Project (Group)

SECR1213 NETWORK COMMUNICATIONS

SEMESTER I, SESSION 2020/2021

Title: Network Design for School of Computing Block N28B by KTWY

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ABSTRACT

In this project, our team was asked to design our own floor plan of new 2-storey building – N28B for School of Computing with actual scale. Hence, we planned to design a ground floor consists of IOT lab, Network lab, General Purpose lab, Computer security lab, server room, electricity room and toilets. For the first floor, there were video conferencing room, lecturer office, lobby and toilets. Our building was designed in butterfly shape. We also did a preliminary analysis on current and future requirements and devices to be used. This portion was done through researching and meetings. After that, we determined the feasibility of the project such as technical feasibility, economic feasibility and legal feasibility. Not only that, we also chose the appropriate LAN devices by referring to the information that we found from internet. Then, we identified the work area on our floor plan and determined the number of connections, patch cords and switch ports that we need. We also identified the cable types and length. We decided to use CAT6 cable to connect the router, switch, PC and access point. At the end, we are also required to develop an addressing scheme that every host can connect to the network without conflict of addresses. We did the subnetting and IP assignation to each lab and room.

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Introduction

This project was aimed to help School of Computing to build local area network (LAN) for the new 2 storey building. The new building will consist of 4 labs which is 1 general purpose lab, 1 computer security lab, 1 network lab, and 1 IOT lab, 2 video conferencing rooms, 8 lecturer rooms. Each lab will have the ability to accommodate at least 30 PC with one multi-terabyte server for the lab.

The scope of this project is to provide a system that is easy to manage and to be scaled. This project will also improve overall performance of the building in the aspect of Internet of Thing by providing protection from network breaches such as e-business application attack, denial-of-service and Internet Worms. The system proposed will also be capable to support high-performance to the core backbone and other features such as security in hardware via access control lists (ACLs) and Quality of Service. The system proposed in this project will also enable secure VPN connection from remote locations. Moreover, this project will design the floor plan of the building and implement the appropriate network devices for the building by investigating required knowledge and paper for the design process. The calculation of the connection between network devices such as length of wired connection will be also included to ensure the network connection in the building is feasible.

The objective of this project is to provide better equipment for the grow of School of Computing by ensuring the services provided is cutting-edge technology and won't be out-of-date for the next 20 years. The system will be cost effective and 'ready for anything' and provide network that is secured, efficient, reliable and at the meantime, easily to be managed. The system will also prepare the lab to be in line with 4th IR (4th Industrial Revolution) education and ensure the network designed is scalable for future growth and ensure wireless connectivity for the future.
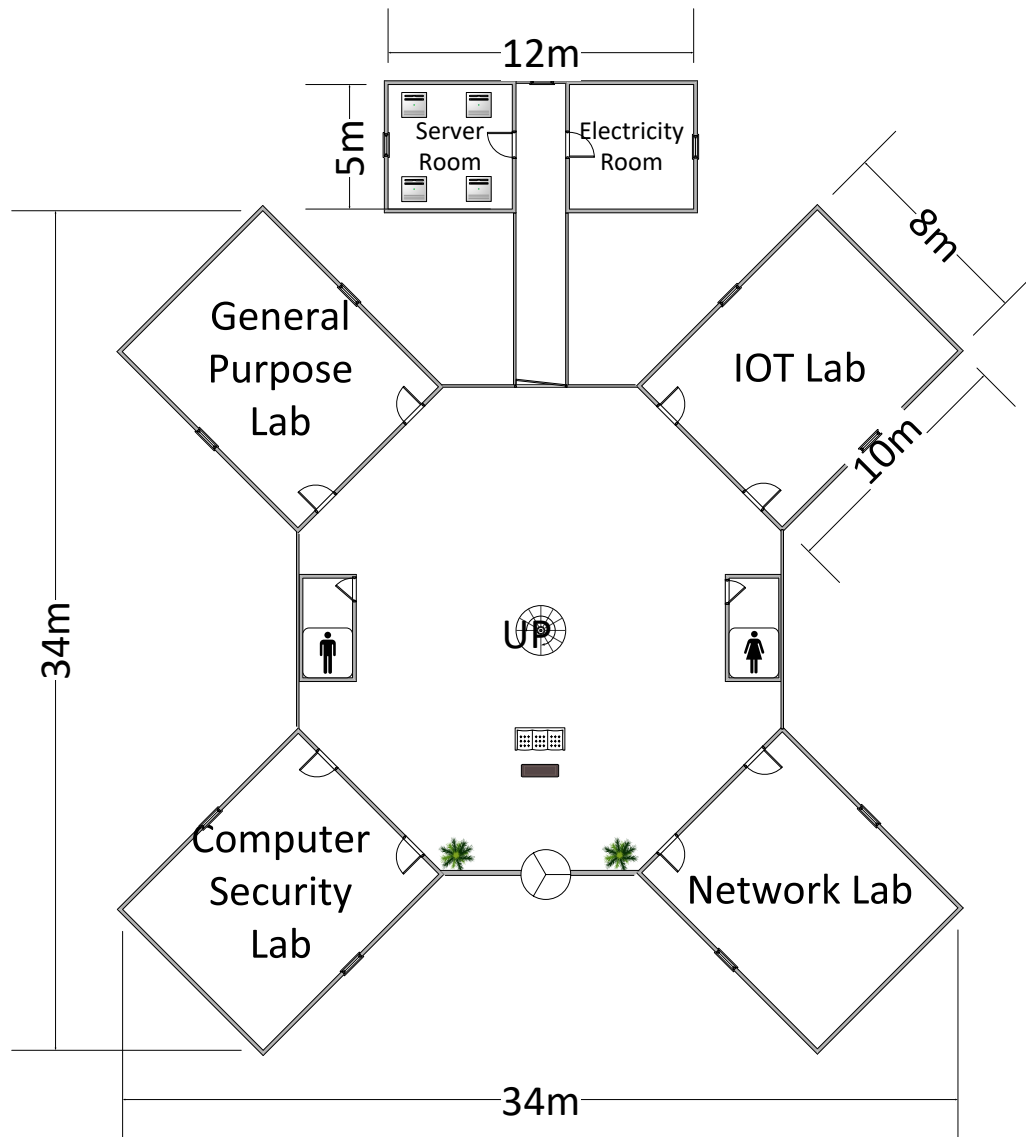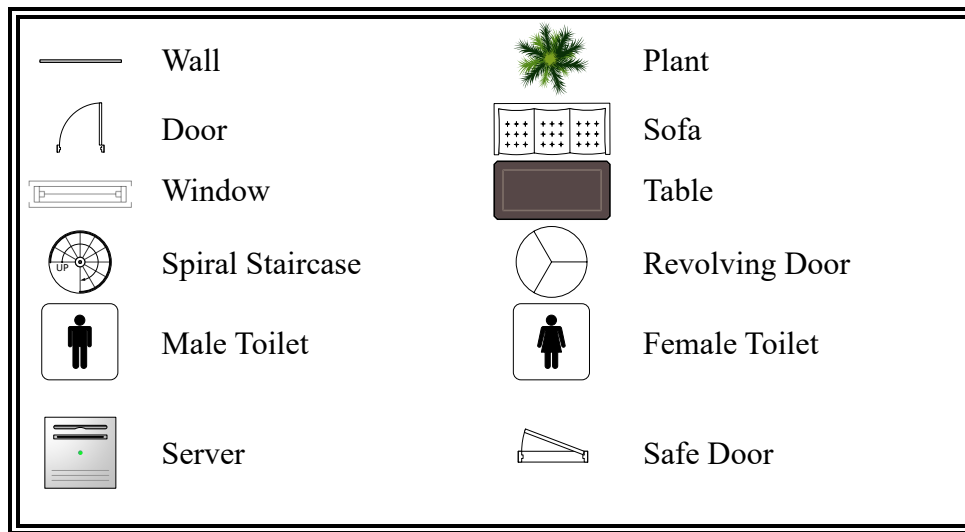
Project Background and an Overview

The School of Computing is currently planning for a new 2 storey building that is capable to accommodate the quantity of personnel to overcome the growth of 10% more than current 1200 students which from both undergraduate and postgraduate, 97 academic staffs and 35 supporting staffs in next 3 years. The building will consist of 4 labs which is 1 general purpose lab, 1 computer security lab, 1network lab, 1 IOT lab which each lab is equivalent in size to current Digital Logic Lab and must be prepared for 4th IR (4th Industrial Revolution) education with high-speed internet connection. Each of the lab will also be able to accommodate 30 PC and 1 multi-terabyte server. The building will also have a vision of 'ready for anything' and able to provide network that is secured, efficient, reliable and at the meantime, easily to be managed.
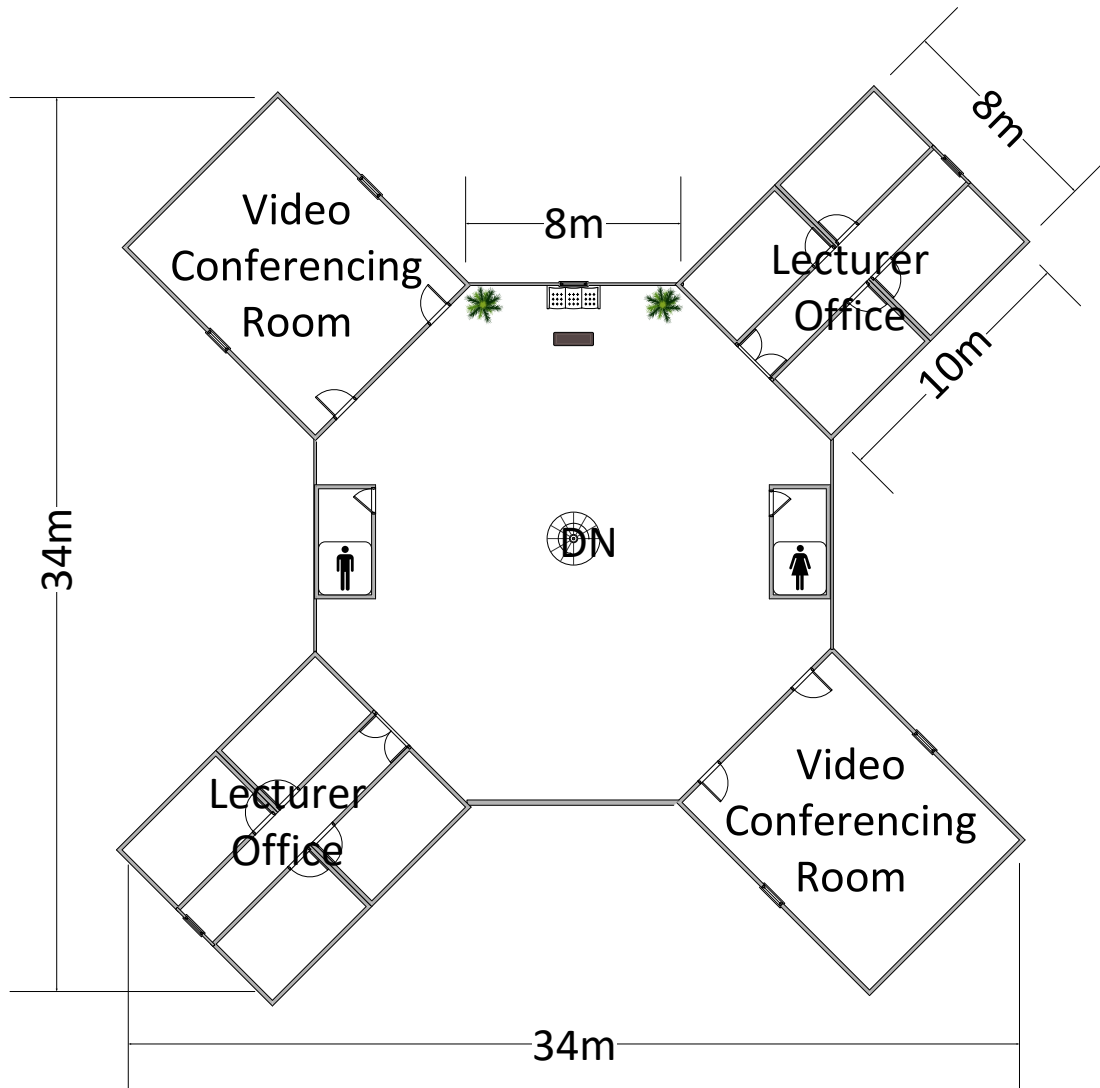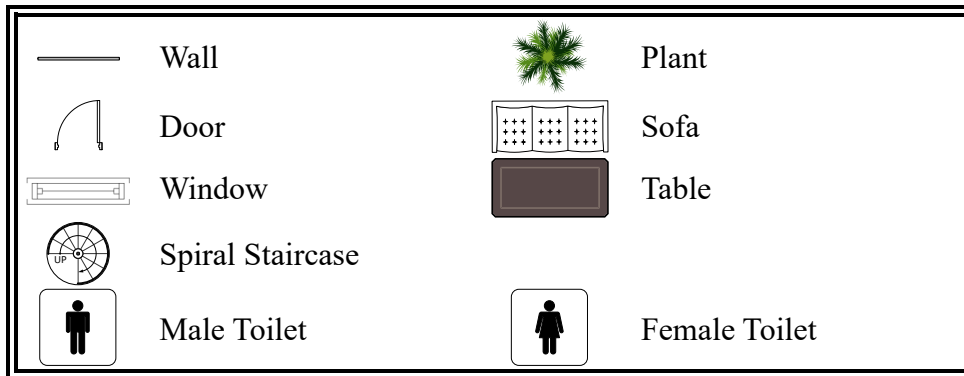
Another essential for the designed network system is it should be cost efficient while providing the highest performance, the equipment purchased, and the technology used must be wisely chosen to achieve highest possible benefit with lowest cost. During the transition to the School of Computing toward the future, it is also important that the access is still provided to their user during this transition from old equipment to new equipment so the tasks on going by the user will not be interrupted. The new building is expected to have cutting-edge technology that is capable to withstand the grow of technology for the future 20 years. The designing process should also take consideration of future issues which is wireless connectivity that cover the whole building and scalable network for future growth as in future, wireless connection might play a big role in network connection. In sum, the essential element that need to be taken consideration in the designed system is easy to be managed and scaled, high performance and high security measures.

