

SWEN90016 Software Processes and Management

# Assignment 2A

## Project Charter and PMP

Choice of SDLC: Waterfall

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## 1. Executive Summary

The Travelling Technology Bus project aims to spark the regional area students' interest in STEM subjects. There are two or more phases of this project, while this report will only cover the contents of the phase one development. The goal of phase one is to design a web application to assist bus schedule as a "proof of concept" prototype, to help business owners bid for grants from funding agencies. This task has been taken by a student team (Group T04\_01) from SWEN90016 subject of Melbourne University for cost-effective reasons from business owners' perspective and study purpose from students. The cost is \$0 for phase one, and a fully functional web application and documentations can be expected around October 17th, which makes the development period around one month.

This project management plan covers analysis and main findings of the following aspects: the key stakeholder, the project scope, chosen software development lifecycle (SDLC) model, business values, project constraints, project governance methods, key risks, chosen technology and project planning. Firstly, six key stakeholders have been identified: business owners, students as end-users, school representatives as end-users, student team, sponsors, and employees. Then combined with the requirements given by the business owner, the project scope, both in-scope and out-of-scope functionalities and contents have been addressed. Followed by that, the waterfall SDLC method is chosen and discussed, and the business value, including public benefits, good brand image and job opportunities, are addressed. Furthermore, ten project risks have been identified, including five specific risks of the project and five generic risks. Meanwhile, the project constraints have been analysed from the project's scope, resources, quality and risks aspects. The technology tool is chosen to be PySimpleGUIWeb in Python since it supports the development of a single module separately is easy to integrate. For project planning, the Gantt chart and the Program Evaluation and Review Technique (PERT) chart used for waterfall planning and project governance methods have been clearly presented.

## 2. Introduction

### 2.1. Purpose of Document

This document is the project management plan of the phase one “Proof of Concept” development for the Travelling Technology Bus project, conducted by Group T04\_01 students enrolled in SWEN90016 from Melbourne University.

Travelling Technology Bus project is the code name for a well-designed bus that showcases the latest technologies to students in the regional area to spark interest in STEM subjects. Phase one of this project aims to provide a “Proof of Concept” to showcase this concept to the target audience by delivering a featured web application. This project management plan provides a general framework and specific strategies for the execution of the prototype for the Travelling Technology Bus project. This PMP includes discussing key stakeholders, the project’s scope, the discussion of a chosen SDLC, project governance methods, potential risks, and project planning. This is a live document and will be updated as required for distinct phases.

### 2.2. Audience of Document

The intended audience for this document is business owners, funding agencies, all team members and project supervisors.

### 2.3. Evolution of Document

| Version | Individual Responsible | Date created | Comments   |
|---------|------------------------|--------------|--|
| Phase 1 | Yang Song              | 12 Sep 2021  | No web application delivered at this stage. Updates will be available shortly. |
|         |                        |              |  |
| ...     |                        |              |  |

### 3. Project Information

#### 3.1. Key Stakeholders

The following people and organizations are critical stakeholders in this project:

- Business owners. Business owners proposed the idea of the Travelling Technology Bus. They identified the requirements for the scheduling system and have the authority to make decisions on using the system the project will deliver or not. The business owner has the responsibility to provide some expertise resources to the development team. It is essential that they feel satisfied with the project's result and rely on it for other work (phase 2).
- Students are the end-users. They will use the scheduling system to take a bus at a scheduled time. As they are the users of the system, they feel happy when using it is also significant. If their attitude towards using this system is negative, it will directly lead to the project's failure. Students, especially those who live in Maryborough, may rely on this scheduling system to exposure to STEM subjects.
- School representatives as end-users. Using the scheduling system, they can request or cancel a bus visit and choose a suitable time. Like the importance of students to this system, school representatives also have high power and high interest in this project – one of the goals of this project is to get them to use the scheduling system actively.
- Student team / development team. As directed by the requirements from Sally and Anna, the student team will execute the tasks in the project plan and produce deliverables -- the scheduling system within the specified time and limited resources. They are an integral part of this project because they are directly accountable for it. Whether the project plan at first, the project implementation, or the system is commissioning at final, the student team are all responsible for them. Their success or not is the outcome of this project.
- Funding agencies / sponsors. They may commit resources, such as money, support, among others, for the project. Whether they are happy and interested in the progress and

results of the project will directly determine the number of resources available for this project, and as we all know, the cost is one of the main constraints of project management.

- Employees, including Admin User (Moderator) and support staff. They can roster a schedule for a school in the scheduling system, drive a bus for students to visit a school, or even provide support for students to engage in STEM. Even though they do not seem too important, they play a defining role in the regular operation of the scheduling system; without them, the system cannot be operated.

### **3.2. In-Scope**

The main task of this project is to design and deliver a Web Application. Also, the scope of our website project analyzes from two parts: functionality and content (Romero, 2018).

#### **3.2.1. Functionality Aspect**

The Web Application we developed should make the end-users complete their goals and leave satisfied from the functionality aspect. In other words, considering this project's goal, this Web Application should help manage the Travelling Technology Bus schedule. Referring to the requirements listed in the case study and analyzing the use cases, we can get several use cases shown in Fig 1 and Fig 2.

