MICHIGAN STATE UNIVERSITY

Beta Presentation

LLM 3D Model Interpretation and Decomposition

The Capstone Experience

Team Magna LLM3DMID

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From Students…
…to Professionals

Project Overview

- Web app that helps engineers find and compare similar parts via their 3D models
- Supports plain-English search to locate relevant parts fast
- Lets users view and compare parts side-by-side in 3D and by metadata
- Built for Magna's engineering teams to speed up comparisons across part variants

Team Member's Technical Tasks

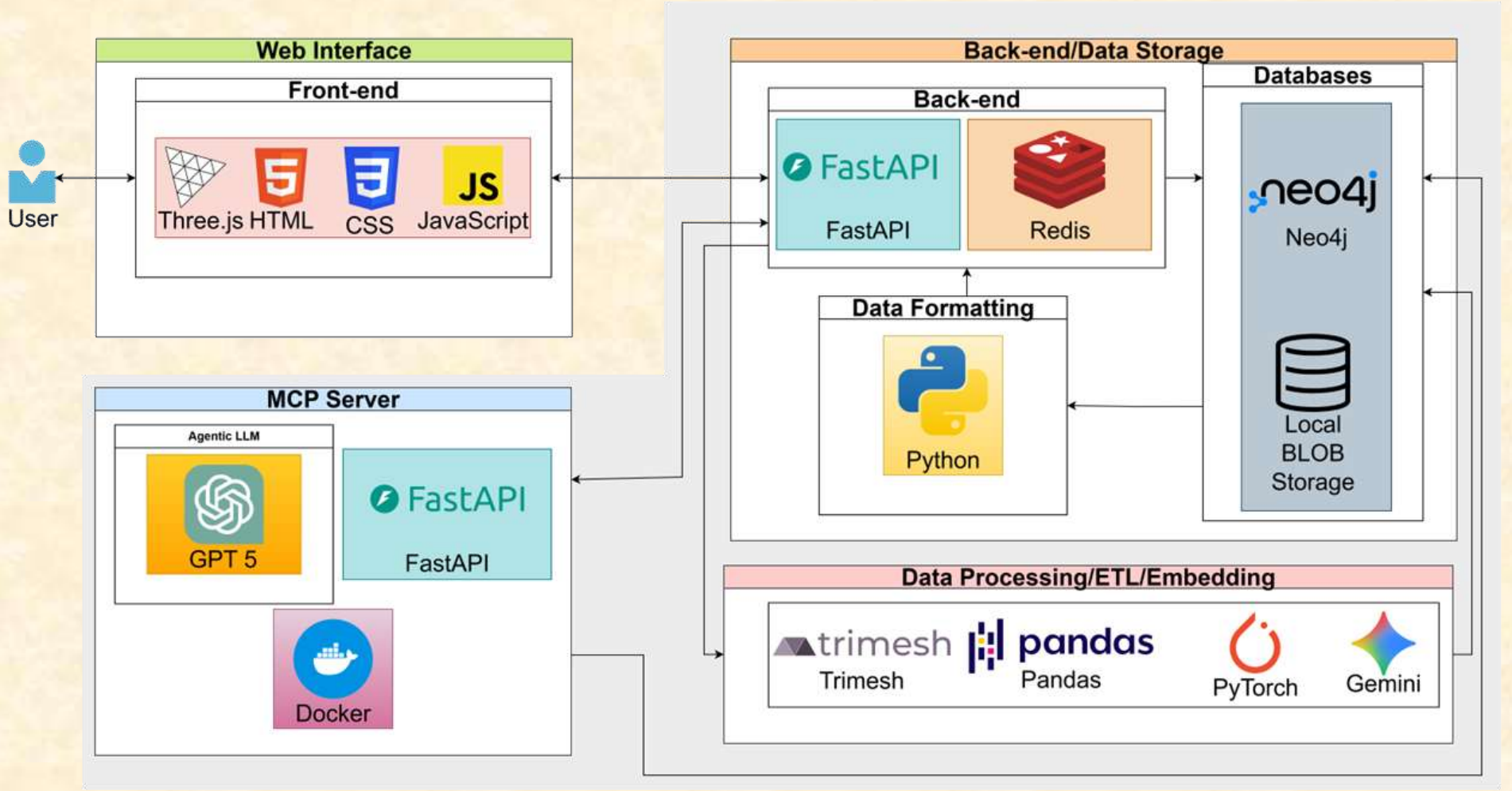
Technical Tasks Assigned

- Ankit Mudunuri
  - Point cloud generation
  - Mesh/PC differential visualization
  - MCP server
- Achint Nagra
  - Extract, Transform, Load pipeline
  - Batch processing system for ETL pipeline
  - Neo4j setup and integration
- Andrew Nguyen
  - Front-end – base website with search bar
  - Semantic search
  - Integration of semantic search into front-end
  - Web scraper
  - CAD viewer functionality
- Saatvik Palli
  - Metadata generation via LLMs
  - 3D model tagging/classification
  - Integrating real parts datasets/databases
- Noah Patenaude
  - 128D vector embeddings for 3D models
  - Training PointNet++ neural network on ShapeNet40 dataset
  - Implementing embedding as a microservice
  - Adding caching to point clouds in back-end
- Jathin Mahendra Sabbineni
  - 3D model view and CAD viewer functionality
  - 3D comparison view
  - Part search, filter options, and history tabs in front-end
  - Website UI
  - Caching in back-end of website

