CS427 - Game Development

FINAL PROJECT

Report

Student Information

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Introduction

Oceanest: A Deep-Sea Odyssey

Genre: Action-Adventure, Exploration, and Monster Hunting

In *Oceanest*, players dive into an exciting action-adventure set in the mysterious and dangerous depths of the ocean. You play as a seasoned sailor, someone who has spent years at sea, driven by a deep love for exploring the unknown. One day, you stumble upon a strange map that hints at a hidden treasure beneath the waves, and without a second thought, you're ready to dive into the adventure of a lifetime.

With your trusty submarine, you set off into the deep sea, eager to uncover secrets and treasures long forgotten. But it's not just the treasure waiting for you—massive, terrifying sea creatures lurk in the darkness, ready to put your courage to the test. Armed with your submarine's weapons and your quick thinking, you'll need to fight these monsters and survive the challenges of the ocean to reach the treasure.

Combining exploration, survival, and thrilling monster battles, *Oceanest* offers an unforgettable adventure that will push you to the limits. Will you uncover the ocean's hidden mysteries, or will the deep sea become your final resting place?

GitHub: Link

Demo poster: Link

Features

1. GUI

1.1. Dynamic Menu

When players open *Oceanest*, they are greeted with an inspiring and immersive menu screen that perfectly captures the deep-sea theme of the game. The background is a stunning blue, evoking the mysterious depths of the ocean. Dark waters are contrasted by vibrant schools of fish, lively coral reefs, and swaying seaweed, all gently moving as if alive. At the top left corner, the *Oceanest* logo is proudly displayed, setting the tone for the epic underwater adventure ahead.

The menu consists of five options, presented as radio buttons in a top-to-bottom order: Continue, Load Game, New Game, Tutorial, and Quit. Each button is designed to smoothly guide the player to their desired action:

- **Continue**: This option allows players to instantly jump back into their last game session. If you've already begun your adventure and want to pick up exactly where you left off, this is the button for you. It's a handy feature for players who have invested time into the game and wish to continue their progress. However, this button only appears if there is a saved game session to continue.
- **Load Game**: For players who want to open a saved game file, this option is the go-to. The game cleverly embeds saved data into a steganographic image, making loading a saved game both unique and seamless.
- **New Game**: Ready for a fresh start? The New Game button allows players to begin a brand new adventure.
- **Tutorial**: For those new to *Oceanest* or anyone wanting a refresher on the controls, the Tutorial option leads to a special scene with no monsters. Here, players can freely explore and learn the basics of controlling the submarine through an interactive tutorial, offering a relaxed space to practice without any pressure.
- **Quit**: This button does exactly what you'd expect—it exits the game and takes the player back to their desktop or console home screen.

Each menu option is crafted to give players an easy, smooth experience as they prepare to dive into the ocean's depths or return to shore.

1.2. Pause Screen

The pause screen in *Oceanest* is designed to let players take a break easily. When the game is paused, the screen is covered by a pitch-black overlay that darkens

everything in the background, putting full focus on the menu options. This strong contrast makes it clear that the game is paused without fully stopping your progress.

The pause menu offers three key buttons, arranged from top to bottom: Continue, Restart, and Quit.

- **Continue**: This button allows players to instantly return to the game exactly where they left off. If you've paused to take a quick break, this is the option to use to dive right back into the action.
- **Restart**: For players who want a fresh start from the current level or encounter, the Restart button lets you reset the gameplay. Whether you want to tackle a challenge differently or simply start over, this option takes you back to the beginning of your current session.
- **Quit**: The Quit button brings players back to the main menu screen. It's perfect for when you're ready to exit your current game session but still want to navigate the main menu or start something new.

This straightforward pause screen keeps everything clear and easy to use, allowing players to quickly take action and get back into their deep-sea adventure.

