

PACSSR-301007

Final Project

Tsukumo Jiang, Wency Wei, Justin Wu, Eric Yin, Austin Zhang

3/22/2025

Contents

01 Project Overview

03 Results

02 Implementation
Approach

04 Teamwork Split-up

PART 01

Project Overview

Project Overview

This project creates an interactive 3D visualization of two procedurally modeled objects: a snowman and a cake. The implementation combines:

- Procedural modeling using OpenSCAD
- 3D rendering with Three.js
- Web deployment via GitHub Pages
- VR display

The final deliverable is an interactive webpage featuring:

- Turntable animation of both models
- Real-time lighting and materials
- Responsive camera controls

PART 02

Implementation Approach

2.1 Modeling Through OpenSCAD

The Cookie uses:

The Snowman Candy uses combination of multiple geometries:

- Hierarchical positioning: Translation vectors (x, y, z) position components relative to parent coordinate system
- Primitive combination: Union operation merges 7 distinct geometries (2 large spheres, 1 cylinder, 4 small spheres)

The cake uses parametric equations for the heart-shape upper layer:

$$\begin{cases} x = 16 \sin^3(t) \\ y = 13 \cos(t) - 5 \cos(2t) - 2 \cos(3t) - \cos(4t) \end{cases}$$

2.2 Three.js Integration

The visualization employs several key animation methodologies within the Three.js framework:

- **Turntable Rotation System:** A continuous rotational animation is implemented using angular displacement about the vertical axis. The models undergo incremental y-axis rotation at a fixed angular velocity of 0.005 radians per frame, creating perpetual circular motion while maintaining visual smoothness.
- **Frame Synchronization:** The animation loop utilizes the browser's native `requestAnimationFrame` API, ensuring optimal frame pacing synchronized with the display refresh rate. This technique guarantees consistent 60Hz rendering performance across different hardware configurations.

|| 2.2 Three.js Integration

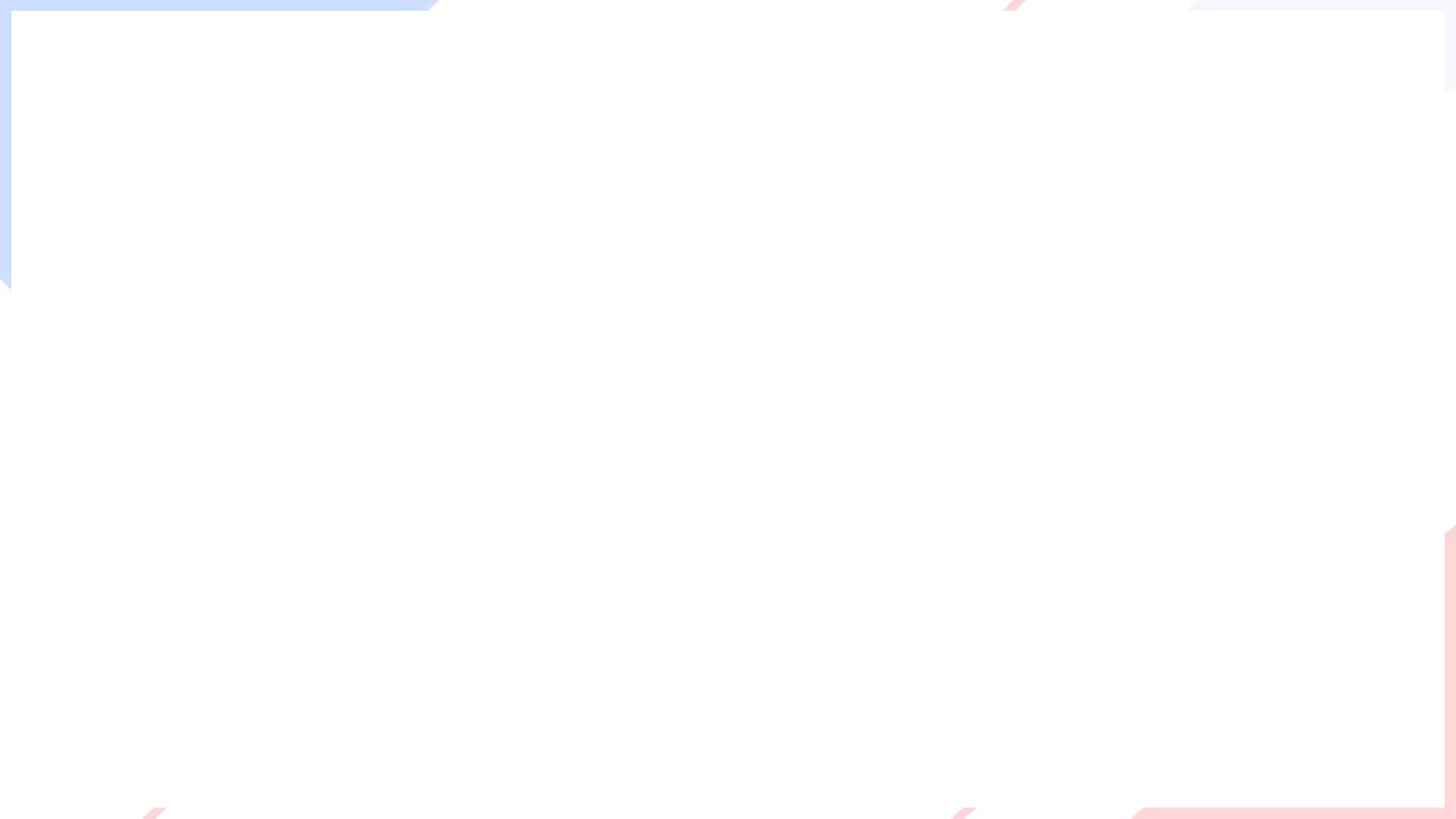
- Interactive Camera Control: OrbitControls integration provides six degrees of freedom camera manipulation through:
 - Drag-based azimuthal and polar angle adjustment
 - Mouse wheel zoom functionality
 - Touch-optimized mobile interaction
- Hierarchical Scene Updates: The scene graph undergoes recursive traversal each frame, applying transformation matrices to all child nodes. This enables simultaneous animation of multiple independent meshes while preserving spatial relationships.