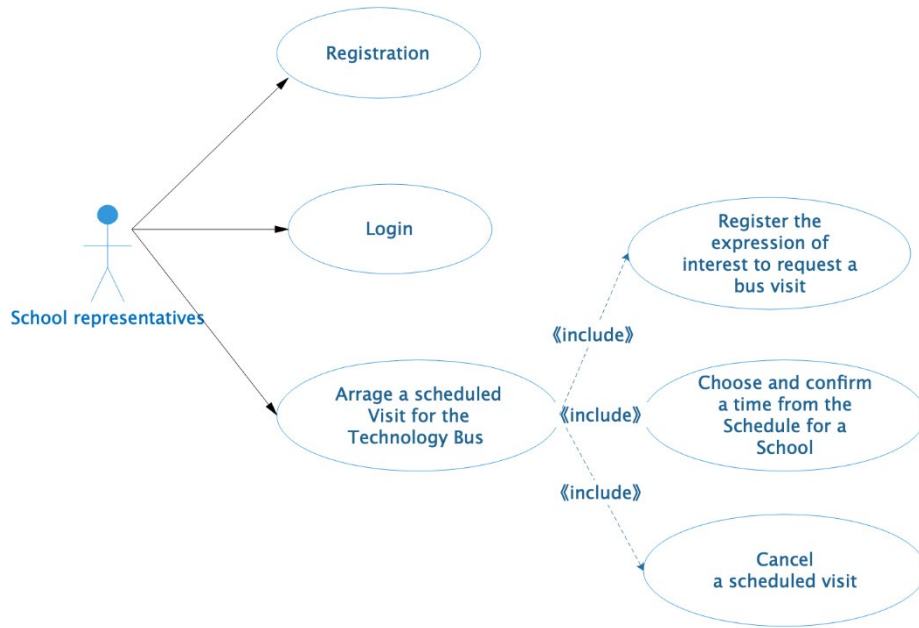


Fig 1. User Case 1

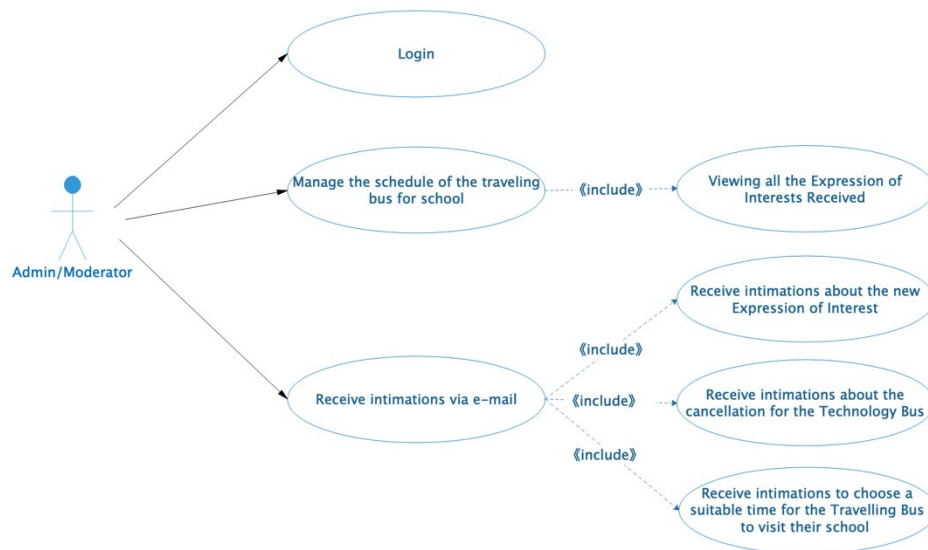


Fig 2. User Case 2

### School Representatives' Functionalities

School representatives are one of the essential types of end-users of this web application. To be more concrete, they can register by filling in basic information including 'School name', 'Contact name', 'Contact number', 'Email' and 'Password'. Additionally, they can log into the Web Application using their email address and the corresponding password. Furthermore, schools' expression of interests can be collected via writing details containing 'School name',

'School address', etc. Also, they can arrange a scheduled visit for the Travelling Technology Bus (i.e., registering the expression of interest to request a bus visit, choosing, and confirming a time from the schedule for a school and cancelling a scheduled visit).

#### Admin (i.e., moderators) Functionalities

The moderators should have a given admin account, including an email address a corresponding password, to manage the schedule of the travelling bus for schools. The admin account should be provided by the development team at the end of the designing phase. In addition, the admin user can be allowed to view the list of all expressions of interests received from different schools in a tabular form containing two columns with the name of the school and school type after logging into the system. Furthermore, it is available for the admin to roster a schedule for a school by choosing a reasonable start date and end date for a particular school.

#### Auto-email Functionality

Also, this Web Application needs to update the information promptly and inform the related users as soon as possible via email. To be concrete, the Web Application should send emails to the admin user when a new school inputs their expression of interest and can send emails to inform the school to choose a suitable time.

#### Database

Setting up databases to store users' information and schedule details is necessary.



### **3.2.2. Contents Aspect**

Our development team considered the contents of this web application. Firstly, we are required to design a registration interface for the admin user and the user interface (UI) including the school registration web page, the expression of interest web page, the expression of interest listing web page, the rostering a schedule web page, the confirming a time from the schedule web page, and the cancelling a schedule visit web page. In addition, we must contain all the user interface elements mentioned in the case study's requirements on each web page.

### **3.3. Out-of-Scope**

The following requirements will be seen as out of scope and will not be covered in web application development.

- Deploy the Web Application on either kind of web browser or multiple platforms.
- Allow the Web Application to be supported on Android and iPhone.
- Create a separate User Interface for creating the Admin User.
- Choose a kind of database that is efficient and costly.
- Allow for casual STEM staff to sign in and apply for this Web Application as moderators.
- Include payment systems in this Web Application and allow schools to pay online using shopping carts and other electric cars.
- Include a module for informal STEM staff training in this Web Application.
- Send information and newsletter reminding the schools near the Bus locations to book in for a visit automatically through this Web Application.
- Include a payment gateway in this Web Application to allow the donations to be made to this project from business sponsors.
- The Web Application will be flexible to add or alter functions.

### 3.4. Delivery approach / SDLC

☒ Waterfall

☐ Agile

☐ Incremental

The software development life cycle (SDLC) model that our team decide to use is the formal SDLC model, waterfall. Waterfall follows a sequence of steps and will not move to the next step if the previous phase has not been finished. There are the following reasons why this decision was made. The comparison between waterfall and agile, as well as the comparison between waterfall and incremental model will be included in this section.

Firstly, from the case study, the requirements provided by Sally and Anne are detailed and structured. Comparing to agile, the waterfall model requires clearly defined, fixed, and documented requirements from clients, which means clients should have a clear view of what they need (Alshamrani & Bahattab, 2015). Moreover, Rastogi (2015) also states that the waterfall model emphasizes planning in the early stage; the design flaws need to be ensured before development. Therefore, the waterfall model is suited for the case study.

Secondly, the end goal is determined early. Waterfall is committed to the end goal at the beginning. For this project, our goal is to build a web application as a prototype that covers all requirements within the scope which is clear enough to every team member. Besides, for a small-scale project with a clear end goal, the probability of significant changes is low. Thus, the advantage of Agile which is good for changes may not be that important.

Thirdly, since our team has less experience with software development, the formal SDLC model, which is friendly to inexperienced developers, should be applied. According to Ragunath et al. (2010), Kramer (2018) and Adenowo and Adenowo (2013), the waterfall model is easy to understand, use and manage because of the rigidity of the model as Khurana and Gupta (2012) and Bassil (2012) indicate that each stage in the waterfall model must be accomplished entirely before the permission of the next stage start. In addition, a review will be held to check whether the project is on the right track and whether we can move to the next stage at the end of each stage. Nevertheless, agile requests developers to be much more

experienced than the waterfall; as Lindvall et al. (2002) argue, experience is essential for both agile methods and building systems to succeed. In this case, the waterfall model's apparent linear and rigid characteristic is efficient and effective to inexperienced development teams like student teams, allowing student developers to apply the method easily.

