3D Studio - Project Presentation

Web-Based Creative Suite for 3D Modeling, Video Editing, Compositing & Character Animation

Slide 1: Title

3D STUDIO

A Unified Web-Based Creative Suite

Features:

- 3D Modeling & Animation
- Video Editing
- Node-Based Compositing
- Character Animation
- AI-Powered Assistance

Technologies: React | Three.js | OpenAI GPT-4o

Slide 2: Problem Statement

The Challenge

Issue	Impact
Cost Barrier	Professional tools cost $500-2000+ annually
Installation Complexity	Large downloads (1-10GB), hardware requirements
Steep Learning Curve	Months to learn complex interfaces

Limited Accessibility	Desktop-only, no cross-platform access
Fragmented Workflows	Separate tools for modeling, video, compositing

Goal: Create an accessible, browser-based alternative with AI assistance
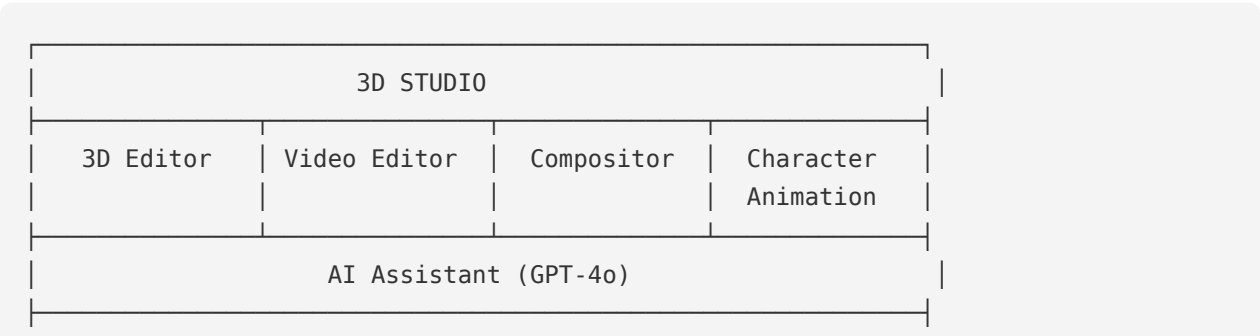
Slide 3: Existing Systems Analysis

Comparison of Current Tools

Tool	Strengths	Weaknesses
Blender	Full-featured, free, open-source	Complex UI, steep learning curve, desktop only
Adobe Suite	Industry standard, polished	Very expensive ($600+/year), multiple apps needed
Canva	Easy to use, browser-based	Limited 3D, no video timeline, no compositing
Online 3D Tools	Accessible	Single-purpose, limited features

Gap: No unified, browser-based solution with AI assistance

Slide 4: Proposed Solution

3D Studio - Key Features

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 │                   3D STUDIO                       │
 ├───────────────┬─────────────┬───────────┬────────┤
 │   3D Editor   │ Video Editor │ Compositor │ Character │
 │               │             │           │ Animation │
 ├───────────────┴─────────────┴───────────┴────────┤
 │              AI Assistant (GPT-4o)                │
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|              React + Three.js + Express              |
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Unique Value: All-in-one solution with AI-powered features

Slide 5: System Architecture

Technology Stack

Layer	Technology	Purpose
Frontend	React 18, Three.js, React Three Fiber	UI & 3D rendering
State	Zustand	Efficient state management
Styling	Tailwind CSS, Shadcn/UI	Modern, responsive design
Backend	Express.js, Node.js	API server
AI	OpenAI GPT-4o	Natural language processing
Build	Vite, TypeScript	Fast development

Slide 6: Module 1 - 3D Editor

3D Modeling & Animation

Features:

- Interactive 3D viewport with orbit controls
- 6 primitive types: Cube, Sphere, Cylinder, Plane, Cone, Torus
- Transform tools: Move (W), Rotate (E), Scale (R)
- PBR materials with 22 presets
- Keyframe animation timeline
- GLTF/GLB export
- Undo/Redo support

- 4 light types: Point, Directional, Spot, Ambient

Keyboard Shortcuts: Q (Select), W (Move), E (Rotate), R (Scale), Space (Play)

Slide 7: Module 2 - Video Editor

Professional Video Editing

Features:

- 32-track timeline (video, audio, images, 3D, masks, adjustments)
- Live preview with transport controls
- Drag-and-drop media import
- Audio mixer with per-track controls
- Video scopes: Waveform, Vectorscope, Histogram
- 16 effect types with keyframe animation
- Transitions: Fade, Dissolve, Wipe, Slide, Zoom
- Clip trimming and splitting

