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TECHNOLOGICAL
UNIVERSITY**
SINGAPORE

SC4060 CE4001 CZ4001 Virtual and Augmented Reality

VR Assignment Report

Done by: Team 3

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1. Introduction

This report aims to outline the development process of "Treasure Hunt," a video game created by our team, Group 3. It will detail the journey from the game's initial concept, the designs of the scenes and obstacles.

"Treasure Hunt" is an adventure game designed to immerse players in a quest for hidden treasures within a fantasy setting. Inspired by the adventurous spirit of games like "Uncharted" and films such as "Indiana Jones," we settled on a fantasy dungeon explorer theme after considering various other themes. Our goal was to create a game that was not only fun to play but also engaging through its various challenges and obstacles.

Our team decided to choose the Unity XR Interaction Toolkit as the foundation for developing "Treasure Hunt" for several compelling reasons. After evaluating various alternatives such as VRTK and SteamVR Plugin, we concluded that the XR Interaction Toolkit offered the best combination of features, ease of use, and compatibility with our project goals. This is because of its XR Device Simulator which allowed us to test our game without a headset and there were more online resources that taught using XR Interaction Toolkit.

We decided to split the game into 3 different scenes: Jungle, Cave and Dungeon.

The first scene, in the jungle, starts off with grappling, where the player uses a grapple gun to swing across tree branches between platforms, guided by a diamond trail. The player ends the scene by swinging into the cave.

The player then enters the next scene, the cave, which has lava surrounding rock platforms. The player climbs up a stairs to a platform, and then climbs the rock climbing wall to the next platform, followed by monkey bars. After these obstacles, the player will have to dodge multiple dodgeballs shot out from cannons on a wall while making their way to the end of the cave. At the end, there is an entrance to the next scene.

The last scene is set in the dungeon, in which the user is first greeted with a maze. The user has to navigate through the maze, picking up 4 puzzle pieces along the way to fit into a puzzle. Once all 4 pieces have been inserted correctly into the puzzle, the door opens to a golden treasure- a teleportation glove. The maze behind the player is then destroyed, revealing floating platforms on a lava. The player has to use the teleportation glove to teleport to different platforms, making their way to the end. The user then swings across tree branches and successfully escapes the dungeon, finishing the game.

