National College of Ireland

<BSCHE>

<Software Engineering>

<2020/2021>

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<Lost in Time (celtic edition)>

Technical Report

https://github.com/kidcolie90/CelticHistory

Contents

Executive Summary

The main purpose of this project is to create a game that will enable students to learn about a topic (in this case celtic history). Most learning was done in a class room pre-pandemic, but society has shown that it can adapt to both learning and working from home, where there can be an issue is interaction through screen. In terms of learning from home we make the learning process more interactive and appealing through gamification. This project is an example of how we can take the topic of history and make it more interesting and engaging for a learner who may otherwise not want to or be able to access an online class.

1.0 Introduction

1.1. Background

The reason I undertook this project was because I have a personal interest in game development and I wanted to learn more about it, furthermore living and learning remotely through the pandemic throughout the last year has been difficult and I believe that new avenues to make working/studying from home should always be explored.

It is my hope that this project will not only teach me more about software development through developing a game but that it will encourage future projects or work in this area.

1.2. Aims

Ultimately this project aims to deliver a sandbox 3d game that a user can log into and play to learn about the ancient celts. Initially the scope and original idea for this project was much larger but given the timeframes and my own lack of experience in this area I have narrowed the scope a lot.

the main aims are :

- The player can launch and start the game
- The player can explore the sandbox environment
- The player can interact with NPC's and game objects
- The player can save and load states in the game
- The player can complete/win the game
- The player can start a new game when they choose to
- The player will learn about the topic covered in the game

1.3. Technology

Originally I planned to use unity 2d in this project but as that 2d is fairly outdated and not as engaging for potential players of the game (Students) I have switched to unity3d.

Unity3d: The game will environment and game objects will be created in unity 3d, I have already started building the environment in 3d. I am using 2d as one of the gameloops within the game as well as the menus.

C#: All of the game scripts will be written in C# and attached to game objects within unity. This includes player movement, NPC movement and all in game interaction between the player and the game.

Visual Studio: All code editing will be done in visual studio.

1.4. Structure

This project document will follow the below structure:

System: This section outlines the functional and non functional requirements of the software as well as describing the architecture and the player interaction with the game through first person view. As the menu's have not yet been implemented it can not yet show the GUI but I will show one of the core game loops "question stone" and how the user would interact with that.

Conclusion: This section will reflect on the project overall and discuss the disadvantages, strengths and limitations of the project.

Further development or Research:

This section will examine as a whole and discuss learnings made from making the project as well as its potential to be carried on or adapted for future research or projects. I will look at the original scope and examine if parts of it can be adapted for future research.

References:

This section will show all references used in developing the project.

Appendix:

This section will show all additional and supplementary documentation

2.0 System

2.1. Non functional Requirements

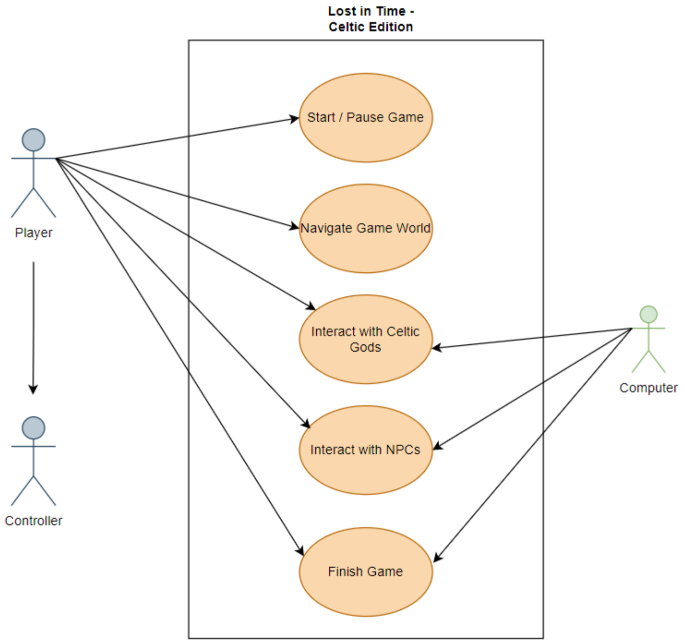
1. **Availability:** ideally the game will eventually **(outside of scope for this project which is intended for internal NCI use only)** be hosted online for users to download and play once it is complete.
2. **Educational:** Player should learn about celtic history by playing and interacting with the game. (This is measurable in game as the player needs to answer questions to progress).
3. **Ease of Use:** The game should be easily played and interacted with by players of all ages after 30 mins of experimenting with the controls and interacting with the game world. / Self-intuitive no training required.
4. **Reliability:** The game on a reasonable hardware spec and not crash when players run it.

2.1.1. Functional Requirements

The below functional requirements are ranked in order of importance starting with "Start Game".

2.1.1.1. Use Case Diagram

Describes all requirements needed for the game to function as intended:



Start Game: This Use Case details the process of beginning the game:

Name	**Start Game**
Brief Description	The Player will be able to start the game by choosing this option from the menu displayed to them.
Actor(s)	Player
Flow of Events	
Basic Flow	
1. This use case is initiated when the player enters the game and clicks “Start Game”. 2. They will be presented with a menu displaying the following options: “New Game, Load Game, Quit”. 3. The player chooses “New Game”. 4. The Game begins.	
Alternate Flows	
Title	**Description**
The player clicks “Quit” at any point.	(1 -4) If the player clicks “quit” at any point during this process, the use case will terminate, and the game will close.
The player clicks “Load Game”	(2-3) If the player clicks “Load Game”, it will start a game that they had previously saved.
Termination	The use case terminates when product information is successfully updated.
Pre-Conditions	
Title	**Description**
The player has downloaded the game	The player must download the game in order to play.
They have the minimum software / hardware requirements to run the game	The player must be accessing the game on a machine capable of running the software.
Post-Conditions	
Title	**Description**
Game begins	The player will be brought into the game world.

Pause Game: This Use Case details the necessary steps to Pause the game :

Name	**Pause Game**
Brief Description	The Player will be able to pause the game by choosing this option from the menu displayed to them.
Actor(s)	Player
Flow of Events	
Basic Flow	
1. This use case is initiated when the player and clicks the "Pause" button. 2. They will be presented with a menu displaying the following options: "Start, Save Game, Quit". 3. The use case ends when the player clicks any of these options.	
Alternate Flows	
Title	**Description**
The player clicks "Quit" at any point.	(1 -3) If the player clicks "quit" at any point during this process, the use case will terminate, and the game will close.
The player clicks "Save Game"	(2-3) If the player clicks "Save Game", it will save their progress and return them to the "Pause Menu"
The player clicks "Start"	(2-3) If the player clicks "Start", it will return them to where they were in the game.
Termination	The use case terminates when the player chooses any of the options displayed to them in the Pause menu.
Pre-Conditions	
Title	**Description**
The player is actively playing the game	The player must be actively playing the game in order to pause it.
Post-Conditions	
Title	**Description**
Player can save their progress	If "Save Game", the players progress will be saved
Player can exit the game	If "Quit", the player will exit the game and be returned to the "Start Game" screen.
Player can continue playing	If "Start", the player will be brought back to where they were in the game.

