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ARISE

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ABSTRACT

With the rapid advancement of artificial intelligence and immersive visualization technologies, there is an increasing demand for interactive and intuitive human-computer interaction systems. Traditional 3D visualization systems lack real-time interaction and do not provide an engaging user experience. To address these limitations, ARISE AI is proposed as an innovative platform that integrates artificial intelligence, real-time 3D rendering, gesture recognition, and holographic projection. The system enables users to generate three-dimensional objects using text input, voice commands, or an AI chatbot interface. These objects are rendered using a 3D engine and displayed as holographic projections using an acrylic sheet based on the Pepper's Ghost illusion. Additionally, the system incorporates real-time hand gesture recognition using MediaPipe, allowing users to interact with the holographic object through intuitive movements such as rotation, scaling, and zooming. The platform is supported by a full-stack architecture including a React-based frontend, Node.js backend, and MongoDB database for efficient data management. By combining AI-driven interaction, gesture control, and holographic visualization into a unified system, ARISE AI provides a highly immersive and futuristic user experience. This system demonstrates the potential of integrating multiple advanced technologies to create next-generation interactive platforms.

Keywords: Artificial Intelligence, Holographic Projection, Gesture Recognition, Three.js, MediaPipe, Human-Computer Interaction.

INTRODUCTION

In recent years, the evolution of artificial intelligence and interactive technologies has transformed the way users interact with digital systems. Traditional interfaces such as keyboards, touchscreens, and static displays are increasingly being replaced by more immersive and natural interaction methods. However, most existing systems still lack real-time interaction and fail to provide a fully engaging user experience.

Three-dimensional visualization has gained popularity in fields such as gaming, education, and design. However, these systems are typically limited to screen-based interaction and do not provide a realistic or immersive experience. Similarly, artificial intelligence systems such as chatbots can understand user input but lack visual representation and physical interaction.

To overcome these limitations, the proposed system **ARISE AI** integrates multiple advanced technologies into a single platform. The system allows users to generate 3D objects using text, voice, or chatbot interaction and visualize them as holographic projections using an acrylic sheet. Additionally, gesture recognition enables users to interact with these objects in real time without physical contact.

By combining AI, 3D rendering, gesture control, and holographic projection, the system provides a futuristic and immersive human-computer interaction experience.

Limitation / Existing System / Research Gap

Traditional online Traditional three-dimensional visualization systems and artificial intelligence interfaces often operate as separate technologies, limiting their overall effectiveness in providing an immersive user experience. Most existing systems rely on screen-based interaction using keyboards, mouse inputs, or touch interfaces, which restrict natural and intuitive user engagement. Additionally, conventional 3D visualization platforms lack real-time interactivity and fail to provide a sense of physical presence, reducing user immersion and practical usability.

Users are often unable to interact with digital objects in a natural manner, as these systems do not support touchless interaction or real-time manipulation. This limitation results in reduced engagement, lower usability, and a less intuitive human-computer interaction experience. Furthermore, traditional visualization methods do not provide spatial or

holographic representation, making it difficult for users to perceive digital objects as part of their real-world environment.

Although some existing solutions implement gesture recognition or artificial intelligence independently, they often function as isolated systems without integration into a unified interactive platform. Similarly, holographic projection techniques are rarely combined with real-time gesture control and AI-driven object generation. Very few systems successfully integrate artificial intelligence, real-time 3D rendering, gesture-based interaction, and holographic visualization into a single framework.

This creates a significant research gap in developing a fully interactive, touchless, and immersive system that combines intelligent input processing with real-time visualization and physical interaction. The proposed ARISE AI platform addresses these limitations by integrating AI-based object generation, real-time 3D rendering, gesture recognition using MediaPipe, and holographic projection using an acrylic sheet within a unified system. By enabling users to generate, visualize, and interact with three-dimensional objects in real time using natural gestures, the system enhances user engagement, improves interaction efficiency, and delivers a futuristic and immersive digital experience.

.Objectives

The main objective of this project is to develop an intelligent and interactive holographic system.
Specific objectives include:

1. To develop a user-friendly interface for input through text, voice, and chatbot.
2. To generate 3D objects using AI-based processing.
3. To implement real-time 3D rendering using Three.js.
4. To integrate gesture recognition using MediaPipe.
5. To create a holographic projection system using an acrylic sheet.
6. To enable real-time interaction with holographic objects.
7. To develop a backend system for storing user data and generated models.

