CS 330

SNHU

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Design Decisions for 3D Scene Creation

This project required creating a 3D scene using OpenGL. The goal was to replicate a 2D image with simple, low-polygon objects. Four objects were chosen: a Tabasco bottle, water bottle, coffee mug, and record drive. Each was constructed from basic geometric shapes like cylinders, boxes, and prisms. I focused on building these objects, applying textures, setting up lighting, and implementing user navigation.

The Tabasco bottle was the most complex object. It required multiple primitive shapes. The body was made from two cylinders, one for the lower part and one for the upper part. The cap was a hexagonal prism. This showed how combining simple shapes can form a recognizable object. The bottle was textured with an image of a label, adding realism.

The water bottle was built from a single cylinder for the body and a smaller cylinder for the cap. A thin ring at the bottom was added using a narrow cylinder. I gave the bottle a matte black appearance, reflecting an industrial look. This object didn't need textures. The material properties were enough to create the intended design.

For the coffee mug, I used two concentric cylinders. This created the hollow effect. The outer cylinder represented the body, and the inner one formed the hollow space. A torus was used for the handle. The mug was colored green and textured with a smiley face. This added character to the object.

The record drive was the simplest object. It was a box with a texture applied to its surface. This object balanced the scene. The simplicity of the shape, paired with the texture, made it fit well with the other objects.

Textures were used on two key objects: the Tabasco bottle and the record drive. The Tabasco bottle had a high-resolution image for its label. The record drive was textured with a realistic surface image. These textures were loaded and mapped using OpenGL. Mipmaps ensured the textures displayed correctly at different resolutions.

Lighting played a major role in the scene. A directional light simulated sunlight. This provided a consistent light source for all objects. I also added five point lights. Each was placed to highlight different parts of the scene. Ambient, diffuse, and specular properties were set for the lights. This created different reflections and shadows depending on the material of each object. For example, the Tabasco bottle reflected light more than the water bottle.

A spotlight was added to focus on the center of the scene. This enhanced the presentation by drawing attention to the main objects. The spotlight used strong ambient and diffuse lighting, which helped create depth in the scene.

The camera navigation system allowed users to explore the scene. WASD keys moved the camera forward, backward, left, and right. QE keys controlled upward and downward movement. The mouse was used to change the camera's orientation, letting users look around. The mouse scroll adjusted the speed of camera movement. These controls let users view all objects from multiple angles.

A toggle for switching between perspective and orthographic views was added. This allowed users to see the scene in two different ways. In perspective view, objects appeared smaller as they moved away from the camera. In orthographic view, objects were displayed without distortion. This provided an alternative way to examine the scene.

Code organization was important. I created custom functions for common tasks. SetTransformations() handled scaling, rotating, and translating objects. This made applying transformations to objects easy and consistent. SetShaderTexture() was used to bind textures to objects before rendering. This ensured that textures were applied in a reusable way. These functions kept the code clean and modular.

The design choices were focused on simplicity and efficiency. Each object was made from basic shapes. Textures and lighting enhanced their appearance without adding complexity. The camera system made the scene interactive. By keeping the code modular, I ensured the project could be expanded or modified easily.

This approach created a functional, efficient 3D scene that met the project requirements.