MICHIGAN STATE UNIVERSITY

Project Plan Presentation

Magna CADAIA

The Capstone Experience

Team Magna CADAIA

Richard Glosser
Navanidhiy Achuthan Kumaraguru
Karan Choudhary
Owen Irving
Harshit Kandpal
Cameron Schwindaman

Department of Computer Science and Engineering
Michigan State University

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From Students…
…to Professionals

Project Sponsor Overview

- Magna is a global supplier within the automotive industry operating for over 65 years with a huge presence particularly in North America.
- They are in 28 countries with 337 manufacturing facilities.
- Magna is a $42 billion dollar company with more than 164,000 employees world-wide.

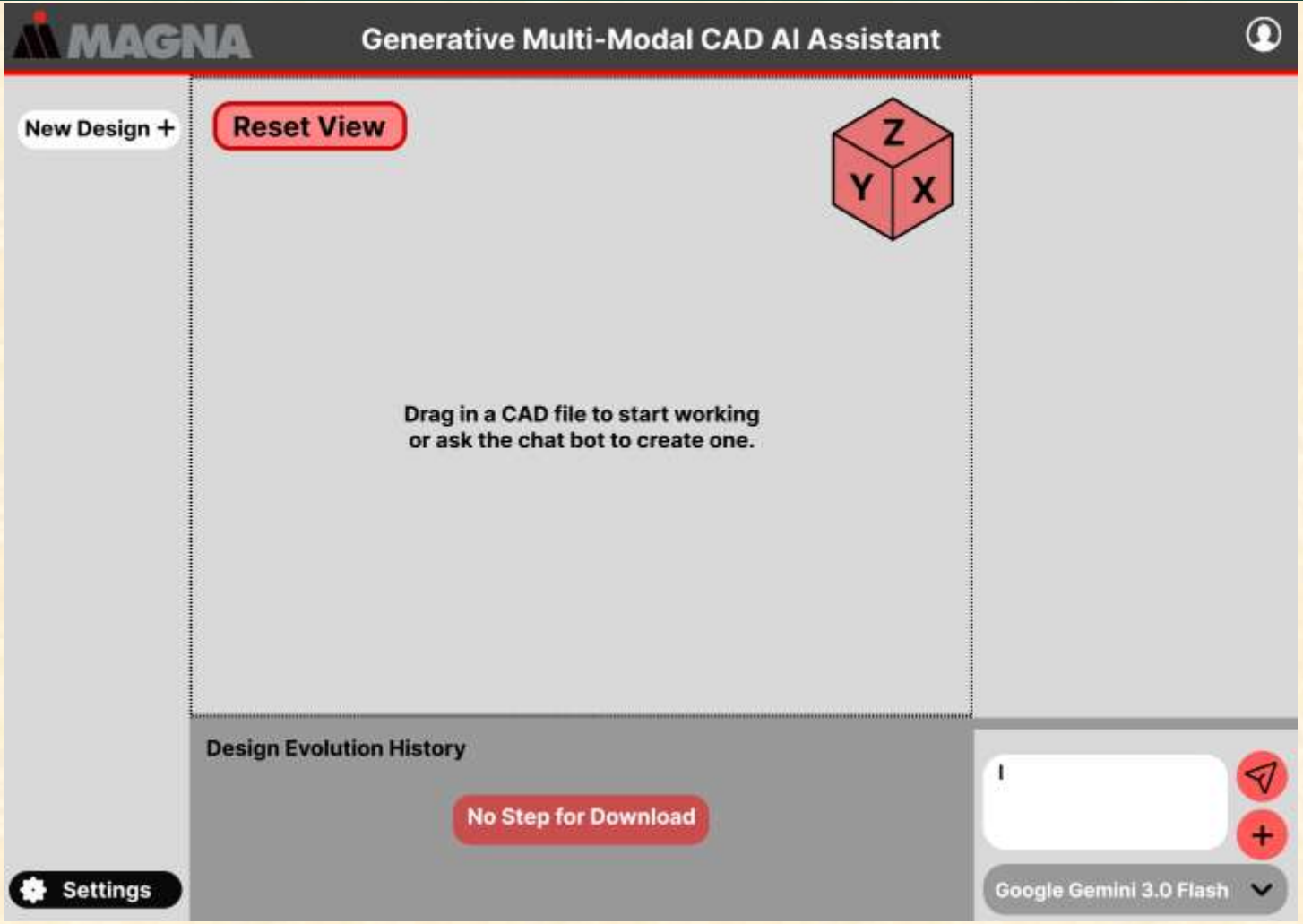
Project Functional Specifications

- This project effectively assists in the time-consuming task that is developing Computer Aided Designs (CAD).
- CAD designers can use this to generate and edit CAD files through the power of a Multi-modal Large Language Model (LLM) enabling a more efficient process for CAD.

