Virtual Reality App- Initial Plan

Author: Harry Suggett

Supervisor: Yukun Lai

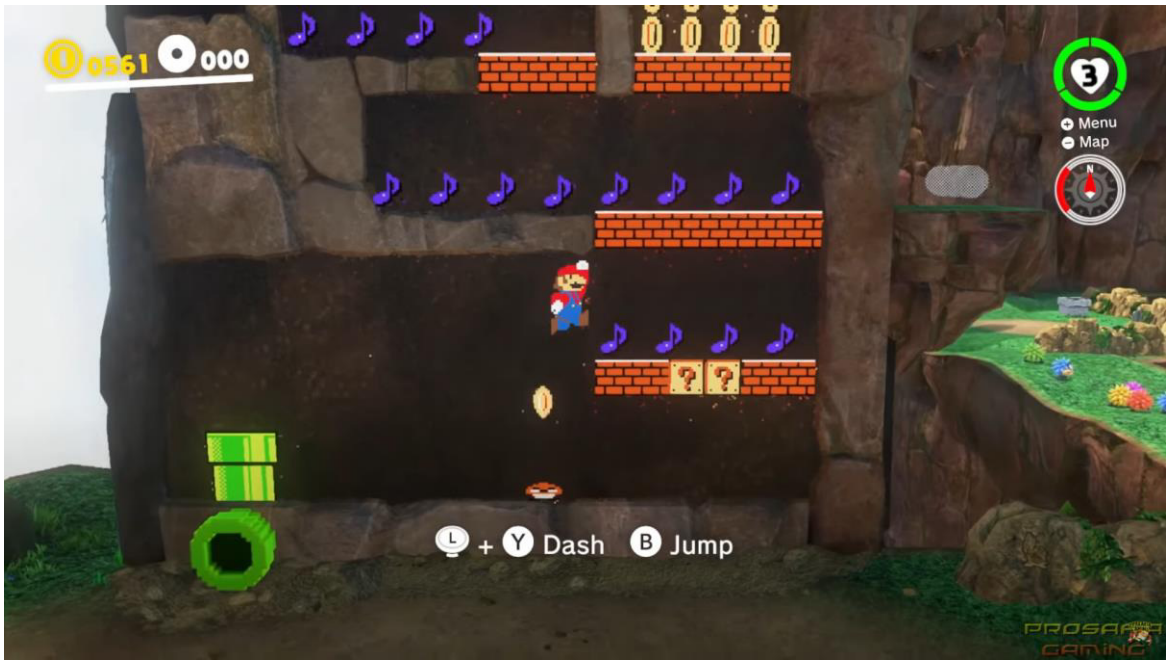
CM3203 One Semester Individual Project – 40 Credits

Project Description

My project will be to create a virtual reality app where the user can interact with a traditional 2D game via a virtual screen in a 3D VR environment and move objects from the 3D space into the 2D virtual screen using their hands to complete levels.

This app will consist of a base 2D side-scrolling game within a 3D environment, in which a virtual screen will display the 2D game, as well as contain the interactive blocks and the VR camera.

My project will aim to build on the 2D minigames that are present in 3D games such as Super Mario Odyssey[1], but within a VR environment with a stereo 3D effect from the 2 eyes, rather than a simple 3D game projected onto a 2D screen. This will allow the user to get a sense of depth that would otherwise not be achieved and to interact with the 2D game by moving objects in the 3D space.



For example, in this screenshot from Super Mario Odyssey, the player is playing a 2D game projected on a wall within the 3D game. This is the basic concept behind my app, except the player will be able to reach out and interact with the 2D game using their hands in the 3D space.

[2]

This is a mock-up of how I plan for the virtual screen to look within the 3D space, along with the virtual hands holding a building block to be added to the 2D game.

The main control method in the 3D environment will be the movement and actions (grabbing, pointing, poking etc.) of the VR controllers tracked in 3D space to pick up and touch objects. The 2D game will be controlled using the more traditional buttons and joysticks on the VR controllers.

I will develop the project using the Unity game engine, scripting the functions of the app using C#. Any object models and textures will either be free creative commons assets from the Unity Asset Store or created by me, either in photoshop or a 3d modelling program such as Blender.

The app will be designed around the Oculus Unity XR Plugin for the Oculus Rift and Quest range of headsets. However, the third-party OpenVR Unity Plug-in could also be used to support many different headsets through the SteamVR platform.

Project Aims and Objectives

3D VR Environment

The first development aim will be to create the actual 3D environment that the user will be positioned in when using the app with a VR headset. This environment will consist of:

- The room and any background objects.
- The camera.
- Any lighting.
- The VR “hands” tracked from the controllers.
- The virtual screen to display the 2D game.
- Any objects that will be used to interact with the 2D game, for example bridges or blocks to complete levels.