Lastly, both the incremental and waterfall models are formal SDLC models; the reasons we choose to use the waterfall rather than the incremental model will be explained in this paragraph. Considering that our team size is ridiculously small, which only has four team members, plus the waterfall needs fewer resources, such as the number of developers compared to the incremental model. Furthermore, the project from the case study is not complex, which only needs a schedule management system without any other functions such as a payment system, as Rangunath et al. (2010) found waterfall works well for more minor software development projects requirements are well described. Moreover, as Zalk (2021) emphasizes, defining the increments is complicated and usually unclear for incremental models. To partition the increments, it requests that developers have more experience and high skills. In addition, the final integration can always increase the risks for the project, and problems may always occur while integrating. Hence the waterfall model is selected in the project instead of the incremental model.

### **3.5. Business Value**

The business values are public benefits, good brand image and job opportunities.

The scheduling system can help young students in regional schools expose themselves to STEM subjects and spark an interest in STEM. Due to students' use of the scheduling system or the increase of students' interest in STEM, some regional schools that have not yet opened STEM courses may offer such courses so that more students can expose STEM subjects. Without this project, students will be less likely to be exposed to STEM.

Since this is a “not for profit” project, government and business sponsors provide public benefits for society, which is an expression of social responsibility. For these business sponsors, this is particularly good for their brand image. With the wide use of the scheduling system, their brand image will be improved, and more people will choose these brands, increasing their revenue.

For employees, the operation of the scheduling system will bring them many job opportunities. The scheduling system needs moderators, bus drivers, support staff, among others, which are new job opportunities for the region where use the system.

Also, this project will be valuable project management and project development experience for the development team, which will be beneficial for future job searching in this area. In the project process, the team can also gain experience on how to arrange time reasonably and communicate effectively.

### **3.6. Constraints**

- The aim of the Web Application is to manage the schedule of travel buses.
- Team members have less experience in developing software. The main scope of this project is to develop a web application for travel bus schedule management. Although the students who play roles as Technical Subject Matter Expert have experience developing accessible WeChat applets and Websites before, they still do not have sufficient ability to design and deliver a perfect web application (i.e., perfect in both UI, UX and data storing).
- A virtual team cannot communicate with each other face to face, so that it is inconvenient to discuss the design of software detailly and clearly, therefore, the overall performance may be affected.
- Customer Satisfaction can be a crucial project constraint (Master of Project Academy, 2017). To be more specific, the difference between Start Date and End Date school

representatives can choose shall be at least one week but no more than three weeks. Additionally, the admin cannot choose the Start and End Dates which have already been scheduled for other schools, also the gaps between the Start and End Date should be within 2 months.

- We use the Waterfall model to manage this project. Since this model only allows customers to respond at the end of the phase. There may be risks over customers rejecting the final products, which means the implementation of this project fails. Thus, our team is required to follow each step carefully when we are developing.

## 4. Project Governance

### 4.1. Roles and Responsibilities

| Name      | Roles                             |
|-----------|-----------------------------------|
| Yujie Lu  | Business owner & Technical Expert |
| Yang Song | Project Manager& Technical Expert |
| Jiaqi Liu | Senior User & Technical Expert    |
| Handan Yu | Senior User & Technical Expert    |

Table 1. The Roles of Waterfall SDLC In the Project

**Business owner:** The business owner has the responsibilities of conveying precise requirements and signing off scopes of the project. The business owner is required to attend meetings scheduled by the project manager.

*Team member: Yujie Lu*

**Project manager:** The project manager will need to do the overall project planning; ensure the project execute respecting its scope, time, and cost; maintain good relationships with key stakeholders and conduct regular meetings with stakeholders Etc. Besides, the project

manager will need to ensure people know what is expected and supervise assigned tasks, providing resources when needed.

*Team member: Yang Song*

**Senior User:** Senior users are representatives of everyday users who will use the application. Senior users will need to communicate with the project team and make sure the solution will meet users' needs. Senior users are responsible for providing regular feedback to the design team.

*Team member: Jiaqi Liu, Handan Yu*

**Technical Experts:** Technical Experts from the development group and are responsible for the design and prototyping of the project. They will need to design and build a prototype that meets users' needs.

*Team member: Yujie Lu, Yang Song, Jiaqi Liu, Handan Yu*

Besides, all members need to know clearly about their responsibilities and deadline, contribute ideas to the project and be prepared to assist other members; join the regular meetings and work together to overcome obstacles.

## 4.2. Communication Plan

| Stakeholder       | Communication objective   | Format                          | Frequency  | Owner                              | Importance |
|-------------------|---|---------------------------------|--|------------------------------------|------------|
| Business owner    | Provide updates on project progress, key issues.<br>Approve final prototype and final acceptance. | Zoom meeting, Report            | Weekly   | Project manager                    | Critical   |
| Senior User       | Provide user needs description, provide feedback.   | Zoom meeting                    | Weekly   | Project manager, Technical Experts | Critical   |
| Technical Experts | Design and build prototypes, issues in the developing stages.                                     | Zoom meeting, instant messaging | Twice a week (Every Wednesday and Friday 9am - 11am) | Project manager                    | Mild       |

Table 2. Communication Plan Table

Communication with business owners will primarily be email and zoom meetings. The project manager is responsible for sending the invitation to the business owner, including time, date, meeting purpose, meeting room link Etc. Documents such as PMP, design sketches or prototypes will need to send through email before the discussion meeting follows, better together with the meeting invitation.

Communication between the team will be facilitated primarily by Zoom for meetings, WeChat group for instant messaging and Microsoft Team Group for document governance. The project manager is responsible for preparing the meeting outline and giving notice to team members about the meeting purpose, providing meeting links and sending it into the WeChat group for team members to join. Besides, the WeChat group can be used for team members to request

help, request resources, raise issues, or just random chat to build relationships. To keep track of changes to the documents in Microsoft Teams, team members are required to add comments of what they would like to modify to inform other members. Other members will react to the changes by replying to the comments. Significant changes will be brought up to the meeting to discuss.

