Technology and Information System (SECP1513)

Design Thinking

Session 2020/2021

CHAPTER 7: SECONDARY STORAGE

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1.0 Introduction

1.1 Design Thinking

Design thinking is an approach that been used by many developers in order to understand the desire of a user. Design thinking is an extremely important way to have a deep interest in developing the needs of the user as it helps us in variety of ways from the basic step of questioning their problem to the last step of testing the solution that been created. By reframing the problem as a human centered problem, as we develop empathy to the user, problems that been tackled either known or unknown, can still be solved in the brainstorming session as it allows us to think outside of the box and think of a creative way to solve the problem. Furthermore, it helps in applying a hand on approach by making prototype and testing phase that allows us to redefine the final product. Design thinking includes works like questioning, thinking, sketching, creating and testing.

In other words, there are five phases in design thinking: empathy, define, ideate, prototype and testing.

1.2 Secondary Storage

Secondary storage is a nonvolatile storage and a permanent storage as it stores programs and data regardless of power and permanently saves countless information that can be used in the future. Secondary storage is an extremely crucial part in computer because without it, many data would be lost at the time the computer is switched off. Secondary storage usually exists in a physical state that holds data and programs. It also exists in variety types that hold variety capacity. There are several types of secondary storage; the first one is hard disk. Hard disk do exists as an internal device or external device. Secondly is the solid-state storage which is widely used by people from many backgrounds as it is the easiest one to carry. Optical discs is also one of the secondary storage been used and it can hold data up to 128 gigabytes. In the world of modernization, cloud storage is quite famous as the users only need internet to store data and information. Meanwhile for big organizations or companies, they store their data and information in secondary storage called mass storage devices.

2.0 Detail Step of Design Thinking

DATE	ACTION
2 November 2020	1. Whatsapp group created. 2. Started a group meeting: - Discussed about design thinking. - Came up with questions to ask.
3 November 2020	1. Divided ourselves into 3 different online interview sessions. 2. Joined the 3 different online interview sessions. - Session 1, 2.30pm, UTM IT Infrastructure: Data Center & Networking : by Mr. Khairul Nizam, Mr. Jaafar, Mrs. Rozee & Mr. Nik Kamal Izuddin - Session 2, 3.00pm, UTM Database Admin: by Mr. Aris Arifin - Session 3, 3.30pm, UTM Network Admin: by Mr. Mohd Zahari 3. Joined the same online interview session in the evening. - Session 4, 9.00pm, Software Application: by Mr. Mohd Faris & PM Dr Murtadha 4. Conducted a survey about secondary storage.
4 November 2020	1. Discussion in Whatsapp group: - Collected the outputs from the online interview session. - Brainstorming the alternative ways to overcome problem. - Agreed to the most relevant solution.
5 November 2020	1. Started writing the report, slides for presentation and prototype.
6 November 2020	1. Kept in update with everyone's tasks.
7 November 2020	1. Finished prototype and 80% of report.
8 November 2020	1. Collected feedbacks from the users.
9 November 2020	1. Final update of assignment before submission.
10 November 2020	1. Submission of assignment

3.0 Detail Description of Design Thinking

As we gone through the first phase, which is empathy, we found out the problem of current technology related to our topic which is secondary storage.

3.1 Problem

From our investigation, observation and interview sessions, we spot one problem that is quite common. The problem is; whenever you have limited storage in phone, you must either have to switch on the laptop and transfer everything to the flash drive or upload things in the cloud storage. For the first condition, it is quite time consuming to do everything especially when you are in a rush like in travel. Furthermore, imagine you are travelling and at the same time your storage already had reached its limit; you do not have any other option than to upload it in the cloud storage. However, there are trust issues to upload things into cloud storage because in this modern era, anything can happen in the internet with or without our concern. We can see many bad cyber issues happening around the world or even in our own circle too. In addition, uploading things into the cloud storage needs a lot and super-fast internet access or else, you cannot successfully upload it into the cloud storage and you will face the same problem again from the square one; limited storage.

