GNG1103

Design Project User and Product Manual

Ten-Ten's VR Experience Manual

Submitted by:

G10: Ten-Ten

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1. Introduction

This user and product handbook aims to give people who use virtual reality information they need to use and, if needed, recreate our product. It is a valuable tool for designers who wish to produce virtual reality experiences that encourage a broader public awareness of the dangers of autonomous weapons. In the hopes that our knowledge and research will be helpful for future engineers. This manual will carefully walk you through creating a VR experience with the Unity platform.

Our product stands out as an efficient and beneficial tool for conveying educational messages on specific topics, notably raising awareness about the perils of autonomous weapons in this context. Its professional construction adheres to market criteria, positioning it favorably for seamless integration into the market at the discretion of potential clients.

Our product is a valuable and effective means of differentiating knowledge on engineering subjects through engineering design thinking. Particularly the dangers of autonomous weaponry and, in our scenario, the faults of target recognition and authorization.

2. Overview

We began our design process by empathizing with our client, Mines Action Canada, and looking at their past work and goals. They tasked us to create an augmented/virtual reality experience that emphasizes the consequences of autonomous weapons and why they should not have the authority to restrain or kill individuals. It was provided that our target audience would be global policymakers such as national politicians or UN representatives.

Autonomous weaponry gives rise to numerous moral and ethical questions that demand the attention of policymakers, such as UN representatives or members of parliament. These policymakers must discuss policy concerning these AI weapon systems before entering conventional civilian or military use. As a younger generation, we want to hold these politicians accountable.

Even though these situations may seem far-fetched to politicians, they should know how their actions will impact ordinary people in the real world.

We had legislators and decision-makers in mind when we created our augmented reality program. The main goal is to explain the consequences associated with the development of autonomous weaponry. The message of our product will convince people to change their minds, thereby saving more lives.

Continuing our design process, we broke down our product and defined the specific issue we wanted to address. Through research and polling amongst our peers, we defined facial and target recognition as the greatest threat to civilians and one of the main reasons why autonomous weapons should not be introduced. The bias and unreliability of a targeting system are the main issues, and we wanted to tackle this as the primary point within our product.

By conversing with the client and doing our research, we devised design criteria and general metrics to measure our product. We also found other pieces of media to create a general benchmarking guideline and a foundation our experience can be built upon.

Benchmarking

Specifications	Importance	Product 1	Product 2	Product 3
Product Name	-	"Clouds Over Sidra"	"Slaughterbots"	"Hunger in Los Angeles"
Duration	3	1	2	2
Graphic	2	3	1	2
Realistic	3	3	2	2
Emotional	3	3	1	1
Simplicity	3	2	2	3
TOTAL		33	20	28

Figure 1: Benchmarking Charts

Prioritized Design Criteria

Needs	Design Criteria	Priority (1-5, 5 being highest)
Simplicity	- No elaborate storylines - No showing actual robots	5
30 to 60 second video	- Duration of VR experience	4
Not graphic	- No blood, gore, explosions	2
Simulation shows altered reality	- Show how people would protect themselves - Consider sensor data weapons would use - Show how buildings or communities would adapt	5
Recognizable and realistic	- Time is present or near future	3
Emotional Simulation	- Show fear, concern, hope, and motivation	3

Figure 2: Design criteria chart

By conversing with the client and doing our research, we devised design criteria and general metrics to measure our product. We also found other pieces of media to create a general benchmarking guideline and a foundation our experience can be built upon.

Continuing our design process, we started brainstorming and created generalized plots our experience could follow. Each group member created a rough storyboard, and then we each graded each other to come to a final plot line. We also incorporated the best aspects of each into our final product.

Ideate

Specifications	Importance	Sami	Fatima	Amanda	Jordon	Mahmoud
Recognizable	3	3	2	1	3	2
Realistic	4	3	3	3	2	3
Simple	5	3	1	3	2	1
Aesthetic	1	2	3	1	2	2
References to real world	3	3	2	1	2	1
Total		47	31	34	35	26

Figure 3: Scoring results of each storyboard

We came to a final storyline of a father and son on a phone call in which the phone call acts as our method to deliver exposition of the consequences of AI weaponry and the unreliability of targeting systems.

We then started prototyping in a program called Unity. It is a software which can be downloaded and used to create a 3D environment. After each prototype was created, we surveyed fellow classmates and people to see how effective our prototype was compared to our desired metrics stated above. Each time a poll was conducted, we then took the feedback and then improved our design.