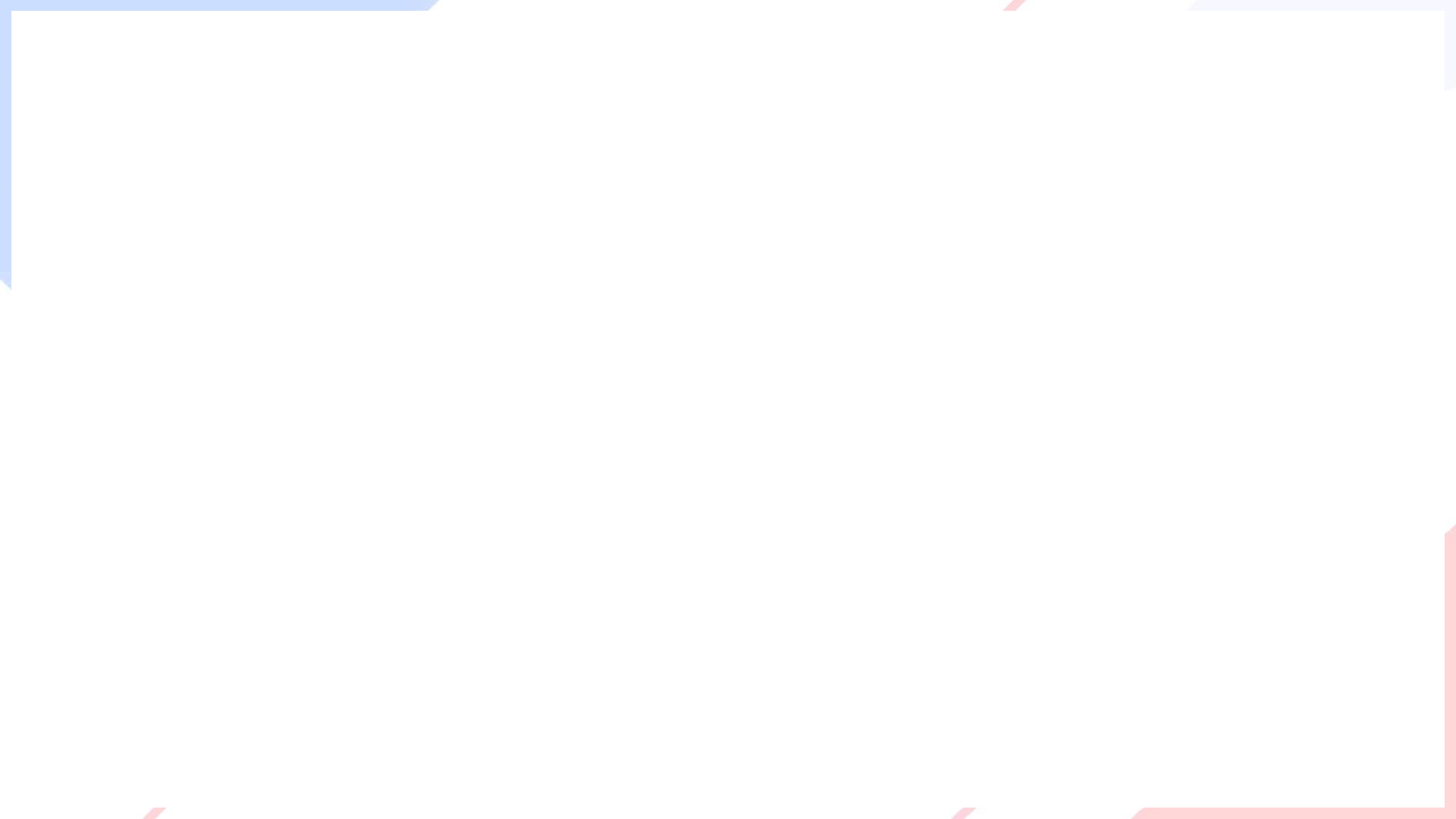
2.3 VR Realization

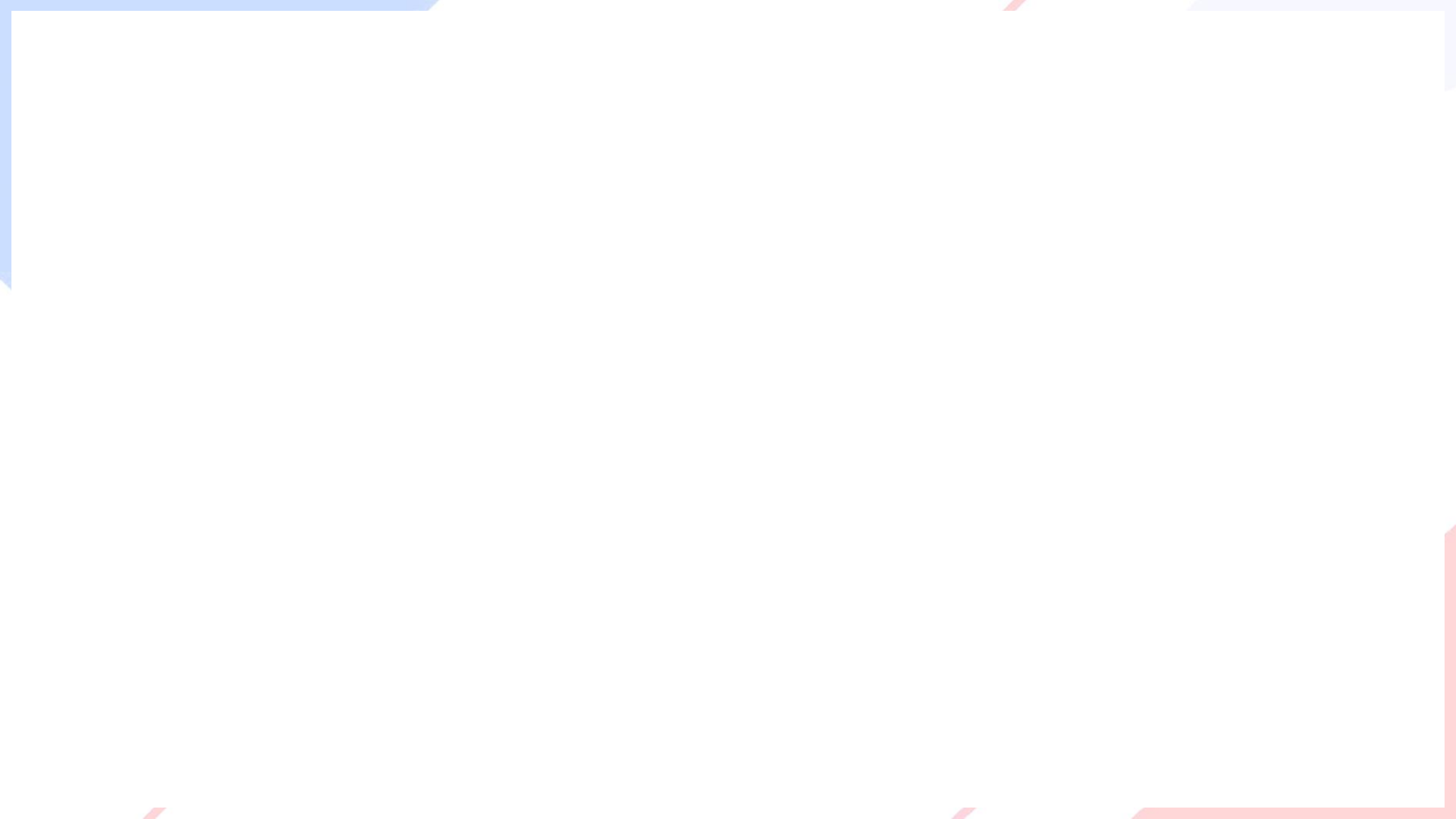
- Interactive Camera Control: OrbitControls integration provides six degrees of freedom camera manipulation through:
 - Drag-based azimuthal and polar angle adjustment
 - Mouse wheel zoom functionality
 - Touch-optimized mobile interaction
- Hierarchical Scene Updates: The scene graph undergoes recursive traversal each frame, applying transformation matrices to all child nodes. This enables simultaneous animation of multiple independent meshes while preserving spatial relationships.

PART 03

Results







PART 04

Teamwork Split-up

|| Teamwork Split-up

- Chengzi Jiang:
- Wency Wei: Cake modeling, Powerpoint design
- Zhuoyuan Wu: Shapes modeling, VR production
- Eric Yin: Cookie modeling
- Austin Zhang: Snowman modeling, Spin animation, Report maintainance

The background features abstract geometric shapes in light blue, light pink, and white. There are diagonal lines and triangular shapes in the corners, creating a modern, minimalist aesthetic.

**Thank you for
watching!**