Cafe Beel Harina: 3D Riverside Dining Experience

Project Description

This project recreates Cafe Beel Harina, a real village restaurant built over a pond, as an interactive 3D environment using OpenGL. The cafe features wooden deck platforms extending over water, creating a peaceful dining space surrounded by nature. The 3D simulation will capture the cafe's unique atmosphere with its distinctive canopy structures, waterside seating and ambient lighting. Users will be able to navigate through the restaurant, exploring the deck areas and enjoying different viewpoints of the pond and surroundings through interactive camera controls.

Visuals of the Project

Figure 1: Daytime view of the floating restaurant platform with covered seating and river backdrop

Figure 2: Evening atmosphere featuring string lights and ambient illumination across the dining deck

Figure 3: Detailed seating arrangement with wooden furniture, planters and decorative lighting

Technical Implementation

- **3D Drawing & Primitives:** The scene will be constructed using OpenGL primitives (triangles, quads). The wooden deck, water surface, railings, canopy structures and furniture will be built from these fundamental shapes combined with appropriate transformations.

- **Illumination & Shading:** The project will implement the Phong illumination model to achieve realistic atmospheric lighting. Material properties (ambient, diffuse, specular) will be defined for wood, metal and water surfaces. Point lights will simulate string lights and spotlights will create focused illumination on seating areas. Special attention will be given to water reflections and wood texture highlights.

- **Texture Mapping:** Wood grain textures for the deck and furniture, water ripple effects and fabric textures for canopy materials will enhance realism. Height mapping may be used for subtle surface details on the wooden planks.

Dynamic Interactive Objects

- **Water Surface:** The river/pond water will feature animated ripples and waves using vertex displacement. Reflections of the structure and lighting will dynamically update based on viewing angle.

- **Lighting System:** String lights will have animated glow effects that can transition between day and night modes. Users can toggle different lighting zones (ambient, decorative, functional).

- **Plants & Foliage:** Potted plants will have subtle swaying animations responding to simulated wind. Leaves can move gently to add life to the scene.

- **Camera Control:** First-person navigation allowing users to walk through the deck, explore seating areas and observe the environment from different angles. Camera can tilt to look up at the canopy or down at the water.

Objects with Complex Shapes

- **Curved Railings:** The white railings feature both vertical bars and curved top sections requiring parametric curve generation. The corner transitions need smooth bezier or spline interpolation.

- **Canopy Structure:** The black metal frame canopy has a complex grid pattern with supporting beams. The translucent roof material requires careful modeling with multiple connected surfaces and proper transparency rendering.

- **Wooden Furniture:** Tables, chairs and benches have organic shapes with rounded edges, slat patterns and joints. The slatted bench backs require multiple parallel elements with precise spacing.

- **Planters:** Round and rectangular planters with smooth curves house the foliage. These require revolution surfaces or modified cylinder primitives with proper material blending.

- **String Lights:** Cable suspension system with evenly spaced light bulbs. Each bulb requires modeling as a small sphere with a glowing material and attached to a catenary curve.

- **Deck Pattern:** The wooden deck features planks with gaps, requiring texture coordinates and potentially instanced geometry for realistic wood grain variation across the large surface area.