THE UNIVERSITY of ADELAIDE

School of Mathematical and Computer Sciences

COMP SCI 3006 - Software Engineering & Project

Software Project Management Plan

Lunar Mapping Rover

Revision 1.0

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Document Revision Table

Version	Date	Comment
0.1	4/9/17	Initial draft release
0.2	3/10/17	Fixed page numbering issue Implemented consistent table caption formatting
0.3	24/10/17	Updated constraints Made figure caption placement consistent Added risk rating definitions Added description of risk mitigation implementation Added detail for the process model Added work breakdown structure *Added description of Github tagging conventions *Added description of release checking process
1.0	1/11/17	Final release

Contents

1 Introduction

The Lunar Mapping Rover project aims to build a working prototype that is able to map an designated area of the lunar surface and find the remnants of Apollo 17. The Software Project Management Plan (SPMP) document outlines the orginisation, management and planning of all aspects of this project.

1.1 Purpose and Scope

This document covers the managerial and technical sections of the project and will contain project organisational information, a risk management plan, a process model description, a work plan and multiple further supporting plans.

1.2 Assumptions and constraints

This section details the assumptions made about the working environment, the resources available, and any constraints which may limit the project outcomes.

Assumptions

- We assume to be working in a group of 6-8 people of varying backgrounds
- We assume the deadlines outlined in the project deliverables file will not change.
- We assume our rover will not be tampered with.
- We assume that we will receive the SML DTD format before the end of week 8.
- We assume that the Lunar Rover operator will follow the instructions given to them by the team and / or the user manual.
- We assume the Lunar Rover will operate within a bounding area the size of an A1 piece of paper on a flat surface.

Constraints

- We will be constrained by the allocated time to complete the project and the various deadlines throughout.
- We will be constrained by the resources provided to build the rover, which is limited to the contents of the Lego Mindstorm EV3 kit.
- We will be constrained by the scope of the project which will limit the work to the development of the prototype rover.

1.3 Project deliverables

The primary project deliverables are:

- Software Requirements Specification
- Software Project Management Plan
- Software development document
- User Manual

- Testing Report
- Prototype Rover and Software

1.4 Evolution of the plan

As the team receives feedback from the client on the format and vision of the SPMP (Software Project Management Plan) the plan itself will be refined. If necessary more information may also be added to the plan to result in a more succinct plan. Any changes or updates will be noted in the document revision table.

1.5 List of definitions

BPM	Backup Project Manager
DET	Development Team
DETL	Development Team Lead
DETBL	Development Team Backup Lead
DOT	Documentation Team
DOTL	Documentation Team Lead
DOTBL	Documentation Team Backup Lead
IDE	Integrated Development Environment
NGZ	No Go Zone
PM	Project Manager
SDD	Software Design Document
SPMP	Software Project Management Plan
SRS	Software Requirements Specification
TL	Team Lead

2 Project Organisation

The project team have been allocated distinct roles to aid the successful completion of this project. This section details the roles of all project teams members and describes their responsibility and tasks within the project. Table 1 summarises the roles allocated.

Table 1: Project Role Allocation.

Role	Team Members
Project Manager	Chris
Project Manager Backup	Fan
Development Team Lead	Sioli
Deveopment Team Backup Lead	Charles
Development Team Members	Philip, Chris
Documentation Team Lead	Brent
Documentation Team Backup Lead	Philip
Documentation Team Members	Charles, Sioli, Chris, Fan

2.1 Roles and responsibilities

2.1.1 Project Manager (PM)

The project manager's primary goal is to ensure that the Lunar Rover project is completed on time, and that all team members contribute equally. The PM plans feasible goals and milestones for the project, assists with the coordination of meetings between members, and generates reports on weekly progress and contributions. In the event that the PM is unable to perform is role, the BPM will take over until the PM can return.

Christopher Luke Lyndon was chosen for this role due to his prior experience and knowledge gained from freelancing as a web developer, in which he had to manage his own progress and budget.

2.1.2 Backup Project Manager (BPM)

The backup project manager's primary goal is to support the PM and be aware of the state of the project, such that he is able to take over for the PM if he is unable to perform his role.

Zhongfan Zhang was chosen for this role due to experience leading teams in other applications and also his aspirations to work in management roles in the future.

