The Lab 2

Report Name	Outline Project Specification
Author (User Id)	Shankly Cragg (shc27)
Supervisor	David Hunter (dah56)
Module	CS39440
Degree Scheme	G401 (Computer Science)
Date	February 12, 2018
Revision	1.0
Status	Release

1.   Project description

Aberystwyth University department of computer science has a history of cutting edge research and pioneering in multiple ventures, with departments such as the "Intelligent Robotics" group, and "Bioinformatics and Computational Biology". With this mindset, Aberystwyth has ongoing research in the relatively new field of VR (Virtual Reality).

VR has niche use as an educational tool. Current examples include Valve's 'The Lab,' (physics), "the Universe Sandbox" (astronomy) and "Job Simulator" (Cooking).

VR presents some advantages as a medium to give unique experiences, these include;
- Being able to be placed into a setting that is expensive or dangerous.
- Being placed in a situation which is difficult or impossible to recreate in the real world.
- The use of gameplay elements to enhance feedback and encourage exploration through play.
- A true sense of immersion.

With these in mind, the project will create a game space where the user is given an object, a ball, and has the challenge of scoring it into a basketball net/target style goal. The difficulty, and the learning opportunity, comes from changing inertial frames of reference for the user in novel and dangerous scenarios. For example, a still basketball net on the ground, with the user atop a moving track moving from left to right, who must consider the sideways momentum of the ball. Another example being the player moving around inside a Ferris wheel with the goal point in the gondola behind or in front.

The project will be managed using a one-man adaptation of the SCRUM methodology. This means doing daily revision of how the previous day went, and what I want to accomplish on the coming day, all kept neatly in a daily diary. A part of this project will be figuring out how to best make SCRUM work in this scenario.

2.   Proposed tasks

Research into good Unity development practices.
This concerns starting the project off on the right foot so as not to accidently fall into a state of "code spaghetti", with misplaced assets, scripts and prefabs disorganised and hard to find. This is important to maintain productivity as the project grows in complexity and size in this unfamiliar environment.

Research existing toolkits and SDKs for VR development.
So as not to re-invent the wheel, it is important to consider what building blocks already exist for the creation of virtual reality games built using the Unity3D game engine. This prevents getting stuck on menial difficult tasks which might halt development which have already been solved. A strong knowledge of the existing tools will enable me to focus on the parts of the project that are important and make it unique.

Configure building and deploying to HTC Vive
Understanding how to deploy the program outside of running it within the Unity3D live editor is a task that will need to be completed for accessibility. It would be restrictive to require you open the project in Unity3D and run there rather than through a desktop application, so this is should be looked into.

Use consistent C# coding standards.
As C# is a language that I have not worked extensively with before, I want to make a point to follow established best practises with my code. Looking at the recommendations by Microsoft with reference to the .NET framework, I intent to stick to these for the practical parts of my project.

Create game for use with the HTC Vive.
With the VR equipment in Aberystwyth University consisting of the HTC Vive, I will focus development on this piece of hardware. This means assets and anything that may be unique when coding VR which pertains to the HTC Vive will try to be adhered to, even at the potential compromise of other VR technologies.

Create multiple levels, each with changing difficulties and learning opportunities.
The game should feature more than 1 level to maintain interest, and expand upon design ideas and concepts to best elaborate on the idea the game will present. It may be the case that 1 in depth highly customizable level will do this the best, but I expect a set of levels with scaling difficulty to be done.

3. Project deliverables

A Scrum diary and task list.
I will be using SCRUM to manage myself, with a stand-up meeting at the start of every day discussing what I plan to accomplish. This will be evidenced with a daily.
I will also use a task list for myself to keep on top of what tasks need to be done, which are ongoing, and which are finished.

A git repository with the final project inside.
My final code for the project will be found on the version control system called Git. This source code will have my progress during my project baked into it with frequent commits.

An interactive educational Virtual Reality experience.
The point of the project is an educational tool with VR, so I plan to deliver an experience which directly or indirectly teaches the user something, in this case about physics and momentum.

Demonstration at the midpoint of the project to show progress at the time.
A presentation with a playable demo of the current state of the project, which should include the basic physics system, and a scene recognisable to be described as "Throwing an object into some goal".

A full write up of the project into the "Final Report".
This document will be the culmination of the project, with a detailed explanation of what goals were accomplished, what technologies were used, and a general discussion of the work undertaken. This report will also feature accreditation to anything warranting, including but not limited to; assets, scripts, or YouTube tutorials which helped with the creation of my work.

4.   Bibliography

[1] Robert Nystrom, "Component · Decoupling Patterns · Game Programming Patterns," [Online]. Available: http://gameprogrammingpatterns.com/component.html.

[2] TheStoneFox, "TheStoneFox - YouTube - YouTube," [Online]. Available: https://www.youtube.com/user/thestonefox/videos.

[3] TheStoneFox, "Virtual Reality Toolkit - YouTube - YouTube," [Online]. Available: https://www.youtube.com/channel/UCWRk-LEMUNoZxUmY1wO7DBQ/videos.

[4] TheStoneFox, "VRTK Github," [Online]. Available: https://github.com/thestonefox/VRTK.

[5] N. A. H. a. N. N. A. Sjarif, "Handwritten Recognition Using SVM, {KNN} and Neural Network," *CoRR,* vol. abs/1702.00723, 2017.

[6] Dofactory, "C# Coding Standards and Naming Conventions - dofactory.com," [Online]. Available: http://www.dofactory.com/reference/csharp-coding-standards.

[7] Microsoft, "C# Coding Conventions (C# Programming Guide) | Microsoft Docs," [Online]. Available: https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/inside-a-program/coding-conventions.

[1] Blog by single team developer on his experience with adapting SCRUM to a single person team. Describes the process of planning, working and reviewing with insightful first-hand experiences with the pitfalls to expect to fall into such as less detailed plans for later stages of a sprint, or under/overestimating the difficulty of tasks.

[2] Helpful description of Object Component Design Pattern, gives C code examples of a "gameobject", which using this pattern of a collection of components, naturally encourages decoupling.

[3] and [4] A series of tutorials for toolkits created by developer "TheStoneFox". Great place to look for implementing the building blocks of a VR application within Unity3D.

[5] The source code for VRTK (Virtual Reality Toolkit) developed by TheStoneFox

[6] and [7] Regard C# coding standards I wish to try and follow to maintain good practise and easy to read, high quality code.