VIET NAM NATIONAL UNIVERSITY HO CHI MINH CITY
HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY
FACULTY OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER NETWORKS

Assignment report

Network Design

Instructor: Nguyen Phuong Duy

HO CHI MINH CITY, DECEMBER 2022

Contents

List of Figures

List of Tables

Member list & Workload

No.	Full name	Student ID	Percentage of work
1	Duong Ngoc Quang Huy	2052489	100%
2	Nguyen Nam Kha	2052515	100%
3	Nguyen Ngoc Hoa	2052485	100%
4	Chau Nguyen An Khang	1952757	100%

SUMMARY

In the scope of this project, we are going to describe the network design for the **H6** building,locating in the campus 2 of **HCMC University of Technology**. In order to build a user friendly, up-to-date and energy efficient University, there is a need for a network to be delivered with management over the overall conditions of the building such as temperature, humidity and light in the classroom in order to reduce the cost for energy. The student studying computer networks courses is offered to bring out the solution design for the building in this project . Based on this design, people can implement the construction and network infrastructure of the building. In order to persuade the investor to choose our solutions, we need to run analysis on the data in order to test and demonstrate the reasonableness of the solutions, specifically:

- The architecture of the building network and its IP settings.
- Based on this architecture, we can calculate the division of subnets for each target device or divide by department.
- The required capacity so that the network can work effectively.
- The system of Router, Switches and the estimated cost of the whole network.
- The reliability and speed of the internet connection.

1 INTRODUCTION

1.1 BACKGROUND

Climate change and other environmental problems has been a concern of the world for recent years. Due to these problems, the HCMC University of Technology has decided to reconstruct the campus into a more energy-efficient and environment-friendly campus. In order to fulfill this target, there is a need for a new system to monitor over the student activity as well as the building resources and implementing measurement devices such as temperature, humidity or light sensors in order to manage and reduce energy consumption if possible.

To start the development process, HCMUT has decided to rebuild and redesign the network for the **H6** building of campus 2. Since the network which is currently operating in the building does not include the measurement devices that we have mentioned above, a completely new design for the network need to be worked from scratch. Therefore, groups of students working in the Computer Network course have been invited to make some new designs for the solutions with minimum cost.

1.2 OBJECTIVES

The result product need to be satisfied some requirements in order to be chose and implemented, which are:

- In campus 2, the H6 building will implement a system of surveillance cameras at some point and the camera's data will be stored centrally in server room 106 H6. There are also computer rooms on floors 6 and 7.
- Every classroom in the building H6 IoT devices include: 6 temperature sensors, 6 light sensors for large theory rooms (an area larger than 60 m2), the light control equipment; 3 temperature sensors, 3 light sensors for the remaining rooms (the smaller area of 60m2), light control equipment. Each operating spread on each floor will be fitted with 4 surveillance cameras.
- The classrooms will be equipped with desktop computers. In practice, the computer room will be fitted with air conditioner equipment control. The measurement device will collect data continuously every 1 minute in real-time and send it to the processing server every 5 minutes.
- Data Description: a sensor will measure a different index but their data format size would be a constant of 32 Kb. These sensors will collect data once ever 1 minute and send the data to the network once every 5 minutes. The surveillance cameras will run 24/7 and store the data directly into the central server with a rate of 100Mbps. The computers in the classrooms will download about 200MB per day (peak hours are from 7:00AM to 5:30PM). Each device when connected to the WIFI network is used with 256 Kbps maximum speed in terms of time 7:00AM to 5:30PM.
- Also, building H6 has an administrative office with 10 computers. The computers download about 200MB per day (peak hours are 8:00 am to 11:40 pm, 13h to 16h30) and send 10 emails per day with a maximum capacity of 10 MB per email.

- Each floor devices will locate in separate VLANs and the system can connect to H6.