1.3. Winning Screen

The winning screen in *Oceanest* is designed to give players a moment of triumph after completing their challenge. The screen is covered with a black overlay, creating a calm and focused atmosphere. At the center, the words "YOU WIN" appear in bright

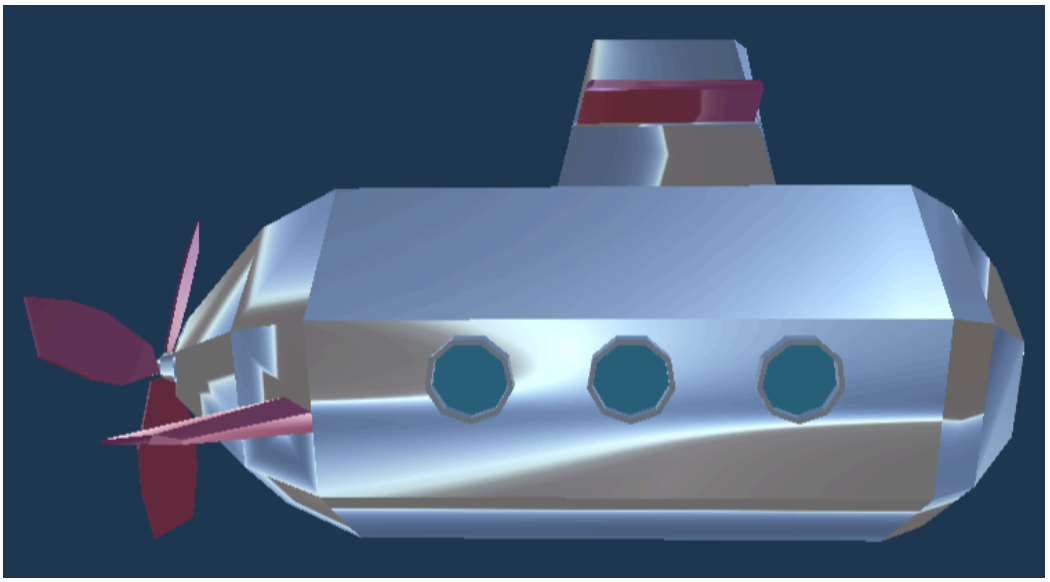
golden letters, slowly fading in to emphasize the victory. Right below it, there's a single button labeled "Return to Menu."

- **Return to Menu**: This button takes players back to the main menu screen, where they can start a new game, load a saved file, or exit the game. It's a simple way to close out the current game session after a well-earned win.

This straightforward winning screen keeps the focus on celebrating the player's success while providing a quick path back to the main menu.

2. Gameplay mechanics

2.1. Submarine control



In *Oceanest*, controlling your submarine and managing your actions is simple with a few easy-to-remember keys. Here's how you can navigate and interact with the game:

- **A and D**: Steer the submarine left (A) or right (D).
- **Q and E**: Use Q to slow down or brake, and E to boost your speed.
- **W and S**: Press W to rise toward the surface, and S to dive deeper into the ocean.
- **J**: Fire a missile to attack sea creatures.
- **I**: Open the shop to upgrade your submarine or buy new gear.
- **P**: Pause the game whenever you need a break.
- **PrtSc**: Capture a screenshot of your gameplay while also saving your progress into a steganographic saved image.

2.2. Missiles

Missiles are your primary and most powerful weapon for hunting down the sea monsters that lurk in the deep ocean. They are crucial for battling these formidable creatures and are the only weapon you have at your disposal.

To use the missiles, first, aim the front of your submarine toward the target you want to hit. When you're ready to fire, press the shoot button (J). This action launches a powerful missile directly at the sea monster. The missile will travel through the water and deal damage to the boss, gradually reducing its health until it reaches zero.

One important thing to note is that, because these sea creatures are unknown to mankind, you won't know exactly how many missiles it will take to defeat each monster. Each creature has its own strength and might require a different number of hits. However, you don't need to worry about running out of missiles. Your submarine is equipped with an almost infinite supply, so you can keep firing as needed until the monster is defeated.

The missile system is designed to be straightforward and effective. By aiming carefully and using your missiles wisely, you can bring down even the toughest sea monsters and continue your exploration of the mysterious deep sea.

2.3. Shop and Upgrades

The shop is where players can upgrade their submarine to improve their chances in battle. There are two main upgrades available, each offering a unique benefit to help you in your adventure.

