Project 22: “STUDY”

KIT301 Planning Report

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Table of Contents

1. Executive Summary

The features of the project described in the requirements trace matrix include the lectern, whiteboard, terminal, and pdf editing features with additional features such as extending the drawing capabilities to do 3d drawings, a wrist-bound whiteboard to do remote drawing and avatar customisation via the lectern also added.

The project schedule has been divided up equally between each team member due to how most of the tasks naturally went to the next step. Because of this, rather than assigning individual tasks between members, the whole team will work on many of the tasks as a group. Some tasks, such as modelling or testing and however assigned to the members who have the most skill or resources in the related area.

In the risk assessment it was determined that the overall technical development was low to medium risk, and that the main areas of concern were team related. In particular, the main risks were around teammate contribution because due to the small team size if a member of the team doesn't contribute enough to their tasks it would lead to the development process getting severely delayed. This would then inevitably lead to certain aspects of development to be rushed, and as of result this the final program will likely have more faults and issues in the design. To combat this issue, it was decided to share much of the programming tasks as a team.

2. Introduction

The project is a VR software mod for the game BONELAB that focuses on education. With the extra bonus of running standalone on the Quest hardware, the software will work on SteamVR using a Quest 2. The virtual classroom, which enables users to produce and study educational content, is one of the software's key features. The user must be able to produce their own material, record it, and choose between recording scenes for slides, a whiteboard, and a room. The user will also need access to a lectern, which will have a macro device like a "Stream deck" for managing the scene and recording functions to easily controlling their session.

The STUDY system is to be fully equipped to perform and record presentations, with particular emphasis and special design considerations to increase the effectiveness of educational presentations. Recorded presentations may be exported as videos to be shared with learners (or other audiences), who are also considered as a user class. The manners in which the two groups of users (content creators and consumers) can be aided in their respective goals is researched and considered for design.

The system has a broad scope of features and requirements, but a set of core features has been defined in a requirements trace matrix. A variety of common risks and many risks specific to this project have been identified and evaluated in relation to the specific circumstances of the STUDY project, with mitigation and prevention strategies present in a risk log.

3. System Users

3.1 Existing Users

The users this system primarily targets are educational content creators and those who consume the former group's content. Here, educational content includes a range of distinct objects such as lecture content, online educational videos, video essays, internal training videos for institutions, and others. The creators and consumers of educational content will be referred to hereon as lecturers and students respectively. The fact that these groups are not necessarily or even *usually* part of any formal academic institution is recognised and considered.

The first group of existing users are the lecturers. This group interacts directly with the VR component of the system and are the driving force in that component's design. The primary need of this group that STUDY aims to address is the need for a more comfortable and natural way to deliver content to students. There is an established link between the degree to which a mode of telecommunication or cooperation is analogous to reality, and the work done. The effects of the analogue's closeness to reality include comfort and positive mood as well as the ability to sort incoming stimuli, process information, handle high cognitive workloads, and communicate information.

A highly relevant framework through which to view this group in relation to STUDY is Csíkszentmihályi's concept of flow. Liljedahl (2016) and Gunderson (2003) independently observed a strong connection between the efficacy of an educator and their ability to enter flow state while teaching. This framework provides a distinct, systematised, and relatable method to empathise with this subset of users and their needs.

Csíkszentmihályi also developed a set of nine principles common to people entering this state:

1. There are clear goals every step of the way.
2. There is immediate feedback to one's actions.
3. There is a balance between challenges and skills.
4. Action and awareness are merged.
5. Distractions are excluded from consciousness.
6. There is no worry of failure.
7. Self-consciousness disappears.
8. The sense of time becomes distorted.
9. The activity becomes an end in itself.

The 2nd, 5th, and 6th of these are the most relevant to the project. While the other principles may be useful on occasion to consider when making design decisions, their adherence is largely outside out of the scope of the project.

Lecturers are not a homogenous group as within their ranks individual members vary dramatically in VR literacy, general technical literacy, and preferred style of presentation. The levels of experience for this group of users come in three general categories. The first of these is those that have *Limited technical literacy* which has particular relevance to the 6th principle above. It indicates there is special need for the system to *observably* guard users against destructive actions, so that action can be taken without hesitation, therefore increasing flow and consequently quality of output. The second category is those that are *Technically literate with limited VR experience.* This is where the user has enough technical skill that they are confident in their avoidance of *failure*. The next hurdle

is the 2nd principle shown above because while these users may not have as great a fear of failure as the previous group, they do still require the project to provide a lens through which to view their actions as they affect the space. The final category is those that are *Technically literate and experienced in the use of VR.* In this case, where neither general lack of technical skill nor specific lack of VR skills cause hindrance to flow, the greatest design consideration to be adhered to is the 5th principle above. To this end, this group can be catered for through increasing multisensory integration in the space, shown by Marucci *et al.* (2021) to increase presence and cognitive workload capacity.

Regarding users' preferred styles of presentation, some user stories can be considered such as someone who is most comfortable presenting aurally and wants to be able to be able to speak naturally through a digital medium so they can communicate with unhindered efficiency.

A major axis along which digital presentation is limited is the speaker's ability to communicate with their full body. This is a common cause of the comparative inefficiency of systems such as audio recordings and video recordings in the communication of information. Our system needs to allow for gesticulation to occur naturally and transfer into the digital environment. Live drawing of visual aids is not only a common preference of educators, but a highly effective one for students (Fiorella *et al.*, 2019). A major consideration and area of much expected testing in the design of this project is the function of a whiteboard and marker in VR space that will function in a way aligning with the 5th principle of flow.

The other larger group of existing users, students, interact with the project through the videos produced by the lecturers. The primary motivation of students is broadly, to learn. This motivation can be broken down further into specific traits desirable in their learning such as students wanting information to be delivered clearly, quickly, memorably, and comfortably.

These traits are not independent. Clear delivery increases comfort, comfort improves memory retention, and concise delivery is only possible where clarity and comfort are both high. In this way, these traits of STUDY's outputs have a weakest-link relationship, where the quality of the final product is limited most by the area the system performs worst in.

Fortunately, there is a wealth of research on these issues. Zimmerman (2016) emphasised the importance of plentiful natural light, neutral background colours, and deadened background noises, and linked these factors to positive learning outcomes. Fiorella *et al*. (2019) recognized effective considerations specific to video education, including live drawing of diagrams and instructor eye contact with the camera. Design elements encouraging these behaviours in lecturers can be made and would be an effective inclusion.

