

Computer Games Development

Project Report

Year IV

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[Declaration form to be attached]

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# Acknowledgements

I would like to thank the following people who assisted in completing this project including;

John Doe of ACME who kindly agreed to …

I would also like to thank ICME for use of ….

# Project Abstract

This project showcases a 3D Virtual world that incorporates elements of farming, animal care, commerce and NPC behaviour. The game features an inventory system, planting, watering and harvesting mechanics, and a day and night cycle. NPCs have two distinct behaviours, wandering and path following. The path following NPCs have an option to loiter at certain locations and enter NPC shops. The traffic system includes NPCs driving cars, stopping at traffic lights, and honking at pedestrians. A map editor allows players to add, move and rotate objects, create custom NPC paths, and save them to a database. This project explores the technical challenges of implementing a complex game world with multiple interactive systems. The project also discuses future directions for the game, and what areas need more forethought.

# Project Introduction and Research Question

Virtual reality is the use of computer technology to produce an artificial 3D world which allows users to engage in a virtual world in a way that simulates reality. It does so by influencing the human senses, specifically sight and hearing, in order to immerse the user in the simulated world. VR has become an increasingly popular game environment, *12bn USD in market value as of 2022, Statista, October 2022,* it is vital to explore just how using a player engagement tactic like Level Editors in VR games could improve the overall experience of the game. A Level Editor is a tool which allows the user to edit the virtual world around them that provides an outlet for the user’s creativity. It gives the user control over the overall look of the world, as well as let the user influence the steering behaviours of the non-player characters (NPCs).

Steering behaviours are artificial intelligence algorithms which influence how the NPC navigates around their environment in a way which would simulate the real-life movement of a person. In terms of improving user experience, aesthetically pleasing world design helps the user fully immerse themself in the virtual world and the storyline of the game.

In this thesis, we aim to investigate the impact level editors, steering behaviours and world design have on the player experience in VR games. We will analyze the important factors to take into consideration when creating a comfortable to use level editor. We will also look into which steering behaviours best simulate real-world movements without causing negative impact to the performance of the game. Additionally, we will explore how the placement of objects in the world and the used colours can alter the player experience.

To achieve these objectives, I will create a playable game with farming mechanisms and conduct playtesting with willing participants to collect data on the comfortability of the controls. The data collected from this will take into account the orientation of the level editor, whether the user would be more comfortable looking up, down or straight ahead when editing a level, the placement of the buttons and choices on the level editor, and the physical wellbeing of the participant, in order to avoid nausea and headaches. I will also conduct a series of tests of the reliability of different steering behaviours to examine which suits the game and which would best react to change in the environment without slowing the game down or causing lag. Finally, I will study the layouts of real-life towns to determine how to split up the game world into different sectors, residential, industrial etc, to maximise the area used without causing crowding.

The results of this thesis will add to the knowledge already available on VR game design and offer new perspectives on how level editors, steering behaviours and world design can be used to improve player experience.

**“Is it possible to create an immersive, smooth level editor by using VR without causing discomfort?”**

# Literature Review

## Virtual Reality

VR games have gradually been gaining popularity since the creation of the first VR machine, the Sensorama (patented in 1962). *“It combined multiple technologies to stimulate all of the senses: there was a combined full colour 3D video, audio, vibrations, smell and atmospheric effects, such as wind.” Dom Barnard, October 2022.*

As of 2022, the Oculus Quest 2 has become the most popular VR headset among the gaming community. With the constantly improving software, the Oculus Quest 2 provides the user with a multitude of features which has gained them a majority of positive reviews. *“It can get phone notifications, pair with keyboards and connect with virtual meeting apps, do basic fitness tracking and wirelessly stream from PCs. It's still the best self-contained VR headset right now, and the most affordable for its features.” Scott Stein, August 2022.*

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## Level Editors

To my knowledge, due to how recent the launch of this headset is, there are no academic works focusing specifically on Level Editors in the Quest 2. There are, however, some works which have researched Level Editors on other headsets. LevelEd VR, for instance, created by Lee Beever, Serban Pop, and Nigel W. John, is a system which allows users to create levels during the VR game. *“The initial focus was on improving or assisting the level creation process for virtual reality games by allowing designers to prototype levels in VR.” Lee Beever, January 2021.*

User Generated Content (UGC) in games has become a very popular tactic to increase player engagement and increase game replayability. UCG refers to any content that has been created by users as opposed to content created by the game developers. “*User generated content, or UGC, is content that has been created and posted by a user on any type of online platform, from social media and streaming platforms to video games.” - Emma Hubert, DigitalMediaKnowledge.*

A popular form of UGC in games are Level Editors, a mechanic which allows users to create levels or maps for a specific game. For instance, *Super Mario Maker 2*, a side-scrolling platform game published by Nintendo in 2019, allows the users to create, play and share their custom-made levels worldwide.

As for Level Editors in VR, however, there are numerous important factors to take into consideration when designing one. One factor to consider is the effect of the added weight of the VR headset. As it stands, the Valve Index headset is the heaviest one, weighing 809 grams (statista: **Comparison of VR headsets worldwide 2022, by weight,** Thomas Alsop, Oct 11, 2022). The lightest being the HP Reverb G2, weighing at 498 grams. The added weight causes leaning down for long periods of time which in-turn causes discomfort and also raises the risk of the headset getting damaged due to it slipping off.

As a result, the optimal placing for an in-game level editor would be at eye-level.

According to the questionnaire given to the play-testers ([**Appendices**](#_Appendices)), another factor to consider is the colourisation. Testers have stated to receive headaches from the too bright colours, particularly the grass.

