FINAL PROJECT

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SNHU

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CS 330 Final Project Reflection

**Development Choices**

For this project, I 3D-rendered a scene from my desk in Japan. I tried to accurately represent objects using primitive 3D forms and include realistic lighting, texture, and camera controls. Everything is there - table, laptop, panda tumbler, mouse, window, couch, and walls that were all positioned to match the reference photo as closely as possible. I took care to get proportions, object placement, and material accuracy right to render an accurate and familiar environment.

Lighting played a key role in making the scene appear natural. I used a combination of window lighting, ceiling lights, and filler lights to achieve a well-balanced effect:

* **Window Light (Left Side):** Artificial daylight, which created soft shadows and reflections.
* **Ceiling Lights:** Overall ambient lighting for general visibility.
* **Filler Lights:** Softened harsh darkness and illuminated shadowed areas.

By adjusting ambient, diffuse, and specular lighting, I was able to create a more realistic and immersive feel. It created a huge difference in how objects were displayed at different angles.

**User Navigation of the 3D Scene**

To allow any users to navigate the scene, I implemented camera controls with an intuitive navigation system:

* **WASD Keys:** Move forward, backward, left, and right.
* **Q & E Keys:** Move vertically (up/down).
* **Mouse Movement:** Look around and pan with camera rotation.
* **Scroll Wheel:** Movement speed control for accurate navigation.

This setup makes navigation and panning easy to view the scene from different angles, which in turn improves the user experience.

**Custom Functions & Code Organization**

Custom functions were utilized to keep my code modular and easy to read. These functions reduce duplication and make the program easier to maintain:

* **SetTransformations()** – Scale, rotation, and position transformations are applied to objects.
* **SetShaderMaterial()** – Materials are initialized for realistic shading and reflections.
* **SetupSceneLights()** – All light sources in the scene are initialized and controlled.

**Challenges & Solutions**

1. **Lighting & Shadows**  
   Achieving the correct lighting was one of the biggest challenges. The scene was originally too dark, with objects hard to make out. To resolve this, I:
   * Raised diffuse and ambient light levels to brighten the overall lighting.
   * Modified Phong shading calculations to balance reflections and highlights.
   * Repositioned the window light to accurately simulate left-side daylight.

These changes significantly improved visibility and provided a more realistic scene.

1. **Texture Mapping Problems**  
   Some textures were distorted or oriented incorrectly due to UV scaling issues. To correct this, I:
   * Manually adjusted UV coordinates for correct texture placement.
   * Rescaled textures to prevent distortion.

This ensured materials were realistic and correctly applied to all objects.

**Future Improvements**

While my scene meets the requirements of the project specification, some possible future improvements are:

* Adding shadow mapping for more realistic, dynamic shadows.
* Implementing real-time reflections for surfaces like glass and metal.
* Enhancing performance optimizations to make lighting calculations more efficient.
* Incorporating bump mapping to improve material depth and detail.