3.2 Team-working

At the moment we identify the problem, we came up with a plan to think and brainstorm to find the right solution for the problem to be solved.

3.3 Solution

After we threw out all the ideas we had, we agreed to the most rational and useful idea; to upgrade the current secondary storage, but make it able to Bluetooth. This solution seem very simple, yet we found out this is the most right way to overcome the problem as it does not require internet access to upload things into the HDD and of course it does not require us to bring laptops everywhere just to transfer things from the phone into the HDD. Of course, there will be no trust issues because it would not be uploaded into the internet and not a time-consuming at all.

4.0 Design Thinking

4.1 Design Thinking Challenge

With the knowledge that we had, we followed the five steps of design thinking, in order to get everything is right in order.

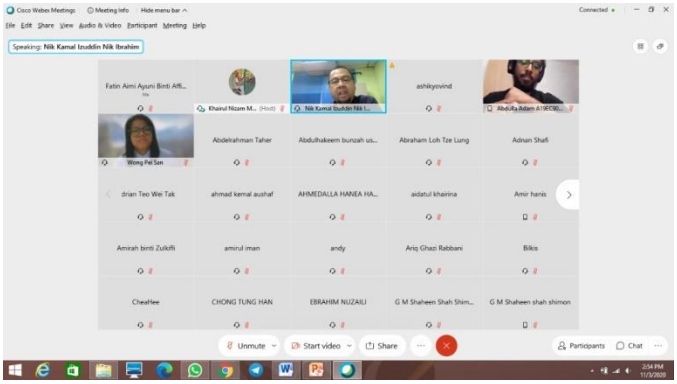
In the first step which is empathy, we had to interview the lecturers and staffs virtually because of the current pandemic situation. Other than that, we did a survey on SSD and cloud storage. For the define step, we took the problem stated and discussed about it. As problems been stated, we can easily understand their needs to get over the problem that they are facing. In the ideate phase, we brainstorm and create ideas to overcome the problem regarding secondary storage. After all the brainstorming activity, we chose the best solution for the problem. In the next stage which is prototype, we create a prototype that can best represent the idea that we had. For the last phase, we test the product to the users to see how it works and for improvement.

4.2 Design Thinking Steps

4.2.1 Empathy

In this phase, we went to three different afternoon and one evening online interview session and collected some relatable answers to our topic as it was a packed meeting so we only got a slight chance to ask question.

Session 1, 2.30pm, UTM IT Infrastructure: Data Center & Networking: by Mr. Khairul Nizam, Mr. Jaafar, Mrs. Rozee & Mr. Nik Kamal Izuddin.



Question: How did UTM kept all the data secured?

Answer: All data is being kept in Data Recovery Centre (DRC) that been regularly updated and back up. Other than that, to keep the data safe, the data is also being kept in Pusat Data Sektor Awam (PDSA).

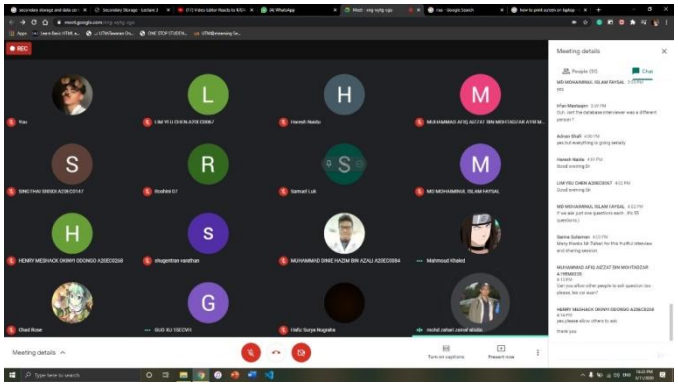
Session 2, 3.00pm, UTM Database Admin: by Mr. Aris Arifin

Question: Is it safe to store complex data in the secondary storage? How do big companies coop with huge information? **Answer**: If you have proper control, proper security and proper tools, then you can make sure the data is secure. You have also to make sure the data and storage have higher ability so if one fails then you have the other one to take over and you have to access it anytime.

