISP and connected to the modem a home router system, this setup would then be connected to a range of IoT devices including but not limited to lamps, power meters solar panels and smoke detectors. All of the IoT devices would be connected to and registered on a central server that would be accessible and controlled by a tablet connected to the network wirelessly.

Methodology

This design was initially built from the ISP connected to a modem which was then connected to the home router. The home router was connected to the control tablet via a wireless connection. Using a physical connection was a cisco 2960 switch and connected to the switch a light with a motion detector. This system was built into the setup for initial connecting to the IoT service.

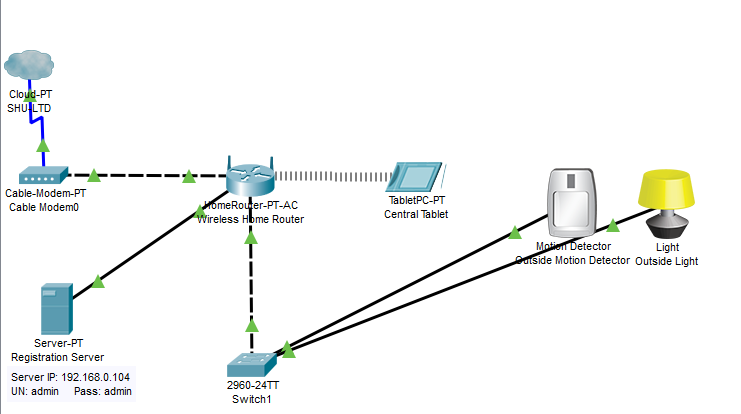


Fig.1 shows the initial placement of the ISP, Modem Home router, Tablet, server, switch, light motion sensor.

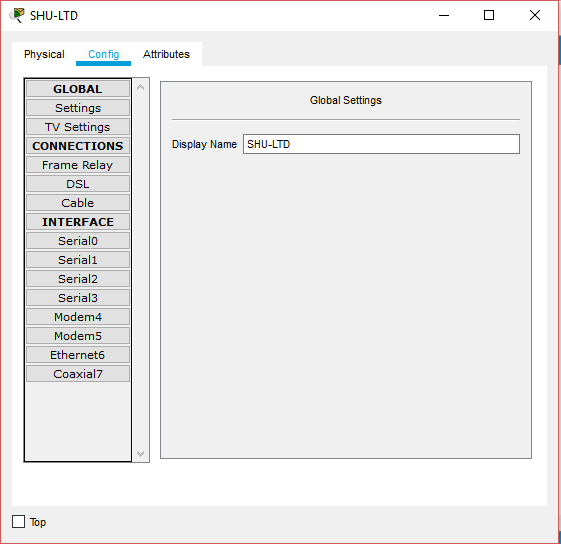


Fig.2 shows the global settings tab for the Cloud-PT.

The first thing to be placed down in this initial setup was the Cloud-PT WAN emulator acting as an ISP which was renamed to SHU-LTD (Fig.2).

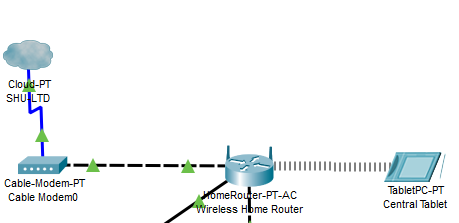


Fig.3 showing the Cloud-PT (ISP) connected to the modem then the modem connected to the home router.

The SHU-LTD ISP was then connected to the modem. The modem configuration was left untouched. After the modem was connected to the home router the home router’s configuration was also left untouched for now (Fig.3).