2.1.3 Development Team Lead (DETL)

The development team lead's primary goal is to plan and coordinate the team's progress goals and workload, inform the PM of any issues within the DET, assist team members with any issues regarding the IDE or repository, and to give final approval to merges on the repository.

Sioli Tiafau O'Connell was chosen for this role due to his larger project development experience, as well as having the most experience with the Java programming language, and the use of Github in a team environment.

2.1.4 Documentation Team Lead (DOTL)

The documentation team lead's primary goal is to create LaTeX documents with templates in order to facilitate effective collaboration through the use of Overleaf, and to assist with any documentation related issues. He also is to inform the PM of any issues with documentation, and mediate any disagreements in regards to documentation standards or design choices.

Brent Aaron Poland was chosen for this role due to having the most experience with LaTex and his experience in writing documentation and reports for Engineering projects.

2.1.5 Team Backup Lead (DETBL & DOTBL)

The team backup lead's primary goal is to assist the team lead when necessary and be aware of the state of the team's activities, such that he is able to take over for the TL if they are unable to perform their role.

Charles Jonathon Zyzniewski was chosen as the development team backup lead due to his level of experience with Java development and his experience with robotics. Philip Fai-Yuen Sung was chosen as the documentation team backup lead due to his experience writing documentation and reports for Engineering projects.

2.1.6 Team Member

A team member's primary goals are to perform the tasks assigned to them by their team lead, inform the TL or PM if any issues arise, keep track of time spent on each task, follow project standards and procedures, and inform their TL of their progress.

3 Risk management plan

A risk management plan has been implemented to pro-actively identify events which could hinder project progress. The purpose of this plan is to identify risks before they occur and have mitigation strategies in place to minimise their impact. Each risk includes details on its severity, likelihood and risk indicator, together with strategies for controlling and/or eliminating the risk. All risks were reviewed at regular intervals during weekly project meetings to determine if the risk mitigation measure should be implemented. The final decision on risk mitigation implementation was the responsibility of the Project Manager.

Table 2: Risk Rating Matrix.

	Severity				
Likelihood	1.*Catastrophic*	2.*Major*	3.*Moderate*	4.*Minor*	5.*Insignificant*
1. Certain	E	E	E	H	H
2. Likely	E	E	H	M	M
3. Probable	E	H	H	M	L
4. Unlikely	H	M	M	M	L
5. Rare	H	M	L	L	L

E - Extreme Risk – Take immediate action. Redirect resources to mitigate risk. Eliminate, substitute or control until risk is minimised.
H - High Risk – Take action. Set time aside to mitigate risk. Implement appropriate control measures.
M - Medium Risk – Prioritise mitigation. Take steps to substitute for alternative or implement measure to minimise risk.
L - Low Risk – Acknowledge possibility. Continuously monitor status and take any steps which will mitigate risk.

Risk	**Pre-mitigation**			**Mitigation Measure**	**Post-mitigation**		
	Likelihood	*Severity*	*Rating*		*Likelihood*	*Severity*	*Rating*
The XML Document Type Definition never arrives from the outsourced company.	4	1	H	We will create our own XML format to be used as import / export information for map data so that the Lunar Rover can still be tested.	4	3	M
A team member is unable to contribute for an extended period of time due to illness or other commitments.	1	2	E	Each team has a lead and also a sub lead. Each are tasked with knowing how the project is currently progressing and with propagating this knowledge to the rest of the team. Also our GitHub repository is updated regularly to ensure that any user in the development team is able to access code to run the project.	2	5	M
GitHub closes our account in error.	5	1	H	Each team member makes sure to have a local cloned copy of the latest revision of their work which could then be collated to result in the same final product.	4	4	M

Risk	**Pre-mitigation**			**Mitigation Measure**	**Post-mitigation**		
	Likelihood	*Severity*	*Rating*		*Likelihood*	*Severity*	*Rating*
The Ultrasonic Sensor fails whilst mapping.	4	1	H	Ensure proper instantiation to act as a method of prevention. Then employ a method to close the ultrasonic sensor ports and restart the sensor safely.	5	3	L
Motor failure whilst mapping.	5	2	M	Ensure proper instantiation to act as a method of prevention. Then employ a method to close the motor sensor ports and restart the motor safely.	5	4	L
Colour sensor fails whilst mapping.	4	1	H	Instantiate a retry on fail method and have the Ultrasonic sensor map for objects as a backup in the hope that after mapping the entire area one of the objects would represent the Apollo 17 remnants.	4	3	M
Robot is lost / stolen.	4	1	H	Provide a combination lock on the Lunar Rover's storage drawer and ensure everyone knows who has the Lunar Rover to ensure responsibility.	5	4	L