Task 1:   Project Setup – Floor Plan

Ground Floor

——	Wall	🌴	Plant
Door	Door	▦	Sofa
Window	Window	▬	Table
Spiral Staircase	Spiral Staircase	Revolving Door	Revolving Door
Male Toilet	Male Toilet	Female Toilet	Female Toilet
Server	Server	Safe Door	Safe Door

12m

5m

Server Room

Electricity Room

8m

General Purpose Lab

IOT Lab

10m

34m

UP

Computer Security Lab

Network Lab

34m

First Floor

Legend:
- Wall
- Door
- Window
- Spiral Staircase
- Male Toilet
- Plant
- Sofa
- Table
- Female Toilet

Video Conferencing Room

Lecturer Office

Lecturer Office

Video Conferencing Room

DN

8m

8m

10m

34m

34m
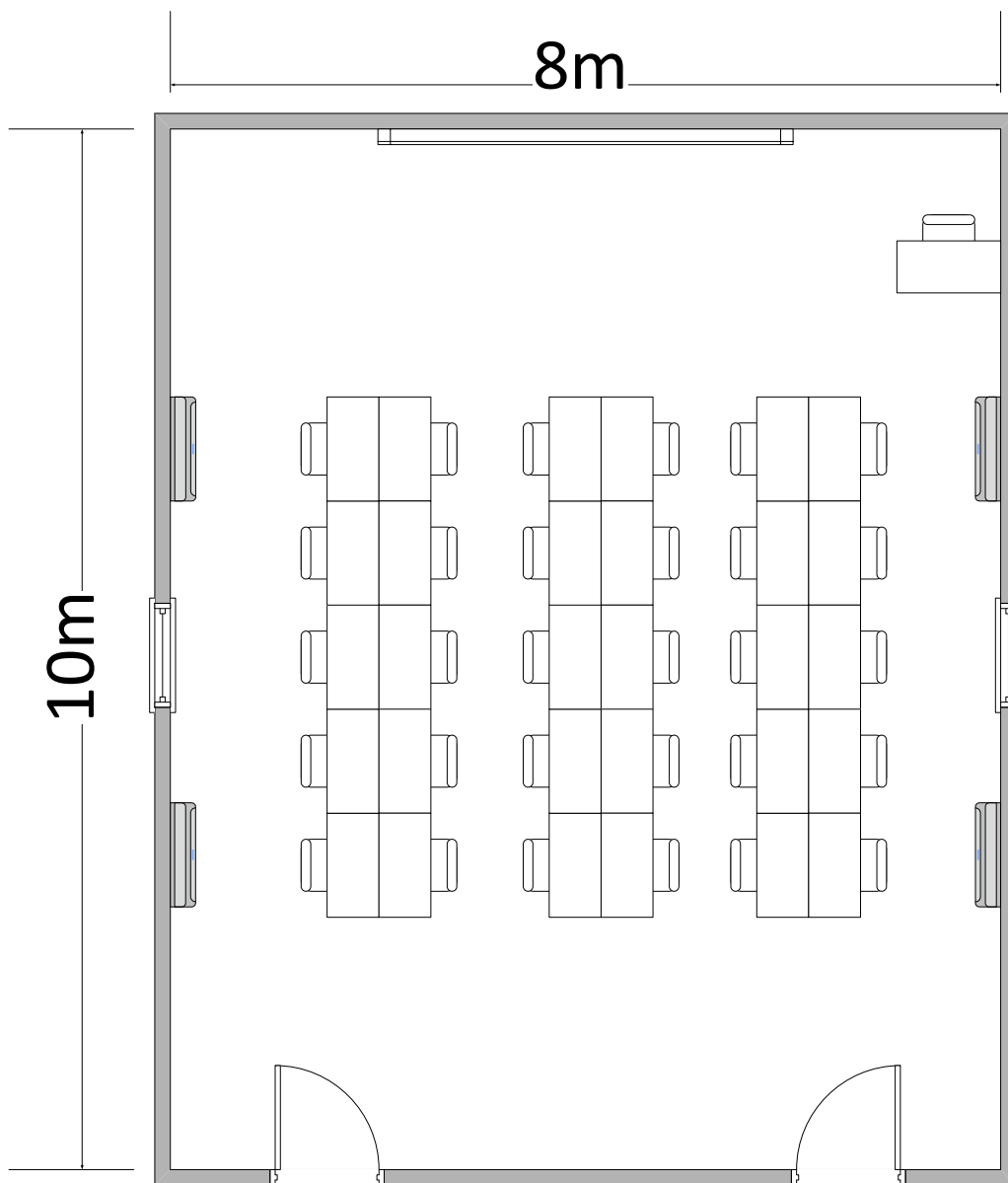
Lab

(1 General Purpose lab, 1 Computer Security lab, 1 Network lab and 1 IOT lab)

——	Wall	Air-conditioner	Air-conditioner
	Door	——	Projection Screen
	Window		Server
	Workstation		Desk

8m

10m

Video Conferencing Room

―――	Wall	[air-conditioner icon]	Air-conditioner
[door icon]	Door	[screen icon]	Projection Screen
[window icon]	Window	[plant icon]	Plant
		[table icon]	Multi-chair Boat Shape Table

8m

10m

Task 2:   Initial Design - Preliminary Analysis

Questions and Answers Regarding Network Plan

1. What are the devices that need to be set up for a LAN and its usage?

Answer:

Before starting to design the layout of network communication, devices that need to be bought and installed are needed to be identified first. There are a few devices that are essential to build a LAN for an academic building usage which are routers, switches, access points and network cable (B.Steele, 2019). Below are the functions of the devices mentioned:

Router- A most vital device in creating a LAN. A router is a device that connects the LAN to the ISP or WAN. A package that flying forth and back on the web of the network are travelling through the router. Without a router, the data cannot be sent out or receive into LAN from the outside network. Usually, a router has a forwarding table that has the destination address to determine the destination of the package and transmit it into the respective outbound link (Margaret Rouse, 2016).

Switches- A device that has many ports on it for other devices to plug into. When the data frame arrives at it, a switch will determine its destination by analysis the header of the data frame and send it in to the respective port which will direct the data frame into the device that it connects. To be simple, the switch functions as one to many (Moumita, 2020).

Access point- A access point had the function to provide a wireless local network connection. The access point function as providing the Wi-Fi connection that your device connects. This method allows a device to connect to the internet without the wired cable plug into it.

Network cable- Network cable functions as connecting the devices such as router, switches, access point of the local area network physically rather than wireless. Usual network cable used is ethernet cable that purposely made for data transmission of the network.

2. How to ensure network security?

Answer:

Network security is essential to prevent the miscellaneous attack from the hacker to get into the LAN or to achieve Denial-of-Service (DoS) on the server. To defend such attack, there is some prevention or defensive action can be taken from the software perspective (Jorge Rojas, 2014). The first action to enhance software security is to install a firewall. Firewall can play a role of first-line defence against all type of attack and control unauthorized access to the computer or internet that will harden the ability of the attacker to sneak into the LAN.

The second action is to install a web-filtering. The purpose of web-filtering is to prevent the device attached to the LAN from surfing unwanted website such as dark web that student will always enter it out of curiosity or to get some illegal information or product from it. Besides, the web-filtering also can prevent the devices to search for adult-content that mostly at high-risk of containing malware from the attacker. Apart from the advantage of the security, web-filtering also can block the surfing of Facebook and social media and game to maintain a high quality and efficiency studying environment.

Below are the summarized advantages of implementing firewall and web filtering:

- The first defence against virus, malware, and other miscellaneous attacks.
- Prevent unwanted and inappropriate content and website.
- Maintain a better studying environment and block adult content.

3. What measurements need to be taken to ensure the physical security of the building?

Answer:

This building will install servers in it and contain important user information and company activity information. It is an essential practice to ensure that the servers are not directly exposed to physical cyber attack such as stealing the hard disk from the server. "Zero trusts" method is taken in this case to ensure there is no unauthorized access to the server. Below is the example of measures that can be taken to strengthen the physical security of this building (Blair Felter, 2019):

Layered Security Measures – server room should be layered by other security layers, this idea is critical when an intruder wants to sneak into the server room, he has to bypass other security layers which will harden their possibility to succeed in the crime. In this case study, the whole building is in the campus of UTM and the guard that hired by UTM at the main gate will indirectly serve as a layer that protects the server room by identifying every person that enters the campus.

Access Lists – access lists are potential to ensure the authority understand the person that have the permission to enter the restricted place rather than allowing a random person to enter the server room. In this case study, only the technician should have permission to enter the room to avoid student or unidentified personal to sneak into the server room and steal the data.

Video Surveillance – Applying for CCTV coverage on the building will help to record the movement inside the building and the backup video can be referenced when there is any suspicious activity occurring. In this case, CCTV is installed in the server room, outside the corridor of the server room, outside and inside view of the main entrance of the building
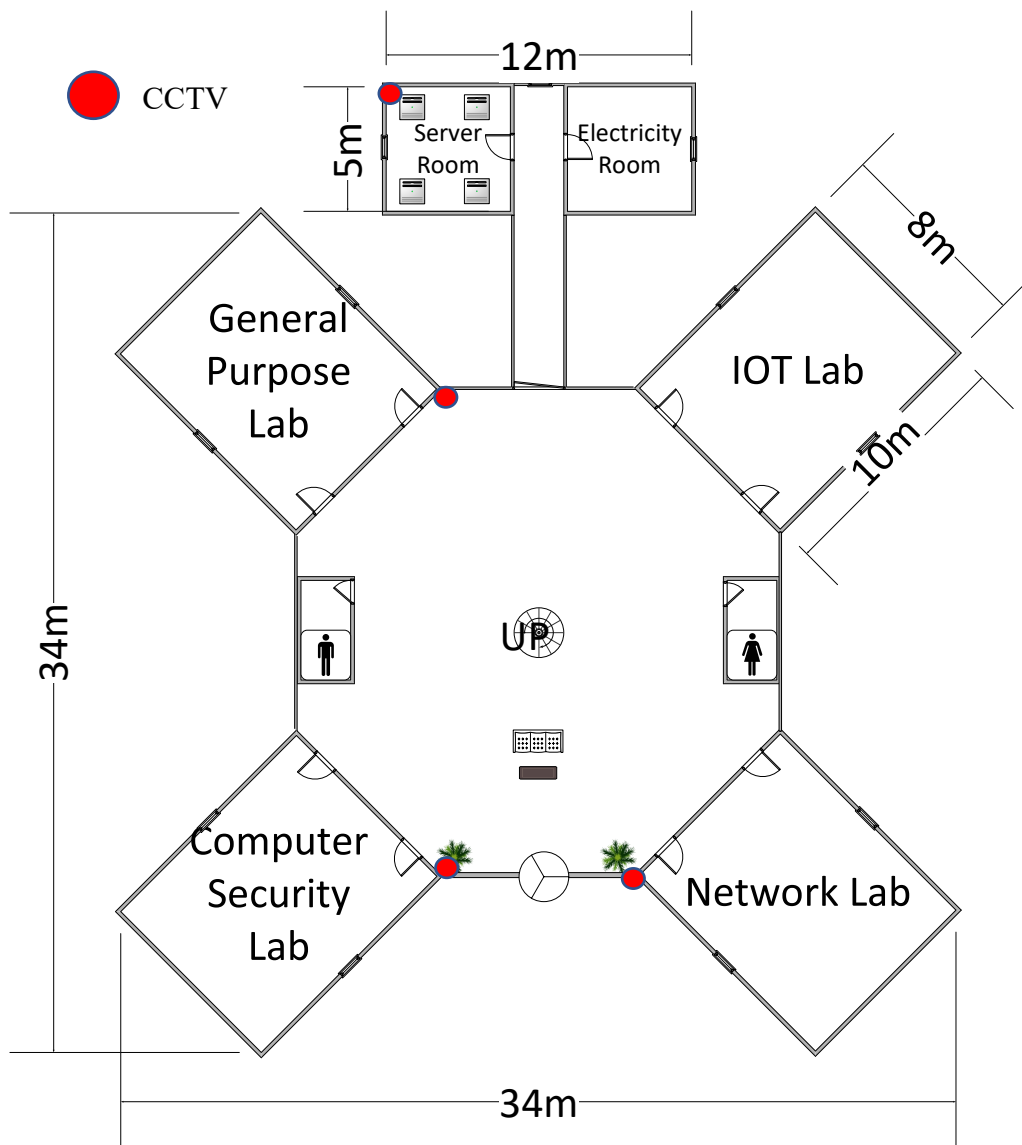
Figure 2.1:   Floor Plan Layout of CCTV

4. What is the cable type suitable to be implanted in this building?

Answer:

There is a lot of variable of cable type that available in the market such as Cat3, Cat5, Cat6, Cat7, Cat8, to choose for the type of cable that most suit in our case, we must consider from the aspect of the price, maximum transmission speed, max bandwidth of the cable ('Ethernet Cable: Types, Performance & Pinout – Cat5, 5e, 6, 6a, 7, 8', electronic notes, n.d.).

ETHERNET CABLE PERFORMANCE SUMMARY

CATEGORY	SHIELDING	MAX TRANSMISSION SPEED (AT 100 METERS)	MAX BANDWIDTH
Cat 3	Unshielded	10 Mbps	16 MHz
Cat 5	Unshielded	10/100 Mbps	100 MHz
Cat 5e	Unshielded	1000 Mbps / 1 Gbps	100 MHz
Cat 6	Shielded or Unshielded	1000 Mbps / 1 Gbps	>250 MHz
Cat 6a	Shielded	10000 Mbps / 10 Gbps	500 MHz
Cat 7	Shielded	10000 Mbps / 10 Gbps	600 MHz
Cat 8		Details to be released later	

Figure 2.2 Type of Ethernet

(Source: https://www.electronics-notes.com/articles/connectivity/ethernet-ieee-802-3/cables-types-pinout-cat-5-5e-6.php)

Cat3, Cat5 ethernets that have limited transmission speed and bandwidth are more suitable for home-usage. To support the bandwidth and the transmission speed of the building, Cat6 and Cat7 will be chosen. Cat 6 will function as connecting the devices in the laboratory and Cat7 will function as connecting the server, router, and access point.

5. How to build wireless connection that cover the whole building?

Answer:

First, set up a wireless router. The router should be placed close to a modem for easy troubleshooting. Besides that, to ensure maximum wireless coverage, the router should be located centrally in the building.

Next, connect a computer into one of the router's LAN port. Open a web browser in computer and type in the router's IP address.

The next step is to log in with an administrator account. In the wireless section of the router settings, change the name of the network in the SSID field. Select the WPA2-Personal as security option and create a strong password.