Track Layout: 8 Video | 4 Image | 4 Scene | 4 Adjustment | 4 Mask | 8 Audio

Slide 8: Module 3 - Node Compositor

Visual Effects & Compositing

Features:

- Canvas-based node editor with bezier connections
- Pan and zoom navigation
- Real-time preview in Viewer node

Node Categories:

Category	Nodes

Input	Image, Render Layers, Color
Output	Composite, Viewer
Keying	Chroma Key, Luminance Key, Difference Key
Matte	Dilate/Erode, Blur, Despill
Color	Color Correction, Curves, Levels, Hue/Sat
Mix	Alpha Over, Mix (with blend modes)

Slide 9: Module 4 - Character Animation

Skeletal Animation System

Features:

- Hierarchical bone system with parent-child relationships
- 20-bone humanoid preset (spine, arms, legs, head)
- Pose editor with rotation controls
- Pose library for saving/loading poses
- IK mode with CCD solver
- Action editor for reusable animation clips
- NLA editor with blend modes (Replace, Add, Multiply)
- Audio sync with waveform visualization

Modes: Pose | Action | NLA

Slide 10: AI-Powered Features

Unique AI Capabilities (Not in Blender or Canva)

Feature	Description
Text-to-Scene	"Create a forest with trees and rocks" generates 3D objects
Material Suggestions	AI recommends 5 contextual materials per object
Animation Suggestions	Get ready-to-apply keyframe animations
Scene Enhancement	Add complementary objects and lighting
Chat Assistant	Conversational guidance with scene context
Texture Prompts	Optimized prompts for texture generation

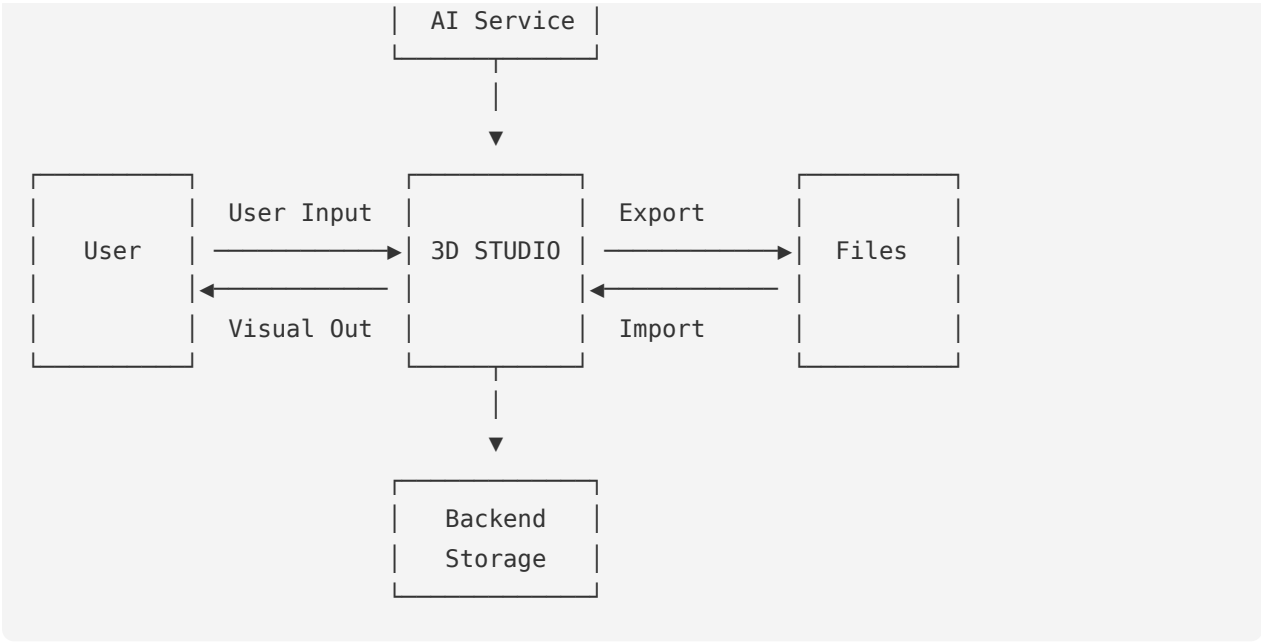**Powered by:** OpenAI GPT-4o via Replit AI Integrations

Slide 11: Use Cases

Who Benefits?