3.2 Potential Future Users

Besides its immediately intended userbase, STUDY provides features that could also cater to non-educational presentations such as product pitches. It could be especially relevant to pitches regarding products in the VR space, although it need not be exclusive to this. It may also be useful to users who don't have access to physical locations appropriate for presenting. These users would be looking for a space with a formal appearance, one which would lend their presentations a sense of professionalism and legitimacy. The needs of this group may call for a less drab presenting space than the one most effective for education. It might be appropriate in the future for more advanced room customisation to be provided for these users, to add liveliness to their presentations.

Outside of performing presentations however STUDY is not a particularly adaptable system to other needs, and the types of presentation that wouldn't fall under the category of 'educational' are limited in number. Consequently, this pool of future users is limited.

4. System Requirements

The resources used to identify whether requirements for the requirements trace matrix were achievable are listed in the references section.

Entry #	Para #	Requirement	Type	Release	Use Case
1.	9.0.0	The client has requested the development of an education-oriented VR software.	HW	1	
2.	9.0.0	The software is in the form of a mod for the existing VR game Bonelab.	HW	1	
3.	9.0.0	The Software will run on SteamVR using a Quest 2.	HW	1	
4.	9.0.0	The software may run standalone on the Quest hardware.	NTH HW	2,3	
5.	9.1.0	A virtual classroom is required for the user to create content and study in.	SW	2	
6.	9.2.0	The user needs to be able to create and record educational content.	SW	2	UC01_User_records_Content
7.	9.2.0	The user must be able to record the whole environment for later playback	SW	2	UC02_User_views_Recording
8.	9.4.0	The user must have access to a lectern to control the virtual space.	SW	2	UC03_User_controls_Environment

9.	9.4.0	The Lectern will have a “Stream deck” like macro device to control the recording and the scene features.	SWC(#8)	2,3	UC03_User_controls_Environment
10.	9.4.1	The lectern must have the ability to test recording and microphone levels.	DR (#7,#10)	3	UC02_User_views_Recording
11.	9.3.1	The room needs to have a whiteboard with drawing and erasing capabilities.	SW	2	UC04_User_annotates_Whiteboard
12.	9.3.1	The user must be able to change the colour of their marker when drawing on the whiteboard.	SWC(#11)	2	UC04_User_annotates_Whiteboard
13.	9.3.1	It would be beneficial for the user to use a pressure sensitive pen that has a thicker stroke the closer it is to the whiteboard.	NTH SWC(#11)	2,3	UC04_User_annotates_Whiteboard
14.	9.3.3	The user must be able to display PDF slides on the whiteboard.	SWC(#11)	3	UC05_User_presents_Slideshow
15.	9.4.1	The user must be able to change the recording scene between the slides, whiteboard and room recording.	SWC(#7, #11,#14)	3	UC01_User_records_Content
16.	9.3.2	The user should have a writing tablet they summon on their wrist used to draw on the whiteboard.	SWC(#11)	2	UC06_User_uses_Tablet
17.	9.3.2	The user must be able to select certain sections of the whiteboard using the drawing tablet, and be	SWC(#16)	2	UC06_User_uses_Tablet

		able to write in a box that scrolls along the whiteboard.			
18.	9.8	It would be nice if the user could customise the room to their liking.	NTH SW	3	UC03_User_controls_Environment
19.	9.8	The room could have multiple whiteboards depending on the user's needs.	NTH SWC(#18)	3	UC03_User_controls_Environment
20.	9.8	The user could be able to customise lighting placement and colour.	NTH SWC(#18)	3	UC03_User_controls_Environment
21.	9.8	The user could toggle different lighting setups using the Stream deck on the lectern.	NTH SWC(#10, #20)	3	UC03_User_controls_environment
22.	9.3.2	The wrist writing tablet will need to be able to select which whiteboard to write on when multiple are present.	DR (#15,#18)	2	UC06_User_uses_Tablet
23.	9.3.4	Whiteboards must be able to save the completed drawings into a final PDF document.	SWC(#11)	2	UC07_User_annotates_PDFs
24.	9.4.2	The user must be able to advance and go back in a PDF document using the lectern.	SWC (#8,#12)	3	UC08_User_view_PDFs
25.	9.4.2	The user must be able to change between multiple slides while presenting using the lectern controls.	DR(#12)	3	UC09_User_uses_Lectern
26.	9.5.1	PDFs should be able to be viewed and annotated in a book.	SW	3	UC07_User_annotates_PDFs

27.	9.5.0	The PDF books should be accessible in a bookshelf.	SWC(#24)	3	UC07_User_annotates_PDFs
28.	9.5.1	PDF books that are annotated should edit the source PDF.	SWC(#24)	3	UC07_User_annotates_PDFs
29.	9.6.0	It would be beneficial if users were able to draw in 3D to create models which could be later recalled.	SW	3	UC10_User_draws_3D
30.	9.9.0	Users can change their avatar via the lectern.	NTH SW	3	UC11_User_Customises_Avatar
31.	9.10.0	The software has a terminal that the lecturer can use to view internet content.	NTH SW	3	UC12_User_accesses_Web
32.	9.7.0	The user should be able to create nested 3D mind maps.	SW	2,3	UC13_User_Creates_Mindmap
33.	9.7.0	The user could create topics in 3D space.	SWC(#30)	2,3	UC13_User_Creates_Mindmap
34.	9.7.0	The user can create thoughts and ideas that link to certain topics.	SWC(#31)	2,3	UC13_User_Creates_Mindmap
35.	9.7.0	The user can create new mind maps inside of topics.	SWC(#31	2,3	UC13_User_Creates_Mindmap

Figure 1: Requirements Trace matrix

The project will utilise code from previous units in the construction of the basic framework of the project. The most notable example is KIT208 - VR and AR technology, as it showcased how to implement basic VR controls that will be integral to the project. As well as this, because Bonelab runs on Unity the knowledge gained from other Unity-based classes such as KIT207 Game Design and Production, will assist in the development of other features.

5. Project Schedule

The Gantt charts below outline for each agile cycle the several system requirements that need to be addressed to successfully deliver the project to the client.