Last but not least, make sure the wireless network enables in settings. Restart the router and test the connection of each wireless devices towards the wireless network in the building. (Assume the access point used can support a range up to 46m to 92m.) (Bradley Mitchell, 2020)
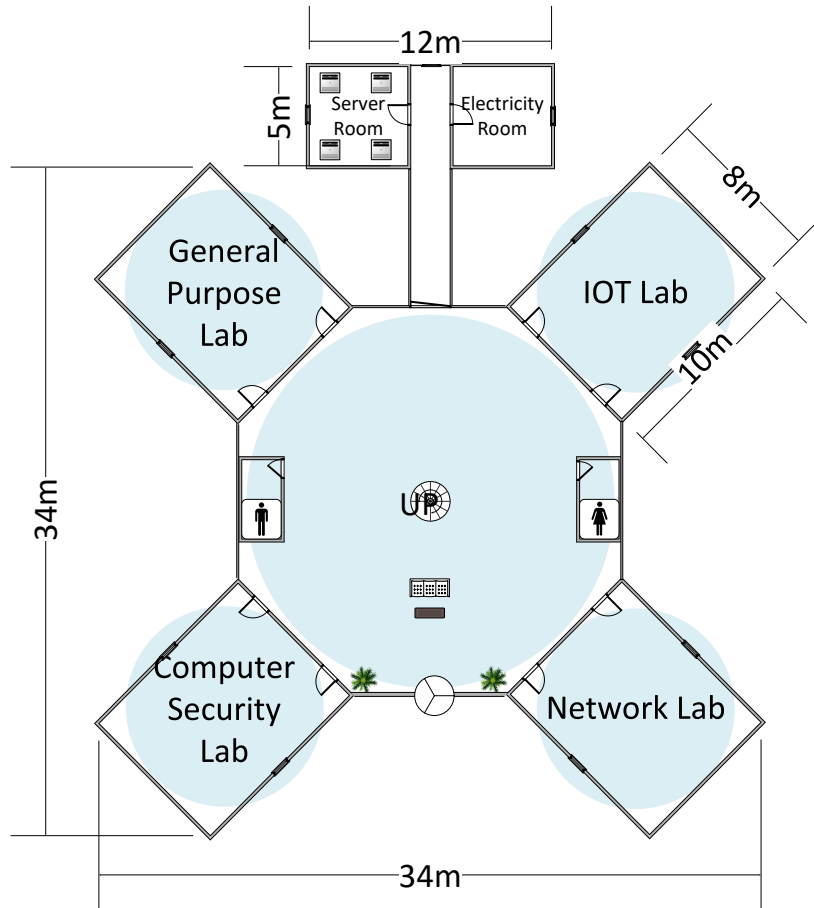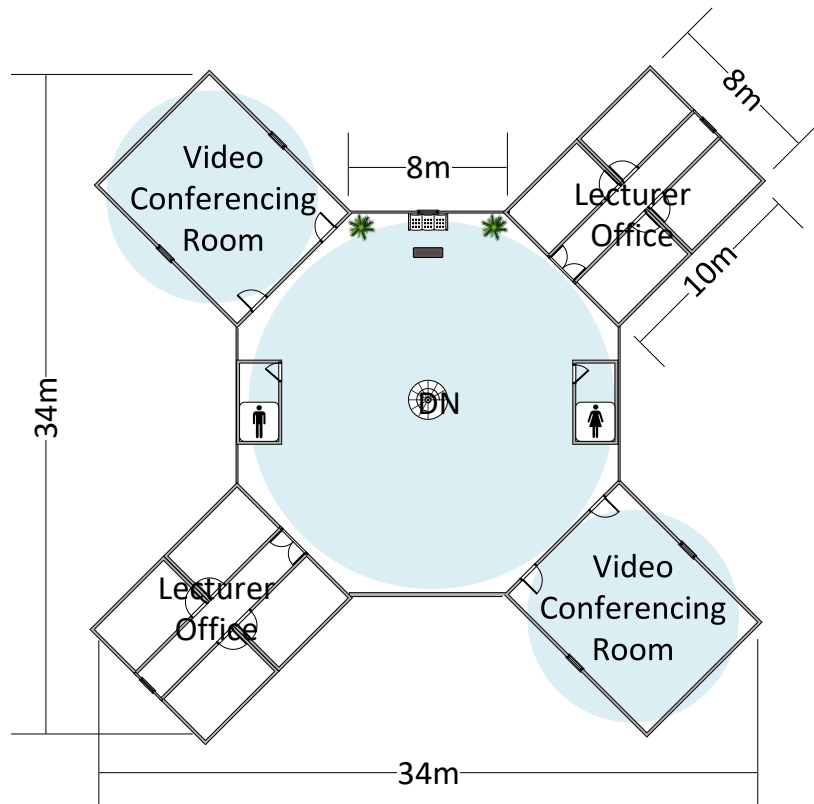
Figure 2.3:   Ground Floor Internet Coverage

Figure 2.4:   First Floor Internet Coverage

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6. How to set up IP addresses for an Office?

Answer:

Due to the multiple devices in an office, one IP address is not sufficient as it will confuse the destination of the packet from the internet.

Although setting up the office network with Dynamic Host Configuration Protocol (DHCP) is simple, but it will cause some issue such as the difficulty of remote administration which is not ideal for an academic purpose LAN. Setting up a static IP address is more complex and time-consuming, but it is chosen in this case to match the purpose of our project. Below are the steps to set up a static IP address for each device in the LAN (Finn McChuhil, 2018):

1. The range of valid IP address to be used on the network need to be picked up.

2. Assign the unique chosen IP address to each of the network-ready devices in the LAN. For example, if the devices attached in the LAN is not more than 250, an ideal range to assign is from 192.16.0.1 to 192.16.0.254 and a subnet mask of 255.255.255.0.

3. The IP address 'xxx.xxx.xxx.0' is a reserved address for a network ID and IP address 'xxx.xxx.xxx.255' is reserved for call-back address. Neither of it should be used to assign for network-ready devices in the LAN.

7. How to set up a LAN?

Answer:

Before setting up the network, it is necessary to identify the local services and number of devices that are going to connect to the internet.

A unique address is required for each server, devices, and workstation. To determine the distance for all hardwired devices, run a cable to servers or any possible working area. (Angelina Twain, 2016)

Next, prepare a standard Ethernet cable and gather all the devices needed especially router and switch.

Configure the WAN and LAN ports of the router. Make sure the address pool has enough addresses for all the workstation.

After that, connect the wire for the network. Use a standard Ethernet cable to connect workstations and servers. Connect the switch to the router LAN port by using a straight port on the switch.

Last, connect the access point to the router via Ethernet cable. Test the internet connectivity with each of the workstations, printers, and servers.

(Kim Staples, 2017)

Below are the questions that answer by interviewing session, our team has interview Mr Ahmad Fariz Ali which is a lecturer in teaching SECR1213 Network Communication in UTM with high experience and knowledge. The interview session is conducted on Google meet with a duration of 15 minutes that clear our question on this project with detail explanation.

8. How to support high-performance on core backbone?

Answer:

After considering the budget and the requirements, our team decided to choose Cat 6 cable to support high performance on core backbone as it can support up to 10Gbps speed with a shorter cable length that is suitable within the distance of each network devices. To support a high backbone performance as required, the fibre-optic cable also indeed a good choice but it was quite expensive. Therefore, in terms of cost and performance, our team had made a choice on Cat 6 cable which is the most suitable cable in the case.

9. Should server be gathered and put in one room rather distributed in each lab?

Answer:

After the discussion, our team has decided to implement the servers in one room rather than distribute it in each lab by considering many aspects. The first reason is the security issue, with the server implement together, the implementation of security both on physical and software is easier to apply on the servers. Besides, the maintenance of the technical team is easier when the servers are all in one room without having travel to a different lab to update or repair all the servers. Moreover, the environment around the server is critical for the life span of the server, by implementing all the server in one room, the temperature, humidity and electric supply is easier to maintain.

10. What is the total bandwidth required in the building?

Answer:

After considering the requirements in the case study, each computer should meet an average bandwidth of 12mbps. Each lab has 30 workstations in total, and the total bandwidth is 360mbps. There is one multi-terabyte storage server in the lab and to achieve the minimum requirement of the client, the recommended bandwidth is 80mbps. Thus, the total bandwidth for four labs is 1760mbps. There are also two video conferencing rooms and to provide a better internet experience, the suggested bandwidth of Wi-Fi is around 170mbps. In overall, the total bandwidth for the whole building is recommended to be around 2Gbps.

11. Where should the devices be bought from?

Answer:

After the discussion, there are two methods or path discovered to buy the devices and equipment:

1. Engage with the UTM Digital Services Department (UTMDigital) to get the contact of the best seller or hire UTM Digital Services Department (UTMDigital) as the intermediary to get the required devices.

2. Surf the shoppee.com and amazon.com to get the cheapest and best deal online.

Our team has decided to use the online shopping method as the COVID-19 situation has caused engaging with UTM Digital Services Department (UTMDigital) will be difficult and troublesome.

Project Feasibility

After identifying the requirements of the project, our group members decided to determine the feasibility of the project from 3 different aspects which are technical, economic, and legal aspects. By conducting the project feasibility study, we believed that this project will be feasible in every aspect needed.

Technical Feasibility

The technical feasibility study is necessary to be conducted as it can help to determine whether we have sufficient technical resources to meet the requirements of the project and also whether we can convert our ideas into reality or not.

Based on the technical feasibility study that we have conducted, we can obtain most of the hardware and software needed in this project from local recognized suppliers through walking in or from local well-known online shopping platforms such as Lazada and Shopee at a reasonable price. Since Malaysia is currently undergoing Covid-19 outbreak, we prefer to buy all the necessary devices such as routers through online as this can reduce the risk of our group members being exposed to Covid-19 virus. Although the movement of the citizen at most of the states in Malaysia are currently restricted, parcel delivery services over Malaysia remain unrestricted. Therefore, purchasing hardware via online will not affect the progress of our project.

Subscription-typed software such as antivirus and Microsoft products can be obtained through negotiation with service providers. All the software and hardware will be installed by the experts from UTM Digital Services Department (UTMDigital) so that software and hardware can work properly.

Economic Feasibility

The budget allocated for this project is RM 3,000,000 and this budget is enough to conduct our project. Aspects that are related to the cost of the project such as length of cables, the number of access points and the number of routers is taken into consideration when designing the floor plan of the building.

The length of cables required for the building that we designed is minimized to reduce the cost for wiring as we know that cables especially Twisted-Pair copper wire are very expensive. This is done by minimizing the distance between routers and switches and distance between labs.

Legal Feasibility

By upholding principle of respecting intellectual property (IP) rights and also to avoid any issue related to legal rights from being triggered, all the hardware and software used in this project are ensured to be original and fully followed the rules of law. For example, routers will be purchased through a legal channel and license keys for software like Microsoft products, antivirus, and also other licensed software will be obtained from authorities (UTM) which is mainly in charged by UTM Digital Services Department (UTMDigital). Besides that, firewall and web filtering are set up to prevent anyone from accessing illegal websites which may violate the rules of law.

Task 3:　　Choosing the Appropriate LAN Devices

Router

Router was chosen by considering several aspects such as number of ports supply, performance, size, throughput and so on. Identifying the throughput of the router was essential to confirm consistent or guarantee the performance of the router. The scalable of the router also was an important aspect, modular chassis router will allow to change element inside of it to upgrade the performance. The connectivity options of router require in this case mostly were connection to the switches and access point to provide both wire and wireless connection. (WorldWideSupply, 2018)

Table 3.1　　Comparison of Router

Product	Cisco RV345 Dual WAN Gigabit VPN Router	Huawei NetEngine AR6000 Series (NetEngine AR6121)	Cisco 900 Series Integrated Services Routers (ISR 921)
Specification	• 2 WAN ports (RJ-45) for load balancing and resiliency • 16 LAN ports that have high-performance connectivity • 2 USB ports that support 3G/4G modem or flash drive • 900 Mbps TCP throughput • Support for the Cisco AnyConnect Secure Mobility Client, ideal for remote access by mobile devices • VPN functionality for secure interconnectivity, including standard IPsec, Layer 2 Tunneling Protocol (L2TP) over IPSec, and Cisco Ipsec	• Forwarding Performance: 2Gbps • Fixed WAN ports: 2*GE Combo, 1*10GE SFP + (compatible with GE SFP) • Fixed LAN ports: 1*GE Combo, 8*GE RJ45(can be configured as WAN) • Dimensions (H * W * D): 43.6mm * 442mm * 220mm	• 4 LAN ports • Dual GE WAN, Category 4 LTE • provide VPN, DMVPN, FlexVPN, firewall • 1 GB DRAM and 2 GB flash • Group Encrypted Transport VPN, DMVPN, FlexVPN, firewall • Internal power supply
Price	RM 1510.30	RM 1220.40	RM1,725.72
Reference	https://www.cisco.com/c/en/us/products/routers/rv345-dual-gigabit-wan-vpn-router/index.html	https://e.huawei.com/en/material/networking/b17b2a7b964d4 52b8c44bc889e0d077c	https://www.cisco.com/c/en/us/products/routers/900-series-integrated-services-routers-isr/index.html#~benefits

By comparing the three product, **Cisco RV345 Dual WAN Gigabit VPN Router** was chosen due to some of its addition feature compare to other devices available on the market. This device has 16 ports that is sufficient to connect to all the switches in the building. Besides, this device has 900 Mbps TCP throughput that will ensure success of data transfer delivered over the TCP connection. This device also has an important feature which is providing VPN that will enhance the security of the LAN.

