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MULTIPLAYER CREATIVE SANDBOX

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Analysis

Project Overview

In this project, I will be exploring a Solution to a problem, to fulfil the needs of my client. Video game, since their creating have been a means of socialising, connecting and relaxing. A recent boom in popularity, owing to people spending more time gaming since the recent Covid-19 pandemic and lockdowns, has resulted in games becoming a staple in many people's lives. This ever-growing popularity creates a strong demand for new and unique games to enjoy.

Project Outline

My client is an avid video game enjoyer, who like many enjoy the social aspect of video games. They require a multiplayer game in the "Creative Sandbox" genre, so that they can play and create with their friends.

While this may be available through other games, their requirements for a game that runs well on very low powered hardware so that they can run the game on their laptops in a LAN configuration, vastly limits the choices of game. This excludes games such as terraria or Minecraft.

With all this in mind, the client has made it clear that they want a complicated and optimised map generation algorithm as well as multiplayer capability, as connecting on the same session is the most core component, and the most decorated feature.

My Client

My client in question is an avid video game fan. They particularly like retro style games, with simple and well executed features.

An Interview with Elliot – My Client

Q1. How would you like the game to be played?

> A1: The Game needs to be playable on PC, as my friends and I all have laptops which we play our games on. Therefore, the controls need to be suited to a keyboard and mouse, and with a trackpad friendly control scheme.

Q2. How would you like the game to be used and by who?

> A2: The game will be played by me and my friends using multiplayer. In either a LAN with all players on my Wi-Fi, or over a WAN hosted by me as I know how to set my router up for Port-Forwarding.

Q3. Which aspects of a "Creative Sandbox" do you find most enjoyable?

> A3: For me I find the building aspect of the game most enjoyable. Coming up with an idea for a build. then creating it in 'reality' most appeals to me. I also enjoy exploring the game world, as I can often find inspiration of new builds in the landscape.

Q4. Which features would you most associated with a “Creative Sandbox”?

> A4: In my opinion, gathering recourses for a build through mining is a key feature of a creative game. As it rewards the player with a real sense of achievement and satisfaction, knowing the work it takes to complete their build. I also enjoy the sense of progression, as getting new tools makes once difficult tasks seem trivial.

Q5. Which areas of a “Creative Sandbox” map are you most interested in?

A5: Of course, the landscape of a map is important, as much of the gameplay occurs there. However, I find exploring the thrill of exploring cave systems in games to be the most enjoyable.

Objectives

O1. Have functioning game element, which:
- 1.1. Allows the player to move around the world,
- 1.2. Contains hostile Mobile-Entities (mobs) in the world,
- 1.3. Has some form of combat between the player and the mobs,
- 1.4. Has a unique procedurally generated terrain and cave system,
- 1.5. Has a destructible world where blocks can be mined by the player,
- 1.6. Has a building system where the player can build structures,

O2. Have a randomly generating map, which:
- 2.1. Is randomly generated at game start,
- 2.2. Has a tunnelling cave generation algorithm,
- 2.3. Has randomly generated trees,

O3. Have a functioning Menu System, which:
- 3.1. Allows for new games to be created,
- 3.2. Allows for players to connect online,
- 3.3. Displays the game title,
- 3.4. Allows the user to close the program,

O4. Have a functioning Multiplayer System, which:
- 4.1. Allows multiple players to play in the same world,
- 4.2. Allows the world to be synced across each player,
- 4.3. Allows interactions between players,
- 4.4. Allow players to connect through LAN or WAN

O5. Satisfy the clients brief by:
- 5.1. Have a save-able and load-able world,
- 5.2. Have a Day / Night cycle,
- 5.3. Include fantasy mobs such as skeletons, or zombies,
- 5.4. Be playable on PC,
- 5.5. Be playable on a mouse and keyboard or trackpad,

O6. Be appealing to my End-Users by:
- 6.1. Having a consistent art style throughout,
- 6.2. Using a consistent pixel by pixel tile size throughout,

Similar Games

In order to create my program and explore possible features, I have researched into 2 existing “Creative Sandbox” games. Minecraft and Terraria.

Minecraft	Terraria

• Made for PC and other platforms.= • 3D • Able to create LAN multiplayer games, however there's no inbuilt way to play WAN multiplayer for free. • Uses 16x16 pixel art style. • Procedurally generated map with cave system.	• Made of PC and other platforms • 2D • Can create free multiplayer games. • Uses pixel art textures. • Side Scroller • Items to enhance your character. •

Research

From these nots I have devised that me "Creative Sandbox" game will:

- Be a side-scrolling 2D game, to reduce computational load on a system.
- Use Keyboard and Mouse/Trackpad controls.
- Feature pixel art graphics (8p8px).
- Have free WAN multiplayer capability.
- Include a uniquely generating map and cave system.
- Include crafting/progression to enhance a player's character.
- Include game saving where the world can be saved and loaded from the server.

Additional Advanced Features

- Be able to save and load player inventories.

My solution will require two applications, a server and client. My client will run the server application and then, they can connect using client applications.

Outline of Solution

Random Map Generation

To meet the clients brief, I will be making use of random map generation, meaning that a uniquely generated map can be made for each new game. In order to do this, I will need to find a way to randomly generate a map.

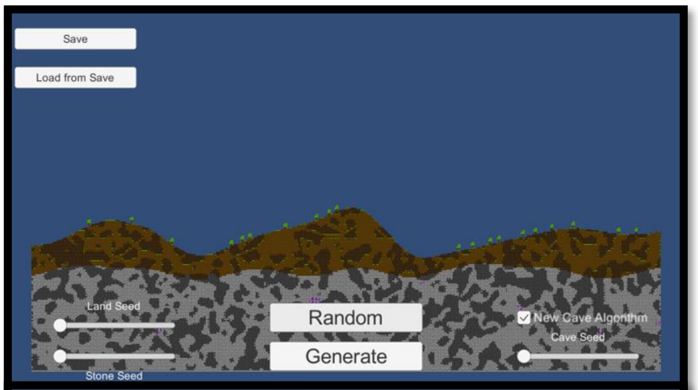
Although, Minecraft is a 3D game its' early beta methods for world generation are great to analyse. As it is made for 3D, an altered 2D version of its' system producing a single slice would be highly efficient. For my research of Procedural generation therefore, I will have researched the solution used by beta versions of Minecraft. Minecraft uses a Perlin noise function to give the height at each given coordinate, in addition to many other functions to add trees and caves when creating a map. As my game will be 2D I will have to research other methods of generation of cave systems and other world features. For cave generation, I will produce a prototype to explore different generation methods; giving me a chance to analyse and evaluate each solution. In this I will explore both a Perlin noise approach and an iterative cellular automata approach.

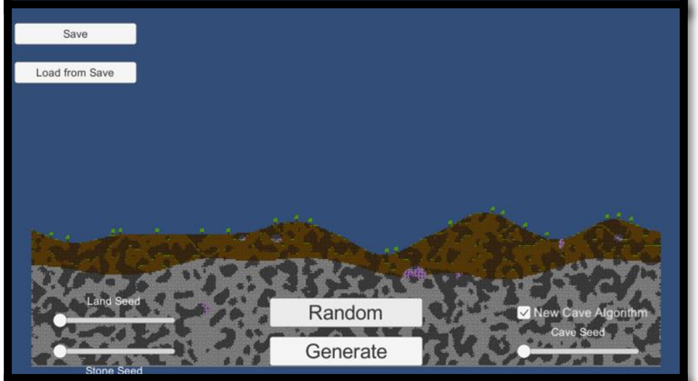
Multiplayer

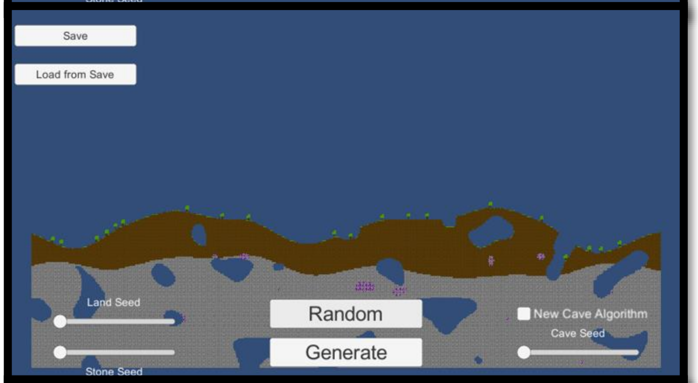
For multiplayer I will be using Riptide Networking through Unity, I chose this as it offers a high degree of control of network entities through code, with open-source code. For my client, I will produce two applications, a server and client build. With clients many clients connecting to one server. Clients will have to send the position of their player to the server as player movement will be managed client side. Ordinarily this is a bad idea for a multiplayer game, as this makes cheating much easier; a cheater can simply change the data in messages sent to the server, however Elliot has said that this won't be a problem as only a few trusted friends will have access to the game. As well as this, managing movement client side will spread the processing load across multiple systems in a thick-client type solution, reducing the load placed on the computer running the server application, Elliot notes that he is likely to run both the client and server applications simultaneously on his laptop and therefore optimisation of the networking side is key.

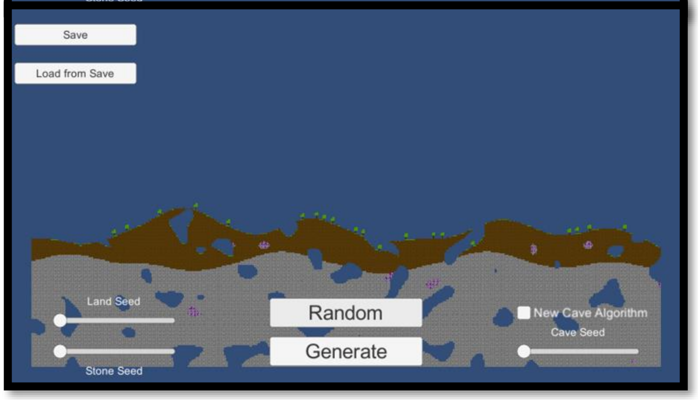
World Generation Prototype

In this prototype, terrain generation is implemented using Perlin noise, by giving the function the x-coordinate and a seed value instead of a y-coordinate, for each value of x. This produces a smooth and varied terrain, before using Perlin noise I had experimented with using a Sin() based function to generate terrain, however this led to a far too periodic looking terrain with repeating hills and few areas of flat land. Elliot says it's important for





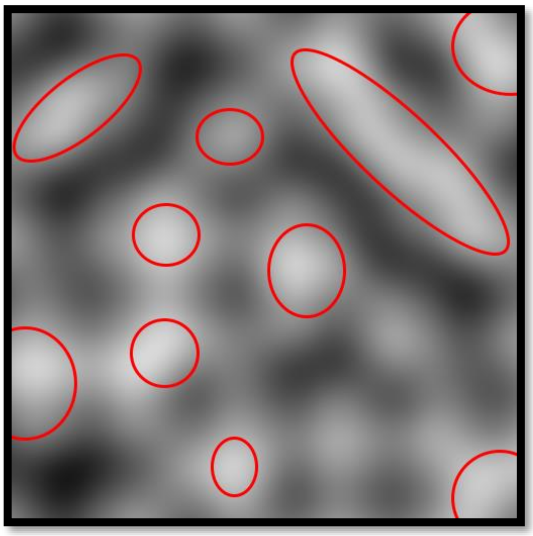




varied terrain to keep worlds looking interesting, however having a few flatter spaces is ideal for building.

Trees are added randomly, using a random integer value for the x-position, then checked for collisions to prevent trees from spawning onto of each other.

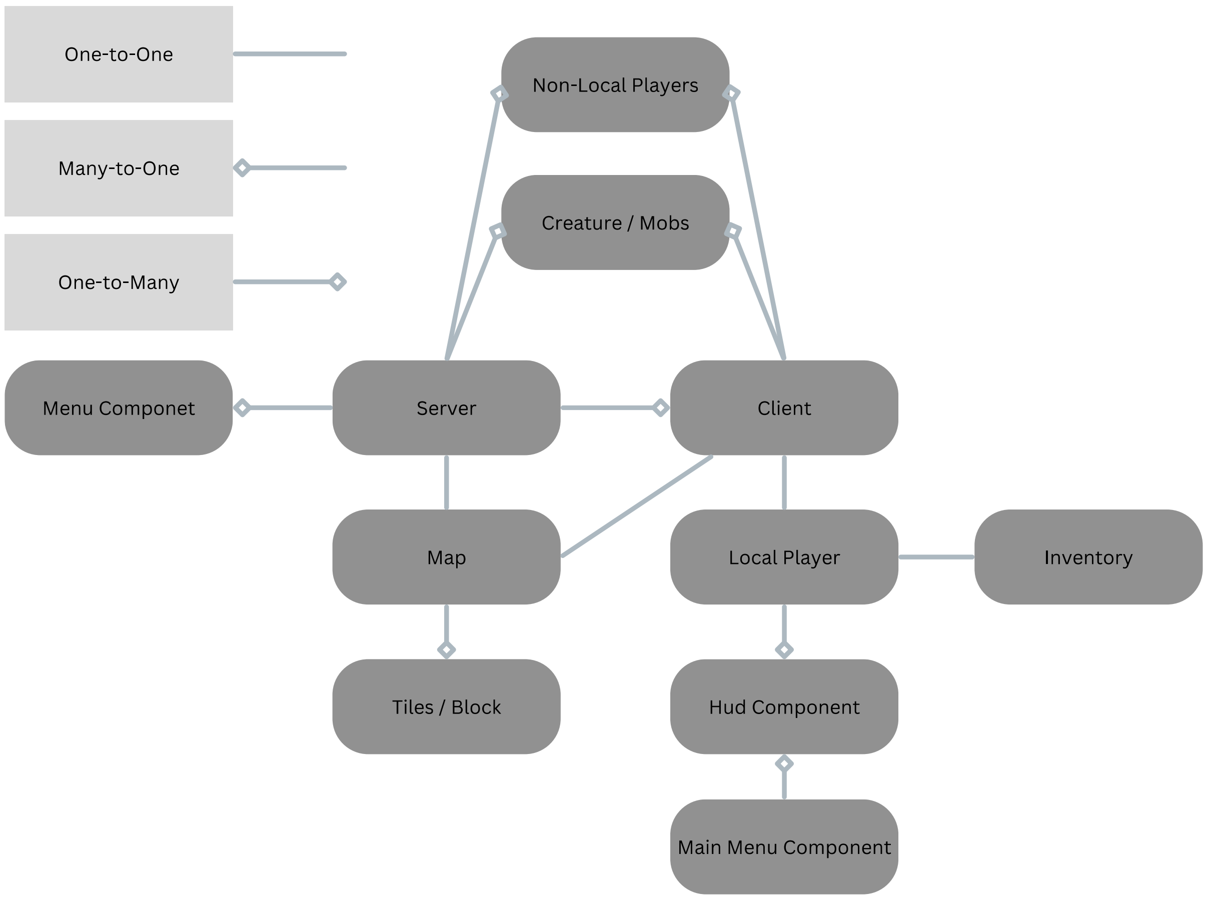
The first two screenshots show a cellular automata approach to cave generation. This code will be explained in Documented Design.



Screenshots 3 and 4 show the Perlin noise cave generation, where parts of the terrain are cut out using a Perlin noise map. Areas on the map are cut out if the resulting Perlin noise output of their position are above a threshold value, as shown. Any area of the map within the ellipse will be cut out as caves.

Elliot says that he greatly prefers the Cellular Automata based cave generation algorithm, as the caves produced by the algorithm are far more complex and varied.

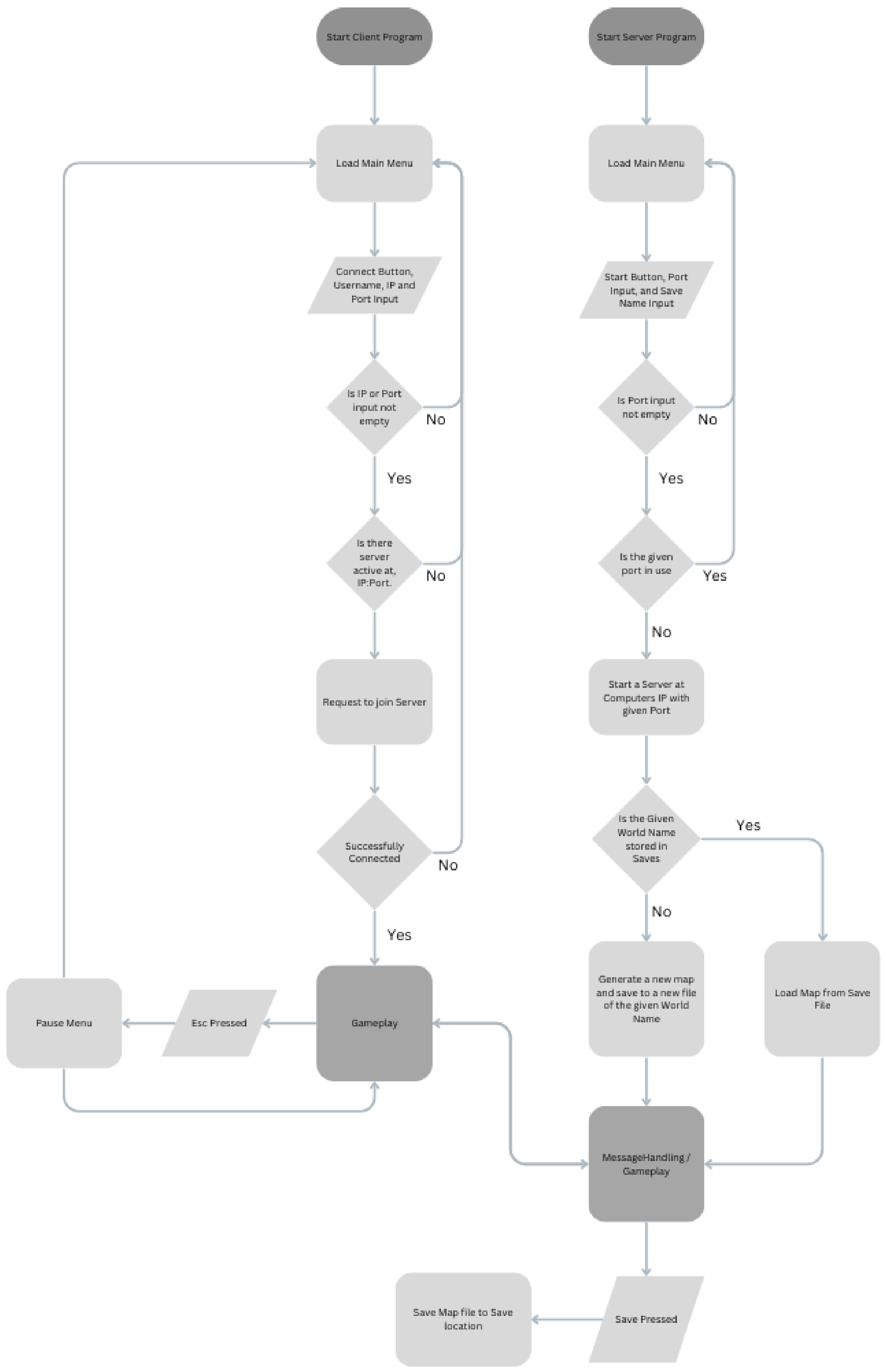
Entity Relationship & Scene Diagram



Within Unity entities, known as "game objects", can be added to scenes, using the Instantiate() function. As shown above, on the client side a local player will be added to a scene in addition to non-local players. A local player contains all the control and interaction scripts which takes in the users' inputs. A non-local player is a projection of another clients' local player, whose position is sent to all other clients through the server to update the position of its' corresponding non-local player.

Map, Mobs and Non-Local players, will be shared between both Server and all Clients connected. With. Mobs being controlled, spawned and respawned by the server.

System Flowchart


Start Client Program
Start Server Program
Load Main Menu
Load Main Menu
Connect Button, Username, IP and Port Input
Start Button, Port Input, and Save Name Input
Is IP or Port input not empty
No
Yes
Is Port input not empty
No
Yes
Is there server active at, IP:Port.
No
Is the given port in use
Yes
No
Request to join Server
Start a Server at Computers IP with given Port
Successfully Connected
No
Yes
Is the Given World Name stored in Saves
Yes
No
Pause Menu
Esc Pressed
Gameplay
Generate a new map and save to a new file of the given World Name
Load Map from Save File
MessageHandling / Gameplay
Save Map file to Save location
Save Pressed

Unity Engine Framework

Within any unity script, derived from UnityEngine.MonoBehaviour there are predetermined methods such as:

- The Method Start(), that runs on an entities' first frame.
- The Method Away(), that runs before an entity is loaded into a scene.
- The Method Update(), that runs on every frame.
- The Method FixedUpdate(), that runs 60 times per second.

Most importantly within unity, individual scripts, and other components can be placed onto objects within a game scene. These include colliders, physics bodies (known as a RigidBody) as well as textures.

Required Runtime Data

Player GameObject		
Data Name/ Access Name	Data Type	Represents
transform.postition	Vector3	Position of the player in the scene
transform.scale	Vector3	The overall scale of the player in the scene
transform.localScale	Vector3	The scale of the player relative to its current scale
playerHealth	integer	Current player health
inventory	Integer array	An array of the current block held in the inventory
hasAxe	bool	Whether the player has a Pickaxe
hasSword	bool	Whether the player has a Sword
itemHolding	integer	The ordinal number for the inventory array
ScreenToWorldPoint(Input.mousePosition)	Vector3	Returns the position of the mouse in relation to its position in the physical scene
velocity	integer	The velocity of the player in the scene
OnGround	bool	A physics overlap at the players feet to determine if they are on the ground
Id	ushort	The players Id in the scene

IsLocal	bool	Whether the player is the Local player

Zombie GameObject		
Data Name/ Access Name	Data Type	Represents
transform.postition	Vector3	Position of the entity in the scene
transform.scale	Vector3	The overall scale of the entity in the scene
transform.localScale	Vector3	The scale of the entity relative to its current scale
playerInViewRange	bool	Whether a player is in sight range
PlayerInAttackRange	bool	Whether there's a playing the attacking range
closestPlayer	Vector3	The closest player entity to the zombie
Id	ushort	The Id of the zombie in the scene

Input field Component		
Data Name/ Access Name	Data Type	Represents
text	string	The text held in the interactable area
position	Vector2	Position on the UI canvas

Button Component		
Data Name/ Access Name	Data Type	Represents
DisplayText	string	The text held in the text area
position	Vector2	Position on the UI canvas
colour	Color	The colour applied to the texture of the button

Tile Component		
Data Name/ Access Name	Data Type	Represents
TileMap	TileMap	The tilemap the tile belongs to.
Tile	RuleTile	The current tile being rendered

position	Vector2	The position of the tile in the TileMap's grid
tilemapCollider	Collider	The physics collider of the tile

Hud Component		
Data Name/ Access Name	Data Type	Represents
text	string	The text held in the text area
position	Vector2	Position on the UI canvas
texture	Texture	Current rendered texture

Asset Requirements

Text fonts used will be acquired from www.dafont.com, specifically using fonts that are completely royalty free, all fonts used will be credited in the source tracker.

All textures are of my own making, made using Adobe Photoshop.

Design

Function Abstraction – From Flowchart

Server	
Function	Definition
Load Main Menu	All Menu Components, and background images in the scene are enabled, input text boxes are unlocked
Request to Start Server	Port Number is taken in from the input field and passed into the constructer for the Server class
Generate New Map	Landscape and Rock seeds are randomly generated. Empty 2D array of map size and width is generated. Perlin noise-based generation function and cellular automata cave generation function is run. This is copied to the 2d array and then rendered to the Tile map.
Load Map from Save	A new Stream Reader is created, then this cycles through each line of the save .txt file and the added to the 2D map array.
Save Map	A new Stream Writer is created. Foreach row in the 2D map array, the content of the row is written to the file with StreamWriter.Write().

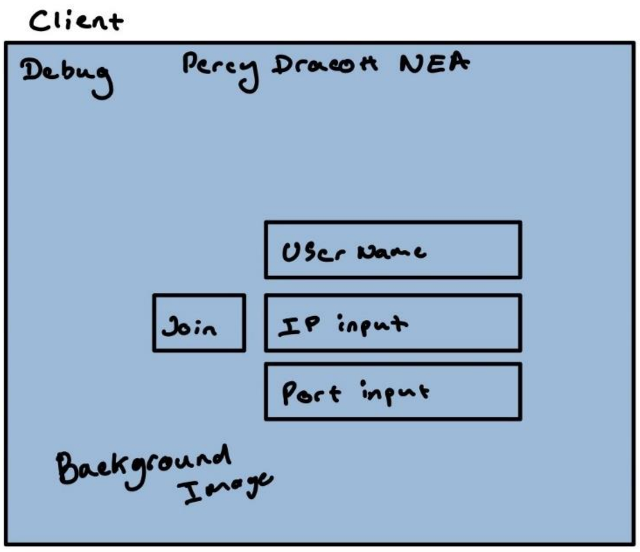
Gameplay	Many functions will run on gameplay, MessageHandling will include syncing player positions, block placing and breaking, in addition to passing the map file between the server and client upon joining.

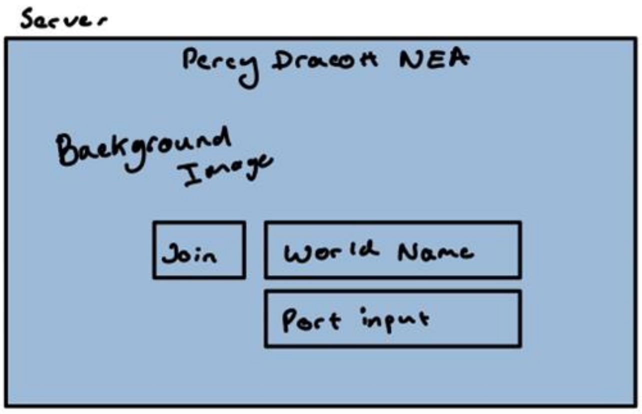
Client	
Function	Definition
Load Main Menu	All Menu Components, and background images in the scene are enabled, input text boxes are unlocked
Request to Join	Port number and IP address will be taken in as a ushort and string from the input fields. All menu Components are disabled, and input fields are locked. A request is sent to join any server at the given Ip and Port. This will return a bool; a failed connection will reload the Main Menu.
Gameplay	First the map will be loaded from the server and then a player spawned. Positions of the local player and any modifications made to the map will be sent to the server.
Pause Menu	Pressing the Esc key will toggle the pause menu. On a press, all pause menu components will be enabled and all player controlling scripts will be disabled. This will allow a player to resume or leave the server, returning them to the main menu.

User Interface Diagram

Throughout the design phase, I have sent various diagrams, algorithms, and interface designs to Elliot, my client, to see if he thinks they meet the objectives, or if they need to be improved on. I will have different versions of these throughout the document.

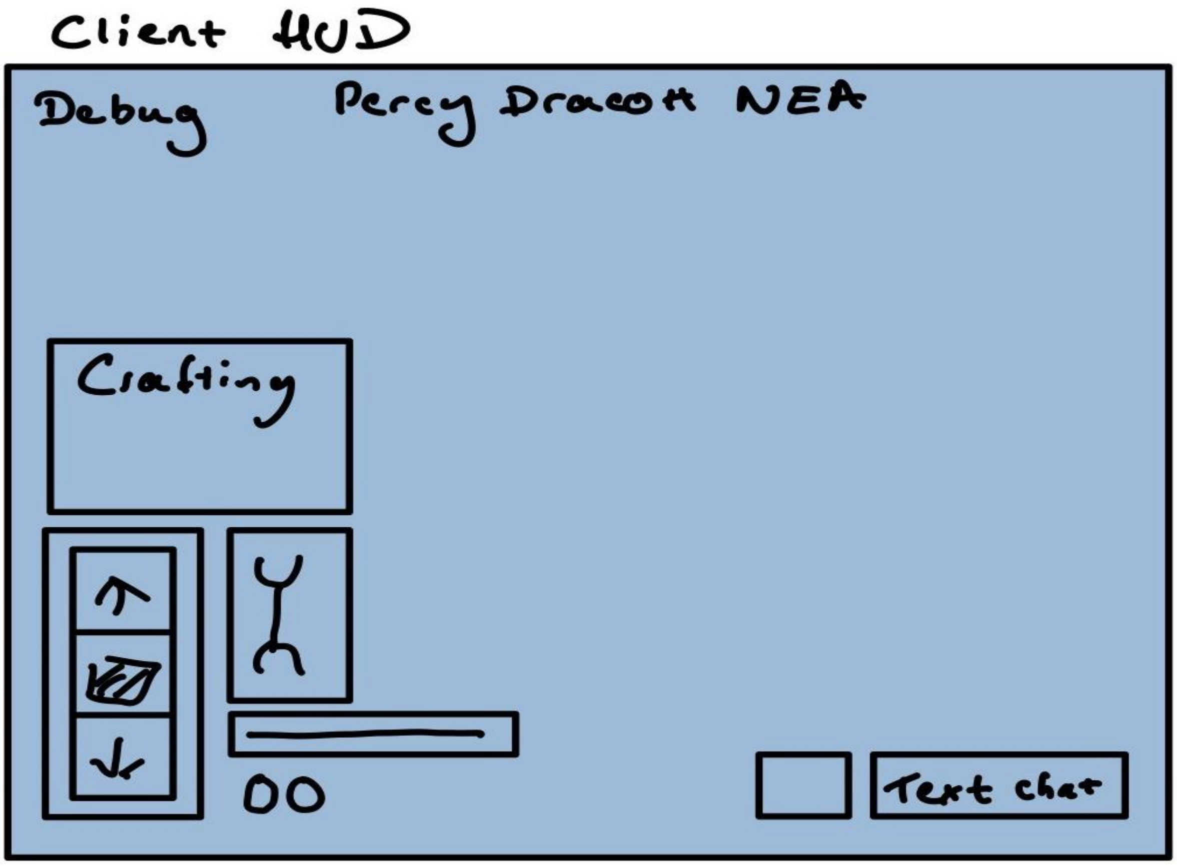
Here's the initial and final designs for the user interface; main menu and HUD.





The Main menu scene of both the client and server applications will obviously contain a few collections of graphics, including text components, buttons, and input fields. These will all need to be unloaded when a game is started.

The HUD layout, as planned is below,



The HUD layout contains a prototype for the inventory system, where the player can scroll through items represented by the shaded square. Each element on the HUD drawing will be rendered above the gameplay. Below the crafting icon, which will toggle the 'crafting' element, is the health bar which will display the hp of the local player.

