

Continuous Assessment Cover Sheet



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Programme: MSc in Games and Extended Reality	Stage: Semester 2	Complete Student Checklist: Re-read brief <input checked="" type="checkbox"/> References and Bibliography <input checked="" type="checkbox"/> Proofread <input checked="" type="checkbox"/>
Module: User Experience Design for Immersive Technologies		
Due Date: 13 Mar 2023	No. Pages: 15	
Lecturer's Name: Naoise Collins & Michael Connolly		
Assignment No. and/or Description/Topic: CA 3 – Obstacle course (33%) of Software Engineering & Animation Modules		Mode of Submission: Softcopy <input checked="" type="checkbox"/> Hardcopy <input type="checkbox"/>

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- I have read and abided by all of the requirements set down for this assignment.

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13/03/2023

SIGNATURE..... **DATE.....**

Lecturer's Comments:

Provisional Mark: _____ **Lecturers Signature:** _____ **Date:** _____



VR Road Safety Training: Safety Squad

James Bunt (D00262403)

12th March 2023

Software Engineering & 3D Animation CA3:
Design Document
MSc in Computing in Games & Extended Reality

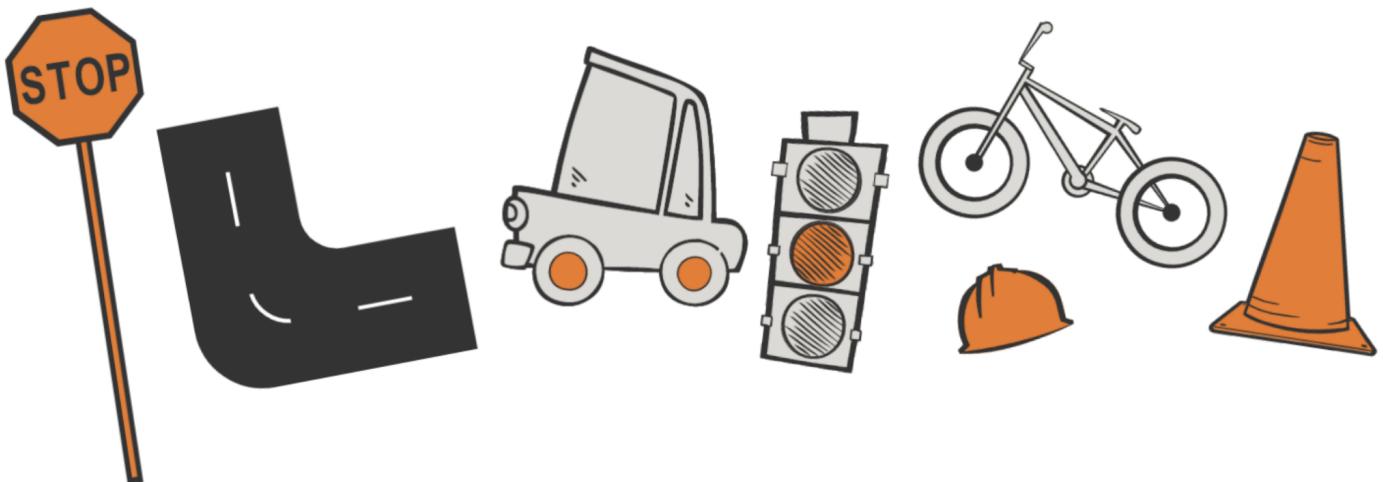


GITHUB:
<https://github.com/jbunt85/SWE-3DA-CA3-GREYBOX>

ONEDRIVE:
https://studentdkit-my.sharepoint.com/:f/g/personal/d00262403_student_dkit_ie/ErJ3ePfkfQhNgCGDWijUluQBthBbjRGmdcvxxHSzMKbPQQ?e=cmVmEM

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1. Introduction

This document specifies the design and development for the gameplay of a VR game with the provisional title 'Safety Squad: Road Safety'. Note that this title is planned to be further developed to cover further educational areas such as online safety and bullying.

According to the World Health Organization (WHO, 2021), road traffic injuries are the leading cause of death among children and young adults aged 5-29 years globally so this is a priority area which needs innovative solutions. To address this issue, an immersive virtual reality (VR) game will be developed to educate minors aged 6-16 on road safety awareness.