Switch

A switch was chosen by considering several aspects such as number of class, port count, form factor, features and so on. Port number of network switch was the key aspect which determine by the number of connecting devices. A network switch plays as a role of connecting all devices on a computer network by using packet switching. (TrendNet, 2020)

Table 3.2   Comparison of Swtich

Product	D-link 52-Port Gigabit Smart Managed Switch DGS-1210-52	Cisco Small Business 48-port 10/100 Managed Switch (SF350-48-K9-UK)	TP-Link TL-SG2452 48-Port Gigabit Smart Switch with 4 SFP Slots
Specification	• Ports: 48 x 10/100/1000BASE-T ports 4 x Gigabit GbE/SFP combo ports • Switching Capacity: 104 Gbps Max. Packet Forwarding Rate: 77.4 Mpps • Maximum Power Consumption: 34.85 W/100 V 34.2 W/240 V	• Ports: 48 x 10/100 + 4 x Gigabit SFP (2 combo) • Performance Switching capacity: 17.6 Gbps Forwarding performance (64-byte packet size): 13.10 Mpps • Power Consumption: N/A	• Ports: 48 10/100/1000Mbps RJ45 Ports (Auto Negotiation/Auto MDI/MDIX) + 4 Gigabit SFP Slots • Bandwidth/Backplane: 104Gbps Packet Forwarding Rate: 77.4Mpps • Power Consumption: Maximum: 40.1W (220V/50Hz)
Price	RM 2,499.00	RM 2,515.00	RM 1,899.00
Reference	https://www.dlink.com/en/products/dgs-1210-52-52-port-gigabit-smart-managed-switch	https://www.cisco.com/c/en/us/products/switches/350-series-managed-switches/index.html#~for-small-business	https://www.tp-link.com/my/business-networking/unmanaged-switch/tl-sg1048/#overview

By comparing the three product, **D-link 52-Port Gigabit Smart Managed Switch DGS-1210-52** was chosen due to some of its addition feature compare to other devices available on the market. This device has 48+4 ports that is sufficient to connect to all he devices in the building. Besides, this device has 104Gbps Switching Capacity and 77.4Mpps Max Packet Forwarding Rate. This device also has an important feature which is Comprehensive Security Features protecting Network that will enhance the security of the LAN. It also has Extensive Management and Layer 2 Features which can directly handle inter VLAN routing using multiple interfaces, making the network run faster and more efficiently and because the switches can manage internal routing, the network router can be assigned to handle external traffic routing only.

The number of switches needed is 5 which located 4 in ground floor and 1 in first floor.

Cable

One of the most important things when choosing a suitable CAT6 cable is shielding type. There are two type of Ethernet cable which is shielded and unshielded. Shielded CAT6 cable has faster transmission speed and fewer data errors while unshielded cable is less effective than shielded cable but less expensive and easier to install than shielded cable. CAT6 cable can support up to a maximum 500mhz bandwidth and it should be considered when choosing the cable. Next, CAT6 cable technically support speeds up to 10Gpbs for up to 55 meters. Thus, it is necessary to select an appropriate cable length for CAT6 cable. Last but not least, in term of colours, various colours are available such as red, blue, gray, and white. Among them, blue may be the most common one and different colours can distinguish different applications.

Table 3.3   Comparison of Cable

Product	Dintek Cat6 UTP Solid Cable	PROLINK Cat6 UTP Full Copper Cable	CK-LINK Cat6 UTP Cable
Specification	- Wire size: 23AWG - Capable of handling the latest version power over Ethernet - Support 10Gpbs up to 70 meters - Colours: blue - Length: 305m	4-pair unshielded twisted pair - Thicker conductor diameter - Provide higher reliability and higher data rates - Support transmission bandwidth 250mhz - Support 10Gpbs up to 55meters - Colours: Blue - Length:305m	- Support transmission bandwidth 250mhz - Achieve 10Gpbs in less than 50 meters - Colours: Grey - Length: 305m
Price	RM 429.00	RM 385.00	RM 248.00
Reference	https://www.lelong.com.my/dintek-cat6-utp-solid-cable-23awg-blue-305m-box-ycshop-F2493774-2007-01-Sale-I.htm	https://www.lelong.com.my/prolink-cat6-utp-23u-full-copper-network-cable-305m-1box-blue-chocobozz-K5924852B-2007-01-Sale-I.htm	https://www.lelong.com.my/ck-link-cat6-utp-network-cable-305m-1box-us04211-grey-chocobozz-K1554190C-2007-01-Sale-I.htm

By considering every factor, **PROLINK Cat6 UTP Full Copper Cable** is the most suitable cable among these options. This is because it can support high transmission bandwidth and a network speeds of 10Gpbs up to 55 meters which is indeed a suitable length for the distance between the devices in the building. In terms of price, it is not the cheapest but definitely an appropriate price for its high performance provided.

The estimated length needed for cat6 cable is 2180 meters and the amount of Cat6 cable needed is 9.

Network Connector

When choosing cat6 modular connector, it is important to consider the connector type, contact plating, prices and quantity needed.

Table 3.4   Comparison of Connector

Product	Dintek RJ45 CAT6 MODULAR CONNECTOR	OEM AMP Tyco RJ45 CAT6 Connector
Specification	• Connector type RJ45 suitable for cat6 cable • Contact Plating: Gold • 100pcs per pack	• Connector type RJ45 suitable for cat6 cable • Gold Plated Leads for better data transmitting and higher signal strength • 100pcs per pack
Price	RM229.00	RM57.00
Reference	https://www.lelong.com.my/dintek-rj45-cat6-modular-connector-100pcs-chocobozz-K2510801B-2007-01-Sale-I.htm	https://www.lelong.com.my/oem-amp-tyco-rj45-cat6e-modular-plug-network-connector-100pcs-ipohonline-F2407603-2007-01-Sale-I.htm

By considering the prices and quantity needed, **OEM AMP Tyco RJ45 Cat6 Connector** is a better option because it is less expensive and there is no huge difference between the two products in the other aspects. The expected quantity of usage of connector is around 310 for connecting the switches, router, server, pc and so on, so the quantity of purchasing will be at least 400 pieces.

Wireless Access Point

There are aspects that we should take into considerations when choosing a wireless access point. One of the aspects is the Wi-Fi standards supported by the access point and a better option of access point is the access point that can support as many Wi-Fi standards as it can. Next, the access point with dual band support can provide 2.4 GHz band that can be compatible with older devices and 5 GHz band for newer devices. Besides that, it is important to choose an access point with larger maximum bandwidth as it can provide faster data transmission between wireless network and devices connected. Last but not least, the security aspect is also one of the important aspects that we should consider when choosing an access point. A secure access point should be able to support as many wireless security protocols as possible and also the latest wireless security protocols such as WPA3 as these security protocols play an important role in encrypting and protecting our data in wireless network.

Table 3.5   Comparison of Wireless Access Point

Product	TP-Link EAP660 HD AX3600 Wireless Dual-Band MultiGigabit Ceiling Mount Access Point	D-link DAP-2680 Wireless AC1750 Wave 2 Dual-Band PoE Access Point
Specification	• Supports IEEE 802.11ax/ac/n/g/b/a wifi standards • 4 X 4 spatial streams • Maximum bandwidth: • 1148 Mbps for 2.4GHz • 2402 Mbps for 5 GHz • Maximum number of users: more than 1000 • Supports WEP, WPA-Personal/Enterprise, WPA2 • Personal/Enterprise, WPA3-Personal/Enterprise • encryption protocols • Mac address filtering with a	• Supports IEEE 802.11a/b/g/n/ac, 802.3i/u/ab, 802.3az, 802.3at standards • 3 X internal dual-band antennas • Operates at 2.4 GHz and 5 GHz frequency. • Maximum bandwidth: • 450 Mbps for 2.4 GHz and 1300 Mbps for 5GHz • Supports WPA-personal, WPA-Enterprise, WPA2-Personal, WPA2-Enterprise and WEP 64/128-bit encryption • MAC address access control • WLAN partitioning

	maximum number of 4000 • Centralized management with cloud access and Omada application • Provides a 2.5 Gbps Ethernet port (supports IEEE802.3at PoE) • Easy to be installed • Ideal for indoor deployment • Wall and ceiling mountable	• Traffic control • Ideal for small to medium business or enterprise usage • MU-MIMO with beamforming • Gigabit PoE-capable LAN port • Easy to be installed • Wall and ceiling mountable
Price	RM 1225.00 to RM 1233.00	RM 899.00
Reference	https://static.tp-link.com/2020/202011/20201111/EAP%20Datasheet.pdf https://shopee.com.my/TP-LINK-EAP660-HD-AX3600-CEILING-MOUNT-DUAL-BAND-WIFI-6-ACCESS-POINT-i.252512310.6551963812	https://dlinkmea.com/index.php/product/details?det=bUh3djV3RU0veTRPTC8vYkUrdnNrZz09 https://www.comms-express.com/assets/specs/DAP_2680.pdf https://shopee.com.my/D-link-DAP-2680-Wireless-AC1750-Wave-2-Dual%E2%80%91Band-PoE-Access-Point-i.13127.1703187862

By comparing the above two wireless access points, **TP-Link EAP660 HD AX3600 Wireless Dual-Band MultiGigabit Ceiling Mount Access Point** is a better option to be used for this project because it supports IEEE 802.11ax Wi-Fi standard which is known as Wi-Fi 6, while another access point does not support it. Wi-Fi 6 standard is the latest standard for Wi-fi and it can allow a maximum throughput at 9.5 Gbps and this means that TP-Link Access Point can provide a faster data transmission speed and perform better under high-density and bandwidth-hungry scenarios. Besides that, it has larger maximum bandwidth for both 2.4 GHz and 5 GHz than the D-Link access point. In term of authentication and encryption, TP-Link access point is a better option because it supports WPA3-Personal and Enterprise protocols which can provide a stronger protection for data transmission.

Expected Cost

Table 3.6 Expected Cost

No	Cable \ Device	Quantity	Price per Unit (RM)	Total Price (RM)
1	Cisco RV345 Dual WAN Gigabit VPN Router	1	1510.30	1510.30
2	D-link 52-Port Gigabit Smart Managed Switch DGS-1210-52	5	2499.00	12495.00
3	PROLINK Cat6 UTP Full Copper Cable	9	385.00	3465.00
4	OEM AMP Tyco RJ45 Cat6 Connector	4	57.00	228.00
5	TP-Link EAP660 HD AX3600 Wireless Dual-Band MultiGigabit Ceiling Mount Access Point	8	1233.00	9864.00
Total Cost				RM 27,565.30

<u>Reflection</u>

1.   Are you surprised by the prices? How were you surprised?

Ans: Yes. Overall, the price of the devices is under expectation and the total cost of the devices does not exceed the budget. However, for the price and cost required for the access point to cover the whole building is higher than the sum of cooper cable and connector. This is a shocking fact for my group as wired connection was expected to have higher guarantee performance than wireless connection. After research, we found that to maintain the minimum TCP throughput in wireless connection that cover a large area require a high-end technology access point so the unexpected high of the price of the access point is explained.

2.   Have you ever considered cost as a factor for choosing networking devices?

Ans: Yes, cost was a significant factor that affect the final decision of the chosen devices. To achieve highest cost performance that will bring the highest profit to the enterprise, the networking devices were compared between others on the aspect of features, cost and durability to obtain the best option of network devices that suitable for the enterprise. The devices that with most promising feature, reputation and lowest price were chosen for final decision.

3.   What are the major differences between the same devices from different brands? For example, Cisco and Huawei Routers.

Ans: Pricing is the biggest difference between difference brand of networking devices. For example, Huawei brand of networking device has lower price for targeting lower cost market to stand on the competition with the brand such as Cisco that have longer history of providing networking devices and higher reputation in the market.

Task 4:   Making the Connections–LAN and WAN

a.   Identify the work areas on the floor plan
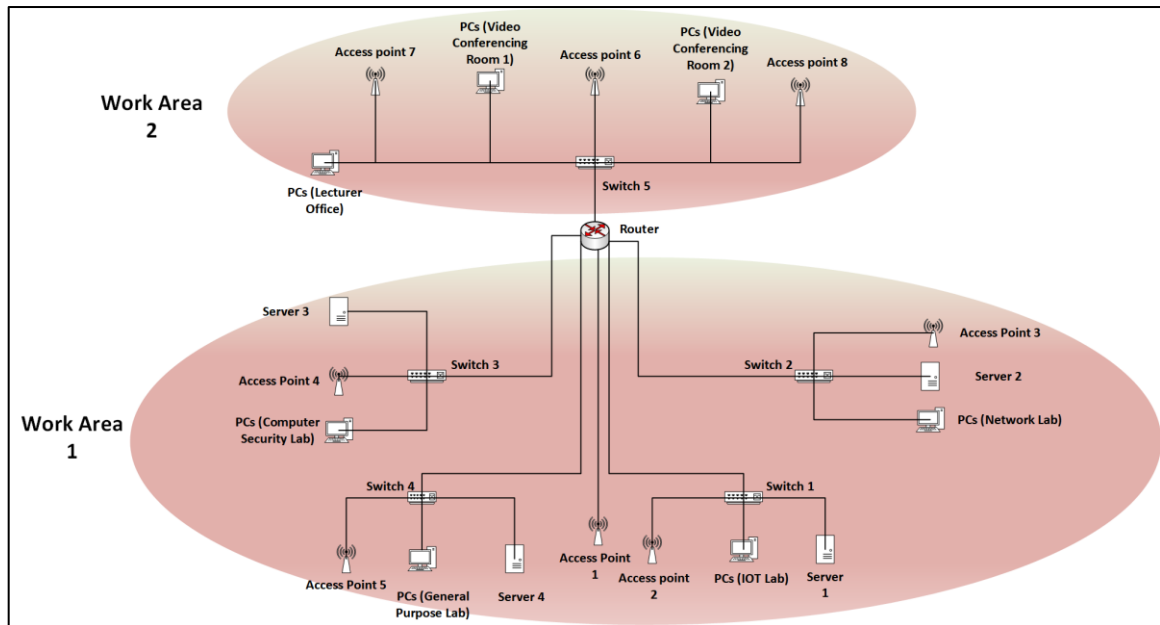

Figure 4.1   Work Areas on the Floor Plan

Work Area 1- The ground floor of the building that provided connection to 4 labs and the lobby. The 4 labs were general purpose lab, computer security lab, network lab and IOT lab respectively. Each lab will have a 48-ports switch that connect to the router and connect 30 PCs (30 ports used), 1 access point (1 ports used) and 1 server (1 ports used) which will total used 32 ports of the switch. The ground floor work area also provided a connection of access point for the lobby for the end-user (PCs, smartphone and tablet) that directly connect with the router.