Algorithms

I've given each algorithm a rough difficulty level to implement, easy, medium, or hard – the harder algorithms may need more revisions as other elements of the design, such as data structures or data storage, develop.

Map Generation

As I've made a world generation prototype, I will go over the procedures and functions contained in that first.

Name: Generation	Definition: Overall function that call each part of the generation script, and initialises the map
Input: worldWidth, worldHeight	Output: N/A

```
Subroutine Generation(worldWidth, worldHeight)
    ForgroundTileMap.ClearAllTiles()
    BackgroundTileMap.ClearAllTiles()
    Seed = Random.WithinRange(0,1000)
    StoneSeed = Random.WithinRange(0,1000)
    CaveSeed = Random.WithinRange(0.02,0.05)
    OreSeed = Random.WithinRange(0.03,0.05)

    map = new int[worldWidth,worldHeight]
    If IsFromSave()
        LoadMap()
        SaveMap()
    else
        OptimisedTerrainGeneration(map, worldWidth, worldHeight, GrassSoil, Stone)
        ApplyCaves(map);
        AddTrees(TreePopulation, TestTileFG, Log, Leaf)
    Endif

    Renderer(map, TestTileFG, TestTileBG)
    GenerateSaveFile(worldName)
    SaveMap()
endSubroutine
```

Relevant Objective: 2.1	Time Complexity: O(1)
Difficulty: medium	

Name: TerrainGeneration	Definition: A function that creates the soil and stone layer of the map, in addition to adding ores. This is done in a loops per column of the map for efficiency.
Input: worldWidth, worldHeight, worldMap, GrassTexture, StoneTexture	Output: N/A

```
Subroutine TerrainGeneration(worldWidth, worldHeight, worldMap, Grass, Stone)
    perlinNoiseSoil = 0
    perlinNoiseStone = 0
    For x = 0, x < worldWidth, x++
        perlinNoiseSoil = RoundToInt(PerlinNoise(x / (smoothness), Seed) * worldHeight / 5)
        perlinNoiseSoil += worldHeight / 3
        For y = 0, y < perlinNoiseSoil, y++
            worldMap[x,y] = 1
        Endfor
        perlinNoiseStone = RoundToInt(PerlinNoise(x / (smoothness), StoneSeed) * worldHeight / 8)
        perlinNoiseStone += worldHeight / 4
        For y = 0, y < perlinNoiseStone, y++
            worldMap[x,y] = 2
        Endfor
        For y = 0, y < perlinNoiseSoil, y++
            PerlinNoiseOre = RoundToInt(PerlinNoise(x * OreSeed, y * OreSeed))
            If  PerlinNoiseOre <= OreThreshhold
                map[x,y] = 3
            Endif
        Endfor
    Endfor
endSubroutine
```

Relevant Objective: 2.1	Time Complexity: O(n^2)
Difficulty: medium	

Adding Caves

Adding Caves was specified by my clients as a major aspect of the generation system, therefore Elliot and I had, many conversations to find the most appropriate generation system that fitted with his expectations.

Name: ApplyCaves Version 1	Definition: Function that cuts caves out of the 2D array map file.
Input: worldWidth, worldHeight, worldMap	Output: N/A

```
Subroutine ApplyCaves(worldWidth, worldHeight, worldMap)
```

```
    For x = 0, x < worldWidth, x++
        For y = 0, y < worldHeight, y++
            PerlinNoiseCave = RoundToInt(PerlinNoise(x * CaveSeed, y * CaveSeed))
            If PerlinNoiseCave >= CaveThreshhold
                map[x,y] = 0
            Endif
        Endfor
    Endfor
endSubroutine
```

Relevant Objective: 2.2	Time Complexity: O(n^2)
Difficulty: easy	

Name: ApplyCaves Version 2	Definition: Function that cuts caves out of the 2D array map file, using cellular automata
Input: worldWidth, worldHeight, worldMap	Output: N/A

```
Subroutine ApplyCaves(worldWidth, worldHeight, worldMap)
    RandomFillGeneration()
    Automata(iterations)

    For x = 0, x < worldWidth, x++
        For y = 0, y < worldHeight, y++
            int topOfWorld = RoundToInt(PerlinNoise(x / (smoothness), Seed) * worldHeight /
5)
            perlinNoiseSoil += worldHeight / 3
            If  cavemap[x, y] == 0 && y != 0 && y != topofworld – 1 && y != topofworld – 2
                If  map[x,y] == 1
                    map[x,y] = 8
                Endif
                If  map[x,y] == 2 OR map[x,y] == 3
                    map[x,y] = 9
                Endif
            Endif
        Endfor
    Endfor
endSubroutine
```

Relevant Objective: 2.2	Time Complexity: O(n^2)
Difficulty: easy	

Name: RandomFillGeneration	Definition: Function that fills a 2D array randomly with a random fill percentage.
Input: worldWidth, worldHeight	Output: N/A


```
Subroutine RandomFillGeneration(worldWidth, worldHeight, caveMap)
    caveMap = new int[worldHeight, worldWidth]
    For x = 0, x < worldWidth, x++
        For y = 0, y < worldHeight, y++
            caveMap[x,y] = Random.WithinRange(0,100) < RandomFillPercentage ? 1 : 0
        Endfor
    Endfor
endSubroutine
```

Relevant Objective: 2.2	Time Complexity: O(n^2)
Difficulty: easy	

Name: Automata	Definition: Function that fills a 2D array randomly with a random fill percentage.
Input: iterationCount, worldWidth, worldHeight	Output: N/A

```
Subroutine Automata(iterations, worldWidth, worldHeight)
    For i = 0, i < count, i++
        int[,] tempMap = caveMap.Clone
        For xs = 0, xs < worldWidth - 1, xs++
            For ys = 0, ys < worldHeight - 1, ys++
                int neighbours = 0
                neighbours = GetNeighbours(tempMap, xs, ys, neighbours)
                If  neighbours > 4
                    caveMap[xs,ys] = 1
                else
                    caveMap[xs,ys] = 0
                Endif
            Endfor
        Endfor
    Endfor
endSubroutine
```

Relevant Objective: 2.2	Time Complexity: O(n^2)
Difficulty: hard	

Name: GetNeighbours	Definition: Finds the number of neighbouring active cells in the array, around a given point.
Input: tempMap, xs, ys, neighbours	Output: int neighbours

```
Subroutine GetNeighbours(tempMap, xs, ys, neighbours)
    For x = xs - 1, x <= xs, x++
        For y = ys - 1, y <= ys, y++
            If  y <= worldHeight AND x <= worldWidth
                If  y != ys AND x != xs
                    If  tempMap[x,y] = 1
                        neighbours++
                    Endif
                Endif
            Endif
        Endfor
    Endfor
    Return neighbours
endSubroutine
```

Relevant Objective: 2.2	Time Complexity: O(1)
Difficulty: medium	

Adding Trees

Adding Trees was also pointed out by Elliot for part of the world generation, in addition this opens avenues for weapon crafting and addition building blocks that can be obtained through crafting, such as the plank block.

Elliot notes that have blocks of multiple colours and textures is important for keeping builds looking interesting.

This algorithm ensures that trees are not placed atop each other, by checking the position of each past tree. This is done by looping through the positions of all placed trees and subtracting the x-coordinate of a proposed tree, from the position of a placed tree, and ensuring that the absolute value of the sum is greater than 6; as this is the padding value given so trees aren't overly clustered.

Name: AddTrees	Definition: Adds a given number of trees to the surface of the terrain, without placing then atop one another
Input: worldWidth, worldHeight, DensityCount	Output: N/A

```
Subroutine AddTrees(worldWidth, worldHeight, Map, density)
    //Check for overpopulation
    If  density >= worldWidth / 6
        density = worldWidth / 6
    Endif
    int temporaryX = 0
    int[] positionHistory = new int[density]

    For i = 0, x < density, i++
        bool collisionAvoidance = true
        While(collisionAvoidance)
            int holdingPositionVariable = Random.WithinRange(2, worldWidth - 2)
            collisionAvoidance = false
            For j = 0, j <= i, j++
                If  AbsoluteValue(holdingPositionVariable - positionHistory[j]) < 6
                    collisionAvoidance = true
                Endif
            Endfor
            If  collisionAvoidance == False
                temporaryX = holdingPositionVariable
            Endif
        Endwhile
        positionHistory[i] = temporaryX

        int temporaryY = worldHeight - 1
        While Map[temporaryX,temporaryY - 1] == 0
            temporaryY--
        Endwhile

        Map[temporaryX,temporaryY] = 4
        Map[temporaryX, temporaryY + 1] = 4
        Map[temporaryX, temporaryY + 2] = 5
        Map[temporaryX, temporaryY + 3] = 5
        Map[temporaryX, temporaryY + 4] = 5
        Map[temporaryX + 1, temporaryY + 2] = 5
        Map[temporaryX - 1, temporaryY + 2] = 5
        Map[temporaryX + 1, temporaryY + 3] = 5
        Map[temporaryX - 1, temporaryY + 3] = 5
        Map[temporaryX + 1, temporaryY + 4] = 5
    Endfor
endSubroutine
```

Relevant Objective: 2.3	Time Complexity: O(n!)
Difficulty: hard	

Name: Renderer	Definition: Function that takes the 2D map array and displays the content to the Tile map
Input: worldWidth, worldHeight, worldMap	Output: N/A

```
Subroutine Renderer(worldMap)
    ForgroundTileMap.ClearAllTiles()
    BackgroundTileMap.ClearAllTiles()
    For x = 0, x < worldMap.GetHorizontalLength, x++
        For y = 0, y < worldMap.GetVerticalLength, y++
            If  worldMap[x,y] == 1
                ForgroundTileMap.SetTile(new Vector3Int(x,y,0), GrassSoil)
                BackgroundTileMap.SetTile(new Vector3Int(x,y,0), GrassSoilBackground)
            Endif
            If  worldMap[x,y] == 2
```

```
                ForgroundTileMap.SetTile(new Vector3Int(x,y,0), Stone)
                BackgroundTileMap.SetTile(new Vector3Int(x,y,0), StoneBackground)
            Endif
            If  worldMap[x,y] == 3
                ForgroundTileMap.SetTile(new Vector3Int(x,y,0), Ore)
                BackgroundTileMap.SetTile(new Vector3Int(x,y,0), StoneBackground)
            Endif
            If  worldMap[x,y] == 4
                ForgroundTileMap.SetTile(new Vector3Int(x,y,0), Log)
            Endif
            If  worldMap[x,y] == 5
                ForgroundTileMap.SetTile(new Vector3Int(x,y,0), Leaf)
            Endif
            If  worldMap[x,y] == 6
                ForgroundTileMap.SetTile(new Vector3Int(x,y,0), Plank)
            Endif
            If  worldMap[x,y] == 8
                BackgroundTileMap.SetTile(new Vector3Int(x,y,0), GrassSoilBackground)
            Endif
            If  worldMap[x,y] == 9
                BackgroundTileMap.SetTile(new Vector3Int(x,y,0), StoneBackground)
            Endif
        Endfor
    Endfor
endSubroutine
```

Relevant Objective: 2.1	Time Complexity: O(n^2)
Difficulty: easy	

Map Saving and Loading

Elliot notes that the ability to save and load past maps is important, as it will enable him and his friends to spend multiple sessions on one project.

Name: SaveMap	Definition: Function that saves the 2D map array to a file
Input: worldMap	Output: N/A

```
Subroutine SaveMap(worldMap)
    Using StreamWriter sw = new
StreamWriter($"WorldSaves/{worldName}/worldSave.txt")
        For y = 0, y < worldMap.GetVerticalLength, y++
            For x = 0, x < worldMap.GetHorizontalLength, x++
                sw.Write(worldMap[x,y])
            Endfor
            sw.WriteLine()
        Endfor
    EndUsing
endSubroutine
```

Relevant Objective: 5.1	Time Complexity: O(n^2)
Difficulty: medium	

The map will be located in a save folder: WorldSaves/{worldName}/worldSave.txt, where worldName is a string variable passed in from the input fields upon starting a server.

Name: LoadMap	Definition: Function that fills an empty 2D array with the map data.
Input: worldMap	Output: N/A

```
Subroutine LoadMap(worldMap)
    int y = 0
    Using StreamReader sr = new
StreamReader($"WorldSaves/{worldName}/worldSave.txt")
        string value
        While (value = sr.ReadLine()) != Null
            For x = 0, x < worldMap.GetHorizontalLength, x++
                worldMap[x,y] = ConvertToByte(value[x]) – 48
            Endfor
            y++
        Endwhile
    EndUsing
    Renderer(worldMap)
endSubroutine
```

Relevant Objective: 5.1	Time Complexity: O(n^2)
Difficulty: medium	

The following two functions will be used on the server application to check if a map is being loaded from a save of is new, and then create the saving directory if necessary.

Name: GenerateSaveFile	Definition: Function that creates the file saving directory upon loading a new world, not a previous save.
Input: worldName	Output: N/A

```
Subroutine GenerateSaveFile(worldName)
    if File.Exists($"WorldSaves/{worldName}") == false
        Directory.Create($"WorldSaves/{worldName}")
    Endif
endSubroutine
```

Relevant Objective: 5.1	Time Complexity: O(1)
Difficulty: easy	

Name: IsFromSave	Definition: Function that returns a Boolean if the given world name has a file directory
Input: worldName	Output: Boolean

```
Subroutine Bool IsFromSave(worldName)
    if File.Exists($"WorldSaves/{worldName}")
        return true
    else
        return false
    Endif
endSubroutine
```

Relevant Objective: 5.1	Time Complexity: O(1)
Difficulty: medium	

Player Control and Spawning

Local players will need to be controlled by the player, interact with the world, and have a health system.

Each of the following function will be part of PlayerController.cs, a script that will be run on the local player in a scene.

Name: xMovePlayer	Definition: Function that uses the keyboard input though unity and sets the velocity of the player. This function is called in the Update() Function of unity.
Input: N/A	Output: n/A

```
Subroutine xMovePlayer()
    float moveX = Input.GetInputsFromAxis("Horizontal")
    Vector2 movement = new Vector2(moveX,0)
    if  PlayerIsOnGround()
        Player.Velocity = movement * speedValue
    ElseIf PlayerIsOnGround() == false AND moveX != 0
        Player.Velocity = moveX * speedValue / 2
    Endif
endSubroutine
```

Relevant Objective: 1.1	Time Complexity: O(1)
Difficulty: easy	

Name: PlayerBreakingBlock	Definition: Function that uses the mouse position in the world to remove a block at its given position, with an amount of time based on the type of block. A call for this function will be run in Update(), if the mouse button is depressed.

Input: timeMining, mousePos	Output: n/A

```
Subroutine PlayerBreakBlock(timeMining, mousePos)
   if timeMining == 0
      Vector2 mousePosOnCall = new Vector2(truncate(mousePos.x),
truncate(mousePos.y))
   Endif
   if mousePosOnCall = new Vector2(truncate(mousePos.x), truncate(mousePos.y))
      timeMining += Time.DeltaTime //Counts the time since a frame where
Time.DeltaTime wasn't called.
      if  timeMining > AmountOfTimeToBreak()
         BreakBlock()
         timeMining = 0
      Endif
   Else timeMining = 0
   Endif
endSubroutine
```

Relevant Objective: 1.5	Time Complexity: O(1)
Difficulty: medium	

Name: AmountOfTimeToBreak	Definition: Function that takes the mouse position, to find the type of block in the 2D map array at the position. Returning the amount of time, it takes to break the block, at the requested position.
Input: mousePos	Output: float

```
Subroutine float AmountOfTimeToBreak(mousePos)
   float timetobreak = 0
   Switch (Map.ReturnBlockType(new Vector2(truncate(mousePos.x),
truncate(mousePos.y))))
      Case 1
         timetobreak = 0.6f
         break
      Case 2
         timetobreak = 1.8f
         break
      Case 3
         timetobreak = 1.8f
         break
      Case 4
         timetobreak = 1f
         break
      Case 5
         timetobreak = 0.2f
         break
      Case 6
```

```
            timetobreak = 1f
            break
        Default
            timetobreak = 1f
            break
    EndSwitch
    if  player.HasAxe
        return timetobreak / 2f
    Else
        return timetobreak
    Endif
endSubroutine
```

Relevant Objective: 1.5	Time Complexity: O(1)
Difficulty: easy	

The additional features functions, of player inventory loading and saving are planned out below.

Name: SavePlayerState	Definition: Function that save the players inventory, items, and position to a file.
Input: worldName, PlayerID	Output: n/A

```
Subroutine SavePlayerState(worldName, PlayerID)
    Using StreamWriter sw = new
StreamWriter($"WorldSaves/{worldName}/{PlayerID}.txt")
        For i = 0, i < inventory.Length, i++
            sw.WriteLine(inventory[i])
        Endfor
        sw.WriteLine(transform.positon.x)
        sw.WriteLine(transform.positon.y)
        if  Player.HasAxe
            sw.WriteLine("1")
        Else
            sw.WriteLine("0")
        Endif
        if  Player.HasSword
            sw.WriteLine("1")
        Else
            sw.WriteLine("0")
        Endif
    EndUsing
endSubroutine
```

Relevant Objective: 1.5	Time Complexity: O(1)
Difficulty: medium	

Name: LoadPlayerState	Definition: Function that takes a save file and fills the players inventory, items, and position.
Input: worldName, PlayerID	Output: n/A

```
Subroutine LoadPlayerState(worldName, PlayerID)
   string value
   int i = 0
   float tempx
   float tempy
   Using StreamReader sr = new
StreamReader($"WorldSaves/{worldName}/{PlayerID}.txt")
      While   (value = sr.ReadLine()) != null
         if  i < 10
            inventory[i] = Convert.ToInt16(value)
         Endif
         if  i == 10
            tempx = (float)Convert.ToDouble(value)
         Endif
         if  i == 11
            tempy = (float)Convert.ToDouble(value)
         Endif
         if  i == 12 AND value == "1"
            Player.HasAxe = True
         Else
            Player.HasAxe = False
         Endif
         if  i == 13 AND value == "1"
            Player.HasSword = True
         Else
            Player.HasSword = False
         Endif
         i++
      Endwhile
      transform.positon = new Vector2(tempx, tempy)
   EndUsing
endSubroutine
```

Relevant Objective: 1.5	Time Complexity: O(1)
Difficulty: medium	

Zombie Control

Zombie movement will be handled by the server, and positions will be passed to the clients. Zombie attacks, however, will be calculated client side as the zombie will attack when a player is within range, as guided by the server's movement.

Name: IdlePatrol	Definition: Function that directs a zombie on a patrolling walk when a player is not in range
Input: playerInRange, patrolRange	Output: n/A

```
Subroutine IdlePatrol(playerInRange, patrolRange)
    float lengthOfTime = walkSpeed * patrolRange
    if  (patrolRange > 0) AND !playerInRange
        timeSinceActive += Time.deltaTime;
        if timeSinceActive > 2 * lengthOfTime
            timeSinceActive -= 2 * lengthOfTime
        Endif
        if timeSinceActive > lengthOfTime
            zombieRB.velocity = new Vector2(walkSpeed * transform.localScale.x,
zombieRB.velocity.y)
        Else
            zombieRB.velocity = new Vector2(-walkSpeed * transform.localScale.x,
zombieRB.velocity.y)
        Endif
    Endif
    timeSinceActive = 0
endSubroutine
```

Relevant Objective: 1.5	Time Complexity: O(1)
Difficulty: medium	

Name: PlayerInRangePositon	Definition: Function that returns the position of the closest player to the zombie, within sight range.
Input: playerInRange, patrolRange	Output: Vector2

```
Subroutine Vector2 playerInRangePosition()
    Vector2 closePlayer = new Vector2(0,0)
    float previousDistance = sightRange
    If playerInRange
        Colliders[] players = (Physics2D.OverlapCircleAll(transform.position, sightRange,
playerLayer)
        float currentDistance
        Foreach var item in players
            currentDistance = item.Magnitude //The overall distance of the Vector2, when
treated as a coordinate Vector2
            If  currentDistance < previousDistance
                closePlayer = item.transform.position
                previousDistance = currentDistance
            Endif
        EndForeach
    Endif
    Return closePlayer
endSubroutine
```

Relevant Objective: 1.5	Time Complexity: O(1)
Difficulty: medium	

Client and Server Scripts

For implementing multiplayer, I will be using Riptide Networking [x], a lightweight C# networking library primarily designed for use in multiplayer games. This enables me to start servers and connect clients using the Server and Client classes, in addition sending messages between Server and Client.

I will be using the Riptides message system and message handling to sync parts of the applications, such as player positions, map files, and map changes. As I am new to Riptide Networking, I will be following a basic tutorial to set up a simple client and server, and to learn the basics.

In Riptide, messages have a capacity of 1200 bytes, in addition to send modes reliable and unreliable. Reliable will check that the data has been received using majority voting and is therefore more taxing on the network as 3 transmissions are sent for each message; I will therefore only be using Reliable send mode for passing the map and spawning / despawning objects.

A message is also sent with an Enum, in the header to tell the receiver which MessageHandler to use upon receiving the message. A message can be sent to a specific client as shown below with NetworkManager.Instance.Server.Send(message, toClientId), or to all with SendToAll, however this can only be done by the server.

As the map is 1024 blocks wide, the map file must be a byte array to save space in the message payload. This is done as the 2D array is sent in rows.

I will also be adding an Override/ Extension to the Message class to allow the transmissions of Vector2 and Vector3 for ease of use.

Name: PassingMapToClient	Definition: Function that is called on a new client connecting to pass the 2D map array to the client.
Input:	Output:
Server Side	

```
Subroutine SendMap(ushort toClientId)
    byte[,] mapToSend = MapManager.SendMap()
    For int y, y < mapToSend.GetLength(1), y++
        Message message = Message.Create(MessageSendMode.reliable,
(ushort)ServerToClientId.map)
        byte[] tempXS = new byte[maptoSend.GetLength(0)]
        For int x, maptoSend.GetLength(0), x++
            tempXS[x] = maptoSend[x, y]
        Endfor
        message.AddShort(y)
        message.AddInt(FindObjectOfType<GenerationScriptV2>().worldWidth)
        message.AddBytes(tempXS, false, true)
        NetworkManager.Instance.Server.Send(message, toClientId)
    Endfor
endSubroutine
```

Client Side

```
[MessageHandler((ushort)ServerToClientId.map)]
Subroutine GettingMapFromServer(Message message)
    short Layer = message.GetShort()
    int lengthofByteArray = message.GetInt()
    byte[] ByteArray = new byte[lengthofByteArray]
    message.GetBytes(lengthofByteArray, ByteArray)
    CallMapBuild(ByteArray, Layer)
    message.Release()
endSubroutine

//Within the Generation Script
Subroutine CallMapBuild(byte[] mapSlice, short layer)
    For int x = 0, x < map.GetLength(0), x++
        map[x,layer] = mapSlice[x]
    Endfor
    If layer = worldHeight - 1
        Renderer(map)
    Endif
endSubroutine
```

Relevant Objective: 4.2	Time Complexity: O(n^2)
Difficulty: hard	

Syncing of Non-Local players first starts with each clients sending the position of their Local player to the server, which stores each of their positions as Non-Local players within the server monitoring scene. It can then send the positions of these out to all clients along with the Id's of each, the clients can then check to see if the Id matches their own and if not move the Non-Local players around. Messages will be sent in Unreliable send mode as losing a position will not matter, as a new and more up to date position will be sent before a resend is possible.

Name: SyncNonLocalPlayer	Definition: Function that is called on in FixedUpdate(), to send the position all players within the server scene to the clients.
Input: N/A	Output: N/A

Server Side

```
Subroutine SyncNonLocalPlayers()
    Foreach Player player in list.Values
        Message message = Message.Create(MessageSendMode.unreliable,
(ushort)ServerToClientId.syncNonLocalPosition)
        message.AddUShort(players.Id);
        message.AddVector3(players.gameObject.transform.position)
        NetworkManager.Instance.Server.SendToAll(message)
    Endforeach
```

endSubroutine	
Client Side	
```
Static Subroutine SyncingPlayers(Message message)
    ushort playerID = message.GetUShort()
    Vector3 playerPosition = message.GetVector3()
    If playerID != NetworkManager.Instance.Client.Id
        Player.list[playerID].gameObject.transform.position = playerPosition
    Endif
    message.Release()
endSubroutine
```
Relevant Objective: 4.1	Time Complexity: O(n)
Difficulty: hard	

Players both Local and Non-Local will be stored in a Dictionary, with the value being their Player.cs class and the key being their network Id. This is done as the local player can be found easily by comparing the dictionary key to the NetworkManager.Instance.Client.Id

Name: SpawnPlayer	Definition: Function that takes is triggered by a message from the server to spawn a new player onto the Client and add them to their dictionary.
Input: ushort id, string username, Vector3 position	Output: N/A
Client Side	
```
Static Subroutine Spawn(ushort id, string username, Vector3 position)
    Player player
    If  id = NetworkManager.Instance.Client.Id
        player = Instantiate(GameLogic.Instance.LocalPlayer, position,
Quaternion.identity).GetComponent<Player>()
        player.IsLocal = true
        player.SetUserNameText = username
    Else
        player = Instantiate(GameLogic.Instance.Non-LocalPlayer, position,
Quaternion.identity).GetComponent<Player>()
        player.IsLocal = false
        player.SetUserNameText = username
    Endif
    player.name = $"Player {id} ({(string.IsNullOrEmpty(username) ? "Guest" :
username)})"
    player.Id = id
    player.userName = username
    list.Add(id, player)
endSubroutine
```
Relevant Objective: 4.1	Time Complexity: O(1)
Difficulty: hard	

Here's all the Enum's I expect to need to use within the networking code:

Name: SpawnPlayer	Definition: Enums that can be added to the head of a message, to determine which message handler the message is sent to.
Input: N/A	Output: N/A

```
public Enum ServerToClientId : ushort
    playerSpawned = 1,
    map,
    syncNonLocalPosition,
    syncMapUpdate,
    lightPosition,
    zombieSpawning,
    zombiePosition,
    zombieDeath,
    textChat,
endEnum

public Enum ClientToServerId : ushort
    name = 1,
    updatePlayerPosition,
    updateServerMap,
    zombieDeath,
    updateTextChat,
endEnum
```

Relevant Objective: 4.1	Time Complexity: N/A
Difficulty: medium	

First the SendBlockUpdateToServer(int x, int y, byte block), function is called by a client on interacting with the map, this then sends a message to the Server to update its map. The server then sends a message to all clients other that the origin of the initial message to update their maps.

Name: SyncMaps	Definition: Function that is called on a client building or breaking parts of the map, to sync the changes across all clients.
Input: int x, int y, byte block	Output: N/A

Client Side

```
Subroutine SendBlockUpdateToServer(int x, int y, byte block)
    RiptideNetworking.Message message = Message.Create(MessageSendMode.reliable,
(ushort)ClientToServerId.updateServerMap)
    message.AddInt(x)
    message.AddInt(y)
    message.AddByte(block)
    NetworkManager.Instance.Client.Send(message) //Runs UpdateMap() on Server Side
endSubroutine
```

```
[MessageHandler((ushort)(ServerToClientId.syncMapUpdate))]
Static Subroutine SyncingMaps(Message message)
    int xPos = message.GetInt()
    int yPos = message.GetInt()
    byte block = message.GetByte()
    MapManager.ServerUpdatingBlock(block, xPos, yPos)
    message.Release()
endSubroutine
```

Server Side

```
[MessageHandler((ushort)ClientToServerId.updateServerMap)]
Static Subroutine UpdateMap(ushort fromClientId, Message message)
    int xPos = message.GetInt()
    int yPos = message.GetInt()
    byte block = message.GetByte()
    MapManager.ServerUpdatingBlock(block, xPos, yPos)
    message.Release()
    UpdatePlayerMaps(block, xPos, yPos, fromClientId) //Runs UpdatePlayerMaps()
endSubroutine

Static Subroutine UpdatePlayerMaps(byte block, int xPos, int yPos, ushort originPlayer)
    Foreach (Player players in list.Values)
        if (players.Id != originPlayer)
            RiptideNetworking.Message message =
Message.Create(MessageSendMode.reliable, (ushort)ServerToClientId.syncMapUpdate)
            message.AddInt(xPos)
            message.AddInt(yPos)
            message.AddByte(block)
            NetworkManager.Instance.Server.Send(message, players.Id) //Runs
SyncingMaps() on Client Side
        Endif
    Endforeach
endSubroutine
```

Relevant Objective: 4.1	Time Complexity: O(n)
Difficulty: hard	

As Zombies need to be synced across all clients, including spawning, movement and despawning; they will need to be created and handled similarly to Non-Local player within a client.

In addition, zombies will need to be spawned into a client upon connecting, if for example they join during the night. Zombies will also be stored in a dictionary with the value being the Zombie class and the Key being an Id given on zombie spawn.

As shown before in **Zombie Control**, the movement of the zombies is controlled on the server and send to each client from within the Zombie class within Zombie.cs.

This Function is similar to the one used to sync player positions with to the server, however the client sends the position, and this is taken in by the server and sent to all other clients to update the Non-Local player in their scene.

Name: SendPositon	Definition: Function that runs in FixedUpdate() to send the position of a zombie to all clients.
Input: N/A	Output: N/A

Server Side

```
Subroutine SendPositionToClients()
    Message message = Message.Create(MessageSendMode.unreliable, (ushort)ServerToClientId.zombiePosition)
    message.AddUShort(Id)
    message.AddVector3(list[Id].gameObject.transform.position)
    NetworkManager.Instance.Server.SendToAll(message)
endSubroutine
```

Client Side

```
Subroutine SendPositionToClients()
    Message message = Message.Create(MessageSendMode.unreliable, (ushort)ServerToClientId.zombiePosition)
    message.AddUShort(Id)
    message.AddVector3(list[Id].gameObject.transform.position)
    NetworkManager.Instance.Server.SendToAll(message)
endSubroutine
```

Relevant Objective: 5.3	Time Complexity: O(1)
Difficulty: medium	

Zombie spawning will be handled by the server, as shown below:

Name: SpawnZombies	Definition: Function that runs in FixedUpdate(), and spawns zombies on the change of day to night.
Input: N/A	Output: N/A

Server Side

```
Subroutine SpawnZombies()
    If  !DayNightCycleInUse.isDay() AND GenerationScriptInUse.terrainGenerationComplete AND !hasSpawnedMobs
        ushort zombieId = 0
        Foreach var position in FindSpawnLocations(spawnAmount)
            FindObjectOfType<GameLogic>().CallZombieSpawn(positionElement, zombieID)
            zombieID++
        Endforeach
        hasSpawnedMobs = true
    Endif
    If  DayNightCycleInUse.isDay
        hasSpawnedMobs = false
    Endif
```

```
endSubroutine
```

Relevant Objective: 5.3	Time Complexity: O(1)
Difficulty: medium	

Name: FindSpawnLocations	Definition: Function that finds a given number of spawn locations
Input: spawnAmount	Output: Vector3[]

Server Side

```
Subroutine FindSpawnLocations(spawnAmount)
    Vector3[] spawnLocations = new Vector3[spawnAmount]
    For i = 0, i < spawnAmount, i++
        int tempxPos = Random.WithinRange(1, GenerationScriptInUse.worldWidth)
        spawnLocations[i] = new Vector3(tempxPos., GenerationScriptInUse.ReturnGroundPosition(tempxPos), 0)
    Endfor
    Return spawnLocations
endSubroutine
```

Relevant Objective: 5.3	Time Complexity: O(n)
Difficulty: medium	

Miscellaneous Scripts

This includes some other gameplay scripts such as the text chat. Text Chat will be implemented using a Queue of string as this will be the easiest way to get the chat to stack in the correct order within the text component.