Question: Do you prefer to store data in SSD or cloud storage? Why? **Answer**: We prefer the SSD as it is faster to be approach even without internet. Even though the price is higher but the access of the data is faster. Thus, we invest money to get faster access and to make sure that our users are happy and that's our concern, the budget is the secondary.

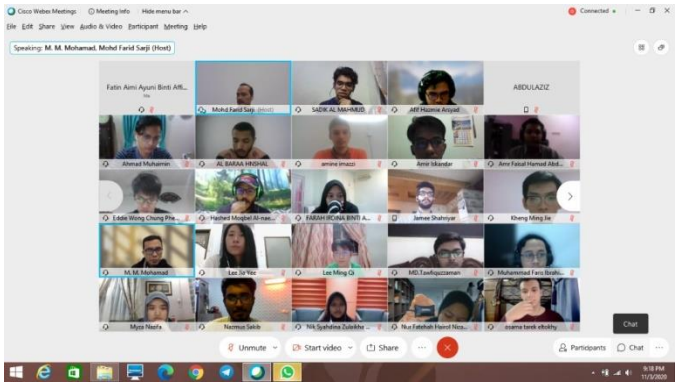
Session 3, 3.30pm, UTM Network Admin: by Mr. Mohd Zahari

Question: As far as I know, UTM is a large organization so what kind of networking storage UTM used to accommodate and adapt to this huge amount of students? Storage Area Network (SAN) or Network Attached Storage (NAS)?



Answer: UTM uses both SAN and NAS to adapt to the volume of data and servers handled in UTM digital center. This is because UTM have thousands of students so, with having this both storages, they can easily have a stable server and network for the students to access the internet for example e-learning website which is used for the students to check their assignments and course overview.

Session 4, 9.00pm, Software Application: by Mr. Mohd Faris & PM Dr Murtadha

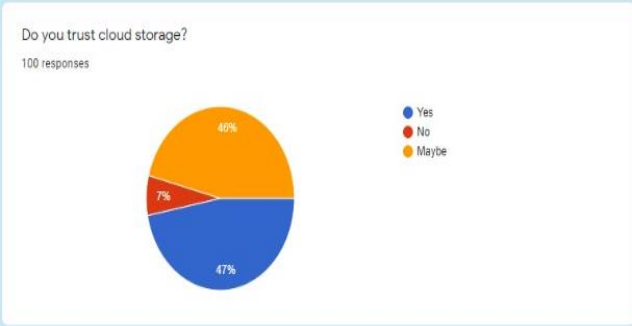


Question: For secondary storage, which one do you use the most?

Answer: At the moment, I use both USB pen drive and portable hard disk. However, I use cloud storage a lot because of the excellence of internet access in UTM. As far as I use it, I encounter no problem with the cloud storage as the internet access is excellent.

Other than four online interview sessions, we also decided to carry out a general survey to random people on their opinions about solid-state storage and cloud storage. The survey includes questions such as their preferences on solid-state storage or cloud storage, the problem they are facing when using both and their trust with cloud storage.

From 100 respondents, 68% are female and 32% are male. 97% of the respondents age 18 and above, meanwhile the rest is from the age below 18. Out of 100 respondents, 54% prefer to store their data in Cloud Storage and the rest prefers to store in solid-state storage. From the survey conducted, the most problems that users are facing when using solid-state storage are limited storage and time-consuming as they need to find laptops as the third party to transfer data from phone to the secondary storage they are using such as pen drives. As for cloud storage, the most problems they are facing when using it are also limited storage and time-consuming when they have weak internet connection because to upload things into cloud storage, one must have a stable and excellent internet connection.