	Task Name	End	Start	Resources	Predecessors
1	**AGILE 1**	**29/05/2023**	**11/04/2023**		
2	**Modeling**	**29/05/2023**	**11/04/2023**		
3	Bookshelf	24/04/2023	17/04/2023	Henry	
4	Books	2/05/2023	25/04/2023	Henry	3
5	Monitor	8/05/2023	1/05/2023	Henry	
6	Lectern	15/05/2023	8/05/2023	Henry	
7	**Avatars**	**29/05/2023**	**8/05/2023**		
8	Hairstyles	23/05/2023	16/05/2023	Henry	6
9	Outfits	29/05/2023	24/05/2023	Henry	8
10	**Research**	**29/05/2023**	**11/04/2023**		
11	VR Behavior Scripts	24/04/2023	13/04/2023	Tyler,Will,Josh,Henry,Duc	
12	VR Technology	3/05/2023	24/04/2023	Tyler,Will,Josh,Henry,Duc	
13	VR And Education	10/05/2023	1/05/2023	Tyler,Will,Josh,Henry,Duc	
14	**Testing**	**29/05/2023**	**16/05/2023**		
15	Test BONELAB	29/05/2023	16/05/2023	Tyler	13
16	**Setup**	**29/05/2023**	**11/04/2023**		
17	Management Tools	15/05/2023	8/05/2023	Tyler,Will,Josh,Henry,Duc	
18	Finalize User Requirements	23/05/2023	16/05/2023	Tyler,Will,Josh,Henry,Duc	17

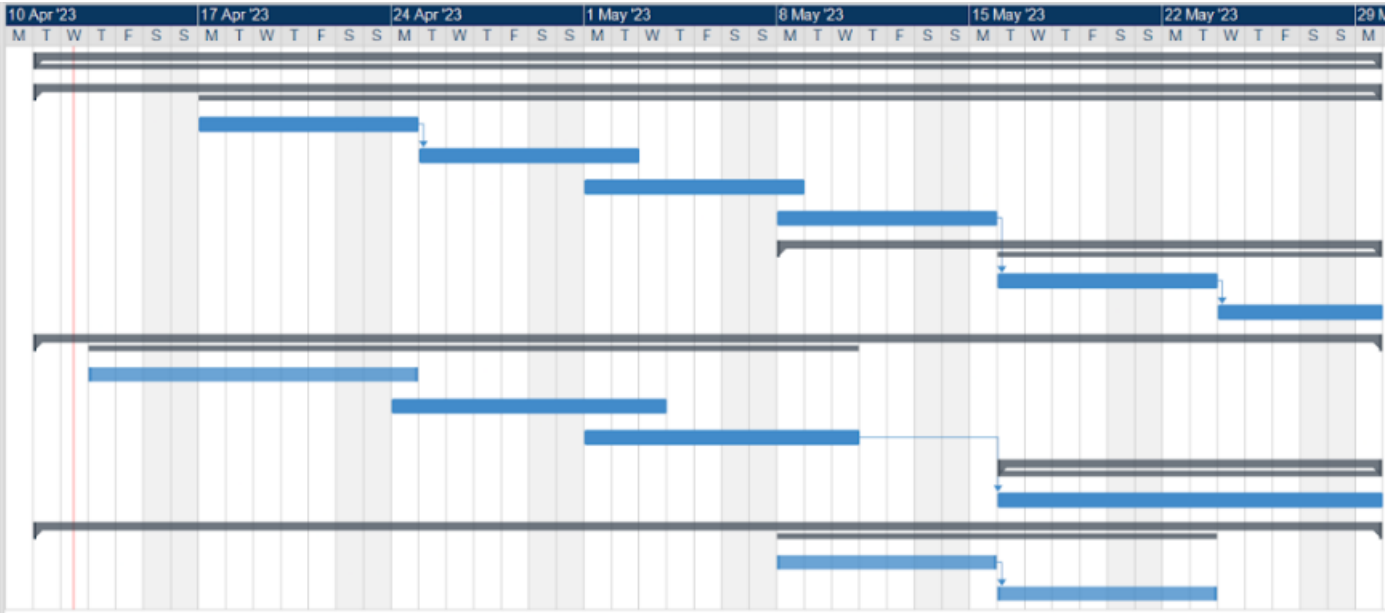

Figure 2: Agile Cycle 1 Gantt Chart (Semester 1 - Weeks 8-13)

	Tas...	Task Name	Start	End	Resources	Predecessors
1		**AGILE 2**	**10/07/2023**	**21/08/2023**		
2		**Feature Development**	**10/07/2023**	**21/08/2023**		
3		Develop Interaction Scripts	10/07/2023	17/07/2023	Tyler,Will,Josh,Henry,Duc	
4		Develop whiteboard drawing and erase	17/07/2023	24/07/2023	Tyler,Will,Josh,Henry,Duc	
5		Develop the ability to summon arm-bound whiteboard	24/07/2023	31/07/2023	Tyler,Will,Josh,Henry,Duc	4
6		Develop area-specific writing on the board	31/07/2023	7/08/2023	Tyler,Will,Josh,Henry,Duc	5
7		Develop the ability to save drawing as pdf	7/08/2023	14/08/2023	Tyler,Will,Josh,Henry,Duc	6
8		Develop Recording Script	14/08/2023	21/08/2023	Tyler,Will,Josh,Henry,Duc	
9		**Misc. Development**	**10/07/2023**	**17/07/2023**		
10		Develop room layout	10/07/2023	17/07/2023	Henry	
11		**Testing**	**10/07/2023**	**21/08/2023**		
12		Test Interaction Scripts	10/07/2023	17/07/2023	Tyler,Other tester	
13		Test whiteboard draw and erase	17/07/2023	24/07/2023	Tyler,Other tester	
14		Test the summoned whiteboard	24/07/2023	31/07/2023	Tyler,Other tester	13
15		Test area-specific whiteboard	31/07/2023	7/08/2023	Tyler,Other tester	14
16		Test ability to save drawings as pdfs	7/08/2023	14/08/2023	Tyler,Other tester	15
17		Test Recording Script	14/08/2023	21/08/2023	Tyler,Other tester	