Work Area 2- The first floor of the building that provide connection to 2 video conferencing room, 8 lecturer room and the first-floor lobby. The first floor will be using a 48-ports switch that connect with the router. The switch will connect to 8 PCs from the 8-lecturer room (8 ports used), 1 access point in each video conferencing room (1 ports used in each room), 10 PCs in each video conferencing room (10 ports used in each room) and 1 access point at the first-floor lobby (1 ports used) which will total used 31 ports of the switch.

b. How many connections have you determined you need?
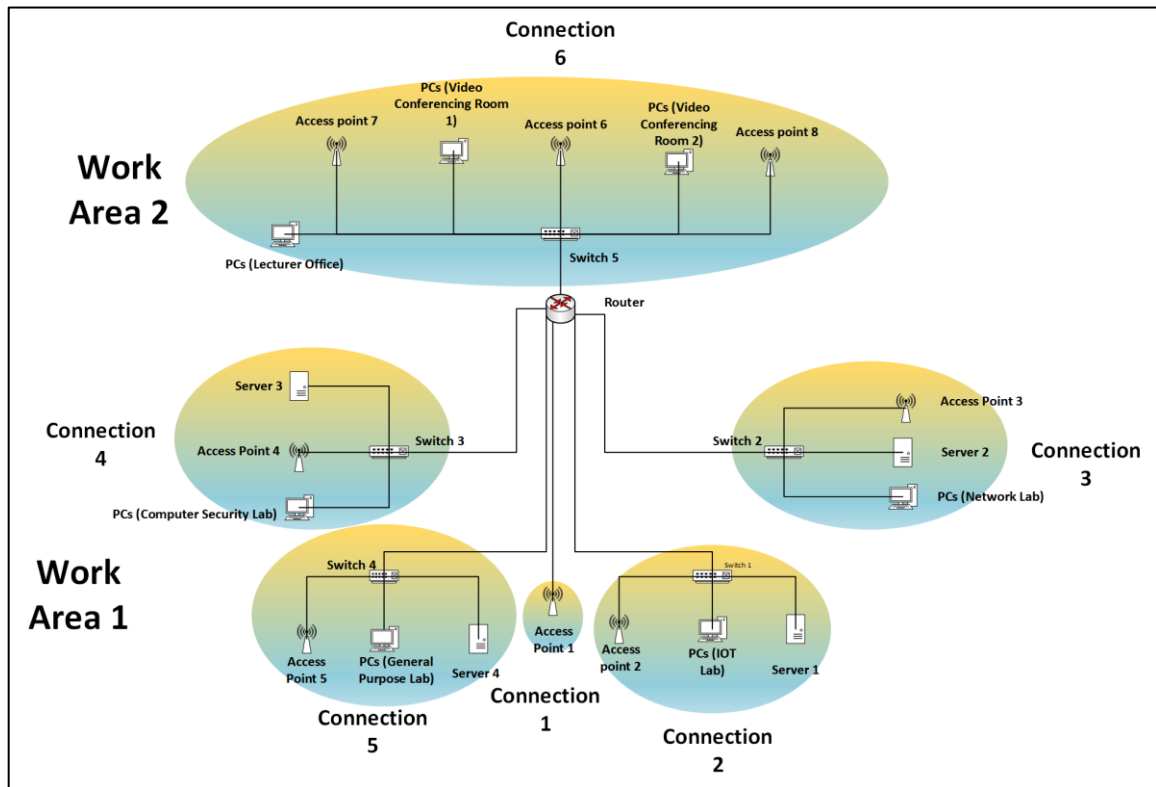
Figure 4.2   Work Areas Connection on the Floor Plan

Based on above diagram we had determined we need six (6) connection for this project.
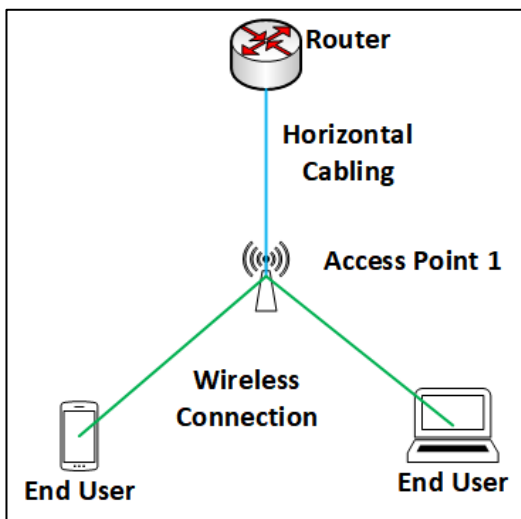
Connection 1   Connection 2

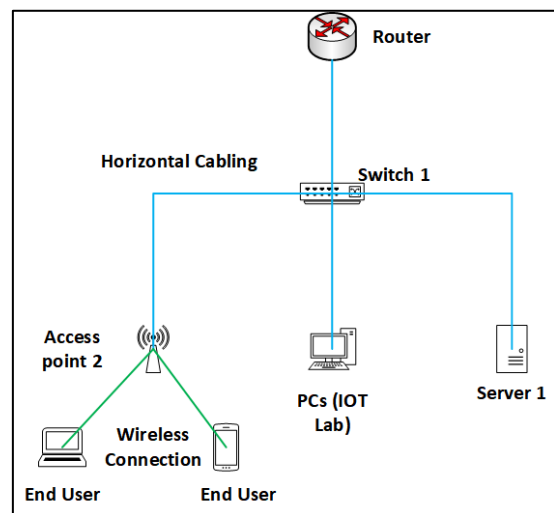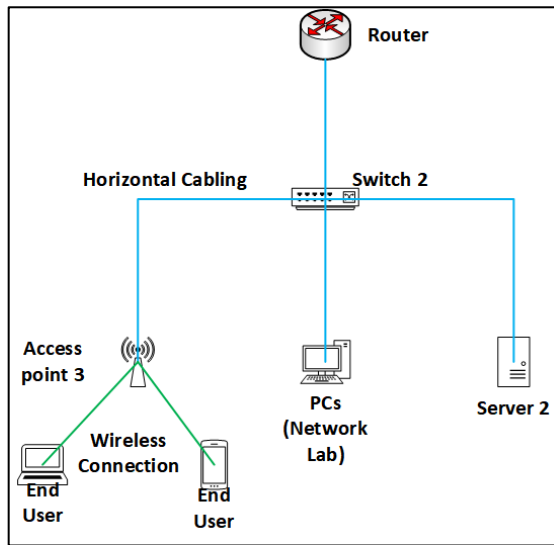Figure 4.3   Connection 1   Figure 4.4   Connection 2

Connection 3
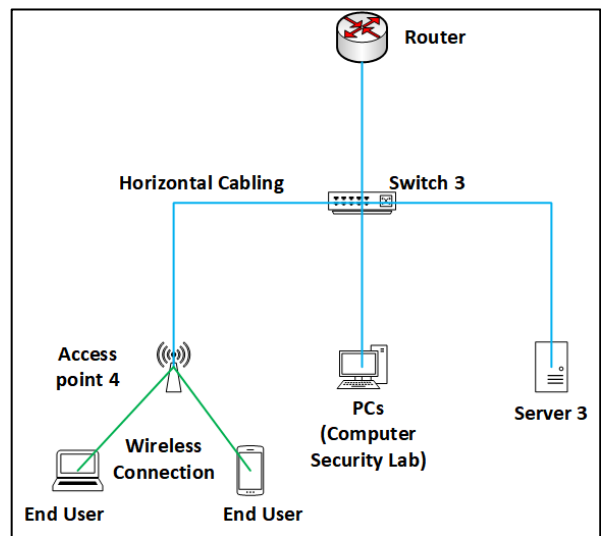

Figure 4.5   Connection 3

Connection 4

Figure 4.6   Connection 4

Connection 5
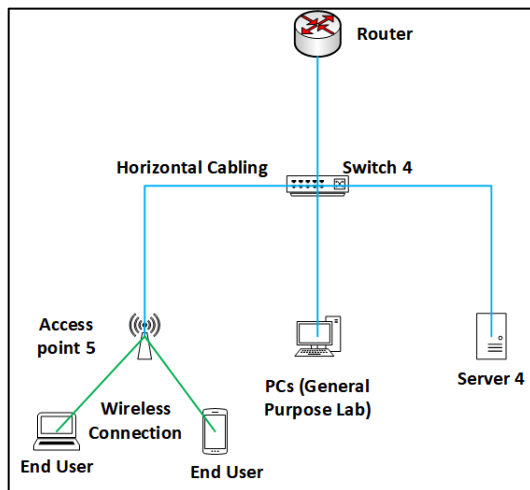
Figure 4.7   Connection 5

Connection 6
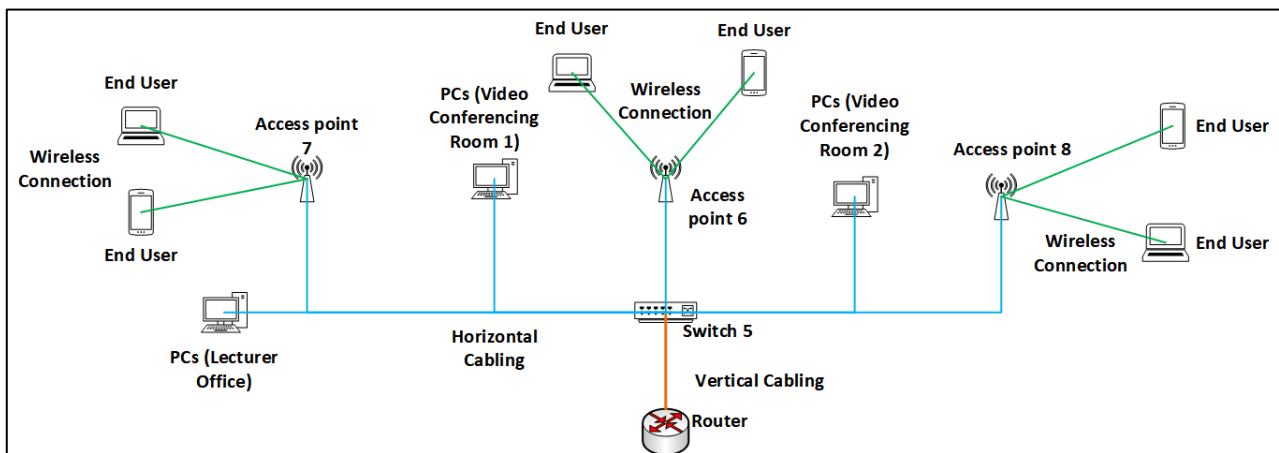
Figure 4.8   Connection 6

c. How many patch cords needed ?

We use CAT6 cable as the patch cords. In overall we will use approximately 165 patch cords.

In each lab, a 48-ports switch will connect with 30 PCs, 1 access point and 1 server. Thus, we will use 32 patch cords in each lab. Since there are four labs with one switch each, we need 4 patch cords to connect the switches to the router. Moreover, on the ground floor we have a connection between an access point to the router and so we need 1 patch cord for it.

Total patch cords used in the ground floor is 133.

On the first floor, we will use a 48-ports switch to connect the router with 1 patch cord. We will use 8 patch cords to connect each PC in 8 lecturer rooms to the switch.Besides that, we also need 20 patch cords in connections between 10 PCs in 2 video conferencing rooms and the switch. Last but not least, we will use 2 patch cords to connect 3 access points to the switch.

Total patch cords used in the first floor is 32.

d. How many switch ports ?

For this project, we planned to use five 48-ports switches. Among the five switches, four will be used in the ground floor to connect each lab's PCs, server and access point to the router and the left 1 will be used in the first floor to connect PCs in lecturer rooms and video conferencing rooms, and three access points to the router.

We planned to use switches that have PoE. Power over Ethernet (PoE) is a technology for wired Ethernet LANs (Local Area Networks) that allows the electrical current necessary for the operation of each device to be carried by the data cables rather than by power cords. Doing so minimizes the number of wires that must be strung in order to install the network. Besides, we have ensured the switches picked are able to transmit data with high speed.

e. Identify cable types and length

There are a total of 5 switches, one router and 8 access points in the building. We will use Cat6 cable in this building.