2 THE RESEARCH PROBLEM

In this section, we are going to analyze through the requirements and identify some problems can appear during the development process:

- First requirement: This requirement only tells us the existance of the surveillance cameras but not specify its operations or capacity. Thus, we only need to concentrate which is the camera's data. Those data is said to be stored in the central server, which is located in the 106 H6, implying that the cameras IP address can be access by the server room in floor 1 so that the record can be fetched and stored in the system.
- Second requirement: this requirement specify the number and type of the sensors which are going to be implemented in the building. However, the requirement does not clearly explain how it is going to be connected or how they work with the control system. This requirement also give us the quantity of surveillance cameras included in each floor, which also need implementation for network path.
- Third requirement: This requirement tell us the frequent of the data collected from the measurement devices so that the system can manage the resource of the classrooms, also imply that the measurement and control devices need connections to the server to operate.
- Fourth requirement: this requirement provide some minor detail about the data format size. From there, we can see that the sensors need to connect to the wireless connection. For the surveillance cameras, wired-connection is required because of the significantly higher data transfer rate. The computers in the computer rooms will be limited to 200MB of data downloaded per day during peak hours. Other wireless devices will only be connect to the internet with maximum speed of 256 Kbps, which is the same as the sensors.
- Fifth requirement: the fifth requirement gives us the information about the administrative office with capacity of 10 computers. The computer will have the same download data size to the normal computers and can send at most 10 emails per day.
- Six requirement: This requires us to configure the VLAN separately for each floor groups of devices.

3 PROJECT ACTIVITIES

3.1 NETWORK COMPONENTS DESIGN

- Since the cameras only transfer the data to the server rooms and can only accessed by the administrators or users in the server room. Therefore, the network design must separate the VLAN between normal computers, devices with cameras, and admin devices, server room.

- There will be 6 computer rooms on floor 6 and 7, which have 32 computers each.
- The camera will be located in the corridors of each floor.
- The Administrative office will consists of 10 computers.
- Each room will be 3m high.
- Maximum port when connecting to the switch is 1 GB.
- Floors 2 to 5 will only contain a normal room with 6 small rooms (Height: 3m, Width: 10m, Depth: 5m), 3 large rooms (Height: 3m, Width: 20m, Depth: 5m). Floor 1 besides two types of rooms above will have 1 server room (Height: 3m, Width: 10m, Depth: 5m).
- Floors 6 and 7 will have 4 small rooms (Height: 3m, Width: 10m, Depth: 5m), 2 large rooms (Height: 3m, Width: 20m, Depth: 5m), 3 computer room (Height: 3m, Width: 20m, Depth: 5m).
- Each room will have an access point for devices to connect to the internet through a wireless connection.
- Each floor will have a switch for the camera and an access point from each room to connect.
- Each switch from each floor then will connect to the main switch on floor 1.
- The main switch then will connect to the final router before going out to the network.
- Each camera will have a data transfer rate of 1 Mbps.
- Each computer in the server room will have a data transfer rate of 10 Mbps (to prevent the bandwidth to balance the network even though those computers connect to the same switch at the server and may have data transfer rate at 100 Mbps)

3.2 LOGICAL DIAGRAM

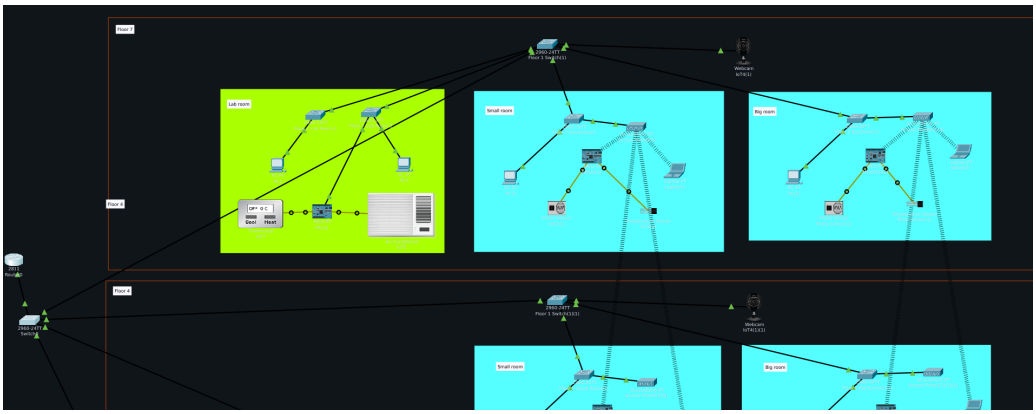

Figure 1: Logical Diagram - 1

This diagram describe the 6-7 floor general design with big rooms, small rooms and lab rooms. In the big rooms and small rooms, there is a normal computer, access point for wireless connection and sensors to monitor the light conditions. On the lab room, there is no dedicated access point or light sensors, however there is a thermometer to observe the temperature and control the air conditioners. Each floor also have some cameras to observer the floor and send data to the server.