1a. Scope

This document is intended to be read by the programmers, artists and producers involved in the design, implementation and testing of **SAFETY SQUAD**.

1b. Project Management

It should be noted that this is a living document which is still in early development and subject to change but will be maintained as the design, development and user testing phases progress.

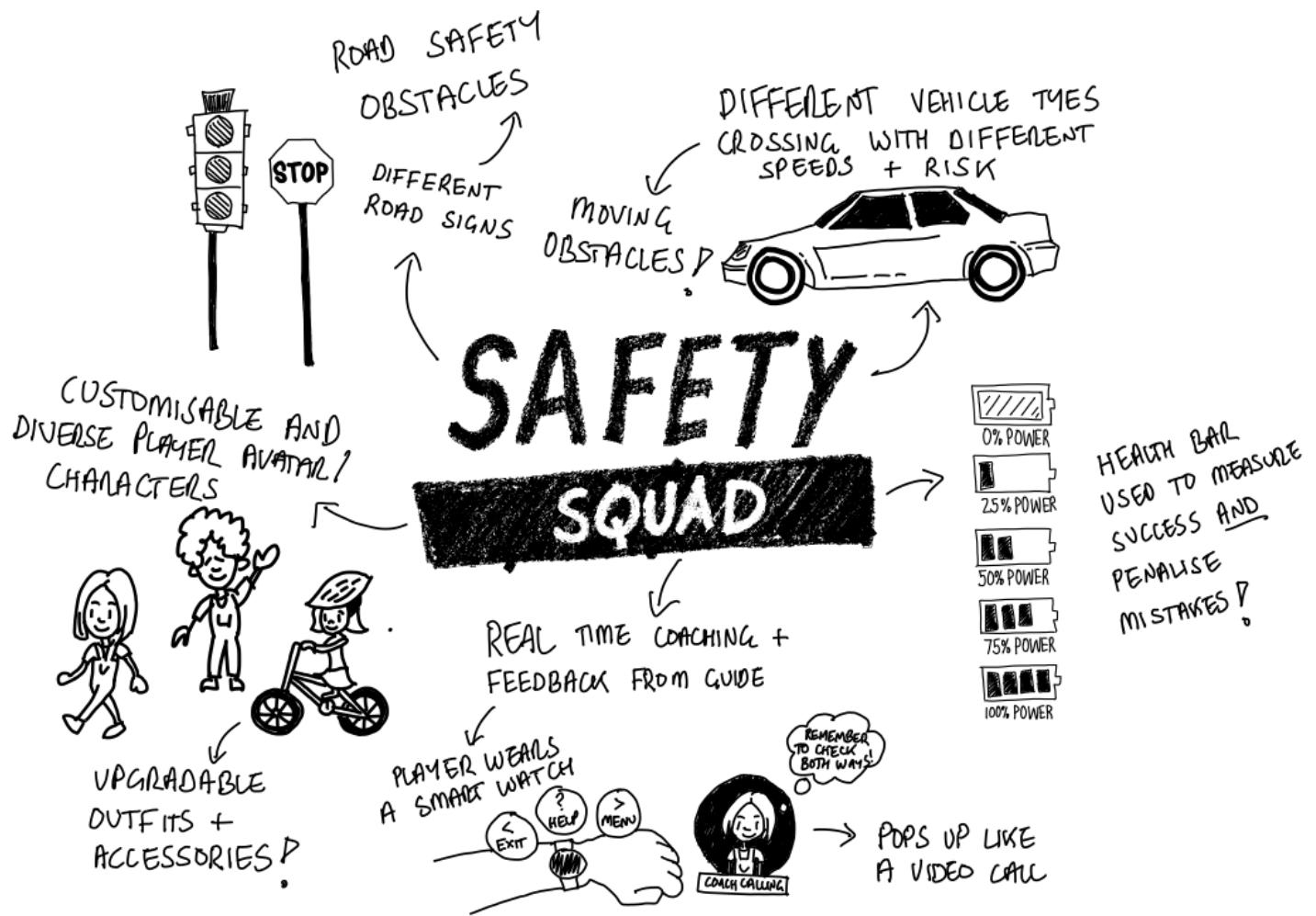
The critical phases along with deliverables are as follows:

Phase	Due Date	Testing Type	Key Activity & Deliverables
Concept	12 Mar 2023	User Interviews	Target audience definition. Character, obstacle, scene & mechanic concept art. Greyboxing with initial user feedback (interview). Storyboard & animatic.
Alpha	27 Mar 2023	Internal Playtesting	Playable beta version of game. Level art, character models and 360 spatial sound effects completion. Gameplay testing and refinement.
Beta	30 Apr 2023	External Playtesting	More extensive testing and feedback activity through play testing. Iteration phase to extensively identify and resolve bugs.
Release	02 May 2023	Player Reports	Final release date and patches before public release. Development of marketing material including trailer and promotional visuals.