Proposed System

Analysis/ Framework/ Algorithm

1. The user registers or logs into the platform and accesses the application interface, which provides options for text input, voice commands, or interaction through an AI chatbot.
2. The user enters a request (e.g., a description of a 3D object) using text, voice, or chatbot, and the system processes the input through the backend server.
3. The backend integrates with an artificial intelligence model to analyze user input and map it to a suitable three-dimensional object or model.
4. The generated or selected 3D model is sent to the frontend, where the Three.js engine loads and renders the object in an interactive viewer.
5. The system prepares the visualization for holographic projection by applying a dark background and enhancing object brightness for better reflection.
6. The rendered object is displayed on the screen, and an acrylic sheet placed at a 45-degree angle reflects the image to create a holographic illusion based on Pepper's Ghost principle.
7. Simultaneously, the system activates the camera and uses MediaPipe to detect real-time hand gestures of the user.
8. The gesture recognition module interprets hand movements such as rotation, zoom, and scaling, and sends corresponding commands to the 3D engine.
9. The Three.js engine updates the object in real time based on detected gestures, and the holographic projection reflects these changes instantly.
10. The user can interact with the holographic object in a touchless manner and refine or regenerate objects using the AI chatbot.
11. The system allows users to save generated models and interaction data in the database for future access.
12. The administrator manages system data, monitors usage, and maintains application performance through the backend system.

Tools and Technologies

Table 1.1 - Tools and Technologies

Layer	Technology
Frontend	React.js
Backend	Node.js + Express.js
Database	MongoDB
3D Engine	Three.js

Gesture Recognition	MediaPipe
AI Integration	OpenAI , Gemini API
Deployment	Vercel, Render