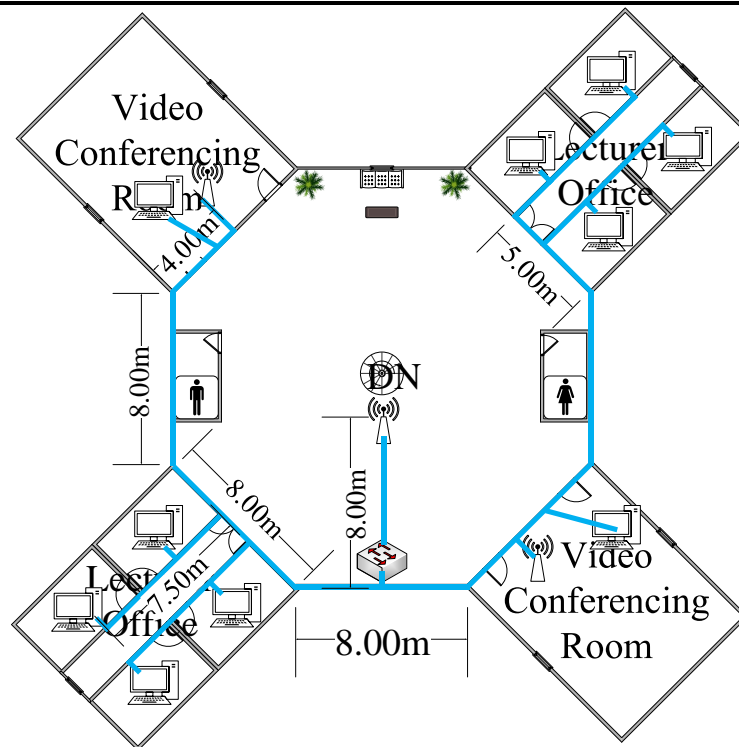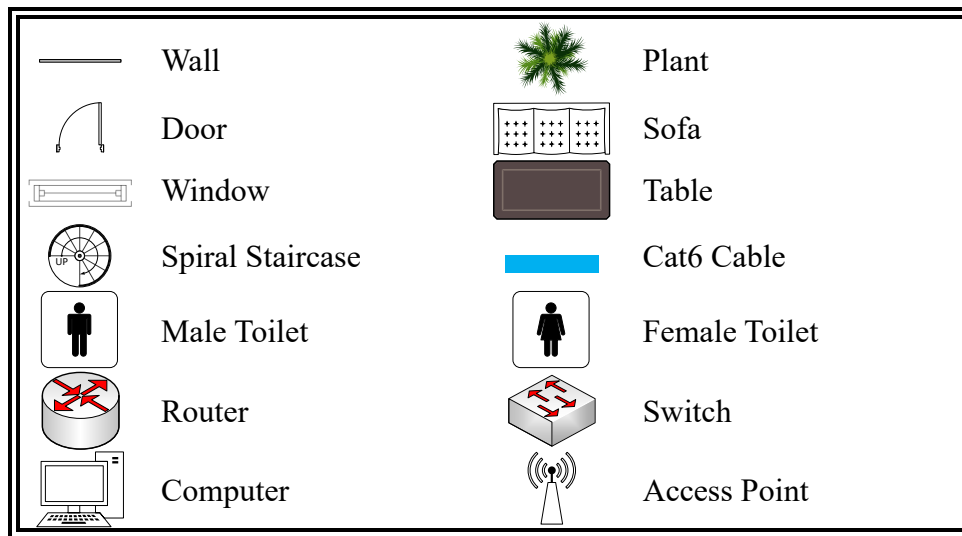## Ground Floor
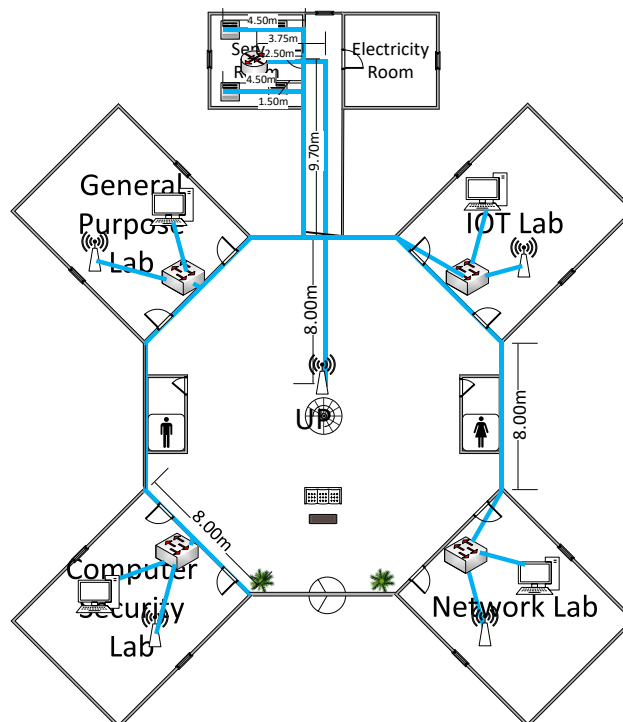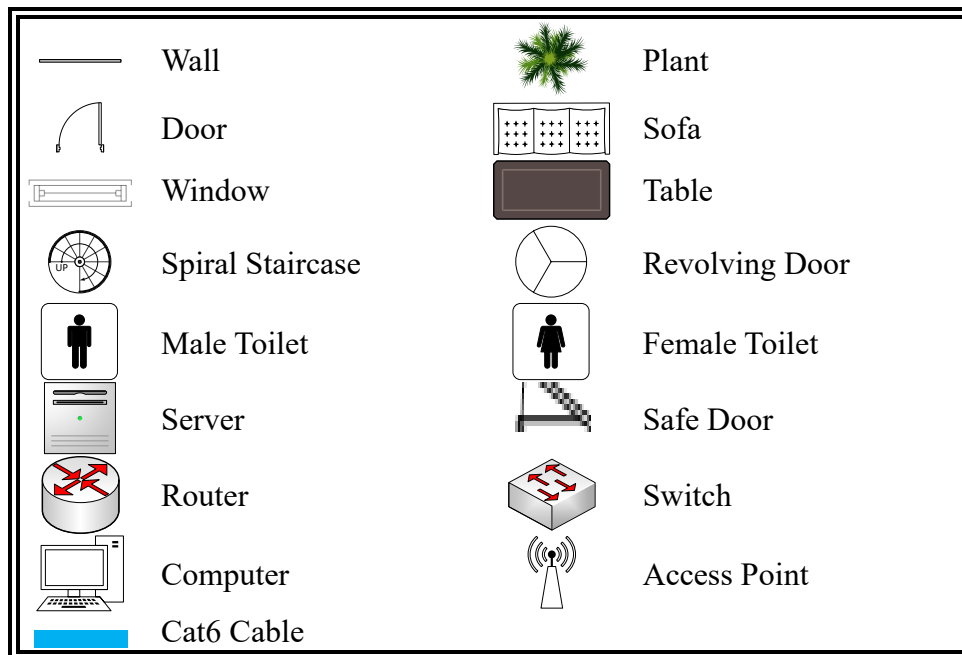
Estimated Length of Cat6 cable needed:

= 4 Switches to Router + Access Point to Router + 4 Server to 4 Switches

= 152.8 + (*2.2*+3.75+9.7+8) + 160.8

= 337.25 m

Remark: *2.2* m is the height from desktop to celling (Formula: Celling Height – Table Height)

First Floor

Estimated Length of Cat6 cable needed:

= Router (Ground Floor) to Switch + 8 Lecturer Rooms PC to Switch + Access Point

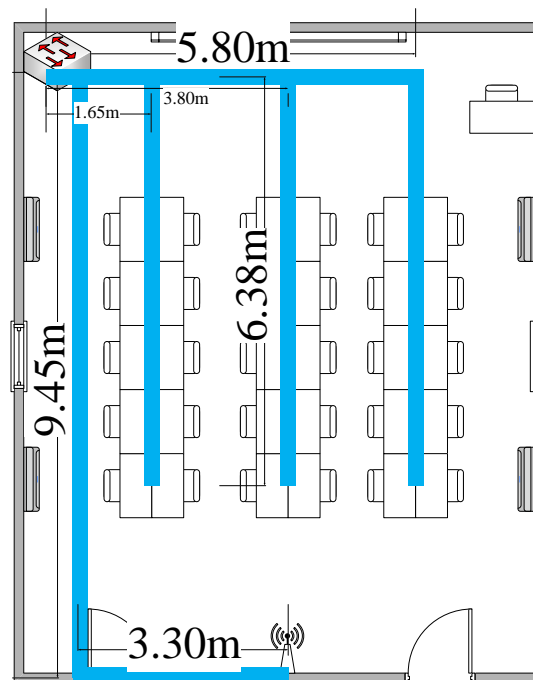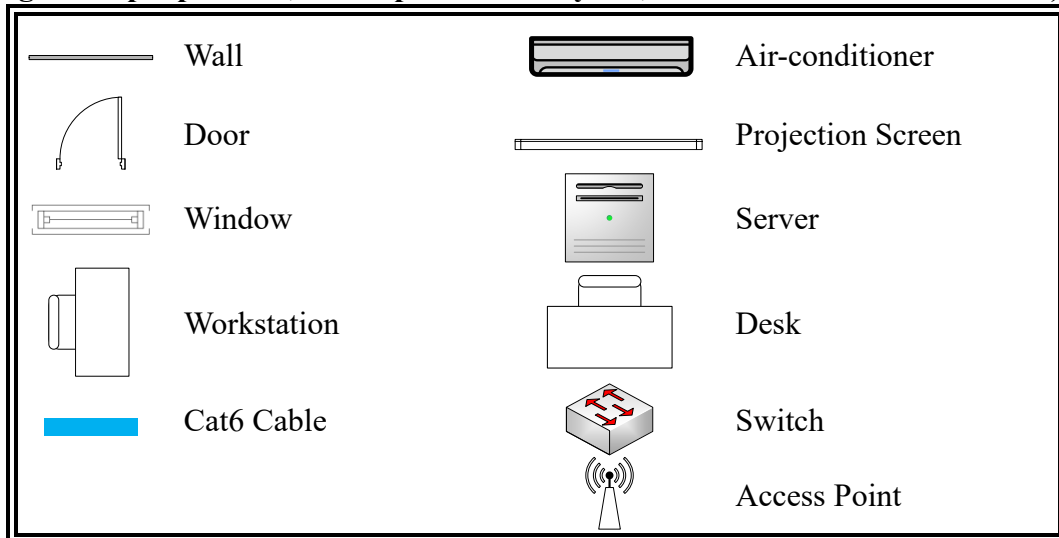to Switch + 2 Video Conferencing Room (Include PC and Access Point) to Switch

= 47.7 + 168 + (1.5 + 8) + 352

= 577.2 m

Remark: 1.5 m is the height from wall to celling.

Lab

(1 general purpose lab, 1 Computer Security lab, 1 Network lab and 1 IOT lab)

Estimated Length of Cat6 cable needed:

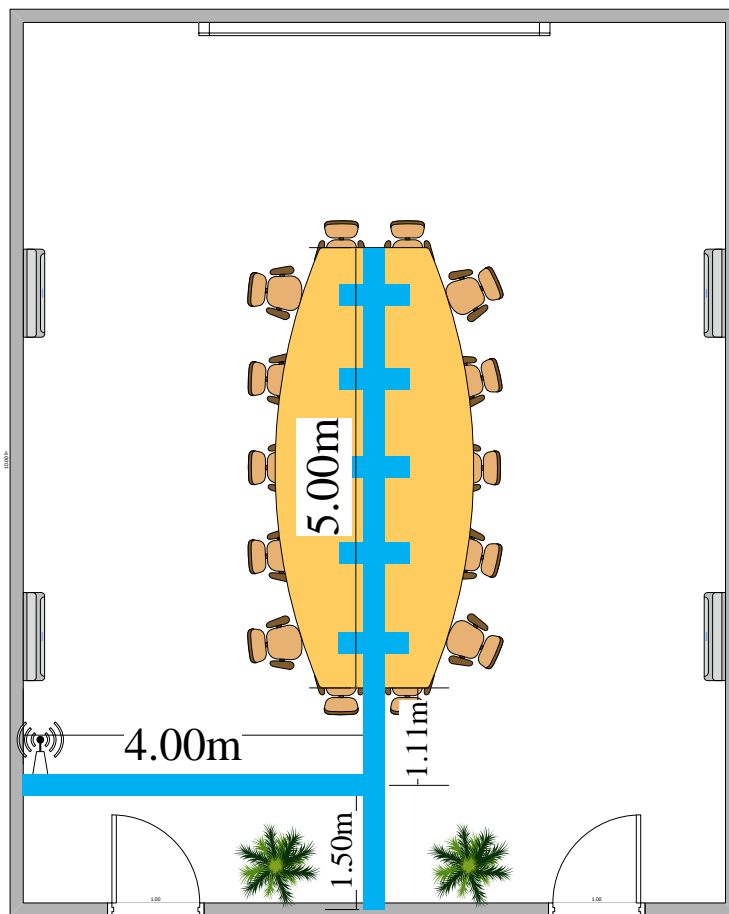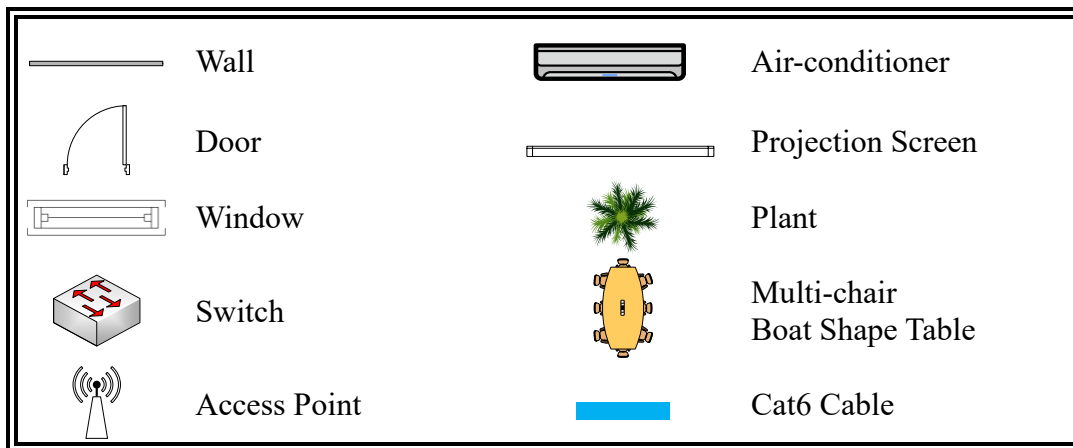= Switch to Access Point + Switch to Each Workstation PC

= [9.45+3.3+3.0(Celling Height)]

  +[(1.65×10+(6.38+5.38+4.38+3.38+2.38)×2+*0.8*×10)+[(3.8×10+(6.38+5.38+4.38+3

  .38+2.38)×2+*0.8*×10)+[(5.8×10+(6.38+5.38+4.38+3.38+2.38)×2+*0.8*×10)]

= 283.65 m

Remark: *0.8* m is the height from floor to desktop workstation

Video Conferencing Room

Estimated Length of Cat6 cable needed:

= Switch to Access Point + Switch to Each Workstation PC

= (1.5+4) + [(1.5×10+1.11×10+(0.5+1.5+2.5+3.5+4.5)×2+*0.8*×10)]

= 64.6 m

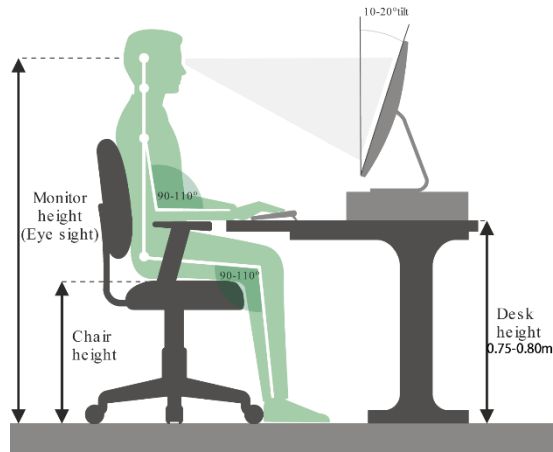**Remark**: *0.8* m is the height from floor to desktop

Figure 4.1:   *Working Table Side View*
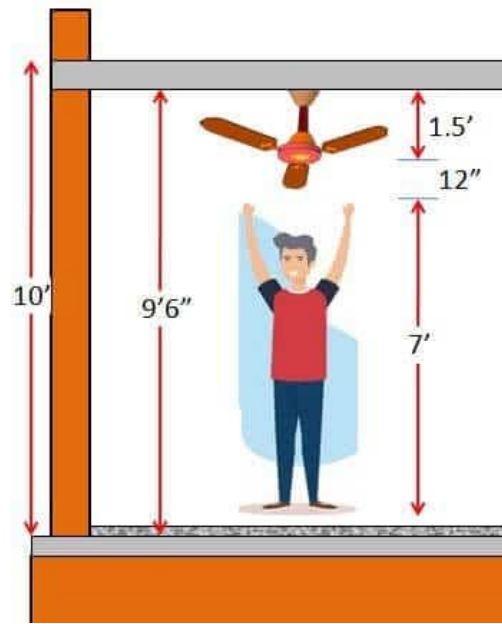
Figure 4.2:

       Celling Height Dimension

All calculation are in meter and have to assume the length floor to desktop which is around 0.8m. We also assume celling height is 3m (around 10feet).