Interacting with celtic gods: This UseCase details the necessary steps for the player to interact with the celtic gods in the game.

Name	**Interact with Celtic Gods**
Brief Description	The Player will be able to interact with game objects. Celtic Gods will provide information to players.
Actor(s)	Player, Computer
Flow of Events	
Basic Flow	
1. This use case is initiated when the player approaches a Celtic God. 2. The player clicks on the Celtic God. 3. The player is displayed with information about the Celtic God. 4. When the player has finished reading the information, they can click on it again and it disappears.	
Alternate Flows	
Title	**Description**
The player clicks "Pause" at any point.	(1 -4) If the player clicks "Pause" at any point during this process, the use case will be interrupted. The player will need to click "Start" again to continue with the use case.
Termination	The use case terminates when the player clicks on the Celtic God a second time and the information is hidden.
Pre-Conditions	
Title	**Description**
The player is actively playing the game	The player must be actively playing the game in order to interact with a Celtic God.
Post-Conditions	
Title	**Description**
Player can continue navigating the game world.	Once the player has read the information, and click the Celtic God for the second time, they can continue navigating the game world.

Interacting with NPC's: The below UseCase details how the player interacts with non player characters

Name	**Interact with Non-Playable Characters (NPCs)**
Brief Description	The Player will be able to interact with non-playable characters to learn more information.
Actor(s)	Player, Computer
Flow of Events	
Basic Flow	
1. This use case is initiated when the player approaches a NPC. 2. The player clicks on the NPC. 3. The player is displayed with information about the Celtic Ireland. 4. When the player has finished reading the information, they can click on it again and it disappears.	
Alternate Flows	
Title	**Description**
The player clicks "Pause" at any point.	(1 -4) If the player clicks "Pause" at any point during this process, the use case will be interrupted. The player will need to click "Start" again to continue with the use case.
Termination	The use case terminates when the player clicks on the NPC a second time and the information is hidden.
Pre-Conditions	
Title	**Description**
The player is actively playing the game	The player must be actively playing the game in order to interact with a NPC.
Post-Conditions	
Title	**Description**
Player can continue navigating the game world.	Once the player has read the information, and click the NPC for the second time, they can continue navigating the game world.

Finish Game: The below details how the user would complete the game:

Name	Finish Game
Brief Description	The Player will be able to complete game.
Actor(s)	Player, Computer
Flow of Events	
Basic Flow	
1. This use case is initiated when the player finds a "Question Stone". 2. The computer presents the player with a question relating to what they have learned throughout the game as well as a text box to enter an answer. 3. The player must enter an answer. 4. If the player submits a correct answer, the computer will display a "Congratulations" message and the game will end.	
Alternate Flows	
Title	Description
The player clicks "Pause" at any point.	(1 -4) If the player clicks "Pause" at any point during this process, the use case will be interrupted. The player will need to click "Start" again to continue with the use case.
The player enters an incorrect answer	(4) If the player enters an incorrect answer, the computer will display a prompt to return to the game to learn more and try again later.
Termination	The use case terminates when the computer displays the message ("Congratulations" or "Try Again Later") .
Pre-Conditions	
Title	Description
The player finds a question stone.	The player must find a question stone in order to finish the game.
Post-Conditions	
Title	Description
The Game Ends.	The player is congratulated, and the game terminates.

2.1.2. Data Requirements

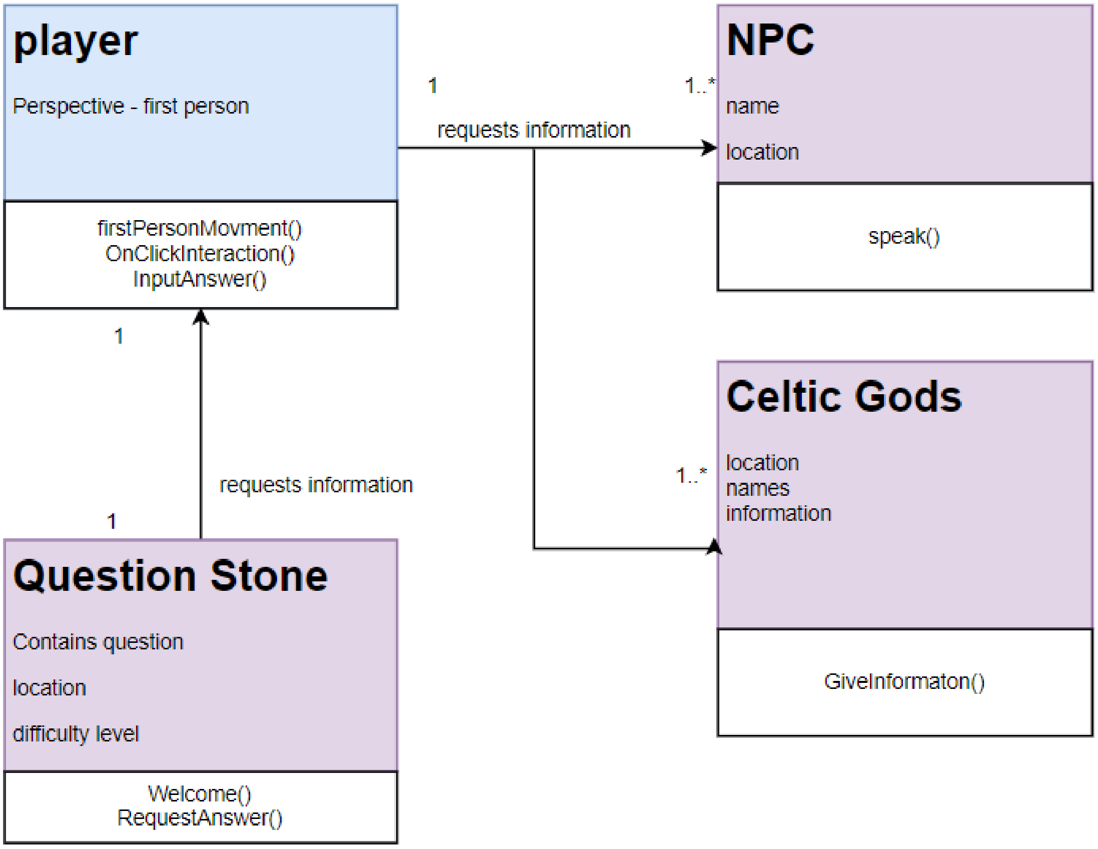
I am unsure of the total size that the game will be upon completion of development, at a guess the user will need 5 gigs of data to install and run the game, the current environment runs on my own pc which has an i7 processor and 8 gigs of RAM. Ideally I would like users to be able to install and run on less than that. Save states will be handled on the disk of the PC via a unity package. The user should be able to remove save data as needed.