Methodology

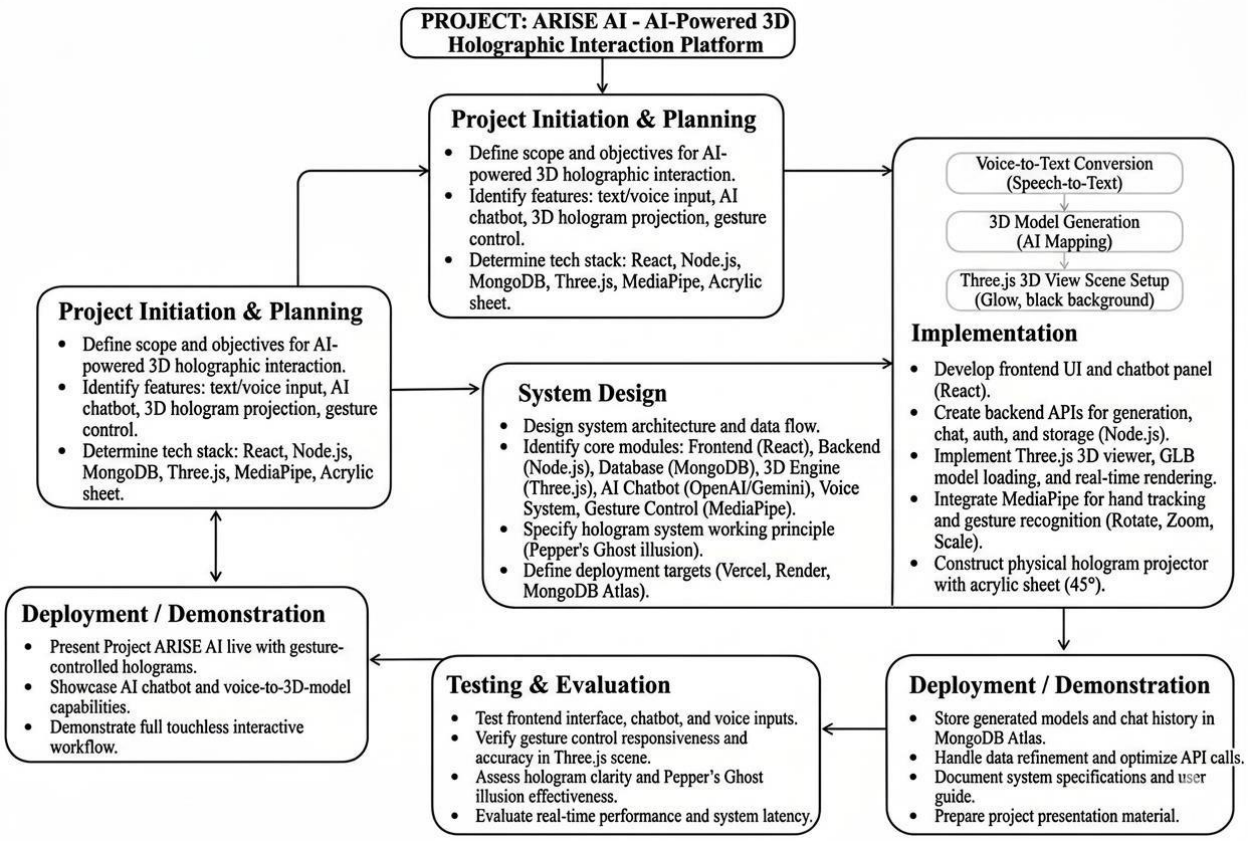


Figure 1.1 – Methodology/ Project Lifecycle

- **Project Initiation & Planning:** Define the problem of lack of immersive interaction and limited real-time control in traditional 3D visualization systems. Gather requirements for AI-based object generation, gesture recognition, holographic projection using an acrylic sheet, and full-stack application development. Finalize the project scope, features, and technology stack including React, Node.js, Three.js, MediaPipe, and AI APIs.
- **System Design:** Design the overall system architecture for the web application, backend server, gesture recognition module, and holographic projection setup. Identify key modules such as User Interface Module, AI Chatbot Module, 3D Rendering Module, Gesture Recognition Module, Hologram Projection Module, and Database Module. Prepare workflow diagrams and system block diagrams for better understanding.
- **Implementation:** The main development stage — where modules such as user authentication, AI chatbot integration, voice input processing, 3D model rendering using Three.js, real-time gesture detection using MediaPipe, and holographic projection setup using an acrylic sheet are developed and integrated. Backend APIs are created for processing user input, managing data, and handling AI responses.
- **Testing & Evaluation:** Perform functional testing of all modules including AI response accuracy, 3D rendering performance, and gesture recognition precision. Conduct real-time testing of holographic projection and gesture interaction. Evaluate system responsiveness, usability, and overall performance, and refine based on feedback.
- **Deployment / Demonstration:** Deploy the web application using cloud platforms and demonstrate the working prototype. Showcase features such as AI-based object generation, holographic visualization, and gesture-controlled interaction in real time.
- **Maintenance & Documentation:** Continuously update system features, improve AI responses, optimize gesture detection accuracy, and fix bugs. Maintain system performance and prepare complete project documentation and final research report.

Design Details

1.2.2

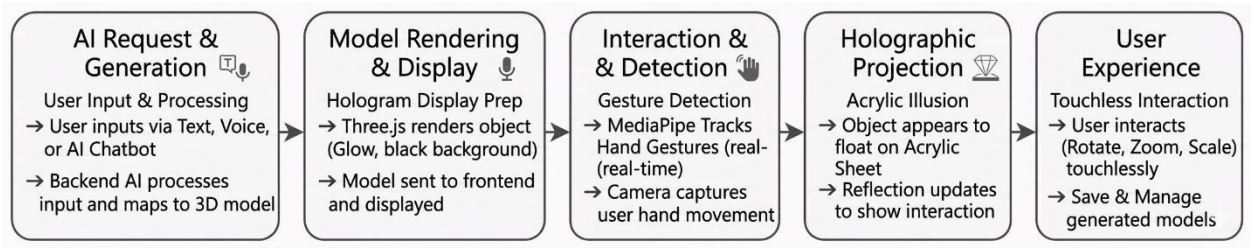


Figure 1.2 – System Design Workflow

- **User Input & Interaction**

➢ Provide multiple input methods including text input, voice commands, and AI chatbot interface.
➢ Allow users to describe or request three-dimensional objects using natural language.