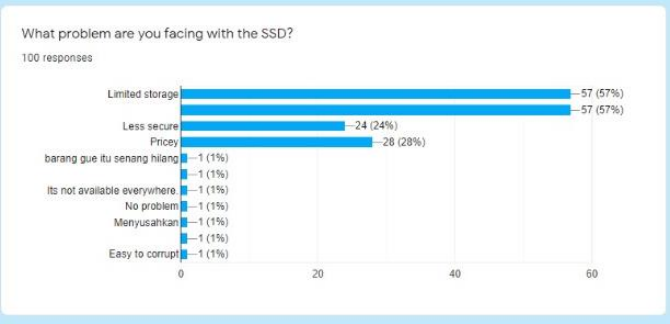


However, from 100 respondents, only 47 respondents fully trust the cloud storage, while 7 respondents do not trust the cloud storage and the other 46 respondents said they may or may not trust the cloud storage, which means, they also felt unsure about the cloud storage.

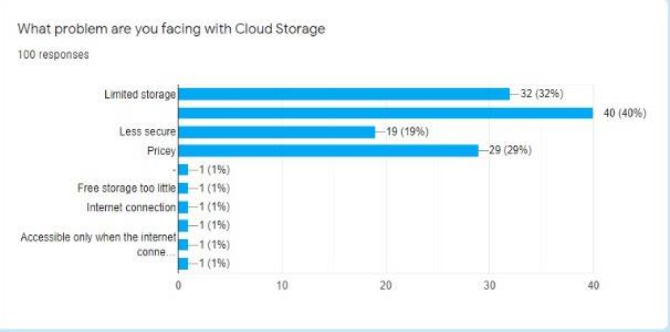
4.2.2 Define

From all the questions asked, we listed out the problem faced by the user in term of secondary storage.

From the interview session, even though they did not state the problem directly, but we can derive things that might occur when they are using what they use right now. For instance, in the session 4, the speaker said that he prefer to use cloud storage because of the excellence of internet connection in UTM. Speaking of another perspective, if the internet connection in UTM is weak one day later, he might face problem to access all the data that he store in the cloud storage because of the limitation of internet.

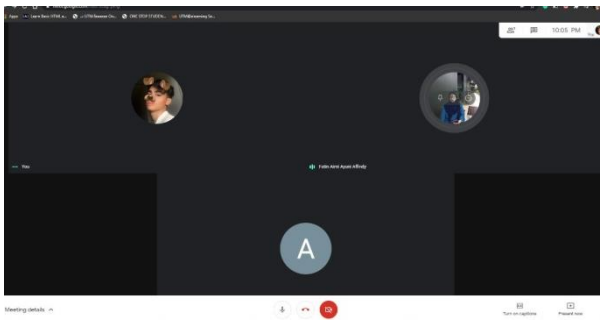


Speaking of the survey, the problems they are facing when using solid-state storages are; limited storage, time-consuming as they need to switch on laptop to transfer everything, less secure, a little bit pricey for some people and more to list. Some of them agreed that they have experience losing solid-state storage like pen drives and memory cards and they lost their data and information. Some of them also agreed that when they store data in solid-state storage, they cannot access it everywhere as they need to bring it everywhere in order to get access into it.



Meanwhile for cloud storage, they faced problems like having limited storage, time-consuming when they have weak internet connection, less secure, a little bit pricey for some people when it comes to widen the storage and more to list. Some also agreed that free storage provided in cloud storage is too little and they need to pay in order to expand the storage. They also mentioned that the quality of photos or videos they upload may go down, which means the quality from uploading is not the same as the quality after uploading. Lastly, they mentioned that in order to store, access or download things from cloud storage, require a stable and excellent internet connection. This is a huge problem for those who live in rural areas because those areas often face internet connection issues.

