

GNG<1103/2101>  
**Design Project User and Product Manual**

**<DOOMSDAY'S END>**

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## List of Acronyms and Glossary

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**Table 1. Acronyms**

<b>Acronym</b>	<b>Definition</b>
VR	Virtual Reality

**Table 2. Glossary**

<b>Term</b>	<b>Acronym</b>	<b>Definition</b>
Bill Of Materials	BOM	A list of items that were used whether purchased or free.


# 1 Introduction

This User and Product Manual (UPM) provides the information necessary for anyone to effectively use the Unity Engine and for prototype documentation. We were assigned a task from Mines Action Canada (MAC), to create a video of an VR environment that helps to promote the danger of autonomous weapons and assist in the banning of autonomous weapons before they become a reality. In addition, we had to ensure it was no more than a one minute video, and to not incorporate any signs pointed to culture, location, stereotypes or include too much gore.

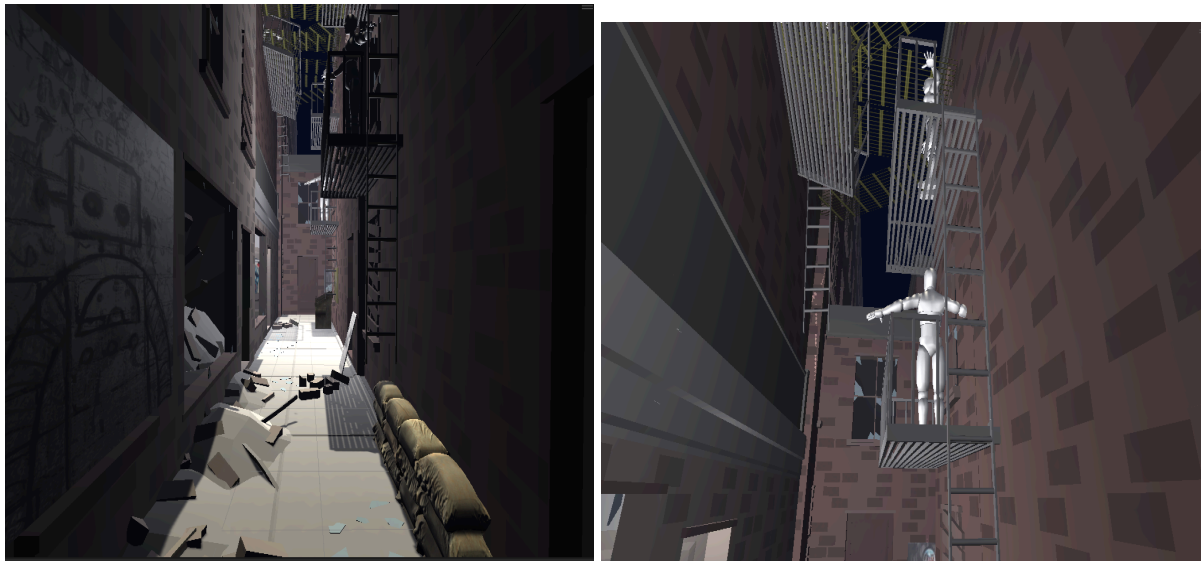
This document outlines the precautions, setup, troubleshooting and use of our VR environment within Unity. We will also depict our prototypes, equipment/BOM and testing. This document is intended for the vast majority of the public who have used technology for more than one to two years. Note that this product manual is for the use and setup of the VR environment specified (Doomsday's End) and cannot be associated with any other project.

## 2 Overview

Autonomous weapons are not reliable and safe, technical glitches and mistakes can cause them to inflict harm uncontrollably. Furthermore, these weapons might have problems identifying opposing combatants, sometimes misidentifying civilians as targets. The user needs a VR environment that demonstrates how people would adapt a city in order to stay safe from these autonomous weapons. Our product features a story, conversation using voice acting and subtitles that demonstrate the consequences of propaganda, as well as adapting our environment.