Name: AddToChat	Definition: Function that takes a text input and adds it to a queue, with overflow protection.
Input: message	Output: N/A

Client Side

```
Subroutine AddToChat(string Message)
    If  messages.Count == chatLength
        messages.Dequeue()
        messages.Enqueue(Message)
    Else
        messages.Enqueue(Message)
    Endif
endSubroutine
```

Relevant Objective: 6.0	Time Complexity: O(1)
Difficulty: easy	

Name: UpdateChat	Definition: Function that updates the content of the text element.
Input: N/A	Output: N/A

Client Side	
```
Subroutine updateChat()
    textBox.text = ""
    int count = 1
    Foreach var item in messages
        textBox.text += "\n" + count.ToString() + " : " + item
        count++
    Endforeach
endSubroutine
```
Relevant Objective: 6.0	Time Complexity: O(1)
Difficulty: easy	

Technical Solution

All code and Assets, including the project file can be found on my GitHub: [x]

Server Scripts

Runs On GameObject: NetworkManager

Name: NetworkManager.cs

```
using RiptideNetworking;
using RiptideNetworking.Utils;
using System;
using System.Collections.Generic;
using TMPro;
using UnityEngine;
using UnityEngine.UI;

/// <summary>
/// Enumberators used in message headers to direct it to the correct Message Handler
/// </summary>
public enum ServerToClientId : ushort
{
    playerSpawned = 1,
    map,
    syncNonLocalPosition,
    syncMapUpdate,
    lightPosition,
    zombieSpawning,
    zombiePosition,
    zombieDeath,
    textChat,
}

public enum ClientToServerId : ushort
{
    name = 1,
    updatePlayerPosition,
    updateServerMap,
    zombieDeath,
    updateTextChat,
}


public class NetworkManager : MonoBehaviour
{

    private static NetworkManager instance;
    /// <summary>
    /// A Singleton spawned in on the first action of the scene, a singleton being a class that 
allows only a single instance of itself to be created and gives access to that created instance.
    /// </summary>
    public static NetworkManager Instance
    {
        get => instance;
        private set
        {
            if (instance == null) instance = value;
            else if (instance != value)
            {
                Debug.Log($"{nameof(NetworkManager)} instance already exists, destroying new");
                Destroy(value);
            }
        }
    }

    /// <summary>
    /// Serialised fields show up in the unity editor window without being public variables, and 
are therefore protected.
    /// </summary>
    public Server Server { get; private set; }
    [SerializeField] private ushort port;
    [SerializeField] private ushort maxClientCount;

    //[SerializeField] private TMP_InputField ipField;
    [SerializeField] private TMP_InputField portField;
    [SerializeField] private Button CurrentServerState;



    /// <summary>
    /// Runs before being loaded.
    /// </summary>
    private void Awake()
    {
        instance = this;
        Application.runInBackground = true;
    }

    /// <summary>
    /// Runs on its first frame of existance, Methods are added to the Servers.ClientDisconnected 
function so they are also run on the event
    /// </summary>
    private void Start()
    {
        //Application.targetFrameRate = 60;
        RiptideLogger.Initialize(Debug.Log, Debug.Log, Debug.LogWarning, Debug.LogError, false);
        Server = new Server();
        //Server.Start(port, maxClientCount);
        Server.ClientDisconnected += PlayerLeft;
        //Server.ClientConnected += SendMap;

    }
    /// <summary>
    /// Runs 60 times per second.
    /// </summary>
    private void FixedUpdate()
    {
        Server.Tick();
        if (Server.IsRunning) CurrentServerState.GetComponent<Image>().color = Color.green;
        else CurrentServerState.GetComponent<Image>().color = Color.red;
    }


    private void OnApplicationQuit()
    {
        Server.Stop();
    }

    /// <summary>
    /// Remopves the player from the scene if they leave.
    /// </summary>
    /// <param name="sender"></param>
    /// <param name="e"></param>
    private void PlayerLeft(object sender, ClientDisconnectedEventArgs e)
    {
        Destroy(Player.list[e.Id].gameObject);
    }

    /// <summary>
    /// Used to start a server from the UI within the scene
    /// </summary>
    public void StartFromButtons()
    {
        if (!string.IsNullOrEmpty(portField.text))
        {
            port = Convert.ToUInt16(portField.text);
            //port = Convert.ToUInt16(ipField.text);
            Server.Start(port, maxClientCount);

        }



    }

    /// <summary>
    /// Used as a function accessible to the stop button.
    /// </summary>
    public void StopFromButton()
    {
        Server.Stop();
        foreach (var item in Zombie.list.Values)
        {
            Destroy(item.gameObject);
        }
        FindObjectOfType<GenerationScriptV2>().ClearMap();
        FindObjectOfType<DayNightCycle>().gameObject.transform.position = new Vector3(30.74265f,
3811.38f, 17.86352f);
     }

    //[MessageHandler((ushort)ClientToServerId.updatePlayerPosition)]
    //private static void PlayerPos(Message message)
    //{
    //    Debug.Log("Received Call");
    //}
}
```

Runs On GameObject: N/A //From to RiptideNetworking GitHub

Name: MessageExtension.cs

```
using RiptideNetworking;
using UnityEngine;

public static class MessageExtensions
{
    #region Vector2
    /// <inheritdoc cref="Add(Message, Vector2)"/>
    /// <remarks>Relying on the correct Add overload being chosen based on the parameter type can 
increase the odds of accidental type mismatches when retrieving data from a message. This method 
calls <see cref="Add(Message, Vector2)"/> and simply provides an alternative type-explicit way to 
add a <see cref="Vector2"/> to the message.</remarks>
    public static Message AddVector2(this Message message, Vector2 value) => Add(message, value);

    /// <summary>Adds a <see cref="Vector2"/> to the message.</summary>
    /// <param name="value">The <see cref="Vector2"/> to add.</param>
    /// <returns>The message that the <see cref="Vector2"/> was added to.</returns>
    public static Message Add(this Message message, Vector2 value)
    {
        message.AddFloat(value.x);
        message.AddFloat(value.y);
        return message;
    }

    /// <summary>Retrieves a <see cref="Vector2"/> from the message.</summary>
    /// <returns>The <see cref="Vector2"/> that was retrieved.</returns>
    public static Vector2 GetVector2(this Message message)
    {
        return new Vector2(message.GetFloat(), message.GetFloat());
    }
    #endregion

    #region Vector3
    /// <inheritdoc cref="Add(Message, Vector3)"/>
    /// <remarks>Relying on the correct Add overload being chosen based on the parameter type can 
increase the odds of accidental type mismatches when retrieving data from a message. This method 
calls <see cref="Add(Message, Vector3)"/> and simply provides an alternative type-explicit way to 
add a <see cref="Vector3"/> to the message.</remarks>
    public static Message AddVector3(this Message message, Vector3 value) => Add(message, value);

    /// <summary>Adds a <see cref="Vector3"/> to the message.</summary>
    /// <param name="value">The <see cref="Vector3"/> to add.</param>
    /// <returns>The message that the <see cref="Vector3"/> was added to.</returns>
    public static Message Add(this Message message, Vector3 value)
    {
        message.AddFloat(value.x);
        message.AddFloat(value.y);
        message.AddFloat(value.z);
        return message;
    }

    /// <summary>Retrieves a <see cref="Vector3"/> from the message.</summary>
    /// <returns>The <see cref="Vector3"/> that was retrieved.</returns>
    public static Vector3 GetVector3(this Message message)
    {
        return new Vector3(message.GetFloat(), message.GetFloat(), message.GetFloat());
    }
    #endregion

    #region Quaternion
    /// <inheritdoc cref="Add(Message, Quaternion)"/>
    /// <remarks>Relying on the correct Add overload being chosen based on the parameter type can
increase the odds of accidental type mismatches when retrieving data from a message. This method
calls <see cref="Add(Message, Quaternion)"/> and simply provides an alternative type-explicit way
to add a <see cref="Quaternion"/> to the message.</remarks>
    public static Message AddQuaternion(this Message message, Quaternion value) => Add(message,
value);

    /// <summary>Adds a <see cref="Quaternion"/> to the message.</summary>
    /// <param name="value">The <see cref="Quaternion"/> to add.</param>
    /// <returns>The message that the <see cref="Quaternion"/> was added to.</returns>
    public static Message Add(this Message message, Quaternion value)
    {
        message.AddFloat(value.x);
        message.AddFloat(value.y);
        message.AddFloat(value.z);
        message.AddFloat(value.w);
        return message;
    }

    /// <summary>Retrieves a <see cref="Quaternion"/> from the message.</summary>
    /// <returns>The <see cref="Quaternion"/> that was retrieved.</returns>
    public static Quaternion GetQuaternion(this Message message)
    {
        return new Quaternion(message.GetFloat(), message.GetFloat(), message.GetFloat(),
message.GetFloat());
    }
    #endregion
}
```

Runs On GameObject: NetworkManager

Name: GameLogic.cs

```
using RiptideNetworking;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class GameLogic : MonoBehaviour
{
    private static GameLogic instance;
    public bool gameIsRunning { get; set; }

    /// <summary>
    /// Singleton
    /// </summary>
    public static GameLogic Instance
    {
        get => instance;
        private set
        {
            if (instance == null) instance = value;
            else if (instance != value)
            {
                Debug.Log($"{nameof(GameLogic)} instance already exists, destroying new");
                Destroy(value);
            }
        }
    }

    /// <summary>
    /// Player Game object made indirectly accessible for security
    /// </summary>
    public GameObject PlayerPrefab => playerPrefab;

    [Header("Prefabs")]
    [SerializeField] private GameObject playerPrefab;
    [SerializeField] private GameObject zombiePrefab;

    /// <summary>
    /// Runs before being loaded
    /// </summary>
    private void Awake()
    {
        Instance = this;

    }

    float timeSinceActive = 0f;

    /// <summary>
    /// Runs 60 times per second
    /// </summary>
    private void FixedUpdate()
    {
        timeSinceActive += Time.deltaTime;
        if (timeSinceActive > 1.0f && FindObjectOfType<NetworkManager>().Server.IsRunning)
        {
            RiptideNetworking.Message message = Message.Create(MessageSendMode.unreliable,
(ushort)ServerToClientId.lightPosition);
            message.AddVector3(FindObjectOfType<DayNightCycle>().ReturnLightPosition());
            NetworkManager.Instance.Server.SendToAll(message);
            //Debug.Log("light Pos sent");
            timeSinceActive = 0f;
        }


    }

    //Zombie Management

    /// <summary>
    /// Used to spawn zombies, is called from the zombie spawning script
    /// </summary>
    /// <param name="position"></param>
    /// <param name="Id"></param>
    public void CallZombieSpawn(Vector3 position, ushort Id)
    {
        Zombie zombie = Instantiate(zombiePrefab, position, 
Quaternion.identity).GetComponent<Zombie>();
        zombie.SendId(Id);

        Message message = Message.Create(MessageSendMode.reliable, 
(ushort)ServerToClientId.zombieSpawning);
        message.AddVector3(position);
        message.AddUShort(Id);
        NetworkManager.Instance.Server.SendToAll(message);

    }



}
```

Runs On GameObject: Player

Name: Player.cs

```
using RiptideNetworking;
using System.Collections.Generic;
using UnityEngine;
//using static UnityEditor.Progress;
//using static UnityEditor.Experimental.GraphView.GraphView;

public class Player : MonoBehaviour
{
    public static Dictionary<ushort, Player> list = new Dictionary<ushort, Player>();

    public ushort Id { get; private set; }
    public string userName { get; private set; }


    /// <summary>
    /// Removes the player fromteh dictionary if they are destroyed within the scene
    /// </summary>
    public void OnDestroy()
    {
        list.Remove(Id);
    }

    /// <summary>
    /// Called From within a message, by a Client attemptiing to join the server. Adds the player 
to the Dictionary, along with defining its' identifiers. This is also sent to all other players 
connected to spawn a Non-Local player
    /// </summary>
    /// <param name="id"></param>
    /// <param name="username"></param>
    public static void Spawn(ushort id, string username)
    {
        foreach (Player otherPlayers in list.Values)
        {
            otherPlayers.SendSpawn(id);
        }



        Player player = Instantiate(GameLogic.Instance.PlayerPrefab, 
FindObjectOfType<GenerationScriptV2>().PlayerSpawnPoint(), 
Quaternion.identity).GetComponent<Player>();
        player.name = $"Player {id} ({(string.IsNullOrEmpty(username) ? "Guest" : username)})";
        player.Id = id;
        player.userName = string.IsNullOrEmpty(username) ? "Guest" : username;

        player.SendMap(player.Id);
        player.SendMobs(player.Id);
        player.SendSpawn();
        list.Add(id, player);
    }

    /// <summary>
    /// SendSpawn and the Override if a variable is passed in are used to send the spawn location
of a new player to the new client or to all existing clients.
    /// </summary>
    private void SendSpawn()
    {
        RiptideNetworking.Message message = Message.Create(MessageSendMode.reliable,
(ushort)ServerToClientId.playerSpawned);

        NetworkManager.Instance.Server.SendToAll(AddSpawnData(message));
    }


    private void SendSpawn(ushort toClientId)
    {
        RiptideNetworking.Message message = Message.Create(MessageSendMode.reliable,
(ushort)ServerToClientId.playerSpawned);

        NetworkManager.Instance.Server.Send(AddSpawnData(message), toClientId);
    }

    /// <summary>
    /// This adds the Id, username and a Vector3 position for the new player to be spawned at.
    /// </summary>
    /// <param name="message"></param>
    /// <returns></returns>
    private Message AddSpawnData(Message message)
    {
        message.AddUShort(Id);
        message.AddString(userName);
        message.AddVector3(FindObjectOfType<GenerationScriptV2>().PlayerSpawnPoint());
        return message;
    }

    /// <summary>
    /// Used to send the spawning position of new mobs in a scene, in addition to tellin the
client to spawn mobs.
    /// </summary>
    /// <param name="toClientId"></param>
    private void SendMobs(ushort toClientId)
    {
        foreach (var item in Zombie.list.Values)
        {
            Message message = Message.Create(MessageSendMode.reliable,
(ushort)ServerToClientId.zombieSpawning);
            message.AddVector3(item.gameObject.transform.position);
            message.AddUShort(item.Id);
            NetworkManager.Instance.Server.Send(message, toClientId);
        }
    }

    /// <summary>
    /// Sends the Map file from the Server to the client, layer by layer due to the capacity limit
of messages.
    /// </summary>
    /// <param name="toClientId"></param>
    private void SendMap(ushort toClientId)
    {
        byte[,] maptoSend = FindObjectOfType<GenerationScriptV2>().SendMap();


        //List<int> TempList = new List<int>();
        //int[] mapAs1DArray;
        //for (int y = 0; y < maptoSend.GetLength(0); y++)
        //{
        //    for (int x = 0; x < maptoSend.GetLength(1); x++)
        //    {
        //        TempList.Add(maptoSend[y, x]);
        //    }
        //}
        ////int[] temporaryarray = new int[maptoSend.GetLength(0)];
        ////temporaryarray[0] = maptoSend[i];
        //mapAs1DArray = TempList.ToArray();

        //message.AddInt(maptoSend.GetLength(0));
        //message.AddInt(maptoSend.GetLength(1));
        ////message.AddInts(mapAs1DArray, false, true);
        ///
        for (short y = 0; y < maptoSend.GetLength(1); y++)
        {
            //message = Message.Create(MessageSendMode.reliable, (ushort)ServerToClientId.map);
            Message message = Message.Create(MessageSendMode.reliable,
(ushort)ServerToClientId.map);
            byte[] tempXS = new byte[maptoSend.GetLength(0)];
            for (int x = 0; x < maptoSend.GetLength(0); x++)
            {
                tempXS[x] = maptoSend[x, y];
            }
            //
            //Debug.LogAssertion(y);
            message.AddShort(y);
            message.AddInt(FindObjectOfType<GenerationScriptV2>().worldWidth);
            message.AddBytes(tempXS, false, true);
            //Debug.Log("sending map to client");
            NetworkManager.Instance.Server.Send(message, toClientId);
        }



        //Debug.Log("sending map to client");
        //NetworkManager.Instance.Server.Send(message, toClientId);

    }

    /// <summary>
    /// Runs 60 times per second.
    /// </summary>
    private void FixedUpdate()
    {
        SyncNonLocalPlayers();
    }

    /// <summary>
    /// Sends the position of all players connected along with their respective Id's to all
players.
    /// </summary>
    private void SyncNonLocalPlayers()
    {
        foreach (Player players in list.Values)
        {
            Message message = Message.Create(MessageSendMode.unreliable,
(ushort)ServerToClientId.syncNonLocalPosition);
            message.AddUShort(players.Id);
            message.AddVector3(players.gameObject.transform.position);
            NetworkManager.Instance.Server.SendToAll(message);
        }
    }

    /// <summary>
    /// Sends updates to the map to all but the origional editor of the map
    /// </summary>
    /// <param name="block"></param>
    /// <param name="xPos"></param>
    /// <param name="yPos"></param>
    /// <param name="originPlayer"></param>
    private static void UpdatePlayerMaps(byte block, int xPos, int yPos, ushort originPlayer)
    {

        foreach (Player players in list.Values)
        {
            if (players.Id != originPlayer)
            {
                RiptideNetworking.Message message = Message.Create(MessageSendMode.reliable,
(ushort)ServerToClientId.syncMapUpdate);
                message.AddInt(xPos);
                message.AddInt(yPos);
                message.AddByte(block);
                NetworkManager.Instance.Server.Send(message, players.Id);
            }
        }
    }

    /// <summary>
    /// Message handler handles changing the position of a clients Local player on the Server.
    /// </summary>
    /// <param name="fromClientId"></param>
    /// <param name="message"></param>
    [MessageHandler((ushort)(ClientToServerId.updatePlayerPosition))]
    private static void PlayerPos(ushort fromClientId, Message message)
    {
        Vector3 positionFromMessage = message.GetVector3();
        //ushort playerIdFromMessage = message.GetUShort();
        //Debug.Log($"CALLED POSITION UPDATE, {positionFromMessage.x}:{positionFromMessage.y}");
        list[fromClientId].gameObject.transform.position = positionFromMessage;
        message.Release();

    }

    /// <summary>
    /// Sent from the client upon connecting
    /// </summary>
    /// <param name="fromClientId"></param>
    /// <param name="message"></param>
    [MessageHandler((ushort)(ClientToServerId.name))]
    private static void Name(ushort fromClientId, Message message)
    {
        Spawn(fromClientId, message.GetString());
    }

    /// <summary>
    /// Updates the Servers map from a message from a Client.
    /// </summary>
    /// <param name="fromClientId"></param>
    /// <param name="message"></param>
    [MessageHandler((ushort)ClientToServerId.updateServerMap)]
    private static void UpdateMap(ushort fromClientId, Message message)
    {
        //Vector2 BlockPos = message.GetVector2();
        int xPos = message.GetInt();
        int yPos = message.GetInt();
        byte block = message.GetByte();
        //Debug.Log($"Block Update Called at {(int)BlockPos.x}:{(int)BlockPos.y} for {block}");
        FindObjectOfType<GenerationScriptV2>().ServerUpdatingBlock(block, xPos, yPos);
        message.Release();
        UpdatePlayerMaps(block, xPos, yPos, fromClientId);
    }

    /// <summary>
    /// Updates the Text Chat of all clients but the origin of the chat.
    /// </summary>
    /// <param name="fromClientId"></param>
    /// <param name="message"></param>
    [MessageHandler((ushort)ClientToServerId.updateTextChat)]
    private static void SendUpdatesToPlayers(ushort fromClientId, Message message)
    {
        string text = message.GetString();

        foreach (var item in list.Values)
        {
            if (item.Id != fromClientId)
            {
                Message message2 = Message.Create(MessageSendMode.reliable, 
(ushort)ServerToClientId.textChat);
                message2.AddUShort(item.Id);
                message2.AddString(text);

                NetworkManager.Instance.Server.Send(message2, item.Id);
            }
        }
    }



}
```

Runs On GameObject: Zombie

Name: Zombie.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using RiptideNetworking;
using RiptideNetworking.Utils;
//using static UnityEditor.Progress;

public class Zombie : MonoBehaviour
{
    public static Dictionary<ushort, Zombie> list = new Dictionary<ushort, Zombie>();

    public ushort Id { get; private set; }


    private void OnDestroy()
    {
        list.Remove(Id);
    }

    /// <summary>
    /// Used to define and add each zombie to the Dictionary
    /// </summary>
    /// <param name="id"></param>
    public void SendId(ushort id)
    {
        Zombie zombie = GetComponent<Zombie>();
        zombie.Id = id;
        list.Add(id, zombie);
    }

    /// <summary>
    /// Runs 60 time per second
    /// </summary>
    private void FixedUpdate()
    {
        SendPositionToClients();
    }

    /// <summary>
    /// Sends the position of the zombie to all clients
    /// </summary>
    private void SendPositionToClients()
    {
        Message message = Message.Create(MessageSendMode.unreliable,
(ushort)ServerToClientId.zombiePosition);
        message.AddUShort(Id);
        message.AddVector3(list[Id].gameObject.transform.position);

        NetworkManager.Instance.Server.SendToAll(message);
    }

    /// <summary>
    /// Function despawns zombie and tells every client also do so
    /// </summary>
    public void Despawn()
    {
        Message message = Message.Create(MessageSendMode.reliable,
(ushort)ServerToClientId.zombieDeath);
        message.AddUShort(Id);
        NetworkManager.Instance.Server.SendToAll(message);
        Destroy(list[Id].gameObject);
    }


    /// <summary>
    /// Handles a zombie death and sends a new message tell all clients to despawn the killed
zombie
    /// </summary>
    /// <param name="fromClientId"></param>
    /// <param name="message"></param>
    [MessageHandler((ushort)ClientToServerId.zombieDeath)]
    private static void ZombieKilledByPlayer(ushort fromClientId, Message message)
    {
        ushort idOfDeath = message.GetUShort();

        Message message2 = Message.Create(MessageSendMode.reliable,
(ushort)ServerToClientId.zombieDeath);
        message2.AddUShort(idOfDeath);
        NetworkManager.Instance.Server.SendToAll(message2);
        Destroy(list[idOfDeath].gameObject);
    }

}
```

Runs On GameObject: MapManager

Name: GenerationV2.cs

```
sing System;
using System.Collections;
using System.Collections.Generic;
using System.IO;
using System.Text;
using UnityEngine;
using UnityEngine.Tilemaps;
using UnityEngine.UI;


public class GenerationScriptV2 : MonoBehaviour
{
    // Start is called before the first frame update
    public int worldWidth = 1024;
    public int worldHeight = 256;
    public bool terrainGenerationComplete { get; private set; }


    [SerializeField] float Seed;
    [SerializeField] float StoneSeed;
    //[SerializeField] float CaveSeed;
    [SerializeField] float OreSeed;

    float Smoothness = 40;
    float OreThreshhold = 0.1f;
    //float CaveThreshhold = 0.7f;


    [SerializeField] TileBase GrassSoil;
    [SerializeField] TileBase Stone;
    [SerializeField] TileBase SoilBG;
    [SerializeField] TileBase StoneBG;
    [SerializeField] TileBase Ore;
    [SerializeField] TileBase Log;
    [SerializeField] TileBase Leaf;
    [SerializeField] TileBase Plank;

    public Tilemap TestTileFG;
    public Tilemap TestTileBG;
    [SerializeField] public Slider SeedSlider;
    [SerializeField] public Slider StoneSlider;
    //[SerializeField] public Slider CaveSlider;

    [SerializeField] float RandomPercentFill;
    [SerializeField] int iterations;
    [SerializeField] int TreePopulation;

    string worldName;

    byte[,] map;
    byte[,] cavemap;


    void Start()
    {
        worldWidth = 1024;
        worldHeight = 256;

        //terrainGenerationComplete = Generation();
    }
    /*
    //void Update()
    //{
    //    if (Input.GetKeyDown(KeyCode.Space))
    //    {
    //        Debug.Log("Reloading");
    //        Generation();
    //    }

    //public void SetWorldName(string name) { worldName = name; }

    /// <summary>
    /// Used
    /// </summary>
    /// <param name="x"></param>
    /// <param name="y"></param>
    /// <returns></returns>
    ///

    public int BreakBlock(int x, int y)
    {
        //Debug.Log($"breakblock called, position {x}, {y}");


        if (!(map[x, y] == 8 || map[x, y] == 9 || map[x, y] == 0))
        {
            TestTileFG.SetTile(new Vector3Int(x, y, 0), null);
            TestTileFG.RefreshTile(new Vector3Int(x, y, 0));
            int block = map[x,y];
            if (map[x, y] == 1)
            {
                map[x, y] = 8;
            }
            else if (map[x, y] == 2 || map[x, y] == 3)
            {
                map[x, y] = 9;
            }
            else map[x, y] = 0;
            FindObjectOfType<AudioManager>().Play("Block Break");
            return block;
        }
        return 0;
    }

    public int ReturnTypeOfBlock(int x, int y)
    {
        if (!(map[x, y] == 8 || map[x, y] == 9 || map[x, y] == 0))
        {
            int block = map[x, y];
            return block;
        }
        return 0;
    }

    public bool BuildBlock(int block,int x, int y)
    {
        //Debug.Log($"buildblock called, position {x}, {y}");
        if ((map[x-1,y] != 0 || map[x + 1, y] != 0 || map[x, y - 1] != 0 || map[x, y + 1] != 0) &&
(map[x,y] == 0 || map[x, y] == 8 || map[x, y] == 9))
        {
            map[x, y] = (byte)block;
            TileBase placing = Plank;
            switch (block)
            {
                case 1:
                    placing = GrassSoil;
                    break;
                case 2:
                    placing = Stone;
                    break;
                case 4:
                    placing = Log;
                    break;
                case 5:
                    placing = Leaf;
                    break;
                case 6:
                    placing = Plank;
                    break;
                default:
                    return false;

            }

            TestTileFG.SetTile(new Vector3Int(x, y, 0), placing);
            TestTileFG.RefreshTile(new Vector3Int(x, y, 0));
            FindObjectOfType<AudioManager>().Play("Block Place");
            return true;
        }
        return false;
    }
    */

    /// <summary>
    /// Used the Player.cs script to update blocks on the map
    /// </summary>
    /// <param name="block"></param>
    /// <param name="x"></param>
    /// <param name="y"></param>
    public void ServerUpdatingBlock(int block, int x, int y)
    {
        map[x, y] = (byte)block;
        TileBase placing = Plank;
        switch (block)
        {
            case 0:
                placing = null;
                break;
            case 1:
                placing = GrassSoil;
                break;
            case 2:
                placing = Stone;
                break;
            case 4:
                placing = Log;
                break;
            case 5:
                placing = Leaf;
                break;
            case 6:
                placing = Plank;
                break;
            case 8:
                placing = SoilBG;
                break;
            case 9:
                placing = StoneBG;
                break;
            default:
                break;

        }
        Debug.Log($"At Position {x}:{y}, Map is now {map[x,y]}");
        if (block == 8 || block == 9)
        {
            TestTileBG.SetTile(new Vector3Int(x, y, 0), placing);
            TestTileFG.SetTile(new Vector3Int(x, y, 0), null);
            TestTileBG.RefreshTile(new Vector3Int(x, y, 0));
            TestTileFG.RefreshTile(new Vector3Int(x, y, 0));
        }
        else
        {
            TestTileFG.SetTile(new Vector3Int(x, y, 0), placing);
            TestTileFG.RefreshTile(new Vector3Int(x, y, 0));
            TestTileBG.RefreshTile(new Vector3Int(x, y, 0));
        }
        //Debug.Log(TestTileFG.GetTile(new Vector3Int(x, y, 0)).name);

    }

    //public void BuildBlock(int block, int x, int y)
    //{
    //    map[x, y] = block;

    //    TestTileFG.SetTile(new Vector3Int(x, y, 0), null);
    //}

    public string CurrentWorldName() { return (worldName); }

    //public void GenerateFromSlider()
    //{
    //    Seed = SeedSlider.value;
    //    StoneSeed = StoneSlider.value;
    //    CaveSeed = CaveSlider.value;

    //    map = new byte[worldWidth, worldHeight];
    //    OptimisedTerrainGeneration(map, worldWidth, worldHeight, GrassSoil, Stone);
    //    ApplyCaves(map);
    //    AddTrees(TreePopulation, TestTileFG, Log, Leaf);
    //    Renderer(map, TestTileFG, TestTileBG);
    //}

    /// <summary>
    /// Called to generate a new map or to lead a map from a save based on the save name given.
    /// </summary>
    /// <param name="saveName"></param>
    /// <returns></returns>
    public bool Generation(string saveName)
    {
        worldName = saveName;
        TestTileBG.ClearAllTiles();
        TestTileFG.ClearAllTiles();
        Seed = (float)UnityEngine.Random.Range(0.0f, 1000.0f);
        StoneSeed = (float)UnityEngine.Random.Range(0.0f, 1000.0f);
        //CaveSeed = (float)UnityEngine.Random.Range(0.02f, 0.05f);
        OreSeed = (float)UnityEngine.Random.Range(0.03f, 0.05f);

        map = new byte[worldWidth, worldHeight];

        if (IsFromSave())
        {
            //GenerateSaveFile();
            LoadMap();
            SaveMap();
        }
        else
        {
            OptimisedTerrainGeneration(map, worldWidth, worldHeight, GrassSoil, Stone);
            ApplyCaves(map);
            AddTrees(TreePopulation, TestTileFG, Log, Leaf);
        }