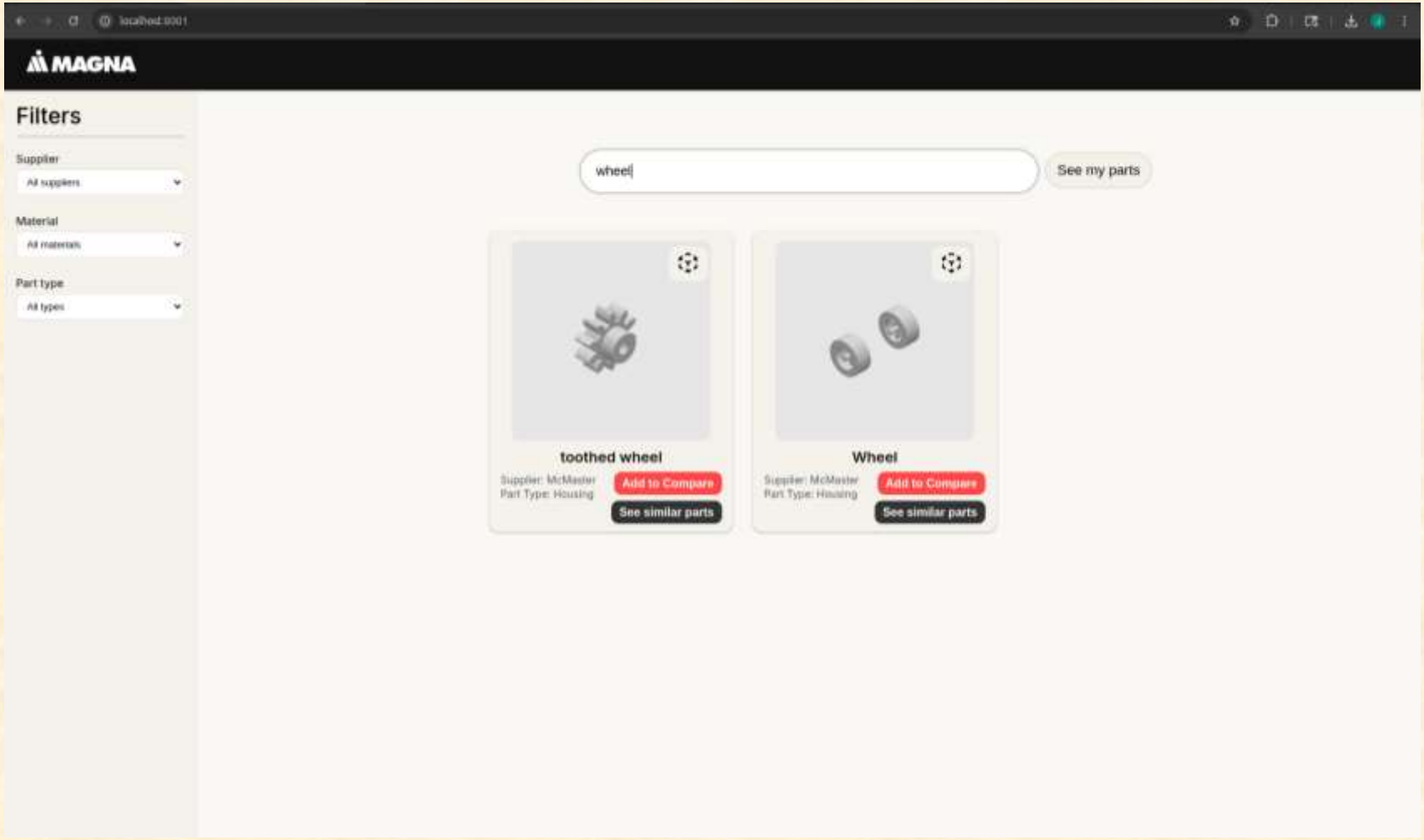
Technical Tasks Completed

- Ankit Mudunuri
  - Point cloud generation
  - Mesh/PC differential visualization (fine-tuned)
  - MCP server and UI (not implemented by betas)
- Achint Nagra
  - ETL pipeline with all functional integrations
  - Batch processing with user uploads
  - Neo4j setup and integration
- Andrew Nguyen
  - Front-end – base website with search bar
  - Semantic search
  - Integration of semantic search into front-end
  - CAD viewer functionality
  - Real parts web scraping (not implemented by betas)
- Saatvik Palli
  - Metadata generation via LLMs
  - 3D model tagging/classification
  - Integrated ShapeNet dataset
- Noah Patenaude
  - 128D vector embeddings for 3D models
  - Trained PointNet++ neural network on ShapeNet40 dataset
  - Implemented embedding as a microservice
  - Added caching to point clouds in back-end
- Jathin Mahendra Sabbineni
  - 3D model view with CAD viewer tools and functionality
  - 3D comparison view
  - Part search, filter options, and history tabs in front-end
  - Website UI
  - Caching in back-end of website