4.2.3 Ideate

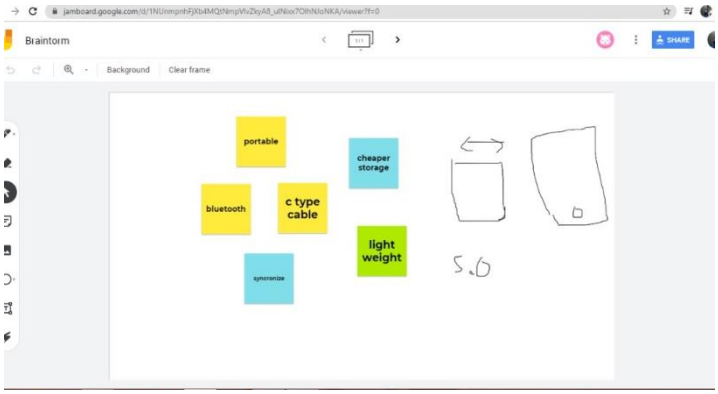


In this phase, as we gone through the previous two phases, we decided to focus on the hard disk. The survey we did ask about the usage of solid-state storage and the usage of cloud storage, but we agreed that we better focus more on HDD specifically external hard disk and improve the features in it. This is because HDD is still a reasonable secondary storage that been used in these days even after the existence of cloud storage. Other than that, HDD is way cheaper than SSD in today's market as you can get cheaper price when buying HDD at the same capacity the SSD providing.

One of the ideas that we came up with is to enhance the feature of HDD in term of synchronization. By mean, we would like make everything in the external hard disk sync with what's in the cloud storage. As in this case, if the user forgets to bring the external hard disk, they still can access to their storage through cloud storage. In addition, if they lose their data in cloud storage for some reason, they still can get back to the data in the hard disk. However in this case, we do not see any improvement on what is already we had right now. By mean, in

this case, the external hard disk is not fully functional as there is nothing different if the user just uses the cloud storage instead of any physical state storage. This can be proved in the survey that we did, where nobody said they lose their data in the cloud storage. There may be some who experience data lost in cloud storage, but that is not the main issues of user using cloud storage. This means current cloud storage is excellent enough to work for now.

For another idea, we came up with innovating solid-state storage that is cheaper than current SSD. The issue of people not using solid-state storage is because it is quite expensive compared to HDD even though both offer the same capacity. Well then, when we discuss further, it may be impossible to make it cheaper, at the same time offer the best security and well functioned SSD. As in cloud storage, it is also quite impossible too to offer cheap price in order to widen the storage more. This is because cloud storage needs maintenance and backups all the time in order to guarantee the user that the data is safe and sound.



At the end, the outcome of our discussion is to enhance the features that already exist in external hard disk which is to add up Bluetooth feature. As far as today's invention, external hard disk needs to be connected to laptop in order to dig in all the information in it. You need USB cable to connect the external hard disk to the laptop. And even worst, if you do not have the laptop charger and the laptop is running out of battery, you will not be able to transfer everything at that moment.

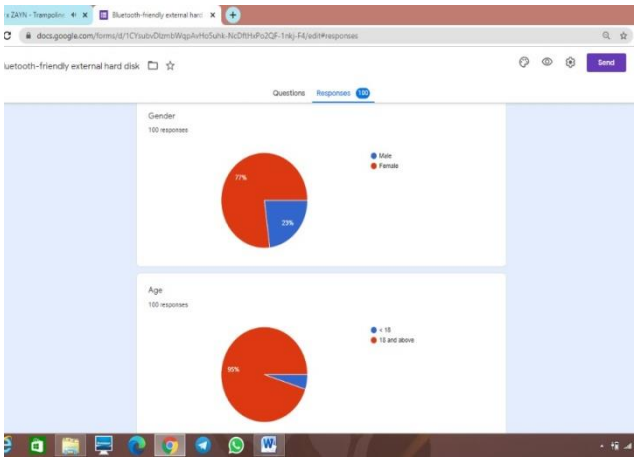
As mentioned in the previous paragraph, in term of accessibility, we would like to develop a Bluetooth feature on the external hard disk so it will ease the users to get access into the hard disk. In addition, if the users opt to use cable instead, the usage of type-c cable will be used as it is the newest cable and the faster to get access compared to micro-USB cable type. This will somehow upgrade the external hard disk from looking old-schooled. In addition, external hard disk offers cheaper price with larger capacity which will satisfy the needs of the user.