Risk	**Pre-mitigation**			**Mitigation Measure**	**Post-mitigation**		
	Likelihood	*Severity*	*Rating*		*Likelihood*	*Severity*	*Rating*
Wireless dongle fails.	2	2	E	Provide backup solutions by having the option of using bluetooth or USB.	4	4	M
Bluetooth fails.	4	2	M	Provide backup solutions by having the option of using WiFi or USB.	4	4	M
The Computer used by the Lunar Rover operator crashes / becomes inoperable.	3	1	E	Ensure that our system version procedure is portable enough to allow for the Lunar Rover to be controlled on a backup computer eliminating a single point of failure.	4	4	M
The EV3 brick has a fatal error and cannot be turned on.	3	1	E	Ensure the system we create is portable enough to be moved to another EV3 brick and launch the program again from the new brick.	4	3	M
The Lunar Rover loses it's heading whilst mapping.	3	2	H	Instantiate a heading check function each time the Lunar Rover moves forward to ensure it's on the right track.	5	4	L
When trying to upload map data, the upload fails.	4	3	M	Ensure that a local version is also saved before transmission as a backup	5	4	L

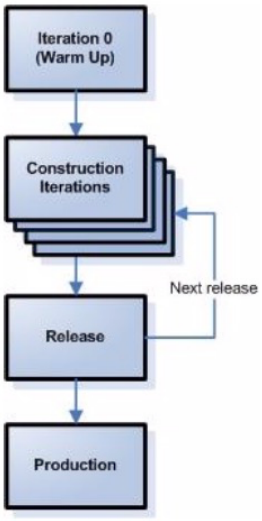
Risk	**Pre-mitigation**			**Mitigation Measure**	**Post-mitigation**		
	Likelihood	*Severity*	*Rating*		*Likelihood*	*Severity*	*Rating*
Due to the inaccuracy of the ultrasonic sensor the Lunar Rover misses an object.	4	1	H	Ensure that when the rover is in the automatic mode it moves at a speed in order to account for the inaccuracy of the ultrasonic sensor and leave the sensor enough time to see the objects that may be in the rover's path.	4	3	M
The Lunar Rover's battery runs out.	3	1	H	Perform a check of the battery on program startup to prompt the user to charge before running. Display a status bar with the remaining charge left in the battery so the user can tell how much longer the Rover can operate for.	5	2	M

4 Process model

The process model that has been selected for this project is the Agile Method. This is due to the short lifespan and scale of the project, possibility of changes to the specification as well as the erratic schedule of the team members.

The Agile Method is suited to projects which are small scale and have a short lifespan. Agile allows for the team to quickly adapt to any changes that may occur through the life of the project. It also facilitates reallocation of manpower if priorities change or if a team member is unable to work.

Figure 1: The Agile Process Method. *Source: Sommerville, Ian. Software Engineering. 9th ed. Boston: Pearson, ©2011.*



We ran on a weekly schedule of iterations. We chose to iterate weekly as this was the cycle that was dictated by the client meetings. Therefore each stage of the prototype was ready for presentation and feedback at each meeting if necessary. Each iteration is outlined with tasks set in our weekly progress reports. As the week comes to a close the release is revised to adapt to changing requirements. This also resulted in three major iterations being the first, second and final prototype.

5 Work plan

This section shows the work activities, milestones, schedule and resource allocation.

5.1 Work activities

Table 3: Feature Completion Timeline.

Task	**Completion Date**
Automatic Control	
No Go Zone Detection	24/10/2017
Object Collision Detection	29/9/2017
Operation Mode Selection	24/10/2017
Semi-Automatic Control	
Implement path traversal to a specific destination	24/10/2017
Manual Control	
Implement precise control for the user	24/10/2017
Implement hazard alerts via the GUI	3/10/2017
Map Data Handling	
Feature Cataloging	3/10/2017
Creation of XML format for storing map data	3/10/2017
Implement functions to import and export maps	24/10/2017
GUI Development	
GUI shell creation	29/9/2017
Implement live drawing of the map	3/10/2017
User No Go Zone creation interface	24/10/2017
Semi-automatic control interface	24/10/2017
User alerts in manual mode	3/10/2017
Implement functions to read and display battery status	24/10/2017

5.2 Milestones

5.2.1 First Prototype

Goals

As per the client's request the first prototype was to represent a basic movement demonstration and GUI layout. The first prototype was then designed to include a basic GUI outlining controls for forward movement, rotation left and rotation right. The Lunar Rover itself would interact remotely to that GUI and move according to user input with a minimal delay.