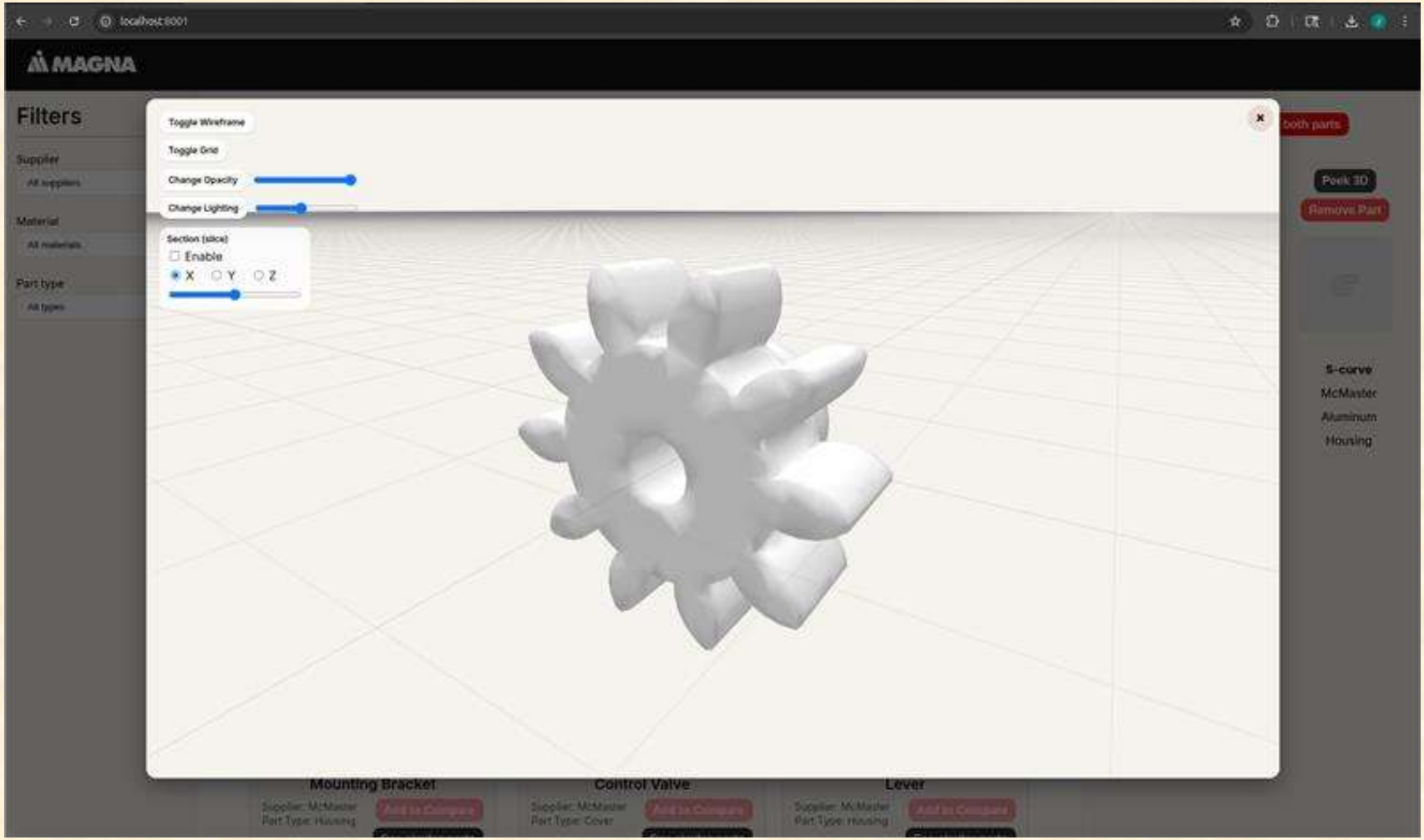
System Architecture



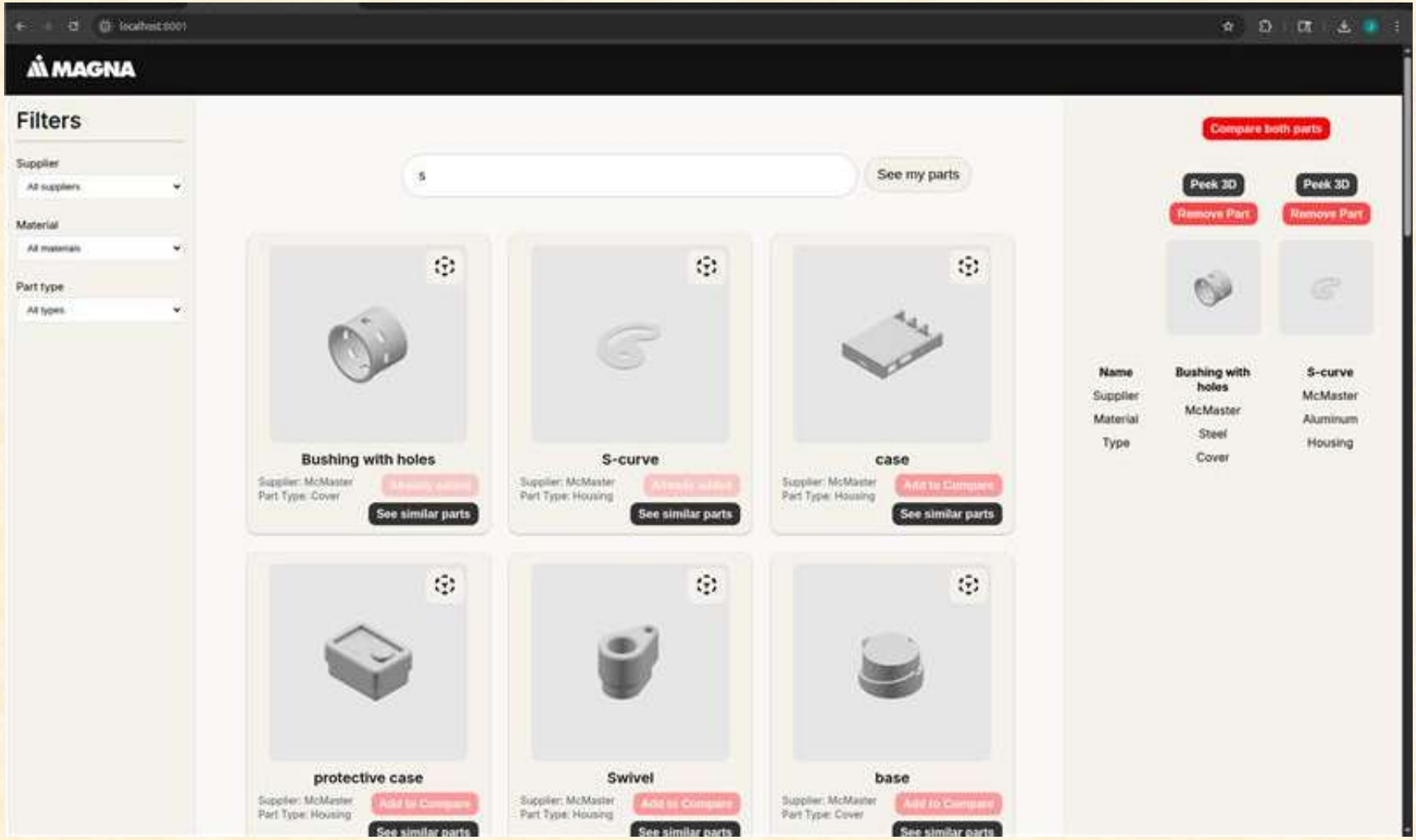
Part Search


MAGNA
Filters
Supplier
Material
Part type
wheel
See my parts
toothed wheel
Supplier: McMaster
Part Type: Housing
Add to Compare
See similar parts
Wheel
Supplier: McMaster
Part Type: Housing
Add to Compare
See similar parts