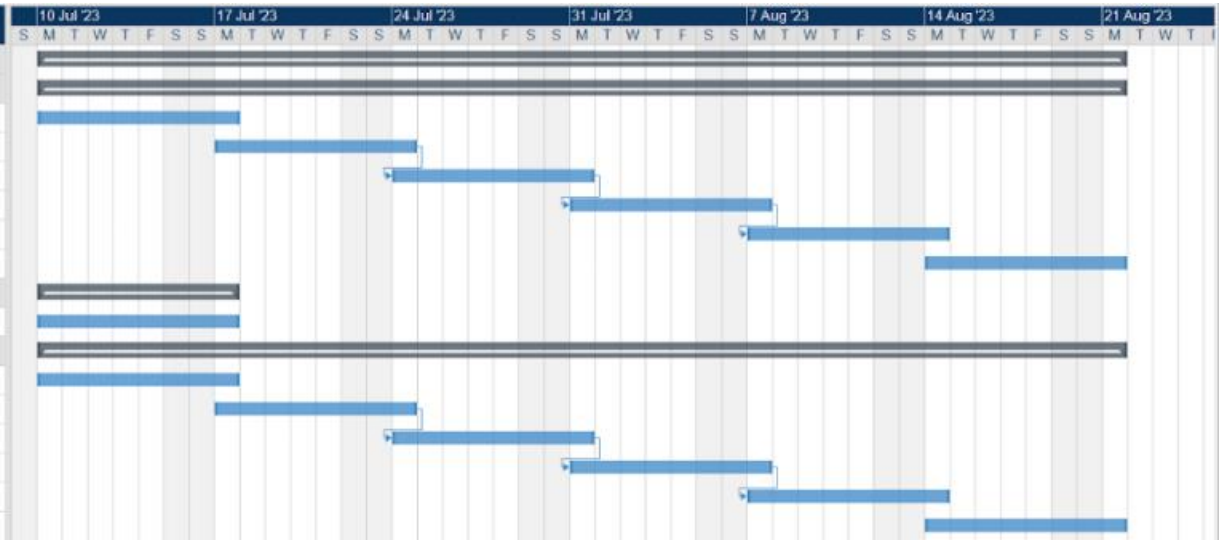

Figure 3: Agile Cycle 2 Gantt Chart (Semester 2 – Weeks 1-6)

	Task Name	Start	End	Resources	Predecessors
1	**AGILE 3**	**28/08/2023**	**9/10/2023**		
2	**Feature Development**	**28/08/2023**	**9/10/2023**		
3	Develop way to change recording scenes	28/08/2023	4/09/2023	Tyler,Will,Josh,Henry,Duc	
4	Develop Recording Microphone levels	4/09/2023	11/09/2...	Tyler,Will,Josh,Henry,Duc	3
5	Develop the lectern and its recording macros	11/09/2023	18/09/2...	Tyler,Will,Josh,Henry,Duc	4
6	Develop the book pdfs to be annotated and shown on the board	18/09/2023	25/09/2...	Tyler,Will,Josh,Henry,Duc	
7	Develop 3d drawing capability and the ability to save it	25/09/2023	2/10/2023	Tyler,Will,Josh,Henry,Duc	6
8	Develop Online Terminal	2/10/2023	9/10/2023	Tyler,Will,Josh,Duc	7
9	Develop Avatar Creation	2/10/2023	9/10/2023	Henry	
10	**Testing**	**28/08/2023**	**9/10/2023**		
11	Test Scene Recording	28/08/2023	4/09/2023	Tyler,Other tester	
12	Test Microphone Levels	4/09/2023	11/09/2...	Tyler,Other tester	11
13	Test Lectern features	11/09/2023	18/09/2...	Tyler,Other tester	12
14	Test book system	18/09/2023	25/09/2...	Tyler,Other tester	
15	Test 3d drawing capability	25/09/2023	2/10/2023	Tyler,Other tester	14
16	Test Online Terminal	2/10/2023	9/10/2023	Tyler,Other tester	15
17	Test Avatar system	2/10/2023	9/10/2023	Tyler,Other tester	

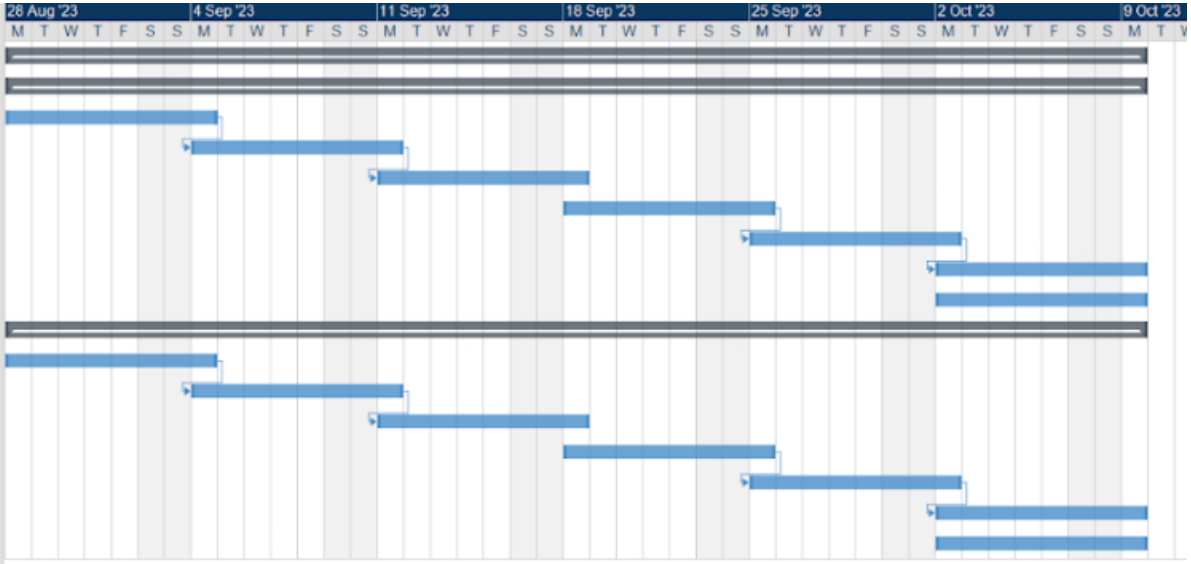

Figure 4: Agile Cycle 3 Gantt Chart (Semester 2 – Weeks 7-12)

6. Risk Analysis

The risk categories used in the below analysis are financial, scope, communication, management, team, stakeholders, change management, technical, and external. Resources used in the category selection process were found at: (Mar, 2016), (*Common Types of Risk in Project Management,* 2021), and (Nizhebetskyi, 2015). Some of the identified risks were also found after conducting research at: (Morphy, 2008), (Mar, 2016), (Nizhebetskyi, 2015), (*10 Common IT Project Risks: Ways to Mitigate Them,* 2019), and (*Simple Risk Log*, 2015).