2.Design

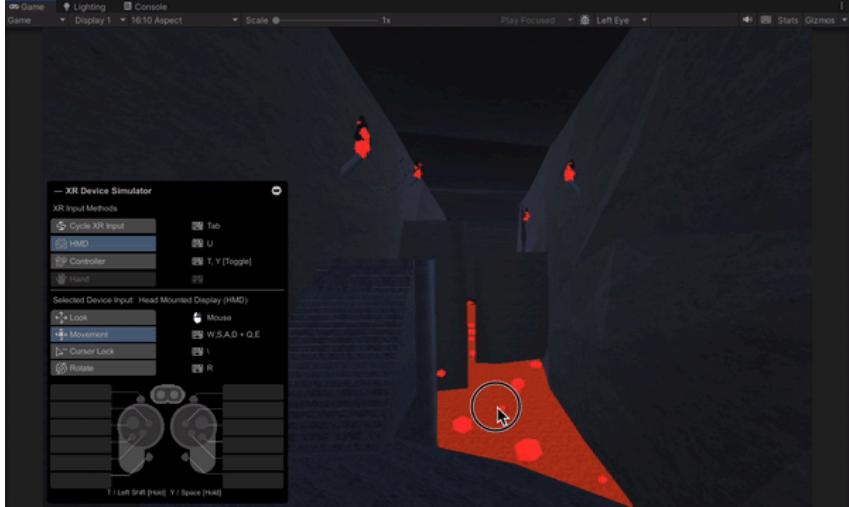
2.1. Physics Rig

Mechanic Breakdown	Description	Contribution
Basic player rig, Movement and Locomotion	<p>The base configuration was referenced from Valem Tutorials on YouTube. The player game object uses a physics rig system using Unity's Rigidbody and Configurable Joint system to create a fluid physics based gameplay. Link to the playlist here:</p> <p>https://www.youtube.com/watch?v=gk0EBle6ZN8&list=PLpEoiloH-4eNsJQkV7C5GzBPc5lNp2LOI&pp=iAQB</p>	Sarvesh
Swing	<p>The grapple gun is attached under the LeftHand Controller gameobject so that the transform position and rotation matches the left hand. Using the grip and trigger buttons can activate the grapple gun and recline the rope to pull the player</p>	Sarvesh
Climb	<p>Using the physics system as referenced earlier the objects will be grouped with a “Grabbable” layer to let the script know that the player’s hands can grab the gameobject which would allow the player to shift their body around.</p>	Sarvesh
Jump	<p>Realised by adding action to XRI default input actions. Player can jump with primary button on the right controller</p>	Zi Hang
Teleport	<p>Realised with XR provider, Teleportation provider, Teleportation Interactor, Teleportation Area, etc. that are from XR Interaction Toolkit. Players can teleport by</p>	Zi Hang

	pushing the right thumbstick forward, adjusting destination and orientation, and releasing the stick.	
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2.2. Scene Overview

Scene	Obstacle/Mechanics	Description	Done by
Start Menu	-	A start menu for the player to start the game. 	Shannen
1 - Jungle	Grappling	The player uses the grapple gun to grapple and swing between tree branches. 	Sarvesh

2 - Cave	Climbing	 <p>All the rocks and bars are placed on a 'grabbable' layer within Unity's physics system.</p> <p>This allows the objects within this layer to be interacted with the player's virtual hands, which was implemented with a script that utilises Unity's physics and Input System to enable the grabbing mechanics.</p> <p>These objects are also attached with a script that uses an audio source such that when the objects are grabbed, there will be an audio that simulates a grab sound.</p>	Shannen
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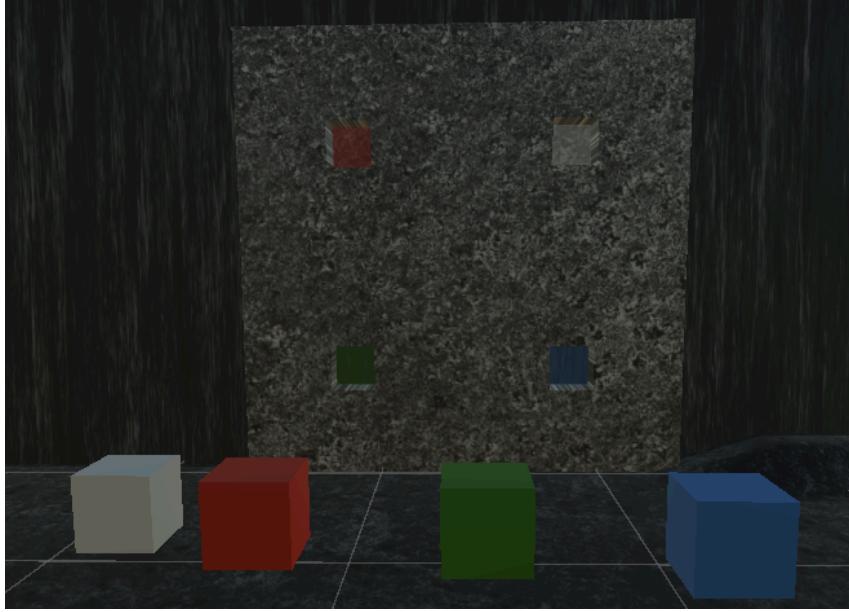