        Renderer(map, TestTileFG, TestTileBG);
        GenerateSaveFile();
        SaveMap();


        terrainGenerationComplete = true;
        return true;
        //map = Generate2DArray(worldWidth, worldHeight);
        //cavemap = GenerateCaveMap(worldWidth, worldHeight);
        //map = TerrainGeneration(map);
        //Renderer(map, GrassSoil, Stone, TestTileMap);
    }
    /// <summary>
    /// Sends the map as an output.
    /// </summary>
    /// <returns></returns>
    public byte[,] SendMap()
    {
        return map;
    }


    //public int[,] Generate2DArray(int worldWidth, int worldHeight)
    //{
    //    int[,] map = new int[worldWidth, worldHeight];
    //    for (int x = 0; x < worldWidth; x++)
    //    {
    //        for (int y = 0; y < worldHeight; y++)
    //        {
    //            map[x, y] = 0;
    //        }
    //    }
    //    return map;
    //}

    //public int[,] GenerateCaveMap(int worldWidth, int worldHeight)
    //{
    //    int[,] cavemap = new int[worldWidth, worldHeight];
    //    TestTexure = new Texture2D(worldWidth, worldHeight);

    //    for (int x = 0; x < worldWidth; x++)
    //    {
    //        for (int y = 0; y < worldHeight; y++)
    //        {
    //            float v = Mathf.PerlinNoise((float)x *0.05f, (float)y *0.05f);
    //            TestTexure.SetPixel(x, y, new Color(v, v, v));
    //            if (v >= CaveThreshhold)
    //            {
    //                cavemap[x, y] = 0;
    //            }
    //            else
    //            {
    //                cavemap[x, y] = 1;
    //            }
    //            TestTexure.Apply();
    //        }
    //    }
    //    return cavemap;
    //}

    ///// <summary>
    ///// Mathf.PerlinNoise(x,y) -- Takes the X and Y coordinates and produces a smooth random
value between 0 and 1
    ///// </summary>
    ///// <param name="map"></param>
    ///// <returns></returns>
    //public int[,] TerrainGeneration(int[,] map)
    //{
    //    int perlinNoise;
    //    for (int x = 0; x < worldWidth; x++)
    //    {
    //        perlinNoise = Mathf.RoundToInt(Mathf.PerlinNoise(x / Smoothness, Seed) * worldHeight
/ 2);
    //        perlinNoise += worldHeight / 2;
    //        for (int y = 0; y < perlinNoise; y++)
    //        {
    //            map[x, y] = 1;
    //        }
    //    }

    //    perlinNoise = 0;
    //    for (int x = 0; x < worldWidth; x++)
    //    {
    //        perlinNoise = Mathf.RoundToInt(Mathf.PerlinNoise(x / (Smoothness*2), StoneSeed) *
worldHeight / 2);
    //        perlinNoise += (worldHeight / 4);
    //        for (int y = 0; y < perlinNoise; y++)
    //        {
    //            map[x, y] = 2;
    //        }
    //    }



    //    return map;
    //}

    /// <summary>
    /// Renderers the map to the tilemaps
    /// </summary>
    /// <param name="MapToRender"></param>
    /// <param name="FG"></param>
    /// <param name="BG"></param>
    public void Renderer(byte[,] MapToRender, Tilemap FG, Tilemap BG)
    {
        FG.ClearAllTiles();
        BG.ClearAllTiles();
        for (int x = 0; x < worldWidth; x++)
        {
            for (int y = 0; y < worldHeight; y++)
            {
                if (MapToRender[x, y] == 1)
                {
                    FG.SetTile(new Vector3Int(x, y, 0), GrassSoil);
                    BG.SetTile(new Vector3Int(x, y, 0), SoilBG);
                }
                if (MapToRender[x, y] == 2)
                {
                    FG.SetTile(new Vector3Int(x, y, 0), Stone);
                    BG.SetTile(new Vector3Int(x, y, 0), StoneBG);
                }
                if (MapToRender[x, y] == 3)
                {
                    FG.SetTile(new Vector3Int(x, y, 0), Ore);
                    BG.SetTile(new Vector3Int(x, y, 0), StoneBG);
                }
                if (MapToRender[x,y] == 4)
                {
                    FG.SetTile(new Vector3Int(x, y, 0), Log);
                }
                if (MapToRender[x, y] == 5)
                {
                    FG.SetTile(new Vector3Int(x, y, 0), Leaf);
                }
                if (MapToRender[x, y] == 6)
                {
                    FG.SetTile(new Vector3Int(x, y, 0), Plank);
                }
                if (MapToRender[x,y] == 8)
                {
                    BG.SetTile(new Vector3Int(x, y, 0), SoilBG);
                }
                if (MapToRender[x, y] == 9)
                {
                    BG.SetTile(new Vector3Int(x, y, 0), StoneBG);
                }
            }
        }
    }

    /// <summary>
    /// Generates a save file at the directory
    /// </summary>
    void GenerateSaveFile()
    {

        if (!System.IO.File.Exists($"WorldSaves/{worldName}"))
        {
            Directory.CreateDirectory($"WorldSaves/{worldName}");
        }
    }

    /// <summary>
    /// Checks if the world save directory already exists
    /// </summary>
    /// <returns></returns>
    bool IsFromSave()
    {
        if (System.IO.File.Exists($"WorldSaves/{worldName}")) return true;
        return false;

    }


    /// <summary>
    /// Saves the map to a file
    /// </summary>
    public void SaveMap()
    {
        using (StreamWriter sw = new StreamWriter($"WorldSaves/{worldName}/worldSave.txt"))
        {
            //sw.WriteLine(worldHeight);
            //sw.WriteLine(worldWidth);
            for (int y = 0; y < map.GetLength(1); y++)
            {
                for (int x = 0; x < map.GetLength(0); x++)
                {
                    sw.Write(map[x, y]);
                }
                sw.WriteLine();
            }
        }
    }

    /// <summary>
    /// Loads the map into the 2D array from a text file.
    /// </summary>
    public void LoadMap()
    {
        int y = 0;

        using (StreamReader sr = new StreamReader($"WorldSaves/{worldName}/worldSave.txt"))
        {
            string value;

            while ((value = sr.ReadLine()) != null)
            {
                Debug.Log(Convert.ToInt16(value[1]));
                for (int x = 0; x < map.GetLength(0); x++)
                {
                    map[x, y] = (byte)(Convert.ToInt16(value[x]) - 48);
                }
                y++;
            }
        }
        Renderer(map, TestTileFG, TestTileBG);
    }

    /// <summary>
    /// More optimised version of the functions above using a shaired for loop to reduce the
number of calls.
    /// </summary>
    /// <param name="worldWidth"></param>
    /// <param name="worldHeight"></param>
    /// <param name="GrassSoil"></param>
    /// <param name="Stone"></param>
    /// <param name="TestTileMap"></param>
    public void OptimisedTerrainGeneration(byte[,] WorldMap, int width, int height, TileBase
GrassSoil, TileBase Stone)
    {
        int perlinNoiseSoil;
        int perlinNoiseStone;
        for (int x = 0; x < width; x++)
        {
            //Making the Soil
            perlinNoiseSoil = Mathf.RoundToInt(Mathf.PerlinNoise(x / Smoothness, Seed) * height /
5);
            perlinNoiseSoil += height / 3;
            //Debug.Log($"Soil Noise Value is {perlinNoiseSoil}");
            for (int y = 0; y < perlinNoiseSoil; y++)
            {
                WorldMap[x, y] = 1;
            }

            //Making the Stone
            perlinNoiseStone = Mathf.RoundToInt(Mathf.PerlinNoise(x / (Smoothness * 2), StoneSeed)
* height / 8);
            perlinNoiseStone += height / 4;
            //Debug.Log($"Stone Noise Value is {perlinNoiseStone}");
            for (int y = 0; y < perlinNoiseStone; y++)
            {
                WorldMap[x, y] = 2;
            }

            //Cutting Cacves out and Rendering to Optimise the code using the same for loops
            for (int y = 0; y < perlinNoiseSoil; y++)
            {
                float OrePL = (Mathf.PerlinNoise((float)x * OreSeed, (float)y * OreSeed));

                if (OrePL <= OreThreshhold)
                {
                    map[x, y] = 3;
                    TestTileFG.SetTile(new Vector3Int(x, y, 0), Ore);
                }

            }

        }
    }

    /// <summary>
    /// Made to Enable me to edit the Cave Generation without messing around with the other parts
of the code, however this is less optimised as the loops have to be run in addition to the main
generation.
    /// </summary>
    /// <param name="map"></param>
    /// <param name="width"></param>
    /// <param name="height"></param>
    public void ApplyCaves(byte[,] map)
    {
        //Version 1
        //for (int x = 0; x < width; x++)
        //{
        //    for (int y = 0; y < height; y++)
        //    {
        //        float CavePL = (Mathf.PerlinNoise((float)x * CaveSeed, (float)y * CaveSeed));
        //        if (CavePL >= CaveThreshhold)
        //        {
        //            map[x, y] = 0;
        //            TestTileFG.SetTile(new Vector3Int(x, y, 0), null);
        //        }
        //    }
        //}

        //Version 2 With Automata
        CaveGeneration();
        Automata(iterations);

        for (int x = 0; x < worldWidth; x++)
        {
            for (int y = 0; y < worldHeight; y++)
            {
                int topofworld = Mathf.RoundToInt(Mathf.PerlinNoise(x / Smoothness, Seed) * 
worldHeight / 5);
                topofworld += worldHeight / 3;
                if (cavemap[x, y] == 0 && y != 0 && y != topofworld-1 && y != topofworld-2)
                {
                    //estTileFG.SetTile(new Vector3Int(x, y, 0), null);
                    if (map[x,y] == 1)
                    {
                        map[x, y] = 8;
                    }
                    if (map[x, y] == 2 || map[x, y] == 3)
                    {
                        map[x, y] = 9;
                    }

                }
            }
        }
    }
    /// <summary>
    /// Creates a randomly filled array
    /// </summary>
    public void CaveGeneration()
    {
        cavemap = new byte[worldWidth, worldHeight];
        for (int x = 0; x < worldWidth; x++)
        {
            for (int y = 0; y < worldHeight; y++)
            {
                cavemap[x, y] = (byte)(UnityEngine.Random.Range(0, 100) < RandomPercentFill ? 1 : 
0);
            }
        }
    }

    /// <summary>
    /// Runs an automata on the randomly filled grid
    /// </summary>
    /// <param name="count"></param>
    public void Automata(int count)
    {
        for (int i = 1; i <= count; i++)
        {
            byte[,] tempmap = (byte[,])cavemap.Clone();
            //Debug.Log(tempmap.GetLength(0));
            //Debug.Log(tempmap.GetLength(1));

            for (int xs = 1; xs < worldWidth - 1; xs++)
            {
                for (int ys = 1; ys < worldHeight - 1; ys++)
                {
                    int neighbours = 0;
                    neighbours = GetNeighbours(tempmap, xs, ys, neighbours);
                    if (neighbours > 4)
                    {
                        cavemap[xs, ys] = 1;
                    }
                    else
                    {
                        cavemap[xs, ys] = 0;
                    }
                }
            }
        }
    }


    /// <summary>
    /// Returns the number of acitve neighbours
    /// </summary>
    /// <param name="tempmap"></param>
    /// <param name="xs"></param>
    /// <param name="ys"></param>
    /// <param name="neighbours"></param>
    /// <returns></returns>
    private int GetNeighbours(byte[,] tempmap, int xs, int ys, int neighbours)
    {
        for (int x = xs - 1; x <= xs + 1; x++)
        {
            for (int y = ys - 1; y <= ys + 1; y++)
            {
                if (y <= worldHeight && x <= worldWidth)
                {
                    if (y != ys || x != xs)
                    {
                        //Debug.Log(y);
                        //Debug.Log(x);
                        if (tempmap[x, y] == 1)
                        {
                            neighbours++;
                        }
                    }
                }
            }
        }

        return neighbours;
    }

    /// <summary>
    /// Adds trees with collision avoidance
    /// </summary>
    /// <param name="density"></param>
    /// <param name="tilemap"></param>
    /// <param name="Log"></param>
    /// <param name="Leaf"></param>
    public void AddTrees(int density, Tilemap tilemap, TileBase Log, TileBase Leaf)
    {
        if (density >= worldWidth/6)
        {
            density = worldWidth / 6;
        }

        int tempx = 0;
        int[] positionHistory = new int[density];
        //positionHistory[0] = 0;

        for (int i = 0; i < density; i++)
        {
            bool collisionAvoidance = true;
            while (collisionAvoidance)
            {
                int holdingvariable = UnityEngine.Random.Range(2, worldWidth - 2);
                collisionAvoidance = false;

                for (int j = 0; j <= i; j++)
                {
                    if (Mathf.Abs(holdingvariable - positionHistory[j]) < 6)
                    {
                        //Debug.Log(Mathf.Abs(holdingvariable - positionHistory[j]));

                        collisionAvoidance = true;
                    }
                }
                if (!collisionAvoidance)
                {
                    tempx = holdingvariable;
                }
            }
            positionHistory[i] = tempx;

            //Debug.Log($"tempx is {tempx}");
            int tempy = worldHeight-1;
            while (map[tempx,tempy] == 0)
            {
                tempy--;
            }
            tempy++;
            //Debug.Log($"tempy is {tempy}");

            map[tempx,tempy] = 4;
            map[tempx, tempy + 1] = 4;
            map[tempx, tempy + 2] = 5;
            map[tempx, tempy + 3] = 5;
            map[tempx, tempy + 4] = 5;
            map[tempx + 1, tempy + 2] = 5;
            map[tempx - 1, tempy + 2] = 5;
            map[tempx + 1, tempy + 3] = 5;
            map[tempx - 1, tempy + 3] = 5;
            map[tempx + 1, tempy + 4] = 5;

        }
    }
    /// <summary>
    /// Returns a vector3 of the ground level in the middle of the world
    /// </summary>
    /// <returns></returns>
    public Vector3Int PlayerSpawnPoint()
    {
        Debug.Log("called");
        Debug.Log(worldHeight);
        Debug.Log(worldWidth);

        int tempy = worldHeight - 1;
        while (map[worldWidth/2, tempy] == 0)
        {
            tempy--;
        }
        tempy += 2;
        Debug.Log($"{worldWidth / 2}, {tempy}");
        return new Vector3Int(worldWidth / 2, tempy, 0);
    }

    /// <summary>
    /// Unused returns the tground level of any given point
    /// </summary>
    /// <param name="xPos"></param>
    /// <returns></returns>
    public int ReturnGroundPosition(int xPos)
    {
        if (xPos-1 >= worldWidth) return worldHeight;
        int tempy = worldHeight - 1;
        while (map[xPos-1, tempy] == 0)
        {
            tempy--;
        }
        tempy += 5;
        return tempy;
    }

    public void ClearMap()
    {
        for (int x = 0; x < worldWidth; x++)
        {
            for (int y = 0; y < worldHeight; y++)
            {
                map[x, y] = 0;
            }
        }
        Renderer(map, TestTileFG, TestTileBG);
    }


}
```

Runs On GameObject: WorldEventManager
Name: WorldEventManager.cs

```
using System.Collections;
using System.Collections.Generic;
using TMPro;
using Unity.VisualScripting;
using UnityEngine;

public class WorldEventManager : MonoBehaviour
{
    public bool EnableDayNightCycle = true;
    public GameObject PlayerPreFab;
    [SerializeField] private TMP_InputField worldNameField;
    [SerializeField] private TMP_InputField PortField;
    //public GameObject MapManager;

    // Start is called before the first frame update
    void Start()
    {

        //Instantiate(PlayerPreFab,
GetComponentInChildren<GenerationScriptV2>().PlayerSpawnPoint(), Quaternion.identity);
        //Debug.Log("finito");

    }

    /// <summary>
    /// Called by the Start button on the main menu
    /// </summary>
    public void GenerateWorld()
    {
        //GetComponentInChildren<GenerationScriptV2>().SetWorldName(PassingVariables.worldName);
        //Debug.Log(PassingVariables.worldName);
        if (!string.IsNullOrEmpty(PortField.text))
        {
            GetComponentInChildren<GenerationScriptV2>().Generation(worldNameField.text);
        }

    }

    // Update is called once per frame
    void FixedUpdate()
    {
        GetComponentInChildren<DayNightCycle>().DayNightEnabled = EnableDayNightCycle;
    }

    /// <summary>
    /// Unused
    /// </summary>
    /// <param name="Player"></param>
    public void PlayerDeath(GameObject Player)
    {
        //Player.GetComponentInChildren<PlayerMenuManager>().EnableDeathScreen();
        //Player.GetComponent<BlockInteractions>().EmptyInventory();
        //Player.transform.position = new Vector3(-1000, 0, 0);

    }

    public void PlayerRespawn(GameObject Player)
    {
        //Player.transform.position =
GetComponentInChildren<GenerationScriptV2>().PlayerSpawnPoint();
    }

    public void SaveAll()
    {
        //GetComponentInChildren<GenerationScriptV2>().SaveMap();

        ////Finding All the Players in the scene
        //GameObject[] players;
        //players = GameObject.FindGameObjectsWithTag("Player");

        //foreach (var item in players)
        //{
        //
item.GetComponent<BlockInteractions>().SavePlayerState(GetComponentInChildren<GenerationScriptV2>(
).CurrentWorldName());
        //}

    }
}
```

Runs On GameObject: Mob Spawner

Name: SpawnController.cs

```
using System.Collections;
using System.Collections.Generic;
using Unity.VisualScripting;
using UnityEngine;


public class SpawnController : MonoBehaviour
{
    public int spawnAmount;
    public GameObject DayNightManager;
    public GameObject WorldGenerator;
    public GameObject MobPrefab;

    [SerializeField]
    bool Day;

    GenerationScriptV2 GenerationScriptInUse;
    DayNightCycle DayNightCycleInUse;
    bool hasSpawnedMobs = false;


    // Start is called before the first frame update
    void Start()
    {
        GenerationScriptInUse = WorldGenerator.GetComponent<GenerationScriptV2>();
        DayNightCycleInUse = DayNightManager.GetComponent<DayNightCycle>();
    }

    // Update is called once per frame
    void FixedUpdate()
    {
        Day = DayNightCycleInUse.isDay();
        if (!DayNightCycleInUse.isDay() && GenerationScriptInUse.terrainGenerationComplete &&
!hasSpawnedMobs)
        {
            ushort ZombieID = 0;
            foreach (var positionElement in FindSpawnLocations())
            {
                FindObjectOfType<GameLogic>().CallZombieSpawn(positionElement, ZombieID);
                ZombieID++;
            }
            hasSpawnedMobs = true;
        }
        //if (DayNightCycleInUse.isDay() && hasSpawnedMobs)
FindObjectOfType<Zombie>().DespawnAll();
        if (DayNightCycleInUse.isDay()) hasSpawnedMobs = false;
    }

    /// <summary>
    /// Finds valid spawn locations, and returns an array of Vector3
    /// </summary>
    /// <returns></returns>
    Vector3[] FindSpawnLocations()
    {
        Vector3[] spawnLocations = new Vector3[spawnAmount];
        for (int i = 0; i < spawnAmount; i++)
        {
            int tempxPos = UnityEngine.Random.Range(1, GenerationScriptInUse.worldWidth);
            spawnLocations[i] = new Vector3(tempxPos,
GenerationScriptInUse.ReturnGroundPosition(tempxPos),0);
        }
        return spawnLocations;
    }
}
```

Runs On GameObject: Zombie

Name: ZombieControl

```
using JetBrains.Annotations;
using System.Collections;
using System.Collections.Generic;
using Unity.VisualScripting;
using UnityEngine;

public class ZombieControl : MonoBehaviour
{
    public int sightRange;

    public LayerMask playerLayer;
    public LayerMask groundLayer;

    public GameObject attackPoint;
    public float attackDamage;
    public float attackRate;

    public float knockbackStrength;
    public float knockbackDuration;
    public float walkSpeed;
    public float jumpHeight = 6;
    float jumpForce;

    int ZombieHealth = 10;
    public bool OnTheGround;
    public bool InSight;
    public bool InRange;

    Rigidbody2D zombieRB;
    Animator animator;
    DayNightCycle DayNightCycleInUse;
    GameObject DayNightManager;

    float patrolRange;
    float timeSinceActive;
    float time;

    bool hasBeenKnockedBack;
    float timeSinceKB;
    float timeSinceAttack;

    /// <summary>
    /// These are physics overlaps, that return a boolean. If an object on the given layer is
within the given range
    /// </summary>
    public bool playerInRange { get { return (Physics2D.OverlapCircle(transform.position,
sightRange, playerLayer)); } }
    public bool OnGround { get { return Physics2D.OverlapCircle(new Vector2(transform.position.x,
transform.position.y - 1.1f), 0.1f, groundLayer); } }
    public bool playerInAttackRange { get { return
Physics2D.OverlapCapsule(attackPoint.transform.position, new Vector2(1, 2),
CapsuleDirection2D.Vertical, 0, playerLayer); } }

    // Start is called before the first frame update
    /// <summary>
    /// This defines many of the components on the zombie gameobject into code
    /// </summary>
    void Start()
    {
        zombieRB = GetComponent<Rigidbody2D>();
        animator = GetComponent<Animator>();
        DayNightManager = GameObject.Find("DayNightCycleLight");
        DayNightCycleInUse = DayNightManager.GetComponent<DayNightCycle>();
        patrolRange = UnityEngine.Random.Range(1, 20);
        RandomStartingDirection();
        Physics.IgnoreLayerCollision(gameObject.layer, gameObject.layer);
        timeSinceAttack = attackRate;

    }

    /// <summary>
    /// Picks a randomm starting direction for the zombie, so when they initally patrol they all
start walking in different directions
    /// </summary>
    void RandomStartingDirection()
    {
        int temp = Mathf.RoundToInt(UnityEngine.Random.Range(0, 1));
        if (temp == 0) transform.localScale = new Vector2(-1, 0);
        if (temp == 1) transform.localScale = new Vector2(1, 0);


    }

    /// <summary>
    /// Used to control the behaviour of each zombie
    /// </summary>
    private void FixedUpdate()
    {
        OnTheGround = OnGround;
        InSight = playerInRange;
        InRange = playerInAttackRange;
        //Debug.DrawLine(new Vector2(transform.position.x, transform.position.y - 1.1f), new
Vector2(transform.position.x, transform.position.y - 1.2f));
        Debug.DrawRay(new Vector2(transform.position.x, transform.position.y - 0.5f), new
Vector2(transform.localScale.x,0), Color.red);
        Debug.DrawRay(new Vector2(transform.position.x, transform.position.y + 0.5f), new
Vector2(transform.localScale.x, 0), Color.red);
```

```
        ZombieWalkAnimations();
        TakeDamageDuringDay();
        JumpUpByOneBlock();
        if (playerInRange)
        {
            FaceTowardsPlayer(playerInRangePosition());
            //if (playerInAttackRange) AttackManager();
            if (!playerInAttackRange) zombieRB.velocity = new Vector2(walkSpeed *
transform.localScale.x,zombieRB.velocity.y);
        }
        else IdlePatrol();

        //if (hasBeenKnockedBack)
        //{
        //    timeSinceKB += Time.deltaTime;
        //    if (timeSinceKB >= knockbackDuration) hasBeenKnockedBack = false;
        //}
    }

    //void Attack()
    //{
    //    Collider2D[] hitPlayers = (Physics2D.OverlapCapsuleAll(attackPoint.transform.position,
new Vector2(1, 2), CapsuleDirection2D.Vertical, 0, playerLayer));
    //    //Debug.Log(hitEnemies.Length);
    //    foreach (Collider2D hits in hitPlayers)
    //    {
    //        hits.GetComponent<HealthManager>().TakeDamage((int)attackDamage);

    //    }


    //}

    //void AttackManager()
    //{
    //    timeSinceAttack += Time.deltaTime;
    //    if (timeSinceAttack > attackRate)
    //    {
    //        timeSinceAttack = 0;
    //        Attack();
    //    }
    //}

    /// <summary>
    /// Zombies local scale is changed so that they are facing a player when in range
    /// </summary>
    /// <param name="playerPos"></param>
    void FaceTowardsPlayer(Vector2 playerPos)
    {
        if (transform.position.x < playerPos.x) transform.localScale = new Vector3(1, 1, 1);
        if (transform.position.x > playerPos.x) transform.localScale = new Vector3(-1, 1, 1);
        Debug.DrawLine(transform.position, playerPos, Color.red);
    }

    /// <summary>
    /// Returns a Vector2 of the closest player within its sight range, even if there's many
players in range.
    /// </summary>
    /// <returns></returns>
    public Vector2 playerInRangePosition()
    {
        Vector2 closePlayer = new Vector2(0, 0);
        float previousDistance = sightRange;
        if (playerInRange)
        {
            Collider2D[] players = (Physics2D.OverlapCircleAll(transform.position, sightRange,
playerLayer));
            float currentDistance;
            foreach (var item in players)
            {
                currentDistance = (Mathf.Sqrt((float)(System.Math.Pow((item.transform.position.x -
transform.position.x), 2) + System.Math.Pow((item.transform.position.y - transform.position.y),
2))));
                if (currentDistance < previousDistance)
                {
                    closePlayer = item.transform.position;
                    previousDistance = currentDistance;
                }
            }
        }
        return closePlayer;
    }

    /// <summary>
    /// The zombies will walk in an alternating direction for a random amount of time, as defined
in Start()
    /// </summary>
    void IdlePatrol()
    {
        float lengthOfTime = walkSpeed * patrolRange;
        if ((patrolRange > 0) && !playerInRange)
        {
            FaceTowardsWalkingDirection();
            timeSinceActive += Time.deltaTime;
            if (timeSinceActive > 2 * lengthOfTime)
            {
                timeSinceActive -= 2 * lengthOfTime;
            }


            if (timeSinceActive > lengthOfTime)
            {
                time = timeSinceActive - lengthOfTime;
                zombieRB.velocity = new Vector2(walkSpeed * transform.localScale.x,
zombieRB.velocity.y);

            }
            else
            {
                time = timeSinceActive;
                zombieRB.velocity = new Vector2(walkSpeed * transform.localScale.x,
zombieRB.velocity.y);

            }
        }
        timeSinceActive = 0;
    }

    /// <summary>
    /// If the zombie detects a block infront of itself that is only one block tall, it will jump
over it.
    /// </summary>
    void JumpUpByOneBlock()
    {
        if (Physics2D.Raycast(new Vector2(transform.position.x, transform.position.y - 0.5f), new
Vector2(transform.localScale.x, 0), 0.5f, groundLayer) && !Physics2D.Raycast(new
Vector2(transform.position.x, transform.position.y + 0.5f), new Vector2(transform.localScale.x,
0), 0.5f, groundLayer) && OnGround)
        {
            jumpForce = Mathf.Sqrt(jumpHeight * -2 * (Physics2D.gravity.y *
zombieRB.gravityScale));
            zombieRB.AddForce(new Vector3(0.0f, jumpForce, 0.0f), ForceMode2D.Impulse);
            //Debug.Log($"Jump Called, {jumpForce}");
        }

    }

    /// <summary>
    /// Faces the zombie towards its velocity.
    /// </summary>
    void FaceTowardsWalkingDirection()
    {
        if (zombieRB.velocity.x > 0)
        {
            transform.localScale = new Vector3(1, 1, 1);
        }
        if (zombieRB.velocity.x < 0)
        {
            transform.localScale = new Vector3(-1, 1, 1);
        }
    }

    /// <summary>
    /// Despawns during the daytime
    /// </summary>
    void TakeDamageDuringDay()
    {
        if (DayNightCycleInUse.isDay())
        {
            GetComponent<Zombie>().Despawn();
        }
    }

    /// <summary>
    /// Simple animation trigger
    /// </summary>
    void ZombieWalkAnimations()
    {
        if (zombieRB.velocity.x != 0)
        {
            animator.Play("ZombieWalk");
        }
        else animator.Play("ZombieIdle");
    }

    /// <summary>
    /// Unused on the server side
    /// </summary>
    /// <param name="damage"></param>
    /// <param name="isFromPlayer"></param>
    public void TakeDamage(int damage, bool isFromPlayer)
    {
        if (isFromPlayer)
        {
            FindObjectOfType<AudioManager>().Play("Mob Damage");

        }
        if (ZombieHealth - damage > 0)
        {
            ZombieHealth -= damage;

        }
        else Destroy(gameObject);

    }

    //public void ApplyKnockback(Vector2 attackPos)
    //{
    //    hasBeenKnockedBack = true;
    //    timeSinceKB = 0;
    //    Vector2 direction = ((Vector2)transform.position - attackPos).normalized;
    //    zombieRB.AddForce(direction * knockbackStrength, ForceMode2D.Impulse);
    //    Debug.Log(hasBeenKnockedBack);
    //}
}
```

Runs On GameObject: DayNightManager

Name: DayNightCycle.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class DayNightCycle : MonoBehaviour
{


    public float MoveY;
    public float DayOrNightTime;

    Vector3 StartPos;
    float timeSinceActive;
    float time;
    public bool DayNightEnabled { get; set; }


    void Start()
    {
        StartPos = transform.position;

    }

    // Days will be 5 mins, Nights wll be 5 mins
    void FixedUpdate()
    {
        if (FindObjectOfType<NetworkManager>().Server.IsRunning) MovingTheLight();
    }

    /// <summary>
    /// Moves the light source within the scene in a periodic vertical wave.
    /// </summary>
    void MovingTheLight()
    {
        if ((MoveY > 0) && DayOrNightTime > 0 && DayNightEnabled)
        {
            timeSinceActive += Time.deltaTime;
            if (timeSinceActive > 2 * DayOrNightTime)
            {
                timeSinceActive -= 2 * DayOrNightTime;
            }


            if (timeSinceActive > DayOrNightTime)
            {
                time = timeSinceActive - DayOrNightTime;
                transform.position = new Vector3(StartPos.x, (StartPos.y + MoveY) - MoveY * (time
/ DayOrNightTime), StartPos.z);

            }
            else
            {
                time = timeSinceActive;
                transform.position = new Vector3(StartPos.x, StartPos.y + MoveY * (time /
DayOrNightTime), StartPos.z);

            }

        }
    }

    /// <summary>
    /// Returns true if the light is far enough away for the ground to be dark.
    /// </summary>
    /// <returns></returns>
    public bool isDay()
    {
        if (timeSinceActive >= DayOrNightTime * 0.5 && timeSinceActive <= DayOrNightTime * 1.5)
return false;
        else return true;

    }
    /// <summary>
    /// Returns the position of the light
    /// </summary>
    /// <returns></returns>
    public Vector3 ReturnLightPosition() { return transform.position; }

}
```