Prototype III

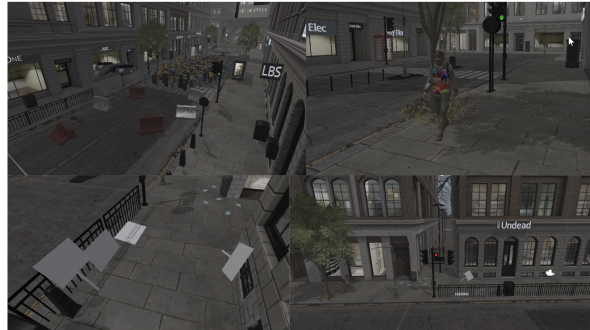

Figure 4: Final Prototype

2.1 Disclaimers

Players new to VR might experience nausea or motion sickness. If users ever experience discomfort, they immediately exit the system to avoid health issues:

- While using the VR, stay aware of your surroundings to avoid collision
- Do not throw VR controllers when interacting with the virtual environment
- Headaches may occur with the use of VR. Ensure to take breaks in between trials and hydrate.

3. Getting Started
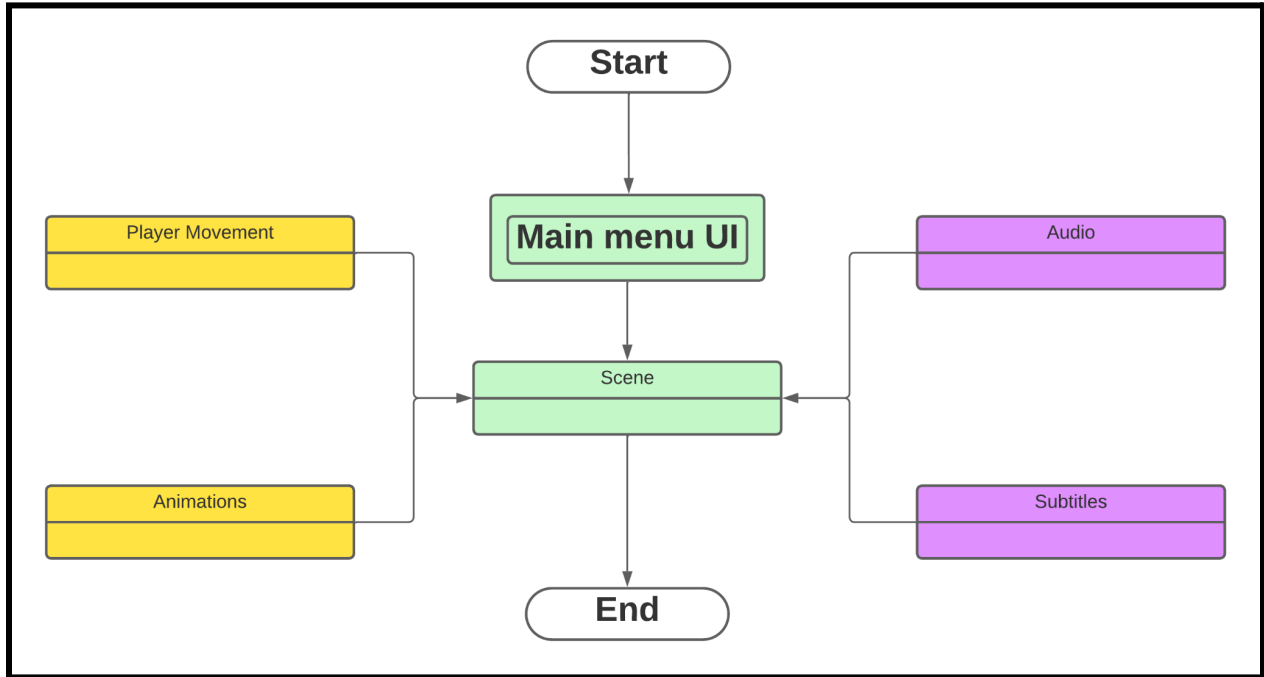
3.1 Configuration Considerations

Figure 5: VR experience flowchart

This flowchart is like a roadmap for the gaming experience, and each color has its own role to play.

First up, the green boxes are all about what the player can control. It's like the user's HQ where they pick the game they want to play from the main menu UI. Once they've made their choice, they enter the scene, a virtual reality playground where they can roam and enjoy the game.

Then we've got the yellow boxes, where they are like the behind-the-scenes crew. They represent the code that makes everything tick, even though players don't see it. The arrows pointing from these boxes to the scene indicate that this code is doing its thing, guiding the interaction within the scene.