1. **Tracking Missiles**
   This upgrade costs 15 coins. Tracking missiles are designed to make it easier to hit your targets. Once equipped, these missiles will automatically follow the boss or any other target you're aiming at, improving your aim and making it less likely for the missiles to miss. This can be especially useful during tough battles where precision is key.
2. **Double Missiles**
   This upgrade costs 10 coins. With double missiles, your submarine can fire two missiles at once instead of just one. This effectively doubles the number of missiles you can shoot, which can significantly increase your firepower and make it easier to take down enemies.

At the beginning of the game, players will only have enough coins to purchase one of these upgrades. To get more coins and access the second upgrade, players need to defeat the first boss. Defeating the boss not only earns you more coins but also

makes the next boss slightly easier to handle, giving you a better chance to buy the remaining upgrade.

With these upgrades, you can enhance your submarine's combat abilities, making it more effective in battle and better prepared for the challenges that lie ahead in the deep sea.

2.4. Boss

A free asset is used for the Giant Worm Boss for time-saving and convenienceIn the boss room, the boss will emerge and launch an attack on the submarine. The boss currently employs two strategies:

- **Random**: The boss appears at a random location and attacks in an arbitrary direction.
- **Frontal Attack**: The boss predicts the submarine's position, emerges in front of it and strikes directly.

3. Interactive Tutorial

The Interactive Tutorial provides players with a hands-on guide to mastering the submarine controls. By choosing the Tutorial option from the main menu, players are taken to a calm underwater scene where they can freely explore and practice without any threats. The tutorial walks players through each control step-by-step, and the

instructions on the screen change only after the player successfully performs the required action. Below are the steps, along with where to insert images for each control instruction:

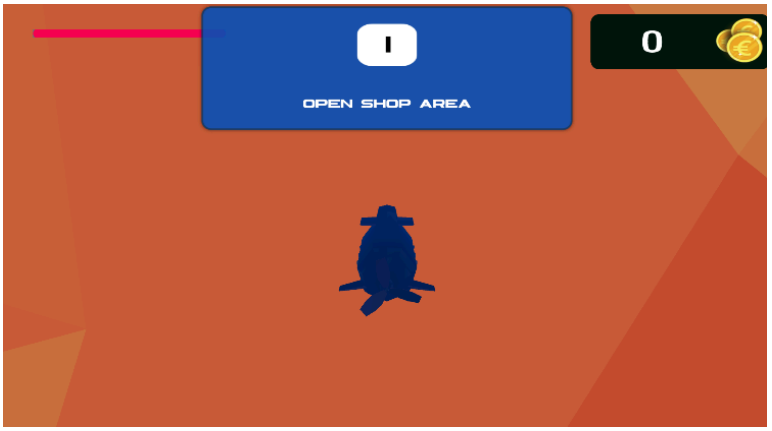
1. **Steering the Submarine**
   The tutorial first introduces basic steering controls. Players will learn to move the submarine left and right by using the **A** and **D** keys.

2. **Moving Up and Down**
   Next, players are taught how to control the submarine's depth. Use **W** to rise toward the surface and **S** to dive deeper into the sea.

3. **Braking and Boosting**
   The tutorial then explains how to adjust the submarine's speed. Press **Q** to brake and slow down, or **E** to boost and increase your speed.

4. **Firing a Missile**
   Players are shown how to attack enemies using missiles. Press **J** to fire a missile at a target.

5. **Accessing the Inventory**
   Finally, the tutorial demonstrates how to open the inventory. Press **I** to access the shop and inventory for upgrades and equipment.



Once players have successfully followed each instruction, a final dialog appears, letting them know the tutorial is complete. This dialog includes a button to return to the main menu.