2. Game Concept

2a. Brainstorming



SAFETY SQUAD is an educational VR experience that teaches road safety awareness to younger users. One of the core challenges is an obstacle course game set in various locations where road safety awareness is important, such as a virtual city. The player would take on the role of a pedestrian trying to safely navigate to their destination while avoiding various hazards and obstacles.



2b. Gameplay Summary

SAFETY SQUAD immerses players in semi-realistic, interactive environments which are fun and engaging but also educational and informative where they can practice and learn important road safety skills. In recognition of the sensitive subject matter, visuals will be animated and cartoon-like but through gamification of appropriate scenarios, positive safety behaviours will be developed.

The game would start with a tutorial that introduces the basic rules of the road, such as using walkways, obeying traffic signals, the different types of crossings and how to safely use them. The player would then progress through different levels, each with increasing difficulty and complexity.

Each level would present the player with different challenges related to road safety, such as crossing busy junctions, avoiding distracted drivers and navigating around unplanned obstacles/ obstructions (i.e. closed walkways due to building works). The player would have to use their knowledge of road safety to navigate the obstacles and reach the end of each level safely.

To make the game more engaging, players will earn both power (for their health bar) and bonus points for successfully passing each obstacle, with the opportunity to unlock different virtual rewards such as new costumes or accessories for their avatar, however power and points can also be lost for taking risks or not following positive road safety behaviours. For further gamification to make this learning experience as engaging as possible, it will also include a leaderboard where players can compete with each other for the highest score (i.e. students could compete within their class or neighbouring schools could challenge each other during road safety week).

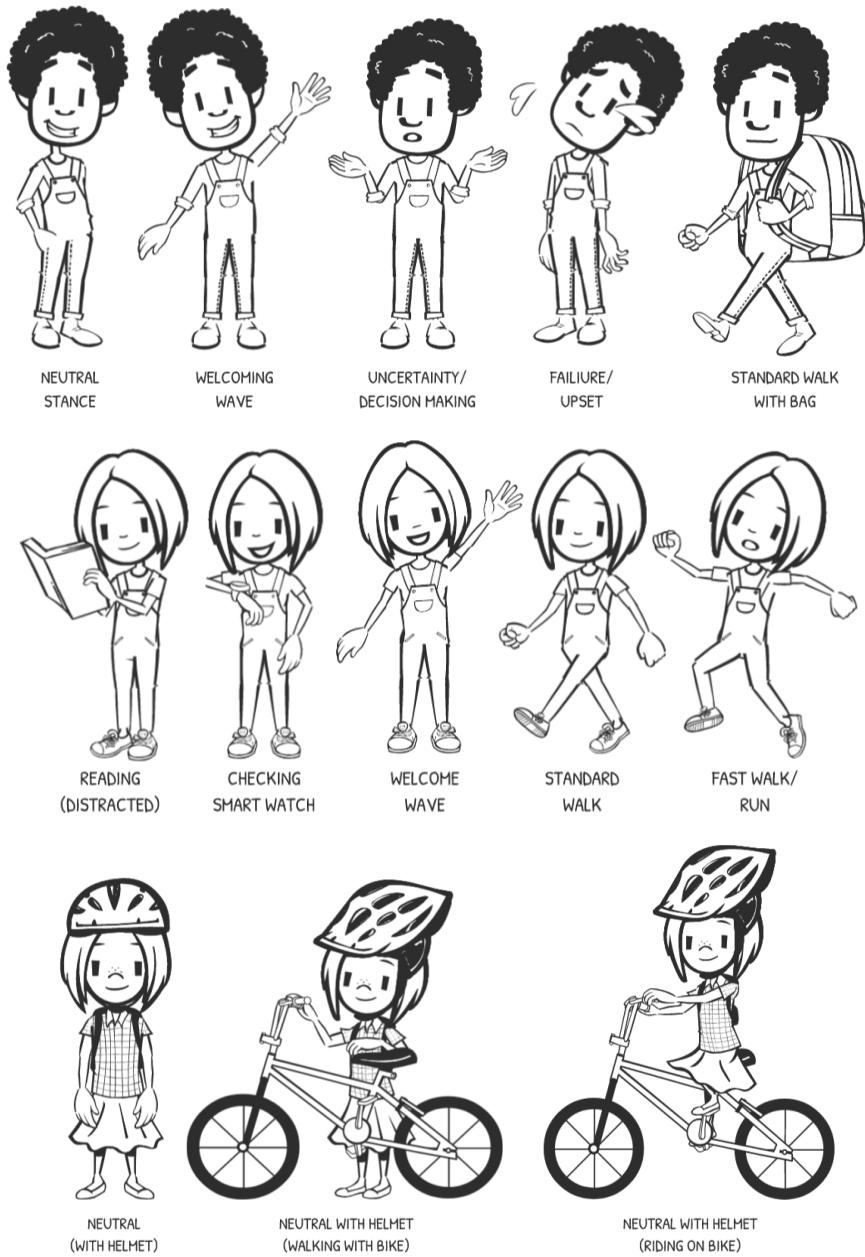
SAFETY SQUAD is a fun and interactive way for younger users to learn about road safety, while also helping them develop important skills and knowledge that will keep them safe on the road in real life.