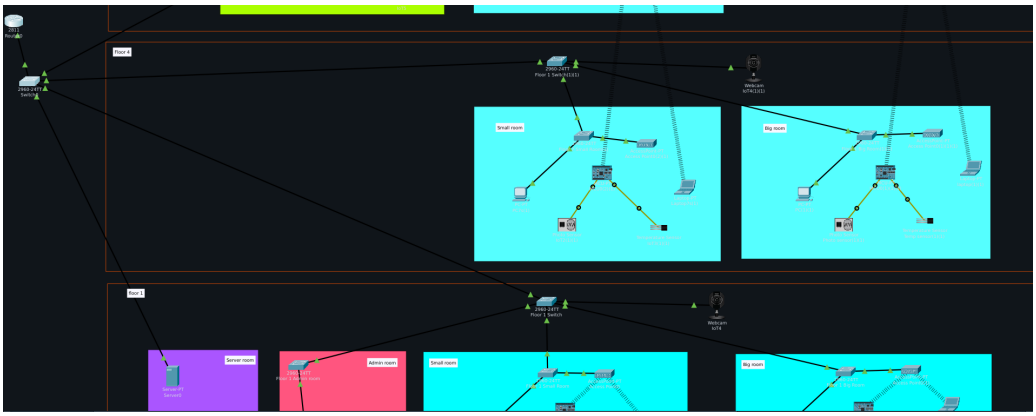

Figure 2: Logical Diagram - 2

On this diagram, the design of a normal floor (floor from 2-5) is described. On these floors only include big rooms and small rooms but no lab room, unlike floor 6-7. The network components of these rooms are similar to those on the above floors.

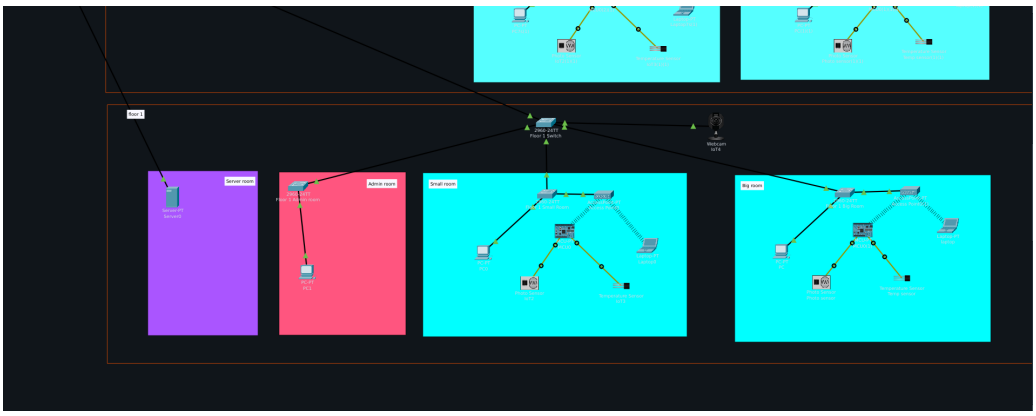

Figure 3: Logical Diagram - 3

This diagram describe the network design of floor 1. This floor design is quite similar to the normal room in general with the addition of the server room and the administrative office. In the server rooms is multiple server computer running to collect and store the data sent by surveillance cameras and measurement devices on other floors. In the administrative office, there are several admin computers with control access over the measurement devices on other floor to control the building energy consumption.