Client Scripts

Runs On GameObject: NetworkManager

Name: NetworkManager.cs

```
using RiptideNetworking;
using RiptideNetworking.Utils;
using UnityEngine;
using System;
using TMPro;
//using UnityEditor.Experimental.GraphView;

public enum ServerToClientId : ushort
{
    playerSpawned = 1,
    map,
    syncNonLocalPosition,
    syncMapUpdate,
    lightPosition,
    zombieSpawning,
    zombiePosition,
    zombieDeath,
    textChat,
}

public enum ClientToServerId : ushort
{
    name = 1,
    updatePlayerPosition,
    updateServerMap,
    zombieDeath,
    updateTextChat,
}


public class NetworkManager : MonoBehaviour
{
    private static NetworkManager instance;

    public static NetworkManager Instance
    {
        get => instance;
        private set
        {
            if (instance == null) instance = value;
            else if (instance != value)
            {
                Debug.Log($"{nameof(NetworkManager)} instance already exists, destroying new");
                Destroy(value);
            }
        }
    }

    public Client Client { get; private set; }
    public TextChatManger DebugText;
    //[SerializeField] private string ip;
    //[SerializeField] private ushort port;

    private void Awake()
    {
        instance = this;
        Application.runInBackground = true;
    }
    /// <summary>
    /// Functions Added to the Clients methods that are called ontop of the normal methods,
similar to overrides
    /// </summary>
    private void Start()
    {
        RiptideLogger.Initialize(Debug.Log, Debug.Log, Debug.LogWarning, Debug.LogError, false);
        Client = new Client();

        Client.Connected += DidConnect;
        Client.ConnectionFailed += FailedToConnect;
        Client.Disconnected += DidDisconnect;
        Client.ClientDisconnected += PlayerLeft;
        //Client.Disconnect += CalledLeave;
    }

    ///
    private void FixedUpdate()
    {
        Client.Tick();

    }

    private void OnApplicationQuit()
    {
        Client.Disconnect();
    }

    public void Connect(string ip, ushort port)
    {
        //DebugText.AddToChat($"Attemping Connection on {ip}:{port}, at
{Time.realtimeSinceStartup}");
        Client.Connect($"{ip}:{port}");
    }



    private void PlayerLeft(object sender, ClientDisconnectedEventArgs e)
    {
        Destroy(Player.list[e.Id]);
    }

    private void DidConnect(object sender, EventArgs e)
    {
        UIManager.Instance.SendName();
        DebugText.AddToChat($"Connected at {Time.realtimeSinceStartup}");
    }

    private void FailedToConnect(object sender, EventArgs e)
    {
        DebugText.AddToChat($"Failed To Connect at {Time.realtimeSinceStartup}");
        UIManager.Instance.BackToMain();
    }

    /// <summary>
    /// If a client diconnects all Local and Non-Local players need to be destroyed
    /// </summary>
    /// <param name="sender"></param>
    /// <param name="e"></param>
        private void DidDisconnect(object sender, EventArgs e)
    {
        DebugText.AddToChat($"Disconnected at {Time.realtimeSinceStartup}");
        UIManager.Instance.BackToMain();
        RemoveEntities();
        UIManager.Instance.BackToMain();


    }

    public void CalledLeave()
    {
        Client.Disconnect();
        DebugText.AddToChat($"Player Called Left at {Time.realtimeSinceStartup}");
        Debug.Log("Disconnect Called");
        RemoveEntities();
        UIManager.Instance.BackToMain();
    }

    void RemoveEntities()
    {
        foreach (Player players in Player.list.Values)
        {
            Destroy(players.gameObject);
        }
        foreach (Zombie item in Zombie.list.Values)
        {
            Destroy(item.gameObject);
        }
    }

}
```

Runs On GameObject: N/A //From to RiptideNetworking GitHub

Name: MessageExtension.cs

```
using RiptideNetworking;
using UnityEngine;

public static class MessageExtensions
{
    #region Vector2
    /// <inheritdoc cref="Add(Message, Vector2)"/>
    /// <remarks>Relying on the correct Add overload being chosen based on the parameter type can
increase the odds of accidental type mismatches when retrieving data from a message. This method
calls <see cref="Add(Message, Vector2)"/> and simply provides an alternative type-explicit way to
add a <see cref="Vector2"/> to the message.</remarks>
    public static Message AddVector2(this Message message, Vector2 value) => Add(message, value);

    /// <summary>Adds a <see cref="Vector2"/> to the message.</summary>
    /// <param name="value">The <see cref="Vector2"/> to add.</param>
    /// <returns>The message that the <see cref="Vector2"/> was added to.</returns>
    public static Message Add(this Message message, Vector2 value)
    {
        message.AddFloat(value.x);
        message.AddFloat(value.y);
        return message;
    }

    /// <summary>Retrieves a <see cref="Vector2"/> from the message.</summary>
    /// <returns>The <see cref="Vector2"/> that was retrieved.</returns>
    public static Vector2 GetVector2(this Message message)
    {
        return new Vector2(message.GetFloat(), message.GetFloat());
    }
    #endregion

    #region Vector3
    /// <inheritdoc cref="Add(Message, Vector3)"/>
    /// <remarks>Relying on the correct Add overload being chosen based on the parameter type can
increase the odds of accidental type mismatches when retrieving data from a message. This method
calls <see cref="Add(Message, Vector3)"/> and simply provides an alternative type-explicit way to
add a <see cref="Vector3"/> to the message.</remarks>
    public static Message AddVector3(this Message message, Vector3 value) => Add(message, value);

    /// <summary>Adds a <see cref="Vector3"/> to the message.</summary>
    /// <param name="value">The <see cref="Vector3"/> to add.</param>
    /// <returns>The message that the <see cref="Vector3"/> was added to.</returns>
    public static Message Add(this Message message, Vector3 value)
    {
        message.AddFloat(value.x);
        message.AddFloat(value.y);
        message.AddFloat(value.z);
        return message;
    }

    /// <summary>Retrieves a <see cref="Vector3"/> from the message.</summary>
    /// <returns>The <see cref="Vector3"/> that was retrieved.</returns>
    public static Vector3 GetVector3(this Message message)
    {
        return new Vector3(message.GetFloat(), message.GetFloat(), message.GetFloat());
    }
    #endregion

    #region Quaternion
    /// <inheritdoc cref="Add(Message, Quaternion)"/>
    /// <remarks>Relying on the correct Add overload being chosen based on the parameter type can
increase the odds of accidental type mismatches when retrieving data from a message. This method
calls <see cref="Add(Message, Quaternion)"/> and simply provides an alternative type-explicit way
to add a <see cref="Quaternion"/> to the message.</remarks>
    public static Message AddQuaternion(this Message message, Quaternion value) => Add(message,
value);

    /// <summary>Adds a <see cref="Quaternion"/> to the message.</summary>
    /// <param name="value">The <see cref="Quaternion"/> to add.</param>
    /// <returns>The message that the <see cref="Quaternion"/> was added to.</returns>
    public static Message Add(this Message message, Quaternion value)
    {
        message.AddFloat(value.x);
        message.AddFloat(value.y);
        message.AddFloat(value.z);
        message.AddFloat(value.w);
        return message;
    }

    /// <summary>Retrieves a <see cref="Quaternion"/> from the message.</summary>
    /// <returns>The <see cref="Quaternion"/> that was retrieved.</returns>
    public static Quaternion GetQuaternion(this Message message)
    {
        return new Quaternion(message.GetFloat(), message.GetFloat(), message.GetFloat(),
message.GetFloat());
    }
    #endregion
}
```

Runs On GameObject: NetworkManager

Name: GameLogic.cs

```
using RiptideNetworking;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class GameLogic : MonoBehaviour
{
    private static GameLogic instance;
    private static GameObject worldLight;

    /// <summary>
    /// Creates a Singleton
    /// </summary>
    public static GameLogic Instance
    {
        get => instance;
        private set
        {
            if (instance == null) instance = value;
            else if (instance != value)
            {
                Debug.Log($"{nameof(GameLogic)} instance already exists, destroying new");
                Destroy(value);
            }
        }
    }

    /// <summary>
    /// Called before the object is loaded
    /// </summary>
    private void Awake()
    {
        instance = this;
        worldLight = FindObjectOfType<DayNightCycle>().gameObject;
    }

    /// <summary>
    /// Enable indirect access to the gameobjects, for security reasons
    /// </summary>
    public GameObject LocalPlayerPrefab => localPlayerPrefab;
    public GameObject PlayerPrefab => playerPrefab;
    //public GameObject ZombiePrefab => zombiePrefab;


    /// <summary>
    /// Serialised Fields are used to make the variables show up in the Unity Editor while
remaining private
    /// </summary>
    [Header("Prefabs")]
    [SerializeField] private GameObject localPlayerPrefab;
    [SerializeField] private GameObject playerPrefab;



    /// <summary>
    /// Message Handler for moving the light source within the scene
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)ServerToClientId.lightPosition)]
    private static void ClientLightPosition(Message message)
    {
        worldLight.transform.position = (message.GetVector3());
        //Debug.Log("light pos received");
    }

    /// <summary>
    /// Enable indirect access to the gameobjects, for security reasons
    /// </summary>
    public GameObject ZombiePrefab => zombiePrefab;


    [SerializeField] private GameObject zombiePrefab;

}
```

Runs On GameObject: UI Canvas

Name: UIManager.cs

```
using RiptideNetworking;
using System.Collections;
using System.Collections.Generic;
using Unity.VisualScripting;
using UnityEngine;
using UnityEngine.UI;
using TMPro;
//using UnityEditor.Experimental.GraphView;
using System;

public class UIManager : MonoBehaviour
{
    private static UIManager instance;

    /// <summary>
    /// Creates a Singleton, to ensure that only one version of this class is used
    /// </summary>
    public static UIManager Instance
    {
        get => instance;
        private set
        {
            if (instance == null) instance = value;
            else if (instance != value)
            {
                Debug.Log($"{nameof(UIManager)} instance already exists, destroying new");
                Destroy(value);
            }
        }
    }

    [Header("Connect")]
    [SerializeField] private GameObject connectUI;
    [SerializeField] private TMP_InputField usernameField;
    [SerializeField] private TMP_InputField ipField;
    [SerializeField] private TMP_InputField portField;

    /// <summary>
    /// Is run before the object is loaded into the scene
    /// </summary>
    private void Awake()
    {
        instance = this;
    }

    /// <summary>
    /// Accessible by the connect button, checks for IP and Port fields not being valid
    /// </summary>
    public void ConnectClicked()
    {
        if (portField.text.Length == 4 && !String.IsNullOrEmpty(ipField.text))
        {
            usernameField.interactable = false;
            connectUI.SetActive(false);
            NetworkManager.Instance.DebugText.AddToChat($"Attemping Connection on
{ipField.text}:{System.Convert.ToUInt16(portField.text)}, at {Time.realtimeSinceStartup}");
            NetworkManager.Instance.Connect(ipField.text,
System.Convert.ToUInt16(portField.text));
        }

    }

    /// <summary>
    /// Used to return the user to the main menu, if they are disconnected or fail to join
    /// </summary>
    public void BackToMain()
    {
        usernameField.interactable = true;
        connectUI.SetActive(true);
    }

    /// <summary>
    /// Sends the username of as new client to the Server
    /// </summary>
    public void SendName()
    {
        RiptideNetworking.Message message = Message.Create(MessageSendMode.reliable,
(ushort)ClientToServerId.name);
        message.AddString(usernameField.text);
        NetworkManager.Instance.Client.Send(message);
    }
}
```

Runs On GameObject: Local and Non-Local Player

Name: Player.cs

```
using System.Collections;
using RiptideNetworking;
using RiptideNetworking.Utils;
using System.Collections.Generic;
using UnityEngine;
using Unity.VisualScripting;
using TMPro;

public class Player : MonoBehaviour
{
    public static Dictionary<ushort, Player> list = new Dictionary<ushort, Player>();

    public ushort Id { get; private set; }
    public bool IsLocal { get; private set; }
    public string userName { get; private set; }

    [SerializeField] private GenerationScriptV2 Generation;
    private void OnDestroy()
    {
        list.Remove(Id);
    }

    /// <summary>
    /// Runs 60 time per second
    /// </summary>
    private void FixedUpdate()
    {
        PassingPlayerPositionToServer();
    }

    /// <summary>
    /// Sends the Vector3 of the players position to the server
    /// </summary>
    private void PassingPlayerPositionToServer()
    {
        if (Id == NetworkManager.Instance.Client.Id)
        {
            //Debug.Log("positon Update called");
            RiptideNetworking.Message message = Message.Create(MessageSendMode.unreliable,
(ushort)ClientToServerId.updatePlayerPosition);

message.AddVector3(list[NetworkManager.Instance.Client.Id].gameObject.transform.position);
            //message.AddUShort(Id);
            NetworkManager.Instance.Client.Send(message);
        }
    }

    /// <summary>
    /// Called by the server, Adds the player to the Dictionary along with filling out variables.
Also spawns in a gameObject for Local and Non-Local players.
    /// </summary>
    /// <param name="id"></param>
    /// <param name="username"></param>
    /// <param name="position"></param>
    public static void Spawn(ushort id, string username, Vector3 position)
    {
        Player player;
        if (id == NetworkManager.Instance.Client.Id)
        {
            player = Instantiate(GameLogic.Instance.LocalPlayerPrefab, position,
Quaternion.identity).GetComponent<Player>();
            player.IsLocal = true;
            player.gameObject.GetComponent<usernameText>().ApplyUserName(username);
        }
        else
        {
            player = Instantiate(GameLogic.Instance.PlayerPrefab, position,
Quaternion.identity).GetComponent<Player>();
            player.IsLocal = false;
            player.gameObject.GetComponent<usernameText>().ApplyUserName(username);
        }
        player.name = $"Player {id} ({(string.IsNullOrEmpty(username) ? "Guest" : username)})";
        player.Id = id;
        player.userName = username;
        list.Add(id, player);
    }

    //private static void CallMapBuild(int xlength, int ylength, int[] mapAs1DArray)
    //{
    //    int[,] map = new int[xlength, ylength];
    //    //int tempy = 0;
    //    for (int y = 0; y < ylength; y++)
    //    {
    //        for (int x = 0; x < xlength; x++)
    //        {
    //            map[x, y] = mapAs1DArray[x];
    //        }
    //    }
    //    FindObjectOfType<GenerationScriptV2>().Renderer(map);
    //    FindObjectOfType<GenerationScriptV2>().setMap(map);
    //}

    /// <summary>
    /// Sends an update request to the server for the text chat, upon this client adding to it
    /// </summary>
    /// <param name="text"></param>
    public void UpdateTextChat(string text)
    {
        Message message = Message.Create(MessageSendMode.reliable,
(ushort)ClientToServerId.updateTextChat);
        message.AddString(text);
        NetworkManager.Instance.Client.Send(message);
    }

    /// <summary>
    /// Called from within the build/break block function by the client to inform the server a
block has been altered.
    /// </summary>
    /// <param name="x"></param>
    /// <param name="y"></param>
    /// <param name="block"></param>
    public void SendBlockUpdateToServer(int x, int y, byte block)
    {
        RiptideNetworking.Message message = Message.Create(MessageSendMode.reliable,
(ushort)ClientToServerId.updateServerMap);
        message.AddInt(x);
        message.AddInt(y);
        message.AddByte(block);
        NetworkManager.Instance.Client.Send(message);
    }

    /// <summary>
    /// Called from a message handler below to fill in a layer of the map.
    /// </summary>
    /// <param name="mapSlice"></param>
    /// <param name="mapLayer"></param>
    private static void CallMapBuild(byte[] mapSlice, short mapLayer)
    {
        FindObjectOfType<GenerationScriptV2>().setMapByLayer(mapSlice, mapLayer);
    }

    /// <summary>
    /// Message sent from the server to spawn a player.
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)(ServerToClientId.playerSpawned))]
    private static void SpawnPlayer(Message message)
    {
        Spawn(message.GetUShort(), message.GetString(), message.GetVector3());
    }

    /// <summary>
    /// Message handler for recieveding layers of the map from the server.
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)(ServerToClientId.map))]
    private static void GettingMapFromServer(Message message)
    {

        //
        short Layer = message.GetShort();
        int lengthofByteArray = message.GetInt();
        byte[] ByteArray = new byte[lengthofByteArray];
        message.GetBytes(lengthofByteArray, ByteArray);
        //short LayerInteger = message.GetShort();
        //Debug.Log(LayerInteger);
        //Debug.LogAssertion(Layer);
        //Debug.Log("Received Call From Server To Build Map");

        CallMapBuild(ByteArray, Layer);
        message.Release();

    }

    /// <summary>
    /// Syncs the position on Non-Local player to the position provided by the server.
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)(ServerToClientId.syncNonLocalPosition))]
    private static void SyncingPlayers(Message message)
    {
        ushort playerID = message.GetUShort();
        Vector3 playerPosition = message.GetVector3();
        if (playerID != NetworkManager.Instance.Client.Id)
        {
            Player.list[playerID].gameObject.transform.position = playerPosition;
        }
        message.Release();

    }

    /// <summary>
    /// Updates the Client's map from any changes to the servers map, made by other clients
connected
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)(ServerToClientId.syncMapUpdate))]
    private static void SyncingMaps(Message message)
    {
        int xPos = message.GetInt();
        int yPos = message.GetInt();
        byte block = message.GetByte();
        //Debug.Log($"Block Update Called at {(int)BlockPos.x}:{(int)BlockPos.y} for {block}");

FindObjectOfType<WorldEventManager>().GetComponentInChildren<GenerationScriptV2>().ServerUpdatingB
lock(block, xPos, yPos);
        message.Release();
        //UpdatePlayerMaps(block, xPos, yPos, fromClientId);

    }

    /// <summary>
    /// Syncs the text chat if any other client has added to it
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)ServerToClientId.textChat)]
    private static void SyncingTextChat(Message message)
    {
        if (message.GetUShort() == NetworkManager.Instance.Client.Id)
        {
            FindObjectOfType<TextChatManger>().AddToChat(message.GetString());
        }

        message.Release();
    }


}
```

Runs On GameObject: Zombie

Name: Zombie.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using RiptideNetworking;
using RiptideNetworking.Utils;

public class Zombie : MonoBehaviour
{
    /// <summary>
    /// Dictionary that stores the Class and Id of each zombie
    /// </summary>
    public static Dictionary<ushort, Zombie> list = new Dictionary<ushort, Zombie>();

    public ushort Id { get; private set; }


    private void OnDestroy()
    {
        list.Remove(Id);
    }

    /// <summary>
    /// Requests to despawn zombies from the server, which will then remove them and tell the
client.
    /// </summary>
    public void DespawnFromClient()
    {
        Message message = Message.Create(MessageSendMode.reliable,
(ushort)ClientToServerId.zombieDeath);
        message.AddUShort(Id);
        NetworkManager.Instance.Client.Send(message);
        //Destroy(list[Id].gameObject);
    }

    /// <summary>
    /// Message Handler for spawning a zombie, at a given position and with Id.
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)ServerToClientId.zombieSpawning)]
    private static void Spawn(Message message)
    {
        Zombie zombie = Instantiate(GameLogic.Instance.ZombiePrefab, message.GetVector3(),
Quaternion.identity).GetComponent<Zombie>();
        zombie.Id = message.GetUShort();
        list.Add(zombie.Id, zombie);
    }
    /// <summary>
    /// Message handler for updating the postition of a zombie from the server
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)ServerToClientId.zombiePosition)]
    private static void UpdatingZombiePosition(Message message)
    {
        list[message.GetUShort()].gameObject.transform.position = message.GetVector3();
    }

    /// <summary>
    /// Update the dictionary, with any zombie despawns requested by the server
    /// </summary>
    /// <param name="message"></param>
    [MessageHandler((ushort)ServerToClientId.zombieDeath)]
    private static void DespawnZombie(Message message)
    {
        ushort idOfDeath = message.GetUShort();
        Destroy(list[idOfDeath].gameObject);
        message.Release();
    }
}
```

Runs On GameObject: GeneratorV2

Name: GenerationScriptV2.cs

```
using System;
using System.Collections;
using System.Collections.Generic;
using System.IO;
using System.Text;
using Unity.VisualScripting;
using UnityEngine;
using UnityEngine.Tilemaps;
using UnityEngine.UI;


public class GenerationScriptV2 : MonoBehaviour
{
    // Start is called before the first frame update
    public int worldWidth = 1024;
    public int worldHeight = 256;
    public bool terrainGenerationComplete { get; private set; }


    [SerializeField] float Seed;
    [SerializeField] float StoneSeed;
    //[SerializeField] float CaveSeed;
    [SerializeField] float OreSeed;

    float Smoothness = 40;
    float OreThreshhold = 0.1f;
    //float CaveThreshhold = 0.7f;


    [SerializeField] TileBase GrassSoil;
    [SerializeField] TileBase Stone;
    [SerializeField] TileBase SoilBG;
    [SerializeField] TileBase StoneBG;
    [SerializeField] TileBase Ore;
    [SerializeField] TileBase Log;
    [SerializeField] TileBase Leaf;
    [SerializeField] TileBase Plank;

    [SerializeField] Tilemap TestTileFG;
    [SerializeField] Tilemap TestTileBG;

    [SerializeField] public Slider SeedSlider;
    [SerializeField] public Slider StoneSlider;
    //[SerializeField] public Slider CaveSlider;

    [SerializeField] float RandomPercentFill;
    [SerializeField] int iterations;
    [SerializeField] int TreePopulation;

    string worldName;

    byte[,] map;
    byte[,] cavemap;
    //int layer;


    void Start()
    {
        worldWidth = 1024;
        worldHeight = 256;
        map = new byte[worldWidth, worldHeight];

        //layer = 0;

        //terrainGenerationComplete = Generation();
    }

    //void Update()
    //{
    //    if (Input.GetKeyDown(KeyCode.Space))
    //    {
    //        Debug.Log("Reloading");
    //        Generation();
    //    }
    public void SetWorldName(string name) { worldName = name; }

    /// <summary>
    /// Returns the block broken to the player.
    /// </summary>
    /// <param name="x"></param>
    /// <param name="y"></param>
    /// <returns></returns>
    public int BreakBlock(int x, int y)
    {
        //Debug.Log($"breakblock called, position {x}, {y}");
        if (x >= worldWidth || y >= worldHeight) return 0;


        if (!(map[x, y] == 8 || map[x, y] == 9 || map[x, y] == 0))
        {
            TestTileFG.SetTile(new Vector3Int(x, y, 0), null);
            TestTileFG.RefreshTile(new Vector3Int(x, y, 0));
            int block = map[x,y];
            if (map[x, y] == 1)
            {
                map[x, y] = 8;
            }
            else if (map[x, y] == 2 || map[x, y] == 3)
            {
                map[x, y] = 9;
            }
            else map[x, y] = 0;
            FindObjectOfType<AudioManager>().Play("Block Break");
            FindObjectOfType<Player>().SendBlockUpdateToServer(x, y, map[x,y]);
            return block;
        }
        return 0;
    }

    /// <summary>
    /// Used to update the map without checks as this is called by the server and has already been
check on the other clients end.
    /// </summary>
    /// <param name="block"></param>
    /// <param name="x"></param>
    /// <param name="y"></param>
    public void ServerUpdatingBlock(int block, int x, int y)
    {
        if (x >= worldWidth || y >= worldHeight) return;
        map[x, y] = (byte)block;
        TileBase placing = Plank;
        switch (block)
        {
            case 0:
                placing = null;
                break;
            case 1:
                placing = GrassSoil;
                break;
            case 2:
                placing = Stone;
                break;
            case 4:
                placing = Log;
                break;
            case 5:
                placing = Leaf;
                break;
            case 6:
                placing = Plank;
                break;
            case 8:
                placing = SoilBG;
                break;
            case 9:
                placing = StoneBG;
                break;
            default:
                break;

        }
        if (block == 8 || block == 9)
        {
            TestTileBG.SetTile(new Vector3Int(x, y, 0), placing);
            TestTileFG.SetTile(new Vector3Int(x, y, 0), null);
            TestTileBG.RefreshTile(new Vector3Int(x, y, 0));
            TestTileFG.RefreshTile(new Vector3Int(x, y, 0));

        }
        else
        {
            TestTileFG.SetTile(new Vector3Int(x, y, 0), placing);
            TestTileFG.RefreshTile(new Vector3Int(x, y, 0));
            TestTileBG.RefreshTile(new Vector3Int(x, y, 0));
        }

        //Renderer(map, TestTileFG, TestTileBG);
        //Debug.Log("GenerationScript Called");
    }

    /// <summary>
    /// Used in TimeBreaking() to find the amount of time it takes to break a block. Also used to
add to teh players inventory
    /// </summary>
    /// <param name="x"></param>
    /// <param name="y"></param>
    /// <returns></returns>
    public int ReturnTypeOfBlock(int x, int y)
    {
        if (x >= worldWidth || y >= worldHeight) return 0;
        if (!(map[x, y] == 8 || map[x, y] == 9 || map[x, y] == 0))
        {
            int block = map[x, y];
            return block;
        }
        return 0;
    }

    /// <summary>
    /// Builds a block at the given position of given type. Check that the placement is valid
    /// </summary>
    /// <param name="block"></param>
    /// <param name="x"></param>
    /// <param name="y"></param>
    /// <returns></returns>
    public bool BuildBlock(int block,int x, int y)
    {
        if (x >= worldWidth || y >= worldHeight) return false;
        //Debug.Log($"buildblock called, position {x}, {y}");
        if ((map[x-1,y] != 0 || map[x + 1, y] != 0 || map[x, y - 1] != 0 || map[x, y + 1] != 0) &&
(map[x,y] == 0 || map[x, y] == 8 || map[x, y] == 9))
        {
            map[x, y] = (byte)block;
            TileBase placing = Plank;
            switch (block)
            {
                case 1:
                    placing = GrassSoil;
                    break;
                case 2:
                    placing = Stone;
                    break;
                case 4:
                    placing = Log;
                    break;
                case 5:
                    placing = Leaf;
                    break;
                case 6:
                    placing = Plank;
                    break;
                default:
                    return false;
            }

            TestTileFG.SetTile(new Vector3Int(x, y, 0), placing);
            TestTileFG.RefreshTile(new Vector3Int(x, y, 0));
            FindObjectOfType<AudioManager>().Play("Block Place");
            FindObjectOfType<Player>().SendBlockUpdateToServer(x, y, map[x, y]);
            return true;
        }
        return false;
    }




    /// <summary>
    /// Adds to teh 2D map array layer by layer, this is done as the capacity for mesages is 1200
byte, therefore the map must be sent layer by layer in order to fit.
    /// </summary>
    /// <param name="newmap"></param>
    /// <param name="layer"></param>
    public void setMapByLayer(byte[] newmap, short layer)
    {
        Debug.Log($"layer is {layer}");
        for (int x = 0; x < map.GetLength(0); x++)
        {

            map[x, layer] = newmap[x];
        }
        if (layer == worldHeight - 1)
        {
            Renderer(map);
        }
        //layer++;

    }

    /// <summary>
    /// Renders teh content of the 2D array to the Tilemaps
    /// </summary>
    /// <param name="MapToRender"></param>
    public void Renderer(byte[,] MapToRender)
    {
        TestTileFG.ClearAllTiles();
        TestTileBG.ClearAllTiles();
        for (int x = 0; x < worldWidth; x++)
        {
            for (int y = 0; y < worldHeight; y++)
            {
                if (MapToRender[x, y] == 1)
                {
                    TestTileFG.SetTile(new Vector3Int(x, y, 0), GrassSoil);
                    TestTileBG.SetTile(new Vector3Int(x, y, 0), SoilBG);
                }
                if (MapToRender[x, y] == 2)
                {
                    TestTileFG.SetTile(new Vector3Int(x, y, 0), Stone);
                    TestTileBG.SetTile(new Vector3Int(x, y, 0), StoneBG);
                }
                if (MapToRender[x, y] == 3)
                {
                    TestTileFG.SetTile(new Vector3Int(x, y, 0), Ore);
                    TestTileBG.SetTile(new Vector3Int(x, y, 0), StoneBG);
                }
                if (MapToRender[x,y] == 4)
                {
                    TestTileFG.SetTile(new Vector3Int(x, y, 0), Log);
                }
                if (MapToRender[x, y] == 5)
                {
                    TestTileFG.SetTile(new Vector3Int(x, y, 0), Leaf);
                }
                if (MapToRender[x, y] == 6)
                {
                    TestTileFG.SetTile(new Vector3Int(x, y, 0), Plank);
                }
                if (MapToRender[x,y] == 8)
                {
                    TestTileBG.SetTile(new Vector3Int(x, y, 0), SoilBG);
                }
                if (MapToRender[x, y] == 9)
                {
                    TestTileBG.SetTile(new Vector3Int(x, y, 0), StoneBG);
                }
            }
        }
    }



    public byte[,] sendMap()
    {
        return map;
    }


    public Vector3Int PlayerSpawnPoint()
    {
        Debug.Log("called");
        Debug.Log(worldHeight);
        Debug.Log(worldWidth);

        int tempy = worldHeight - 1;
        while (map[worldWidth/2, tempy] == 0)
        {
            tempy--;
        }
        tempy += 2;
        Debug.Log($"{worldWidth / 2}, {tempy}");
        return new Vector3Int(worldWidth / 2, tempy, 0);
    }



}
```

Runs On GameObject: LocalPlayer

Name: PlayerController.cs

```
using System.Collections;
using System.Collections.Generic;
using TMPro;
using UnityEngine;

public class PlayerController : MonoBehaviour
{
    public float moveX;
    public float speed;
    public float jumpHeight;
    public bool OnTheGround;
    public float checkradius;
    public CapsuleCollider2D PlayerCC;
    public Rigidbody2D PlayerRB;
    public LayerMask groundLayer;
    Animator animator;

    float jumpForce;
    bool facingRight = true;

    bool isFalling { get { return (!OnTheGround && PlayerRB.velocity.y < 0); } }
    bool wasFalling;
    bool wasGrounded;
    float startofFall;

    // Start is called before the first frame update

    void Start()
    {
        animator = GetComponent<Animator>();

    }

    // Update is called once per frame
    /// <summary>
    /// Takes in the users inputs to control the player
    /// </summary>
    void Update()
    {
        if (GetComponentInChildren<PlayerMenuManager>().hasAnyMenuOpen) return;
        xMovePlayer();
        PlayerWalkAnimation();
        //PlayerFall();

        jumpForce = Mathf.Sqrt(jumpHeight * -2 * (Physics2D.gravity.y * PlayerRB.gravityScale));
        if (Input.GetKey(KeyCode.Space) && OnGround())
        {
            PlayerRB.AddForce(new Vector3(0.0f, jumpForce, 0.0f), ForceMode2D.Impulse);
        }

