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Design Decisions Document

The development of my 3D scene focused on creating an engaging environment that balanced visual detail with computational efficiency. Throughout the process, I aimed to meet the project requirements by employing strategic design choices in shape construction, texturing, lighting, camera controls, and coding practices. The goal was to produce a functional and visually appealing scene while maintaining performance and modularity in the code. For the 3D objects, I selected basic shapes such as boxes, cylinders, spheres, torus’, etc. to construct the scene’s components. These shapes were chosen due to their simplicity and versatility, making them suitable for representing real-world objects in a low-polygon environment. Each shape was built with a polygon count under 1,000 triangles to optimize rendering efficiency while preserving essential details. This approach allowed me to create a scene that captured the necessary elements without overloading the graphics processing.

The choice of basic shapes was guided by the need for efficiency and versatility. By using simple geometric forms like boxes, cylinders, and spheres, I could meet the project’s low-polygon requirement without sacrificing visual clarity. These shapes were versatile enough to represent various real-world objects, and their minimal polygon count ensured the scene performed smoothly. The careful positioning of these shapes, using precise coordinates, helped to achieve a layout that felt structured and realistic.

Positioning and scaling were key in replicating the layout from the reference image, as I used precise X, Y, and Z coordinates to accurately place objects within the scene. This positioning ensured that the spatial arrangement felt intentional, with varied heights and distances creating a sense of depth. For example, columns were aligned to avoid visual inconsistencies, and different object sizes were used to highlight the scale of the environment.

Textures were applied to enhance the realism of the objects. At least two textures with resolutions of 1024x1024 pixels or higher were used, ensuring high-quality details. I selected textures that matched the appearance of real-world materials, such as wood grain or stone. These textures were applied using UV mapping to ensure alignment with the shape's geometry. Additionally, material properties like roughness and reflectivity were adjusted to make the textures interact more realistically with the lighting. This added visual depth to the scene, making objects appear more dynamic under different lighting conditions.

Lighting was implemented using point lights, which served as the primary source of illumination in the scene. The point lights were strategically positioned to provide general ambient lighting from different angles, simulating real-world light sources. One light was placed above the scene to cast light across the environment, while another was located closer to specific objects to create focal points. By adjusting the intensity and position of the point lights, I was able to achieve a balance that highlighted textured surfaces without causing harsh shadows. This setup ensured that the objects were uniformly lit while still exhibiting subtle variations in light intensity.

For the camera controls, I implemented an interactive system that allowed the user to navigate the 3D environment seamlessly. The WASD keys enabled movement along the X and Z axes, while additional keys controlled vertical movement along the Y axis. Mouse input allowed the user to adjust the camera's pitch and yaw, providing full control over orientation. The scroll wheel added zoom functionality, allowing users to explore the scene from different perspectives and get a closer view of specific objects. This setup created an intuitive and immersive experience for navigating the 3D space. Also, the navigation system was designed to provide a natural and interactive experience for exploring the scene. The use of keyboard controls for movement and mouse controls for orientation made the camera easy to manipulate, allowing users to freely explore different angles and distances. The addition of the scroll wheel for zooming further enhanced the user experience by offering a way to dynamically adjust the view. This combination of input methods ensured that the camera controls felt intuitive and allowed for a comprehensive exploration of the environment.

To maintain code modularity and organization, I developed custom functions for tasks like drawing objects, managing lighting, and handling input controls. For example, separate functions for camera movement and object rendering allowed the code to be easily updated or extended without affecting other parts of the program. Each function was designed to be reusable, enabling similar logic to be applied across different components. This modular approach not only made the code easier to understand but also flexible enough for future modifications. Clear variable names and concise comments were used throughout to enhance readability and explain the purpose of each function.

During the development process, I iterated on different elements based on testing and feedback. For instance, I adjusted the intensity and color of the lights to achieve a balance that highlighted textured objects while avoiding overly harsh shadows. I also refined the camera sensitivity to ensure smoother navigation, providing a more comfortable experience for users. These iterations contributed to a more polished final product that met the project requirements and offered an engaging 3D experience.

Overall, the design decisions and development practices employed in this 3D scene project successfully created a functional and visually appealing environment. By combining low-polygon models, high-quality textures, strategic lighting, intuitive camera controls, and modular coding practices, I was able to meet the project’s goals while laying a foundation for future enhancements. The project demonstrated the importance of planning, iteration, and attention to detail in creating interactive 3D graphics.