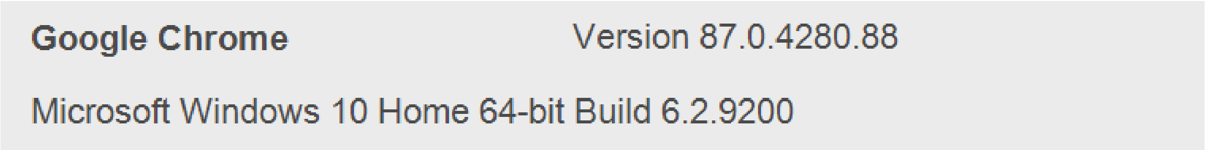
2.1.3. User Requirements

The user should be able to comfortably use the mouse and keyboard and access the internet to download the game. The user should be aware of generally how to install programs on the PC and how to open programmes on the PC.

2.2. Design & Architecture

Below is an ERD for the game demonstrating how the different components of the game will interact with each other:



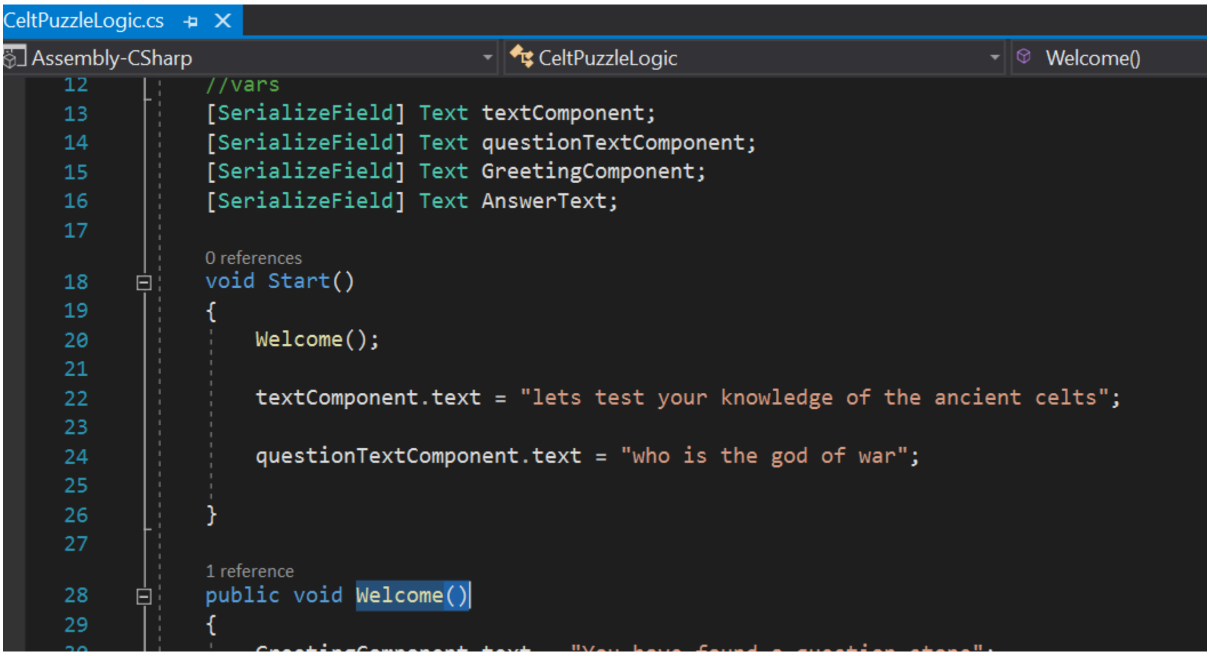


Google Chrome Version 87.0.4280.88

Microsoft Windows 10 Home 64-bit Build 6.2.9200

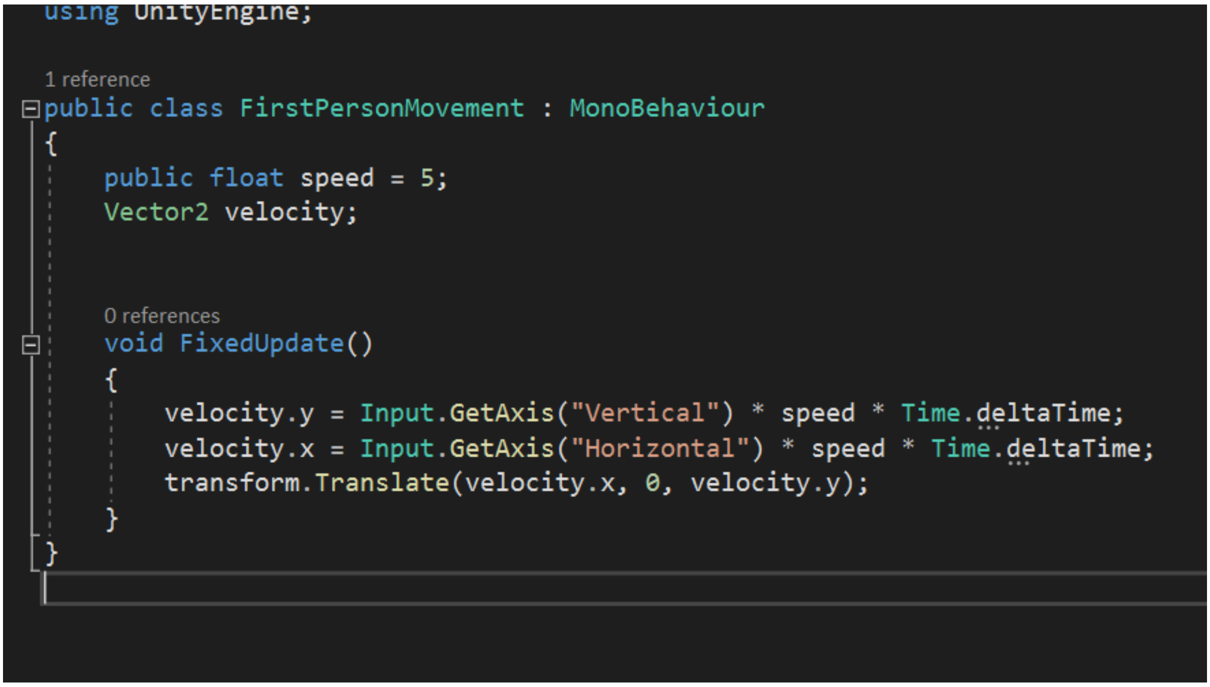
2.3. Implementation

One of the core game loops within the game is answering questions from the question stone, the below code snippets shows how this is working by taking an answer through a serialised filed after asking the user a question and displaying a welcome message :