3. Concept Art

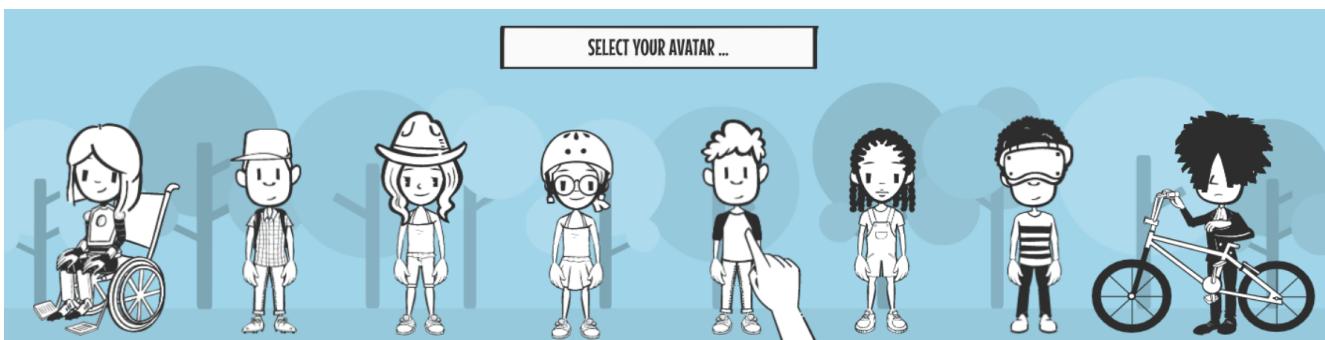
3a. Characters

The characters would be designed to be non-realistic cartoon like characters who are relatable and engaging to the young target audience. There would also be a range of coaches offering credible and authoritative guidance to reinforce important safety messages and support the development of positive behaviours. Here are some character concepts:





- **Player Character/ Avatar:** The player's avatar is a customisable cartoon character which allow the young users to create a character that reflects their personality and interests, including sufficient variety to ensure diversity is adequately reflected in the game. Advanced game features could also enable the player to enhance their avatar with different costumes and accessories that are unlocked as they progress through the game's challenges.