Division of work

Sioli and Christopher presented with the most experience with Java and from that assessment so that the best foundation could be built, the first prototype would be created by them both whilst introducing the rest of the development team for further prototypes.

Completion Date

Presentation: 29th August 2017 / Client Meeting Four

5.2.2 Second Prototype

Goals

On clarification from the Client after the first prototype presentation the second prototype aims to add in majority of the automated Lunar Rover operations. The Second Prototype Lunar Rover aims to catalogue features that are detected in the area whilst detecting objects that may be hazardous to the Lunar Rover's traversal. Subsequently the rover operator's experience will be enhanced by providing extra information to the interface such that they will be able to inspect data that has been catalogued as well as have more feedback for hazardous objects whilst in manual operation.

Division of work

The division of work will be spread much more evenly throughout the team for the second prototype. Sioli will start by integrating the GUI with a more advanced layout to accommodate the new features to come. Chris will then be tasked with providing discovery for the sensor's that the Lunar Rover will be taking advantage of. This includes looking into methods for robust retry on fail protocols. Charles and Philip will then spearhead the development of the automated movement features and the methods of cataloguing any objects that are detected. Once Chris and Sioli have completed their upgrades they will work with the rest of the development team to increase efficiency.

Completion Date

Presentation: 3rd October 2017 / Client Meeting Seven

5.2.3 Final Prototype

Goals

The final prototype aims to provide full functionality as a solution to all of the client's requirements gathered as per the Software Requirements Specification. Over and above the previous prototypes the final aims to include further detection techniques to be able to detect and catalogue the applied "No Go Zones". On top of this the final prototype system aims to include the ability to import / export map data. The final prototype also aims to include another method of control known as semi-automatic to then allow for a direct traversal to be inputted for the Lunar Rover to execute.

Division of work

If the XML DTD has arrived from the outsourced company then we would simply adhere to that outline for the creation of the map data to be exported / imported. However, if this were not the case we would call for a team meeting to ensure that we came to an agreement on the documentation standard we would create. From there we would allocate two team members to work on the map data input / output. This would include the mechanics of opening and saving the file but also how the Lunar Rover's data is converted to the XML format. The other two team members would then work on the Lunar Rover automation side of the problem. This would include creating a user-friendly interface to create a set traversal and also how that interface then relates to moving the Lunar Rover specifically.

Completion Date

Presentation: 1st November 2017 / Final Commit

5.3 Schedule allocation

The schedule allocation for this project is described by Gantt charts for each of the primary document deliverables.

5.3.1 Deliverables

Gantt Charts

SRS

See Appendix A.

SPMP

See Appendix B.

SDD

See Appendix C.

Deadlines

Table 4 summarises the project deliverables and the corresponding delivery dates.

Table 4: Project Deliverables.

Deliverable	Delivery Date
SRS first draft	22/8/2017
GUI prototype & basic movement demo	29/8/2017
SPMP first draft	5/9/2017
First milestone demo	12/9/2017
SDD first draft	3/10/2017
Final Rover software version & user manual	1/11/2017

5.3.2 Team member availability

Weekly team member availability was identified for all team members to assist with task allocation. The availability is shown in Table 5.

Table 5: Team member availability

Member	Monday	Tuesday	Wednesday	Thursday	Friday
Fan	2pm - 3pm	9am - 12pm	NA	9am - 5pm	NA
Sioli	2pm - 3pm	9am - 12pm	NA	9am - 5pm	NA
Phillip	2pm - 3pm	9am - 2pm	11am - 1pm	3pm - 5pm	9am - 5pm
Charles	2pm - 3pm	9am - 5pm	11am - 1pm	9am - 5pm	9am - 5pm
Brent	2pm - 5pm	9am - 1pm	9am - 5pm	NA	9am - 5pm
Chris	2pm - 3pm	9am - 5pm	9am - 1pm 3pm - 5pm	N/A	N/A

6 Supporting plans

In order to be informed of the standards in place to assist in achieving the project goals in a timely fashion the following section will outline the project management plans.