The likelihood grading is on a scale from low to high and the impact grading is on a scale of low to severe. From this the risk score is calculated as the likelihood multiplied by the impact where the low grading is one and the severe grading is four.

Risk #	Risk Category	Risk Description	Likelihood	Impact	Score	Countermeasures	Risk Owner
Risk 1	Financial	Project will cost more than the allocated budget. The project has a low number of potential costs so this is unlikely to occur and if it was to happen then there would be minimal impact on the project due to the willingness of the client to provide any funds required.	Low	Low	1	**Prevention:** To prevent this from happening a detailed budget will be created and closely monitored throughout the project. **Mitigation:** A small excess fund will be allocated that is readily available for any expenses not already accounted for. **Contingency:** After any change or deviation from the budget has been approved by the Project Manager the client will be informed on what extra expense has arisen to determine if they are willing to provide additional funds.	Project Manager
Risk 2	Scope	Errors or omissions being present in the scope definition. The requirements of the project have been discussed in detail amongst the project team and with the client, so this is unlikely to occur. If this were to happen it would impact the project schedule and potentially lead to wasted productivity and key deliverables getting missed.	Low	Medium	2	**Prevention:** The project team will fully proofread the scope definition before finalising it so it can be ensured that there are no errors or omissions. **Mitigation:** The project team will discuss any potential issues that have been found in the scope definition at weekly project team meetings, so they have no impact on the project schedule. **Contingency:** The scope definition will be fixed and as a result any changes to the project will	Project Manager

						be included in the schedule. The project manager should also inform the rest of the team of these changes and any additional responsibilities any member may have.	
Risk 3	Scope	Scope creep. It is very possible that some requirements may be more complex than initially expected due to relative inexperience of the project team, or that some requirements included are not required by the client so this may occur. If it was to happen it would impact the project schedule and potentially lead to deliverables being incomplete due to difficulty or time constraints.	Medium	Medium	4	**Prevention:** The project team will have regular meetings at which any requirements that are beginning to appear more challenging than initially anticipated can be addressed so there is no scope creep. **Mitigation:** Core requirements will be defined and developed first so any scope creep is inconsequential as it would only surround additional features that are not crucial to the project's success. **Contingency:** The project team will review the item in question and collectively decide on a way to implement the requirement, or if the requirement is best removed from the project.	Project Manager
Risk 4	Scope/ Change management	Project requirement being identified as being infeasible or unable to be met. This will probably occur due to the number of requirements and the expected difficulty in implementing many of them. If this was to happen it may impact the entire project if a key requirement was not possible to be implemented.	Medium	Medium	4	**Prevention:** Before beginning development on any requirement, the project team will fully research how this requirement will be developed and if this is feasible. **Mitigation:** Before beginning development, the project team will focus research efforts on the core requirements so they will not be the ones that are unable to be met. This is because it is not as much of an issue if an additional requirement cannot be developed. **Contingency:**	Project Manager

						The project team will collectively decide if there is a way to introduce a new requirement that accomplishes the same task or if a meeting with the client is required to discuss the situation and find a solution.	
Risk 5	Change Management	Requirement change proposed by the client or project team is ambiguous, inaccurate or without a process to implement the requested change. The requirements have been discussed at length both amongst the project team and with the client so there should not be a need for a drastic requirement change and therefore this risk should not occur if the requirement change is small. If this was to happen it would need to be discussed between the relevant parties until a solution was found, potentially disrupting the entire project team and the project schedule.	Low	Medium	2	**Prevention:** A set framework for change requests will be implemented by the project team so none of the potential issues surrounding a change request arise. **Mitigation:** The project team will communicate regularly so any issues that arise from a change request can be swiftly dealt with and their impact on the project minimised. **Contingency:** The project team will discuss with the party that proposed the change to clarify any parts of it that were not understood.	Project Manager
Risk 6	Change Management/ Stakeholders	Client does not approve a proposed requirement change. This should not occur as the client has been very open to the project team driving the project. If this was to happen it would pose a serious problem and could potentially lead to conflict between the project team and the client.	Low	High	3	**Prevention:** The project team has discussed in detail with the client their vision for the project so any requirement changes should reflect this and therefore the client will have no reason to not approve it. **Mitigation:** The Lead Communications will make contact with the client to discuss the requirement change and determine if an easy compromise can be reached so no formal meeting is	Lead Communications

						required to address this issue. **Contingency:** The project team will internally meet to decide if they think the change is necessary and if so will set up a meeting with the client to discuss it in more detail.	
Risk 7	Change Management/ Scope	Too many requirement changes are made resulting in an overload of complexity. This is unlikely to occur because the requirements have been discussed in great detail, both internally among the project team and externally with the client. If this was to happen it could result in confusion in the project team as to what their responsibilities are, or a decrease in engagement from the project team due to the appearance of an overwhelming project.	Low	Medium	2	**Prevention:** The requirements have been defined by the project team before the project development begins, both with the client and internally within the project team, so there should be no need for mass changes. **Mitigation:** Before a change is approved a quick discussion will take place within the project team to determine if this change is necessary, hence reducing the overall number of requirement changes. **Contingency:** The project team will meet and review the entire project to decide exactly what the changes are, and which are necessary to reduce the overall project complexity.	Project Manager
Risk 8	Change Management/ Scope	Space design is not appropriate to meet the requirements and must be changed. This is expected to occur as there are no specific designs for the appearance of the virtual space at this point in development. If this was to happen though it would cause minimal disruption as the designs are to be reviewed before they are to be implemented.	High	Low	3	**Prevention:** The Lead Architect will consider all relevant factors when designing the space, so their design meets all requirements and does not need to be regularly changed. **Mitigation:** The space designed by the Lead Architect will be simply editable, so any required changes are able to be made without causing any disruption to the project. **Contingency:** The Lead Architect will review their design and update it based on any feedback received from	Lead Architect