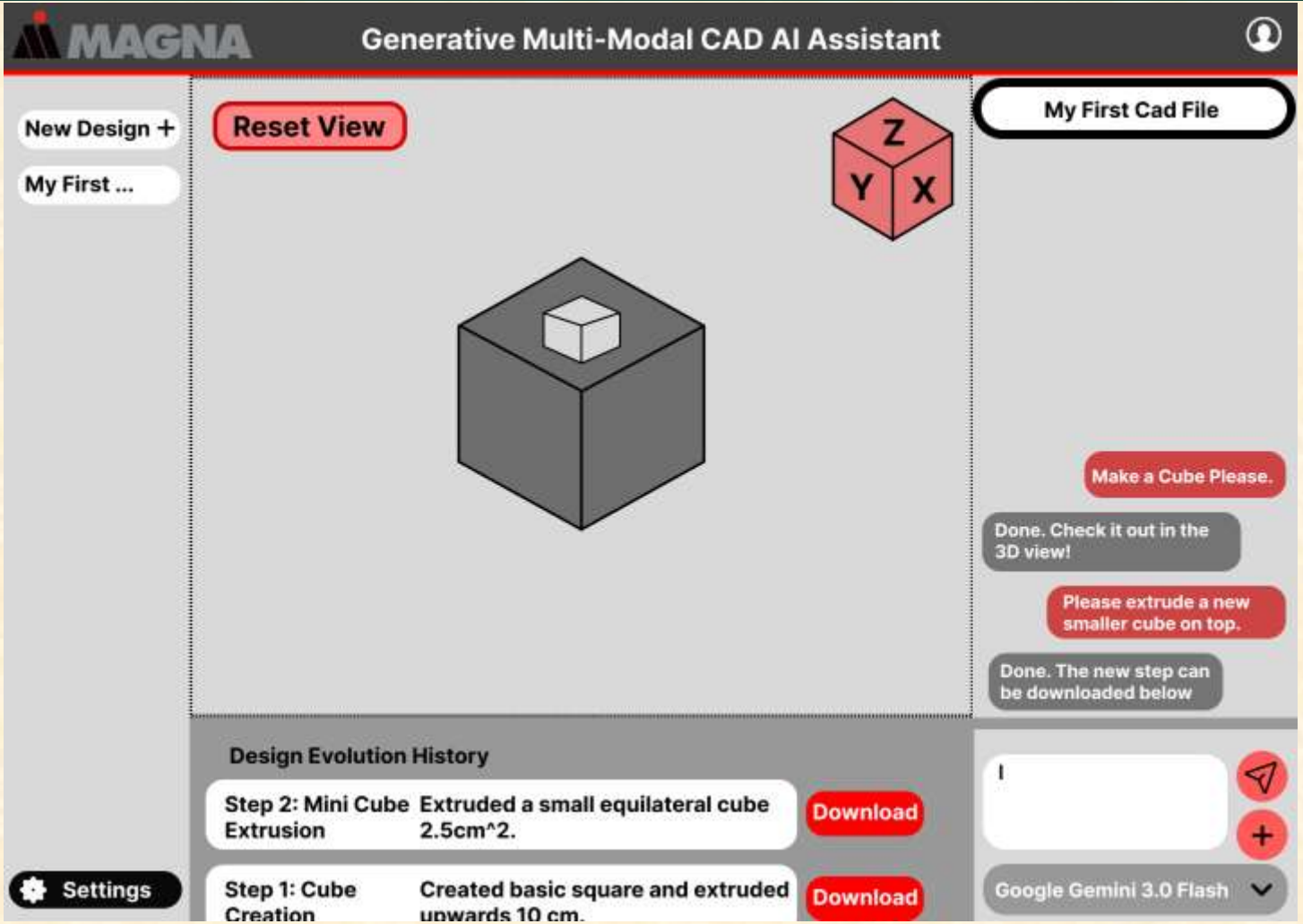
Project Design Specifications

- Web-based, client-server CAD assistant multi-modal user input (text, CAD files, images/meshes).
- Central 3D workspace with interactive model viewer.
- Integrated chat interface for iterative design refinement.
- Allows STEP file generation, downloads at any design stage, and further modifying the design.

