# 3D Campus Explorer

# Final Year Project

# Mathew Ross – 201130125

Project Description

* Target Audience  
  The 3D Campus Explorer will be intended for use by visitors of the university, or potential future students and open day attendees.
* Aim of Project  
  The 3D Campus Explorer will be intended for use by visitors of the university. It will act as a way for people interested in joining University of Liverpool to have a look around the campus and find their way around to particular buildings, or just to see what the campus is like. People who are going to Open Days could have access to the explorer so that before they arrive they can see for themselves what to expect, and if they have an itinerary for the day, they can find where the buildings they need to go to are actually located, how to get to them and how far apart they are. It will also feature a game mode which will provide a more fun way for the users to get to experience the campus.
* Proposed Solution  
  To achieve an immersive 3D explorer of the campus, I will create 3D models of the buildings on campus as individual objects, and then use the Unity engine to position them to form the campus layout. This will be done by referencing the campus map for correct building positions, google earth for building details as well as going around campus, picturing building details, route details etc. to apply to the scene.

The paths and roads will be created in Unity to be then used for directional purposes, a 3D model will be used to create a movable characters, which the user will be able to control with the standard WASD / arrow keys and move around campus. To assist visitors who do not know the layout of campus, a menu will be provided in Unity that will allow the user to select a desired building and it will provide them with a form of directional assistance to get to that building, as well as highlighting it in the scene. This way the user will fully be able to experience campus, walk around and find buildings they want to see / need to visit, without actually needing to be there.

The explorer will have a start screen which will allow the user to select either “Free Roam Mode” or “Game Mode”, the free roaming will be as it says, just allowing the user to walk around campus as they please. The game mode will start a new game, in which the user will have to collection mini diplomas hidden around the campus, which will be timed.

The game will be hosted on a webpage, as unity provides the ability to embed your game into a webpage.

Statement of Deliverables

* Anticipated Documentation  
  + Design Specification
  + Basic tutorial / user guide
* Anticipated Software (essential and desirable aspects of the program)

**Essential:**

* + - 3D interactive model of computer science section of campus
    - Movable character / avatar
    - UI to select desired building, highlighting that building in the scene
    - Directional guidance to that building
    - Second mode, enabling game including collection of objects located around campus
    - Collision detection with buildings (i.e. can’t walk through buildings)

**Desirable:**

* + - Leader board of top 5 / 10 scores and times, including allowing the user to enter a nickname
    - On-floor guidance to your destination building
    - Multiple camera angles
    - Complete texturized model of the whole campus
    - AI cars / people with basic patrol routes (using pre-made 3D warehouse models to save time)
    - Collision detection with AI, e.g. getting ran over ends game
    - Able to walk into buildings, interactive automatic doors and able to see interior of buildings
    - VR mode

Conduct of the Project and Plan

* + Preparation
    1. Background research

One of the first things that I researched for the project was the campus size, number of buildings etc. which can be found from the campus map [1]. The map tells me there are roughly 272 building numbers on the entire campus, and there are roughly 55 buildings that need to be modelled over 23 weeks, which will give me around 2 buildings a week to model.

Online resources will primarily be utilized to turn the proposed solution into a functioning reality, primarily the use of tutorials for the use of Blender, SketchUp and Unity engine. So far I have used the Unity interactive tutorials [2], as well as videos to figure out how to make a movable object within the scene [3]. I have also confirmed from Unity documentation [4] that the engine supports models from both SketchUp and Blender.

Further research will be needed for implementing the collision system of the user’s avatar and the building objects, any physics involved such as levels etc. As well as research into an interface, options menu, starting screen, and interactive objects such as the collectable items for the game aspect. A lot of research will need to be allocated to route finding to fulfil the directional aspect of the system to particular buildings, such as its implementation in the game as well as graph theory to be used to find the best possible routes.

I will also need to find out how to keep track of a leaderboard in the game, whether this is just an array that is updated with new scores or a built in database.

* + 1. Data Required

The primary data required for the project relates to the buildings, locations will be gathered from the campus map, google maps and earth. Scaling could be gathered from the library archives of building plans. This will constitute as Real Non-Human data and will not have human participants for the project to succeed.

* + Design Stage
    1. Design methods will be used, what the design documentation will consist of

The main design method to be used for the program will be storyboarding to layout how I see the game looks, and to keep a consistent design throughout. There will also be User Interface design to keep to best principles when implementing the interface for the user.