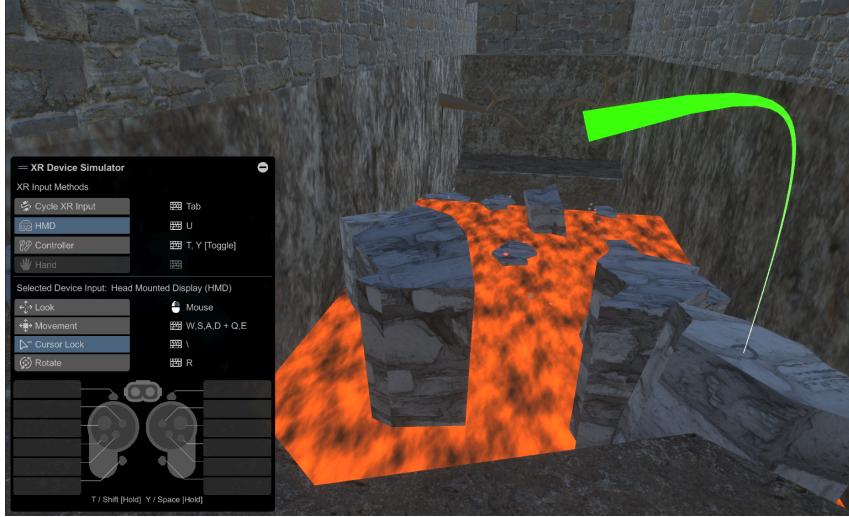
Dodging

Sahaj

Players are required to dodge incoming rock balls, spawned from multiple wall-mounted cannons inside the cave with rapid interval spawning. Spawn points are attached to each cannon as child objects to align the position and direction in which bullets are instantiated and shot. Each rock ball has a rigidbody component attached to it to utilise Unity's physics engine for movement and a collider component to detect collision with other game objects. The balls are destroyed upon collision with the player in the scene, and the player receives feedback on hits and is pushed.

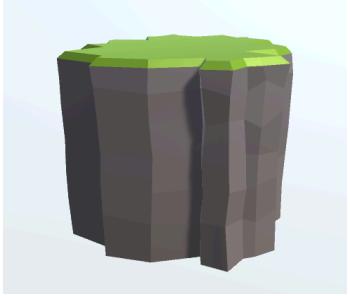
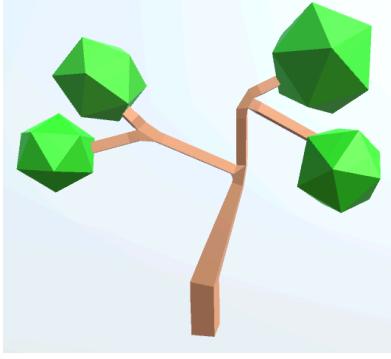
3 - Dungeon	Maze		Pranwanth
		<p>In this maze, puzzle pieces are strategically dispersed throughout, compelling players to explore to uncover them. These essential pieces are the keys to deciphering the final puzzle, which, when solved, grants access to the treasure waiting at the end of the level.</p> <p>The incorporation of the maze serves as an additional layer of</p>	

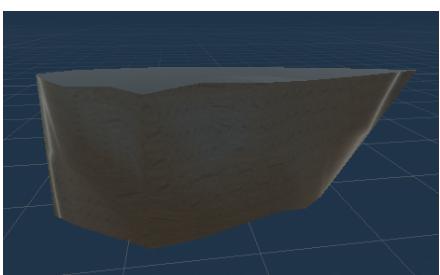
		complexity, elevating the gameplay beyond the mere assembly of puzzle pieces. It challenges players to navigate the maze, thereby enhancing their spatial awareness and problem-solving skills.	
Puzzle		 <p>Upon successful navigation of the maze, players will arrive at the gateway to the treasure room, equipped with the four coloured keys acquired during their journey. Adjacent to the final door, they will find a key slot puzzle. This mechanism requires the precise insertion of the keys into their corresponding colour-coded slots. Each correct placement triggers a mechanism that incrementally lowers the door. With the insertion of all four keys, the door will fully retract, granting the players access to the treasure within.</p>	Pranwanth

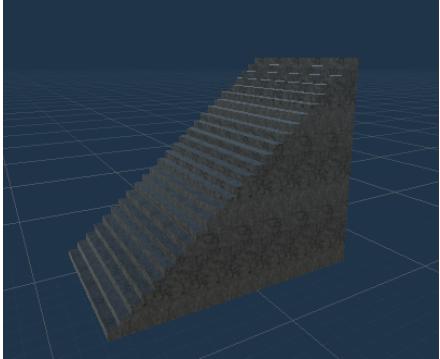
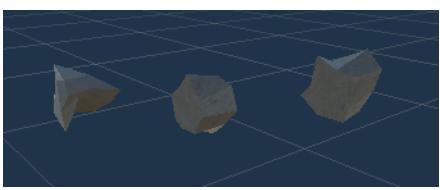
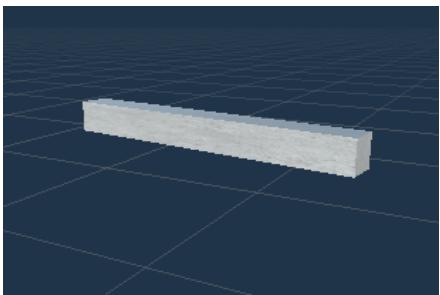
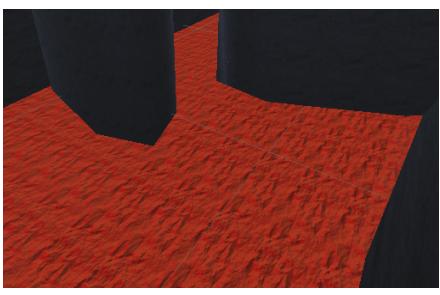
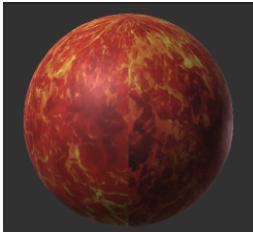
		<p>This final puzzle tests the players' perseverance and attention to detail but also enhances the sense of accomplishment as they unveil the treasure.</p>	
Treasure		 <p>After the door opens, the player will be presented with the treasure. Upon claiming the treasure, the floor behind the player will collapse.</p>	Pranwanth, Zi Hang, Sarvesh
Teleportation Combo		 <p>After retrieving the treasure, the player gains the ability to teleport in the final challenge. The task is to return from the</p>	Zi Hang