Connected to the home router system was a server tower and a cisco 2960 switch this switch was designed to maximise the amount of ethernet ports available in the system. Connected to the home router via a wireless connection was the control tablet (Fig.1). The first thing that was setup was the server tower to act as a registration server for the IoT devices on the network and also to provide some of the basic rules for the server (Fig.4, 5, 6)

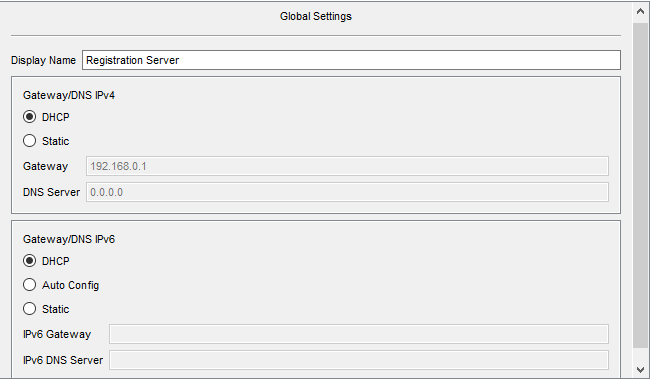


Fig.4 showing the initial setup of the server tower’s global settings. The display name was changed to Registration server and the IPv4 and IPv6 gateway/DNS settings were set to DHCP.

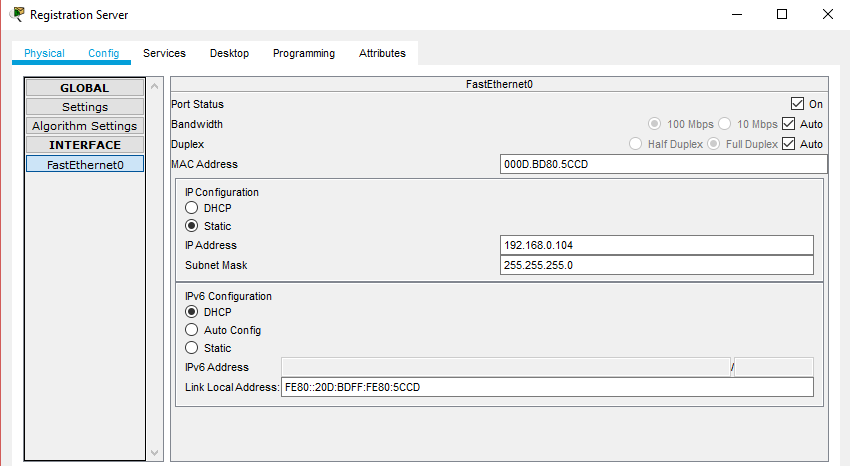


Fig.5 showing the setup of the Fast ethernet port of the server tower ipv4 was set to static and given an IP address and Subnet mask whereas IPv6 was set to DHCP setting to get what it needed from the home router.

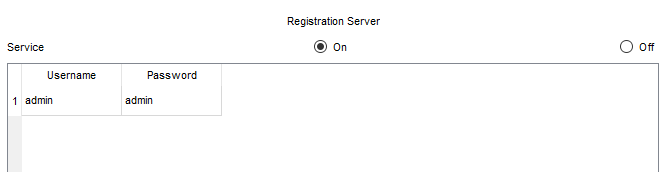


Fig.6 showing the setup for the IoT services page with the Registration server set to on and a basic login system implemented to get the system off the ground.

With the initial setup of the server complete the next thing to do was to connect the light and the motion sensor all of the fast ethernet ports for these devices were connected to the switch with the DHCP setup selected for both IPv4 and 6. The motion sensor and the light work on the idea of an outside light such that when the motion sensor is tripped the light will come on and when the sensor is no longer being tripped the light would go off again. These rules were quickly implemented and tested (Fig.7, 8, 9, 10, 11).

