UNIVERSITY OF SUSSEX

Final Project

Project Proposal – Initial Draft

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Contents

Outline

This document details and outlines the objectives and goals of the final year project to produce an 'Oculus Rift VR Game'. This document includes initial proposal ideas, the broad aims of the project as a whole, the relevance of the project to the degree course itself and bibliographies and lists of resources consulted for research purposes thus far.

Working Title

A Space Simulator Game for the Oculus Rift Virtual Reality Device

Aims and Objectives

Statement of Purpose

This project is to be produced in order to demonstrate the culmination of skills and knowledge gained throughout the degree course at Sussex University by producing a large-scale application that requires significant time and effort to complete.

Project Description

This project is intended to produce a full interactive 'space simulator' game that clearly demonstrates the abilities of the Oculus Rift device as a significant step towards achieving better immersion within a computer game, taking full advantage of the features offered by the Oculus Rift device. This project will explore three main topics throughout the dissertation: *The Oculus Rift* itself, *Exploring Virtual Reality and the Potential of Immersive User Experiences in Games*, and *A Space-Simulator Game Produced for the Oculus Rift*.

The Oculus Rift

The Oculus Rift consists of a combination of software and hardware components. The hardware device includes a head-mounted display that utilises lenses and a 1200x800 pixel mobile phone screen in order to project a stereoscopic image to the left and right eyes simultaneously to achieve a very wide (>=110 degree) field of view 3-dimensional image of a game environment. Additionally the inclusion of gyro, accelerometer and magnetometer sensors inside the unit allows for extremely precise motion detection allowing for direct measurements to be taken from the device and translated into pitch, roll and yaw input inside a game environment. A full description of the device including technical specifications, software development kit details and other information about the Oculus Rift will be included within the first few chapters of the dissertation.

Exploring Virtual Reality and the Potential of Immersive User Experiences in Games

Virtual Reality relating to games and electronic media has existed as an idea for over thirty years with various advances in interface and 3D graphics over the years; however it is only with the Oculus Rift that the culmination of several key components has finally come close to fruition. The combination of modern GPUs and the power they offer in terms of realistic real-time rendering, the availability of cheap, high resolution and high pixel density displays and advances in sensor technologies have allowed for a device that can live up to expectations for a consumer VR device targeted at gaming in particular. This section of the report would detail the history of VR and the development of VR as a 'next step' in video game immersion and interaction with a focus towards

the applications of VR and the user interaction considerations that must be raised with such a device when designing games for the Oculus Rift and other future VR devices.

A Space-Simulator Game Produced for the Oculus Rift

The main body of the project will involve the production of a simple game where the player takes on the role of a pilot within the cockpit of a spaceship in various space environments. The player will have full control of their 'head' utilising the Oculus Rift to directly translate their head movements to look around the cockpit at various windows and instruments whilst controlling their spacecraft with 6-degrees of freedom using a combination of traditional flight-controls for pitch, roll and yaw alongside translation controls in the x, y and z dimensions.

The player will also have control over a weapons system that allows them to fire at targets placed on asteroids or other genre-appropriate objects such as other target spacecraft. The main objectives of the game at a very basic level will be to provide the player with a sense of immersion inside the cockpit of a spacecraft and to offer them the challenge of manoeuvring to navigate through the environment in order to destroy the targets provided for them.

These objectives are broken down as follows:

Primary Objectives

- Produce a working cockpit-based camera that takes direct input from the Oculus Rift motion tracking sensors to allow for orientation of the head to look around in every direction. A simple 3D model of the cockpit interior is needed for the basic functionality to make sense.
- Adapt output of the game to be compatible with the stereoscopic 'pincushion' effect required by the Oculus Rift.
- Produce a space environment consisting of a star field skybox and other celestial bodies such as a nearby planet, asteroids, nebulae etc.
- Implement a control scheme for the spacecraft based on a simple physics model of simplified flight-controls as seen in flight-simulators. In addition translation in x, y and z dimensions will allow for 6 degrees of freedom in the controls.
- Produce a simple user-interface that is designed to be read from the various consoles and features of the cockpit itself much like a modern military fighter plane.
- Implement a weapons system that allows the player to shoot at various targets within the environment in order to destroy them to meet a specified objective (e.g. destroy x numbers of targets in y time)
- Collision detection to allow for said weapons to be effective in contacting and destroying targets within the game environment.
- Other realistic goals/ideas that continue to be developed

Extensions

- Implementation of basic enemy AI that allows for the player to dogfight with enemy ships in a simple manner. This could be expanded to increase difficulty and the sophistication of the AI as time allows.
- Design of a fully immersive UI that integrates well with the Oculus Rift as a believable interface directly tied to the spacecraft itself.

- Implementation of advanced graphics and lighting techniques to take advantage of modern graphics hardware and techniques.
- Expansion of control and physics to incorporate a fun representation of Newtonian flight through space (e.g. turning to face the enemy while conservation of momentum/inertia allows movement along current movement vector)
- Use of procedural generation of meshes and textures to generate realistic asteroids and planetary bodies based randomly according to input parameters.
- Exploration of shaders and current graphics trends to enhance visual experience as well as explore what works well with the Oculus Rift.
- Expansion of core gameplay to include scripted scenarios and missions as time allows.
- Including varied environments in which to fly in.
- Enhance the experience of the player in the cockpit with various effects such as g-forces pulling the head around, vibrations, creating a sense of acceleration and speed.
- A missile system that allows the player to lock a target by looking at them from any direction within the cockpit making full use of the Oculus Rift as a targeting device while the player continues to track a target regardless of the spacecraft's facing.
- A menu and interface implementation.
- Adjustable difficulties.
- Looking at tessellation to enhance detailed asteroid and terrain models on the GPU.
- Any other extensions that may be thought of between now and the submission of the final project proposal.