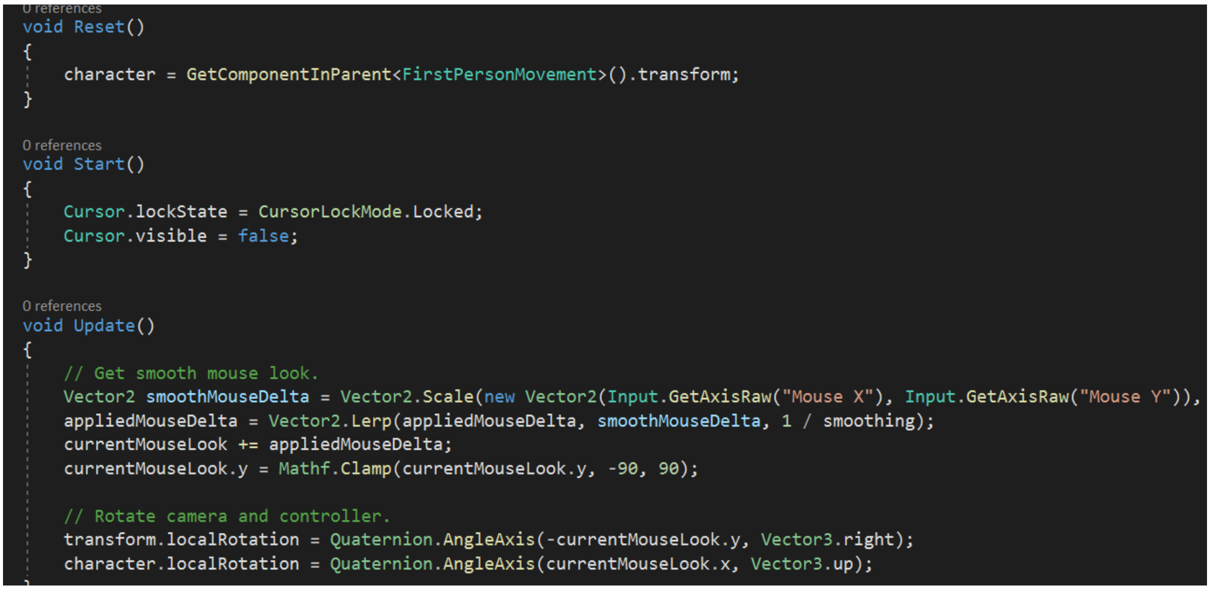


```
    //vars
    [SerializeField] Text textComponent;
    [SerializeField] Text questionTextComponent;
    [SerializeField] Text GreetingComponent;
    [SerializeField] Text AnswerText;

    0 references
    void Start()
    {
        Welcome();

        textComponent.text = "lets test your knowledge of the ancient celts";

        questionTextComponent.text = "who is the god of war";

    }

    1 reference
    public void Welcome()
    {
        GreetingComponent.text = "You have found a question stone";
```

The below code snippet shows how the player operates the first person controller through two separate classes one for smoothing mouse movement and the first for quiring vertical and horizontal movement speed (not included are a separate class for “checkground” and “jump” which is a GetKeyDownSpacebar method :

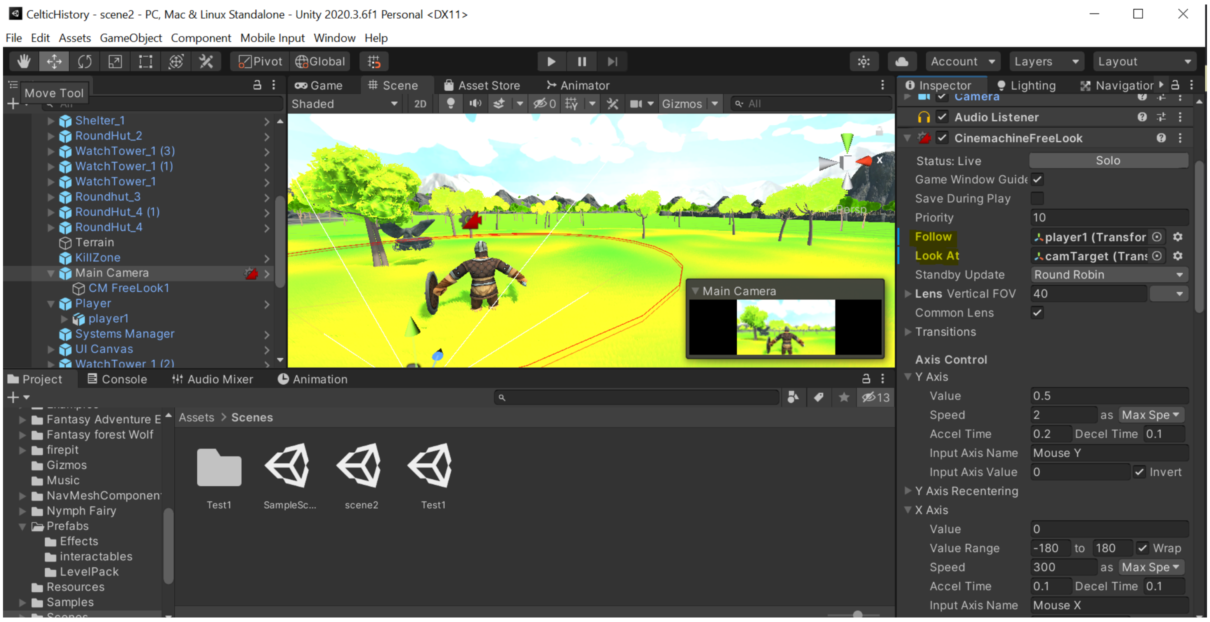


```
using UnityEngine;

1 reference
public class FirstPersonMovement : MonoBehaviour
{
    public float speed = 5;
    Vector2 velocity;


    0 references
    void FixedUpdate()
    {
        velocity.y = Input.GetAxis("Vertical") * speed * Time.deltaTime;
        velocity.x = Input.GetAxis("Horizontal") * speed * Time.deltaTime;
        transform.Translate(velocity.x, 0, velocity.y);
    }
}
```



```
0 references
void Reset()
{
    character = GetComponentInParent<FirstPersonMovement>().transform;
}

0 references
void Start()
{
    Cursor.lockState = CursorLockMode.Locked;
    Cursor.visible = false;
}

0 references
void Update()
{
    // Get smooth mouse look.
    Vector2 smoothMouseDelta = Vector2.Scale(new Vector2(Input.GetAxisRaw("Mouse X"), Input.GetAxisRaw("Mouse Y")),
    appliedMouseDelta = Vector2.Lerp(appliedMouseDelta, smoothMouseDelta, 1 / smoothing);
    currentMouseLook += appliedMouseDelta;
    currentMouseLook.y = Mathf.Clamp(currentMouseLook.y, -90, 90);

    // Rotate camera and controller.
    transform.localRotation = Quaternion.AngleAxis(-currentMouseLook.y, Vector3.right);
    character.localRotation = Quaternion.AngleAxis(currentMouseLook.x, Vector3.up);
```

Since the midpoint we have switched to third person view, this was to give me more of a chance to experiment with controlling the camera. The script is similar to the above but it works in conjunction with rig set up in the unity engine itself. To set the third person camera up I used the cinemachine Unity plug and added a "camTarget" object placed on top of the player avatar so the camera was never following the players feet. Screenshots outline this below:



CelticHistory - scene2 - PC, Mac & Linux Standalone - Unity 2020.3.6f1 Personal <DX11>