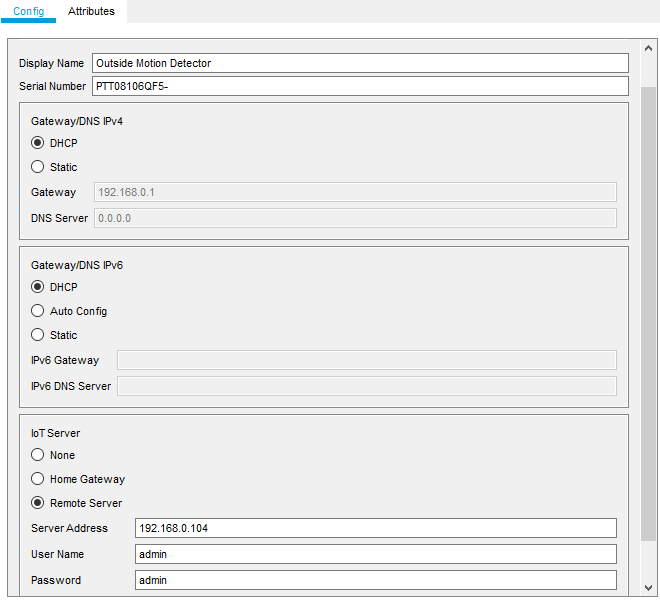


Fig.7 showing the global settings for the outside motion detector detailing its IPv4/6 gateway and DNS settings and the IoT server settings.

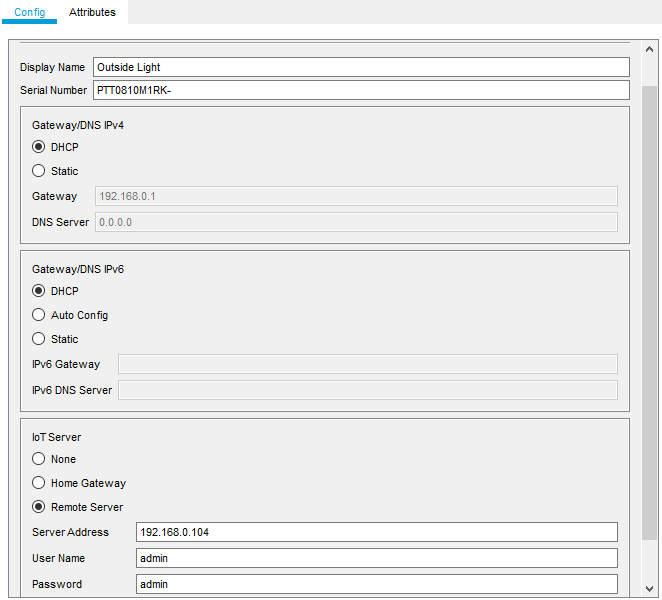


Fig.8 showing the global settings for the outside light detailing its IPv4/6 gateway and DNS settings and the IoT server settings.

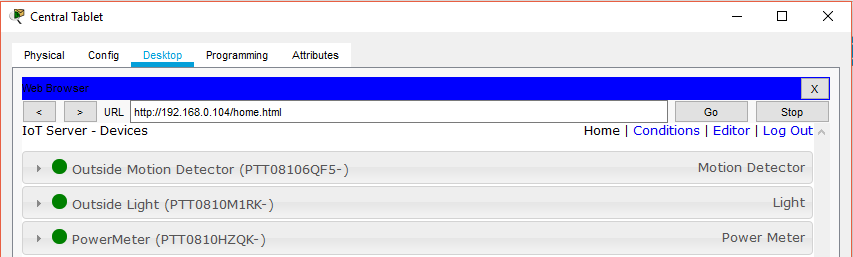


Fig.9 a screenshot from the central tablet’s web browser after logging into the Registration server’s webservice this page shows all of the connected devices.

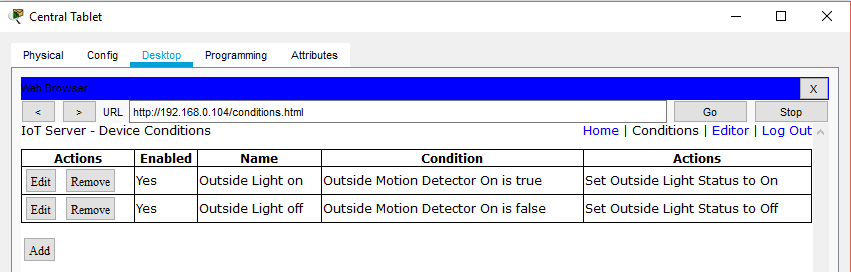


Fig.10 showing the rules for the outside motion detector and the outside light.

