README

Name: RuiqingCHEN
Student Number: 124107923

Project Overview

This project is an interactive virtual learning environment built with Three.js and WebXR, simulating a classroom or lecture hall. It meets all assignment requirements, including a virtual classroom, two independently animated characters, a video lesson, multiple light types, spatial sound, custom shaders, and WebXR support. The code follows modular design and best practices, with console logging for debugging, and uses Stats.js and dat.GUI for performance stats and interactive controls.

Features

1. **Virtual Classroom**
   - Includes floor, walls, ceiling, door, windows, teacher's desk, student desks, and chairs.
   - Enhanced with textures (e.g., carpet texture) for realism.
   - Features a window with dynamic rain effects and a real-time wall clock.
2. **Two Independently Animated Characters**
   - Loads two external models (model1.glb and model2.glb) using GLTFLoader.
   - Characters have independent keyframe animations and are positioned differently in the classroom.
   - Source: SketchFab.
3. **Shadows**
   - All objects (characters, lights, furniture) and lights cast and receive shadows.
   - Uses PCFSoftShadowMap for optimized shadow quality.
4. **Video Lesson**
   - Uses THREE.PlaneGeometry for a projection screen textured with a video from an HTML <video> element.
   - Includes a projector model, with video playback controllable via keyboard (Space, P, S, R) and GUI.
5. **Light Types**

Type	Count	Function
Ambient Light		Provides overall illumination
Directional Light		Main light source with shadow support
Spot Light	2	IIlluminates the projection screen
		Spotlight, dynamically adjustable
Point Light	1	Bulb
RectAreaLight	3	Ceiling lights

6. **Spatial Sound**

- Implements THREE.PositionalAudio for spatial sound, attached to a glowing cube.
- Adjustable volume and pitch via GUI.

7. Three Custom Shaders

Shader	Function
Glass Material	For windows, with dynamic raindrop effects
Desk Material	For teacher desk, dynamic color transition effect
Wavy Material	For a sphere, demonstrating wave deformation
Glow Material	For the spatial sound cube, generating a gradient glow based on normal direction

8. WebXR Support

- Enables VR mode with rendered controllers.
- Includes a VR play button (playButton) positioned at $(0, 27, 90)$ with a default green color (0x00ff00).
- **Controller Interaction**:
  - **Button Color Change**: When a VR controller clicks the play button, its color changes to red (0xff0000), reverting to green (0x00ff00) upon release.
  - **Ray Emission**: Pressing the controller emits a red ray (initial length 0, extends to 10 when pressed) to indicate the interaction target. The ray's length adjusts dynamically based on the distance to intersected objects.
  - **Video Playback**: Clicking the play button with the controller triggers video playback; the video continues playing after release.
- In VR mode, the camera and controllers are bound to a user rig (userRig) for immersive navigation.

9. Physics (Bonus)

- Uses Cannon.js for cloth simulation, featuring a hanging cloth interacting with a moving sphere.

10. Controls and Debugging

- Displays performance stats with Stats.js.
- Provides an interactive control panel with dat.GUI for video, lights, sound, and water parameters.
- Logs key function calls and results (e.g., classroom loading, video state) to the console.