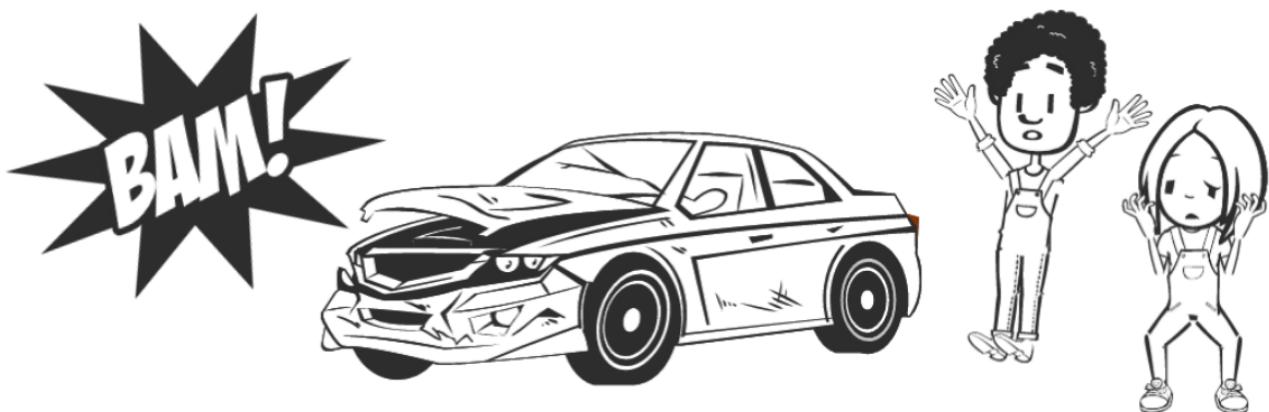
- **Safety Coach:** This guidance character (a coach in the 'Safety Squad') will popup throughout the game resembling a video call if the player was wearing smart glasses. This Coach will offer guidance on gameplay, advice on how to stay safe when in certain situations to ensure positive safety behaviour in the moment. The Coach will also provide feedback on the player's performance in real time, offering suggestions on how to improve their road safety skills.



- **Uncompliant pedestrians:** These characters could appear throughout the game as examples of what not to do when crossing the road. For example, a distracted pedestrian could be shown crossing the road while looking at their phone or listening to loud music or perhaps there are a group of pedestrians taking shortcuts (i.e. running across the road before the light turns green whilst there are no cars in sight) all behaviour which can be instinct to to copy but could easily lead to an accident. Advanced gameplay here could also include the opportunity to identify others unsafe behaviour to win bonus points.



- **Distracted vehicle drivers:** Either driving safely without due care or breaking traffic laws. This unsuspected behaviour happens in the real world so it is important that player's are provided with such examples (i.e. a car going through a red light or not giving way to the pedestrian at a zebra crossing), this could be used as a way to reinforce the importance of following traffic rules but also being aware and reacting to other road users. Note that you would probably only see the vehicle rather than the driver for these character sets.



By including relatable and engaging characters, **SAFETY SQUAD** can create a more immersive and memorable experience for the younger target audience users, while reinforcing important road safety messages.



3b. Obstacles

The obstacles in the **SAFETY SQUAD** VR obstacle course game would be designed to simulate real-life road safety situations that young pedestrians might encounter when crossing the road or walking along a pavement. Note that as earlier discussed, visuals would be cartoon like which helps engage the learner in a fun gameplay environment which can support effective learning but also helps to reduce any wellness risks (i.e. road safety and the associated risks can be triggering to some so the combination of engaging cartoons with an important learning subject is very complementary to the young target audience). Here is additional detail and examples:



- **Vehicles** - the player would be faced with a variety of vehicles used with different levels of size, visibility, volume, risk and speed. The different kinds of vehicles have different levels of difficulty to navigate against and different levels of risk:
 - **Bicycles:** A popular form of transportation, and players will need to watch out for them when roads but also whilst crossing bike lanes or shared paths. The risk here is low but the volume is high.
 - **Motorcycles:** Motorcycles are fast-moving, can be difficult to see and can be unpredictable, so players will need to be extra careful when crossing the road near them.
 - **Scooters:** Electric scooters are becoming more popular and the amount of accidents have seen a significant spike recently due to the lack of awareness. Players will need to be aware of such scooters and their associated risk especially as they could face them both when walking on sidewalks or crossing the road.
 - **Cars:** The most common type of vehicle that players will need to watch out for when crossing the road. They could be designed to move at different speeds and obey traffic signals however towards the harder levels, players could also be faced with cars not following the proper rules (i.e. crossing a red light or not correctly giving pedestrian right of way on a zebra crossing - which does happen so the player needs to be ready to react to such credible risks).