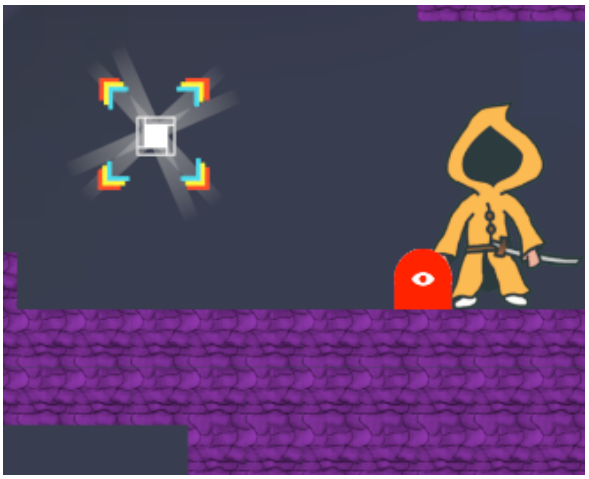
Advanced Features

1. Save as Stenganographic Image

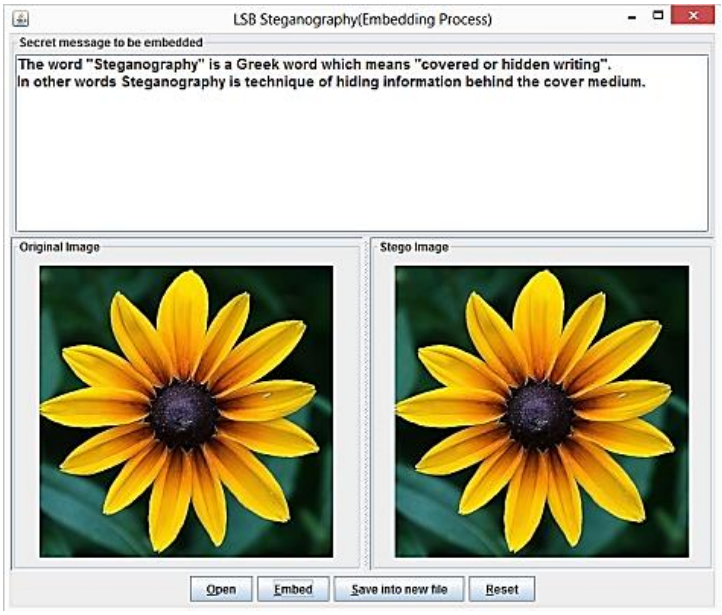
The *Save as Steganographic Image* feature in *Oceanest* is adapted from our previous project, *Cliquey*, where we first introduced this unique save system. This method allows players to save their game progress by embedding their data directly into a screenshot of their gameplay, eliminating the need for traditional save files.

By using a steganographic algorithm, the game hides essential data—such as player progress, inventory, and settings—within the colors of the screenshot. This data embedding is completely invisible to the human eye, meaning the image looks like any normal screenshot. When the player loads the screenshot, *Oceanest* reads the hidden data and restores the game to the exact point where the player left off.

This system ensures a seamless experience, making it easy for players to transfer or share their game progress simply by saving and using a screenshot.



Our last game Cliquey with the similar unique save file mechanic



A brief description of 'Steganography'
is embedded into the flower image with no noticeable difference

2. Supported Multiple Platforms and Multiple Resolutions

Oceanest is available to play on both PC and Web platforms, giving players the flexibility to choose how they want to experience the game. Whether you're playing on your computer or through a browser, the controls remain the same, so there's no need to learn different setups for different platforms.

For players using the browser-based version, there's no need to download or install any software. Just head to our website and start playing instantly with an internet connection. This makes the game easily accessible to everyone, without the hassle of managing large files. You can play the web version of *Oceanest* at:
[Insert game website link here]

No matter the platform or screen resolution, *Oceanest* adjusts to provide a smooth, immersive experience for all players.

