MICHIGAN STATE UNIVERSITY

Project Plan Presentation

VR Human-AI Multimodal Interaction

The Capstone Experience

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From Students…
…to Professionals

Project Sponsor Overview

- One of the world's largest automotive suppliers
- Specialization in embedded vehicle systems
- Aims to innovate the connection between technology and automobile manufacturing

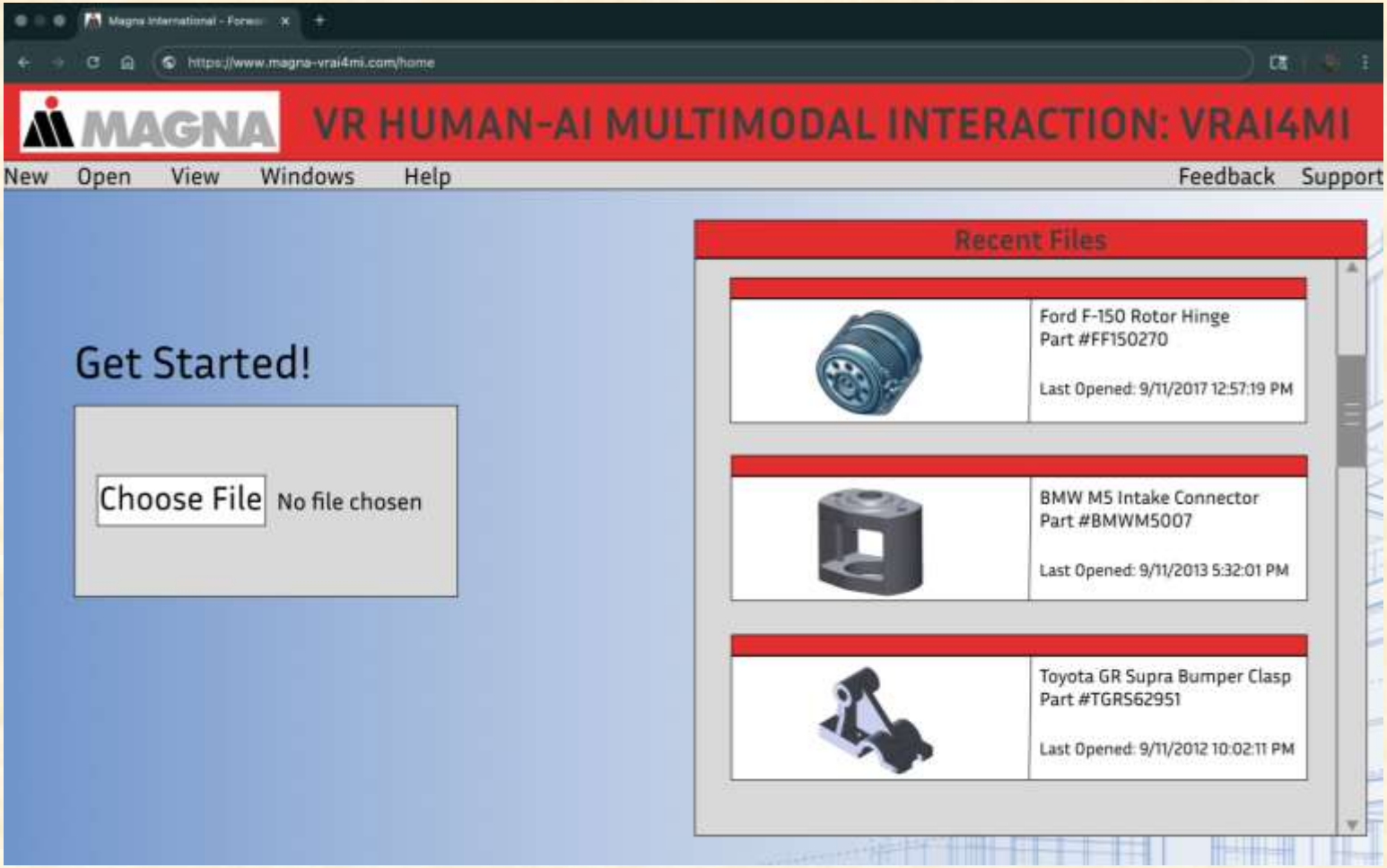
Project Functional Specifications

- Expand CAD accessibility beyond experienced designers
- Allow for easier model collaboration
- Integrate virtual reality and artificial intelligence
- Hand gestures, speech-to-CAD