- **Buses:** Buses and coaches are larger and slower-moving than cars but the risk is far greater especially around schools where they are often parked on walkways with limited visibility. Players will need to learn about the greater patience and awareness needed around such vehicles along with the requirement to wait for them to pass before crossing the road.
- **Trucks:** Trucks are much larger alike to a bus but can often be as fast than cars so is at the highest risk level but also the highest difficulty level in road safety. Players will experience these vehicles at the harder levels with the need to be especially cautious when crossing the road near them.
- **Emergency vehicles:** Players will need to know how to safely yield to emergency vehicles like ambulances and fire trucks when they're on the road, especially as they take priority when their emergency lights are activated which can be especially confusing to both pedestrians and drivers.
- **Junctions with distracted drivers** - the player would need to first identify the appropriate place to cross the road (or multi-use walkway) then ensure that the vehicles see them before stepping into the crossing - possibly in the advanced stages, avoiding distracted drivers who may be on their phones or not paying attention to the road.
- **Unusual surroundings** - construction/ building sites or road works leading to with blocked pavements or unusual crossings will force the player to navigate around barriers and closed pavements in the advanced stages, such as crossing the road safely in a non planned way to get to the other side.
- **Blind corners** - as players need to be especially cautious when approaching blind corners or concealed ways, opportunities to assess whether the player is able to demonstrate the right behaviours to spot potential hazards will be critical.
- **Pedestrian distractions** - the player would need to avoid being distracted by their own devices (i.e. mobile devices, loud music) or other distractions (i.e. a waving friend across the road or a impending deadline to meet) and still pay attention to their surroundings, safely.

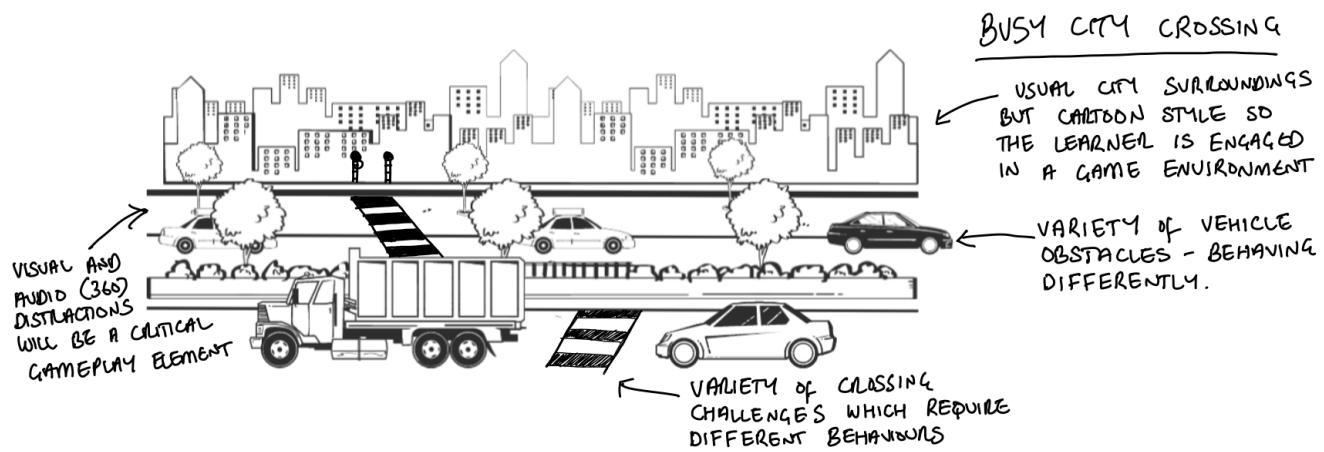
By designing the obstacles to mimic real-life situations, players can gain practical knowledge and experience in navigating the roads safely, while having fun in a VR environment.



3c. Scenes

The game will be set in a present day world and will include several different possible scenes since different environments can involve different types of road safety risks.

- **Busy city road crossing:** Lots of loud noises and distractions with faster and larger passing vehicles. This level would include multiple safe crossing points but also tempting unsafe crossing points too. Note that this is an early low fidelity sketch for brainstorming and userfeedback purposes only at this point.

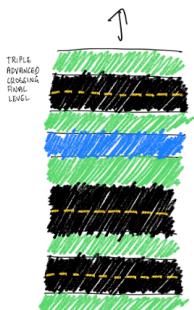


- **School commute route:** It is common for school aged users to independently walk to and back from school so it'll be important to simulate such an experience. Here is a higher fidelity mockup of such visuals (before 3D modelling) which simulates an example of poor road safety since the user has crossed at a non designated crossing point and in front of the school bus with limited visibility of incoming traffic.