### PHOTOS OF FINAL PROTOTYPE

Our project included an alleyway, featuring pro-autonomous weapons posters along the walls. It has nets along the rooftops, which stop robots from entering the alleyway from above. There are dummy mannequins, to overwhelm the weapons with targets and lowering the chances of them identifying civilians as a target. We wrote a script, involving a detective talking to a supporter of autonomous weapons, whose house has been attacked. The environment contains boundaries preventing the player from leaving the alleyway.



### 2.1 Cautions & Warnings

The user should ensure all equipment is charged before using, as well as being in a safe, obstacle free space. Set up a virtual boundary using the VR headset, to make sure you will not collide with anything. Make sure the straps on the controllers are attached to your wrists, otherwise they may come flying off with any sudden movements. Do not use a virtual reality headset if you are susceptible to motion sickness or epilepsy.

## 3 Getting started

This part goes over all relevant information regarding setting up and putting away the VR system. It will also include step by step procedures to enter, set up, and put away the system.

### **3.1 Configuration Considerations**

To start the configuration process you should visit the oculus website where it gives you information and a step by step process on how to download the oculus app as well on how to connect the headset to your computer. The headset we used for this is the Oculus Metaquest 2 and our VR experience requires the headset to see and look around as well as the controllers to move the character.

Note: This project was only tested on a windows PC so can not confirm if our program will run properly on a MacBook.