        //Debug.Log(PlayerRB.velocity.x);

    }

    /// <summary>
    /// Control the players movement on the x-axis
    /// </summary>
    void xMovePlayer()
    {
        PlayerDirection();
        moveX = Input.GetAxis("Horizontal");
        Vector2 movement = new Vector2(moveX, 0);
        if (OnGround()) PlayerRB.velocity = movement * speed;
        else if (!OnGround() && moveX != 0) PlayerRB.AddForce(new Vector2(transform.localScale.x, 
0));
    }

    /// <summary>
    /// Faces towards the input
    /// </summary>
    void PlayerDirection()
    {

        if (moveX < 0.0f && facingRight)
        {
            FlipPlayer();
        }
        else if (moveX > 0.0f && !facingRight)
        {
            FlipPlayer();
        }
    }

    /// <summary>
    /// Changes the x-orientation of the player
    /// </summary>
    void FlipPlayer()
    {
        facingRight = !facingRight;
        Vector2 localScale = gameObject.transform.localScale;
        localScale.x *= -1;
        transform.localScale = localScale;
        GetComponentInChildren<MeshRenderer>().transform.localScale = localScale;
    }

    /// <summary>
    /// Returns true if the player's feet overlap with the ground layer
    /// </summary>
    /// <returns></returns>
    bool OnGround()
    {
        Vector3 checkPos = new Vector3(transform.position.x, transform.position.y - 
PlayerCC.bounds.extents.y, 0);
        return Physics2D.OverlapCircle(checkPos, checkradius, groundLayer);

    }

    void PlayerWalkAnimation()
    {
        if (moveX != 0)
        {
            animator.Play("PlayerWalk");
        }
        else animator.Play("PlayerIdle");
    }

    /// <summary>
    /// Checks if the player has transitioned from a falling state to a landed state and check the 
distance fell
    /// </summary>
    void FixedUpdate()
    {
        OnTheGround = OnGround();
        if (!wasFalling && isFalling) startofFall = transform.position.y;
        if (!wasGrounded && OnTheGround) GetComponent<HealthManager>().FallDamage(startofFall -
transform.position.y);
        wasGrounded = OnTheGround;
        wasFalling = isFalling;
    }






}
```

Runs On GameObject: LocalPlayer

Name: BlockInteractions.cs

```
using System;
using System.Collections;
using System.Collections.Generic;
using System.IO;
using TMPro;
using UnityEngine;


public class BlockInteractions : MonoBehaviour
{
    public GameObject MapManagerObject;
    [SerializeField]
    Vector2 mousePos;
    public int block;
    /// <summary>
    /// The Player inventory is held in an array, with the ordinal number representing the type of
block and the value representing the quanity they have.
    /// </summary>
    public int[] inventory = new int[10];
    public int range;

    [SerializeField]
    public bool hasAxe { get; private set; }
    [SerializeField]
    public bool hasSword { get; private set; }

    [SerializeField]
    float timemining;
    Vector2 mousePostionOnCall;

    //[SerializeField] private string TempID;

    public string PlayerID { get; private set; }
    public TextMeshPro iDText;

    void Start()
    {
        //transform.position =
MapManagerObject.GetComponent<GenerationScriptV2>().PlayerSpawnPoint();
        //PlayerID = TempID;

        SetPlayerName();
        MapManagerObject = GameObject.Find("GeneratorV2");
    }
    public void SetPlayerName()
    {
        PlayerID = PassingVariables.playerID;
        iDText.text = PlayerID;
    }

    // Update is called once per frame
    void Update()
    {
        if (!GetComponentInChildren<PlayerMenuManager>().hasAnyMenuOpen)
        {
            mousePos = GetComponent<Camera>().ScreenToWorldPoint(Input.mousePosition);
            //if (Input.GetMouseButton(0)) Break();

            if (Input.GetMouseButton(1) && block == 0 && MouseInRange()) TimedBreaking();
            if (Input.GetMouseButtonDown(1) && block != 0 && MouseInRange()) Build(block);
        }



        //if (Input.GetKeyDown(KeyCode.P))
        //{
        //    LoadPlayerState("PlayerSaveFile.txt");
        //}
        //if (Input.GetKeyDown(KeyCode.O))
        //{
        //    SavePlayerState("PlayerSaveFile.txt");
        //}
    }

    /// <summary>
    /// Breaks a block in the Map Script and Increments the array at the given position
    /// </summary>
    void Break()
    {

//Debug.Log(MapManagerObject.GetComponent<GenerationScriptV2>().ReturnTypeOfBlock((int)System.Math
.Truncate(mousePos.x), (int)System.Math.Truncate(mousePos.y)));

inventory[MapManagerObject.GetComponent<GenerationScriptV2>().BreakBlock((int)System.Math.Truncate
(mousePos.x), (int)System.Math.Truncate(mousePos.y))]++;
    }

    /// <summary>
    /// Makes breaking a block take time
    /// </summary>
    void TimedBreaking()
    {
        if (timemining == 0) mousePostionOnCall = new
Vector2((int)System.Math.Truncate(mousePos.x), (int)System.Math.Truncate(mousePos.y));
        if (mousePostionOnCall == new Vector2((int)System.Math.Truncate(mousePos.x),
(int)System.Math.Truncate(mousePos.y)))
        {
            timemining += Time.deltaTime;
            //Debug.Log(timemining);
            if (timemining > AmountofTimetoBreak())
            {
                Break();
                //Debug.Log("Mined");
                timemining = 0;
            }
        }
        else timemining = 0;
    }

    /// <summary>
    /// Return the amount of time it take for each block type
    /// </summary>
    /// <returns></returns>
    float AmountofTimetoBreak()
    {
        float timetobreak;
        switch
(MapManagerObject.GetComponent<GenerationScriptV2>().ReturnTypeOfBlock((int)System.Math.Truncate(m
ousePos.x), (int)System.Math.Truncate(mousePos.y)))
        {
            case (1):
                timetobreak = 0.6f;
                break;
            case (2):
                timetobreak = 1.8f;
                break;
            case (3):
                timetobreak = 1.8f;
                break;
            case (4):
                timetobreak = 1f;
                break;
            case (5):
                timetobreak = 0.2f;
                break;
            case (6):
                timetobreak = 1f;
                break;
            default:
                timetobreak = 1f;
                break;
        }
        if (hasAxe)
        {
            return timetobreak / 2;
        }
        else return timetobreak;

    }

    /// <summary>
    /// Builds a block if its present in the inventory, deincreaments the inventory
    /// </summary>
    /// <param name="BlockPassed"></param>
    void Build(int BlockPassed)
    {
        if (inventory[BlockPassed] > 0 &&
MapManagerObject.GetComponent<GenerationScriptV2>().BuildBlock(BlockPassed,
(int)System.Math.Truncate(mousePos.x), (int)System.Math.Truncate(mousePos.y)))
        {
            inventory[BlockPassed]--;
        }

    }


    public void HudInput(int selectedBlock)
    {
        block = selectedBlock;
    }

    public string QuantityinInventory()
    {
        if (block == 0)
        {
            return "";
        }
        else return inventory[block].ToString();


    }

    /// <summary>
    /// Used to check if the player has sufficient materials to craft each item
    /// </summary>
    /// <param name="item"></param>
    /// <returns></returns>
    public bool RequestToCraft(int item)
    {
        if (item == 0 && !hasAxe)
        {
            if (inventory[2] >= 12 && inventory[3] >= 12 && inventory[6] >= 8)
            {
                inventory[2] -= 12;
                inventory[3] -= 12;
                inventory[6] -= 8;
                hasAxe = true;
                return true;
            }
        }
        if (item == 1 && !hasSword)
        {
            if (inventory[2] >= 12 && inventory[3] >= 10 && inventory[6] >= 4)
            {
                inventory[2] -= 12;
                inventory[3] -= 10;
                inventory[6] -= 4;
                hasSword = true;
                return true;
            }
        }
        if (item == 2)
        {
            if (inventory[4] >= 1)
            {
                inventory[4] -= 1;
                inventory[6] += 4;
                return true;
            }
        }
        return false;
    }

    /// <summary>
    /// Checks if the distance from the player to the mouse is below a given value
    /// </summary>
    /// <returns></returns>
    public bool MouseInRange()
    {
        if (Mathf.Sqrt((float)(System.Math.Pow((mousePos.x - transform.position.x), 2) +
System.Math.Pow((mousePos.y - transform.position.y), 2))) < range) return true;
        else return false;
    }

    /// <summary>
    /// Unused in final code, however has been left in incase of a version2
    /// </summary>
    /// <param name="worldName"></param>
    public void SavePlayerState(string worldName)
    {
        using (StreamWriter sw = new StreamWriter($"WorldSaves/{worldName}/{PlayerID}.txt"))
        {
            for (int i = 0; i < inventory.Length; i++)
            {
                sw.WriteLine(inventory[i]);
            }
            sw.WriteLine(transform.position.x);
            sw.WriteLine(transform.position.y);
            if (hasAxe) sw.WriteLine("1");
            else sw.WriteLine("0");
            if (hasSword) sw.WriteLine("1");
            else sw.WriteLine("0");
        }
    }

    /// <summary>
    /// Unused in final code, however has been left in incase of a version2
    /// </summary>
    /// <param name="worldName"></param>
    public void LoadPlayerState(string worldName)
    {
        string value;
        int i = 0;
        float tempx = 0;
        float tempy = 0;

        using (StreamReader sr = new StreamReader($"WorldSaves/{worldName}/{PlayerID}.txt"))
        {
            while ((value = sr.ReadLine()) != null)
            {
                //Debug.Log($"{i},{value},{(float)Convert.ToDouble(value)}");
                if (i < 10) inventory[i] = Convert.ToInt16(value);
                if (i == 10) tempx = (float)Convert.ToDouble(value);
                if (i == 11) tempy = (float)Convert.ToDouble(value);
                if (i == 12)
                {
                    if (value == "1") hasAxe = true;
                }
                else hasAxe = false;
                if (i == 13)
                {
                    if (value == "1") hasSword = true;
                }
                else hasSword = false;
                i++;
            }
            transform.position = new Vector2(tempx,tempy);
        }
    }

    /// <summary>
    /// Used on player death
    /// </summary>
    public void EmptyInventory()
    {
        hasAxe = false;
        hasSword = false;
        for (int i = 0; i < inventory.Length; i++)
        {
            inventory[i] = 0;
        }
    }
}
```

Runs On GameObject: LocalPlayer

Name: HealthManager.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;

public class HealthManager : MonoBehaviour
{
    public Image healthBar;
    public int playerHealth = 10;
    public float regenTime;
    float timeWhenDamage;
    float healthToGain;

    // Start is called before the first frame update
    void Start()
    {

    }

    // Update is called once per frame
    void FixedUpdate()
    {
        healthBar.rectTransform.localScale = new Vector3((float)playerHealth / 10, 1, 1);
        HealthRegeneration();
    }

    /// <summary>
    /// If the player takes damage from falling or from an attack it will call this function
    /// </summary>
    /// <param name="damage"></param>
    public void TakeDamage(int damage)
    {
        if (playerHealth - damage > 0)
        {
            playerHealth -= damage;
            timeWhenDamage = Time.time;
        }
        else PlayerDeath();
        FindObjectOfType<AudioManager>().Play("Take Damage");
    }

    /// <summary>
    /// Finds the amount of damage a fall will result in based on distance
    /// </summary>
    /// <param name="distance"></param>
    public void FallDamage(float distance)
    {
        // Debug.Log(Mathf.RoundToInt(distance / 4));
        if (distance > 6) TakeDamage(Mathf.RoundToInt(distance / 2));

    }

    /// <summary>
    /// Manages health regen
    /// </summary>
    void HealthRegeneration()
    {
        if (playerHealth < 10 && playerHealth != 0)
        {
            if (Time.time - timeWhenDamage > regenTime)
            {
                healthToGain += Time.deltaTime;
                playerHealth += Mathf.RoundToInt(healthToGain);
            }
            else healthToGain = 0;
        }
    }

    /// <summary>
    /// Called if the health is 0
    /// </summary>
    void PlayerDeath()
    {
        playerHealth = 10;
        FindObjectOfType<WorldEventManager>().PlayerDeath(gameObject);
    }
}
```

Runs On GameObject: LocalPlayer

Name: AttackManager.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class AttackManager : MonoBehaviour
{
    public GameObject Sword;
    public GameObject AttackPoint;
    public float AttackRate;
    public int AttackDamage;
    public LayerMask NPCLayer;


    Animator animator;
    float timeSinceAttack;

    // Start is called before the first frame update
    void Start()
    {
        animator = Sword.GetComponentInChildren<Animator>();
        Debug.DrawLine(Sword.transform.position, new Vector2(Sword.transform.position.x + 1,
Sword.transform.position.y + 2));
    }

    // Update is called once per frame
    /// <summary>
    /// Takes input from the users mouse and if they have crafted a sword then they attack
    /// </summary>
    void Update()
    {
        if (!GetComponentInChildren<PlayerMenuManager>().hasAnyMenuOpen)
        {
            timeSinceAttack += Time.deltaTime;
            if (Input.GetMouseButtonDown(0) && GetComponent<BlockInteractions>().hasSword &&
timeSinceAttack > AttackRate && GetComponent<BlockInteractions>().MouseInRange())
            {
                timeSinceAttack = 0;
                animator.Play("SwordSwing");
                FindObjectOfType<AudioManager>().Play("Sword Swing");
                Attack();

            }
        }


    }

    /// <summary>
    ///
    /// </summary>
    private void FixedUpdate()
    {
        if (GetComponent<BlockInteractions>().hasSword)
        {
            Sword.GetComponent<SpriteRenderer>().enabled = true;
        }
        else Sword.GetComponent<SpriteRenderer>().enabled = false;
    }

    /// <summary>
    /// Adds all entities of type NPC layer, within the capsule range, and adds then to an array
of colliders. It then calls the damage function for each
    /// </summary>
    void Attack()
    {
        Collider2D[] hitEnemies = (Physics2D.OverlapCapsuleAll(AttackPoint.transform.position, new
Vector2(1, 2), CapsuleDirection2D.Vertical, 0, NPCLayer));
        //Debug.Log(hitEnemies.Length);
        foreach(Collider2D hits in hitEnemies)
        {
            hits.GetComponent<ZombieControl>().TakeDamage();
            //hits.GetComponent<ZombieControl>().ApplyKnockback(transform.position);
        }


    }




}
```

Runs On GameObject: LocalPlayer

Name: UsernameText.cs

```
using System.Collections;
using System.Collections.Generic;
using TMPro;
using UnityEngine;

public class usernameText : MonoBehaviour
{
    [SerializeField] private TMP_Text userName;

    public void ApplyUserName(string name) { userName.text = name; }
}
```

Runs On GameObject: LocalPlayer - HUD

Name: HUDManager.cs

```
//using Microsoft.Unity.VisualStudio.Editor;
using System.Collections;
using System.Collections.Generic;
using TMPro;
using UnityEngine;
using UnityEngine.UI;

public class HUDManager : MonoBehaviour
{

    public int scrollPosition = 1;
    [SerializeField]
    public GameObject Player;
    public UnityEngine.UI.Image Icon;
    public Sprite axeIcon, emptyIcon;
    public Sprite[] BlockIcons = new Sprite[6];
    public TextMeshProUGUI quantityText;
    int[] blockKey = { 0 ,1, 2, 4, 5, 6 };

    public GameObject PauseDeathMenuManager;
    public GameObject craftMenu;
    bool craftMenuShowing;

    // Start is called before the first frame update
    void Start()
    {
        //Temporary Code
        //Player = GameObject.Find("Player");
    }

    // Update is called once per frame
    void Update()
    {

        if (!PauseDeathMenuManager.GetComponent<PlayerMenuManager>().hasAnyMenuOpen)
        {
            MouseScroll();
            SendtoPlayer();
            QuantityText();
        }

        //Debug.Log(block);
        //Debug.Log("running");
    }
    /// <summary>
    /// Changes the icon for the Axe tool if one has been crafted
    /// </summary>
    void FixedUpdate()
    {
        if (!PauseDeathMenuManager.GetComponent<PlayerMenuManager>().hasAnyMenuOpen)
        {
            if (PauseDeathMenuManager.GetComponent<PlayerMenuManager>().hasAnyMenuOpen) return;
            if (Player.GetComponent<BlockInteractions>().hasAxe) BlockIcons[0] = axeIcon;
            else BlockIcons[0] = emptyIcon;

            craftMenu.SetActive(craftMenuShowing);
        }

    }

    /// <summary>
    /// Controls which icon appears in the hud
    /// </summary>
    void MouseScroll()
    {
        if (Mathf.RoundToInt(Input.GetAxisRaw("Mouse ScrollWheel") * 10) == 1) HudUP();
        if (Mathf.RoundToInt(Input.GetAxisRaw("Mouse ScrollWheel") * 10) == -1) HudDown();
    }

    void SendtoPlayer()
    {
        Player.GetComponent<BlockInteractions>().HudInput(blockKey[Mathf.Abs(scrollPosition)]);
        Icon.sprite = BlockIcons[Mathf.Abs(scrollPosition)];


    }

    public void HudUP()
    {
        //Debug.Log("Up Called");
        scrollPosition += 1;
        scrollPosition = (scrollPosition % blockKey.Length);
        FindObjectOfType<AudioManager>().Play("Hud Interact");
    }

    public void HudDown()
    {
        //Debug.Log("Down Called");
        scrollPosition += -1;
        scrollPosition = (scrollPosition % blockKey.Length);
        FindObjectOfType<AudioManager>().Play("Hud Interact");
    }

    /// <summary>
    /// Returns a sprite to the itemInHand Script passing the item currently selected in the HUD
    /// </summary>
    /// <returns></returns>
    public Sprite PasstoHand()
    {
        return BlockIcons[Mathf.Abs(scrollPosition)];
    }

    /// <summary>
    /// Shows the Quanitity of block in in the inventory
    /// </summary>
    void QuantityText()
    {
        quantityText.text = (Player.GetComponent<BlockInteractions>().QuantityinInventory());
    }

    /// <summary>
    /// Toggles the crafting screen
    /// </summary>
    public void ToggleCraftMenu()
    {
        craftMenuShowing = !craftMenuShowing;
        FindObjectOfType<AudioManager>().Play("Hud Interact");
    }

    public void CraftRequestAxe()
    {
        if (Player.GetComponent<BlockInteractions>().RequestToCraft(0))
FindObjectOfType<AudioManager>().Play("Craft Success");
        else FindObjectOfType<AudioManager>().Play("Craft Fail");
    }

    public void CraftRequestSword()
    {
        if (Player.GetComponent<BlockInteractions>().RequestToCraft(1))
FindObjectOfType<AudioManager>().Play("Craft Success");
        else FindObjectOfType<AudioManager>().Play("Craft Fail");

    }

    public void CraftRequestPlank()
    {
        if (Player.GetComponent<BlockInteractions>().RequestToCraft(2))
FindObjectOfType<AudioManager>().Play("Craft Success");
        else FindObjectOfType<AudioManager>().Play("Craft Fail");
    }


}
```

Runs On GameObject: LocalPlayer - ItemInHand

Name: ItemInHandScript.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class iteminhandscript : MonoBehaviour
{
    // Start is called before the first frame update
    SpriteRenderer spriteRenderer;

    void Start()
    {
        spriteRenderer = GetComponent<SpriteRenderer>();
    }

    // Update is called once per frame
    void FixedUpdate()
    {
        spriteRenderer.sprite = FindObjectOfType<HUDManager>().PasstoHand();
    }
}
```

Runs On GameObject: LocalPlayer - HUD

Name: PlayerMenuManager.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class PlayerMenuManager : MonoBehaviour
{

    public GameObject PauseMenu;
    public GameObject DeathMenu;
    public GameObject Player;
    public bool hasAnyMenuOpen { get; private set; }

    bool hasDeathMenuOpen;
    bool hasPauseMenuOpen;

    // Start is called before the first frame update
    void Start()
    {
        hasDeathMenuOpen = false;
        hasPauseMenuOpen = false;
        hasAnyMenuOpen = false;
    }

    // Update is called once per frame
    void Update()
    {
        if (Input.GetKeyDown(KeyCode.Escape))
        {
            TogglePauseMenu();
        }
    }

    /// <summary>
    /// Toggles the Pause menu on Esc.
    /// </summary>
    void TogglePauseMenu()
    {
        Sound();
        if (!hasDeathMenuOpen)
        {
            if (hasPauseMenuOpen)
            {
                PauseMenu.SetActive(false);
                hasAnyMenuOpen = false;
                hasPauseMenuOpen = false;
            }
            else
            {
                PauseMenu.SetActive(true);
                hasAnyMenuOpen = true;
                hasPauseMenuOpen = true;
            }



        }

    }
    /// <summary>
    /// Accessed by the Resume button
    /// </summary>
    public void Resume()
    {
        PauseMenu.SetActive(false);
        hasPauseMenuOpen = false;
        hasAnyMenuOpen = false;
        Sound();
    }

    // <summary>
    /// Accessed by the Leave button
    /// </summary>
    public void Leave()
    {
        //Temporary Before Network Code
        Debug.Log("Leave Called");

        PauseMenu.SetActive(false);
        hasPauseMenuOpen = false;
        hasAnyMenuOpen = false;
        //Save();
        FindObjectOfType<NetworkManager>().CalledLeave();
        Sound();
    }

    /// <summary>
    /// Enable the overlay upon death
    /// </summary>
    public void EnableDeathScreen()
    {
        DeathMenu.SetActive(true);
        hasAnyMenuOpen = true;
        hasDeathMenuOpen = true;

    }

    /// <summary>
    /// Respawns the player
    /// </summary>
    public void Respawn()
    {
        DeathMenu.SetActive(false);
        hasAnyMenuOpen = false;
        hasDeathMenuOpen = false;
        FindObjectOfType<WorldEventManager>().PlayerRespawn(Player);
        Sound();
    }

    /// <summary>
    /// Unused
    /// </summary>
    public void Save()
    {
        FindObjectOfType<WorldEventManager>().SaveAll();
        Sound();
    }

    void Sound() { FindObjectOfType<AudioManager>().Play("Hud Interact"); }

}
```

Runs On GameObject: LocalPlayer - HUD

Name: PlayerTextChat.cs

```
using System.Collections;
using System.Collections.Generic;
using TMPro;
using UnityEngine;
using UnityEngine.UI;

public class PlayerTextChat : MonoBehaviour
{
    // Start is called before the first frame update
    public TMP_InputField input;


    public void Send()
    {
        FindObjectOfType<TextChatManger>().AddToChat(input.text);
        FindObjectOfType<AudioManager>().Play("Hud Interact");
        //GetComponent<Player>().UpdateTextChat(input.text);
        GetComponentInParent<Player>().UpdateTextChat(input.text);
    }


}
```

Runs On GameObject: TextChatHUD

Name: TextChatManager.cs

```
using System.Collections;
using System.Collections.Generic;
using TMPro;

using UnityEngine;
using UnityEngine.Rendering.Universal;
//using static UnityEditor.Progress;

public class TextChatManger : MonoBehaviour
{
    // Start is called before the first frame update
    public int chatLength;
    public Queue<string> messages;
    public TMP_Text chat;

    void Start()
    {
        messages = new Queue<string>(chatLength);
        //chat = GetComponent<TextMeshPro>();
        UpdateChat();
    }

    // Update is called once per frame
    void UpdateChat()
    {
        chat.text = "";
        int count = 1;
        foreach (var item in messages)
        {
            chat.text += "\n" + count.ToString() + " : " + item;
            count++;
        }

    }

    /// <summary>
    /// Adds to the chat, with overflow protection
    /// </summary>
    /// <param name="Message"></param>
    public void AddToChat(string Message)
    {
        if (messages.Count == chatLength)
        {
            messages.Dequeue();
            messages.Enqueue(Message);
        }
        else messages.Enqueue(Message);

        UpdateChat();

    }
}
```

Runs On GameObject: WorldEventManger

Name: WorldEventManager.cs

```
using System.Collections;
using System.Collections.Generic;
using Unity.VisualScripting;
using UnityEngine;

public class WorldEventManager : MonoBehaviour
{
    public bool EnableDayNightCycle = true;
    public GameObject PlayerPreFab;
    //public GameObject MapManager;

    // Start is called before the first frame update
    //void Start()
    //{
    //    GetComponentInChildren<GenerationScriptV2>().SetWorldName(PassingVariables.worldName);
    //    Debug.Log(PassingVariables.worldName);
    //    GetComponentInChildren<GenerationScriptV2>().Generation();
    //    Instantiate(PlayerPreFab,
GetComponentInChildren<GenerationScriptV2>().PlayerSpawnPoint(), Quaternion.identity);
    //    //Debug.Log("finito");

    //}

    // Update is called once per frame
    void FixedUpdate()
    {
        //GetComponentInChildren<DayNightCycle>().DayNightEnabled = EnableDayNightCycle;
    }

    /// <summary>
    /// Moves the player away from the world on death, then empties the inventory
    /// </summary>
    /// <param name="Player"></param>
    public void PlayerDeath(GameObject Player)
    {
        Player.GetComponentInChildren<PlayerMenuManager>().EnableDeathScreen();
        Player.GetComponent<BlockInteractions>().EmptyInventory();
        Player.transform.position = new Vector3(-1000, 0, 0);

    }

    /// <summary>
    /// Teleports the player from limbo, back to the centre of the map
    /// </summary>
    /// <param name="Player"></param>
    public void PlayerRespawn(GameObject Player)
    {
        Player.transform.position =
GetComponentInChildren<GenerationScriptV2>().PlayerSpawnPoint();
    }

    /// <summary>
    /// Unused
    /// </summary>
    public void SaveAll()
    {
        GetComponentInChildren<GenerationScriptV2>().SaveMap();

        //Finding All the Players in the scene
        GameObject[] players;
        players = GameObject.FindGameObjectsWithTag("Player");

        foreach (var item in players)
        {

item.GetComponent<BlockInteractions>().SavePlayerState(GetComponentInChildren<GenerationScriptV2>(
).CurrentWorldName());
        }

    }
}
```

Runs On GameObject: Zombie

Name: ZombieControl.cs

```
using System.Collections;
using System.Collections.Generic;
using Unity.VisualScripting;
using UnityEngine;

public class ZombieControl : MonoBehaviour
{
    public int sightRange;

    public LayerMask playerLayer;
    public LayerMask groundLayer;

    public GameObject attackPoint;
    public float attackDamage;
    public float attackRate;

    public float knockbackStrength;
    public float knockbackDuration;
    public float walkSpeed;
    public float jumpHeight = 6;
    float jumpForce;
    int ZombieHealth = 10;
    public bool OnTheGround;

    Rigidbody2D zombieRB;
    Animator animator;
    DayNightCycle DayNightCycleInUse;
    GameObject DayNightManager;

    float patrolRange;
    float timeSinceActive;
    float time;

    bool hasBeenKnockedBack;
    float timeSinceKB;
    float timeSinceAttack;

    public bool playerInRange { get { return (Physics2D.OverlapCircle(transform.position, 
sightRange, playerLayer)); } }
    public bool OnGround { get { return Physics2D.OverlapCircle(new Vector2(transform.position.x, 
transform.position.y - 1.1f), 0.1f, groundLayer); } }
    public bool playerInAttackRange { get { return 
Physics2D.OverlapCapsule(attackPoint.transform.position, new Vector2(1, 2), 
CapsuleDirection2D.Vertical, 0, playerLayer); } }

    /// <summary>
    /// Assigns variables and ensure that zombies don't run into each other
    /// </summary>
    private void Start()
    {
        zombieRB = GetComponent<Rigidbody2D>();
        animator = GetComponent<Animator>();
        Physics.IgnoreLayerCollision(gameObject.layer, gameObject.layer);
    }

    /// <summary>
    /// Controls animations
    /// </summary>
    void ZombieWalkAnimations()
    {
        if (zombieRB.velocity.x != 0)
        {
            animator.Play("ZombieWalk");
        }
        else animator.Play("ZombieIdle");
    }

    /// <summary>
    /// Faces the zombie towards its waiking direction, using local scale
    /// </summary>
    void FaceTowardsWalkingDirection()
    {
        if (zombieRB.velocity.x > 0)
        {
            transform.localScale = new Vector3(1, 1, 1);
        }
        if (zombieRB.velocity.x < 0)
        {
            transform.localScale = new Vector3(-1, 1, 1);
        }
    }

    /// <summary>
    /// As movement is controlled by the server, this only control what the zombie attack.
    /// </summary>
    private void FixedUpdate()
    {
        OnTheGround = OnGround;
        Debug.DrawRay(new Vector2(transform.position.x, transform.position.y - 0.5f), new 
Vector2(transform.localScale.x, 0), Color.red);
        Debug.DrawRay(new Vector2(transform.position.x, transform.position.y + 0.5f), new 
Vector2(transform.localScale.x, 0), Color.red);
        ZombieWalkAnimations();
        FaceTowardsWalkingDirection();
        if (playerInRange)
        {
            FaceTowardsPlayer(playerInRangePosition());
            if (playerInAttackRange) AttackManager();
            //if (!playerInAttackRange) zombieRB.velocity = new Vector2(walkSpeed * 
transform.localScale.x, zombieRB.velocity.y);
        }

    }

    void FaceTowardsPlayer(Vector2 playerPos)
    {
        if (transform.position.x < playerPos.x) transform.localScale = new Vector3(1, 1, 1);
        if (transform.position.x > playerPos.x) transform.localScale = new Vector3(-1, 1, 1);
        Debug.DrawLine(transform.position, playerPos,Color.red);
    }

    /// <summary>
    /// Returns the closes player's position as a Vector3
    /// </summary>
    /// <returns></returns>
    public Vector2 playerInRangePosition()
    {
        Vector2 closePlayer = new Vector2(0, 0);
        float previousDistance = sightRange;
        if (playerInRange)
        {
            Collider2D[] players = (Physics2D.OverlapCircleAll(transform.position, sightRange, 
playerLayer));
            float currentDistance;
            foreach (var item in players)
            {
                currentDistance = (Mathf.Sqrt((float)(System.Math.Pow((item.transform.position.x - 
transform.position.x), 2) + System.Math.Pow((item.transform.position.y - transform.position.y), 
2))));
                if (currentDistance < previousDistance)
                {
                    closePlayer = item.transform.position;
                    previousDistance = currentDistance;
                }
            }
        }
        return closePlayer;
    }