4.2.4 Prototype

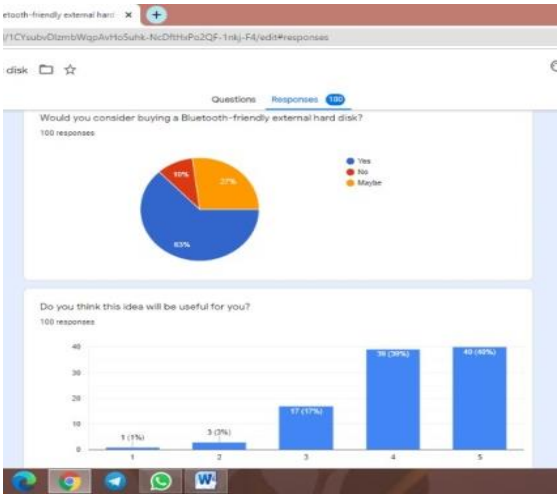
As for the prototype, we created them out of cardboard and make a phone and hard disk miniature. As for the cable, we used a rope as if it is a cable. The prototype we made applied the ideas that we agreed on, which is to make a Bluetooth-friendly external hard disk that may ease the users to transfer their storage without any cable.

The left side of the photo is the phone and the right side is the hard disk. The cable that connects the phone and hard disk is type-c USB cables that can make things go faster. The Bluetooth sign on the phone's screen indicates that the hard disk is being connected to the phone through Bluetooth. The connecting cable only indicates that the users can opt to connect Bluetooth or to use cable to transfer their data. We did try our best to make sure that the prototype is exactly the same like the idea we agreed on. This is somehow will make the uncertainty of our idea be reduced. We had the idea to put the price on our product in the range of RM50 to RM150 for 1TB storage.

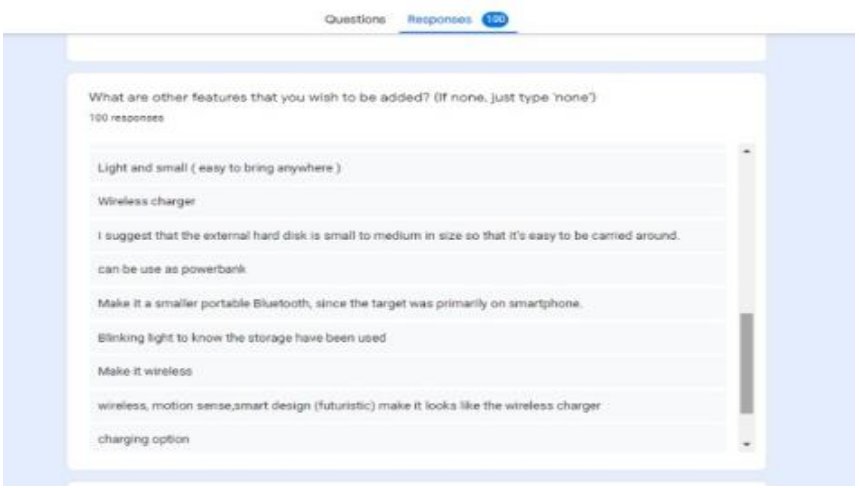
4.2.5 Testing



Due to current situation, we do not get chance to test our prototype to the users face-to-face. Instead, we provide a survey to see their feedbacks on out prototype. In the survey we did, we successfully got 100 respondents where 77% are female meanwhile the other are male. From the 100 respondents, 95% age 18 and above meanwhile the rest are below 18.



50% of the respondents do not use external hard disk to store their data, 38% store their data in the external hard disk meanwhile the other 12% are unsure whether or not they store their data in it. However, when it comes to the question showing our prototype, 63% are considering to buy the product, 27% are unsure meanwhile only 10% of the respondents will not buying the product. From the scale 1 to 5, 79% of the respondents agreed that the product is useful for them where 39% vote at the scale of 4 and 40% vote at the scale of 5. Meanwhile 17%, 2% and 1% vote at the scale of 3, 2 and 1 respectively. This means that our product really did satisfy the need of the user.