- **AI-Based Object Generation**

➢ Process user input using an AI model to understand intent and map it to a suitable 3D object.
➢ Generate or select appropriate three-dimensional models based on user requests.

- **Three-Dimensional Visualization**

➢ Render the generated object using a Three.js-based interactive 3D viewer.
➢ Enable users to rotate, zoom, and explore the object for better understanding.

- **Holographic Projection (Acrylic Sheet)**

➢ Display the 3D object on a screen with a dark background and high brightness.
5. Use an acrylic sheet placed at a 45-degree angle to create a holographic illusion based on Pepper's Ghost principle.

Gesture-Based Interaction

➢ Capture real-time hand movements using a camera and MediaPipe framework.
➢ Allow users to control the object through gestures such as rotation, scaling, and zoom.

6. Real-Time Interaction System

➢ Process gesture inputs and update the 3D object instantly.
➢ Reflect real-time changes in the holographic projection for a seamless experience.

7. Data Storage & Management

➢ Store user data, generated objects, and interaction history in the database.
➢ Enable users to save and manage their generated models.

8. Admin & System Monitoring

➢ Provide backend control for managing users, models, and system performance.
➢ Monitor system activity and maintain smooth operation.

Hardware and Software Setup Software Requirements:

• Operating System: Windows 10/11, macOS, or Linux.
• Programming Languages: Python 3.x and JavaScript (ES6+).
• Frontend Technologies: React.js with Vite and Tailwind CSS.
• Backend Framework: Node.js with Express.js
• Database: MongoDB (MongoDB Atlas for cloud storage).
• Authentication Services: JWT Authentication / Firebase Auth (optional).
• AI Integration: OpenAI API / Gemini API for chatbot and object generation.
• 3D Rendering Engine: Three.js for real-time 3D visualization.
• Gesture Recognition: MediaPipe Hands for real-time hand tracking.
• Voice Input: Web Speech API for speech-to-text conversion.
• Hologram Technology: Acrylic sheet setup based on Pepper's Ghost illusion.
• Tools and Libraries: Axios, Three.js, MediaPipe, React Libraries.
• IDEs and Testing Tools: Visual Studio Code, Postman.
• Browser: Google Chrome (recommended for best performance).

Hardware Requirements: For Development:

- **Minimum:** Intel Core i3 processor, 8 GB RAM, 128 GB SSD, stable internet connection.
- **Recommended:** Intel Core i5 or higher, 16 GB RAM or above, 256 GB SSD, high-speed internet connection.

For End Users:

• Laptop or desktop with a display screen for hologram projection.
• Webcam or camera for gesture recognition.
• Transparent acrylic sheet for holographic display setup.
• Smartphone (optional) for additional interaction.
• Device capable of running modern web browsers.
• Stable internet connection (minimum 5 Mbps).

RESULT AND DISCUSSION

Implementation Plan
Phase 1: System Design and Backend Development

• ***Requirement Analysis:***
– Collected detailed system requirements for AI-based object generation, gesture recognition, holographic projection using an acrylic sheet, and full-stack web application development.
– Defined the complete workflow for user input (text/voice/chatbot), AI processing, three-dimensional visualization, gesture interaction, and holographic display.

• ***Database Design:***
– Structured a scalable database schema using MongoDB to manage users, generated 3D models, and interaction history efficiently.
–Implemented secure authentication and role-based access control for users and administrators.
Enabled efficient data storage and retrieval for real-time interaction and model management.

Backend Development:
– Developed Node.js and Express-based APIs for handling user input, AI processing, model generation, and data management.
– Integrated AI APIs (OpenAI / Gemini) for chatbot interaction and object generation.
– Implemented secure authentication mechanisms and ensured smooth communication between frontend and backend systems.

Phase 2: Frontend Development and AI Integration
• *Frontend Interface Design:*
– Developed a responsive web application using React with Vite and Tailwind CSS.
– Designed user-friendly interfaces for chatbot interaction, 3D model viewing, and system controls.
– Created an interactive dashboard for managing generated objects and user data.

• *3D Visualization and Gesture Integration:*
– Integrated Three.js for real-time three-dimensional object rendering and interaction.
– Implemented MediaPipe for real-time hand gesture recognition and tracking.
– Connected gesture inputs to the 3D engine to enable object rotation, scaling, and zooming in real time.

