In developing this 3D scene, I aimed to create a familiar, functional environment using everyday objects like a pen, cup, and paper towel roll. These objects were chosen not only for their relatability but also for their ability to demonstrate different 3D modeling techniques. Each object allowed me to explore transformations, textures, and lighting effects, helping to create a visually interesting and technically sound scene.

**Object Selection and Justification**

I picked these objects to showcase various shapes and materials:

* Countertop (Box Mesh): A large, flat surface like a marble countertop provides an ideal base for experimenting with reflective textures. The glossy finish highlights how light interacts with smooth surfaces.
* Pen and Tip (Cylinder, Tapered Cylinder Meshes and Cone Meshes): The pen’s cylindrical shape was ideal for demonstrating rotations and transformations. A pink marble texture was chosen for its visual appeal, while the brass tip adds contrast through its metallic sheen like a real pen.
* Cup and Straw (Tapered Cylinder and Thin Cylinder Meshes): The clay-textured cup contrasts nicely with the glass straw, showcasing the interaction between matte and reflective surfaces.
* Paper Towel Roll (Cylinder Mesh): This allowed me to experiment with layered textures, using a bright, reflective outer layer and a matte cardboard inner tube for realism.
* Coaster (Flat Cylinder): A small, colorful object like the coaster helps break up the neutral tones of the scene and match my original scene image.

By using familiar objects, I was able to focus on showing how different materials and textures respond to lighting and shading, bringing the scene to life.

**Programming for Functionality**

To ensure smooth functionality, I relied on GLM (OpenGL Mathematics) for object transformations, allowing me to scale, rotate, and position objects accurately. For loading textures, I used the stb\_image library, which efficiently handled different image formats and applied them to objects.

Lighting played a key role in balancing the scene. I set up multiple light sources, providing both ambient and specular light. This helped objects like the glass straw reflect light naturally, while matte objects, like the cup, absorbed it for a softer effect.

**Scene Navigation and Camera Control**

Navigating the scene is intuitive, using a combination of mouse and keyboard controls. The mouse and mouse wheel allows the user to rotate the camera around the scene and change speed of movement, while the W, A, S, D, Q, and E keys handle movement of up, down, forward, backward, left and right. This setup is familiar to most users and provides full control over exploring the 3D environment. The camera’s view matrix updates dynamically based on user input, creating smooth and responsive navigation.

**Modular Code and Custom Functions**

I organized the code to be as modular as possible, making it easier to manage and extend. Key functions include:

* CreateGLTexture(): Loads and binds textures, simplifying texture management across the scene.
* SetTransformations(): Applies scaling, rotation, and translation to objects in a single function, making it easy to adjust their positions.
* SetShaderMaterial() and SetShaderTexture(): These handle material and texture assignments, keeping the main rendering code clean and efficient.
* LoadSceneTextures() and DefineObjectMaterials(): Centralize texture and material setup, ensuring everything is prepared before rendering begins.

This modular structure ensures that the code is easy to expand. New objects, textures, or materials can be added with minimal changes to the existing system.

**Conclusion**

Creating this 3D scene took a lot of thoughtful planning, blending both creative and technical decisions. I chose everyday objects because they’re familiar and make the scene feel more grounded, while also giving me a chance to highlight different 3D modeling techniques. The way I structured the code makes it super flexible—if I want to add new textures or objects later, it’s easy to do. In the end, the scene isn’t just technically sound; it’s also something that feels interactive and visually engaging, making it fun for users to explore.