						either the other project team members or the client. They will then share their updated design so it can be approved before development continues.	
Risk 9	Stakeholders	Client becomes disengaged or has inaccurate or unrealistic expectations. There are not regular meetings with the client due to time and availability constraints, but the client is heavily invested in the project, so this is unlikely to occur. If it was to happen it would greatly impact the project by potentially resulting in a complete requirement and hence schedule review, or in a lack of clarity surrounding the project requirements.	Low	High	3	**Prevention:** The project team has met with the client to discuss in detail their vision for the project as well as what the project team thinks they can implement. As a result, both parties are proceeding with a shared vision so there is no reason the client should become disengaged or have any unrealistic expectations. **Mitigation:** The Lead Communications will remain in regular contact with the client to ensure that they are kept informed about, and hence engaged in, the project. **Contingency:** The Lead Communications will meet with the client to discuss their feelings on the project and find ways that they can be reengaged or have their expectations managed. They will then report to the rest of the project team to discuss the outcomes of that discussion.	Lead Communications
Risk 10	Stakeholders	The organisation of the client changes. This is very unlikely as the client is a valued member of their organisation. If this was to happen however it would be disruptive due to the client meeting arrangements becoming much more challenging.	Low	Medium	2	**Prevention:** The client will continue to meet all their obligations toward their current organisation during the project so there will be no reason for any abrupt organisation change. **Mitigation:** The Lead Communications will communicate with the client whenever there is a need and therefore will learn of any organisation change quickly so there is no lengthy disruption to the project. **Contingency:**	Lead Communications

						The Lead Communications will talk to the client to determine what their new organisation is and what methods of communication, both online and physical, are best for all parties to proceed with.	
Risk 11	Stakeholders/ Communication	Slow, unclear, or ambiguous client feedback. Due to the client's position and experience in providing feedback this is unlikely to occur. If this does happen though it would take time out of the Lead Communications project team member's schedule to chase up or clarify this information.	Medium	Medium	4	**Prevention:** There will be a set feedback framework developed by the project team so there is no possibility of slow, unclear, or ambiguous client feedback. **Mitigation:** The Lead Communications will quickly email the client to resolve any misunderstanding as soon as possible. **Contingency:** The Lead Communications will discuss their feedback with the client to clarify any parts of it that were not clear, before relaying that information to the rest of the project team.	Lead Communications
Risk 12	Stakeholders	Client rejects the project. This is extremely unlikely to occur due to the dedication of the project team. If this did happen though it would be an enormous issue and potentially call the future of the project into question.	Low	Severe	4	**Prevention:** The project team and the client have met and discussed the project in detail so there is no chance that the client will not be satisfied with the project upon its completion. **Mitigation:** The project will be presented to the client enough time before it is due to be completed, so any rejection can be quickly addressed before the final due date. **Contingency:** The project team will physically meet with the client to discuss the client's exact feelings on all project aspects and any areas of concern that must be addressed before the project will be accepted.	Lead Communications

Risk 13	Management/ Team	Time management of any of the project team members is not appropriate. Due to all project team members having other commitments outside the project this is possible. If this were to occur depending on the severity of this, it could drastically impact the project schedule as that member's contribution would be vastly lower than required.	Medium	High	6	**Prevention:** All project team members will maintain a diligent work ethic and manage their time effectively between this project and any other commitments they have. **Mitigation:** The Project Manager will monitor the progress of the project to ensure that there are no project team members that are falling behind on their responsibilities due to their time management skills. **Contingency:** The Project Manager will talk to this team member away from the rest of the group either at a team meeting or another time convenient to both so the issue can be resolved.	Project Manager
Risk 14	Communication / Team	Project team members misunderstand the project requirements. Given the number of requirements and the complexity of some of these, this risk is somewhat likely to occur. If this did happen it could lead to an immense decrease in that member's output until they were able to rectify the issue.	Medium	High	6	**Prevention:** All project requirements have been discussed within the project team and recorded in a document that is accessible to all members, so there should be no one that is unclear about any project requirements. **Mitigation:** There are simple methods of communication that have been put in place so any project team member can quickly and easily contact the rest of the team to ask for any clarification about the project requirements they need. **Contingency:** The Project Manager will address the rest of the team either at a team meeting or sooner if the issue is great enough, so any requirements can be clarified, and all project team members can move forward with full clarity.	Project Manager

Risk 15	Communication /Team	Project team members are not kept informed on project development progress or project requirement changes. Due to the frequency of project team meetings and the even greater frequency of intrateam communication this risk is very unlikely to transpire. However, if it does it would only pose a problem until the project team contacts the affected member which should not impact the project too much.	Low	Medium	2	**Prevention:** Any major changes or milestones achieved will be discussed amongst the project team as soon as a need arises so there should not be any project team member that is not kept informed on any relevant aspect of the project. **Mitigation:** Any project team member will communicate either at the weekly meeting, before any major milestones are achieved, or before any change requests is required. **Contingency:** The Project Manager will outline to the rest of the project team a progress report and any requirement changes at the weekly team meeting, so all members are fully aware of what is going on.	Project Manager
Risk 16	Team	One or many project team members are unavailable for a substantial period. Due to the high probability of events transpiring that would lead to someone being unavailable, such as becoming sick or injured, this risk is highly likely to materialise. If this was to happen though it would have minimal impact on the project due to the ease implementing workarounds such as online communication.	High	Low	3	**Prevention:** All project team members will practise healthy behaviours to reduce the chance of a serious illness. They will also manage their time effectively, so they are never in the situation where their other commitments lead to them being unable to contribute to the project for a substantial period. **Mitigation:** All project team members will have the ability to work online so if something does come up that would potentially impact any member's ability to work on the project a framework will already be in place to potentially address this. **Contingency:** The Project Manager will assign any of the affected project team member's tasks for that period which must be completed to other members of the project	Project Manager

						team to ensure the project stays on schedule.	
Risk 17	Team	A project team member withdraws from the unit or fails to pass semester one and is unable to complete semester 2. Due to the commitment and professionalism of the project team members this is exceedingly unlikely to take place. If it was to happen though it would greatly impact the project schedule by leading to an immense increase in the workload of the remaining members.	Low	Severe	4	**Prevention:** The project team as a whole will ensure that all members meet all requirements to pass, and all members will work in a professional manner to ensure a passing result. The project team will also be supportive to each member so there is no reason created for any member to withdraw and all members continue to give their all to each project aspect. **Mitigation:** Some extra flexibility will be initially included in the project schedule by the project team so if there is any reason member cannot continue the rest of the team are not overloaded. **Contingency:** The Project Manager will equally divide the tasks of the project team member that has left to other members to ensure the least disruption to the project as possible. If necessary, some of the project requirements will also be removed so the project remains achievable with the reduced number of members.	Project Manager
Risk 18	Team	A project team member's performance does not meet expectations. This is extremely improbable due to the commitment and expertise of the project team members. If this was to happen it could lead to internal conflict within the team if the project team member in question was unwilling	Low	High	3	**Prevention:** All project team members will work diligently so everything produced is of a high standard. **Mitigation:** The Project Manager will monitor the progress of the project to ensure that there are no project team members that are producing substandard work. **Contingency:** The Project Manager will talk to this team member away from the rest of the	Project Manager