6.1 Configuration management plan

The Lunar Rover will consist of three key prototypes. The first, second and final prototypes. In order to distinguish these prototypes apart form the features each possess, the GitHub repository will represent each version respectively.

To keep track of which version holds up to each particular prototype a version table will be visible on the README. This is in place so that there is a quick reference to which previous version applies to the prototype that is requested. From this reference the codebase for any given particular prototype may be cloned with ease using the version number from the table itself.

As well as this the repository will be created in a way such that it's structure holds with past, current and future prototypes or iterations. To ensure this, the repository will adhere to the Maven Standard Directory Layout with additional folders for project documentation(`https://maven.apache.org/guides/introduction/introduction-to-the-standard-directory-layout.html`).

6.2 Documentation plan

6.2.1 Software Requirements Specification - SRS

The main goal of the SRS is to outline the requirements as interpreted by the team in a format such that the client can review and align with the presented vision of the final system.

Preparation

In order to go into enough depth to outline the vision to the client the team had to fully understand what it was that was the problem that the Lunar Rover would encounter. To do this requirements elicitation was scheduled via two meetings with Space Explorations.

Review

The first revision of the SRS was presented at the third client meeting. At this meeting we asked for and received feedback from the client as to how well we had interpreted the requirements. Using this information we were able to review our performance by examining how closely our interpretations lined up with the actual requirements of the client. This process was then finalised with a video self review and a one page report.

6.2.2 Software Project Management Plan - SPMP

The SPMP is designed to outline the processes that will lead to the successful completion of the Lunar Rover design.

Preparation

To complete this plan, extensive knowledge was required in areas such as software engineering process models, risk management, quality assurance and team organisation to name a few. These skills were learned through lecture material as well as the previous experience of team members.

Review

After receiving feedback from client meeting five, a review will be structured by acknowledging how our processes align with industry practice. A self review process will then be finalised with a video self review and one page report.

6.2.3 Software Design Document - SDD

The SDD facilitates the understanding of the system architecture for the Lunar Rover. Outlining the class structure and the rationale behind the outline itself allows for easier understanding of the solution that is presented to the client. As well as this the document provides a framework for any future developers to follow.

Preparation

Both the SRS and SPMP documents help to build an understanding of the client's needs as well as implementation steps for the solution. These documents are needed as the software must ultimately be a vessel for the solution to the requirements elicited from the client and implemented using process management structures. On top of this the team must have a general technical knowledge base to be able to come up with solutions that align with the gathered information. Once these components have come into line the system can be outlined in a succinct manner using the SDD as the vessel.

Review

Due to choosing the Agile Development Process the SDD review process will be implemented as a rolling review. In saying this a formal review will be completed via a video self review and a one page report.

6.2.4 Lunar Rover User Manual

The Lunar Rover Operator must be able to be trained to use the rover when the team is not available to train them. To provide this service a User Manual will be implemented that outlines steps on how to control the Lunar Rover to achieve the goals outlined from the requirements elicitation.

Preparation

At minimum the system outline must be finished and the general outline of how the Lunar Rover will be operated must be completed. Once that is completed a User Manual will be able to be constructed so that current and future rover operators will have a reference to refer to if they are stuck.

Review

The ideal review process will involve user testing and feedback. We would want a prospective Lunar Rover Operator to attempt to control the Lunar Rover prototype using solely the User Manual and then receive feedback on any areas that may require improvement.

6.2.5 System Testing Review Document

To ensure consistent user experience now and into the future proper evaluation of testing processes is required. On top of this the team wants to ensure that no potential issues have been overlooked. A proper review of the tests that the system underwent aims to uncover any of these outliers.

Preparation

The final system will need to be tested and proper thought would need to go into the testing process that is to be undertaken. As we are adhering to the Agile Development Process, testing must be fast and frequent. Once this has occurred proper evaluation can be implemented by having an unbiased team member evaluation the performance of the testing.

Review

In order to produce the most unbiased review the creator of the review must be a team member who was not involved specifically with the testing of the Lunar Rover. This team member would take steps to think outside of the box for test cases that may not have been tested already. Once these options have been narrowed down and the current testing results had been evaluated they would then be in a position to create the review.

6.3 Quality assurance plan

In order to validate and verify our documentation each major document has a preparation stage as well as a rigorous review phase. This is explained in more detail in the documentation plan above.