• *Hologram System Integration:*
– Conducted functional and integration testing of frontend, backend, AI, and gesture modules.
– Performed real-time testing of gesture accuracy and holographic projection quality.
– Evaluated system responsiveness, usability, and performance before deployment.

Phase 3: Deployment and Evaluation
• *Cloud Deployment:*
– Deployed the backend application using cloud platforms such as Render.
– Hosted the frontend application using Vercel for fast and reliable access.
– Configured the system for cross-device compatibility and real-time interaction.

• *Performance Evaluation:*
– Monitored system responsiveness, rendering speed, and gesture detection accuracy.
– Conducted cross-device testing to ensure stable 3D visualization and interaction performance.
– Gathered user feedback to improve usability and interaction experience..

• *Final Optimization:*
– Optimized API performance and reduced latency for real-time interaction.
– Improved user interface for better visual experience and usability.
– Enhanced system stability, security, and overall performance before final demonstration.

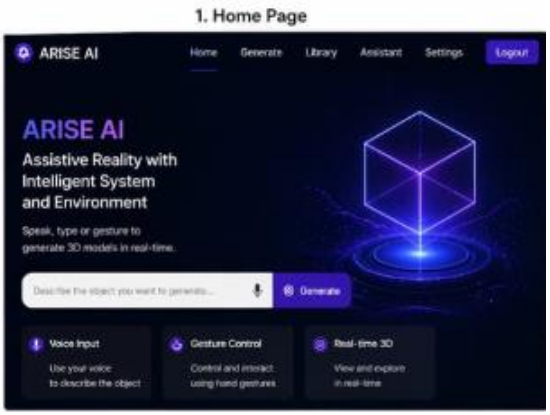
RESULT

The developed ARISE AI system successfully demonstrated an advanced interactive platform by integrating artificial intelligence, real-time three-dimensional visualization, gesture recognition, and holographic projection. The system enabled users to generate 3D objects using text, voice, or chatbot input and visualize them as holograms using an acrylic sheet.

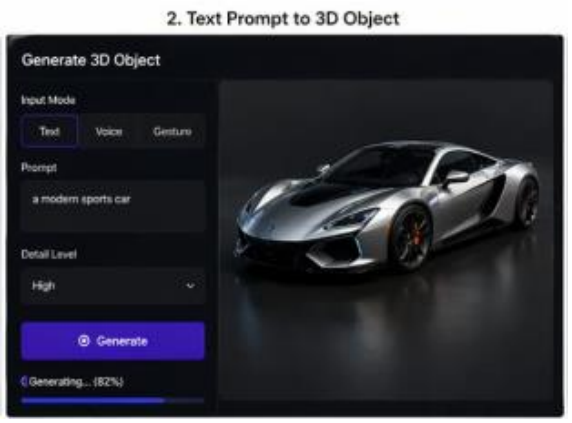
The integration of Three.js, MediaPipe, and AI APIs provided a seamless and responsive user experience. Gesture recognition allowed users to interact with objects in real time, enabling rotation, scaling, and zooming without physical contact. The holographic projection created an immersive visual effect, enhancing user engagement and interaction.
Performance evaluation showed smooth rendering, accurate gesture detection, and minimal latency during real-time interaction. User feedback indicated a highly engaging and intuitive experience due to the combination of AI-driven interaction and touchless control. Overall, the system proved effective in delivering a futuristic and immersive human-computer interaction platform with potential applications in education, visualization, and entertainment.

Results/ Outputs (Website)

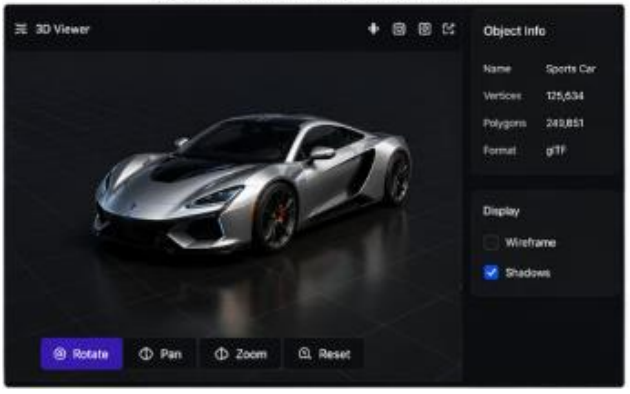
1. Home Page



2. Text Prompt to 3D Object



3. 3D Object in Viewer (New Screen)

