**Project Deliverable H: Prototype III and Customer Feedback**

GNG 1103C – Engineering Design

Faculty of Engineering – University of Ottawa

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# **Introduction**

This deliverable presents the ideas and results of our final prototype. We cover the adjustments and modifications that have been made while finalizing the project. We first had to change the VR environment from our last prototype as the Google Maps renders when ported in VR were simply too low resolution for any immersivity to be expected from the user. This was made particularly obvious to us when we were able to test the VR headsets.

Prototype three is therefore three folds. First, we test a new VR environment from new assets and how immersive and realistic it is. Next, we test how to import our custom-made posters into Unity, and how to dimension them to ensure again realism and scale. Finally, the third part covers our testing on how to edit audio to give a plausible audio effect that fits in well with the scene.

We conclude the deliverable with a summary of the work left to do, as well as a project plan snapshot.

# **Prototype III**

## Prototype IIIA

In this final prototype, significant changes have been implemented to enhance the realism of the experience. In the previous environment, we had developed an urban city landscape using a blender add-on. However, following user feedback and testing under the VR conditions, we noticed that the asset had a low resolution, which wasn’t ideal for our experience. We decided to use an alleyway asset from Unity instead for the following reasons: it provided us a more focused environment for the user to explore under a short amount of time, it gave us more control on the direction the user will take as it discovers our environment and it also emphasized the eerie aspect of our storyline with the dim lighting and dark alleyway, which pairs well with the audio component.

A computer screen shot of a hallway

Description automatically generated

We also incorporated an NPC character accompanied by its animations. This character seems more realistic and with the use of the timeline feature, it seamlessly transitions from an idle state to a walking state. We’ve also set up the character to disappear at specific intervals so we can prevent the user from observing unrealistic interactions with the surrounding assets.

A person standing in a dark hallway

Description automatically generated

Finally, we incorporated our posters under a collage form on the walls. This delivers visual information on ads to improve citizens’ ID visibility against killer robots, as well as warning posters on the presence of killer robots. They were brightened to be more visible and more prominent so our user would be drawn to explore them. We would only need to manually light up specific posters as the user observes specific ones.

A screenshot of a video game

Description automatically generated

For this prototype, testing was conducted to confirm the realism of the experience, the walkthrough effect under VR conditions, as well as the visibility of our posters. Each test was found successful, and we received general positive user feedback on the main aspects of our environment.

## Prototype IIIB

Next, we wish to verify the relative size of posters in pixels that will give us a realistic poster size in the VR environment. When placing an image in Unity using a canvas, the size of the image can be stretched or compressed. All that matters for us is to preserve aspect ratio (the ratio of the width and height of the image) as well as the pixel density. In Unity the dimensions of everything are given in meters. We chose rather arbitrarily 250 pixels per meters. Therefore, a canvas of 8.4 meters by 4.2 meters in Unity will be given an image of 2100 pixels by 1050 pixels. What is then left to verify is how many posters should we fit in this collage. Said differently, what roughly should be the dimensions of posters in pixels.

To test this, we will try three collections of pictures with increasing sizes of posters while maintaining the overall collage dimensions.

A group of banners with text

Description automatically generated with medium confidence

We then place these images in our VR environment (see the next figure). We decided as a team after having collected user feedback that the smaller posters were overall more realistic and fitted better in the environment.

A screen shot of a sign

Description automatically generatedA screenshot of a video game

Description automatically generatedA wall with signs on it

Description automatically generated

From this, we learn that the posters should at most measure 80 pixels by 65 pixels to remain realistic. This corresponds to about 32 cm by 26 cm which is smaller than we would have expected had we not done this prototype. We were also able to test with this prototype the usage of transparency. Unity in facts supports PNG alpha transparency, and we were able to demonstrate that we can have gaps in our collage it still renders properly.

## Prototype IIIC

Next, we wanted to test how to edit audio in such a way that it sounds natural when played in our environment. Specifically, we expected that adding Echo or Reverb would give the desired immersive experience we are looking to provide. We are using Audacity as a free editing audio tool. We tested using a simple waveform of a team member saying “Hello, this is a sample audio”.

**Trial I (Fail)**

The first attempt was simply playing the audio as recorded. The collected feedback is summarized as so:

Playing the raw recording in the VR experience is jarring. The sound quality is both too “good” for an alley way, while also sounding like it was recorded from a cell phone. It is not immersive.