### 4.3. Risk Management

#### 4.3.1. Specific Risks

There are five critical specific risks defined in the project displaying in the risk impact analysis table (Table 3), ordered from high-risk exposure to low-risk exposure (P\*I Score). Overall, two product risks, two business risks and a project risk were included and introduced in this section. For risks 1 and 3, product design defects, including unchangeable participation information and restriction of start date and end date, may significantly decrease the system efficiency and customer satisfaction. Furthermore, for risks 2, lack of authentication of the school registration system can harm the reputation of the business. Besides, for risk 4, which is the period of the start date and end date provided is restricted to one week to three weeks, can be an imperfect design and has a risk of losing profits. For example, if a school has few participants, one week could be too long and other schools lose the chance to visit for that week. On the other hand, three weeks may not be enough for schools with too many participants. There could be more profit if the bus stays longer than three weeks in that case. For risk 5, the defined scope of our project may cause risk because of the decision to focus on the PC version only.

| Risk ID | Risk Type | Description  | Probability (0%-100%) | Impact (0-10) | Justification  |
|---------|-----------|--|-----------------------|---------------|--|
| 1       | Product   | Schools cannot make any changes to submitted participation | 70%                   | 6             | The risk can significantly decrease the efficiency of the system. For example, |



|   |          |  |     |   |   |
|---|----------|--|-----|---|---|
|   |          | information, and they must cancel the scheduled visit and rebook it.   |     |   | schools have to cancel the booking to change the number of participating students.  |
| 2 | Business | Lacking an identification system after school registration, which means unauthentic users may access the system and make fake schedule visit bookings.   | 50% | 7 | Available time will be occupied by fake users, which cause less available time for real users and can cause a reduction in profit.  |
| 3 | Product  | Schools must choose the time between the start date and end date that the admin user provides. If the schools cannot schedule the event during that time, there is no backup plan.                             | 70% | 4 | The risk may decrease customer satisfaction because schools cannot submit a preferred time before the admin user allocates.   |
| 4 | Business | The requirement restricts the period between start date and end date, which is at least one week and no more than three weeks. Schools do not have freedom to set a period according to their student numbers. | 40% | 6 | It can cause other schools to postpone their scheduled visit due to the school with fewer students took the time. Moreover, for the school to have too many students causes not all students to have a chance to visit. |

|   |         |   |     |   |  |
|---|---------|---|-----|---|--|
| 5 | Project | Due to the time limit, the web application that our team decided to develop was only based on PC rather than smartphones such as Android and iPhone. However, some school representatives may want to make the booking on smartphone. | 30% | 4 | The compatibility of the web application would be a risk as it only supports PC. In this case, it may decrease the user satisfaction and efficiency of using the application because they must use a laptop or PC. |
|---|---------|---|-----|---|--|

Table 3. Risk Impact Analysis Table for Specific Risks

To deal with each specific risk that we defined, the risk trigger and response were analyzed and shown in the risk register (Table 4). Since the risk register is based on the risk impact analysis table, the risk IDs represent the same risk. For risks 1 and 5, we chose to ignore them because they request many resources if mitigating them. In addition, there will be not much benefit if mitigating them. Nevertheless, for risks 2, 3 and 4, the advantages of risks mitigating outweigh the disadvantages.

| Risk ID | Trigger   | Owner                               | Response  | Response Strategy Type | Resources Required |
|---------|---|-------------------------------------|---|------------------------|--------------------|
| 1       | The school tries to make modification of participation information. | Project Manager & Technical Experts | The admin user must spend time on checking and approving modification requests from schools if the system allows users to modify. Therefore, we will do nothing about it. | Ignore                 | People, cost, time |

|   |  |                                     |   |          |                    |
|---|--|-------------------------------------|---|----------|--------------------|
| 2 | Unauthentic users make registration.                                   | Senior User                         | The admin user calls each school to activate after they register.   | Mitigate | People             |
| 3 | The admin user offers a time that the school cannot make it.           | Project Manager & Technical Experts | The system allows school representatives to submit a preferred time to the admin user first.  | Mitigate | People, cost       |
| 4 | The school has too fewer students or the school has too many students. | Business Owner & Project Manager    | Redesign the schedule time system.  | Mitigate | People, cost, time |
| 5 | The school representative tries to make the booking on a smartphone.   | Business Owner & Project Manager    | The team will not do anything about it because it will spend much more time and money on developing a smartphone version except PC version, which may cause our team cannot complete the project within time limit. | Ignore   | People, cost, time |

Table 4. Risk Register for Specific Risks

#### 4.3.2. Generic Risks

Five generic risks are presented in an order from highest to lowest priorities in table 5. The number given for the probability and impact column is through historical project information and estimation under the current situation, such as the effect of Covid-19. Risk 6 presents a risk that there may be no participants of this Travelling Technology Bus project as the government lockdown rules due to the Covid-19 pandemic. For example, students may be

unable to attend school; the bus as an enclosed space may not be allowed to hold activities etc. Both the probability and the impact of this risk are high. The covid is spreading heavily in Australia and the project may be paused or terminated for this risk. Risk 7 indicates that the fundings may be insufficient for this project. According to the business owner, the grants will be from funding agencies and there is no guarantee of the amount. The impact of this risk is huge as the project may be paused or terminated. Risk 8 describes the hiring issues. The regional area has typically fewer resources than large cities, including STEM talents, which can limit the number of students who can participate, or features are presented on the bus. Risk 9 and risk 10 are very normal in most software projects. The probability of risk 9 is low as all members are students who enrolled in this SWEN90016 subject, and the census date has passed. So does the risk 10, the probability is low as the database structure is more straightforward than other software databases.

| Risk ID | Risk Type    | Description                            | Probability (0-100%) | Impact (1-10) | Justification  |
|---------|--------------|--|----------------------|---------------|--|
| 6       | Generic risk | No participants due to Covid lockdown. | 70%                  | 8             | The project is likely to be paused / terminated. Covid is spreading heavily.         |
| 7       | Generic risk | Fundings are insufficient.             | 50%                  | 9             | The project is likely to be paused / terminated.                                     |
| 8       | Generic risk | Hiring difficulties.                   | 40%                  | 6             | Activities in bus may decrease. / Participants may decrease.                         |
| 9       | Generic risk | A key member leaving the team.         | 20%                  | 6             | The project may not be able to finish in time. Hire new people need extra resources. |

|    |              |                            |     |   |  |
|----|--------------|----------------------------|-----|---|--|
| 10 | Generic risk | Data base security issues. | 20% | 5 | This will damage the reputation of the business. |
|----|--------------|----------------------------|-----|---|--|

Table 5. Risk Impact Analysis Table for Generic Risks

In table 6, a risk register shows responses of every identified risk. For risk 6, since lockdown may cause significant impact of the project, it is recommended to transfer or avoid the risk. For risk 7, it is recommended to mitigate the risk by looking for other funding sources. For risk 8, business owners can mitigate the risk by increasing the salary to attract potential candidates and providing more help to staff training. For risk 9 and risk 10, the project manager can mitigate or ignore the risk, because the exposure of these two risks is low and there are few requirements over data privacy for this “proof of concept” prototype.