User Type	Use Case
Students	Learn 3D modeling, animation, and video editing for free
Indie Creators	Create game assets, short films, motion graphics
Hobbyists	Experiment without expensive software
Professionals	Quick prototyping and web-based collaboration
Educators	Teach creative skills in browser-based environment

Slide 12: Data Flow

System Data Flow (Level 0)

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        │  GPT-4o  │
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           | AI Service |
           |_____|
                 |
                 |
                 ▼
 _____  User Input  _____    Export   _____
|            | ──────────→ |            | ──────────→ |            |
|    User    |            |  3D STUDIO  |            |    Files   |
|            | ←────────── |            | ←────────── |            |
|_____|  Visual Out |_____|    Import   |_____|
                                 |
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                         |            |
                         |  Backend   |
                         |  Storage   |
                         |_____|
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Slide 13: Testing Results

Validation Summary

Test Cases: 31 Total (All Passed)

Module	Test Cases	Status
3D Editor	10	All Pass
Video Editor	8	All Pass
Compositor	6	All Pass
Character Animation	7	All Pass

Performance Metrics

Metric	Result
Initial Load Time	2.5s
Viewport FPS (100 objects)	60 FPS
Timeline Scrubbing	Real-time

Node Graph (50 nodes)	Responsive

Slide 14: Browser Compatibility

Cross-Platform Support

Browser	Version	Status
Chrome	90+	Fully Supported
Firefox	88+	Fully Supported
Edge	90+	Fully Supported
Safari	14+	Supported
Opera	76+	Fully Supported

Requirements:

- WebGL 2.0 support
- 4GB RAM minimum (8GB recommended)
- 1280x720 minimum resolution

Slide 15: Feature Comparison

3D Studio vs Competitors

Feature	3D Studio	Blender	Canva
Browser-based	Yes	No	Yes
3D Modeling	Yes	Yes	Limited
Video Editing	Yes	Yes	Limited
Node Compositing	Yes	Yes	No

Character Animation	Yes	Yes	No
AI Assistance	Yes	Limited	Yes
Free/Open	Yes	Yes	Freemium
Learning Curve	Low	High	Low

Slide 16: Limitations

Current Constraints

1. **WebGL Constraints**

   - Limited compared to native OpenGL/Vulkan
   - No GPU compute (WebGPU coming)

2. **Memory Limits**

   - Browser memory restrictions for large projects
   - ~4GB practical limit

3. **Video Processing**

   - Preview only, no actual video encoding
   - WebCodecs API for future export

4. **IK Accuracy**

   - Simplified CCD solver
   - May produce suboptimal solutions

Slide 17: Future Work

Planned Enhancements

Enhancement	Technology	Benefit

GPU Compute	WebGPU	Advanced simulations and effects
Collaboration	WebSockets	Real-time multi-user editing
Video Export	WebCodecs API	Actual video rendering
AI Textures	Stable Diffusion	AI-generated seamless textures
Physics	Rapier.js	Cloth, fluid, rigid body dynamics

Slide 18: Key Contributions

What Makes 3D Studio Unique

1. **Unified Creative Suite**

   - First browser-based tool combining 3D, video, compositing, and character animation

2. **AI Scene Generation**

   - Natural language to 3D scene conversion (not available in Blender)

3. **Intelligent Material System**

   - Context-aware material suggestions

4. **Accessible Character Animation**

   - Simplified skeletal animation that rivals desktop tools

5. **Zero Installation**

   - Professional tools without downloads or setup

Slide 19: Live Demo

Demo Walkthrough

1. **3D Editor**

   - Create primitives, apply materials, animate

2. **AI Assistant**

   - Generate scene from text prompt

3. **Video Editor**

   - Import media, arrange on timeline, apply effects

4. **Compositor**

   - Create node graph, apply chroma key

5. **Character Animation**

   - Load humanoid, pose, create action

Slide 20: Conclusion

Summary

3D Studio demonstrates that professional-grade creative tools can be delivered through web browsers.

Key Achievements:

- 4 integrated editors in a single application
- AI-powered features not found in traditional tools
- Accessible, free, browser-based platform
- Performant real-time 3D rendering
- Cross-browser compatibility

Impact: Democratizes access to professional creative workflows for students, educators, indie creators, and hobbyists.

Slide 21: References

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5. Marrin, C. (2011). WebGL specification. Khronos Group
6. OpenAI. (2023). GPT-4 Technical Report
7. Poimandres. (2019). React Three Fiber documentation
8. Porter, T., & Duff, T. (1984). Compositing digital images

Slide 22: Thank You

Questions?

Project Links

- **Live Demo:** [Replit URL]
- **Source Code:** [Repository]
- **Technical Report:** TECHNICAL_REPORT.md

Contact

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