Lastly, the purple boxes are complementary elements that run alongside the main scene to extend clarity and further induce our message across. The purple boxes make sure the player can hear the audio and read subtitles while they're in the scene, adding an extra layer to the gaming experience.

So, in a nutshell, it's a flowchart showing how player control, behind-the-scenes code, and complementary elements come together to create a seamless and enjoyable adventure.

3.2 User Access Considerations

The soundtrack and audio will give users background information about autonomous weapons and instructional information during the opening scenes, which feature a deep phone call between a father and his son. Users with visual impairments won't be able to experience the visual effects, but they will be able to learn about the dangers and precautions people take on a regular basis to avoid being mistaken for enemies and being killed by killer robots with the help of the audio of the phone call. Users can still experience the storyline because all dialogue is recorded and provides a brief description of what is going on. Users who are deaf will be able to enjoy the experience because subtitles are displayed on the screen at all times. All of the dialogue is written out so that the user can read along, and the restriction does not prevent them from understanding the experience's message. Government officials and diplomats would also be using our VR experience, so we allowed movement through the left joystick to avoid making the space required for use more limiting. The final group of users who would use VR would be the younger generation. With all of their excitement about the functionality of VR, they may overlook the background information in the first scene and thus miss the point of the experience. During our design day trials, we noticed that many students who tried it became engulfed in the size of the city and the visual effects of the scene, leaving them perplexed as to how everything was connected. As a result, we had to explain the storyline much more than we anticipated to ensure that the users got what they were supposed to get out of the experience.

3.3 - Accessing/setting up the System

On your computer:

1. First, install and open the Oculus PC software.
2. Open the Oculus app on your computer.
3. Power on your VR headset.
4. Connect your headset to your PC using a USB 3.0 cable, inserting one end into your PC's USB 3.0 port and the other into your headset. For a wireless connection, ensure both your PC and headset are on the same Wi-Fi network.

On your headset:

1. Put on your VR headset and access the universal menu.
2. Find and select the clock on the left side of the menu to open Quick Settings.
3. Go to the System settings and scroll to find Quest Link.
4. Activate Quest Link by toggling it on. If you want to connect to the headset wirelessly toggle on Air link
5. Finally, select 'Launch Quest Link' to start using the Link feature.

Opening the environment:

1. Now that the headset is connected to install the Unity project file and open it using Unity.
2. From there select PLAY and the environment will open on the headset.

3.4 - System Organization & Navigation

The player cannot see the inner workings of the system, so they shouldn't require any interaction. However, a rundown of how they function is provided below.

3.4.1 Physical components

The only physical component used is the actual vr headset.

3.4.2 Audio system

The audio is an independent subsystem and works on its own. The audio starts when the environment is started and plays until the audio is done.

3.4.4 Subtitles

All text was managed by textmeshpro. It interacts with user interface elements for subtitles and shows subtitles in the selected language.

3.4.5 Character animations

The character animations are independent subsystems and will start when the environment is also started. There are three sets of animations, one for the protest, one for the person walking, and one for the drones. Both the protest and drones will enter an ideal animation and will remain at the same spot for the duration of the environment. The person walking will walk past and keep walking until out of sight.

3.5 Exiting the System

There is no endscreen or existing feature implemented in the system, The only way to exit out of the environment is to exit out of playmode in unity.

4 - Using the System

When starting the system, the environment will place you directly in the main scene. There isn't any interaction other than just walking around and hearing the audio. When in the scene you can walk around freely and look around to discover what the environment has to offer.

5 Troubleshooting & Support

5.1 Error Messages or Behaviors

There were no error messages implemented for the vr experience. Any error messages that might appear are thus connected to unity directly and/or device you use to run the simulation.

Audio-Subtitle Synchronization:
In certain situations, the synchronization between audio and subtitles may not be flawless, potentially causing a slight delay or advancement in the display of subtitles relative to the corresponding audio. We do recommend utilizing earphones to optimize your viewing experience. However, if the disparity proves to be distracting, you have the option to lower the volume and rely solely on the subtitles.

Subtitle Coverage:
At the beginning of the simulation, the subtitles may be covered momentarily by a non-player character that approaches. This is a cosmetic issue and should not hinder the understanding of the experience.

5.2 Special Considerations

Users prone to motion sickness may experience discomfort during certain simulated movements. We recommend taking breaks if needed and adjusting VR settings to minimize potential discomfort.

5.3 Maintenance

No maintenance needed on the software part of the system. Refer to the VR headset's user manual for instructions on hardware maintenance.