    /// <summary>
    /// Sends an attack command, catches errors
    /// </summary>
    void Attack()
    {
        Collider2D[] hitPlayers = (Physics2D.OverlapCapsuleAll(attackPoint.transform.position, new 
Vector2(1, 2), CapsuleDirection2D.Vertical, 0, playerLayer));
```

```
        //Debug.Log(hitEnemies.Length);
        foreach (Collider2D hits in hitPlayers)
        {
            try
            {
                hits.GetComponent<HealthManager>().TakeDamage((int)attackDamage);
            }
            catch
            {

            }

        }


    }

    /// <summary>
    /// Attack at the given attack rate
    /// </summary>
    void AttackManager()
    {
        timeSinceAttack += Time.deltaTime;
        if (timeSinceAttack > attackRate)
        {
            timeSinceAttack = 0;
            Attack();
        }
    }


    /// <summary>
    /// Despawns the zombie on being attack
    /// </summary>
    public void TakeDamage()
    {
        GetComponent<Zombie>().DespawnFromClient();

    }

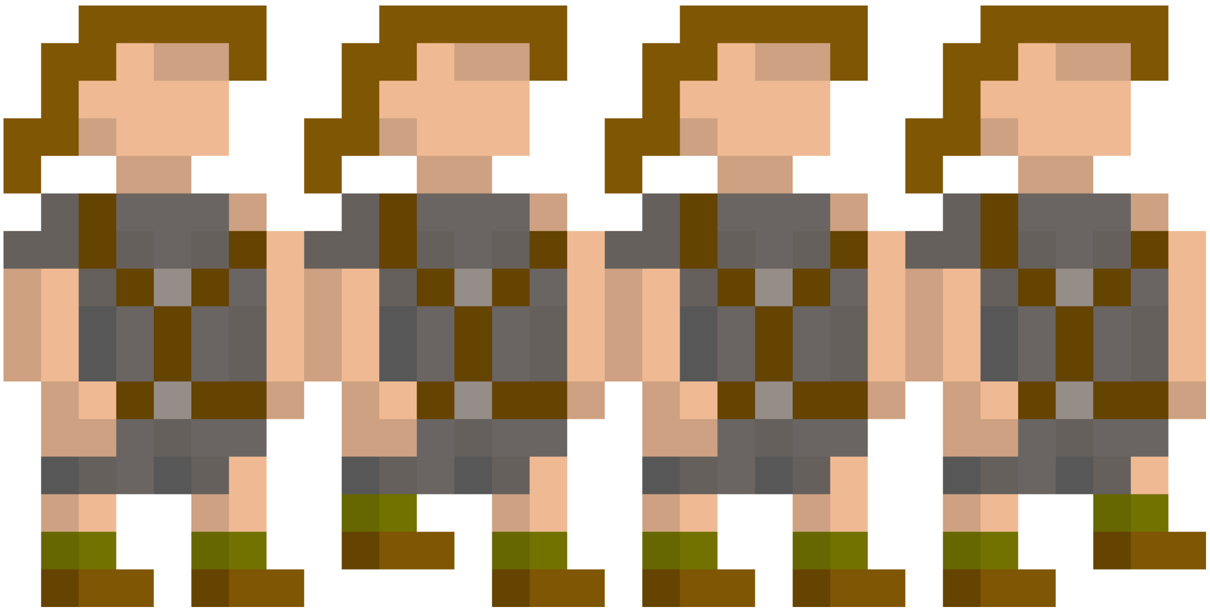
}
```

Assets

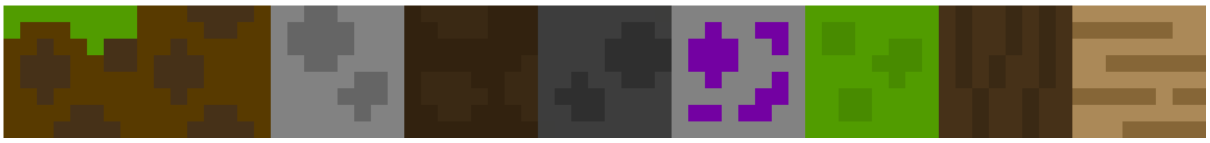
As listed in Objective 6.1 and 6.2, the art style of the project is important to my client, Elliot has noted that the art style should be consistent throughout, taking inspiration from games of the late 80s and early 90s, in addition to the newer wave of retro looking games.

Here's the final texture for each asset in the game, as mentioned in **Asset Requirements** all assets are produced by myself.

Character.png



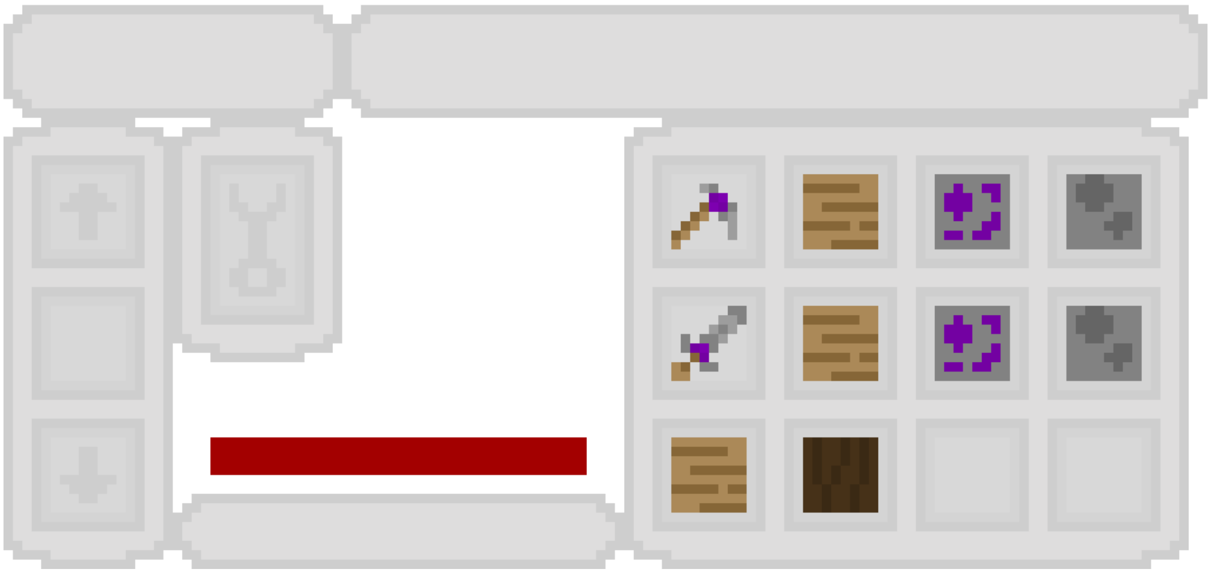
BlockTextures.png



ClientIcon.png

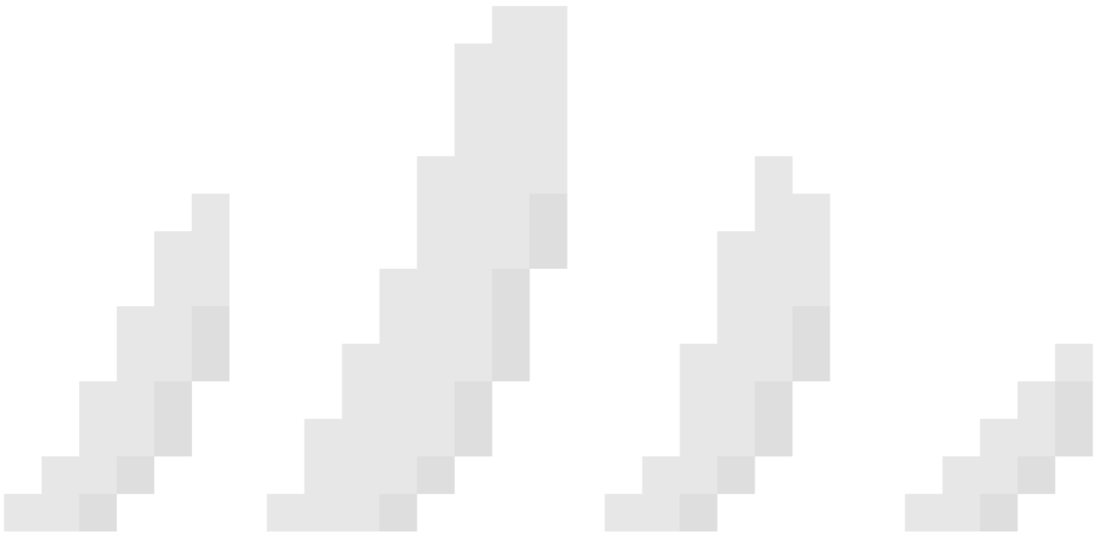
ServerIcon.png

InventoryTexture.png

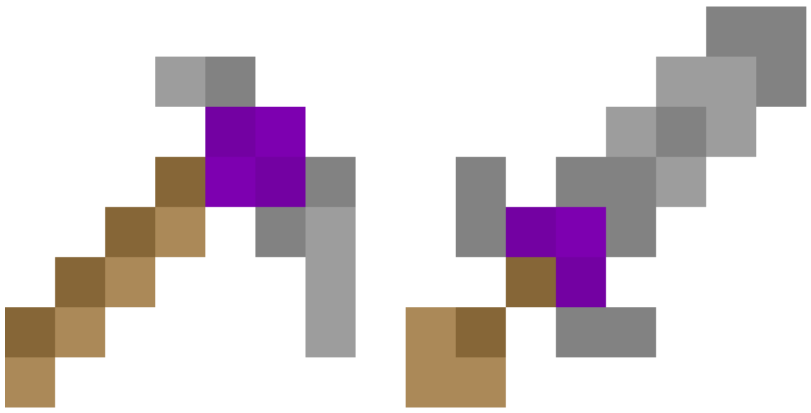


Note that each piece of the texture can be cut out, as shown then top two pieces are the button icons. The bottom left cluster is the player HUD, along with the crafting menu in the bottom right.

SwingAnimation.png



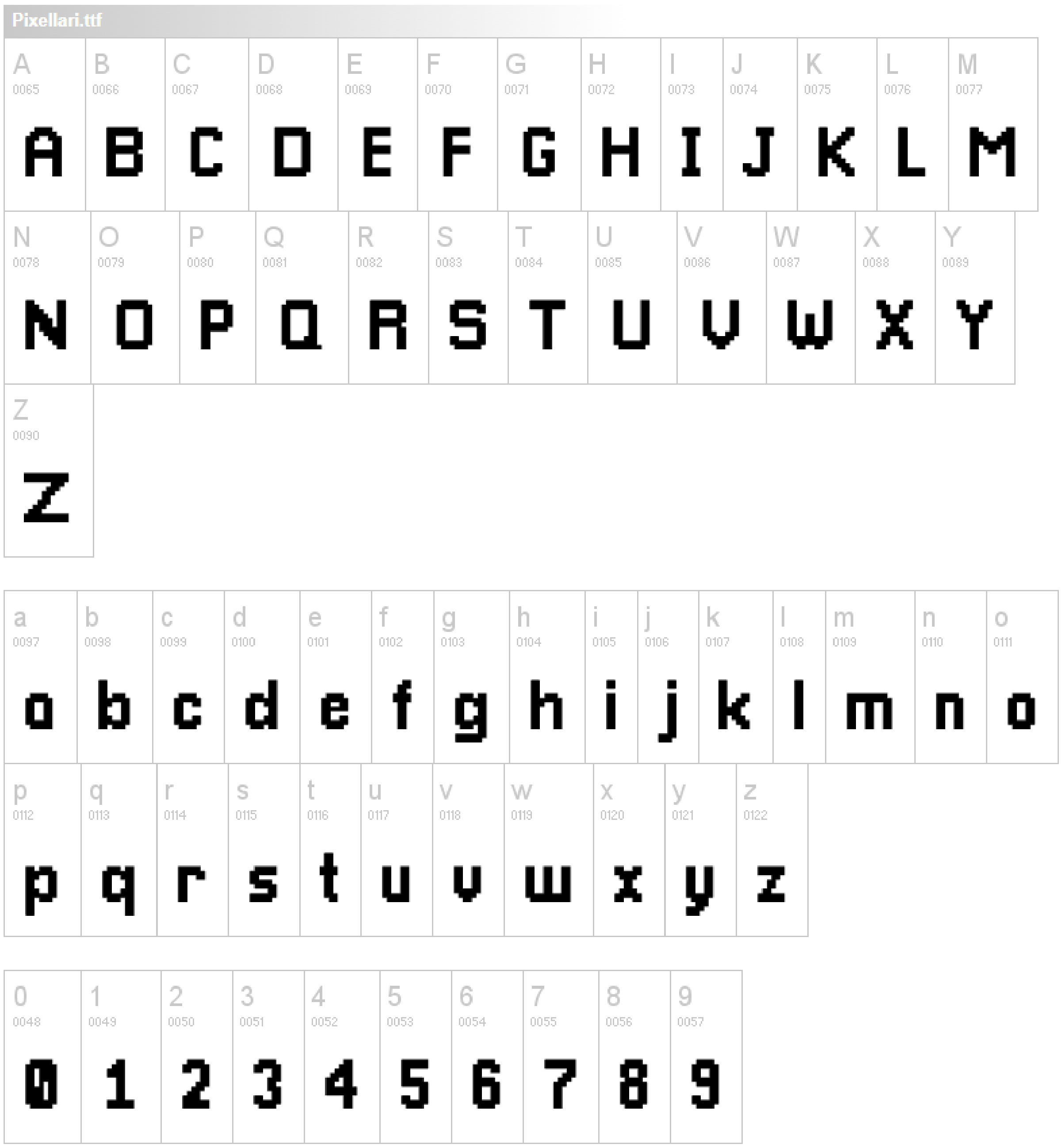
toolTextures.png



ZombieMob.png

Font Used – From DaFont.Com

https://www.dafont.com/pixellari.font



Technique Table

Technique Group	Coding Technique	Location in Code
A	Queue	TextChatManager.cs
A	Dynamic generation of objects based on complex user-defined use of OOP model	Zombie.cs Player.cs
A	Server-side scripting using request and response objects	NetworkManager.cs GameLogic.cs

	and server-side extensions for a complex client-server model	Player.cs Zombie.cs
A	Complex User Defined algorithm	GenerationScriptV2.cs (cellular automata algorithm)
A	Advanced matrix operations	Use of Vector2 and Vector3 throughout ZombieControl.cs playerInRangePosition
B	Writing and Reading from files	GenerationScriptV2.cs
B	Generation of objects based on a simple OOP model	Throughout…
B	Simple User Defined Algorithms	Throughout…
B	Multi-Dimensional Arrays	GeneratioScriptV2.cs
B	Dictionary	Player.cs Zombie.cs
C	Single-Dimensional Arrays	Throughout…
Undefined	Use of Enumerators	NetworkManager.cs
Undefined	Procedural Map Generation	GeneratioScriptV2.cs

Testing

Testing Table

To test my programs robustness, I will have to run each application to test its' functions and data:

Note that any test numbered with a V, will have its' testing evidence covered in this video:

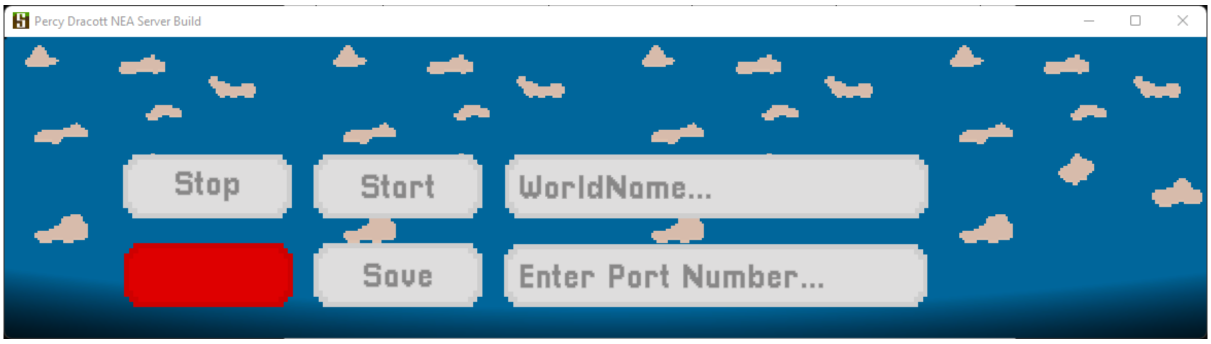
Video URL

Server Application

Test No.	Test Purpose	Test Type	Test Data (if applicable)	Expected Outcome
1.1	Loads to Menu	Functionality	N/A	Loads to main menu
1.2	Main menu graphics inspection	Design	N/A	The Main menu displays all starting graphics
1.3	Main Menu input fields are unlocked	Functionality	N/A	Input fields allow an input to be typed
1.4	Start Button Check	Functionality	Valid Port Number Input.	Server should start, and indicator light should go green. A map is generated
1.5	Erroneous Input Check	Erroneous Input	Empty Port Number Input.	No Change.

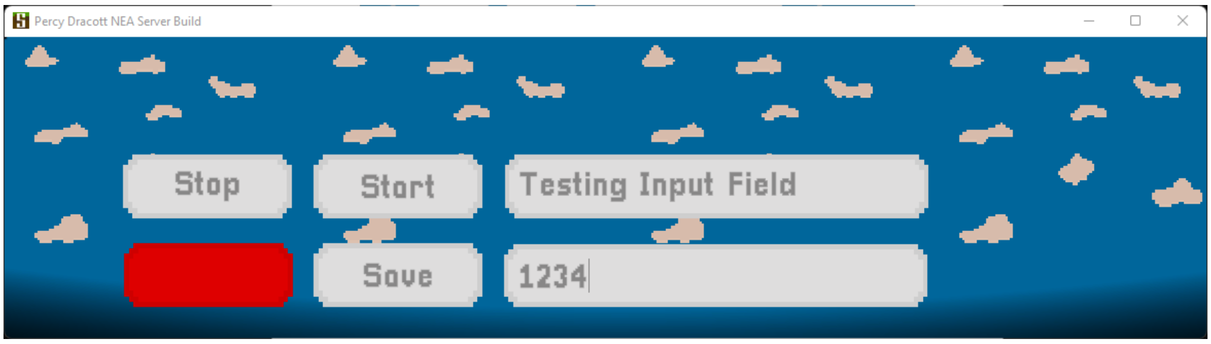
1.6	Erroneous Input Check	Erroneous Input	Non-number input into Port Input Field	Input should not be entered into the Port Input Field.
1.7	Start Button Check	Functionality	New World Name Input, Valid Port Number Input.	Server starts, indicated by the green indicator. A new map is generated and saved to a new location.
1.8	Start Button Check	Functionality	Already used and saved World Name Input, Valid Port Number Input.	Server starts, indicated by the green indicator. A map is loaded from the save, including all previous builds.
1.9	Stop Button Check	Functionality	N/A	Server stops, indicated by the red indicator icon.
V.1	Client Joining Check	Functionality	Client Username	Client Spawns a player into the scene, given their specified username.
V.2	Client Joining Check	Erroneous	Empty Client Username	Client Spawns a player into the scene, given “Guest” as a username
V.3	Client Leave Check	Functionality	N/A	Client’s player is removed from the scene

Server Testing Evidence

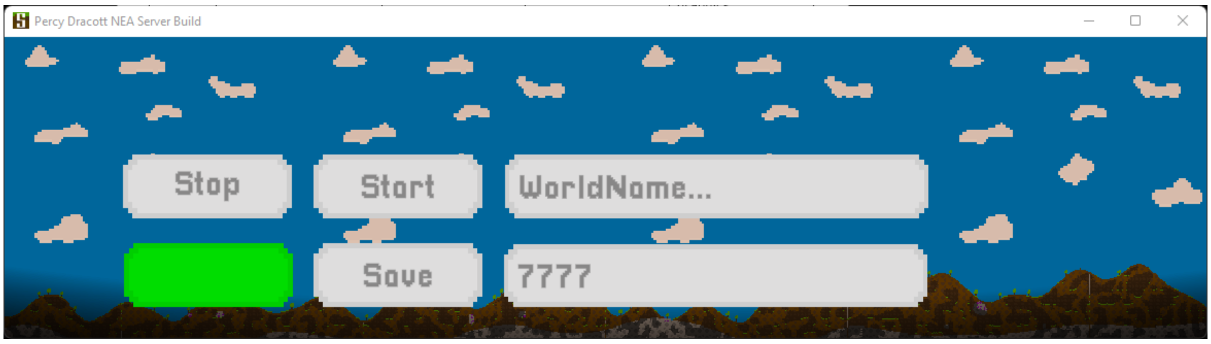


Test 1.1: Server Application loads to main menu with no issues, expected outcome. Test Successful

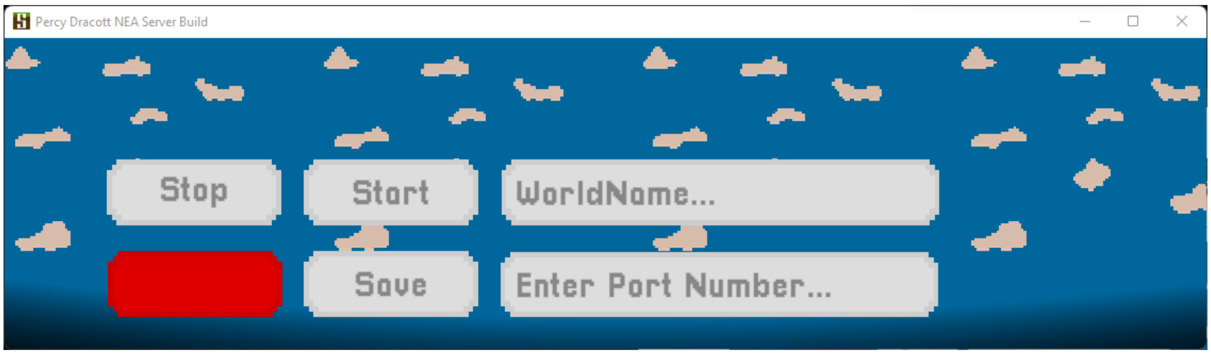
Test 1.2: The Main menu starting graphics all load in the correct positions, expected outcome. Test Successful



Test 1.3: Menu Input fields are unlocked on loading the application, expected outcome. Test Successful.

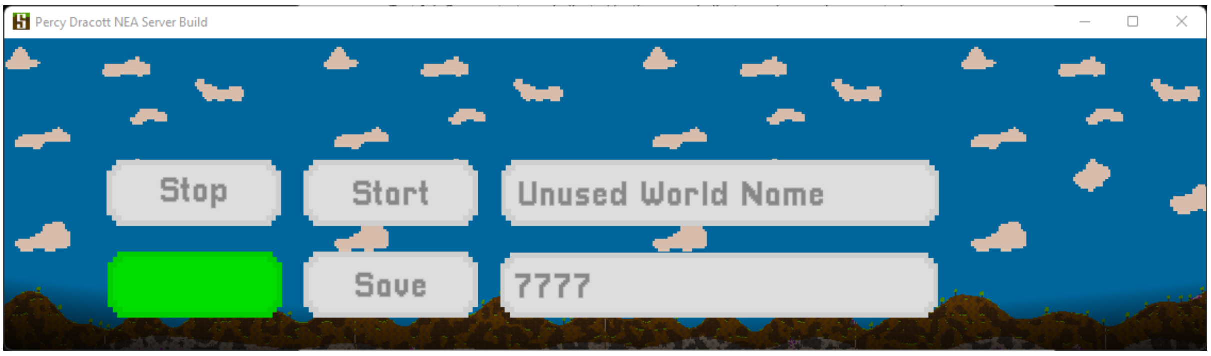


Test 1.4: Server starts, as indicated by the green indicator and a map is generated, expected outcome. Test Successful

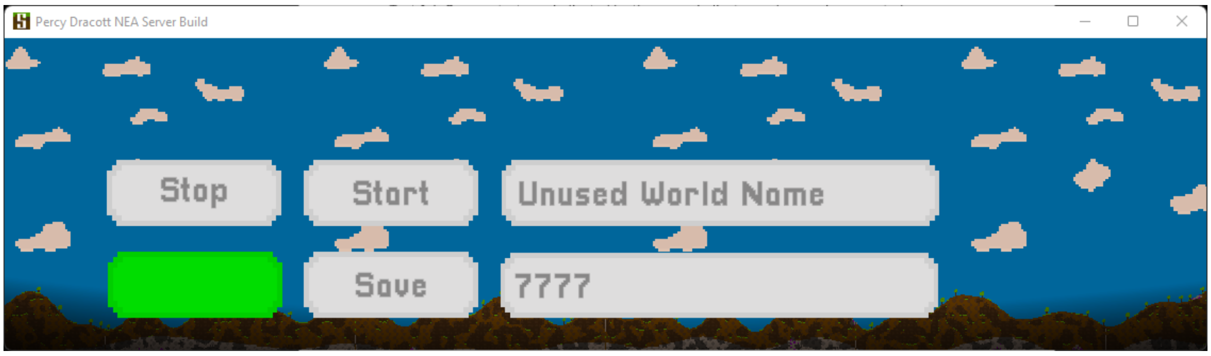


Test 1.5: Server doesn't start, no change, expect outcome. Test Successful

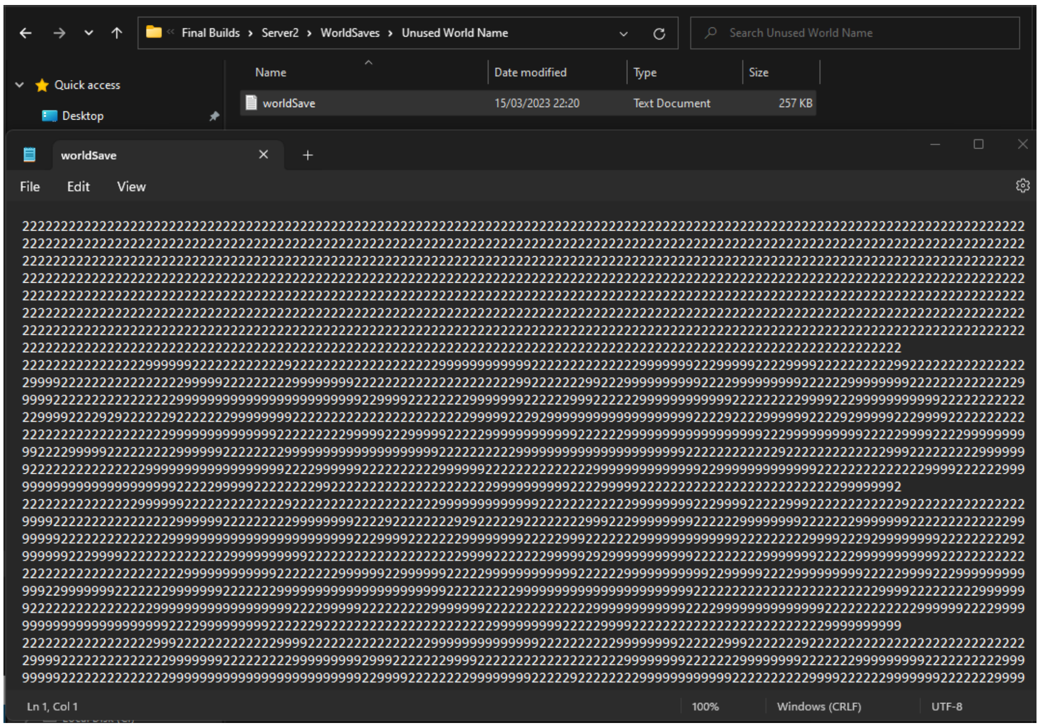
Test 1.6: Port Input field only accepts number characters, expected outcome. Test Successful



Test 1.7: Server Starts and a newly generated world is created, expected outcome. Test Successful



Note that the program was closed and reopened, with the same world name entered.



Name	Date modified	Type	Size
worldSave	15/03/2023 22:20	Text Document	257 KB

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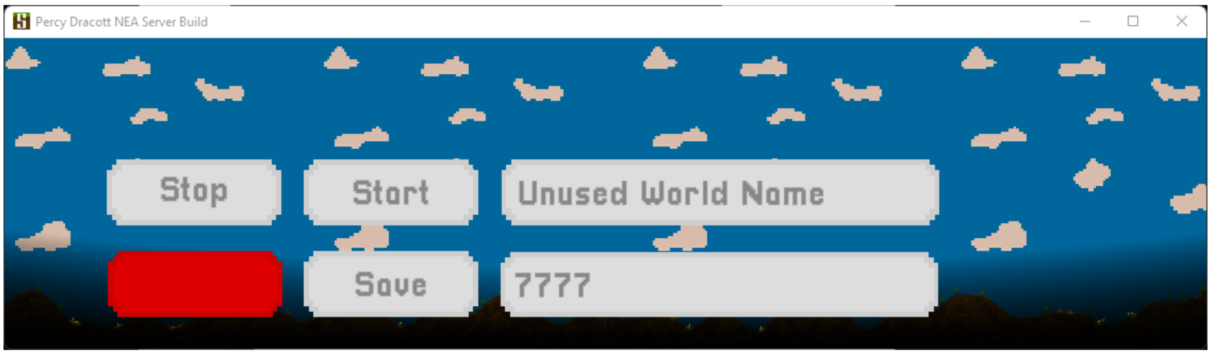
```

Test 1.8: Server starts, and the world is loaded from the save file, expected outcome. Test Successful



Test 1.9: Server stops, as indicated by the red icon, expected outcome. Test Successful

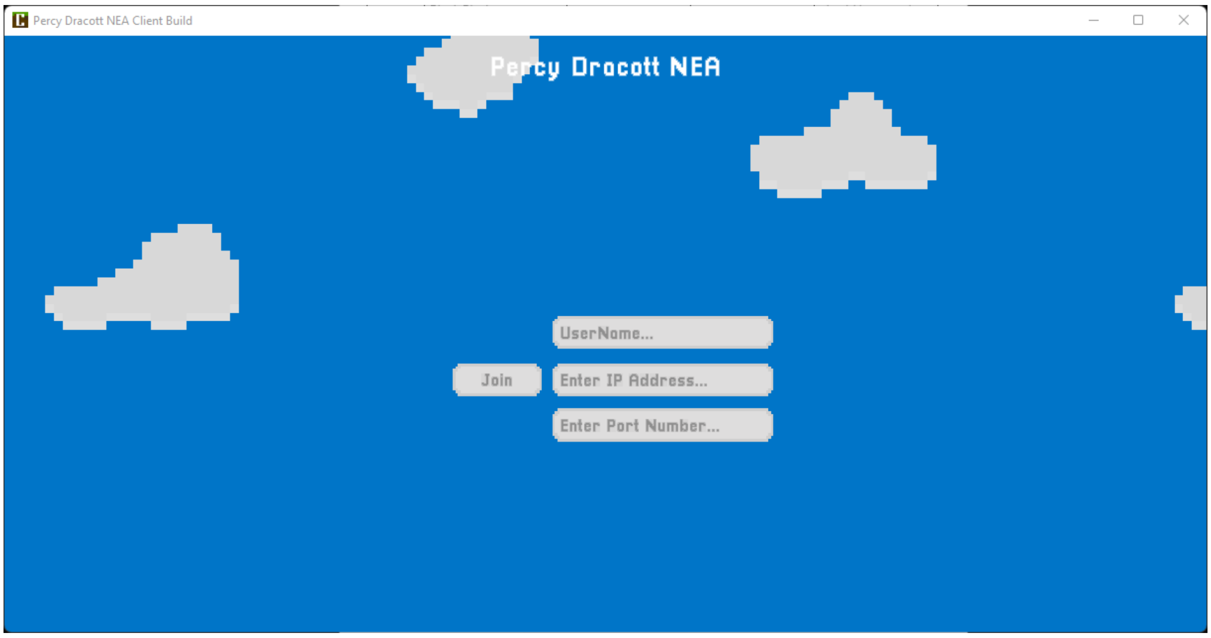
Client Application

Test No.	Test Purpose	Test Type	Test Data (if applicable)	Expected Outcome
1.1	Loads to Menu	Functionality	N/A	Loads to main menu
1.2	Main menu graphics inspection	Design	N/A	The Main menu displays all starting graphics
1.3	Main Menu input fields are unlocked	Functionality	N/A	Input fields allow an input to be typed
1.4	Connect Button Check	Functionality	Valid Port, IP, and Username. (Active Server Running)	Player should connect and be spawned into the world
1.5	Connection Check	Erroneous	Invalid Port, Valid IP, and Username. (Active Server Running)	Client should attempt to connect, however upon being unable, should return to the main menu, with a chat notification.
1.6	Connection Check	Erroneous	Invalid IP, Valid Port, and Username. (Active Server Running)	Client should attempt to connect, however upon being unable, should return to the main menu, with a chat notification.
1.7	Attempting to connect to a full server	Boundary	N/A	Client should attempt to connect, however upon being unable, should return to the main menu, with a chat notification.
2.1	Client Pause Menu	Functionality	“Esc” keyboard input	Pause menu should appear.
2.2	Client Pause Menu	Functionality	“Esc” keyboard input	Pause menu should toggle off.