Having initially placed the basics for the home IoT solution the setup for the rest of the IoT devices could begin to be placed. This started with the addition of an IoT door that could be locked, unlocked and its status monitored from the tablet (Fig.11).

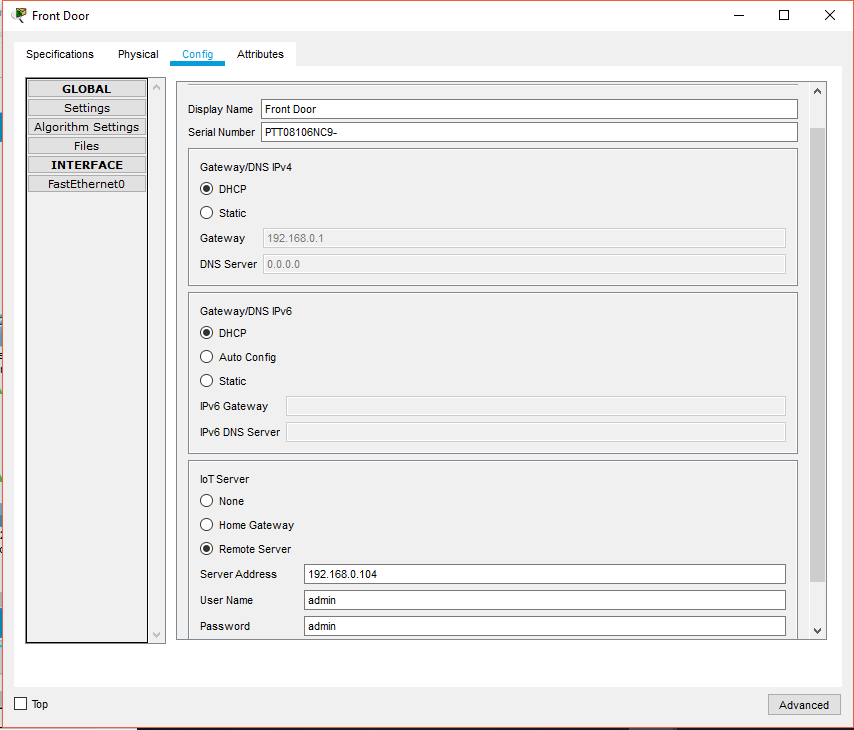


Fig.11 showing the global settings setup for the Front door

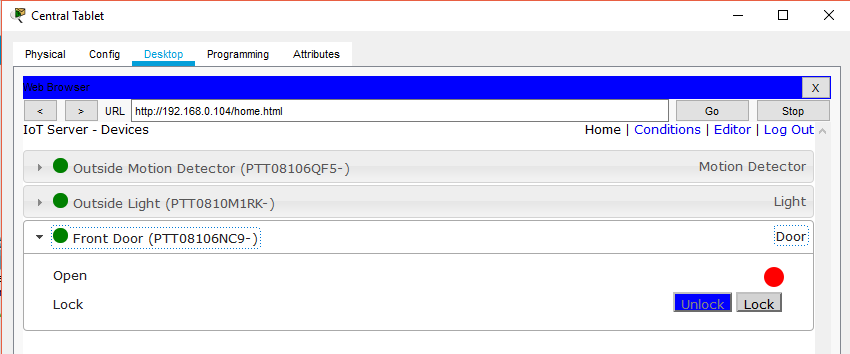


Fig.12 showing the tablets view of the doors status and the ability to lock and unlock the door.

Following the addition of the IoT door the addition of a thermostat with air conditioning and a furnace. With the addition of this system both CO2 and CO detectors were added (Fig.13).