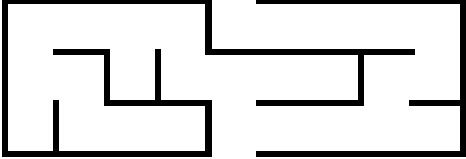
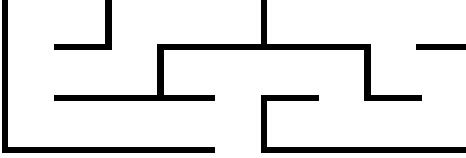
	<p>treasure pedestal to the entrance of the room. Player has to first move among dilapidated pillars using teleportation without falling into lava. Then the player has to teleport or jump onto boards floating on the lava. Before the boards carry the player to the lava falls, the player has to hook the trunks on the wall, and swing himself to a platform on the other side. Finally the player has to hook another trunk and return to the entrance.</p>	
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2.3. Assets/Models

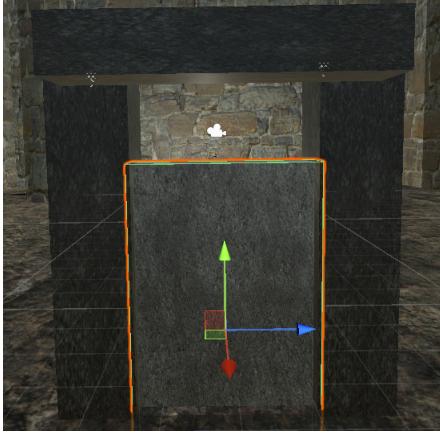
Scene	Item	Description	Image	Done by
1	Cliff platform	Platform floor for player to traverse with the grapple hook		Sarvesh
	Grapple gun	Grapple gun that shoots the hook line		Sarvesh
	Trees with Branch	For grapple gun to shoot its anchor and swing upon		Sarvesh

	Cave Outer Walls	The Level map of the level 1 walls. Play area happens inside this model asset		Sarvesh
	Diamond	Collectible item to guide player how to traverse the level but also serves as a scoring system		Sarvesh
2	Cave (walls and platforms)	Created using ProBuilder, made the surfaces uneven to seem more realistic	 	Shannen