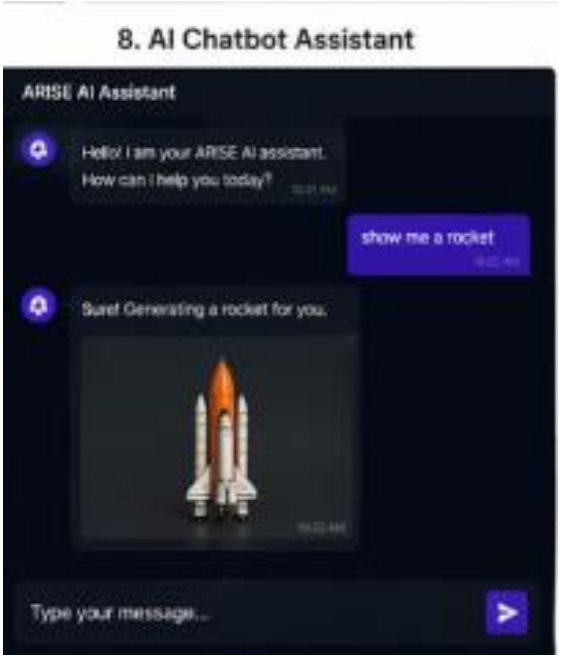


4. Holographic View with Acrylic Sheet (Pepper's Ghost Effect)

6. Voice Command in Action

7. Color Change & Real-time Update

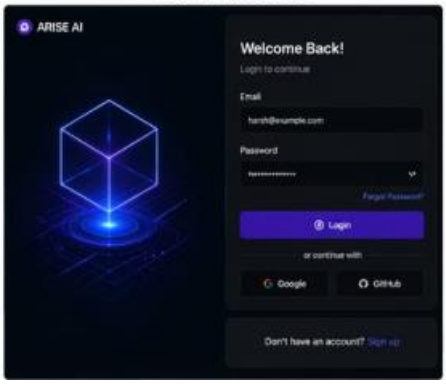
8. AI Chatbot Assistant



9. Backend API Response (Postman)

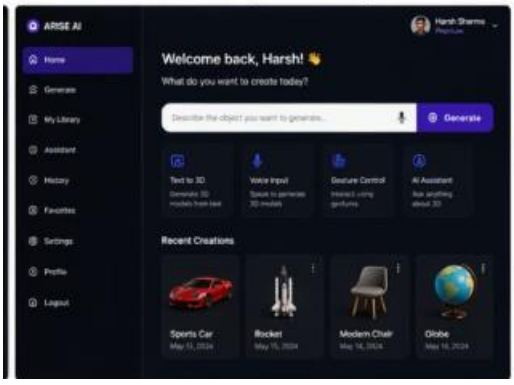
10. Backend Server Running (Terminal)