Other game components

1. Deep sea reef

To be continued…

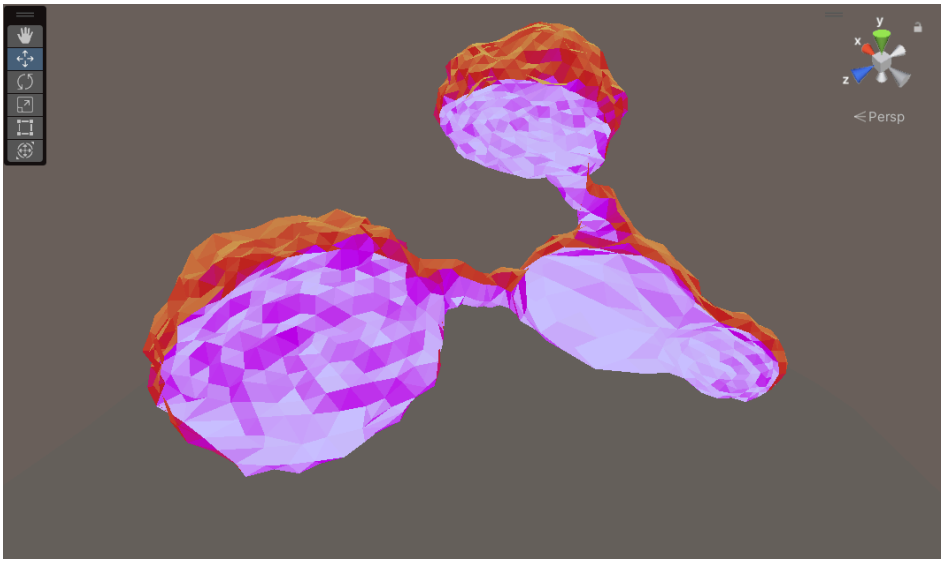
2. Fish Boids

The fish boids component in Oceanest is designed to emulate a vibrant underwater ecosystem. By simulating schools of fish with boid or flocking behavior, the game creates a dynamic and realistic marine environment. Each fish moves in groups, following natural patterns such as avoiding collisions with nearby fish, matching speed with their flockmates, and staying close to the group. This behavior not only adds depth to the underwater world but also enhances the overall immersive experience, making the ocean feel alive and bustling with activity.

3. Map

The map in *Oceanest* is a vast and intricate environment built from a large triangulated mesh. This mesh is designed with inverted normal vectors, creating a unique visual effect that is suitable for the game's underwater cave system setting. The map features a system of interconnected cave rooms and tunnels, each filled with vibrant, colorful details that stand out against the deep sea backdrop.

The bright and varied colors not only make the environment visually striking but also help players navigate through the complex network of caves and tunnels. The design of the map ensures a rich and engaging exploration experience, inviting players to discover hidden areas and secrets as they journey through the underwater world



An overview of the total map cave system

4. Ambience Sound

The ambience sound plays a crucial role in creating the game's immersive atmosphere. The sounds are designed to evoke the feeling of being deep underwater, where the environment is mysterious and full of adventure.

The ambient sounds are crafted to reflect the deep sea’s unique environment. You’ll hear subtle, echoing noises that mimic the vast, open spaces of the ocean, along with distant, haunting tones that suggest the presence of hidden treasures and lurking monsters. These sounds help to set the mood for exploration and create a sense of wonder as you dive deeper into the game world.