* + Implementation Stage
    1. What hardware and software will be used

**Software:**  
Unity – the engine for the game that will provide the platform to put all the models together, create an interface and the users interaction [5].

SketchUp – primarily used for the architecture due to it being efficient and easy to learn [6].

Blender – to be used for the avatar creation and animations [7].

**Hardware:**  
Minimum requirements for developing in Unity are as follows:

**OS**: Windows 7 SP1+, 8, 10, 64-bit versions only; macOS 10.11+  
**CPU**: SSE2 instruction set support.  
**GPU**: Graphics card with DX10 (shader model 4.0) capabilities.

Minimum requirements to run the game are:  
To run as a desktop game –   
OS: Windows 7 SP1+, macOS 10.11+, Ubuntu 12.04+, SteamOS+  
Graphics card with DX10 (shader model 4.0) capabilities.  
CPU: SSE2 instruction set support.

To run on a website - WebGL: Any recent desktop version of Firefox, Chrome, Edge or Safari. [8]

* + 1. What testing will be carried out

Type of testing to be done:

* GUI testing – ensuring all UI elements work correctly, the start screen is as intended, the in-game building selector correctly selects buildings and highlights them
* Regression testing – when updating the model and its functionality, ensuring existing aspects, objects and functionality in the game work correctly
* Acceptance testing – ensuring the end product is as stated in the spec

Minimum test cases to be carried out:

* Player cannot occupy same location as other objects such as buildings, trees etc.
* Player cannot leave campus
* Player cannot fly
* Correct building is highlighted according to user selection in menu
* Correct vector for directional guidance
* Shortest route given for directions
* Leader board changes to new score / name upon new high score
* AI do not divert from patrol routes
* AI cannot go through buildings
* Camera angle cannot be through the floor
* Risk Assessment

The main risk involved with the development of the project is the time needed to model all the buildings. There are roughly 55 buildings that need modelling, which means around two per week need to be modelled by demonstration time and they are of vastly different scales, this isn’t including doing terrain. Time organisation will be key to keeping this within the deadline.

Another risk is that I will have to learn Unity as I go, fortunately I already know some C# which is the language used in Unity, so this shouldn’t be as big of a risk.

A factor to take into account is any route finding algorithms will need to be studied, using graph theory if possible within Unity to create a best route algorithm within the game.

To minimise these risk I will be modelling the computer science section of the campus first, to have a relevant portion of campus ready for demonstration. I will also initially be setting up route finding using a directional arrow that will point towards the building that is being searched for, which should be achievable using vectors within the game, this way I will give myself extra time to implement the more desirable features of the game.

* Project Schedule



Bibliography

[1] Campus map

[2] unity interactive tutorials <https://unity3d.com/learn/tutorials/projects/interactive-tutorials/game-objects-components?playlist=49382>

[3] movable object within unity <https://www.youtube.com/watch?v=sXQI_0ILEW4>

[4] unity documentation (SketchUp import) <https://docs.unity3d.com/Manual/HOWTO-ImportObjectSketchUp.html>

[5] Unity <https://unity3d.com/>

[6] SketchUp <https://www.sketchup.com/>

[7] Blender <https://www.blender.org/>

[8] Unity system requirements <https://unity3d.com/unity/system-requirements>

USEFUL LINKS:

Smooth camera follow in Unity:

<https://www.youtube.com/watch?v=MFQhpwc6cKE>

SketchUp tips:

<https://www.youtube.com/watch?v=buKN2ztJhW8>

Importing SketchUp model to Unity:

<https://www.google.co.uk/search?q=import+sketchup+to+unity&rlz=1C1FGGD_enGB505GB505&oq=import+sketchup+to+u&aqs=chrome.1.69i57j0l5.5567j0j7&sourceid=chrome&ie=UTF-8#kpvalbx=1>

Unity mouse orbit player:

<https://www.youtube.com/watch?v=xcn7hz7J7sI>

Unity basic collision:

<https://www.youtube.com/watch?v=ObjvGBhyaB4>

Unity terrain tool:

<https://www.unityterraintools.com/tools.php>

Unity, MMORPG style movement (my current implementation):

<https://www.youtube.com/watch?v=Cfr6Yh11s_c>