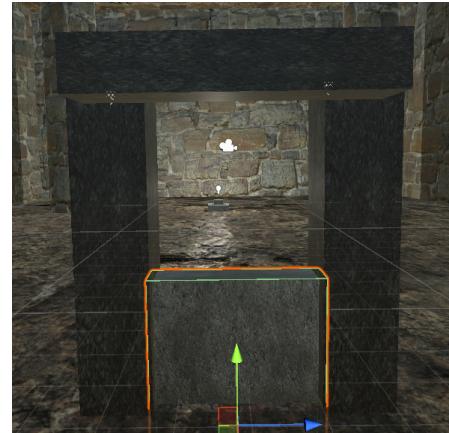
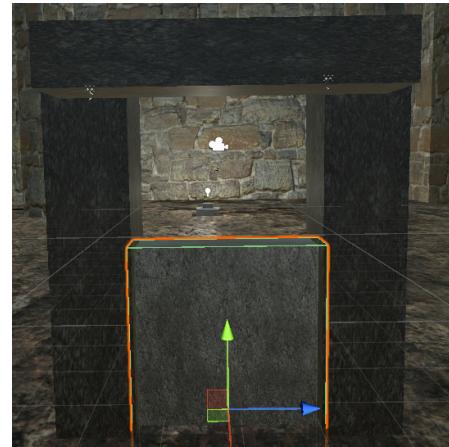
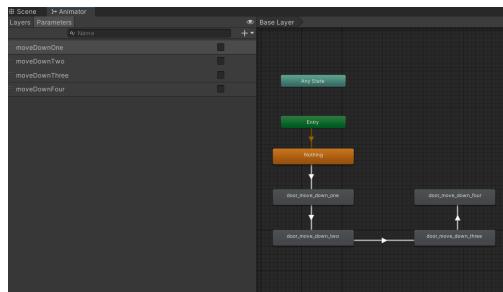
	Stairs	Created using ProBuilder, to go up to the platform		Shannen
	Rocks	Created using ProBuilder, to grab for rock climbing		Shannen
	Bars	Created using ProBuilder, to grab for monkey climbing		Shannen
	Lava	Applied a lava material using an image of a lava to a plane and added a script to make it move to emulate a lava flowing		Shannen
	Dodgeball	Created using ProBuilder, as a rigid body and disabled with gravity, and applied rock Albedo texture for an element of danger		Sahaj

	Cannon	Created using ProBuilder, attached with SpawnPoints perpendicular to the surface.		Sahaj
3	Maze	<p>The maze was developed using Unity's Terrain Tools. The foundational step involved generating initial maze layouts through the use of the online resource, https://www.mazegenerator.net, which provided the maze patterns below</p> <p>Maze 1:</p>  <p>Maze 2:</p>  <p>For the construction of the final maze, a blank terrain template was initialised within Unity, specified with dimensions of 30 units in width and 90 units in length. This served as the canvas for the forthcoming design iteration.</p> <p>The pre-generated maze images from</p>		Pranwanth

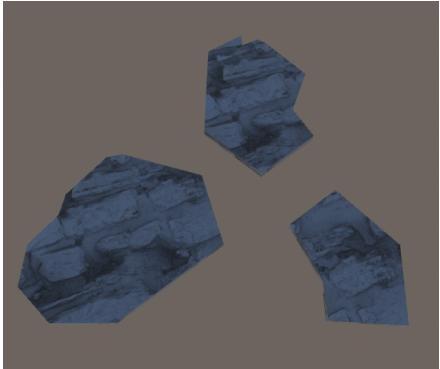
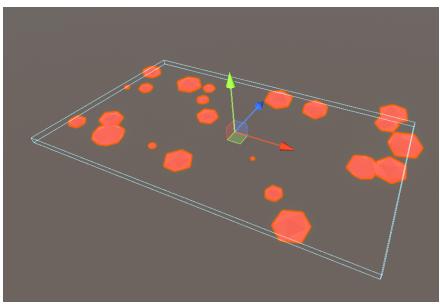
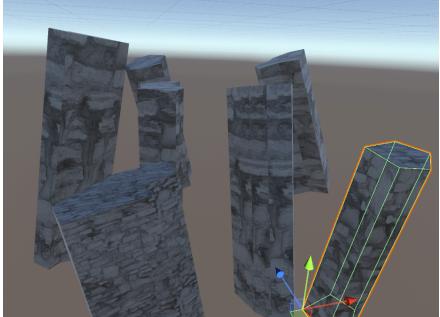
	MazeGenerator.net were then utilised as texture brushes. This technique allowed for the precise application of the maze patterns onto the Unity terrain, facilitating the transformation of flat, empty space into a complex, three-dimensional maze environment.		
Puzzle pieces	The puzzle pieces were created using Unity's default cube models, each assigned a different colour material for distinction.		Pranwanth
Puzzle	The final puzzle was crafted using Blender. This was achieved by modifying a cube, where one side was divided into four segments to simulate key slots through the application of the 'extrude region' technique, resulting in a realistic slot appearance. Subsequently, this model was imported into Unity, where box colliders were assigned to each slot to enable interaction. The 'isTrigger' attribute was activated for these colliders to facilitate the detection of the corresponding keys.		Pranwanth

