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Final Project Reflection: 3D Scene Creation

For my final project in CS 330, I created a 3D scene using a combination of primitive shapes, textures, lighting, and camera controls. This project allowed me to explore the fundamentals of computer graphics and apply various concepts I learned throughout the course, such as object transformations, texture mapping, and lighting models. Below, I reflect on the key design decisions, the technical implementation of navigation, and the custom functions used to achieve a modular and organized approach to my scene creation.

Development Choices for My 3D Scene

In developing my 3D scene, I focused on using primitive shapes to create realistic representations of the objects in my reference image. One of the primary goals was to select shapes that were simple enough to avoid excessive polygon counts while still conveying the necessary detail to make the scene visually accurate. For example, I constructed the butter dish using a combination of box and sphere shapes. The base of the butter dish is represented as a box with precise dimensions, while the lid

was created using a cylinder, and a sphere was added on top as the knob. This combination allowed me to balance simplicity and realism, focusing on form and functionality rather than overcomplicating the geometry. Similarly, I used a cylinder for the plate and additional primitive shapes, such as spheres and cylinders, to represent the fruit on the plate. These choices ensured that I adhered to the guideline of using basic shapes while still creating a scene that closely resembled the 2D reference image.

The texture mapping added depth and realism to the scene. By applying accurately projected textures, such as the wood texture for the counter and a white texture for the plate, I enhanced the visual appeal and provided the appropriate material representation for each object. I was able to use OpenGL’s texture functionalities to bind these textures, ensuring they mapped correctly onto the 3D objects.

Lighting was another crucial element in my design. I implemented two light sources—a directional light to simulate sunlight and a point light to add focus to the objects. These light sources helped me achieve a more polished and visually appealing scene, creating shadows and highlights that enhanced the depth of the objects. I carefully positioned the lights to avoid overexposing or dimming any part of the scene, ensuring a balanced visual experience.

How a User Can Navigate My 3D Scene

I implemented camera controls to allow the user to explore the 3D scene from different angles. Using input controls like the WASD keys for forward, backward, left, and right movement, and QE keys for upward and downward movement, the user can easily move through the scene in a manner similar to navigating a virtual world in a video game. Additionally, I included mouse controls for adjusting the camera's pitch and yaw, enabling the user to look around the scene from different perspectives.

These controls allow the user to move freely and observe the objects from multiple angles, which is essential for a 3D scene. The camera's depth and positioning are also adjustable, giving the user full control over the viewing experience. This approach ensures that the entire 3D world can be explored interactively, with smooth transitions between different viewpoints.

Custom Functions for Modularity and Organization

To keep my code organized and modular, I developed several custom functions that handled specific tasks such as object transformations, texture application, and shader configuration. For instance, the SetTransformations function allowed me to easily manage the scaling, rotation, and positioning of each object in the scene. This function took in the necessary transformation parameters and applied them to the object without repeating code for each individual object, ensuring reusability and minimizing redundancy.

Additionally, the SetShaderTexture and SetShaderMaterial functions streamlined the process of binding textures and materials to the objects. These functions enabled me to switch between different textures and materials efficiently, making the process of texturing various objects more manageable. The modular design of these functions contributed to a cleaner, more maintainable codebase, which is critical when working on larger, more complex projects.

All and all, the process of creating this 3D scene provided me with invaluable experience in working with OpenGL, primitive shapes, texture mapping, and lighting techniques. By keeping the code modular, focusing on simplicity and accuracy in object representation, and providing intuitive navigation controls, I was able to create a polished final project that met the course requirements. Through this project, I gained a deeper understanding of the principles of 3D graphics and how to apply them in real-world applications.