		to accept criticism of their work.				group either at a team meeting or another time convenient to both, so the issue can be resolved. If necessary, some of the tasks will be reassigned to other members.	
Risk 19	Team	A project team member has a negative attitude toward the project or another team member. Due to the importance of the project to all project team members conflict is a distinct yet remote possibility. If this was to occur there may be a marked reduction in the productivity of the project team members involved, greatly impacting the project schedule.	Low	High	3	**Prevention:** All project team members will support all others in all aspects of the project so there is never any ill will toward either the project or another team member. **Mitigation:** Any negative feelings among the project team will be able to be addressed quickly by communicating to relevant members due to the positive work environment created. **Contingency:** The Project Manager will talk to this team member away from the rest of the group or with the other team member if there is a dispute at a time convenient to all so the issue can be resolved.	Project Manager
Risk 20	Team	A project team member has low motivation toward the project. All project team members have many other aspects to their lives so burnout, and hence this risk, is possible. If this was to happen it could disrupt the rest of the project team as they may have to take on additional work due to the anticipated reduction in productivity of the affected member, consequently impacting the project schedule and even resulting in a snowball effect.	Low	High	3	**Prevention:** All project team members will do everything they can to contribute to the project due to a shared goal of getting the best result possible. **Mitigation:** All project team members will support all others, so they all maintain a desire to succeed. **Contingency:** The Project Manager will talk to this team member away from the rest of the group either at a team meeting or another time convenient to both so the issue can be resolved.	Project Manager

Risk 21	Team/ Management	Project team does not have a clear direction or authority figure on any project aspect. Due to the effective division of project tasks and project team member roles this risk should not materialise. If it does however it could result in a minor disagreement amongst project team members or reduced productivity while the issue is resolved.	Low	Medium	2	**Prevention:** Before project development begins the project team met and discussed what each member's role would be within the team. These roles then determine which member has authority in each aspect of the project. **Mitigation:** The Project Manager will be available for contact if any project team members have any issues they wish to bring up. **Contingency:** The Project Manager will settle any disputes as soon as they arise by ruling on the project aspect in question and providing a clear direction for this aspect to move.	Project Manager
Risk 22	Team	Project team structure changes. Due to the interconnected roles of the project team members this risk is unlikely to occur as each member is encouraged to assist the project development in all areas, not just the one they are primarily responsible for. If this was to take place though it could result in massive disruptions to the project team while this change was taking place, and potentially in the immediate aftermath of this change. This would be if any project team members were either not comfortable with the change, or unsure of their new responsibilities.	Low	High	3	**Prevention:** Before project development begins the project team met and discussed what each member's role would be within the team. As all members agreed with the decisions made there should be no requirement for any team structure changes. **Mitigation:** The project team member's primary roles do not prevent them from assisting with another area of the project meaning that any official structure change will have minimised effect. **Contingency:** The Project Manager will discuss with the rest of the project team at an emergency team meeting what changes have or should be made, how this will affect all members, and what all members' responsibilities are for the rest of the project.	Project Manager

Risk 23	Team/ Communication	A project team member is unclear on their role or responsibilities. As a result of the detailed schedule produced for the project members should be fully able to see exactly what they are meant to be responsible for. If this was to occur, it would cause minimal disruption due to the ease and frequency of intrateam communications.	Low	Low	1	**Prevention:** All project team member's roles and responsibilities have been discussed within the project team and recorded in a document that is accessible to all members, so there should be no one that is unclear about what they should be doing. **Mitigation:** There are simple methods of communication that have been put in place by the project team so any member can quickly and easily contact the rest of the team to ask for any clarification about the task they should be completing. **Contingency:** The Project Manager or another project team member will clarify the role of the affected member as soon as a question is raised to ensure minimal disruption to the project.	Project Manager
Risk 24	Technical	A piece of software or hardware used is found to be unsuitable for the purpose it was intended. Due to the relative inexperience of the project team members compared to veteran industry professionals with many of the technologies used in the project, this risk is a distinct possibility. If this was to happen it could result in great disruption to the project because of the time taken to find a solution.	Medium	High	6	**Prevention:** Substantial amounts of research will be conducted by the project team to ensure that all pieces of software and hardware chosen for use in the project is suitable to accomplish the required task. **Mitigation:** Testing will be conducted both during and after development of all project requirements by the project team to ensure that all pieces of software and hardware chosen are working as intended and any that are not can be replaced before the project is due. **Contingency:** The Lead Programmer will discuss with any project team member that was using that piece of software or hardware to come up	Lead Programmer

						with a replacement as soon as possible.	
Risk 25	Technical/ External	Security breach or attack. Due to the relative isolation of the project from any external parties there is a very low chance of this occurring as external parties are not able to easily access the project or even learn of the project's existence. If this was to happen it could be catastrophic to the project as it could be completely stolen, erased, or sold before its intended release.	Low	Severe	4	**Prevention:** The project team will ensure that all online project components are guarded using online protection methods, so the chances of a security breach are minimised. **Mitigation:** Copies will be made of all online project components by the project team so the project can continue if there is a breach. **Contingency:** The Project Manager will consult with the Lead Programmer to ascertain the damage and will then relay those findings to the rest of the project team to collectively decide on a way forward.	Project Manager
Risk 26	Technical	Project deliverable is found to be unsuitable for the target users. As the project is to be tested regularly both internally and externally with the target users the possibility of this occurring is reduced but still somewhat likely due to the number of requirements that require testing before the user experience is optimised. If this was to occur especially late in project development, it could have a great impact on the project schedule due to the extra work then required to rectify any issues.	Medium	High	6	**Prevention:** Substantial amounts of research will be conducted to ensure that every project deliverable developed is suitable for the target users. **Mitigation:** Testing of all project deliverables will be conducted early in the development process by the project team to ensure that any that are unsuitable for the target audience can be reworked before the project is due. **Contingency:** The Lead Programmer will conduct extra testing to determine exactly what aspect of the deliverable is the issue and will then, with the project team member responsible for that deliverable, discuss and implement a solution.	Lead Programmer