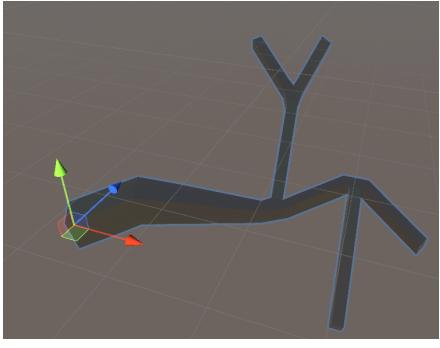
		<p>A specialised 'KeySlot' script was affixed to each slot. This script employs the 'OnTriggerStay' method to ascertain the correctness of the inserted key, upon which it precisely aligns the key within its slot.</p> <p>Additionally, this action triggers a designated function within the 'Door Script', tasked with sequentially lowering the door with each correctly placed key.</p>		
Door		<p>The door frame in the game was constructed using three of Unity's default cube models, each scaled to appropriate dimensions to mimic a traditional door frame. Similarly, the door itself was fashioned from a cube model, resized to resemble an actual door. To animate the door's opening mechanism, Unity's Animator tool was employed. Each stage of the door's incremental opening was manually recorded by adjusting the door object's Y-axis, capturing the precise movements needed for a realistic retraction.</p> <p>Within the Door Script, the insertion of the correct keys activates specific animation</p>	 	Pranwanth

triggers. These triggers then initiate the corresponding animations, ensuring that the door opens in the correct order.



	<p>Teleport</p> <p>Power Up</p>	<p>The treasure that the player picks up.</p> <p>The pedestal base in the game environment was crafted utilising Unity's built-in cube model, scaled appropriately. Supporting the centrepiece, the golden glove treasure, is a stand made from Unity's standard cylinder model.</p> <p>The treasure itself, a golden glove, was modelled by adapting the Oculus Right Hand Prefab. This base model was then enhanced with a custom gold material to achieve its distinctive appearance. The material was configured with an RGBA colour value of (255,215,0,255), embodying the vibrant hue of gold. Further refinement was applied by setting the material's metallic property to 1 and the smoothness to 0.9, with the metallic smoothness source set to Metallic Alpha.</p>		Pranwanth
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	Lava platforms	Created with Probuilder, can move along given waypoints with MovementManager.cs, can be destinations of teleportation		Zi Hang
	Lava particles	Unity particle system, can glow with post-processing		Zi Hang
	Fire torch	Fire: Unity particle system, essentially same as Lava particles. Smoke: Unity particle system Handle: built with Probuilder		Zi Hang
	Pillars	Built with Probuilder, can be destination of teleportation		Zi Hang

	Branches	Used mesh from level1, grapple, can be the target of grapple gun		Zi Hang
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3. Audio/Visual feedback

It is important for players to identify that they are actively interacting with an item or the level environment through the use of Sound, Visual and Haptic feedback. The first two scenes explore the potential possibility of implementing these systems which can be carried over in the later levels and future designs. The table below lists the current implementations of feedback:

Description of action/interaction	Type of Feedback
When the player tries to aim the grapple towards a tree, a yellow sphere with a red hook will appear at the target position to visually indicate to the player where the hook will align towards and allows the player to identify if the gun is in range to be activated.	Visual, Audio, Haptic
When activated, a sound effect will be played with haptic feedback vibration being sent to the left hand controller to signal to the player the anchor has hit	
If the player does not aim towards a valid anchor point and tries to shoot the grapple gun, a “jammed” sound effect would play to let the player know the grapple cannot be activated	Audio
When the player is swinging, a “wind” sound effect will be played and the volume/pitch of the wind sound will vary according to the velocity at which the player is swinging	Audio
When a player grabs a rock or monkey bar, a “grab” sound effect would play to let the player know that they have successfully grabbed a climbable object	Audio
When a player falls into the lava, a “dying” sound effect would play to let the player know that they have fallen into the lava	Audio

4. Conclusion & Future Work

In summary, while time constraints have left some features, like a comprehensive haptic feedback system and detailed GUI instructions for player guidance, unfinished, the project has successfully culminated in a fully functional game.

This game boasts a diverse array of mechanics that test player skills and facilitate navigation through progressively challenging levels, culminating in a final level that masterfully integrates all previously introduced gameplay elements for a climactic escape experience. Future work will likely focus on enhancing the game's interactive feedback and player support to further enrich the gaming experience.