| Risk ID | Trigger  | Owner           | Response   | Response strategy type | Resources Required |
|---------|--|-----------------|--|------------------------|--------------------|
| 6       | Lockdown rules issue: students cannot attend school. / People are not allowed to participant activities. | Business owner  | Buy insurance / postpone project                                   | Transfer / Avoid       | Cost               |
| 7       | Funding agencies provide insufficient amount / stop providing findings.                                  | Business owner  | Seek other funding agencies  | Mitigate               | Cost               |
| 8       | Selection criteria is too high / staff training test is hard to pass.                                    | Business owner  | Assist staffs with their training. Increase salary base etc.       | Mitigate               | Cost               |
| 9       | A key member leaves the team. (e.g., sick / other personal issues)                                       | Project manager | Persuade this key member to stay (if possible) / look for new team | Ignore                 | People, time, cost |

|    |   |  |  |                  |                    |
|----|---|--|--|------------------|--------------------|
|    |   |  | members / ignore   |                  |                    |
| 10 | Data base system has loopholes that can be attacked easily. | Project team (Project manager & Technical Experts) | Debug and provide better protection of users' information. | Mitigate / Igone | People, cost, Time |

Table 6. Risk Register for Generic Risks

#### 4.4. Technology

The following are some technologies, including languages, frameworks, and platforms we researched for web development.

| Name | Applicable occasions   | Pros  | Cons   |
|------|--|---|--|
| Java | Web development projects such as banking and financial technology; large application systems | <ul style="list-style-type: none"> <li>Needs less time and less code to improve the performance and response time of the website due to reusing of codes in Object-oriented programming.</li> <li>Available to be implemented on all platforms.</li> <li>Supports multi-threading and distributed computing.</li> <li>Contains many useful Web development framework</li> </ul> | <ul style="list-style-type: none"> <li>Hard for a new starter due to the complex module and language.</li> <li>Need amount of time to set up environment and modules.</li> </ul> |

|        |  |   |  |
|--------|--|---|--|
| Python | Analysis data  | <ul style="list-style-type: none"> <li>• Easy to set up deployment environment.</li> <li>• Easy for a new starter to use and understand.</li> <li>• Convenient to get data from database and analysis them.</li> <li>• Convenient for testing modular individually thanks to asynchronous coding and modularity.</li> </ul> | <ul style="list-style-type: none"> <li>• Slower than other languages.</li> <li>• Do not support multi-threading computing</li> </ul>                         |
| PHP    | Online database system, message board, subscription-based website, blog with comment function and registration system. | <ul style="list-style-type: none"> <li>• Reusable components can save developers' efforts and shorten the time required for custom web application development.</li> <li>• Available to be implemented on a variety of popular platforms.</li> </ul>  | <ul style="list-style-type: none"> <li>• Do not support multi-threading computing</li> <li>• Not stable</li> <li>• Programming is not very normal</li> </ul> |

Table 7. Back-end Programming Language

| Name       | Based Language | Pros   | Cons   |
|------------|----------------|--|--|
| Spring MVC | Java           | <ul style="list-style-type: none"> <li>• Lots of coding can be reused</li> <li>• Good scalability and stability</li> </ul> | <ul style="list-style-type: none"> <li>• Too complex for beginners</li> <li>• Hard to set up deployment environment</li> </ul> |

|                |        |   |   |
|----------------|--------|---|---|
| Django         | Python | <ul style="list-style-type: none"> <li>• Flexible</li> <li>• Support ML (Machine Learning)</li> </ul>   | <ul style="list-style-type: none"> <li>• Not suitable for small projects</li> <li>• the lack of conventions</li> <li>• difficult to learn.</li> <li>• does not support multiple requests (Bhatt, 2020)</li> </ul> |
| PySimpleGUIWeb | Python | <ul style="list-style-type: none"> <li>• Quick and easy to learn and read.</li> <li>• Suitable for small project.</li> <li>• Easy to install</li> </ul> | <ul style="list-style-type: none"> <li>• Not suitable for a large project.</li> </ul>   |

Table 8. Back-end Framework

| Name      | Describe                               | Pros  | Cons  |
|-----------|--|---|---|
| Wix       | A prevalent cloud website.             | <ul style="list-style-type: none"> <li>• Ease of use</li> <li>• Provide numerous kinds of website templates</li> <li>• Easy to design UI</li> </ul> | <ul style="list-style-type: none"> <li>• Templates are not flexibly changed</li> <li>• Cannot easily design database customarily</li> <li>• More functions need more price</li> </ul> |
| WordPress | A free and open-source website builder | <ul style="list-style-type: none"> <li>• Easy to design UI</li> <li>• Ease of use</li> </ul>  | <ul style="list-style-type: none"> <li>• More functions need more price</li> </ul>  |



|  |  |   |  |
|--|--|---|--|
|  |  | <ul style="list-style-type: none"> <li>• Provide numerous kinds of website templates</li> </ul> | <ul style="list-style-type: none"> <li>• Hard to customize database and functions</li> </ul> |
|--|--|---|--|

Table 9. Web Development Platform

According to the concrete requirements of the Scheduling System shown in the case study and among all technologies we researched and listed above, we determined to use PySimpleGUIWeb framework to design UI and use MySQL database to store and analyze data based on Python programming language.

We agree that web development platforms such as Wix and WordPress have fewer constraints on programming skills, also massive templates they provide are user-preferred and even gorgeous. However, the web application this project needs seems like an information management system. It can be separated into several modular. Moreover, the development of this web application focuses more on its functionality than the design of UI. Additionally, this Web Application has two diverse types of end-users (i.e., Admin and Student Presentative). Therefore, using such web development platforms is inflexible to customize database and functionality and hard to design two types of User Interfaces for admin and student representative, respectively.

Furthermore, the web application we are going to develop is not a large project. Additionally, the development team members are unfamiliar with frameworks like Django. Also considering our \$0 budget and limited human resources, such complexity frameworks (i.e., Spring MVC and Django) are undesirable, which will be a waste of our limited developing time and consume us much energy.

Ultimately, taking the development team members' specialties and experiences into consideration, we currently choose our familiar programming language Python and use the current GUI framework packets PySimpleGUIWeb to implement all features of this web application.

The type of database we chose to store the project data is MySQL. Taking our \$0 budget into consideration, we tend to use MySQL because it is open source. In addition, it is a relational database that stores the data in rows and columns and uses primary keys to establish a relationship with each other. It works well with structured data. Also, according to Software Testing Help (2021), it is an excellent choice because of its high concurrency and high speed for transactions with the help of its InnoDB, since this web application should support multiple users use simultaneously.