2.3	Client Pause Menu, Resume Button	Functionality	N/A	Client's pause menu should disappear, client should remain in the game
2.4	Client Pause Menu, Leave Button	Functionality	N/A	Client's pause menu should disappear, client should leave the game and should be returned to main menu.
V.4	Client HUD Checks	Functionality	Mouse Scroll Wheel	Item in the players hand and HUD icon should change.
V.5	Client HUD Checks	Functionality	Button Click	Item in the players hand and HUD icon should change.
V.6	Crafting Button Check	Functionality	Button Click	Crafting menu should toggle on/off
V.7	Crafting Check	Functionality	Button Click	Client should obtain crafted item; quantities of recourses decrease as per the crafting requirements.
V.8	Crafting Check, with insufficient items	Boundary	Button Click	Client should be unable to craft item, no recourses are removed. Audio queue is given.
V.9	Client placing blocks	Functionality	Right Click	Block should appear in the map, clients inventory quantity for the given block should decrease.
V.10	Client breaking blocks, without tool	Functionality	Right Click	Block should disappear from the map, clients inventory quantity for the given block should increase. Should take a reasonable amount of time to break.
V.11	Client breaking blocks, with tool	Functionality	Right Click	Block should disappear from the map, clients inventory quantity for the given block should increase. Time taken to break the block is halved.

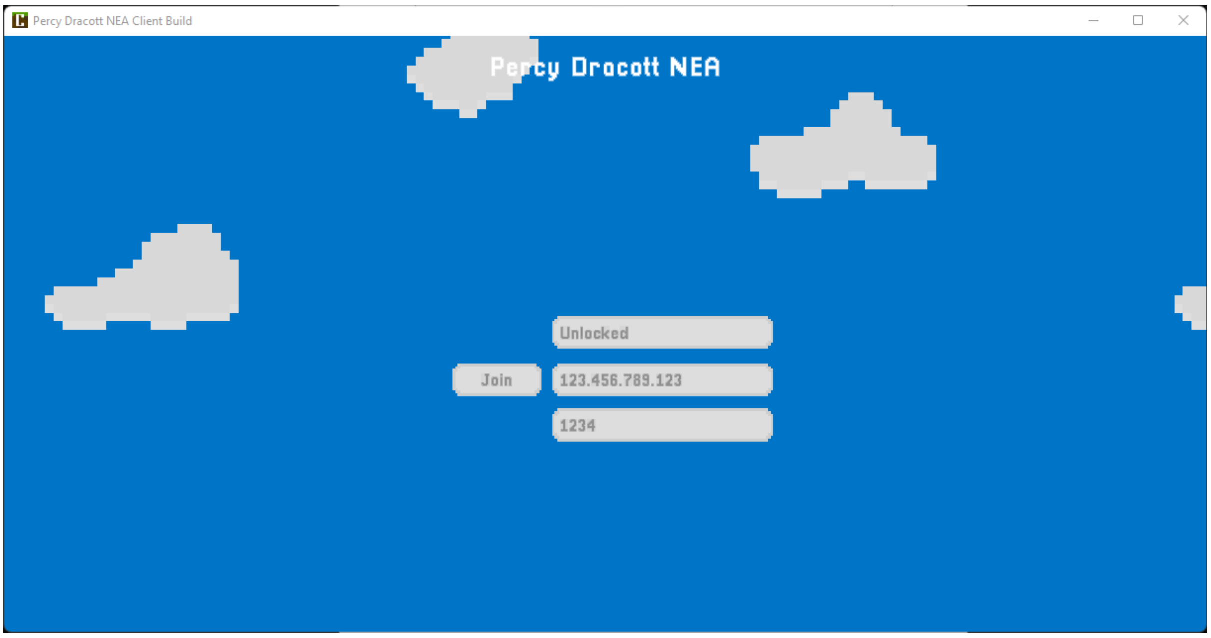
V.12	Player Taking Damage From falling	Functionality	N/A	Player's health should decrease
V.13	Player Death	Functionality	N/A	Player should be presented by a Death Screen
V.14	Death Screen Respawn Button	Functionality	Button Click	Player should be spawning back into the world with an empty inventory.
V.15	Death Screen Leave Button	Functionality	Button Click	Player should be disconnected from the server and returned to the main menu.
V.16	Connecting Multiple Clients	Functionality	N/A	Two players should appear in the scene.
V.17	Syncing Multiple Clients Movements	Functionality	N/A	Each players movements should be synced across both connected clients
V.18	Syncing Multiple Clients Block Placing	Functionality	N/A	Each players maps should be synced across both connected clients
V.19	Syncing Multiple Clients Block Breaking	Functionality	N/A	Each players maps should be synced across both connected clients
V.20	One of Multiple Clients Disconnecting	Functionality	N/A	Player should be removed from the scene; remaining player should remain connected.
V.21	Zombie Spawning across multiple clients	Functionality	N/A	Zombies position should be synced across all connected clients.
V.22	Zombie Despawning across multiple clients	Functionality	N/A	Zombies despawning should be synced across all connected clients.

Client Testing Evidence

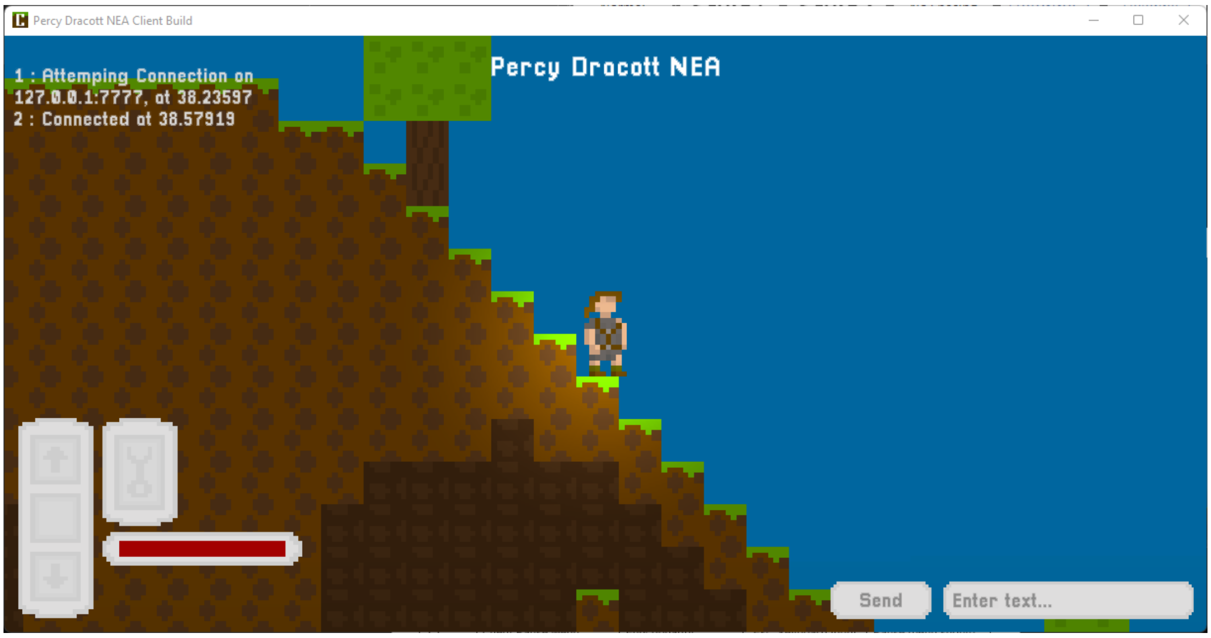


Test 1.1: Application loads to main menu, expected outcome. Test Successful

Test 1.2: All menu graphics are loaded in, expected outcome. Test Successful

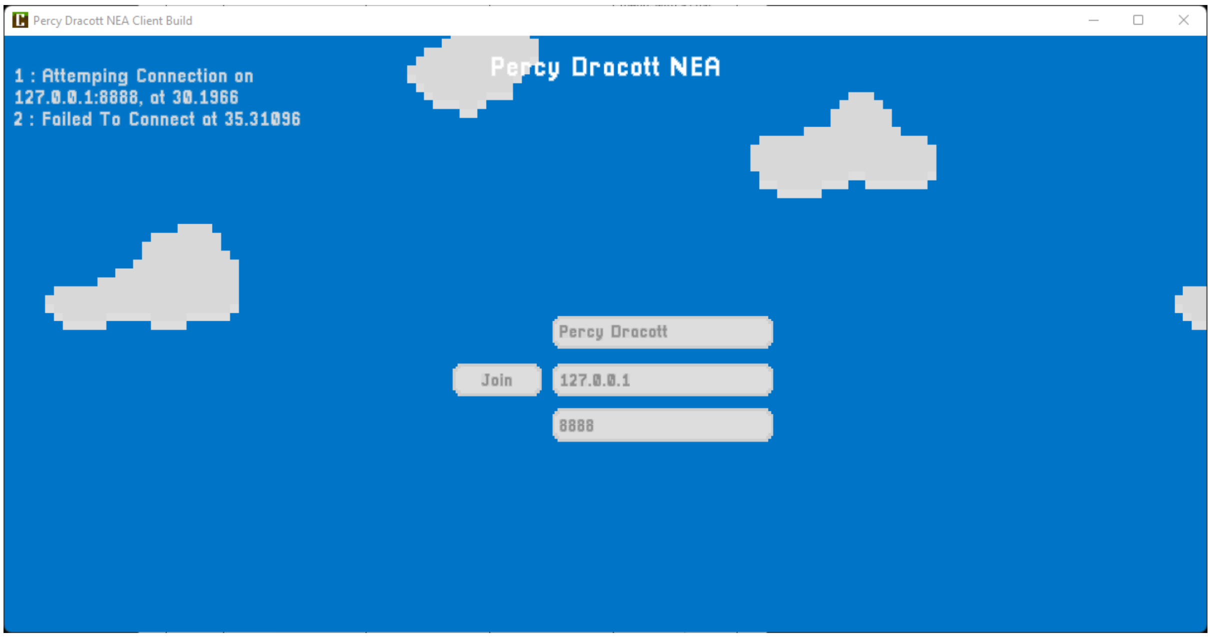


Test 1.3: Input fields are unlocked on loading the application, expected outcome. Test Successful



```
1 : Attemping Connection on
127.0.0.1:7777, at 38.23597
2 : Connected at 38.57919
```

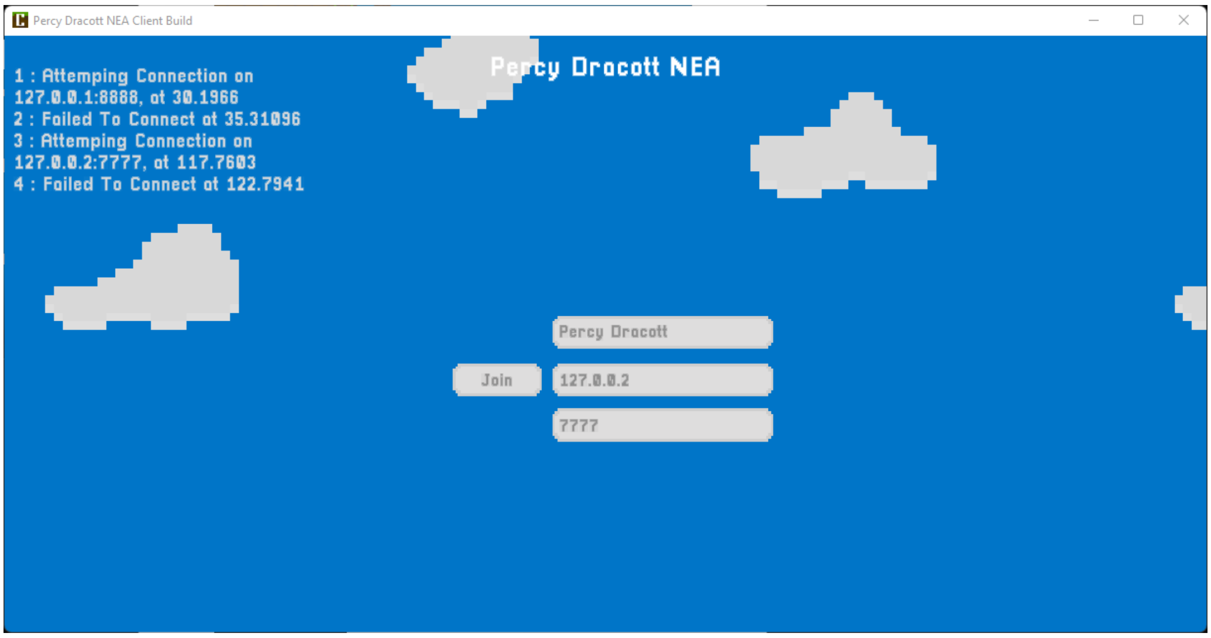
Test 1.4: Player connected and be spawned into the world, expected outcome. Test Successful



```
1 : Attemping Connection on
127.0.0.1:8888, at 30.1966
2 : Failed To Connect at 35.31096
```

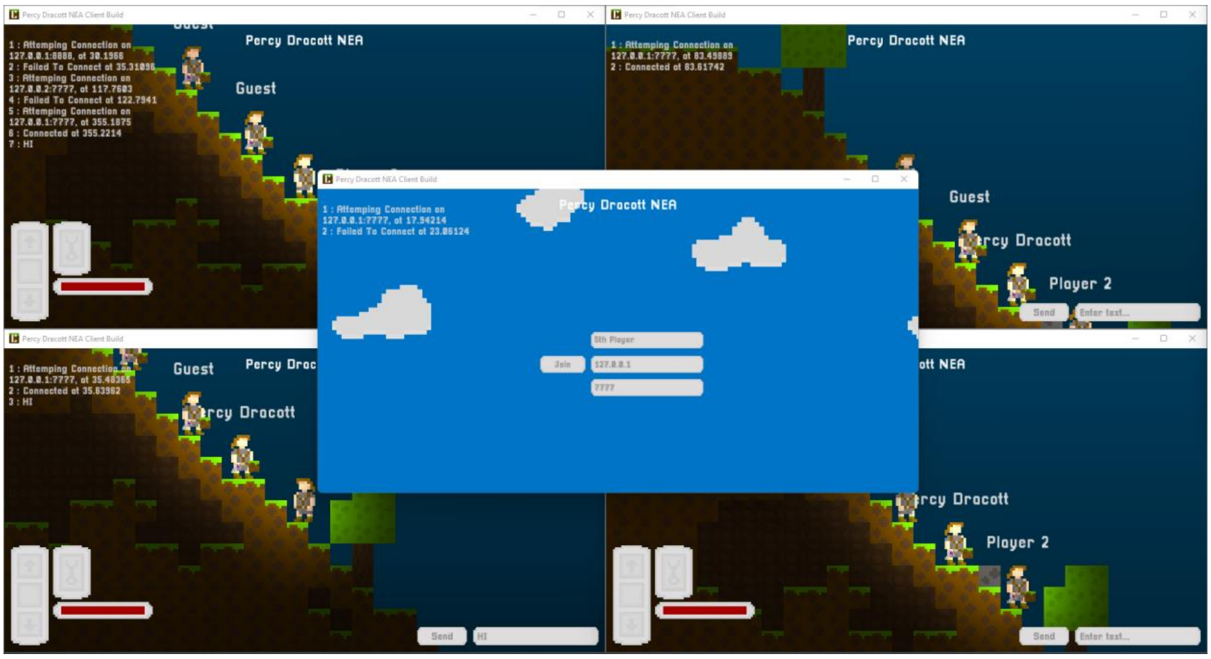
Percy Dracott
127.0.0.1
8888

Test 1.5: (Server running on local machine, with port 7777 used) Attempted to connect, returned to main menu, message added to log, expected outcome. Test Successful



```
1 : Attemping Connection on
127.0.0.1:8888, at 30.1966
2 : Failed To Connect at 35.31096
3 : Attemping Connection on
127.0.0.2:7777, at 117.7603
4 : Failed To Connect at 122.7941
```

Test 1.6: (Server running on local machine with local IP 127.0.0.1, with port 7777 used) Attempted to connect, returned to main menu, message added to log, expected outcome. Test Successful



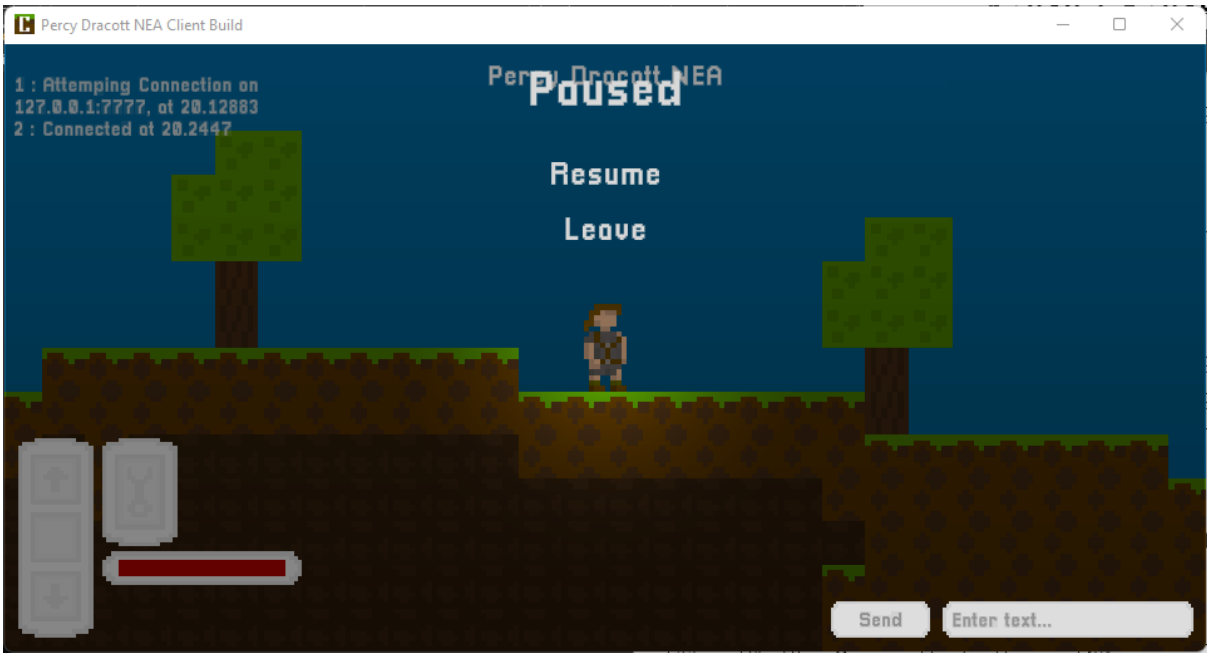
```
1 : Attemping Connection on
127.0.0.1:8888, at 30.1966
2 : Failed To Connect at 35.31096
3 : Attemping Connection on
127.0.0.2:7777, at 117.7603
4 : Failed To Connect at 122.7941
5 : Attemping Connection on
127.0.0.1:7777, at 355.1875
6 : Connected at 355.2214
7 : HI
```

```
1 : Attemping Connection on
127.0.0.1:7777, at 83.49889
2 : Connected at 83.61742
```

```
1 : Attemping Connection on
127.0.0.1:7777, at 17.94214
2 : Failed To Connect at 23.06124
```

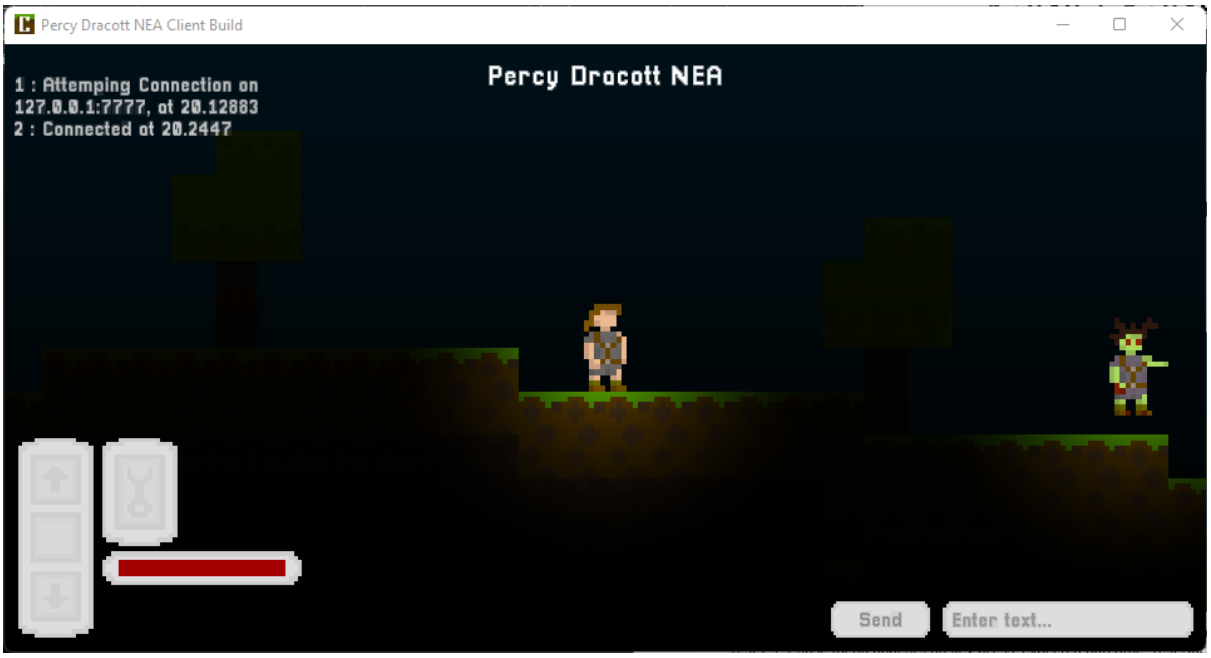
```
1 : Attemping Connection on
127.0.0.1:7777, at 35.46365
2 : Connected at 35.63962
3 : HI
```

Test 1.7: Attempted to connect, returned to main menu, message added to log, expected outcome. Test Successful



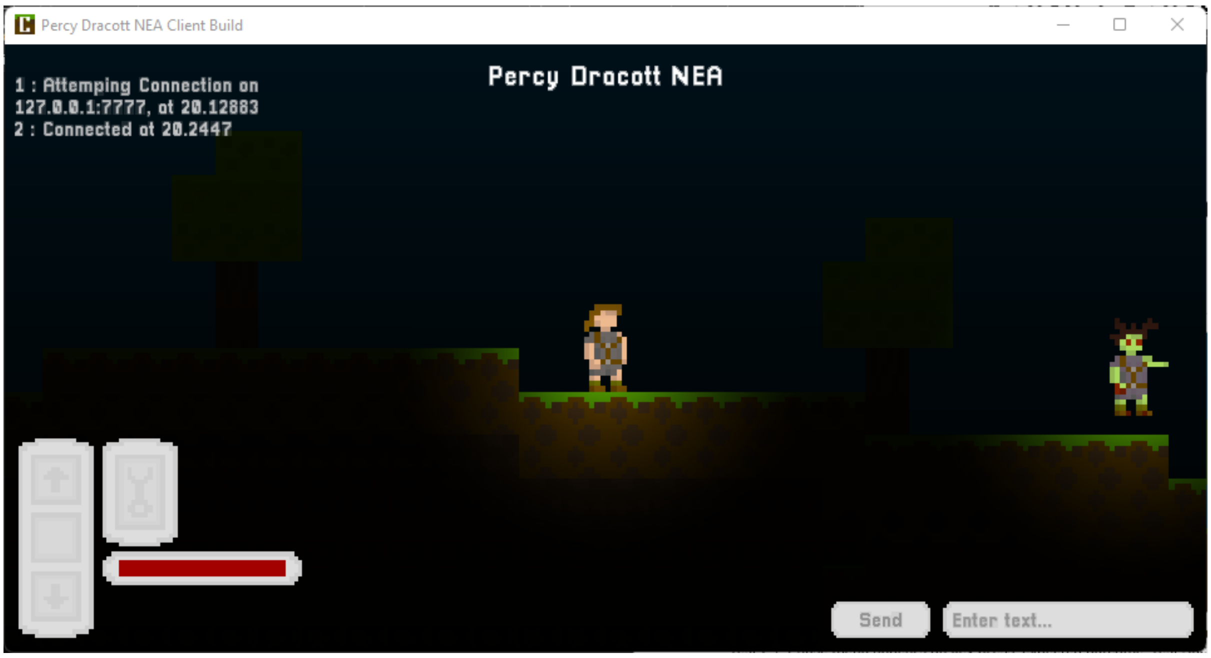
1 : Attemping Connection on
127.0.0.1:7777, at 20.12883
2 : Connected at 20.2447

Test 2.1: Pause menu appears on key press, expected outcome. Test Successful



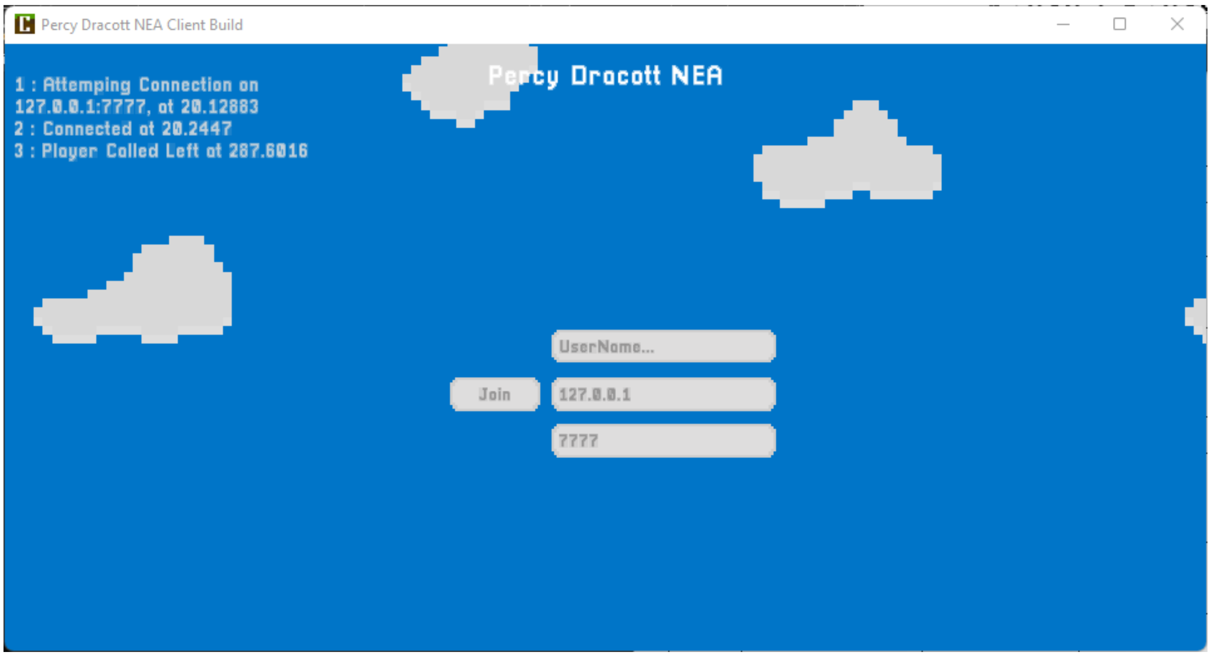
1 : Attemping Connection on
127.0.0.1:7777, at 20.12883
2 : Connected at 20.2447

Test 2.2: Pause menu is disabled on key press, expected outcome. Test Successful



```
1 : Attemping Connection on
127.0.0.1:7777, at 20.12883
2 : Connected at 20.2447
```

Test 2.3: On “Resume” button press, pause menu is disabled, expected outcome. Test Successful



```
1 : Attemping Connection on
127.0.0.1:7777, at 20.12883
2 : Connected at 20.2447
3 : Player Called Left at 287.6016
```

Test 2.4: On “Leave” button press, player disconnects and is returned to main menu, expected outcome. Test Successful

Add Source Tracker