(All estimation done based on the picture above and calculation below.)

Estimated Total Length of Cat6 cable needed:

Ground Floor + First Floor

= (General Purpose Lab + IOT Lab + Network Lab + Computer Security Lab + Ground Floor Cable Connection) + (2 Video Conferencing Room to Switch +First Floor Cable Connection)

= (283.65×4+337.25) + (64.6×2+577.2)

= 2178.25 m

≈ 2180 m

Task 5: **IP Addressing Scheme**

Network address: 192.16.0.0/8

<u>By using Fixed Length Subnet Mask (FLSM)</u>

Number of subnets = 8

A. Subnet Mask

Subnet No	Area	IP Address/Subnet Mask (Binary)	IP Address /Subnet Mask (Decimal)
0	General Purpose Lab	1100 0000.0000 0000.0000 0000.0000 0000/11	192.0.0.0/11
1	IOT Lab	1100 0000.0010 0000.0000 0000.0000 0000/11	192.32.0.0/11
2	Network Lab	1100 0000.0100 0000.0000 0000.0000 0000/11	192.64.0.0/11
3	Computer Security Lab	1100 0000.0110 0000.0000 0000.0000 0000/11	192.96.0.0/11
4	First Floor, Video Conferencing Room and Lecturer Room	1100 0000.1000 0000.0000 0000.0000 0000/11	192.128.0.0/11
5	Unused	1100 0000.1010 0000.0000 0000.0000 0000/11	192.160.0.0/11
6	Unused	1100 0000.1100 0000.0000 0000.0000 0000/11	192.192.0.0/11
7	Unused	1100 0000.1110 0000.0000 0000.0000 0000/11	192.224.0.0/11

B. Range of IP address, network and broadcast address for subnet

Subnet No	Area	Range of IP address	Network Address	Broadcast Address
0	General Purpose Lab	192.0.0.1-192.31.255.254 1100 0000.0000 0000.0000 0000.0000 0001- 1100 0000.0001 1111.1111 1111.1111 1110	192.0.0.0	192.31.255.255
1	IOT Lab	192.32.0.1-192.63.255.254 1100 0000.0010 0000.0000 0000.0000 0001- 1100 0000.0011 1111.1111 1111.1111 1110	192.32.0.0	192.63.255.255
2	Network Lab	192.64.0.1-192.95.255.254 1100 0000.0100 0000.0000 0000.0000 0001- 1100 0000.0101 1111.1111 1111.1111 1110	192.64.0.0	192.95.255.255
3	Computer Security Lab	192.96.0.1-192.127.255.254 1100 0000.0110 0000.0000 0000.0000 0001- 1100 0000.01111 111.1111 1111.1111 1110	192.96.0.0	192.127.255.255
4	First Floor, Video Conferencing Room and Lecturer Room	192.128.0.1-192.159.255.254 1100 0000.1000 0000.0000 0000.0000 0001- 1100 0000.1001 1111.1111 1111.1111 1110	192.128.0.0	192.159.255.255
5	Unused	192.160.0.1-192.191.255.254 1100 0000.1010 0000.0000 0000.0000 0001- 1100 0000.1011 1111.1111 1111.1111 1110	192.160.0.0	192.191.255.255
6	Unused	192.192.0.1-192.223.255.254 1100 0000.1100 0000.0000 0000.0000 0001- 1100 0000.1101 1111.1111 1111.1111 1110	192.192.0.0	192.223.255.255
7	Unused	192.224.0.1-192.255.255.254 1100 0000.1110 0000.0000 0000.0000 0001- 1100 0000.1111 1111.1111 1111.1111 1110	192.224.0.0	192.255.255.255

C. Range of IP address allocated for user types based on the area.

i. General Purpose Lab

User	IP range
Student (PCs)	192.0.0.1-192.0.0.30

ii. IOT Lab

User	IP range
Student (PCs)	192.32.0.1-192.32.0.30

iii. Network Lab

User	IP range
Student (PCs)	192.64.0.1-192.64.0.30

iv. Computer Security Lab

User	IP range
Student (PCs)	192.96.0.1-192.96.0.30

v. First Floor

User	IP range
Video Conferencing Room 1	192.128.0.1-192.128.0.10
Video Conferencing Room 2	192.128.0.11-192.128.0.20
Lecturer from 8 lecturer room (PCs)	192.128.0.21-192.128.0.28

Conclusion

The project is finally completed in a few weeks of work and task. We have to admit that the project is not easy as we thought because we have faced a lot of problems and obstacles in every project tasks. However, we still managed to overcome them and complete all the tasks on time despite some small mistakes we did. The project can be considered as success and achieving the goals we have set for each task. We have learned and simulated the process of designing and building a network system based on a real life case study given. We also learned how to choose the appropriate network devices depends on the requirement and budget given. It was also indeed a first-time experience for us to design a LAN network system under a building by drawing the floor plans and determining the suitable position of each devices. Last but not least we also learned the ways to set the IP address scheme for every network in the whole system.

Besides the fundamental knowledge of network system, we also learned how to work as a team as well as the importance of team cooperation while doing the tasks. We have conducted a meeting for every task before we started to work on it. It was effective to ensure all the team members know how the process would go from start to end in each project tasks. After the meeting, we would get our own separated job but we still discussed a lot and helped each other. We would respect the other's opinions even though sometimes we stood for different ideas. If some members made a mistake, we would point it out and help them to correct it. We believed the cooperation and communication between the team are the key of a success group project.

We also have found our weakness in this project which is insufficient understanding of network system planning. We have zero experience in handling in such tasks before and we do not know how a network system is built from ground in real life. However, we tend to do more researches and try to ask the people who has certain experience and knowledge about the project.

Hence, we still need to improve our projects by enhance us with the related information and skills that required to design a good network. In order to do this, we can learn by reading more related articles on internet. We need to do more researches that will be useful to our future career.

In conclusion, we are very grateful by giving an opportunity to do this project and apply our knowledge learned from the course. We do believe all the lessons we learnt in this project would be very beneficial to us in the future.

Team Member and Responsibilities

Group Members:

1. See Wen Xiang

2. Kong Hao Yang

3. Tai Wen Jun

4. Yong Jing Xuan

Responsibilities:

See Wen Xiang

- Group leader
- Divide the works
- Conduct meeting
- Compile final report
- Draw floor plan
- Do Task 1, Task 2, Task 3 and Task 4

Kong Hao Yang

- Contribute idea in meeting
- Do Task 1,2,3, and 4
- Do Task 5
- Draw floor plan
- Write abstract

Tai Wen Jun

- Contribute idea in meeting
- Do Task 1,2,3 and 4
- Design floor plan
- Conduct interview
- Write Introduction and Overview

Yong Jing Xuan

- Contribute idea in meeting
- Do Task 1,2,3 and 4
- Design floor plan
- Assist interview
- Write Conclusion

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Appendices

Title: *Task 1 of NC Project*

LOGS # 1

DATE: 08/11/2020 (Sun)

TIME: 9.30a.m.

LOCATION: Google Meet

MEETING CALLED BY	SEE WEN XIANG
TYPE OF MEETING	Idea-Sharing Meetings
FACILITATOR	KONG HAO YANG
NOTE TAKER	YONG JING XUAN
TIMEKEEPER	TAI WEN JUN
ATTENDEES	SEE WEN XIANG KONG HAO YANG YONG JING XUAN TAI WEN JUN
ABSENTEES	-

DISCUSSION/CONCLUSIONS/ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Discussion and contribute idea of floor plan/layout *-Butterfly floor plan*	*Everyone*	
Drawing floor plan by using Microsoft Visio	*SEE WEN XIANG*	*11/11/2020 (Wed)*

RISK/ISSUE UPDATE	STATUS
-	-

ADDITIONAL REMARKS	

PREPARED BY	YONG JING XUAN	APPROVED BY	SEE WEN XIANG

Title: *Task 2 of NC Project*

LOGS #2

DATE: 16/11/2020 (Mon)

TIME: 8.30p.m.

LOCATION: Google Meet

MEETING CALLED BY	TAI WEN JUN
TYPE OF MEETING	Problem-Solving Meeting
FACILITATOR	YONG JING XUAN
NOTE TAKER	KONG HAO YANG
TIMEKEEPER	SEE WEN XIANG
ATTENDEES	SEE WEN XIANG KONG HAO YANG YONG JING XUAN TAI WEN JUN
ABSENTEES	-

DISCUSSION/CONCLUSIONS/ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Discuss about the list of question need to do research and for interview	*Everyone*	
Contact Lecturer to book time for interview	*TAI WEN JUN*	*11/11/2020 (Wed)*

RISK/ISSUE UPDATE	STATUS
-	-

ADDITIONAL REMARKS	

PREPARED BY	KONG HAO YANG	APPROVED BY	SEE WEN XIANG

Title: *Task 3 of NC Project*

LOGS #3

DATE: 03/12/2020 (Thu)

TIME: 3.15p.m.

LOCATION: Google Meet

MEETING CALLED BY	SEE WEN XIANG
TYPE OF MEETING	Problem-Solving Meeting
FACILITATOR	YONG JING XUAN
NOTE TAKER	TAI WEN JUN
TIMEKEEPER	KONG HAO YANG
ATTENDEES	SEE WEN XIANG KONG HAO YANG YONG JING XUAN TAI WEN JUN
ABSENTEES	-

DISCUSSION/CONCLUSIONS/ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Split Task 3 to small task to everyone	*SEE WEN XIANG*	
Find and compare Router	*TAI WEN JUN*	*10/12/2020 (Thu)*
Find and choose a better switches	*SEE WEN XIANG*	*10/12/2020 (Thu)*
Calculate approximately Cable and network connector needed and choose among some brand by consider some factor	*YONG JING XUAN*	*10/12/2020 (Thu)*
Find, compare and choose a better Wireless Access Point	*KONG HAO YANG*	*10/12/2020 (Thu)*

RISK/ISSUE UPDATE	STATUS
-	-

ADDITIONAL REMARKS	

PREPARED BY	TAI WEN JUN	APPROVED BY	SEE WEN XIANG

Title: *Task 4 of NC Project*

LOGS #4

DATE: 23/12/2020 (Wed)

TIME: 11.45a.m.

LOCATION: Google Meet

MEETING CALLED BY	TAI WEN JUN
TYPE OF MEETING	Problem-Solving Meeting
FACILITATOR	KONG HAO YANG
NOTE TAKER	SEE WEN XIANG
TIMEKEEPER	YONG JING XUAN
ATTENDEES	SEE WEN XIANG KONG HAO YANG YONG JING XUAN TAI WEN JUN
ABSENTEES	-

DISCUSSION/CONCLUSIONS/ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Identify the work area on floor plan	*TAI WEN JUN, KONG HAO YANG*	*27/12/2020 (Sun)*
Calculate the patch cords and switch ports needed	*YONG JING XUAN*	*27/12/2020 (Sun)*
Identify cable types and length	*SEE WEN XIANG*	*28/12/2020 (Mon)*

RISK/ISSUE UPDATE	STATUS
-	-

ADDITIONAL REMARKS	

PREPARED BY	SEE WEN XIANG	APPROVED BY	SEE WEN XIANG

Title: *Task 5 of NC Project*

LOGS #5

DATE: 03/01/2021 (Sun)

TIME: 8.00p.m.

LOCATION: Google Meet

MEETING CALLED BY	YONG JING XUAN
TYPE OF MEETING	Problem-Solving Meeting
FACILITATOR	SEE WEN XIANG
NOTE TAKER	KONG HAO YANG
TIMEKEEPER	TAI WEN JUN
ATTENDEES	SEE WEN XIANG KONG HAO YANG YONG JING XUAN TAI WEN JUN
ABSENTEES	-

DISCUSSION/CONCLUSIONS/ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Contribute Idea about Task 5	*Everyone*	
IP ADDRESSING SCHEME	*KONG HAO YANG*	*05/01/2021 (Tue)*
Make Correction Task 2	*SEE WEN XIANG*	
Make Correction Task 3	*YONG JING XUAN*	

RISK/ISSUE UPDATE	STATUS
-	-

ADDITIONAL REMARKS	Need make correction for the previous project task.

PREPARED BY	KONG HAO YANG	APPROVED BY	SEE WEN XIANG

Title: *Task 6 of NC Project*

LOGS #6

DATE: 20/01/2021 (WED)

TIME: 4.00p.m.