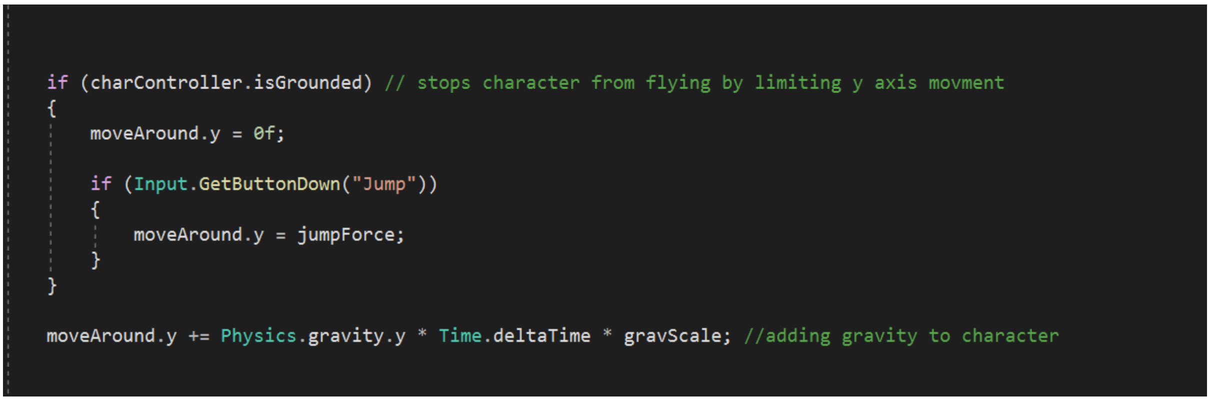
Camera
☑ Audio Listener
☑ CinemachineFreeLook

Status: Live — Solo
Game Window Guide ☑
Save During Play □
Priority 10
Follow player1 (Transfor
Look At camTarget (Trans
Standby Update Round Robin
Lens Vertical FOV 40
Common Lens ☑
Transitions

Axis Control
Y Axis
Value 0.5
Speed 2 as Max Spe
Accel Time 0.2 Decel Time 0.1
Input Axis Name Mouse Y
Input Axis Value 0 ☑ Invert
Y Axis Recentering
X Axis
Value 0
Value Range -180 to 180 ☑ Wrap
Speed 300 as Max Spe
Accel Time 0.1 Decel Time 0.1
Input Axis Name Mouse X

With the third person camera set up movement needed to be handled slightly differently than with the first person controller. I also needed to add some conditional statements to stop the player from moving while taking damage. I managed this through the player controller script. Some of the key features are outlined below.

Below shows stopping the player being able to move along the y axis in the 3d environment, essentially stopping the player from being able to fly as well as applying gravity to the player:

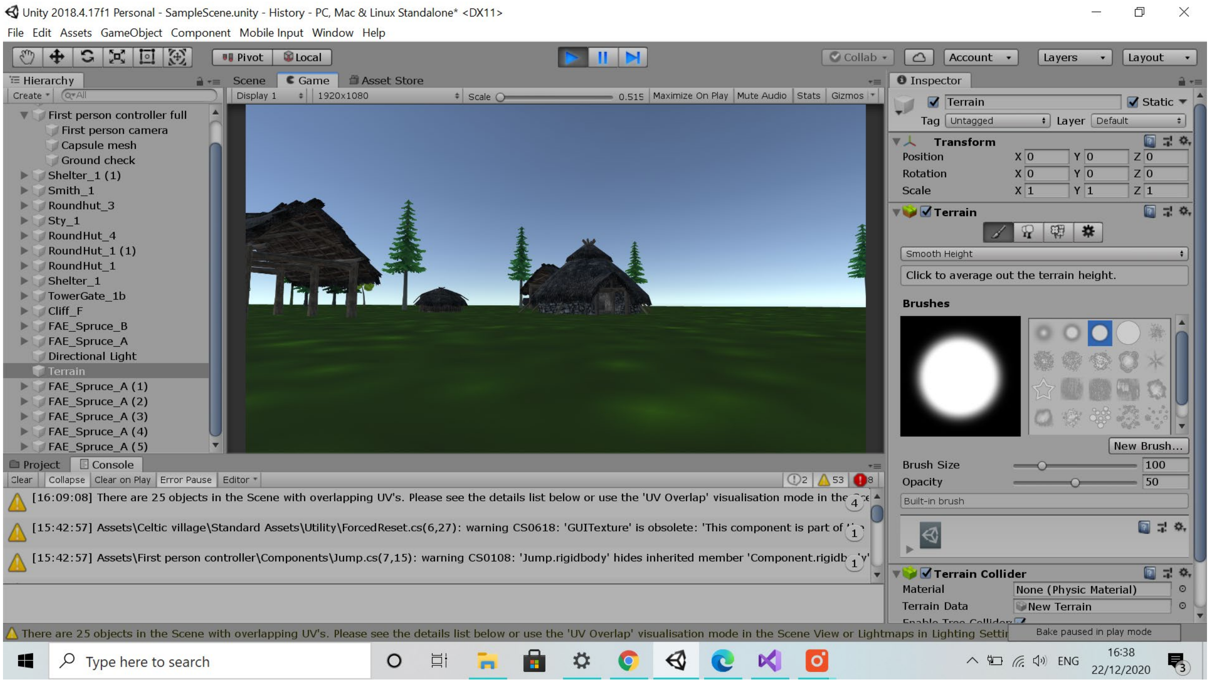


```
if (charController.isGrounded) // stops character from flying by limiting y axis movment
{
    moveAround.y = 0f;

    if (Input.GetButtonDown("Jump"))
    {
        moveAround.y = jumpForce;
    }
}

moveAround.y += Physics.gravity.y * Time.deltaTime * gravScale; //adding gravity to character
```

2.4. Graphical User Interface (GUI)

I have not yet created the start or pause menu yet, but below I can show some of the key user interactions and how they appear to the user in the game world:

The below is the firstperson controller perspective of an old Celtic hut they come across when exploring the game:



Terrain ☑ Static
Tag Untagged Layer Default

Transform

	X	Y	Z
Position	0	0	0
Rotation	0	0	0
Scale	1	1	1

☑ Terrain

Smooth Height

Click to average out the terrain height.

Brush Size 100

Opacity 50

Built-in brush

☑ Terrain Collider

Material None (Physic Material)