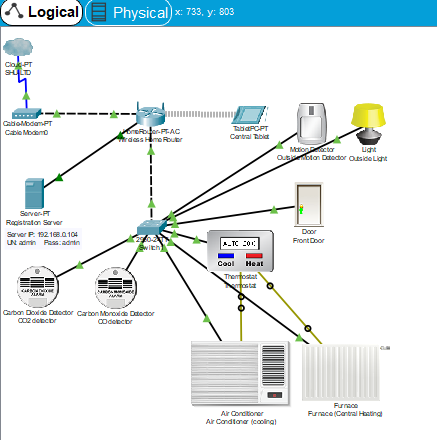


Fig.13 the current layout of the network showing the addition of the CO2 and CO alarms along with the thermostat, AC and Furnace. The thermal regulation system is interconnected by the custom IoT cables in Cisco Packet tracer.

The thermal regulation system comprising of the thermostat, furnace and air conditioning units is both interconnected and connected up to the registration server. This system is connected up in this way in order for it to work both autonomously and manually if needed connecting everything up in this way also allows for better monitoring and control of the thermal regulation system (Fig.14, 15).

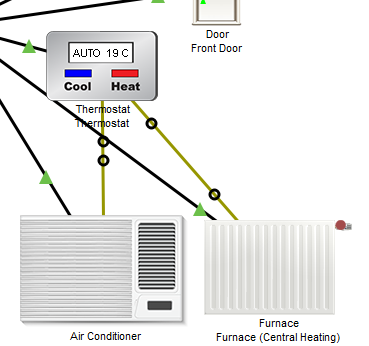


Fig.14 shows the cabling setup for the thermal regulation system each of the three devices is connected to the Cisco 2960 switch via their fast ethernet ports and the D0 port of the air conditioner is connected to the D2 port of the thermostat and the D0 port of the furnace is connected to the D1 port of the thermostat.

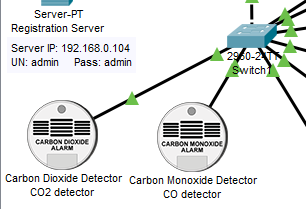


Fig.15 shows the CO2 and CO detectors connected to the Cisco 2960 switch both of these detectors can be managed and monitored by the central tablet.

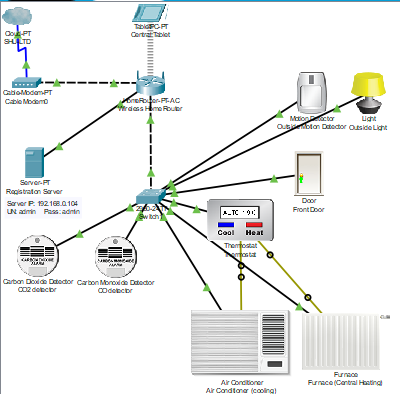


Fig.16 shows the current setup of the network and its current components and layout.

Following the addition of the thermal system and the CO and CO2 alarms a way of venting the house in the event of a serious incident a window was added to the system to simulate a venting system in the house this was attached to the alarms via the registration server so that in the event that one of the detectors alarms was set off then the venting system would be engaged allowing the harmful gasses to be dispersed out of the property.

Conclusions

To conclude this home Internet of Things solution contains a home router connected to a modem that is connected to the SHU-LTD ISP. The home router is also connected to a control tablet via a wireless connection and has a wired connection to a registration server and a Cisco 2960 switch. The 2960 switch is unmanaged and is connected to an IoT door that’s lock can be controlled by the tablet and its open and close status can also be monitored. A motion sensor and a light that acts as an outdoor lighting system but can also be used throughout the house to light rooms when there is an occupant. CO2 and CO alarms connected to the registration server and to the house’s windows can alert the house’s occupants to dangerous levels of these gases but also if triggered the alarms open the house’s windows as a safety measure to vent these gases and reduce the level to stop them being toxic. A thermostat system using a thermostat, a furnace and an air conditioning unit that are interconnected using custom IoT cabling adds an automated temperature regulation system this system also connected to the registration server allows the user to interact with the system from the control tablet changing the settings on the thermostat and also manually activating and deactivating the furnace and air-conditioning unit. This system can be left alone but can also have user interaction and monitoring.