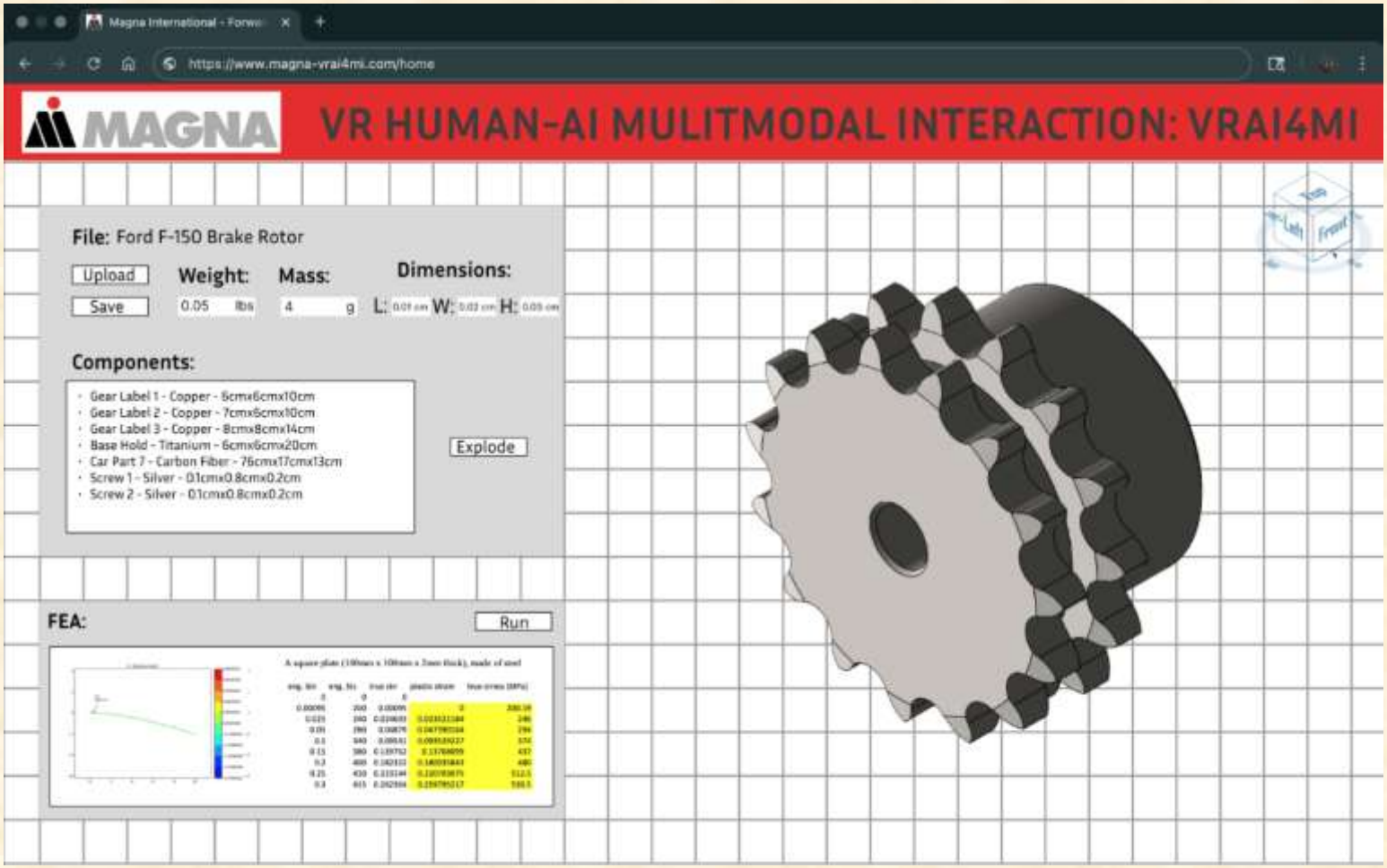
Project Design Specifications

- Home page to manage CAD model files
- Object file page for model display and specifications
- Separate interface for “exploded” models
- AI Assistance box for easy use and history
- Corresponding environments in VR