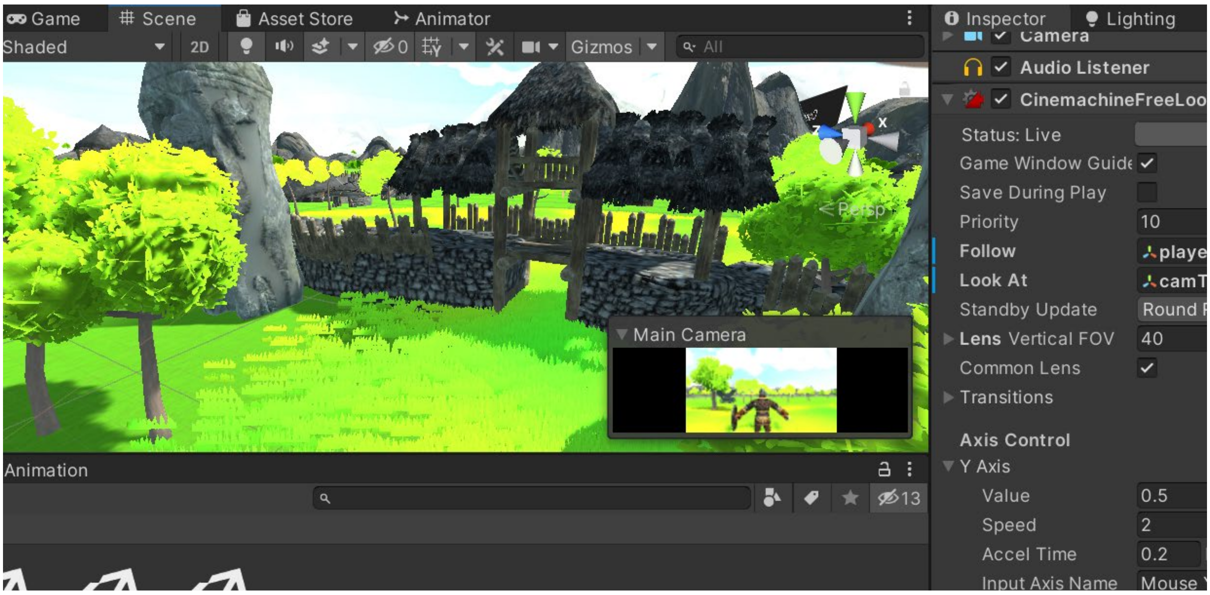
Terrain Data New Terrain

```
[16:09:08] There are 25 objects in the Scene with overlapping UV's. Please see the details list below or use the 'UV Overlap' visualisation mode in the Sce   4
[15:42:57] Assets\Celtic village\Standard Assets\Utility\ForcedReset.cs(6,27): warning CS0618: 'GUITexture' is obsolete: 'This component is part of '   1
[15:42:57] Assets\First person controller\Components\Jump.cs(7,15): warning CS0108: 'Jump.rigidbody' hides inherited member 'Component.rigidb  'y'   1
```

There are 25 objects in the Scene with overlapping UV's. Please see the details list below or use the 'UV Overlap' visualisation mode in the Scene View or Lightmaps in Lighting Settir

Bake paused in play mode

The map has been updated with better assets since the above screen shot, this is the same village the player encounters at present for comparison (comparisons will be more clear in the demo video) :



☑ Camera

☑ Audio Listener

☑ CinemachineFreeLoo

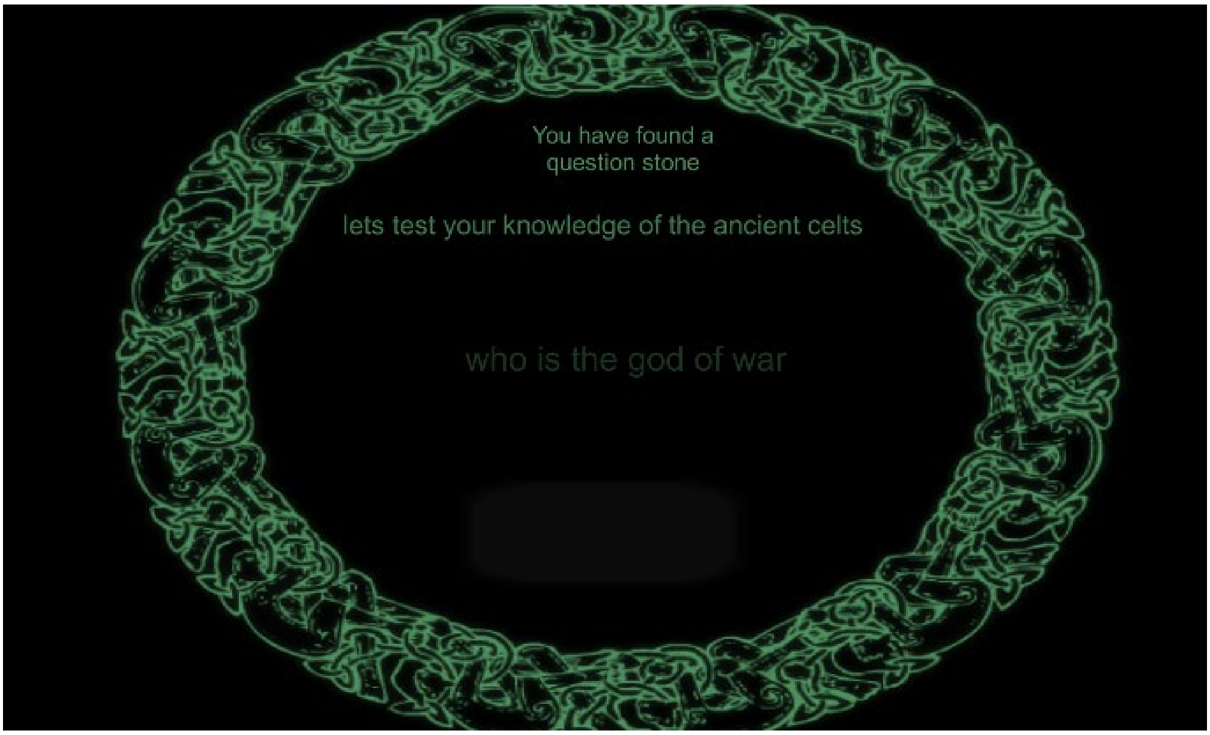
Status: Live	
Game Window Guide	☑
Save During Play	□
Priority	10
Follow	playe
Look At	camT
Standby Update	Round
Lens Vertical FOV	40
Common Lens	☑
Transitions	

Axis Control

Y Axis

Value	0.5
Speed	2
Accel Time	0.2
Input Axis Name	Mouse

The below is a screenshot of what the player will see upon interaction with one of the games question stones(core game loop for testing learned celtic knowledge):