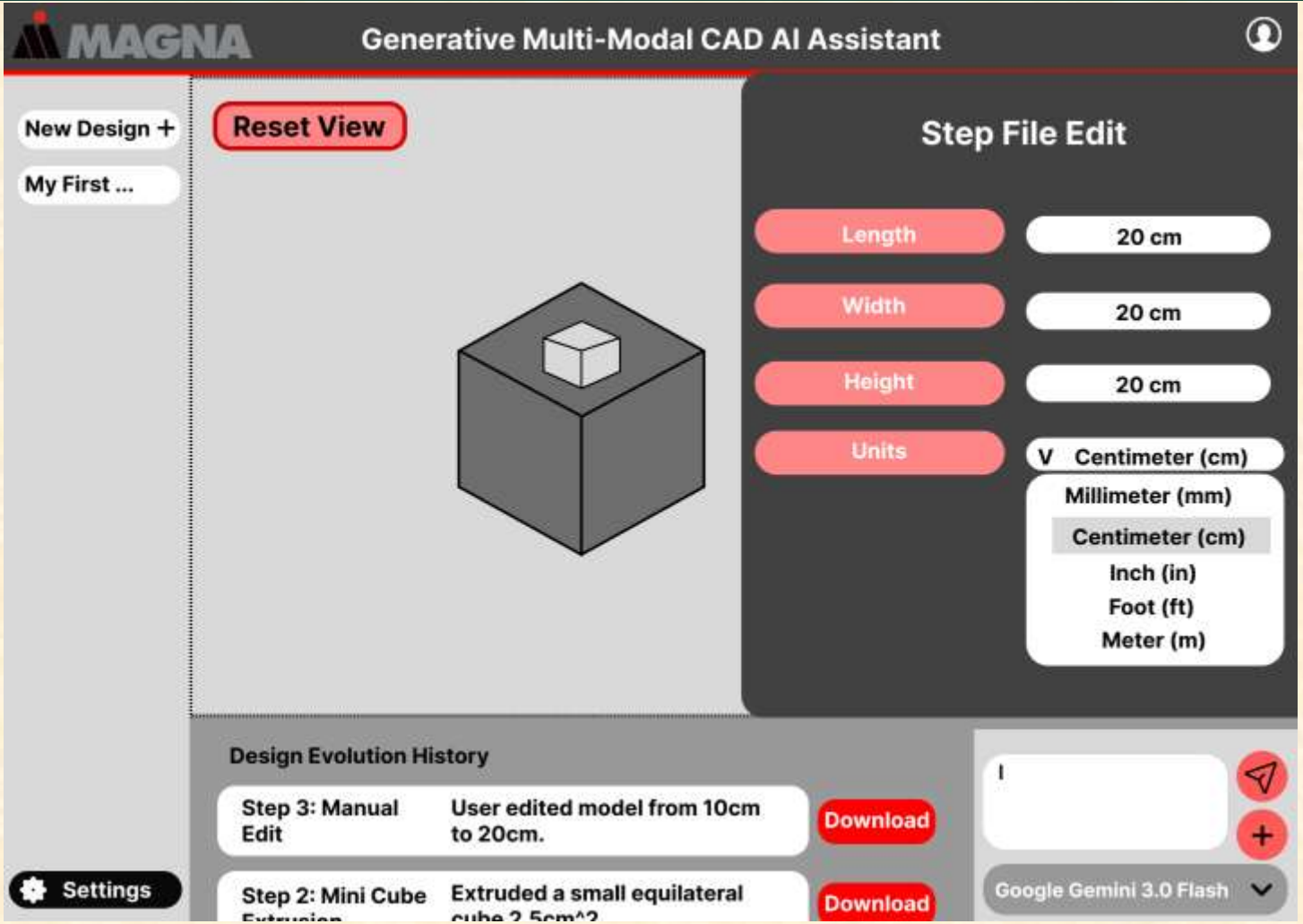
Screen Mockup: Home Page



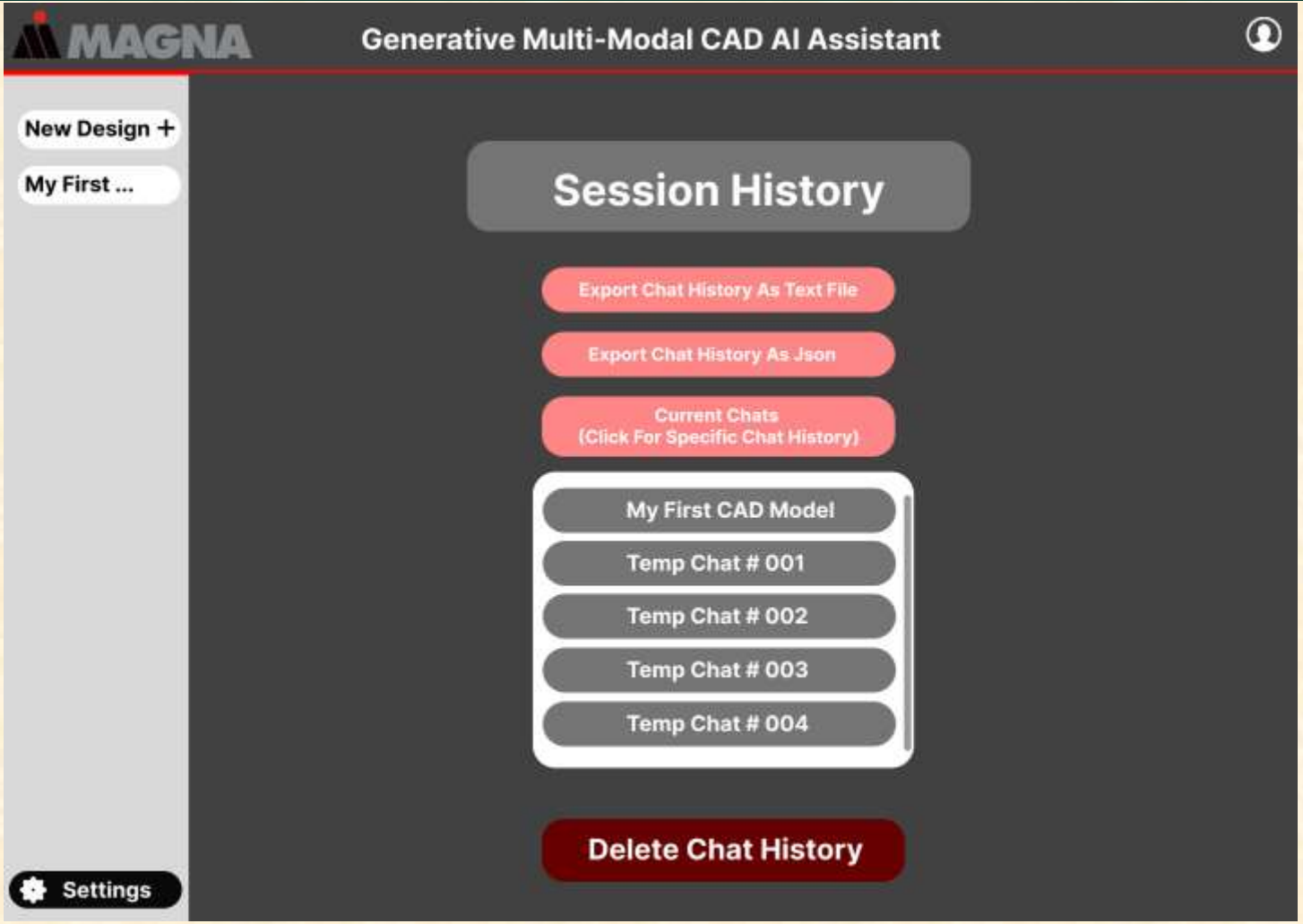
Screen Mockup: Active Chat



Screen Mockup: Manual Edit Settings



Screen Mockup: Session History Settings

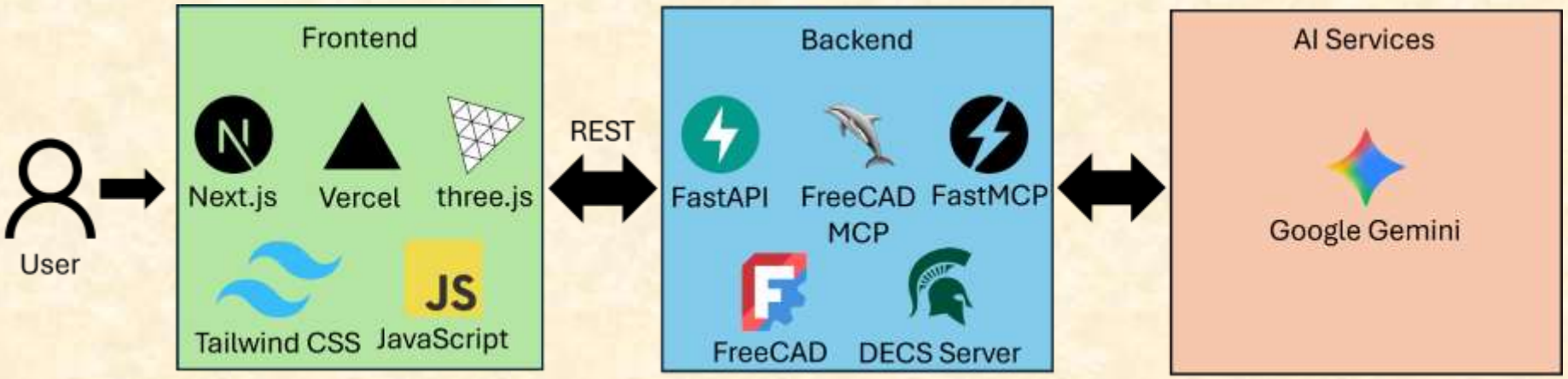


Project Technical Specifications

- Development Tools
  - PyCharm
  - VSCode
- Frontend
  - Next.js
  - three.js
  - Tailwind CSS
  - Vercel
- Backend
  - FastAPI
  - FreeCAD
  - FastMCP
  - Python
  - DECS Server
- AI Services
  - Google Gemini API



Project System Architecture



Project System Components

- Hardware Platforms
  - User end devices
  - Compute systems (RAM, CPU)
- Software Platforms / Technologies
  - Web Application (Next.js frontend)
  - Backend Server (FastAPI, DECS Server)
  - LLM Services (Google Gemini)
  - CAD Software Environment (FreeCAD)

Project Risks

- Risk 1: MCP Server is Token Expensive
  - MCP server CAD commands require the LLM to use too many tokens per prompt.
  - Host an open-source model, lower the commands per prompt, but maintain output consistency.
- Risk 2: Low Quality LLM Output
  - LLM frequently produces lower quality output due to CAD complexity and fails to meet user expectations.
  - Adding model edit and downloadable revision functionality.
- Risk 3: Handling Image/3D file Input
  - Users must be able to input images and 3D models as input for the LLM.
  - Structuring the prompts to the LLM to understand user expectation in the context of CAD commands.
- Risk 4: High CPU and RAM usage
  - MCP server runs on the server side and can potentially consume large percentages of compute resources.
  - Monitor resource usage, reduce model complexity to lower resource needs.

Questions?