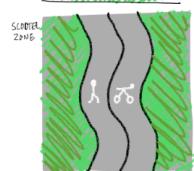


3d. Map Layout Overview



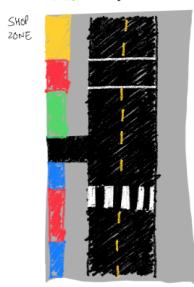
7. Triple Advanced Crossing

- Faster and bigger vehicles.
- More unpredictable and distracted drivers.
- Harder to identify safe crossing areas.



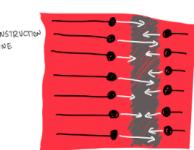
6. Electric Scooter Evasion

- It's time to go through the park but this means a single walkway shared with bikes/ scooters - who sometimes do not stick to their own side.
- Player must evade other walkers and dangerous bikes/ scooters.



5. High Street Sprint

- Busy and loud highstreet with lots of distractions.
- Concealed entrance with car coming out when the player gets close.
- Player is called over by a friend and needs to practice safe crossing practice to visit their friend and get more information on the next stage.



4. Construction Zone Crisis

- The player enters an area with roadworks and needs to time their route correctly to evade the building machinery along the narrow walkway.



3. Pot Hole Monster Maze

- Maze with various routes to explore.
- Although the pavement is damaged and the player needs to evade the pot holes to escape this section!



2. Double Beginner Crossing

- Slower standard vehicles where basic crossing ability is required.
- Player needs to identify correct crossing route.
- Player needs to practice double checking to prevent collision.

1. Puddle Panic Playground Escape

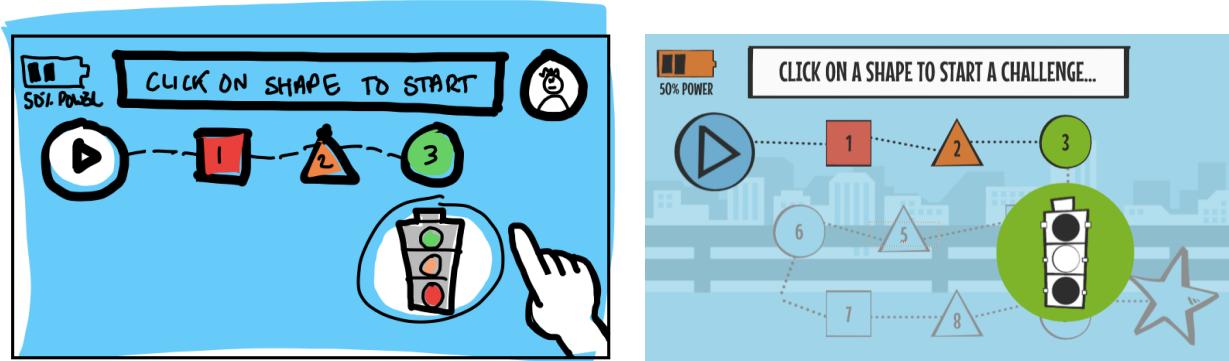
- School is out but its been raining and the playground is full of puddles!
- Puddles which need navigating around and jumping over to escape



4. Game Design Mechanics

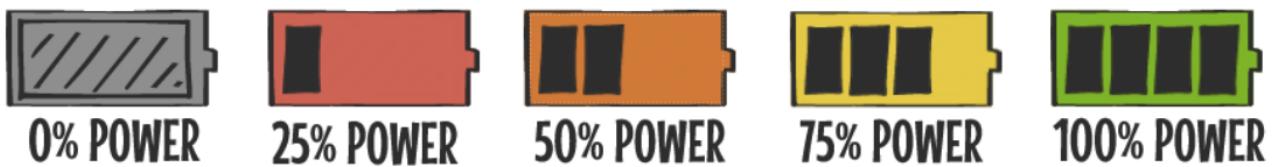
4a. Level Flow & Journey

- Command Control Centre:** In the first instance, players will start at a menu screen where they must choose from one of the available challenges which are each focused on a specific road safety topic or behaviour.