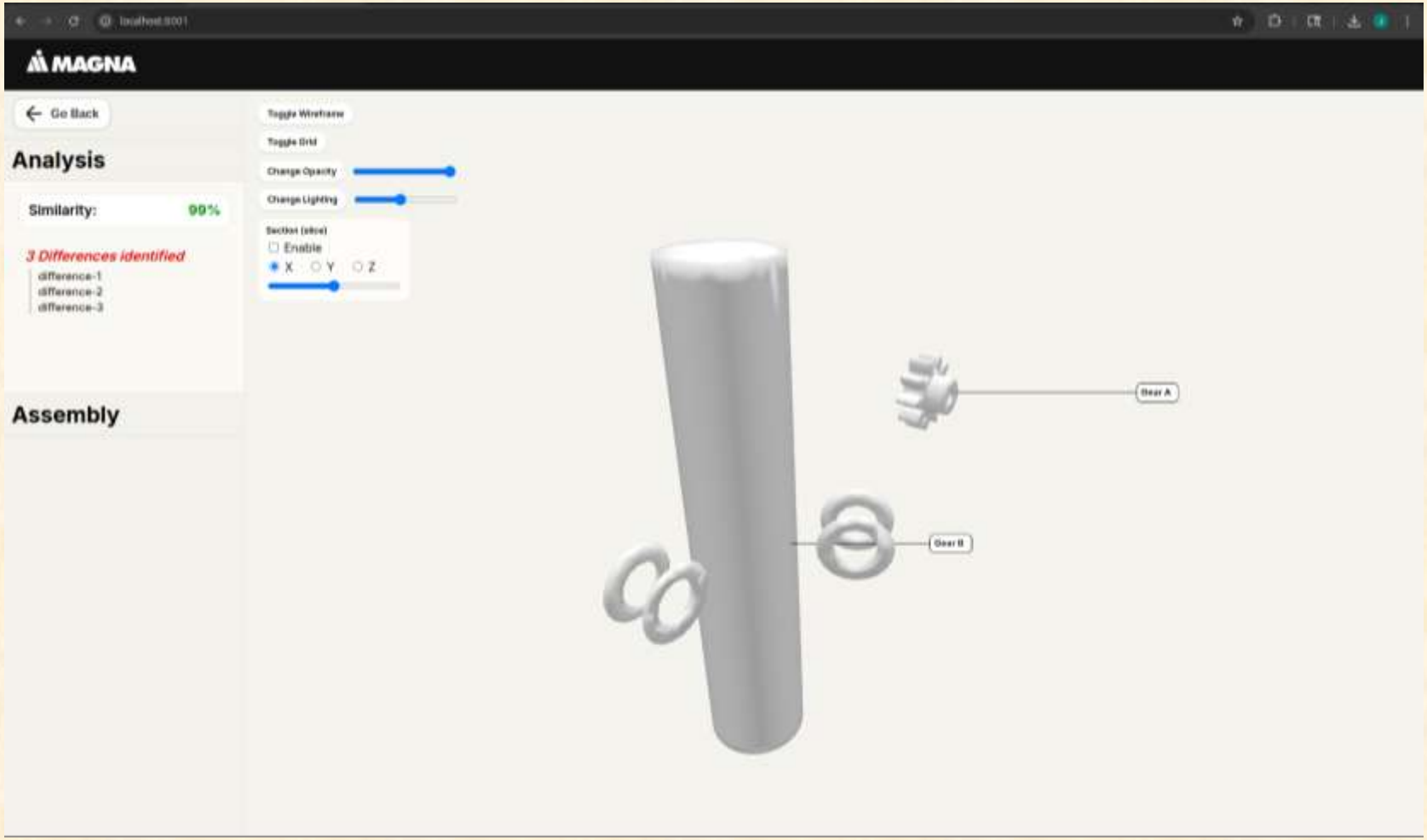
Singular Part 3D View



Selecting Parts for Comparison



Comparison 3D View



What's left to do?

- Stretch Goals
  - Further embedding improvements
  - Adding decomposition view to the website
  - Integrating MCP server
  - Integrating web scraper for real parts

Questions?