Due to the credibility of the system and it's previous uses for our coding standards we adhere to the Google Java style guide(`https://google.github.io/styleguide/javaguide.html#s3.4-class-declaration`). To make sure that we have correctly followed this standard we will have a review completed by the 10th of October 2017. As part of that review any and all code as part of the repository will be surveyed and assured to be in alignment with the standards outlined in the Google Java style guide.

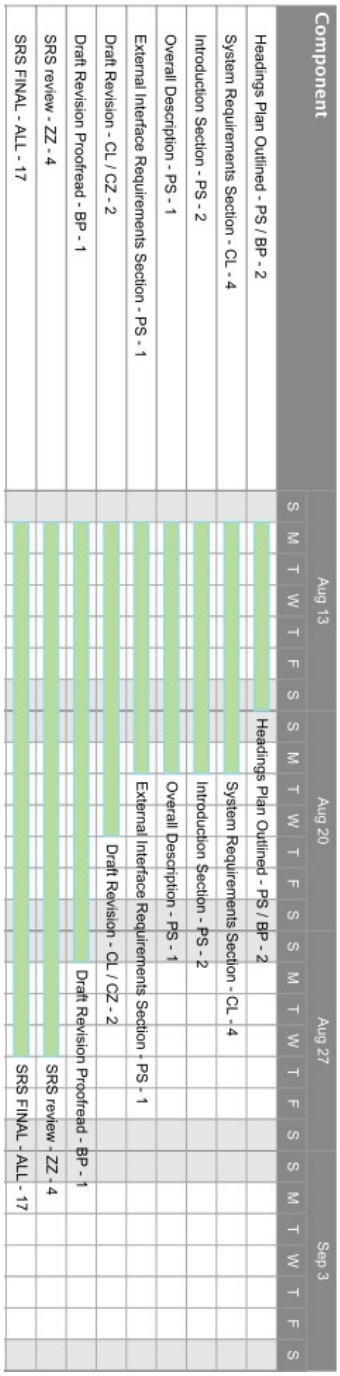
As for software review and testing, as each team member creates codebase to be appended to the repository another team member will implement and test the added components in order to the scale the system as a whole. Ultimately the team will also perform a testing review by the 10th of October 2017 to ensure that each facet of the system has been tested to the standards expected by the requirements elicitation.

6.4 Appendix

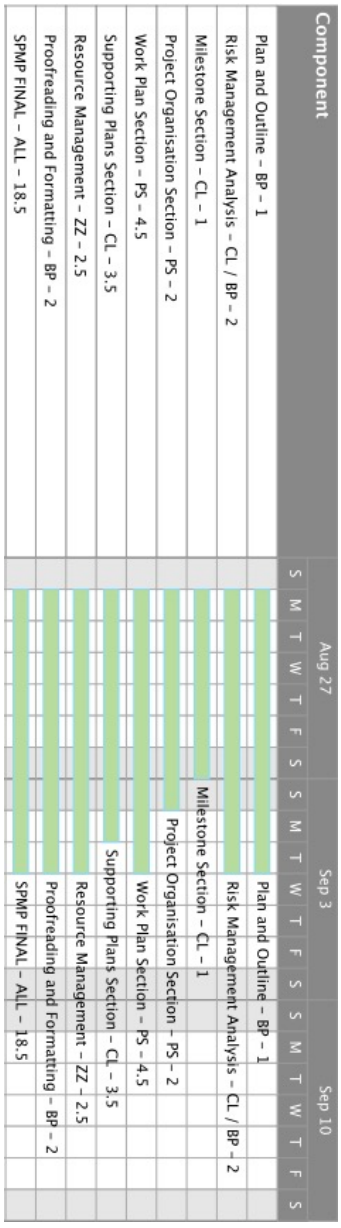
For appendices A, B and C the convention of each component is [Task - Participant - Hours]. Where the participants are as follows:

- PS - Philip Fai-Yuen Sung
- BP - Brent Aaron Poland
- CL - Christopher Luke Lyndon
- ZZ - Zhongfan Zhang
- CZ - Charles Jonathon Zyzniewski
- SO - Sioli Tiafau O'Connell

6.4.1 Appendix A - SRS Gantt Chart



6.4.2 Appendix B - SPMP Gantt Chart



6.4.3 Appendix C - SDD Gantt Chart