As a result, the shade of the grass in the Level Editor as well as in the game world, has been dimmed.

Replace this text with an appropriate Literature Review.

The literature review places your research in context. You aren’t the first person to investigate or research a particular topic. Present a short literature review with the following goals:

* Give the reader a good overview of the key concepts;
* Describe the most relevant work (in your own words) that other people have done in this area;
* Use proper academic writing with references.
* Show how the existing work influenced your project.

# 

# Evaluation and Discussion

Replace this text with Results and Discussion.

Describe the results using diagrams such as graphs etc. as appropriate and discuss what the results mean.

Example: Results indicate that once the threshold gets over a certain point it significantly reduces player performance and player experience

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**Project Milestones**

Replace this text with Project Milestones.

Key project milestone dates and measurement on schedule, was project schedule adhered to, effectively planned for delivery on-time or ahead of schedule if appropriate.

**Major Technical Achievements**

* Developing an interactive 3D environment with realistic physics and collision detection algorithms that enable players to pick up and interact with objects in the game world.
* Implementing an inventory system that allows players to store and manage items they collect in the game.
* Developing an advanced planting and growth system that simulates real-world farming practices, including watering and harvesting.
* Implementing a day and night cycle that dynamically changes the environment and NPCs' behaviours.
* Developing AI algorithms for NPCs with wander and path following behaviours that simulate realistic human behaviours and interact with the environment and other NPCs.
* Implementing a traffic system with traffic lights, car parking, and realistic car and pedestrian interactions.
* Developing a map editor that enables players to modify the game environment and create custom paths for NPCs.
* Creating a database to store custom path information for NPCs, enabling the game to remember and use this information for future gameplay sessions.

**Project Review**

What went right? What went wrong? What (if anything) is still outstanding/missing (i.e., still left to do)? If starting again, how would you approach this project differently? What advice would you have for someone attempting a similar project in the future? Were your technology choices the right or wrong ones? If you chose the wrong technology, provide justifications for why you think this. What were the implications of your technology choices?

# Conclusions

summarise your work and findings.

**Future Work**

Indicate what might be some next steps to try (if a student next year was going to undertake a project in this area what might be an interesting thing for him/her to examine?).

# References

The weight of UGC in the gaming industry, Emma Hubert, January 2022, <https://digitalmediaknowledge.com/audiences/the-weight-of-ugc-in-the-gaming-industry/#:~:text=User%20generated%20content%2C%20or%20UGC,streaming%20platforms%20to%20video%20games>.

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L. Beever, S. Pop and N. W. John, "LevelEd VR: A virtual reality level editor and workflow for virtual reality level design," *2020 IEEE Conference on Games (CoG)*, 2020, pp. 136-143, doi: 10.1109/CoG47356.2020.9231769.

# Appendices

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Game Rating** | **Was there anything you wanted to do that the game wouldn't let you do?** | **What element of the game did you enjoy the most? (Farming, Exploring, Aesthetics etc). Explain your answer** | **How do you feel about the layout of the world and UI?** | **Did you enjoy the art style?** | **Was the UI (inventory) an appropriate distance away from your eyes?** |
| 4 |  | Farming is so fun and the map is vivid and interesting, loved the way you can drag and drop a tree down and move the house | I like the layout, the UI clock on the wrist should be bigger so it's easier to see | Yes | Too Close |
| 4 | Destroy the terrain/ environment | Customisation | Easy to understand and navigate | Yes | Just right |
| 5 | No, the game performed perfectly and did exactly what I wanted. | Exploring! I felt like I was in my own little world discovering new things in every corner I looked. | The layout was simple and pleasing to the eye! | Yes | Just right |
| 5 | More activities in the gameplay loop, like mining or fighting bad guys | Aesthetics | Clear and easy to read | Yes | Just right |
| 4 | I would like to see more interactions. Interacting with the environment around you Interacting with people other than the shop keep | I enjoyed the farming, as a Horticulturist the farming aspect was very realistic in the game world. I enjoyed the small detail of the gun to shoot away birds which is a common issue amongst Horticulturist | It's simple, and effective. You're able to find everything and everything isn't too far apart where the player would loose time | Yes | Too Close |
| 4 | Hired NPC to help do some of the farming | Exploration , the exploration was the most fun part for me as the more I explore , the more I learned about the game | The game world is pretty good and fit the theme | Yes | Just right |
| 5 | Not Particularly, seems quite extensive and the editor is very good. | Map editing and how easy and seamless it is | Very good, one note about UI, I feel like inventory should be a bit smaller as it takes up a lot of space on screen and can be very overwhelming in terms of its size. I feel a slightly smaller sized inventory would be a little bit better. Other UI elements work very well . | Yes | Too Close |
| 4 | Have more animals | Farming because its fun to grow carrots | Good | Indifferent | Just right |
| 4 | Shoot npcs | Farming | Very nice, pretty easy to follow and understand | Yes | Too Close |
| 3 | Friendship/Romancing of the NPCs | Acquisition of capital | Suitable readability | Yes | Just right |
| 5 | Fishing! | Farming | The world was easy to traverse | Yes | Too far |
| 4 | Fishing | Aesthetics, everything felt very cohesive and pleasing to look | UI felt natural and easy to use, made the layout and overall game a much more enjoyable experience than some VR games I've played with poor, clunky UI that got in the way of what could of been a fun game underneath | Yes | Just right |
| 4 | I wish we had the ability to interact with the NPCs. | I mostly enjoyed sitting back and watching the NPCs and the vehicles move around. | I like it. Everything is close by. | Yes | Just right |