Design Decisions for My CS 330 Final Project

Working on this CS 330 Final Project has been quite a journey, filled with many challenges and accomplishments. As a student balancing the pressures of being actively in the military, having a full-time job, and spending time in the hospital, this project pushed me to test my limits in time management, determination, and technical growth. Despite the hurdles, I learned a lot and am proud of the final result. Here's a breakdown of the choices I made throughout the development of my 3D scene, from the selection of objects to the coding and implementation process.

3D Objects and Shapes

For this project, I selected an image that had a simple design but required thoughtful planning to recreate it in a 3D environment. The objects I chose were low-polygon versions of a cupcake and its associated elements: a cylinder for the base, a sphere for the frosting, and another small sphere to represent a cherry on top. These choices allowed me to work with basic shapes such as a cylinder, sphere, and plane, all while keeping the polygon count under the required 1,000 triangles. This decision minimized complexity and saved time, which was especially important as I juggled my military duties and time spent recovering in the hospital.

Texturing Challenges

Applying textures was definitely one of the more time-consuming aspects of this project. I initially struggled with finding appropriate royalty-free images, but after some trial and error, I was able to source a frosting texture and a cake texture from online resources. One of the problems I encountered was ensuring the texture resolution met the required 1024x1024 pixel size. I learned the importance of scaling textures correctly to avoid stretching or warping them, which was something that came up in earlier milestones. The YouTube tutorials I watched helped a lot with UV mapping and aligning the textures properly.

Lighting Setup

When it came to lighting the scene, I knew I wanted to create a polished look that made the objects stand out. I applied two light sources—one directional light to simulate sunlight and one point light to illuminate the scene from a specific angle. Setting up the lighting took more time than expected because I had to tweak the positions to make sure none of the objects appeared too dark when viewed from different camera angles. I also incorporated the Phong shading model for ambient, diffuse, and specular lighting. Initially, I had some issues getting the lighting to interact properly with the textures, but refining the light source parameters allowed me to get the polished result I was aiming for.

Camera Navigation

The navigation system was another key focus of the project. I applied horizontal, vertical, and depth camera movement, which required adjusting the camera's orbit to ensure it captured all the objects. The WASD and QE keys allow users to move forward, backward, and up or down, while the mouse cursor changes the camera's orientation. There were moments when I struggled with the camera's responsiveness, particularly when trying to moderate the speed of movement, but I implemented fine controls that allowed the user to adjust both speed and camera orientation. Creating the ability to switch between perspective and orthographic views with a keyboard tap was another feature that required precision but added a nice touch to the final scene.

Time Management and Personal Challenges

Managing my time was one of the hardest aspects of this project. Being in the military and working a full-time job often left me with limited hours to focus on coding. Additionally, being in the hospital for an extended period made it even more difficult to meet deadlines. I had to constantly adjust my schedule to fit in coding sessions, whether late at night or early in the morning. Despite these constraints, I was able to break the project down into manageable pieces by following the milestones and focusing on one aspect at a time. Without the help of some online tutorials and guidance from a few YouTube videos, I might not have been able to get past the tougher coding problems. The sense of accomplishment I felt once I overcame these obstacles was worth the effort.

Modular Code and Best Practices

In terms of coding best practices, I made sure to break down my code into modular functions. For example, I created custom functions to handle the transformation and lighting setup, which kept the project organized and allowed for easier debugging. Each function had a clear purpose—whether it was loading textures, setting object materials, or handling camera movement. I followed industry standards by ensuring my code was well-commented and easy to follow. This modular approach also helped me track down and resolve issues more quickly, especially when I encountered problems with texture alignment or camera navigation.

Final Reflection

Looking back, the project was stressful, but the experience also solidified my understanding of 3D graphics and OpenGL. I learned how to approach problem-solving more systematically and gained a new appreciation for the complexity behind seemingly simple 3D scenes. Despite the challenges of managing military responsibilities, full-time work, and personal health, I persevered and created a 3D scene I am proud of. The final result reflects the hard work and countless hours I put in, often during moments when I wasn't sure I had the time or energy. It's been a rewarding learning process, and I'm happy with how the project turned out.