Project Relevance

The proposed project is considered to be relevant to the degree course as it explores a full game concept that will require a significant investment of time and effort into a fully realised game that incorporates programming knowledge gained throughout the course in order to implement various game logic, 3D graphics programming as well as a focus on the Oculus Rift itself as both an input and output device that must be considered fully in the games development. Throughout the project the game will be developed as a programming task first and foremost with efforts focused on implementing and expanding upon the game code with creation of assets as a secondary task, utilising open-source assets where appropriate as a proof-of-concept for the programming.

By the end of the project a large amount of programming should have been completed to allow for the core functionality of the game itself alongside a full set of associated documentation, commenting, version control history and various other documents entailing research and development of the game throughout the project lifespan.

Resources Required

Aside from the Oculus Rift device which has already been obtained for the duration of the project, no other resources are currently anticipated to be required. The possibility of a Unity-Pro license may be considered but a 4-month trial is available if that engine is chosen for development with.

Engine Considerations

- Custom written engine – would comprise a large task that may encompass too much time devoted to engine programming over the development of the game itself. If this project weren't focused on producing an Oculus Rift game this would be the best exploration of programming skills but a focus on the Oculus Rift itself would be preferable.
- Unity engine – very appropriate for Oculus Rift projects with new built-in support for the Oculus SDK, however the 'Pro' version is required for use of the Oculus Rift in the development of a project. A 4-month trial is available with the Oculus Rift on request as well as a cheap educational license which can be purchased by myself for approximately £80
- Irrlicht 3D engine – open source MIT licensed engine without current Oculus Rift support, though could be integrated as part of the project.
- CryEngine 3 FreeSDK – Oculus Rift support added with the latest revision and full source code access to the engine components offer a surprisingly fully featured engine to begin development with. However updated source code is not yet available for current revision with no firm ETA on the next release to include source code. Possibility if source is re-released with Oculus Integration up to date before project work begins in earnest.
- Ogre 3D engine – Open source with plenty of documentation and an active community that has already integrated Oculus Rift support. However engine features are somewhat limited compared to others in some respects.

Language Considerations

- C++ can be used for full control over the game engine and components however personal experience is not as great with C++ as with C#. Will be required alongside LUA if using CryEngine 3, Irrlicht, Ogre or a custom-built engine.
- C# offers a better language in the case of Unity where basic engine functions are already written in C++ for efficiency. Project code will be built on top using C# to develop game components and systems.

Version Control

Either Git (using GitHub) or a Perforce server would seem like the best options for maintaining version control with a leaning towards Git for ease of use and speed.

Timetable

Study Timetable 13/14, Week starting « 23-Sep-2013 » Today iCal Help

Term: Autumn Teaching Week: 2 Year: 13/14

Timetable data maintained by your School Office
Total time: 9 hours

	Monday 23 Sep	Tuesday 24 Sep	Wednesday 25 Sep	Thursday 26 Sep	Friday 27 Sep
08:00					
08:30					
09:00					
09:30					
10:00					
10:30					
11:00		*3D Animation* (Laboratory 1) Chichester 1 CI021-LAB1B			*Video Production Techniques* (Laboratory 1) Richmond 3B11
11:30					
12:00					
12:30					
13:00					
13:30					
14:00				*3D Animation* (Lecture 1) Jubilee Building JUB-144	*Video Production Techniques* (Lecture 1) Richmond 3B11
14:30					
15:00					
15:30					
16:00				*Human-Computer Interaction* (Seminar 3) Pevensey 1 1B8	
16:30					
17:00	*Human-Computer Interaction* (Lecture 1) Pevensey 1 1A7				
17:30					
18:00					
18:30					
19:00					
19:30					
20:00					
20:30					

Figure 1 - Personal timetable for Autumn Teaching Term

Bibliography

HOLLISTER, Sean. 2013. *Inside Oculus: a tour of virtual reality's would-be savior*. [online]. [Accessed 20 September 2013]. Available from World Wide Web: <http://www.theverge.com/2013/3/19/4122388/can-oculus-rift-save-virtual-reality>

IRRLICHT ENGINE. 2013. *Irrlicht Engine*. [online]. [Accessed 20 September 2013]. Available from World Wide Web: <http://irrlicht.sourceforge.net/>

LANG, Ben. 2012. *Former Apple Talent Developing Oculus Rift Headtracker, "9 DOF" and 760Hz Gyro Sampling*. [online]. [Accessed 25 September 2013]. Available from World Wide Web: <http://www.roadtovr.com/2012/10/25/oculus-rift-headtracker-adjacent-reality-1695>

LONG, Neil. 2013. *Oculus VR on why John Carmack joined the Rift revolution*. [online]. [Accessed 20 September 2013]. Available from World Wide Web: <http://www.edge-online.com/news/oculus-vr-on-why-john-carmack-joined-the-rift-revolution/>

OCULUS VR. 2013. *Oculus Developer Forums*. [online]. [Accessed 20 September 2013]. Available from World Wide Web: <https://developer.oculusvr.com/forums/viewforum.php?f=39>