5.4 Support

For technical support/questions you can contact the university for contact information of any of the team members.

6 Product Documentation

This section of the report focuses on the project's documentation, which includes how each individual feature of the VR experience was developed in Unity and how they were integrated in the software.

All prototypes were built with Unity3D, a cross-platform game engine. Most assets were imported from the Unity Asset Store. All text displayed uses built in Unity UI elements.

Voice lines were recorded by team members.

The simulation revolves around a single primary scene, designed with a focus on simplicity and impact.

There are no interactable elements during the experience, users are intended to explore and observe various elements, as there are no interactive features.

All the simulation's code can be accessed in the Unity file upon downloading and running the project.

6.1 Assets

6.1.1 BOM (Bill of Materials)

Part #	Part name	Description	Quantity	Cost	Extended cost
1	Computers	Provided by team members and the university	5	$0	$0
2	Unity software	3D game design engine. Personal license version is used	5	$0	$0
3	Oculus Quest VR set	VR set that is provided by the university in the makerLab	1	$0	$0
4	Unity Asset	https://assetstore.unity.com/packages/3d/characters/robots/scifi-enemies-and-vehicles-15159	1	$0	$0
5	Unity Asset	https://assetstore.unity.com/	1	$0	$0

		packages/3d/props/exterior/old-plastic-barrier-182509			
6	Unity Asset	https://assetstore.unity.com/packages/3d/characters/humanoids/humans/man-in-a-suit-51662	1	$0	$0
7	Unity Asset	https://assetstore.unity.com/packages/3d/animations/idle-mocap-28345	1	$0	$0
8	Unity Asset	https://assetstore.unity.com/packages/3d/characters/humanoids/humans/free-scavenger-261065	1	$0	$0
9	Unity Asset	https://assetstore.unity.com/packages/3d/environments/urban/city-builder-london-214943	1	$24.99	$0
				Total	$24.99

Figure 6: Bill of Materials

6.1.2 Equipment List

Item name	Description	Type	Prototype #	Source
Oculus Quest VR set	VR set to test the program/prototype	Equipment	1,2,3	MakerLab
Testing Area	Space needed to test the VR simulation	Test Environment	1,2,3	MakerLab
Test Computers	Powerful computers to test simulation on	Equipment	1,2,3	MakerLab

Figure 7: Equipment List

6.1.3 Instructions

Begin by installing Unity version 2022.3.11f1. Also, ensure to install additional modules such as the latest version of Microsoft Visual Studio Community, which will be used to develop and edit C sharp scripts in unity, Mac Build Support for Mac users and Windows Build Support for Windows users respectively, since build supports are required to build your game for respective platforms. After everything is downloaded, begin collecting and gathering different assets to use for the environment. This project uses various assets with prices ranging from $0 to $30, which can be purchased and downloaded from the Unity Asset Store or Blender. Refer to the BOM to see exactly which assets were used for the simulation as well as their associated costs. To streamline our approach to creating the simulation, our team categorized the conceptual design into five distinct subsystems:

1) Environment

The environment was the core of the simulation as it is the base of where the entire simulation takes place. It was imported from the Unity Asset store and chosen to be a city with tall buildings on every street, a sidewalk for the user to walk on, and streets filled with other pedestrians, drones, and other items. All of the elements showing how one would adapt to living with killer robots were incorporated into this subsystem, and most were taken from the Unity Asset Store or Blender. For instance, masks that people would use to protect their face from the robots, protestors on the streets, and civilians wearing AI confusing clothing. The pictures of signs around the environment were drawn by our team and then imported into Unity.

2) Audio

The audio was incorporated to add an emotional aspect to the simulation. The script followed a father walking to pick up his son from school. The user is in the perspective of the father and as he is walking through the environment, the script draws attention to the various aspects around the neighborhood, such as the masks and protests, to ensure that the user notices them. The audio also portrays fear in the voices of the father and son due to issues with the security drones. The script was played out by our team members, recorded, and implemented into Unity.

3) Storyline

The storyline follows the script below:

Act - Phone Call

Phone rings, user(parent) picks up

Kid: Hey Dad, are you free to pick me up from school right now? They want everyone out.

Parent: Sure. Are you okay, you're not in any danger are you? What's going on?

Kid: yeah i'm fine the new security drones are having issues again, i don't know they're identifying everyone as criminals, and there's a girl in my class being restrained by them. They can't turn them off like they usually can

P: I'm on my way right now. I want you to just follow your teacher's instructions for now ok?