## **5. Planning**

### **5.1. Project Planning**

This section introduces the Breakdown Structure, by using it, it will make the development team easier to manage and understand this project. Moreover, to make the project more detailed and more precise, this section will also introduce the Pert chart (the dependencies of every step in Breakdown Structure), the Resource table (the resource that the development team will use), and the Gantt chart (show the schedule of the project).

The goal of this project is to develop a web application of the scheduling system. To achieve this goal, we can divide it into the following steps: analyzing projects, analyzing web application requirements, designing web applications, developing web applications, testing the web application, and writing documents. Every step is essential to the success of the project. Also, we choose to use the waterfall model in this project which allows us to document at the end of each phase.

| Level1                   | Level2                                | Level3                                 | Level4                              |
|--------------------------|---------------------------------------|--|-------------------------------------|
| Complete Web Application | Project Analysis                      | Key Stakeholder                        | /                                   |
|                          |                                       | Scope                                  |                                     |
|                          |                                       | SDLC                                   |                                     |
|                          |                                       | Constraints                            |                                     |
|                          |                                       | Risk                                   |                                     |
|                          |                                       | Business Case                          |                                     |
|                          | Analysis Web Application Requirements | UI Requirements                        |                                     |
|                          |                                       | Application Functionality Requirements |                                     |
|                          |                                       | Technology Requirements                |                                     |
|                          | Designing of Web Application          | Technical Specifications               | Development Language Specifications |
|                          |                                       |  | Platform Specifications             |
|                          |                                       | UI Specifications                      | Application Navigation              |
|                          |                                       |  | Page Mockup                         |
|                          |                                       | Functional Specifications              | Frame Models                        |
|                          |                                       |  | User Interface                      |
|                          |                                       |  | nTier Logic                         |
|                          |                                       |  | Database Model                      |
|                          | Web Application Development           | Development Environment                | /                                   |
|                          |                                       | UI Development                         |                                     |
|                          |                                       | Database Development                   |                                     |
|                          |                                       | Functionality Development              |                                     |
|                          |                                       | Coding Review                          |                                     |
|                          |                                       | Bug Fixes                              |                                     |
|                          | Integration & Testing                 | Integrate                              |                                     |
|                          |                                       | Test Environment                       |                                     |
|                          |                                       | Test Plan                              |                                     |
|                          |                                       | Test Application                       |                                     |
|                          | Documentation                         | Programming Documentation              |                                     |
|                          |                                       | User Manual                            |                                     |

Tabel 10. Work Breakdown Structure

After making a Work Breakdown Structure (WBS), our team straightened each high-level task's responsibilities and then allocated them to team members. We also analyze the dependencies of each task. Project Analysis (i.e., analyze the basic information of the project) must be the first step to complete, including analyzing UI, functionality, and technology needs since only clearing requirements before development can guarantee the success of developing the Web application.

After defining all the technological requirements, setting up a development environment can be arranged for the next step. Until now, we can start to produce web applications. Once we get the initial product, it is necessary for us to try to guarantee its performance. We would need to write a user manual based on the testing results and designing ideas for the last step.

Based on the analysis above, we visualize the dependencies of each task in the PERT chart (Fig 3). It is easy to find that the critical path is marked by red. Having this PERT chart can lead us to complete this project methodically.

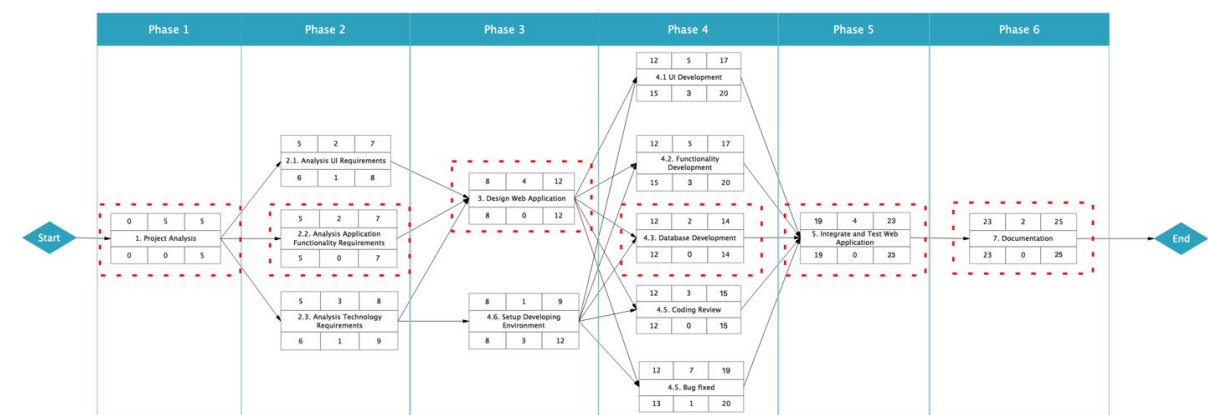


Fig 3. PERT

The next step to planning this project is making a resources table (Table 11), which is a crucial stage. Each task requires the use of human resources and material resources to complete the work, so we need to allocate carefully to maximize the use of resources. This process is also beneficial for drawing Gantt charts.

The entire project plan only begins when resources are assessed and allocated, and tasks assigned to the development team. If resource requirements can be determined as early as

possible, it is easier to avoid bottlenecks, which provides more excellent reliability. In this project, every task needs the development team's participation, laptops, and the internet. In the beginning, the development team needs a tutor's support to analyze this project. Furthermore, as the Pert chart shows, every latter task depends on the outcome of the previous task.

| Task                                  | Resources   |
|---------------------------------------|---|
| Project Analysis                      | <ul style="list-style-type: none"> <li>• Development team</li> <li>• Laptops and Internet</li> <li>• Tutor's support</li> </ul>   |
| Analysis Web Application Requirements | <ul style="list-style-type: none"> <li>• Development team</li> <li>• Laptops and Internet</li> <li>• Customers' requirements</li> </ul>   |
| Designing of Web Application          | <ul style="list-style-type: none"> <li>• Development team</li> <li>• Laptops and Internet</li> <li>• requirements analysis</li> </ul>   |
| Web Application Development           | <ul style="list-style-type: none"> <li>• Development team</li> <li>• Laptops and Internet</li> <li>• The design of web application</li> <li>• Developing software - python</li> </ul> |
| Integration & Testing                 | <ul style="list-style-type: none"> <li>• Development team</li> <li>• Laptops and Internet</li> <li>• The final web product</li> <li>• Developing software - python</li> </ul>         |
| Documentation                         | <ul style="list-style-type: none"> <li>• Development team</li> <li>• Laptops and Internet</li> </ul>  |

Table 11. Resources Table

To be more specific, we draw the Gantt chart (Fig 4) to show the project schedule and indicate the duration and milestone of each task. Additionally, it can easily monitor the team members' working process and the tasks' progress, which is helpful to the project manager to manage the project and be easy to alter the progress.