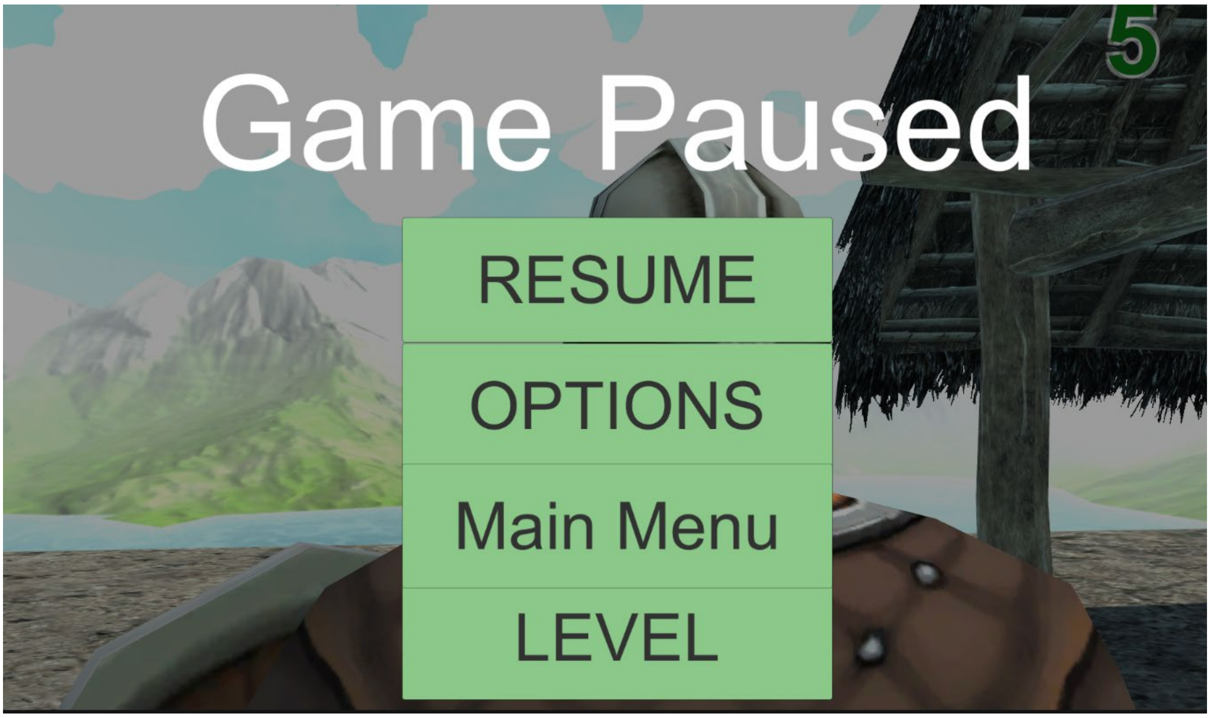


You have found a question stone

lets test your knowledge of the ancient celts

who is the god of war

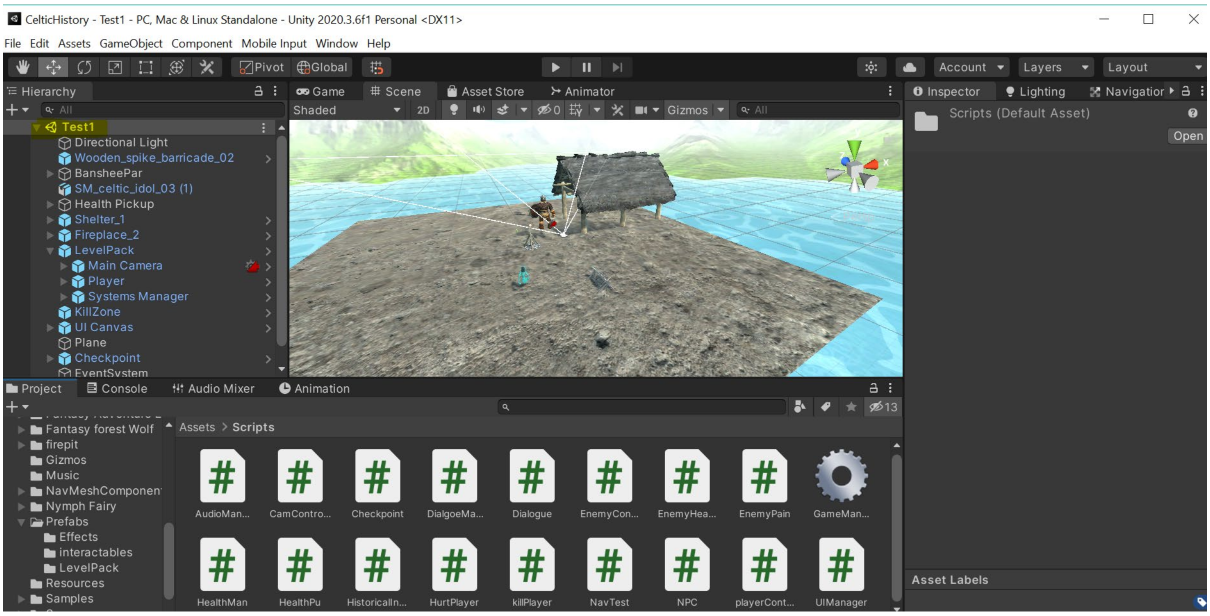
In terms of UI a pause menu has also been implemented allowing users to stop game state and change the volume of the in game music:



2.5. Testing

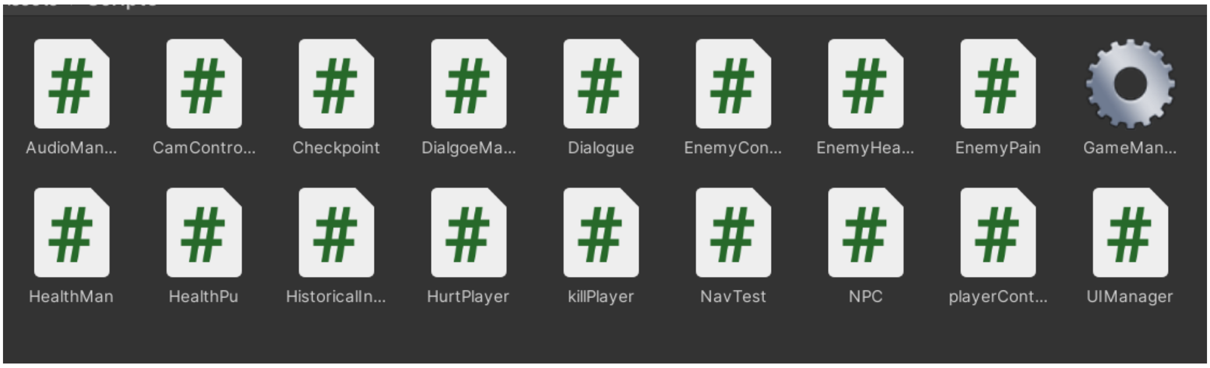
The testing for this project was done incrementally, as I developed a script within unity I had test seen to test its functionality. We can see some examples of this below, the testing scene I created here has some aspect of all of the different systems enabled. I had to test the 3rd person camera, gravity, physics, combat, sound systems, damage systems, respawns, enemy ai and most of the scripts seen in the project window below.

I would then make changes to the scripts as needed, once the systems were working as best as I could make them I would then add them to a levelpack prefab, was used to build the main area of the game. One of the systems I cant get working properly currently is the dialogue system which should display text containing knowledge based on the ancient celts when a player interacts with it.



3.0 Conclusions

This project was a very steep learning curve for me on an area I'm extremely interested in but had not explored in very much detail over the course of my degree at NCI. When undertaking this project I hadnt realised the amount of time it would take to adapting to using the unity game engine, learning how to animate assets and bridging the gap between my in game objects and assets and my actual c# scripts. The game is made up of 18 different c# scripts controlling everything the player does and interacts with on screen, from how the camera moves to how enemies patrol areas and damage the player.