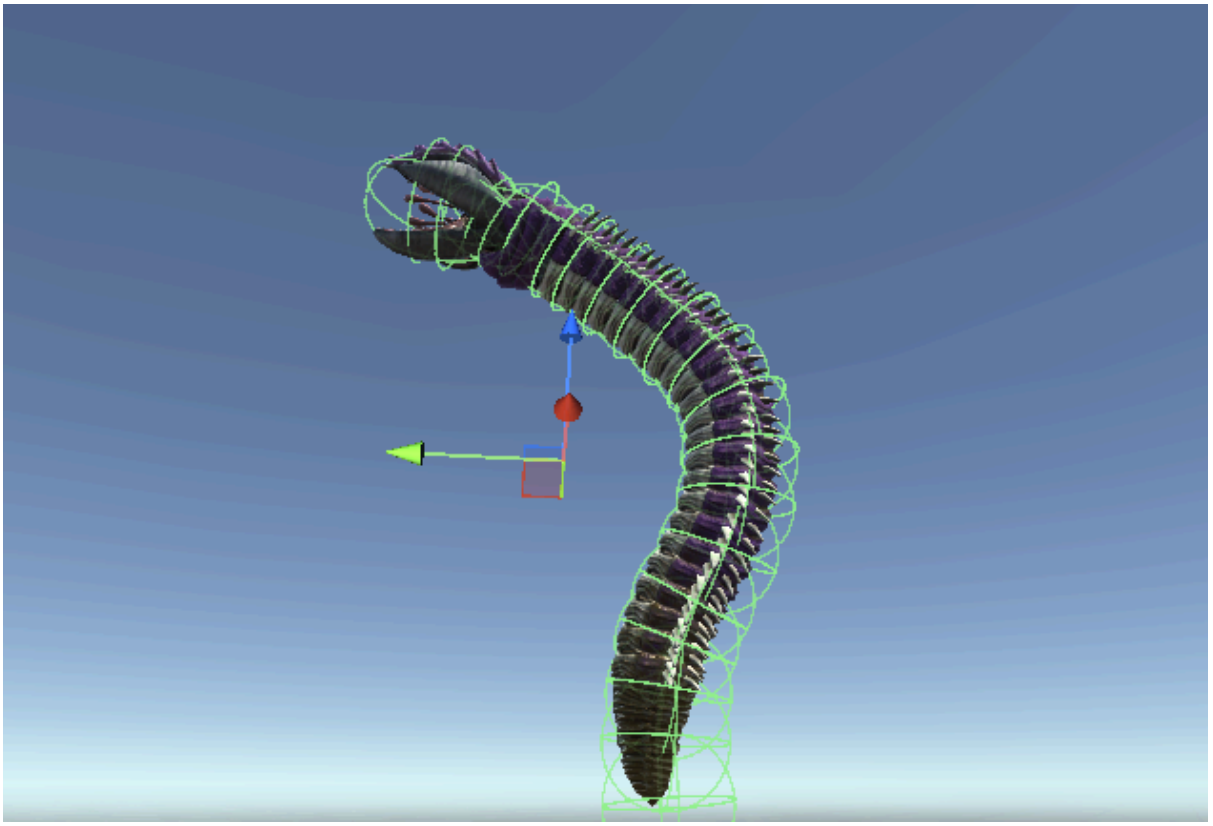
The choice of sounds enhances the adventurous feel of the game, making each dive into the ocean more thrilling. Whether you're hunting for treasures or facing off against giant sea creatures, the ambient sounds contribute to the feeling that you’re truly in an expansive and mysterious underwater world. This audio atmosphere is designed to draw you in, making every moment of exploration and combat feel more intense and engaging.

Techniques

1. Cube Marching Terrain with parallel computing

To be continued…

2. 3D model skeleton animation with hitbox



3. Underwater Camera Shader

We use a custom underwater camera shader to give the game its distinctive deep-sea look. This shader works by adjusting how the camera captures and displays the underwater environment. Essentially, it takes each pixel from the camera's view and changes its color to create a more immersive experience.

The shader applies a blue tint to all the pixels, reflecting the ambient blue color of the deep sea. This blue effect simulates the way light filters through water, giving the game a realistic underwater atmosphere. By multiplying the color of each pixel with this blue tint, we create a visual effect that makes the environment feel like it's truly beneath the ocean's surface.

The use of this shader helps to enhance the overall mood of the game, making the underwater world look and feel more authentic. It adds to the sense of depth and immersion, ensuring that players experience the ocean in all its blue, mysterious beauty.

Notice that the shader does not affect the GUI elements of the game.

4. Map Creation using Blender Geometry Graph

To be continued…

5. Boid simulation

We simulate schools of fish using a technique called boid or flocking behavior. This system allows the fish to move in groups, creating a natural and realistic underwater experience. The behavior of each fish is based on three simple principles:

1. **Collision Avoidance**: Each fish tries to avoid bumping into nearby fish by steering away when they get too close.
2. **Velocity Matching**: The fish attempt to match their speed and direction with the fish around them to move together smoothly.
3. **Flock Centering**: Fish try to stay close to the group, maintaining a sense of unity as they swim.