Screen Mockup: VRAI4MI Home

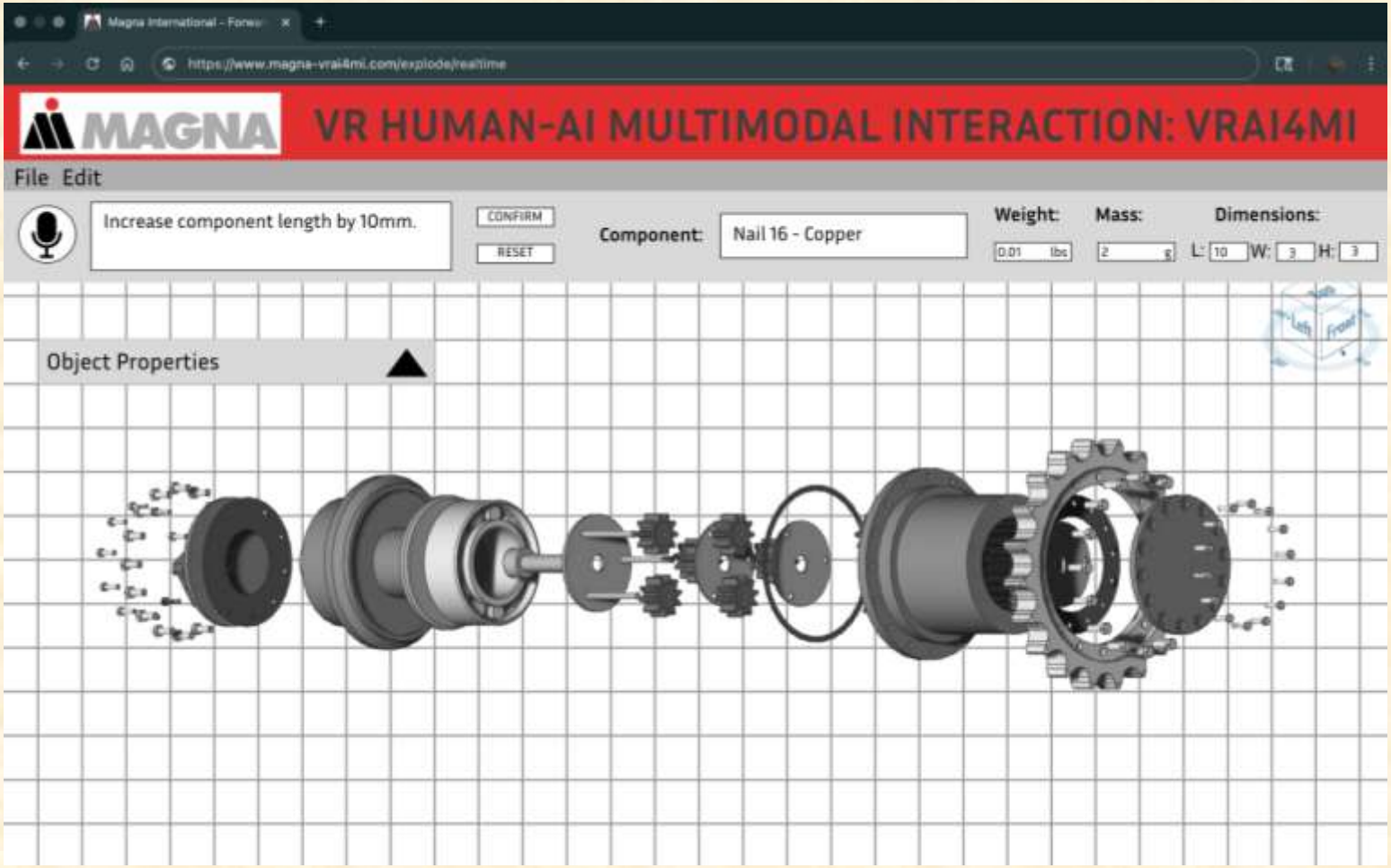


Screen Mockup: Object File Page

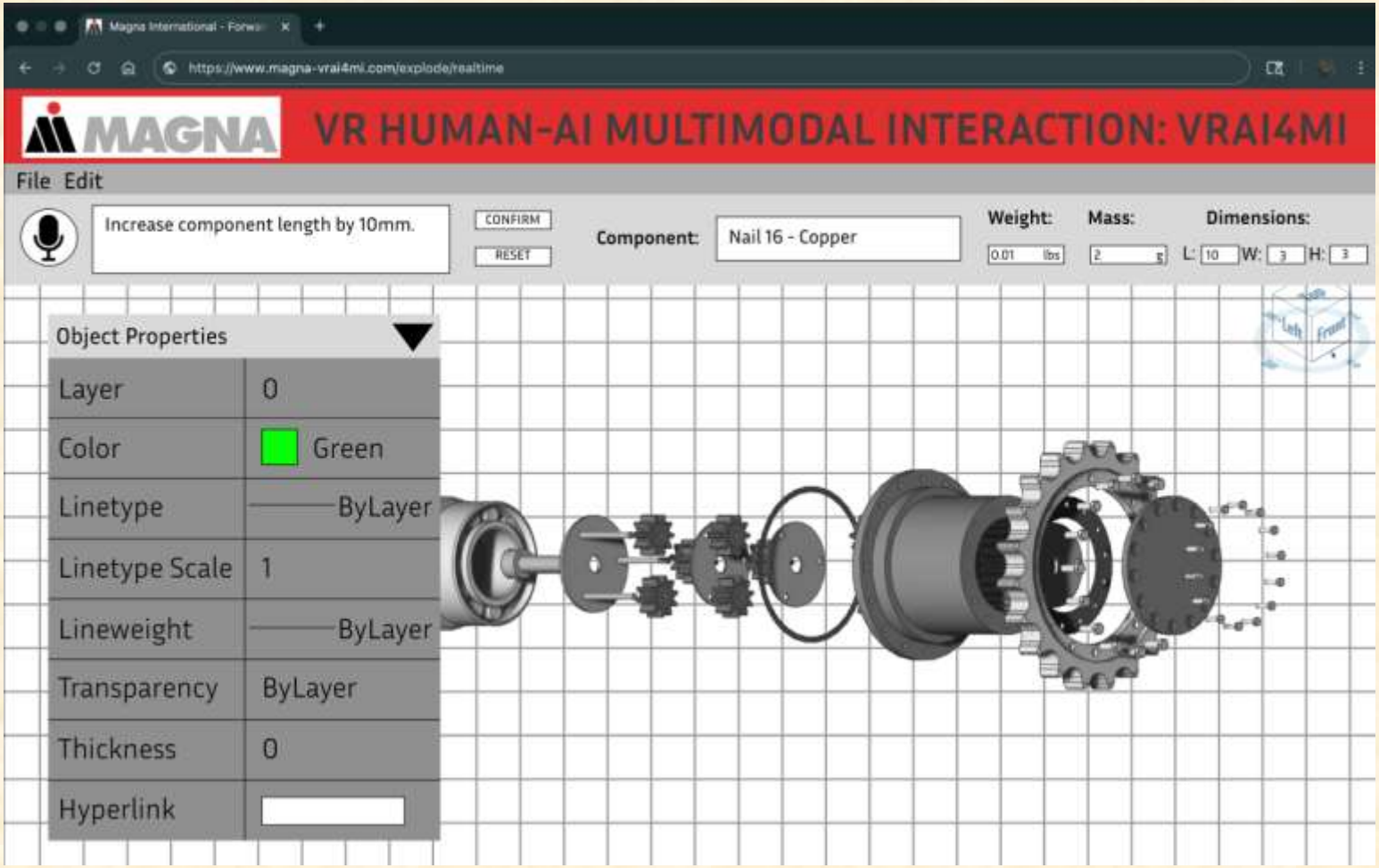


Screen Mockup: Object Page VR View

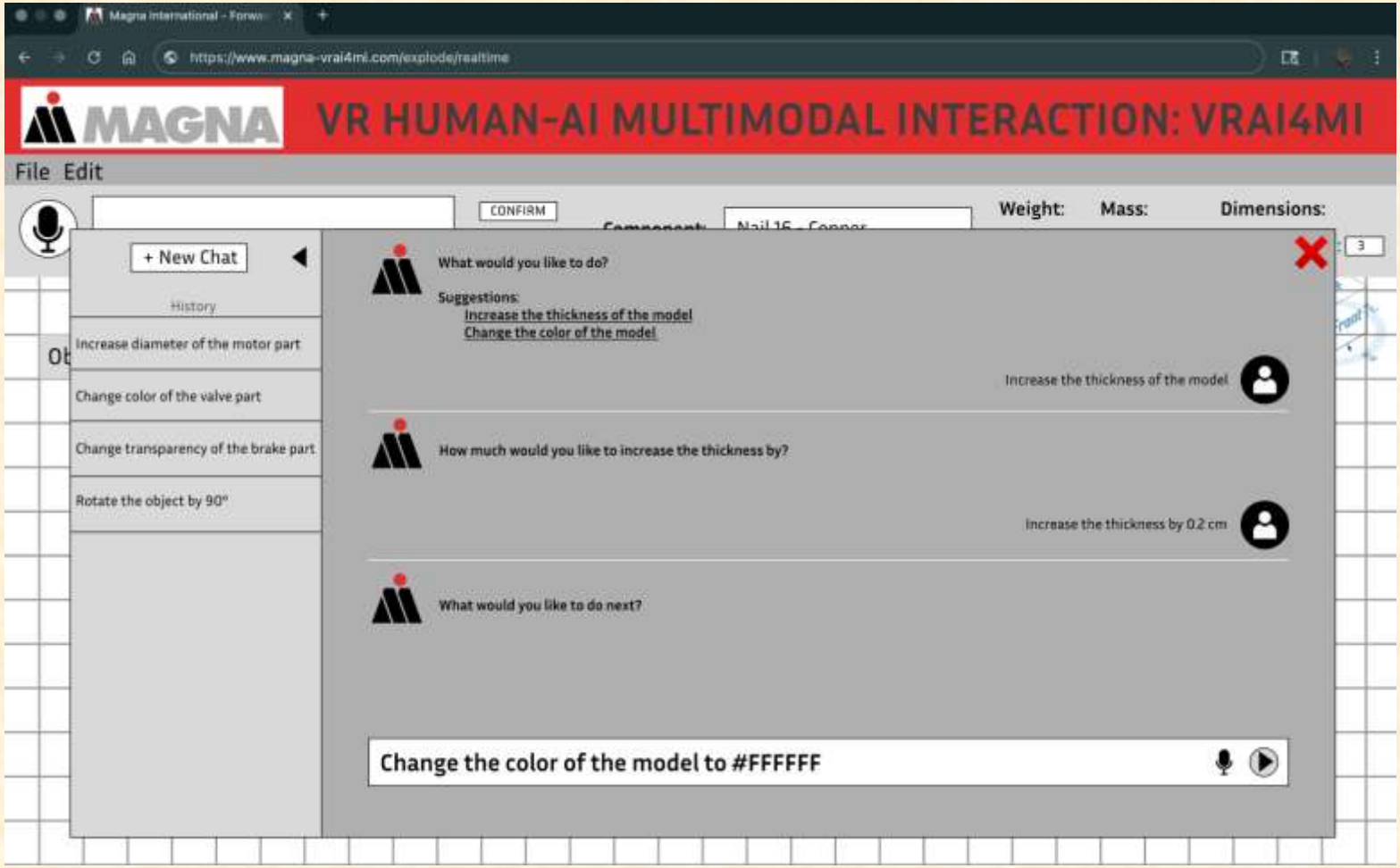
Screen Mockup: Exploded Object



Screen Mockup: Properties Dropdown



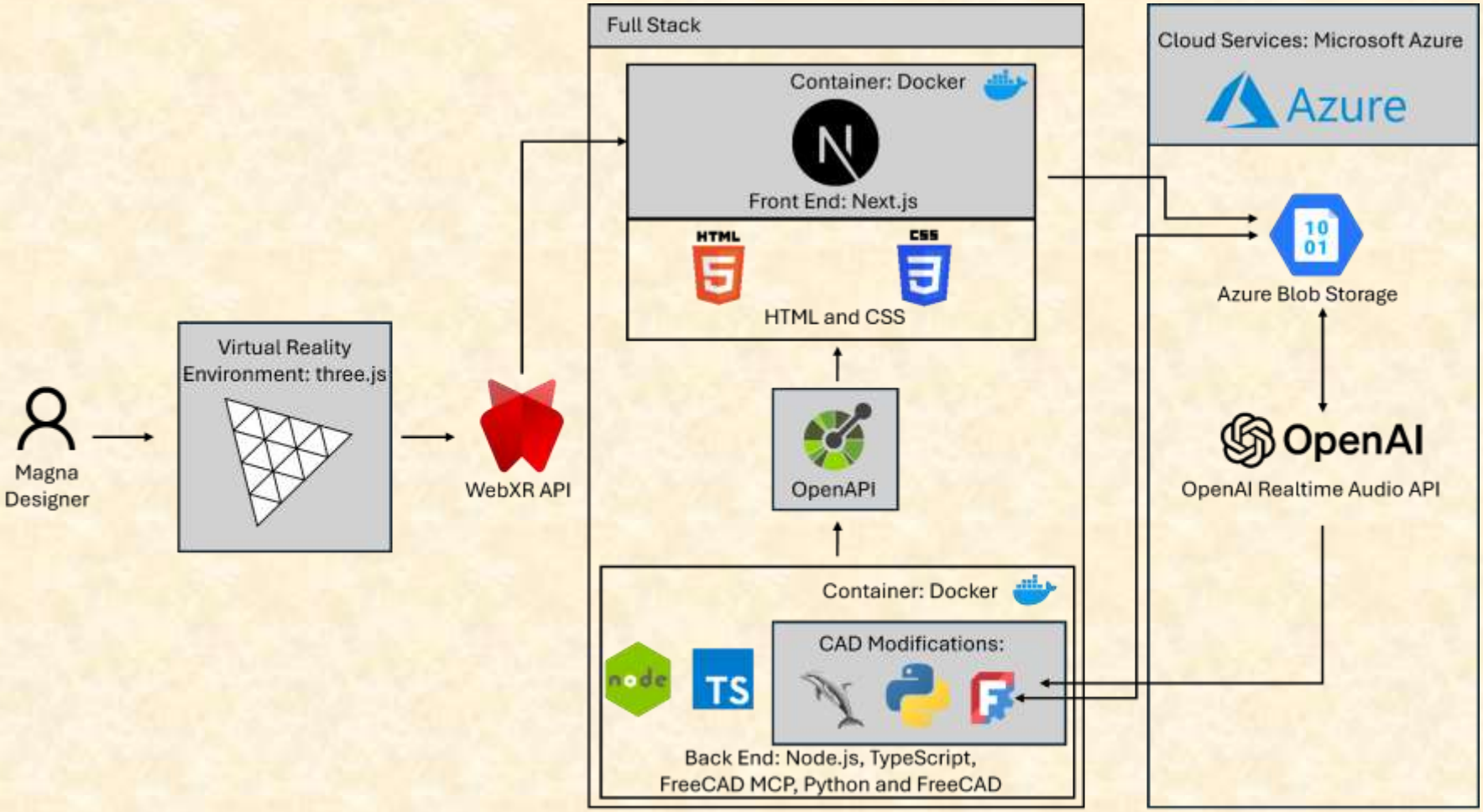
Screen Mockup: Voice Assist Pop-up



Project Technical Specifications

- Web and VR Application utilizing Node.js and its extensions
