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CS 330

CS 330 Final Project Design Plans

This final project has been one of the most challenging and rewarding experiences I’ve faced in my CS 330 course. From the very beginning, I knew that replicating a 2D image in a fully interactive 3D scene would push my skills in C++ and OpenGL to a new level. In each Milestone I had to carefully consider not just how each object would look, but also how they would interact in a virtual space, how lighting would affect their appearance, and how users could navigate around them smoothly. While all of these things led to countless errors and frustrating defeats, it also offered a unique opportunity to think creatively and problem-solve in ways I hadn’t before. I chose to build a workspace scene featuring a microphone, a laptop, a mouse, and a table. Originally, I had planned to include a squirrel as one of the objects, but after attempting it, I realized that the complexity of modeling the squirrel based on the picture I had sent would take far too much time and effort for the level of detail required. Replacing it with a table allowed me to focus more on the quality of the objects I could realistically complete, ensuring that the scene felt complete and balanced without overwhelming myself with overly complicated models.

Creating the lighting for the scene was one of the first major challenges. I started with a directional overhead light to illuminate the overall scene and added a colored point light near the microphone to add depth and create visual interest. Positioning these lights required multiple iterations—too close and some objects appeared washed out, too far and shadows became unrealistic. It was also a struggle to balance the Phong shading components of ambient, diffuse, and specular lighting so that each object looked realistic while keeping the scene visually appealing from all angles. I spent a significant amount of time tweaking the intensity and position of the lights, and these adjustments taught me how subtle changes in lighting can dramatically affect the perception of depth and realism in a 3D scene.

Next were the applying textures. For the laptop screen and table surface, I sourced high-resolution, royalty-free images and had to carefully map them to the objects’ geometry. Ensuring that the textures didn’t stretch or misalign required me to think about UV coordinates and how each polygon should correspond to the texture image. It was tricky at first, especially on objects like the laptop where the screen and body had different shapes and required separate textures, but seeing the textures applied correctly made the scene feel much more lifelike and polished.

Adding multiple objects and arranging them in the scene was another process that demanded careful attention. Each object—the microphone, mouse, laptop, and table—had to be created from basic shapes like boxes, cylinders, and spheres, and sometimes combined to form a single object, such as the microphone which used both a cylinder and a sphere. Placing them correctly in 3D space to match the reference image required adjusting X, Y, and Z coordinates repeatedly, ensuring objects didn’t unintentionally intersect while still maintaining the composition from the original photo. Managing all these objects also pushed me to write custom functions that could build complex objects from multiple shapes, which helped keep my code modular, organized, and reusable for future projects.

Finally, implementing camera controls and navigation added another layer of complexity. I wanted users to explore the scene freely, so I coded horizontal, vertical, and depth movement along the X, Y, and Z axes using WASD and QE keys. The mouse controls allow pitch and yaw rotations to look around the scene naturally, and the scroll wheel adjusts movement speed, giving a sense of smooth, responsive navigation. Testing the camera around all four objects revealed areas that needed adjustment, especially in making sure the point light illuminated everything properly as the viewpoint changed. This part of the project really highlighted how interconnected each element is—the placement of objects, lighting, textures, and camera movement all needed to work together seamlessly to create a satisfying user experience.

Overall, this project required me to think critically, experiment with different approaches, and continually revise my work. There were many moments of frustration—lights that didn’t reach certain areas, textures that looked distorted, and objects that overlapped in unexpected ways—but each challenge taught me more about the nuances of 3D graphics development. I feel proud of the final scene I created, not just for its visual appearance, but for the process of problem-solving and creative thinking it represents. This project pushed me technically and creatively, and it’s one of the most complex pieces of work I’ve completed in my programming career so far.