Kid: Yeah i am

P:
I don't understand. The government was confident in those drones' advanced threat and facial recognition.

They shouldn't be allowed to tase and restrain people in the first place.
I want you to find a mask to put on right now too.

I'll also have you always wear yours to school from now on

K: Okay, there are other students here already doing that. But I heard they might enforce a no mask policy so they can still scan you in the building though…

P: [sigh] We'll figure it out. I'm seeing people are starting to put reflective curtains on their windows. I'll do that when we get home. Where do you want me to pick you up?

K: There is a protest on the intersection when you turn in, come to the backfield.

P: K, I see it, gosh there are so many police officers.

(Officers are visibly wearing masks)

K: Wait, one of the drones is free- Oh my god, they're tasing the teachers! HEY, GET AWAY FROM ME! Dad, I have to go-

(Hangs up)

    4) Accessibility
To ensure that the simulation is available to everyone, subtitles were added in english. These were timed to sync up with the audio so that if someone is unable to hear the audio, they will still be able to understand the simulation by reading the subtitles.

6.2 Testing & Validation

The final prototype included our last two prototypes, however with the use of user feedback we were able to enhance and improve them to get a better final product.

The table below outlines the various tests that we performed, including a description, the results obtained, and an estimated timeline for each.

Test ID	Test Objective (Why)	Description of Prototype used and of Basic Test Method (What)	Description of Results to be Recorded and how these results will be used (How)	Estimated Test duration and planned start date (When)
1	Determine user comprehension of scene	- Comprehensive Prototype - Measure if the user can understand what is happening in the simulation	- Gather user feedback at the end with a survey - Ask users to identify any parts that confused them or that they didn't understand	Continue test up until the end of the development of the final product
2	Determine if simulation is realistic	- Comprehensive Prototype - Measure how realistic the simulation is to the user	- Gather user feedback at the end with a survey - Ask users to identify which parts were not realistic enough	Continue test up until the end of the development of the final product
3	Determine emotional impact	- Focused Prototype - Measure the emotional impact of the simulation on the user	- Gather user feedback at the end with a survey - Ask user what emotions they felt and specifically what made them feel that way	Continues up until the end of the development of the final product
4	Determine if problems with robots are easily identifiable	- Focused Prototype - Measure if the core message of the simulation has gotten across to the user	- Gather user feedback at the end with a survey - Ask user how their opinions on killer robots changed from out simulation and what specifically made them come to that conclusion	Continues up until the end of the development of the final product
6	Regulate synced audio	- Focused prototype - Add audio throughout the simulation that is synced and corresponds with the environment, including ambience noise	- Gather users to test out prototype and see if audio feels immersive - Rate how well audio corresponds with environment and rate if it adds or takes away from storyline	Continues until the completion of the final product
7	Test immersion with VR	- Comprehensive prototype - Connect the unity	- Each team member will try on the VR headset and walk around the	Continue testing up until the end of the final product

		simulation to the VR headset, Oculus Quest 2 in order to ensure that the realistic features translate well into the VR. It is also to ensure that the connection is smooth for the final presentation of our product	environment to see if it is immersive and realistic	

Figure 8: Tests and Results

7. Conclusion, Recommendations, and Final Thoughts

The development of this VR experience has expanded everyone's knowledge and understanding. This was our first experience designing and creating a product for a client within an engineering context. Not only did we learn how to cater to their needs, but we also learned how to apply the engineering design process. We followed the general guidelines of "Empathize, Define, Ideate, Prototype, Test" to create our product, and it proved effective as we were reasonably satisfied with our final product.

We also learned the importance of presenting our product and receiving fair criticism during the process. We effectively conveyed what we were doing and what our goal was to the client during the creation of our product, and as a result, we were able to receive honest and specific feedback. Upon presenting our final product, we were satisfied with it and could convey and "sell" it to an extent.

If we redo this project, some recommendations would be to conduct more extensive polls. We wish we were able to get in contact with more politicians and representatives to receive their input and thoughts on autonomous weapons. It would be a great source of feedback and could have substantially improved our storyline or design. We also would have conducted more extensive testing; we did not have full access to the VR headset and did not get as much first-hand testing of the experience as we would have liked. The last recommendation is that we would like to conduct more research about AI target avoidance and problems. If we had more time relative to what we had, we could incorporate more of these within our experience to convey a more powerful message.

Overall, as a group, we are very proud of our work and satisfied with the results. With a longer timeline and a more significant investment of time and resources, our experience could impact decision-makers.