**3D Scene Design Decisions**

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CS-330 Computer Graphic and Visualization

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10/19/2025

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**Selection of Objects and Composition of Scenes.**

The chosen 2D reference image was an image of a home office workspace with a desk having different objects such as a computer monitor, a pen holder with pens, a potted plant, and ornaments. The choice of this scene is due to its practical use in business visualization and variety of geometric primitives. The last scene contains over four separate objects, fulfilling the project requirements without exceeding the necessary number of polygons (below 1,000 triangles per object) to optimize.

The desk was made from box primitives and a desktop surface, and four cylindrical legs at specific coordinates to form a stable and realistic base. The computer monitor assembly used four box primitives of the base, neck, frame, and display screen located at coordinates (0.0f, 3.2f, -1.5f) to rest on the desk surface. The workspace was made authentic with the addition of a keyboard and a mouse through flattened box primitives.

**Texture Application and Material Design**

The choice of texture was limited to high-resolution royalty-free materials by AmbientCG, which guarantees a professional quality that will fit the presentation to clients. The floor was made using UV scaling (15.0f, 15.0f) to make realistic tiling on the 50-unit plane. Walls were covered with wallpaper scaled to (10.0f, 8.0f) to give the walls a visual difference between the floor surfaces. The desk used Wood that was scaled with (3.0f, 2.0f) to replicate the pattern of natural wood grains. Ceramic objects used roofing tiles to achieve terracotta-like material properties. Custom textures for organic elements like plant leaves and stems provide botanical realism.

Wood materials were set at low specular intensity (0.3-0.4) to appear matte whereas ceramic and plastic items were set at high values (0.6-0.8) to appear glossy. The metal elements of the keyboard and mouse were made to have maximum specular intensity (1.0) and close focal strengths to produce realistic highlights.

**Lighting Design and Implementation.**

The evolution of the lighting system was not only to a simple illumination system but also to an advanced four-source with simulation of realistic indoor conditions. Light 1 is the primary overhead ceiling light at (0.0f, 18.0f, 2.0f) with warm white diffuse color (1.0f, 0.95f, 0.85f) and amber ambient (0.35f, 0.32f, 0.28f) which is used as the primary source of light in the scene with the focus strength of 48.0. Light 2 is used to light up the desk on the left at (-12.0f, 8.0f, 3.0f) with warmer color (0.9f, 0.85f, 0.7f) and lesser intensity to have accent lights. Light 3 uses the cool daylight colors (0.7f, 0.8f, 0.95f) to simulate the natural window light of the right at (20.0f, 12.0f, 5.0f) in order to provide temperature contrast. Light 4 depicts monitor glowing at (0.0f, 5.0f, 0.0f) with faint blue emission (0.4f, 0.6f, 0.9f) to give depth of atmosphere.

**Camera Navigation and User Interaction.**

Camara movements were adopted in terms of standard first-person navigation patterns in the industry. WASD keys are used to move forward, backward, to the right, and to the left across the horizontal plane, and QE keys are used to move up and down, across the Y-axis, which makes it possible to traverse the entire 3D space. The camera rotation is changed based on the movement of the mouse cursor by computing yaw and pitch using a higher sensitivity (0.05f) to control the camera in a smooth and responsive manner. Mouse scroll wheel modulates movement speed from 0.5 to 25.0 units per second, with scroll-up increasing speed and scroll-down decreasing it through a 0.5x multiplier for smooth adjustment.

**Conclusion**

The 3D final scene effectively represents the 2D reference image with the help of the proper use of the geometric primitives, the high-quality textures, the realistic lighting, and the easy navigation control. The project displays expertise in the development of OpenGL, computational graphics concepts, and user experience design that can be used in the delivery of professional clients and the preparation of 3D prints.