2D Side-Scrolling Game

The next aim will be to create the actual 2D game that the user will play on the virtual screen. This will need to contain:

- A player model and texture.
- A background.
- Obstacles or terrain.
- Enemies to avoid or objects that deal damage eg. fire, lava.
- A camera that moves along left and right with the player.

Projecting the 2D game into the 3D environment

The final main development aim will be to display the 2D game projected onto the screen in the 3D environment, and to implement interacting with the 2D game by placing objects into the screen with their hands. This step will consist of:

- Projecting the 2D game onto the virtual screen.
- Translating the 3D objects that are moved into the screen from the 3D space to the 2D space of the game so that they can be added and interact with the 2D game.
- Adding any effects to make the virtual screen have more of a texture and realism to it, eg. a CRT filter or a reflection like from a real screen.

Testing for Usability and Functionality

After the main functions of the app are complete, I will begin testing for both functionality and usability. This testing will be done by me, and by members of my household, due to current restrictions and a lack of widespread adoption of VR headsets.

Any testing that is done by someone other than me will require approval from the ethics committee by submitting an Ethical Approval Form. This is because my testing will involve recording data about the person testing, along with their responses and feedback on the app.

Testing will be done on my local PC using an Oculus Quest 2 headset

Documentation

Finally, I will document the research, development and testing process with the aid of notes that I will keep during the development and testing stages. I will evaluate the functionality and usability of my app and compare it to other implementations of similar games to establish if it is a successful approach.

Work Plan

My project will be split into weekly segments within the 12 weeks of the semester, to give distinct milestones, while still allowing for some flexibility on timing on a day-to-day basis. I have scheduled meetings with my supervisor every Monday at 13:00 to discuss the previous week's progress and any problems, as well as the coming week's tasks. 3 of these meeting will be review meetings at core milestones where a significant portion has been completed, for example the 3D environment, to review this portion in more depth and gauge the functionality of it in its completed state.

Deliverables:

- Initial Plan
- A basic 3D environment that the user can move around in and see their hands using the VR headset.
- 2D game that can be played using the controllers.
- An interaction method between the 3D environment and the 2D game.
- Usability and functionality test results from myself and others.
- Final report evaluating the app.

Project timeline

Week 1 (01/02/2021):

- Research existing games and solutions for initial plan.
- Write initial plan.
- **Deliverable: Initial Plan**

Week 2 (08/02/2021):

- Research background of project and make notes for final report.
- Install necessary software and plugins for Unity to develop VR games.
- Refamiliarize myself with the Unity program and test simple VR programs.

Week 3 (15/02/2021):

- Refamiliarize myself with the Unity software and test simple VR programs (cont.)
- Start creating my basic 3D environment that the user can walk around.
- Make notes on development.
- Create or download any models and textures needed for the 3d environment.

Week 4 (22/02/2021):

- Continue working on 3D environment.
- Make notes on development.

Week 5 (01/03/2021):

- Finish basic 3D environment.
- Start creating 2D game, independent of the 3D environment for now.
- Make notes on development.
- **Deliverable: Basic 3D environment**

Week 6 (08/03/2021):

- **Review Meeting: 3D environment**
- Make notes on development.
- Continue to create 2D game.

Week 7 (15/03/2021):

- Finish 2D game
- Start work on combining the 2D Game and the 3D environment.
- Make notes on development.
- **Deliverable: 2D game**

Week 8 (22/03/2021):

- **Review Meeting: 2D game**
- Make notes on development.
- Continue combining the 2D game into 3D environment.

Easter Break – 3 weeks (29/03/2021 – 18/04/2021):

- Finish combining the 2D game into 3D environment.
- Make notes on development.
- Nothing else scheduled but can be used as overrun if scheduled tasks above slip.
- **Deliverable: Interaction method between 3D environment and 2D game**

Week 9 (19/04/2021):

- **Review Meeting: Interaction between 3D environment and 2D game, testing and final report.**
- Carry out usability and functionality tests.
- Write up test results and conclusions.
- **Deliverable: Usability and functionality test results**

Week 10 (26/04/2021):

- Writing Final Report with aid of notes from background, development and testing

Week 11 (22/02/2021):

- Writing Final Report

Week 12 (22/02/2021):

- Finish Final Report
- **Deliverable: Final Report**

References

[1] https://www.nintendo.com/games/detail/super-mario-odyssey-switch/

[2] 8-bit pipe locations in Mario Odyssey: https://www.youtube.com/watch?v=_G7zimesCXM