Design Decision Document

Project: Creation of 3D House with Lighting, Texture, and Color using OpenGL

## Objective:

The objective of this project is to design and implement a 3D house using the OpenGL graphics library. The house should have realistic lighting, textures, and colors to enhance visual appeal and create an immersive experience.

## Design Decisions:

1. Graphics Library Selection:

The project will utilize the OpenGL graphics library due to its wide adoption, cross-platform compatibility, and extensive support for rendering 3D graphics. OpenGL provides the necessary tools and functionality to achieve realistic lighting, texture mapping, and color rendering.

2. 3D Modeling Approach:

The house will be modeled using a combination of geometric primitives, such as cubes, rectangles, and triangles, to create the basic structure. Additional details, such as windows, doors, and roof, will be modeled as separate objects and combined to form the complete house.

3. Lighting Techniques:

To achieve realistic lighting effects, the project will implement lighting techniques such as ambient lighting, diffuse lighting, and specular lighting. Ambient lighting will provide a base level of illumination, while diffuse lighting will simulate light reflecting off the surfaces of the house objects. Specular lighting will create highlights on shiny surfaces.

4. Texture Mapping:

Texture mapping will be used to apply realistic textures to the surfaces of the house objects. Textures will be carefully selected and mapped onto the corresponding polygons, enhancing the visual quality and adding depth to the 3D scene. Techniques like UV mapping may be used to ensure accurate texture placement.

5. Color Rendering:

The project will incorporate a color scheme that complements the house design. Colors will be carefully chosen to represent different elements of the house, such as walls, roof, windows, and doors. The color palette will aim to create a visually pleasing and cohesive composition.

6. User Interaction:

The project may include user interaction features, such as mouse or keyboard controls, to allow users to navigate the 3D scene and explore the house from different perspectives. User-friendly controls and intuitive navigation will be prioritized to ensure a smooth and immersive experience.

7. Performance Considerations:

To optimize performance, the project will employ techniques like culling and level-of-detail rendering. Culling will prevent the rendering of objects that are not within the camera's view, reducing unnecessary computations. Level-of-detail rendering will dynamically adjust the level of detail based on the distance from the camera, optimizing the rendering process.

8. Testing and Iteration:

Regular testing will be conducted throughout the development process to identify and address any issues related to lighting, texture mapping, and color rendering. User feedback will be collected and incorporated into iterative improvements to enhance the overall quality of the 3D scene.

9. Camera Controls:

The project will provide intuitive controls for users to manipulate the camera view. These controls may include keyboard inputs, mouse interactions (such as dragging or scrolling), or a combination of both. The camera controls will allow users to pan, tilt, zoom, and orbit around the 3D house, providing flexibility and a sense of exploration.