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CS557 - Computer Graphics Shaders

Final Project Proposal

Fire and Smoke Simulation Using GLSL Shaders

Overview This project aims to simulate fire and smoke effects using vertex and fragment shaders in GLSL. The simulation will be based on a particle system combined with a 3D noise texture to introduce realistic turbulence and dynamic movement. The approach leverages OpenGL for rendering and real-time updates.

Approach

1. **Setup:** Initialize an OpenGL rendering context from the sample.cpp setup program and create a shader program to handle vertex and fragment processing.
2. **Particle System:** If possible within a weeks' time, implement a particle-based approach where each particle represents a small component of smoke or fire. Particles will have attributes like position, velocity, lifetime, and color.
3. **3D Noise Texture:** Utilize the precomputed 3D noise texture to create turbulence and randomness in the movement and opacity of the particles.
4. **Shader Implementation:**
 - **Vertex Shader:** Handles the movement and scaling of particles over time, incorporating velocity and noise-based disturbances.
 - **Fragment Shader:** Samples the 3D noise texture to modify the opacity and color of particles dynamically, creating a swirling effect for smoke and a flickering effect for fire.
5. **Animation and Rendering:** Continuously update the particle system, adjusting properties based on time and interactions. Use blending techniques to achieve smooth transitions and fading effects.

Expected Outcome The final simulation will produce realistic fire and smoke behavior, with dynamic movement influenced by noise patterns. The project can be extended by adding external forces like wind and temperature variations for more advanced effects.