4b. Features

- Character Damage System:** With a young target audience, the scoring and damage system is very simple which mirrors the severe consequences of getting road safety wrong too. Players will have a power battery in the top left hand side of their visual which will show one of 5 states (from zero where gameplay ends upto 100% full power). Players will be rewarded for significant demonstration of positive road behaviours with a power up but be deducted a power back for every risk taken however any obstacle collision will result in all power being lost



- Simulated Social interaction:** Multiplayer or social elements can increase the sense of presence in a virtual environment however it is not appropriate for the young users in this learning experience. Instead of multiplayer features, players will have their virtual coach who will call in at key points of gameplay to advise on next steps, performance or just encourage and commend on good road safety behaviour.
- 360 Spatial Sound:** Sounds of the environment and obstacles will both help with a sense of presence, provide realistic signals to identify risks but also provide the same distractions that will make gameplay harder.



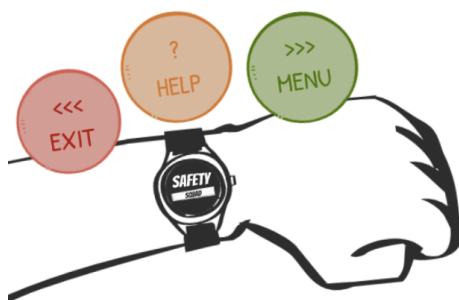
4c. Controls

- VR handheld controls:** In VR games, the controls can vary depending on the hardware being used however since software development will be within Unreal Engine specifically for use on the Meta Quest devices, game controls can be specified. The Meta Quest VR headsets come with handheld controllers that allow the player to interact with the virtual environment and while these headsets now allow for motion tracking of the hands for input, controlling movement is critical to this game so handheld controls will be mandatory.



The handheld controllers include buttons, triggers and joysticks which will be used to move the player's virtual hands, interact with objects in the virtual environment, move and navigate menus. Haptic feedback is possible with these controls however will be purposely turned off to the physical sensations which can over stimulate the younger user who is already engaging in a subject matter area which might already be triggering.

- The joystick will be the primary control and walk movement will be the only key requirement without the traditional gaming requirements to jump or fight.
- The player will also have a virtual smart watch which can be used for scene selection, help and game navigation:





5. Research & Testing

To better understand initial target audience feedback, a grey box has been created to give a better understanding of the general gameplay, objectives and challenges. After presenting users with the concept art, level map, storyboard, animatic and a video simulation of the grey box gameplay, 8 players within the target audience were asked for feedback using the below 8 questions (note this was done remotely).

Note that players were asked to provide a rating out of 5 (1 being the worst and 5 being the best rating) with comment. Also note that the young age of the target audience (aged 6-16 years old) so the traditional industry standard research questions needed to be simplified for sufficient user understanding and the results were brutally honest and often needed follow up questioning to accurately evaluate the true intent of the feedback (reflection point: don't work with kids again!).

Below is a summary of the results:

No.	Research Question	Rating					Comments & Additional Context
		1	2	3	4	5	
1	Do the controls feel natural and easy to use, or are they confusing or difficult to understand?			X			Simple and easy to understand game controls: 'I understand how to play', 'it was nice and fun', 'the controls were simple but I'd like to do more'.
2	How engaging is the gameplay? Is the game fun and entertaining or does it feel dull and repetitive?			X			Enjoyable and immersive gameplay: 'So cool', 'Freaky but good', 'I loved it', 'such a great idea for road safety training', 'would be better with guns and monsters'.
3	How clear is the game's objective? Do you understand what you are supposed to do in this game?	X					Enjoyable gameplay and clear on individual tasks but uncertainty on the overall objective: 'Will there be a boss at the end?', 'Can we fight?', 'What do I win?'.
4	How effective is the game's feedback system? Are you receiving enough feedback on your actions and progress?			X			Although the grey box did not include any feedback systems which confused players, the animatic provided enough context 'the power bar is a fun idea', 'exciting'.
5	How visually appealing is the game? Does the art style and visual design make the game appealing and engaging?	X					The players tested were solely focused on the grey box demonstration which limited their understanding of the end product but really liked the concept art.
6	Do you feel like you have a good idea of what the final game will look like and feel like or are you uncertain?		X				The grey box was confusing for the users due to its early visuals but all concept art and mockups received positive feedback by players and their parents!
7	Are there any major bugs or issues that need to be addressed/ preventing you from enjoying the game?					X	No bugs in the demonstrations provided.