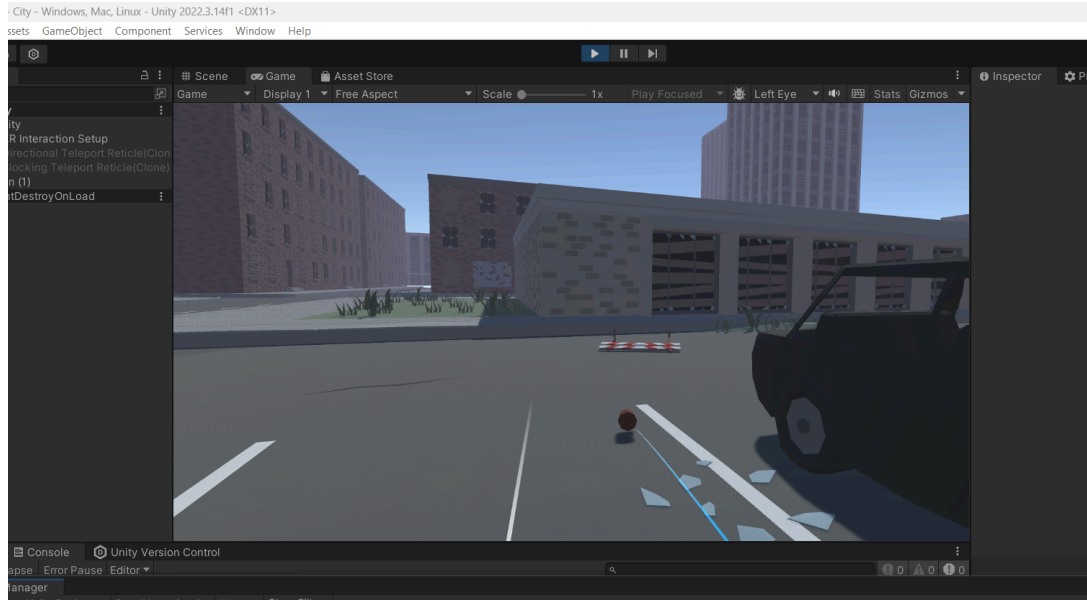
### **3.2 User Access Considerations**

The sounds during the VR experience consists of low eerie background music, the storyline of the two characters talking and at the end there will be a gradually louder drone sound implying incoming autonomous weapons. Due to this it accommodates well with people who are visually impaired because without even missing out on posters, body bags and other aspects to the experience, the user will still get a good grasp of the message trying to be sent in our VR experience. The visual aspects include an alleyway, where the user walks down and interacts with the other character and while the storyline commences and during that you can see pro and anti autonomous weapons posters, body bags, bullet holes, and also nets, mannequins and more. There are also subtitles that will go along with the script to account for people who are hearing impaired or do not have access to sound. For the script to start however, the user must move the character straight forward a few steps to initiate it then the user can look or move wherever in the VR environment and the script will still play. This feature would help potential law makers, politicians, or elderly, who may have little to no experience with VR. This way, we made it simple for all they need to do to initiate the story is to just move the left controller straight forward. This seems like a simple task but could still be hard for some to understand where to go as it's just an alleyway. This is why we made the window, where the story starts, a lot brighter than the rest of the alley to naturally attract interest from the user. If there are still potential worries about using the VR environment, explaining the controls beforehand or showing a video demonstration of the VR experience would help the user before going into the simulation.

### **3.3 Accessing/setting up the System**

1. Install and open the Oculus PC app on your computer
2. Grab and power on your VR headset
3. Connect the headset to the computer using a USB cable or to use a wireless connection make sure the computer and headset are set to the same internet connection
4. Adjust the sizing on your VR headset, then put it on to access the universal menu
5. Then on your computer, double click on the download application
6. After downloading, click on the Unity project file and open it using Unity.
7. Lastly click the blue play button at the top-middle of the screen as shown in the picture below.
8. Once pressed the simulation will start and the computer will show the user's headset view





### 3.4 System Organization & Navigation

Once the simulation begins the user will hear the background music as well as the alleyway. Nothing else will happen until the user moves forward using the controller in their hands to the bright window down the alley. Once reached will trigger the script and along with the subtitles and the voice acting. Once the trigger is reached and the script starts, the character animation starts and the user is free to move and look wherever in the boundary of the VR environment. This boundary is from the start of the alley to the end where there are invisible blocks that restrict the user from moving further. While the script is playing the user can look at the different posters, newspaper and other elements in the alleyway or watch the conversation ensue. Once the script comes to an end the user will hear the gradual increasing volume from a drone type sound trying to show that the autonomous weapons are coming. Once that happens the screen cuts to black the simulation is over. Overall, all the user needs to do to truly start the story is to walk forward a couple feet and the rest is up to them until the simulation ends.

### 3.5 Exiting the System

Once the simulation is over, carefully remove the headset from your head and place carefully with the controllers to a safe spot. Then, simply exit Unity by pressing the windows button then closing the tab or pressing ALT+F4. Afterwards shut down the computer as well as click the power button on the headset to shut it off.

## 4 Using the System -CHRISTOPHER

The following subsections provide detailed, step-by-step instructions on how to use the various functions or features of the VR environment.

### 4.1 Main Game Environment

#### **Description:**

Beyond the title screen, players enter the primary setting of the game—a city filled with menacing robots. This VR space allows for complete exploration.

#### **Input:**

- VR controls include:
- Looking around is controlled by head movements.
- Walking is managed through hand controllers.

#### **Output:**

- Visuals: The game dynamically renders the 3D urban environment, hostile robots, and other elements in real-time.
- Sound: Players experience immersive audio effects, including their footsteps, the distant sounds of robots, or the urban atmosphere.

#### **Expected Behavior:**

- Players have the freedom to roam the virtual city without predefined objectives or goals.
- The autonomous movement of the killer robots enhances the sense of danger in the environment.

#### **Special Instructions:**

- In this mode, players are not required to interact with specific elements; they can fully engage with the immersive experience at their leisure.



### 4.1.1 Killer Robot Movement

This segment details how the killer robots operate within the game setting.

#### **Robot Behaviors:**

- Input: The robots' movements are not influenced by player actions.
- Output: These robots navigate the game world on their own, contributing to a sense of peril and suspense.

#### **Engaging with Robots:**

- Input: There is no mechanism for players to engage with the killer robots.
- Output: The robots serve as environmental elements to enhance the mood and do not react to players being nearby.