I feel that when I started I had an idea of what I wanted the game to be but I had to adapt and change these plans as I went on. I initially didn't plan on having any enemys in the game and developed the code for the puzzle which would have been the core part of the game early on. I then wanted to experiment with the AI system in unity and as a result decided to add enemies that would patrol the map and purse the player whenever the player got too close, damaging and ultimately killing the player. This led me to needing a checkpoint system where the player could respawn if they were killed, it also meant I needed to set up a health system and a damage system for both the player and enemy. I also needed to find assets for enemies and learn how to animate them. The project really spiralled for me and although I really enjoyed learning the unity platform I feel the game overall suffered because I went off plan and kept adding things to it that I thought I would like to have in a game I was playing. One of the systems that I thought would be simple enough to make and left until last was the dialogue system which would pop up and give the player information about the celts when they interacted with certain objects in the game. This took three different scripts to set up and I am still working on it on submission day. Prioritisation and planning were the biggest weaknesses of this project.

The game looks nice because of the assets I used and feels nice to play because of the amount of time I spent setting up the camera rigs in unity and working with controlling the camera through the mouse. I would have liked to be able to learn blender and photoshop to be able to make my own assets to work along side my code which is something I will do in the future.

What the game did well for me was give me an broad view of a subject area I would like to pursue after college. I can re-use and build on all of the scripts I developed for this game in future projects. For users playing the game they get to play a game that looks and feels nice as well as learning about ancient celts and seeing a celtic style village which they can walk around and explore in the game world.

4.0 Further Development or Research

For me if I had additional time I would like to learn and work on the art side of game development and really spend a lot of time working on and perfecting asset generation and character building. I would also spend a lot more time styling the pause menu and developing alternate sound tracks and effects for the game rather than just same one on a loop which is currently being used.

For future development I believe that the concept could easily be expanded upon. A much more detailed game about the celts could be made or any other ancient civilisation, it could even be applied to English studies where the game takes place in a Shakespearian play providing the player with knowledge about famous plays and poetry.

5.0 References

Assets used:

https://assetstore.unity.com/packages/2d/textures-materials/nature/terrain-tools-sample-asset-pack-145808 - Free Terrain Asset tools by Unity

https://assetstore.unity.com/packages/3d/props/exterior/wooden-barricades-pack-2-variations-107531 - barrcade asset pack by ANRUVAL_3D_MODELS https://assetstore.unity.com/packages/3d/characters/ghost-and-banshee-animated-characters-102319 - Ghost asset pack used for banshee by - Kornica3D

https://assetstore.unity.com/packages/3d/environments/fantasy/fantasy-adventure-environment-70354 - fae enviroment asset pack (used for trees and grass) by Saggart Creations

https://assetstore.unity.com/packages/3d/props/exterior/celtic-pagan-idols-177494 - Statue asset used for god statues – by Elargin

https://assetstore.unity.com/packages/3d/celtic-village-68086 - Old Village used for celtic buildings in game – by Roman Valanta

https://assetstore.unity.com/packages/3d/characters/toon-rts-units-barbarians-117277 - Used for player avatar - by Polygon Blacksmith

References:

Mythology, C., 2021. *Celtic Mythology – Mythopedia*. [online] Mythopedia. Available at: <https://mythopedia.com/celtic-mythology/> [Accessed 1 May 2021].

ROOS, D., 2021. *8 Facts About the Celts*. [online] HISTORY. Available at: <https://www.history.com/news/celts-facts-ancient-europe> [Accessed 7 April 2021].

Online courses:

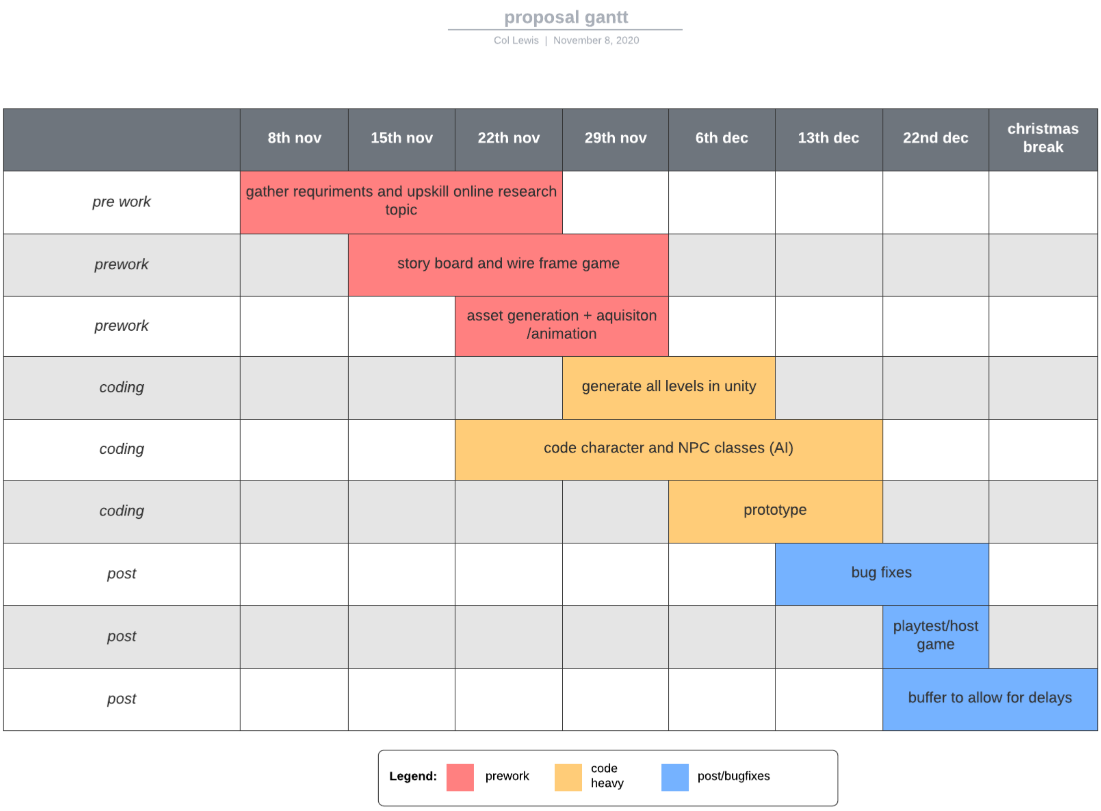
Doyle, J., 2020. *Learn To Make a 3d Platormer Game with Unity*.[udemy.com 2020]

Tristem, B., 2020. *Complete C# Unity Game Developer 3D*. .[udemy.com 2020]

6.0 Appendices

This section should contain information that is supplementary to the main body of the report.

6.1. Project Plan



proposal gantt

Col Lewis | November 8, 2020

	8th nov	15th nov	22th nov	29th nov	6th dec	13th dec	22nd dec	christmas break
pre work	gather requriments and upskill online research topic							
prework		story board and wire frame game						
prework			asset generation + aquisiton /animation					
coding				generate all levels in unity				
coding			code character and NPC classes (AI)					
coding					prototype			
post						bug fixes		
post							playtest/host game	
post							buffer to allow for delays	

Legend: 🟥 prework 🟨 code heavy 🟦 post/bugfixes

Reflective Journals

3789_Colm_Lewis_October2020_x171064

September 2019.docx

october2020.docx

December2020.docx

Febuary2021.docx

April2021.docx

March2021.docx

6.2. Other materials used

Project Pitch Final Year.docx

Proposal Template (1).docx