4 PROJECT OUTCOME

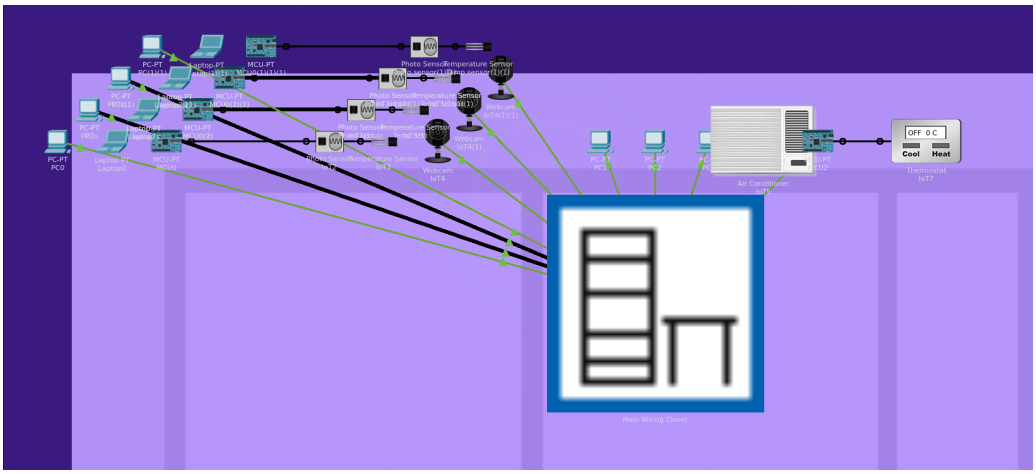

Figure 4: Physical View - Small and big floor general Design

4.1 ADVANTAGES

- The measurement data of the building get update frequently, so that the energy consumption is optimized
- The system cost per performance is optimized which cost less for maximum energy efficiency.
- The system administrators can have management over the building resources and condition.

4.2 DISADVANTAGES

- The system still remains some security risks to be fixed later.

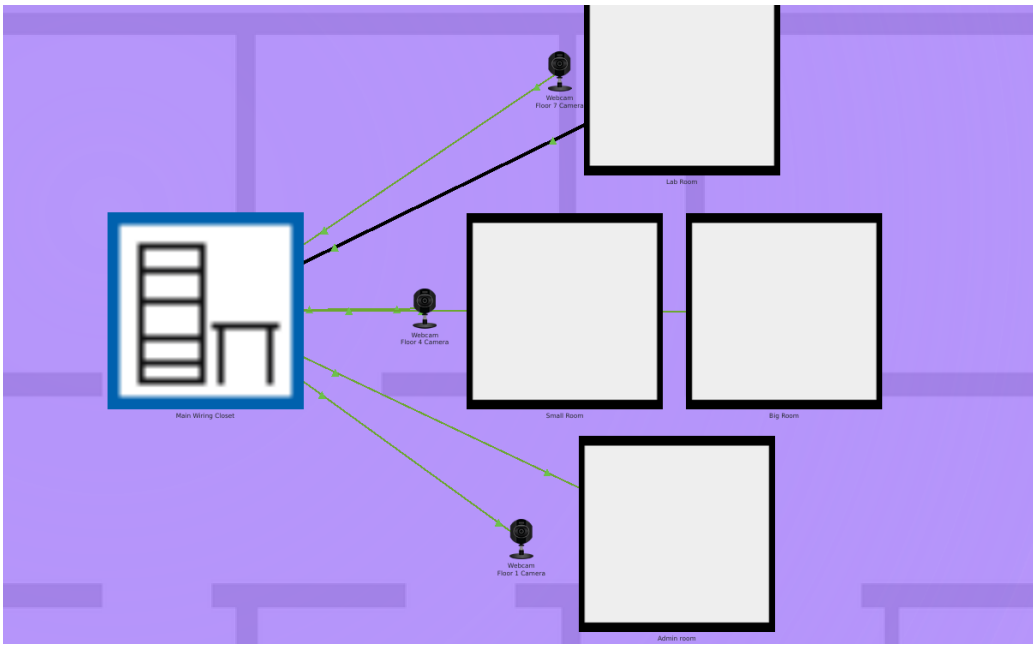

Figure 5: Physical View - Building general Design

References

[1] Keith W. Ross James F. Kurose, editor. *Computer Networking, A Top-Down Approach*. Pearson, 8th edition.

APPENDIX

ABBREVIATION AND ACRONYMS

—END—