## 4.2 Exiting the Game

Description : The process to quit the game is deliberately made easy, involving a keyboard command for the user.

## 5 Troubleshooting & Support

Undergoing the setup and use of our system, possible errors will be most likely attributed to the Unity software itself, except for those mentioned below. If Unity is at fault, contacting tech support will be the most straightforward option at <https://create.unity.com/contact-unity-expert>.

Otherwise browsing through the web, Unity forums and other mediums is what most of us did and is suggested to avoid pricing and other hassles. You can find the Unity forums at <https://forum.unity.com/> or look at the reddit community <https://www.reddit.com/r/unity/>.

### 5.1 Error Messages or Behaviors

Our VR environment encounters errors near the edges of our boundaries. Our entire setting is in one alleyway and is blocked by invisible barriers at the very ends. It is possible to phase through the walls near the barriers and be lost inside the VR map. Simply, try to walk back where you came from or restart the game.

When you start the game you might encounter some of the subtitles and audio playing, while not being in the correct position, the only solution is to just restart the game or wait for the audio cycle to finish, and it will repeat.

### 5.2 Special Considerations

When using the VR headset, it is recommended to use headphones as our testing did not allow us to hear the audio otherwise.

### 5.3 Maintenance

There is no maintenance for our VR environment, but for the equipment used such as the headset refer to that equipment's manual.

### 5.4 Support

When encountering issues with our VR environment, first contact unity support as the issues most likely reside with the software and not the project. Otherwise any other inquiries or questions can be handled at any of our emails.

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## **6 Product Documentation - JEAN-LOUIS NEL**

This section of the report documents how the final prototype was built. In this project all three prototypes, including the final one, were made using Unity, a cross-platform game engine that can be used to construct various interactive content including 3D VR environments. The final prototype contained the following subsystems: environment design, VR interaction, and storyline.

### Environment Design:

This subsystem deals with the bare essentials of the environment without any functionality. It consists solely of imported assets that have been manipulated to construct a detailed environment in which the audio and VR interaction will be implemented.

### VR Functionality:

This subsystem deals with the interactive elements that allow a player to actually use the VR experience. This subsystem deals primarily with the functionality of the VR experience. The ability to play the VR experience is dealt with by this subsystem.

### Storyline:

This subsystem deals with the audio and dialogue that will take place within the VR experience. The storyline is a vital component in this project as it, along with the environment design, contributes the most to formulating a convincing VR experience.