**Trial II (Adding Echo)**

The second attempt was adding an Echo effect with a delay of 1s and delay factor of 0.5 in Audicity. The general feedback was immediately negative because the delay of 1s was too large especially on such a short audio clip (about 2 seconds). It sounded like “you simply doubled up the audio and superposed it”. It was overall negative feedback.

**Trial III (Adding Echo)**

We did not immediately abandon the Echo effect. We instead shortened the delay to 0.3 and reduced the factor to 0.4 in Audacity. The feedback we collected was immediately more positive and we also preferred the overall sound. The audio was still in this uncanny valley of too clean sounding for the environment while being a bit low quality.

**Trial IV (Adding Reverb)**

Audacity offers non-destructive (real-time) effects, including Reverb. Adding this, the feedback was immediately positive. Reverb adds an echo, while making the audio sound like it is coming from a room with walls that distort the sounds and reflect them back to you. It was exactly what we were looking for and the feedback was very positive.

**Trial V (Changing Reverb settings)**

Reverb offers a “Wet only” setting which we decided to try as the alleyway in our simulation has rain and puddles. However, the effect is very bad on our audio and dampens quite strongly the audio recording. We did not even attempt to get feedback for this trial as it was clearly not worth exploring further.

**Analysis**

Trial IV had the best feedback, and we can generate an audio recording from a laptop/cellphone and edit it by adding reverb so that the final audio could plausibly be from the VR environment we are presenting. We can now complete the full audio message we want to have along with the final prototype.

# **Updated Bill of Materials**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item number** | **Item description** | **URL/Source** | **Quantity** | **Unit Price (in CAD)** |
| 1 | Oculus VR Set | [Oculus Rift - Windows VR Headset : Amazon.ca: Video Games](https://www.amazon.ca/Oculus-Rift-Windows-VR-Headset/dp/B00VF0IXEY/ref=sr_1_6?crid=YZPED0YM3GBP&keywords=oculus+rift&qid=1698601395&s=videogames&sprefix=oculus+rift%2Cvideogames%2C146&sr=1-6) | 1 | N/A |
| 2 | Computer/Laptop |  | 1 | N/A |
| 3 | Unity | [Unity Real-Time Development Platform | 3D, 2D, VR & AR Engine](https://unity.com/) | 1 | 0$ |
| 4 | Blender | [3.0 — blender.org](https://www.blender.org/download/releases/3-0/) | 1 | 0$ |
| 5 | Visual Studio | [Visual Studio Code - Code Editing. Redefined](https://code.visualstudio.com/) | 1 | N/A |
| 6 | Mixamo Characters and animations | [Toon City People | Characters | Unity Asset Store](https://assetstore.unity.com/packages/3d/characters/humanoids/humans/toon-city-people-163720#description) | 2 | 0$ |
| 7 | Alleyway Landscape | [The Alleyway | HDRP Asset Pack | 3D Urban | Unity Asset Store](https://assetstore.unity.com/packages/3d/environments/urban/the-alleyway-hdrp-asset-pack-153779) | 1 | 28$ |
| 8 | Billboards |  | 7 | N/A |
| 10 | Car sounds | [Vehicle - Essentials | Transportation Sound FX | Unity Asset Store](https://assetstore.unity.com/packages/audio/sound-fx/transportation/vehicle-essentials-194951); [Free General Ambience Sounds | Urban Ambient | Unity Asset Store](https://assetstore.unity.com/packages/audio/ambient/urban/free-general-ambience-sounds-246000#content) | 1 | 0$ |
| 11 | Radio broadcast |  | 1 | N/A |
| 12 | ID pins |  | 5 | N/A |
|  | | | Total: | 30$ |

# **Conclusion**

We now have in hand a VR scene that we perfect for our desired concept. It retrains the user in a sufficiently small, enclosed space that the game will not last more than a minute. It also provides ample wall space to populate it with posters, something that we verified in Prototype IIIb. The scene also offers enough direction as it is an alleyway so that the user does not require instructions: there is only one direction to go. Finally, we have tested audio editing and audio effects on a sample sound to create an audio clip that could reasonably be heard in the alleyway. We have collected audio for our final script and will be applying the same effects onto it for the final project prototype.

# **Wrike Snapshot**

<https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=YeqHDs14OeNOHi5Sxcymfa4WDg9dR59o%7CIE2DSNZVHA2DELSTGIYA>