**Reflection on 3D Scene Development for Triangle and Cube Studios**

As a C++ and OpenGL 3D graphics developer at Triangle and Cube Studios, my task was to transform a 2D image provided by our client into a 3D scene suitable for use as a preliminary concept for 3D printing. The goal was to create a simplified yet accurate representation of the client's vision using basic 3D shapes, while also ensuring that the scene could be effectively visualized and navigated.

A house under construction with sand and blue sky

Description automatically generated

**Development Choices for 3D Objects**

In developing the 3D scene, I selected objects based on the essential components visible in the original 2D image. The objects were created using low-polygon models to ensure efficient rendering, which is particularly important when the end goal is 3D printing. The shapes I used include box, plane, and prism. For example, the box shape was used to construct the main structure of the house, while planes were utilized for surfaces like roof shade and ground. Prisms were employed to capture more complex geometrical features that added depth to the scene.

The use of these basic shapes allowed for a reduction in polygon count, which ensured that the models were lightweight and could be processed quickly during rendering. This approach also helped in maintaining structural integrity when these models are eventually 3D printed.

**Application of Textures**

For the visual fidelity of the scene, I applied textures that closely mimicked the materials depicted in the 2D image. Textures were applied to all objects in the scene, with a focus on realism and detail.

**Lighting Setup**

Lighting was a key aspect of the scene, used to enhance the visual appeal and realism of the 3D models. I implemented 4 light sources, including a directional light. The point light was positioned to emphasize the front of the house, ensuring that all objects were well-lit and visible from various angles. The Phong shading model was utilized to create realistic lighting effects, incorporating ambient, diffuse, and specular components. This not only added depth to the scene but also helped in creating a polished final visualization.

**Object Placement and Scene Composition**

Positioning the objects within the 3D scene required careful attention to the original 2D image. Using the X, Y, and Z coordinates, I arranged the objects to match the photograph as closely as possible. This process was iterative, involving adjustments to ensure that the objects' relative positions and proportions were accurate. The placement of each object was crucial in maintaining the integrity of the scene, particularly when viewed from different angles.

**5. Navigation and Camera Control**

To allow users to explore the scene fully, I implemented comprehensive camera controls that enabled navigation along the X, Y, and Z axes. The WASD keys were programmed for horizontal and depth movement, while the QE keys allowed for vertical movement. This setup ensured that users could navigate the entire scene, viewing all objects from multiple perspectives.

In addition to basic navigation, I incorporated nuanced camera controls to enhance the user experience. The mouse cursor was used to change the camera's orientation, allowing for pitch and yaw adjustments. The mouse scroll was implemented to adjust the speed of movement, giving users precise control over how they navigate the scene. These features were essential in providing a detailed and user-friendly exploration of the 3D environment, which is particularly important when evaluating a model intended for 3D printing.

**Conclusion**

This project required a thoughtful balance between simplicity and accuracy, with every decision guided by the need to create a 3D scene that faithfully represented the client's vision. By carefully selecting and positioning basic shapes such as boxes, planes, and prisms, and applying appropriate textures and lighting, I was able to create a scene that met the client's needs while also being suitable for 3D printing. The navigation and camera controls ensured that the scene could be explored thoroughly, providing a complete and immersive experience for the client.

A screenshot of a video game

Description automatically generated