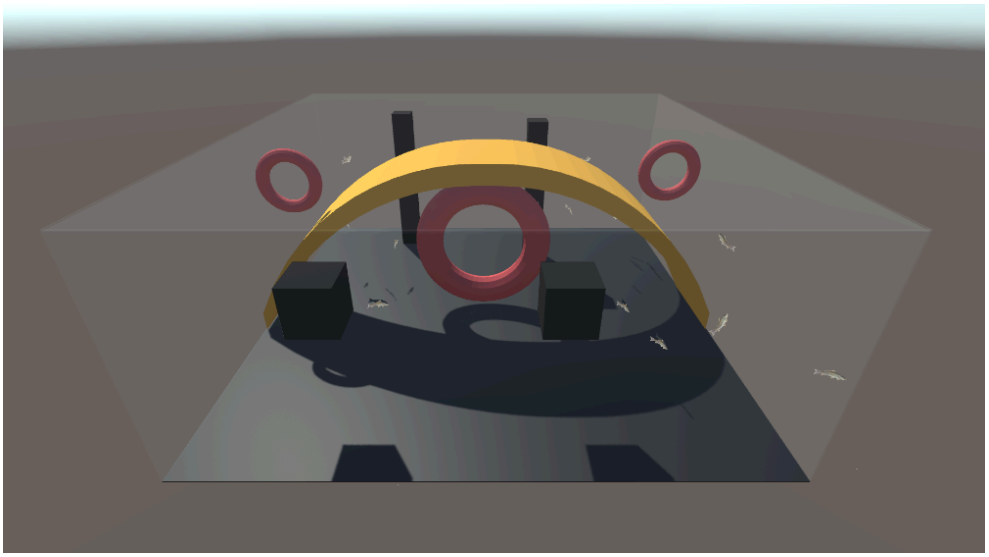
Each of these factors is computed separately but combined to determine how each fish moves and adjusts its direction. By adjusting the "look-at" vector (where the fish is heading), we achieve a smooth, natural flocking movement. The way these principles are balanced helps create the lifelike schooling behavior that you see in the game.

When simulating the boids in 3D space, each fish has a specific view range, which is shaped like a cone. To detect collisions or obstacles, we cast rays from the fish's

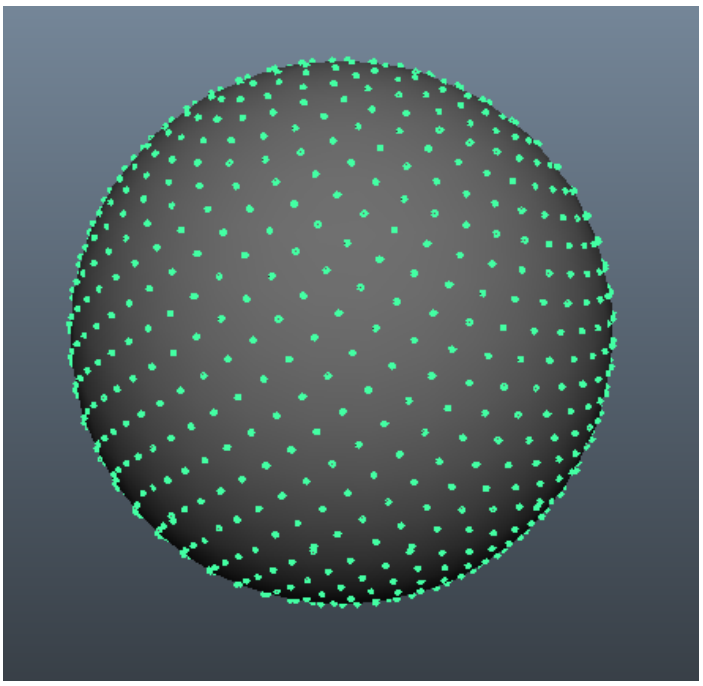
point of view (like its "eyes") out into the environment. This helps the fish know what's around them and where to steer.

To make this process efficient, we use a method called the Fibonacci sphere algorithm to scatter points evenly across a sphere. This gives us a good spread of directions for the fish's view range. Although the algorithm is quite old and doesn't always perfectly distribute the points, it's fast and works well enough for our needs. We take a subset of these points to form the cone-shaped view range of the fish and use that to calculate possible collisions with other objects.

By combining the boid behavior principles with efficient ray casting using the Fibonacci sphere, we create dynamic, lifelike schools of fish that can navigate the 3D underwater world of *Oceanest* in a believable way.