As for the suggestion part, the respondents did give out their wants in the product. The suggestions include make the hard disk become charge-friendly. By mean, they want the hard disk to act as a power bank as well rather than as a hard disk alone. This will give them benefits of both at the same time, where they can store the data and at the same time charge their phone. At the same time, bringing the hard disk will become more reasonable because not only they can transfer their information to the hard disk, they also can use it as a power bank whenever their phones are running out of battery. Other brilliant feedbacks from the respondents are adding a blinking light as an indicator of the storage that had been used in the hard disk, adding a backup system just in case they lost their hard disk and making the hard disk smaller and lighter so they can be easily carried everywhere.

As for the price range the users are willingly to buy is almost the same like our expectation. 60% of the respondents are willingly buying the product at the price range of RM50 to RM100, 13% agreed to buy it at the price more than RM100 meanwhile 27% vote for the price below RM50. This brings the meaning that our product will be at a very reasonable price because 73% of the respondents are expecting the price to be more than RM50.

5.0 Reflection

5.1 Goals and Dreams With Regard to Our Program

Before anything else, we would like to express our gratitude for being accepted into Universiti Teknologi Malaysia (UTM) especially in this program which is Graphic and Multimedia Software. It is a great pleasure for us to study in this field as it can be considered as one of the job demands for today's life, especially with this modernization happening around us.

For the very first and foremost, our goal is to have a wider vision and clear purposes for studying in this field. Some of us may or may not have a crystal clear vision on how this field will bring us success in the future life. Thus, by studying this field in detail, we believe it can give us a better and clear vision on everything that is happening to ourselves right now.

Speaking of another perspective, time management is also plays a vital part in this field, and we believe for any other fields too. An excellent time management can be described if we manage to get finish with everything before the due because we believe that on time is late. Other than that, having an excellent time management means we do not postpone everything and finish it on the very last minute which will give us more consequences than benefits.

5.2 Impact Design Thinking on Our Goals and Dreams With Regard to Our Program

Design Thinking really gave impacts on our goals and dreams especially for being in Graphic and Multimedia Software. This is because design thinking requires us to think outside of the box and to put ourselves in others shoes which means to feel what other feels.

Design thinking really helps in term of creativity because we get to think critically on how to solve problem by innovating something extraordinary because mainstream is boring. It trains us to fulfill the users' needs so they will not feel regret to buy and trust our product. In addition, it makes us think of other countless function of a hard disk instead of focusing on what is already invented. By mean, we got to think the hard disk may function in a different way instead of the function itself right now.

From another perspective, we learn to accept our colleague's idea by not judging before everything. This is because human think in a different way from each other as different people have different perspective. It teaches us to have a great teamwork to work on the problem so we can find the right solution that not only will give benefit to the user, but to ourselves as well.

5.3 Actions and Improvement to Improve Our Potential in the Industry

From Design Thinking, we realized that we need to take action and improve from various type of perspective. This will somehow increase out potential in the industry in years ahead of us.

Firstly, we need to improve ourselves in term of risk. In this perspective, we shall be brave in thinking of other way around even if it takes risk because if we don't, we might stay at the same hole and not improving at all. Being a risk taker really should increase our potential in the industry because we are not afraid of every what ifs that everyone else are always thinking. Even an employer would like their employees to be brave in whatever decision that been made.

Other than that, we should also improve ourselves in term of communication. This is because in the industry soon, we will work with different types of people. We should learn how an effective communication happens just so it can ease our tasks in the future. Effective conversation results a tasks to be successful with great teamwork.

6.0 Task for Each Members

GROUP MEMBERS	TASKS
Muhammad Luqman Bin Nazam	• Acts as a leader. • Making sure everything is done on time. • Joined the third and fourth online interview sessions and asked questions. • Provide evidences from the online interview session. • Gave ideas on report. • Provide slides for presentation. • Edited video for presentation.
Aliya Malika Sugimin	• Acts as an active member. • Joined the second and fourth online interview sessions and asked questions. • Provide evidences from the online interview session. • Gave ideas on report. • Creating prototype.
Fatin Aimi Ayuni Binti Affindy	• Acts as an active member. • Joined the first and fourth online interview sessions and jot down important answers from panels. • Provide evidences from the online interview session. • Writing the report.