- Cutting-edge AI and agent tool interaction
  - Azure and OpenAI models
- Voice and gestures through the Meta Quest 3
- FreeCAD MCP with AI prompting to create and modify CAD models

Project System Architecture



Project System Components

- Hardware Platforms
  - Meta Quest 3
- Software Platforms / Technologies
  - OpenAPI
  - Three.js
  - WebXR
  - Azure Services (Blob)
  - Docker
  - OpenAI Realtime
  - FreeCAD
  - Python
  - FreeCAD MCP
  - Next.js
  - Node.js

Project Risks

- Minimizing Computational & Storage Costs in Azure
  - Description: Running heavy compute/storage on Azure can quickly spike costs beyond the $200 trial.
  - Mitigation: Prompt engineering and rely on external model retention to reduce both necessary storage and in-program computation.
- VR Interaction Complexity
  - Description: Designing natural VR gestures is hard, especially with no prior experience.
  - Mitigation: Study gesture libraries, follow WebXR best practices.
- CAD Back End Integration
  - Description: Integration FreeCAD MCP is complex and risks unstable performance without CAD expertise.
  - Mitigation: Research framework, leverage sponsor expertise, and validate with small cases.
- AI Command Reliability
  - Description: LLMs may generate invalid or inconsistent CAD command, leading to inaccurate results.
  - Mitigation: Apply prompt engineering, use function calling and build reliable prompt schema.

Questions?