LOCATION: Google Meet

MEETING CALLED BY	YONG JING XUAN
TYPE OF MEETING	Status Update Meeting
FACILITATOR	KONG HAO YANG
NOTE TAKER	TAI WEN JUN
TIMEKEEPER	SEE WEN XIANG
ATTENDEES	SEE WEN XIANG KONG HAO YANG YONG JING XUAN TAI WEN JUN
ABSENTEES	-

DISCUSSION/CONCLUSIONS/ACTION ITEMS	PERSON RESPONSIBLE	DEADLINE
Abstract	*KONG HAO YANG*	*22/01/2021 (FRI)*
Introduction, Project background and an overview	*TAI WEN JUN*	*22/01/2021 (FRI)*
Conclusion, Team Members and responsibilities	*YONG JING XUAN*	*22/01/2021 (FRI)*
Appendices, Compile Report	*SEE WEN XIANG*	*25/01/2021 (MON)*

RISK/ISSUE UPDATE	STATUS
-	-

ADDITIONAL REMARKS	

PREPARED BY	TAI WEN JUN	APPROVED BY	SEE WEN XIANG

Meeting Photo at Google Meet
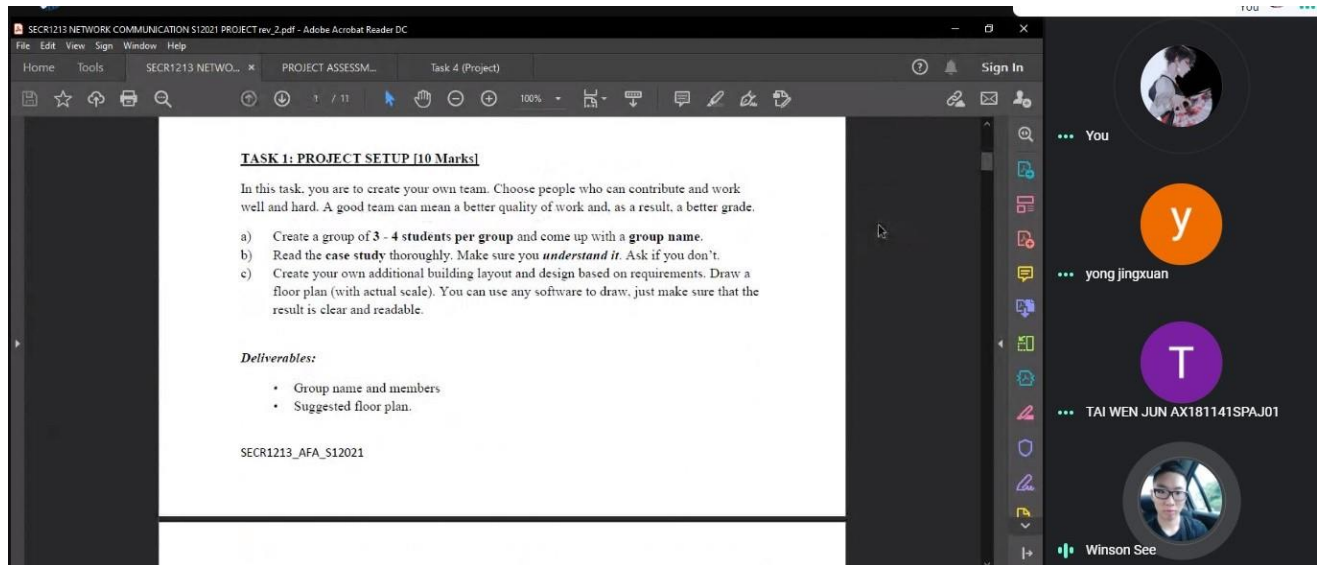
Figure A1:   Meeting of Task 1
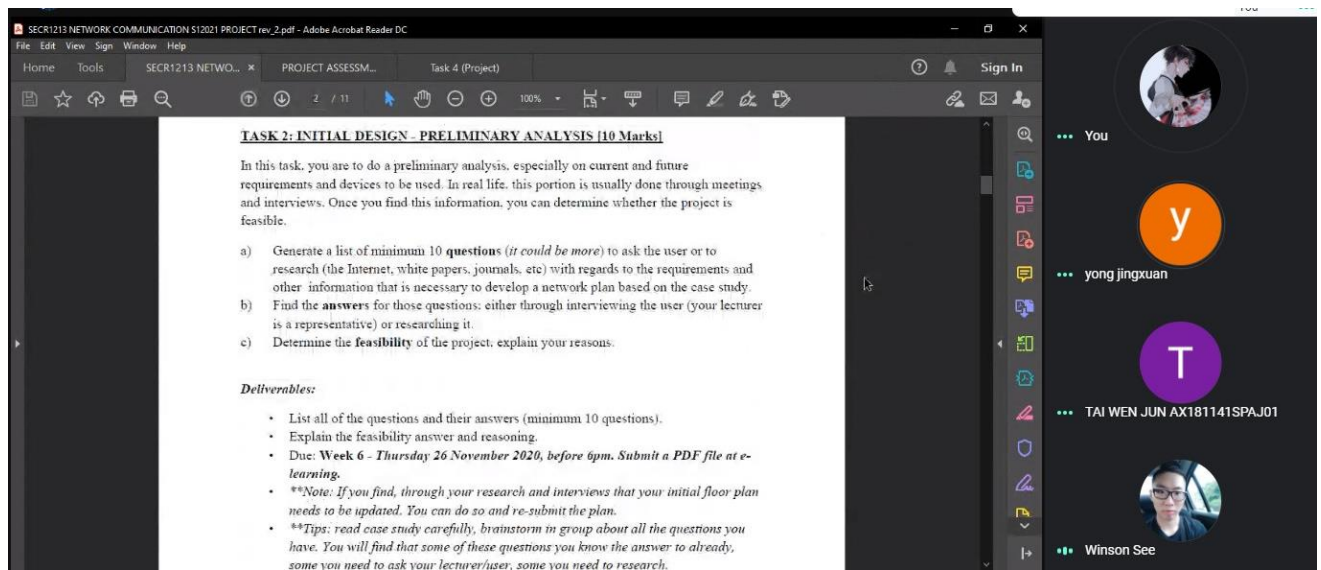
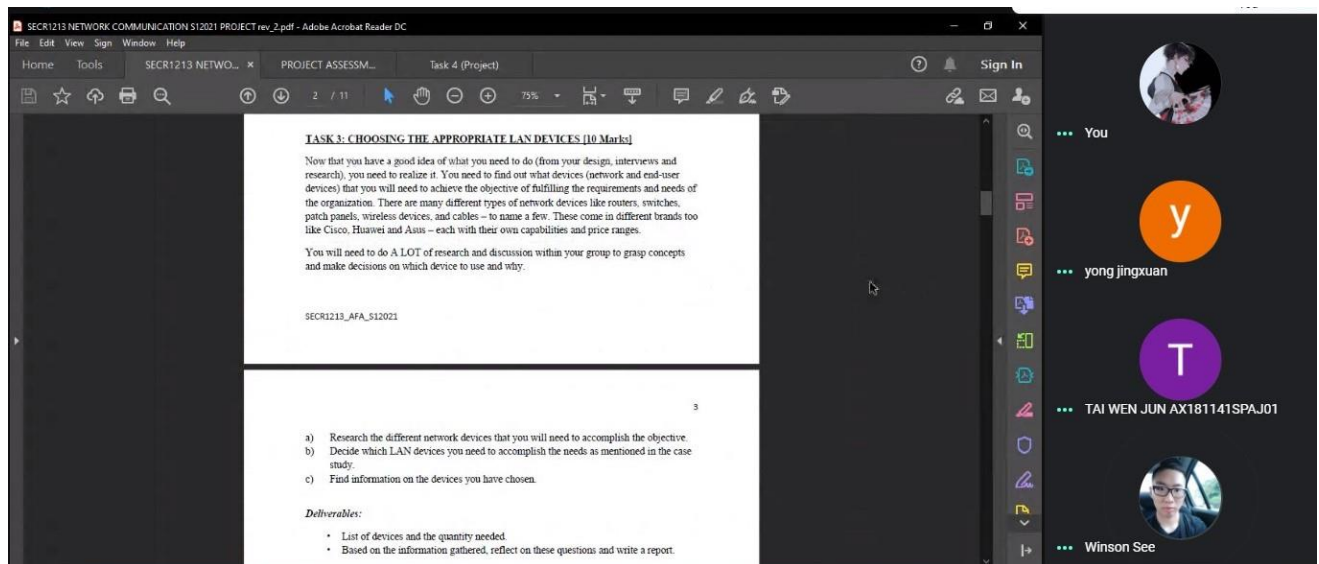*Figure A2:   Meeting of Task 2*

Figure A3:   Meeting of Task 3

Figure A4:   Meeting of Task 4

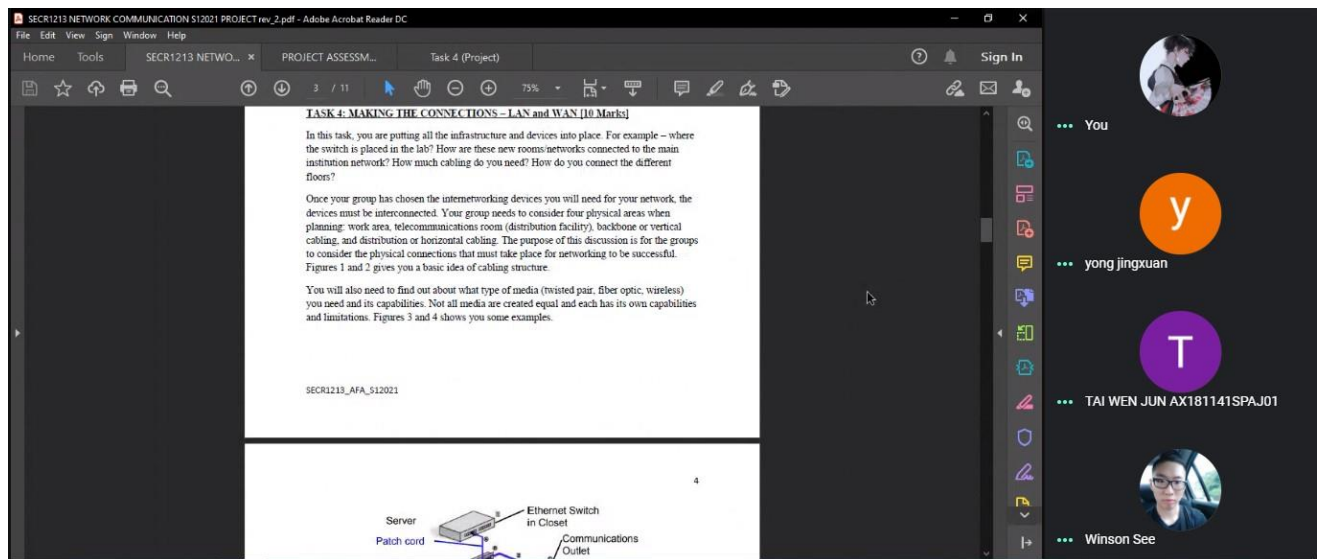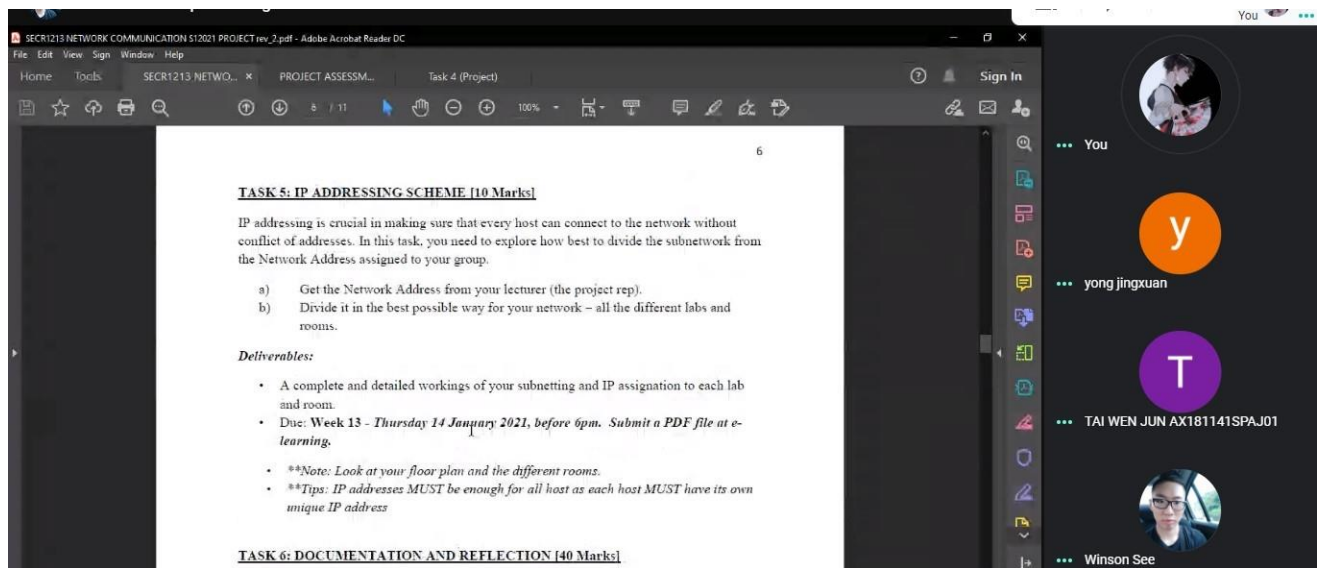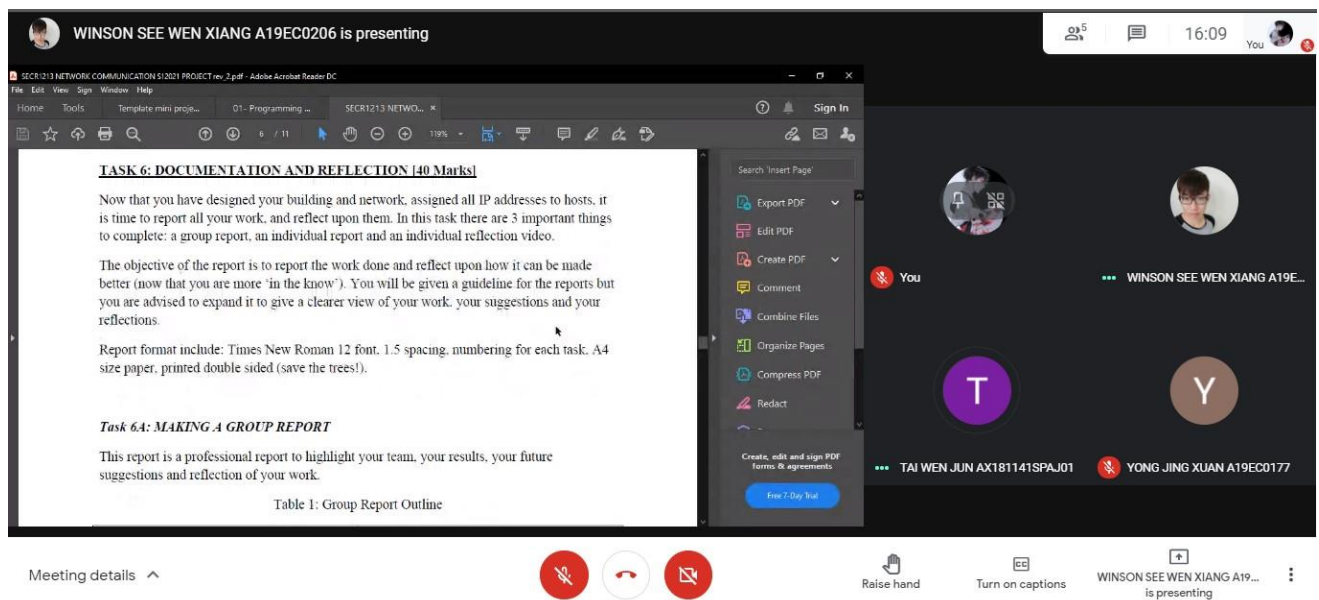*Figure A5:   Meeting of Task 5*

Figure A6:   Meeting of Task 6