Risk 27	Technical	Project deliverables are not up to the required standard. Because the project team will do everything they can to ensure the product produced is of a high-quality standard this is unlikely to occur. If it does happen it could result in major disruption to the project schedule as work that was seen as being completed would need to be revisited.	Low	High	3	**Prevention:** All project team members will work diligently so everything produced is of a high standard. **Mitigation:** The Project Manager will monitor the progress of the project to ensure that there are no project team members that are producing substandard work. **Contingency:** The Project Manager will talk to the project team member responsible for this deliverable away from the rest of the group either at a team meeting or another time convenient to both, so the issue can be resolved. If necessary, the Project Manager will reassign this deliverable to another member of the project team.	Lead Programmer
Risk 28	Technical/ Management	Inadequate testing of the project deliverables. It is crucial that the product is usable for the target audience so testing is extremely important and hence will be given a high priority. Due to time constraints though it is possible although unlikely that despite this the risk may occur. If it was to happen the project schedule would be greatly impacted as past features may have to be revisited due to them not being sufficiently tested.	Low	High	3	**Prevention:** Due to the importance of sufficient testing a large portion of the project schedule has been devoted to testing by the project team to ensure this issue never arises. **Mitigation:** Testing of any project aspect will be made easy through the availability of the required equipment, so any occasion there has not been adequate testing this issue can be swiftly rectified. **Contingency:** The Lead Programmer will conduct extra testing to ensure that the deliverables meet all the user's requirements. They and the project team member responsible for that deliverable will then implement any changes that were found to be necessary from the testing session.	Lead Programmer

Risk 29	Technical	Technological component used is not scalable, interoperable, compliant with relevant standards and practices, stable, extensible, or reliable. As many of the technological components that are to be used in the project have not been previously used by all project team members this risk is distinctly possible as any of these factors may be overlooked or not properly evaluated when the technology selection process is undergone. If this does happen it could greatly disrupt the project as it could result in needing new ways to implement some of the project requirements or a complete rework of the current method.	Medium	High	6	**Prevention:** Substantial amounts of research will be conducted by the project team to ensure that every technological component chosen for use in the project does not exhibit any of these potential issues. **Mitigation:** Testing will be conducted by the project team both during and after development of all project deliverables to ensure that all technological components chosen are working as intended and any that are not can be reworked before the project is due. **Contingency:** The Lead Programmer will discuss with any project team member that was using that technology to come up with a replacement as soon as possible.	Lead Programmer
Risk 30	External	Theft of any physical or non-physical project components. Due to the very low probability of any external parties being both aware of the project and with malicious intent toward it this is extremely unlikely to occur. If this does happen however the impact on the project would be catastrophic and it could potentially lead to the project's termination due to lost resources.	Low	Severe	4	**Prevention:** The project team will ensure that all physical components are securely kept so the chances of theft are minimised. Any non-physical components will be guarded using online protection methods, so the chances of theft are minimised. **Mitigation:** Copies will be made of all non-physical project components so the project can continue if one copy is stolen. There will also be many of the physical components in use by the project team so if one is stolen it does not mean the project will have to cease development. **Contingency:** The Project Manager will ascertain the impact of the	Project Manager

						theft and will then relay those findings to the rest of the project team to collectively decide on a way forward.	
Risk 31	External	Legal action being launched against the project. As the project has no current competitors and will follow all relevant standards and practices this is exceedingly unlikely to occur. If it does materialise though the effect on the project would be catastrophic and would likely lead to the project not being completed due to time lost or terminated as a result of the legal action.	Low	Severe	4	**Prevention:** The project team will ensure that all actions taken comply with any relevant standards or practices to ensure there are no grounds for legal action. **Mitigation:** Nothing can be done to mitigate the impact of legal action being launched against the project. The best that can be done is to ensure there is no reason for any action to be launched. **Contingency:** The Project Manager will ascertain the facts of the legal action and will then relay those findings to the rest of the project team to collectively decide on a way forward. If necessary, project development will be halted during the legal process.	Lead Compliance
Risk 32	External	Natural force such as severe rain or wind results in outcomes such as blackout or flooding. Due to the unpredictable and at times severe weather events around the project team's area this is possible but not too likely as a result of the infrequency of events of this magnitude. If this was to happen it could greatly disrupt the project as it could mean the project team members would not have access to or the ability to use services such as transport or device charging.	Low	High	3	**Prevention:** Nothing can be done by the project team to prevent any natural force. The best that can be done is to mitigate the impact on the project team members. **Mitigation:** All project team members will have the ability to work online so if this event does impact any member, then a framework will already be in place to potentially deal with that. **Contingency:** The Project Manager will communicate with any affected project team members to come up with an individual solution for each of them. This could include them working from	Project Manager

						home or reassigning their tasks temporarily.	
Risk 33	External	Local strike action. This is exceedingly rare and the likelihood of this affecting an area that is crucial to the project development is extremely low. If this does happen and affects a service the project team requires such as bus services, the impact would not be too great as there are other methods of communication already established.	Low	Low	1	**Prevention:** Nothing can be done by the project team to prevent strike action. The best that can be done is to mitigate the impact on the project team members. **Mitigation:** All project team members will have the ability to work online so if this event does impact any member, then a framework will already be in place to deal with that. **Contingency:** The Project Manager will communicate with any affected project team members to come up with an individual solution for each of them, this most likely being online communication until the strike action is over.	Project Manager
Risk 34	External	Disease outbreak. The likelihood of this event has grown over recent years so it must be considered possible. If this did happen it would not have much of an effect on the project team as all members have grown accustomed to online communication.	Medium	Low	2	**Prevention:** Nothing can be done by the project team to prevent a disease outbreak. The best that can be done is to mitigate the impact on the project team members. **Mitigation:** All team members will implement healthy practices such as regular hand washing to best reduce the impact of this event on the project team members. **Contingency:** The Project Manager will communicate with all project team members to come up with a collective solution, this most likely being online communication until normal activities are able to resume.	Project Manager

Figure 5: Risk Log

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