## 6.1 <Subsystems of prototype>

### 6.1.1 BOM (Bill of Materials)

Items	Price (\$)	Type	Link	Total Cost:
Post-Apoc Buildings	0	Asset	<a href="https://assetstore.unity.com/packages/3d/vehicles/land/post-apocalyptic-truck-with-buildings">https://assetstore.unity.com/packages/3d/vehicles/land/post-apocalyptic-truck-with-buildings</a>	8.99
Building Pack	0	Asset	<a href="#">Russian buildings pack</a>	
City	0	Asset	<a href="https://assetstore.unity.com/packages/3d/environments/urban/city-voxel-pack-136141">https://assetstore.unity.com/packages/3d/environments/urban/city-voxel-pack-136141</a>	
Bathroom	0	Asset	<a href="https://assetstore.unity.com/packages/3d/props/furniture/bathroom-set-interior-263462">https://assetstore.unity.com/packages/3d/props/furniture/bathroom-set-interior-263462</a>	
Room Interior	0	Asset	<a href="https://assetstore.unity.com/packages/3d/props/furniture/table-set-interior-263303">https://assetstore.unity.com/packages/3d/props/furniture/table-set-interior-263303</a>	
Furniture	0	Asset	<a href="https://assetstore.unity.com/packages/3d/props/furniture/furniture-free-pack-192628">https://assetstore.unity.com/packages/3d/props/furniture/furniture-free-pack-192628</a>	
Office Interior	0	Asset	<a href="https://assetstore.unity.com/packages/3d/props/interior/office-pack-free-258600">https://assetstore.unity.com/packages/3d/props/interior/office-pack-free-258600</a>	
First Person Controller	0	Asset	<a href="https://assetstore.unity.com/packages/3d/characters/modular-first-person-controller-189884">https://assetstore.unity.com/packages/3d/characters/modular-first-person-controller-189884</a>	
Bunker	0	Asset	<a href="https://assetstore.unity.com/packages/3d/props/army-bunker-2093">https://assetstore.unity.com/packages/3d/props/army-bunker-2093</a>	
Low Poly Apocalypse City	8.99	Asset	<a href="https://assetstore.unity.com/packages/3d/environments/urban/low-poly-apocalyptic-city-148064">https://assetstore.unity.com/packages/3d/environments/urban/low-poly-apocalyptic-city-148064</a>	
Prototyping Pack	0	Asset	<a href="https://assetstore.unity.com/packages/3d/prototyping-pack-free-94277">https://assetstore.unity.com/packages/3d/prototyping-pack-free-94277</a>	
House Interior	0	Asset	<a href="https://assetstore.unity.com/packages/3d/props/interior/house-interior-free-258782">https://assetstore.unity.com/packages/3d/props/interior/house-interior-free-258782</a>	
Destroyed Building	0	Asset	<a href="https://assetstore.unity.com/packages/3d/environments/destroyed-building-kit-demo-174899">https://assetstore.unity.com/packages/3d/environments/destroyed-building-kit-demo-174899</a>	
Rubble Pieces	0	Asset	<a href="https://assetstore.unity.com/packages/3d/environments/rubble-pieces-detailed-package-74004">https://assetstore.unity.com/packages/3d/environments/rubble-pieces-detailed-package-74004</a>	
Laptops	0	Tool	N/A	
Meta Quest 2	0	VR Headset	N/A	
Unity	0	Software	N/A	
Trello	0	Planner	N/A	
Realistic Sandbags	0	Asset	<a href="https://assetstore.unity.com/packages/3d/props/exterior/realistic-sandbags-95964">https://assetstore.unity.com/packages/3d/props/exterior/realistic-sandbags-95964</a>	
3D Character	0	Asset	<a href="https://assetstore.unity.com/packages/3d/characters/humanoids/humans/3d-character-dummy-178395">https://assetstore.unity.com/packages/3d/characters/humanoids/humans/3d-character-dummy-178395</a>	
Nets	0	Asset	<a href="https://assetstore.unity.com/packages/2d/textures-materials/yughues-free-grids-nets-materials-13004">https://assetstore.unity.com/packages/2d/textures-materials/yughues-free-grids-nets-materials-13004</a>	

### 6.1.2 Equipment list

Item Name	Description	Type	Source
Laptop/computer	Used to run Unity software	Hardware	Makerspace
Meta Quest 2 VR headset	Used to run the VR environment	Hardware	Makerspace
Unity software	Used to build the VR environment	Software	<a href="https://unity.com/download">https://unity.com/download</a>
Unity Asset Store	Used to find and purchase assets	Website	<a href="https://assetstore.unity.com/">https://assetstore.unity.com/</a>
Audio recorder	A device with a microphone that allows the recording of audio	Hardware	Provided by group members.

### 6.1.3 Instructions

#### Environment Design:

The VR environment design is rather straightforward to build. First Unity hub and Unity editor must be downloaded by accessing the provided link. Our group installed version 2022.3.18f1.

Once installed, a new project can be opened in the Unity editor. Any purchased assets can then be imported into the new project from the unity asset store. To import an asset find it the “My assets” page in the unity asset store and select “open in unity”. The asset will then open in your project where it must be first downloaded and then imported. Once imported it can be found in the asset library of the unity editor. To place any imported asset, simply select it in the asset library and then drag and drop it into the environment.