As for weekly milestones, at the end of the first week (i.e., week 6, 2021-09-05), we must fully complete the project analysis and accomplished 80% of part 2 (i.e., analysis of requirements). Moreover, at the end of the current week (i.e., week 7, 2021-09-12), we are required to complete the analysis of the requirements and begin to design the web application. At the end of the coming week (i.e., week 8, 2021-09-18), we should finish designing the web application and document the design ideas, which will be helpful to the following producing the web application. Meanwhile, the initial database and UI should be created. It is possible to implement some application's functionalities if we have extra time.

Additionally, we are supposed to realize all required functionalities and finish code review, and then if there are some bugs, it would be best to fix them as soon as possible in week 9 (i.e., 2021-09-25). Furthermore, at the end of week 10, we are supposed to integrate and test our web application in some testing samples. Then in the last week (i.e., week 11), we should write down the user manual.

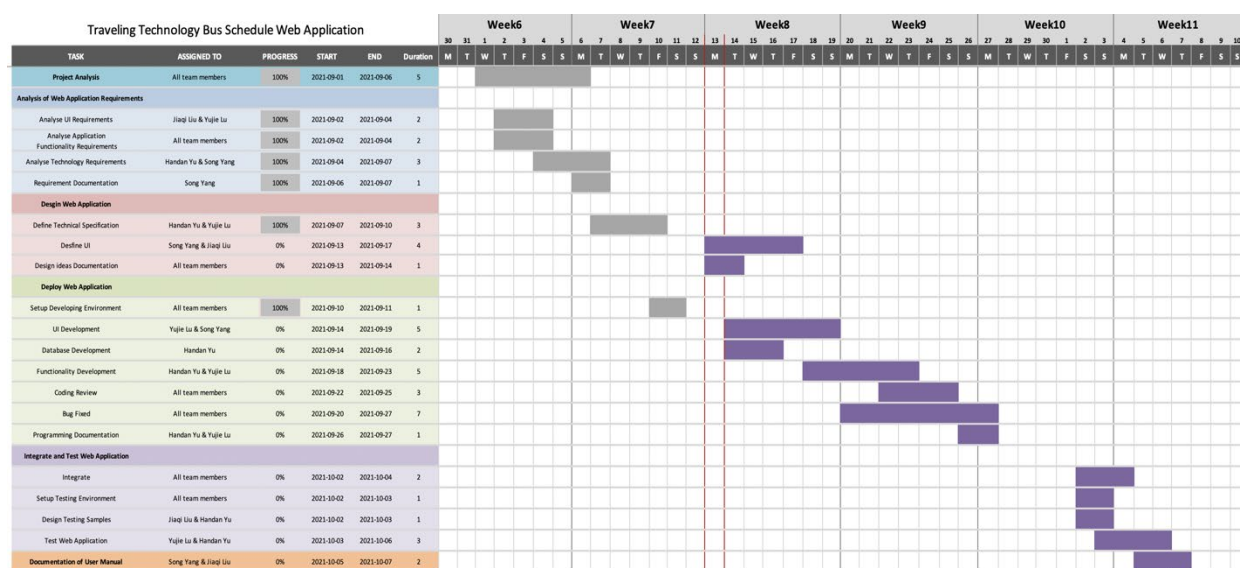


Fig 4. Gantt Chart

## 5.2. Group Planning

### Group Contract

Group Name: T04\_01

These are the terms of group conduct and cooperation that we agree on as a team.

**Participation:** We agree to....

- Meet as a team and work on the Group Projects.
- All decisions will be mutually agreed to by group members.
- Equal participation across members in discussions and contributions.
- Use Microsoft Teams to share files and collaborate.

**Communication:** We agree to...

- Regular contact as required and agreed by majority of members.
- We will communicate via WeChat group chat as required.

**Meetings:** We agree to....

- We will meet via Zoom as required.
- Regularly meet 2 times each week, on Wednesday and Friday.
- If member(s) are unable to attend the meeting, they are required to advise ASAP.

**Conduct:** We agree to...

- Respectful behavior and of others' opinions.
- Equal contribution is encouraged, mindful of allowing equal participation.

**Conflict:** We agree to...

- Resolve conflict diplomatically amongst ourselves first. If escalation is required, we will ask for assistance from the tutor or subject coordinator.

**Deadlines:** We agree to...

- Mutually agree on deadlines and actions before conclusion of meetings.

- If deadlines are not able to be achieved closer to date, the member should advise team ASAP.

| Team Member's Name | Team Member's Signature  |
|--------------------|--|
| Handan Yu          |    |
| Jiaqi Liu          |    |
| Yang Song          |   |
| Yujie Lu           |  |

Table 12. Group Member Signatures



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## 7. Appendix

### 7.1. Appendix A: Timesheet

*Member Name:* Handan Yu, Jiaqi Liu, Yang Song, Yujie Lu

*Team name:* T04\_01

*Tutor:* Christina Liang & Rajesh Chittor Sundaram

*Date:* 3<sup>rd</sup> / Sep; 6<sup>th</sup> / Sep; 8<sup>th</sup> / Sep; 12<sup>th</sup> / Sep

| Date   | Activity  | Planned | Actual  |
|--|---|---------|---------|
| Wednesday 1 <sup>st</sup> / Sep                                    | Reading assignment specification and case study. Moreover, analyzing the requirements from case study by each member self.                      | 4 hours | 4 hours |
| Friday 3 <sup>rd</sup> / Sep                                       | Attend meeting 1<br>- Brainstorm each question.   | 2 hours | 2 hours |
| Monday 6 <sup>th</sup> / Sep                                       | Attend meeting 2<br>- Brainstorm<br>- Assign tasks  | 2 hours | 2 hours |
| Monday 6 <sup>th</sup> / Sep -<br>Wednesday 8 <sup>th</sup> / Sep  | Complete draft for Introduction. Scope, Constraints, Key Stakeholders, Business Value, SDLC, Roles and Responsibilities and Communication Plan. | 2 days  | 2 days  |
| Wednesday 8 <sup>th</sup> / Sep                                    | Attend meeting 3<br>- Discuss the draft<br>- Assign tasks   | 2 hours | 2 hours |
| Wednesday 8 <sup>th</sup> / Sep -<br>Friday 10 <sup>th</sup> / Sep | Complete the draft for risk section and project planning section.   | 2 days  | 2 days  |
| Sunday 12 <sup>th</sup> / Sep                                      | Attend meeting 4<br>- Discuss the draft   | 2 hours | 2 hours |

|   |   |          |          |
|---|---|----------|----------|
|   | - Assign tasks  |          |          |
| Sunday 12 <sup>th</sup> / Sep                                     | Complete Executive Summary.                                 | 6 hours  | 6 hours  |
| Monday 13 <sup>th</sup> / Sep -<br>Tuesday 14 <sup>th</sup> / Sep | Finalizing the report and proofreading, then submit to LMS. | 1.5 days | 1.5 days |

## 7.2. Appendix B: Team Agenda

*Date: 3rd September*

1. Understands the assignment requirements.
2. Analyse the assignment requirements.
3. Go through each section of the assignment.
4. Go through the case together.
5. Brainstorm.