A demo scene for the fishes with custom obstacles



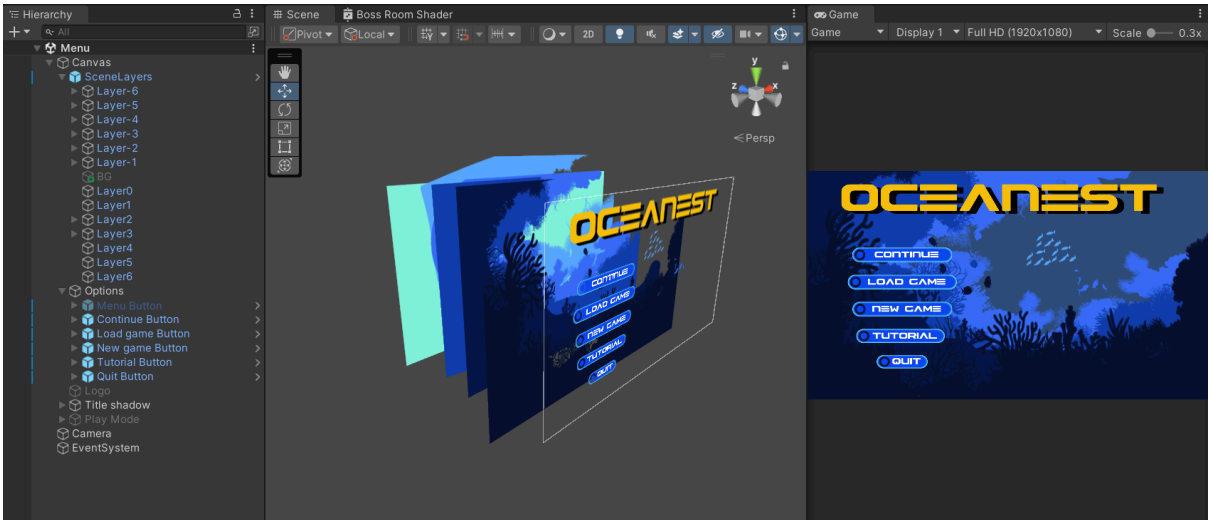
The image of distribution of n = 1000 points on a sphere using Fibonacci Sphere Algorithm

6. 3rd viewpoint camera follow

The camera system in this submarine simulation is set up to follow the submarine dynamically, ensuring that the camera remains fixed on the submarine's position regardless of its movement. This allows the player or viewer to always stay focused on the submarine as it navigates the ocean.

In addition to the main camera, there is a secondary "deep camera" that is responsible for capturing depth information. This depth data is utilized to create custom shaders, which enhance the visual fidelity of the underwater environment by simulating realistic light absorption, scattering, and other effects typically seen in ocean water. The combination of these two camera systems adds to the immersive experience, ensuring that both the movement and visual depth of the ocean world feel authentic.

7. Parallaxing



We use a technique called parallaxing to create a more dynamic and engaging menu screen. Parallaxing involves using multiple 2D layers that are arranged in 3D space, similar to how billboards are set up. These layers are designed to give the illusion of depth and distance as the camera moves.

The layers are placed at different distances from the camera and move at different speeds. When the camera, which is set in orthogonal mode, shifts position, the layers move at varying rates. Layers that are closer to the camera move faster than those further away. This difference in movement speeds creates a sense of depth and makes the scene feel more three-dimensional.

By using parallaxing, we enhance the visual experience of the menu screen, making it feel more lively and immersive. It helps to draw players into the game right from the start, adding an extra layer of visual interest to the game's interface.

References

Boss asset: [Giant Worm Pack PBR - Fantasy RPG - Free Download | Dev Asset Collection (unityassetcollection.com)]

Music: Underwater Sounds 10 Minutes | 🎧 Underwater Ambience Sound Effect

The Fibonacci Sphere Algorithm: [Measurement of areas on a sphere using Fibonacci and latitude–longitude lattices]

Boid/Flocking behavior simulation paper: [Craig Reynolds: Flocks, Herds, and Schools: A Distributed Behavioral Model (toronto.edu)]