The process described above can be used repeatedly with various assets to construct a detailed environment that suits various needs. Further movements and manipulations can be applied on imported assets by operating the various built-in functions of the unity software. For our project, our group used the described methods to construct an alleyway that suited our project’s aim.

#### VR Functionality:

VR functionality is built by installing the XR interaction toolkit from the unity packet manager and importing XR device simulator. This asset has everything necessary to run the environment in VR. Once the correct assets are imported and inserted into the unity project VR functionality should be working. The VR functionality allows for various modifications in order to optimize movement, starting location, and interactions. The various settings for the VR interaction asset may need to be customized to suit the environment being constructed.

The main interaction in our project was the triggering of the timeline that would run the storyline of our VR experience. This was done by creating a cube object that served as a trigger for the main timeline once the player enters it.

#### Storyline:

A storyline can be implemented using timelines. Timelines can be added in the unity editor by selecting to create a new timeline in the new asset menu. Once a timeline is created various audio clips, animations, or events can be scripted using relevant tools. A timeline must also be linked to a trigger that will cause it to run.

Our prototype had a single timeline that contained animations, subtitles, and audio. Animations and their corresponding models were imported from <https://www.mixamo.com/>. Subtitles are created by attaching a transparent plane to the player camera and then linking events in the timeline to a text box on that plane. Audio clips can be imported directly into unity from files on a computer and then can be inserted into the timeline to play at set times.

It is worth noting that the process to fully build a complex timeline is rather long and tedious. It takes much trial and error as well as a lot of time researching various possible solutions.

## 6.2 Testing & Validation

The final prototype was subjected to various tests to ensure that it met established criteria. Qualitative assessments with clear pass or fail results were used to verify functionality while feedback was gathered to evaluate non-functional design choices. Any given test may have been conducted multiple times during the design process with the final prototype having passed all tests with acceptable results. The following table details the kinds of tests that were performed on the VR environment.

Test ID	Test Objective	Description of Test
1	Evaluation of VR functionality	Test all relevant controls and interactions. (player movement, script triggers, etc.)
2	Evaluation of VR Environment design	Gather feedback on the environment design.
3	Evaluation of character implementation.	Verify that the character models function as intended and are animated correctly.
4	Evaluate audio and dialogue implementation	Test that all audio and dialogue is implemented properly.
5	Story Evaluation	Gather feedback on the story once it is fully implemented.
6	Final Review	Gather feedback for the finished project.



## **7 Conclusions and Recommendations for Future Work**

During this project, time management was our largest obstacle, we fell behind and missed some deadlines on deliverables, which caused a backlog of work. Due to some technical issues, the VR environment took even longer to create, and the limited number of laptops also slowed down the process. For future work, acquiring your own personal laptop that is capable of running the unity software smoothly, with everything you demand from it, would be extremely helpful, as it removes any wait time. If we had a few more months to work on this project, we would expand the story to include real robot models, improve the animations on the character model, and improve the consistency of the netting on the rooftops.

Due to a lack of time, we switched from our initial prototype which was a room and tunnel system where it shows how humanity has moved down to an underground tunnel system. If we were given more time, we are unsure if we would have stayed with this initial plan, we are very satisfied with the current model and do not wish to switch away from it.

# APPENDICES

## 8 APPENDIX I: Design Files

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
Deliverable F	<a href="https://makerepo.com/ChristopherO/2051.gng-1103group-7doomsdays-end">https://makerepo.com/ChristopherO/2051.gng-1103group-7doomsdays-end</a>	Mar. 3. 2024
Deliverable G	<a href="https://makerepo.com/ChristopherO/2051.gng-1103group-7doomsdays-end">https://makerepo.com/ChristopherO/2051.gng-1103group-7doomsdays-end</a>	Mar. 10. 2024
Deliverable H	<a href="https://makerepo.com/ChristopherO/2051.gng-1103group-7doomsdays-end">https://makerepo.com/ChristopherO/2051.gng-1103group-7doomsdays-end</a>	Mar. 24. 2024