*Date: 6th September*

1. Discuss each question.
2. Share brainstorm notes each member and discuss together.
3. Assign tasks for each member.

*Date: 9th September*

1. Share each section draft that each team member wrote.
2. Discuss the issues occurring in wiring each section.
3. Separate the team into two subgroups.
4. Assign second part of tasks for each subgroup.

*Date: 12th September*

1. Share drafts that each subgroup wrote.

2. Discuss the issues.
3. Assign tasks of executive summary and finalizing the report.

## 7.3. Appendix C: Meeting Minutes

### 7.3.1. Meeting Minute 1

*Meeting of:* Group T04\_01

*Held at:* Zoom

*Date:* 3/9/2021

*Time:* 3-5pm

#### **Present:**

All members

#### **Apologies:**

None

#### **Approval of minutes**

This is the first group meeting.

#### **Agenda items**

1. Analyse the assignment requirements. Go through each section of the assignment to see what needs to be discussed. Make sure every member understands the assignment requirements.
2. Go through the case together. Highlight critical parts and discuss thoughts.

#### **Action items**

| Action Item  | Owner(s)    | Deadline | Status   |
|--|-------------|----------|----------|
| Brainstorm each question. Write notes under each question. | All members | 6/9/2021 | Assigned |

**Next meeting**

The next general meeting will be at 6<sup>th</sup> Sep on Zoom.

Minutes submitted by: Yujie Lu  
Approved by: Handan Yu

**7.3.2. Meeting Minute 2**

*Meeting of:* Group T04\_01  
*Held at:* Zoom  
*Date:* 6/9/2021  
*Time:* 3-5pm

**Present:**

All members

**Apologies:**

None

**Approval of minutes**

Brainstorm each question listed in Assignment 2 document. Write notes under each question.

**Agenda items**

1. Discuss over each question. Everyone shared their brainstorm notes and points have been preserved through group discussion. By the end of the discussion, an outline of what needs to be include in the report has formed.
2. Discuss how to assign the writing task for the first half of the assignment. Members select their favourite parts and sum the points listed in the guideline. Each member was assigned equally points of writing tasks.

**Action items**

| Action Item  | Owner(s) | Deadline | Status    |
|--|----------|----------|-----------|
| Brainstorm and make notes  | Handan   | 6/9      | Completed |
| Brainstorm and make notes  | Yujie    | 6/9      | Completed |
| Brainstorm and make notes  | Jiaqi    | 6/9      | Completed |
| Brainstorm and make notes  | Song     | 6/9      | Completed |
| Write scope (10), Constraints (5) out-of-scope (5)                       | Handan   | 8/9      | Assigned  |
| SDLC (20marks)   | Jiaqi    | 8/9      | Assigned  |
| Roles and Responsibilities (5); communication plan (5); Introduction (5) | Yujie    | 8/9      | Assigned  |
| Key stakeholders (10) Business value (5)                                 | Song     | 8/9      | Assigned  |
| Meeting minutes  | Yujie    | 8/9      | Completed |

**Next meeting**

The next general meeting will be at 8<sup>th</sup> Sep on Zoom.

Minutes submitted by: Yujie Lu

Approved by: Handan Yu

### 7.3.3. Meeting Minute 3

*Meeting of:* Group T04\_01

*Held at:* Zoom

*Date:* 8/9/2021

*Time:* 3-5pm

#### **Present:**

All members

#### **Apologies:**

None

#### **Approval of minutes**

Writing assigned parts.

#### **Agenda items**

1. Discuss issues occurs during the first part of writing. The key stakeholder has been partly modified and the members assigned roles and responsibilities has been discussed deeper.
2. Assign the second part of assignment. Discuss ideas for all remaining parts and assign writing tasks. Separate the team into two subgroups, assigned different tasks for better results.

#### **Action items**

| Action Item  | Owner(s) | Deadline | Status    |
|--|----------|----------|-----------|
| Write scope (10), Constraints (5) out-of-scope (5)                       | Handan   | 8/9      | Completed |
| SDLC (20marks)   | Jiaqi    | 8/9      | Completed |
| Roles and Responsibilities (5); communication plan (5); Introduction (5) | Yujie    | 8/9      | Completed |



|   |               |      |           |
|---|---------------|------|-----------|
| Key stakeholders (10);<br>Business value (5)          | Song          | 8/9  | Completed |
| Write task on risks<br>(total 30 points)              | Jiaqi & Yujie | 10/9 | Assigned  |
| Project planning &<br>technology (total 35<br>points) | Song & Handan | 10/9 | Assigned  |

### Next meeting

The next general meeting will be at 12<sup>th</sup> Sep on Zoom.

Minutes submitted by: Yujie Lu

Approved by: Handan Yu

### 7.3.4. Meeting Minute 4

*Meeting of:* Group T04\_01

*Held at:* Zoom

*Date:* 12/9/2021

*Time:* 10am-12pm

#### Present:

All members

#### Apologies:

None

#### Approval of minutes

Write allocated tasks and bring issues to discussions.

### Agenda items

1. Discuss issues regarding on select specific risks as well as generic risks. Discuss how to improve Gantt chart and PERT chart.
2. Assign tasks to each team member, including writing executive summary and proofreading.

### Action items

| Action Item                              | Owner(s)      | Deadline   | Status    |
|--|---------------|------------|-----------|
| Write project planning                   | Handan & Song | 10/9       | Completed |
| Write risks parts                        | Jiaqi & Yujie | 10/9       | Completed |
| Write Executive Summary                  | Handan        | 12/9 4pm   | Assigned  |
| Write executive Summary                  | Song Yang     | 12/09 11pm | Assigned  |
| Modify executive summary & proof reading | Jiaqi         | 13/9 3pm   | Assigned  |
| Modify executive summary & proof reading | Yujie         | 13/9 12pm  | Assigned  |

### Next meeting

The next general meeting will be at 14<sup>th</sup> Sep on Zoom.

Minutes submitted by: Yujie Lu

Approved by: Handan Yu