1. Login / Sign Up Page

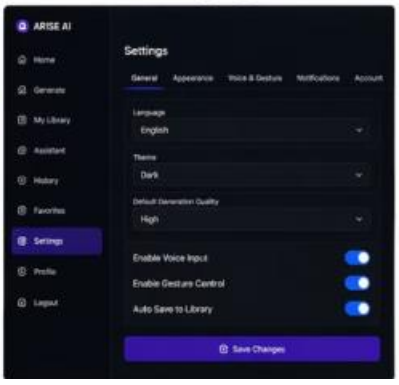


2. Sign Up Page

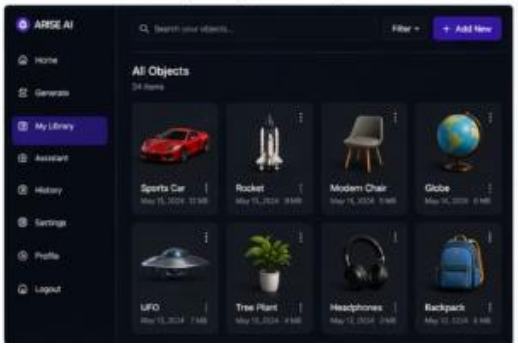
3. Dashboard / Home After Login



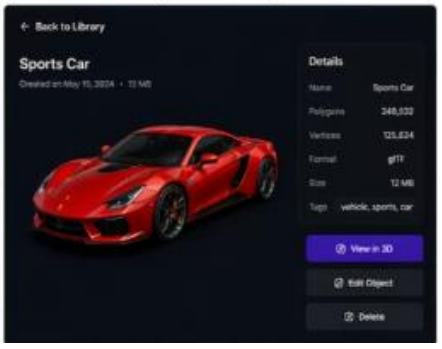
4. Settings Page



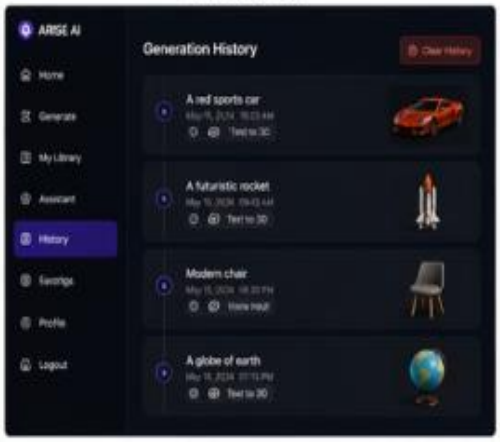
5. My Library / Saved Objects



6. Object Details Page



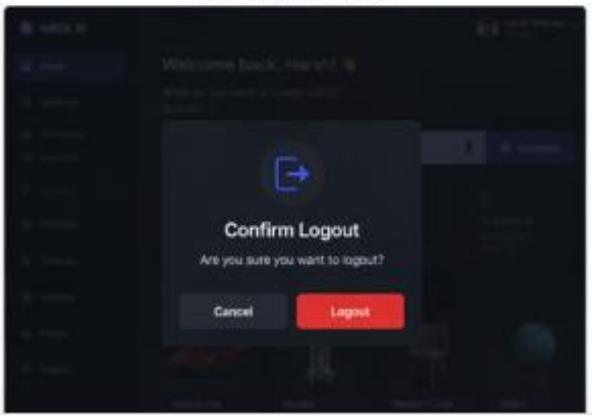
7. History Page



8. Favorites Page

11. Export / Share Object

12. Logout Confirmation



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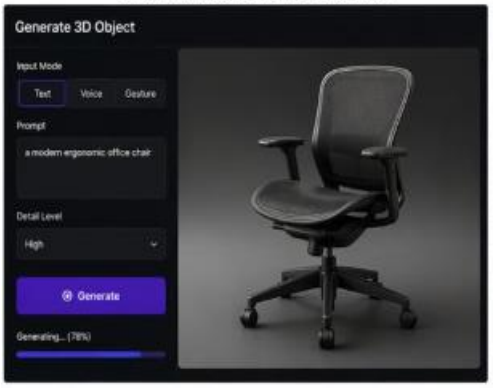
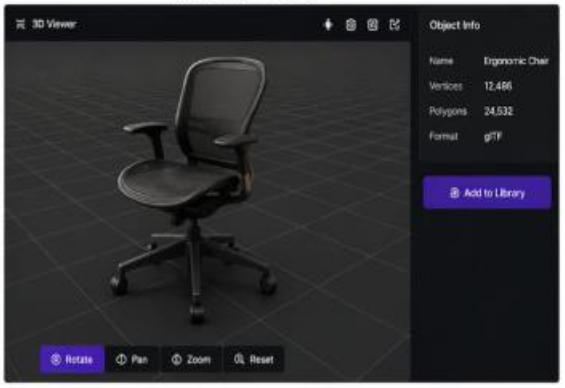


3. 3D Object in Viewer



10. MediaPipe Hand Landmarks (Debug View)

CONCLUSION

The ARISE AI system effectively enhances human-computer interaction by integrating artificial intelligence, real-time three-dimensional visualization, gesture recognition, and holographic projection into a unified platform. It overcomes the limitations of traditional interaction methods by enabling users to generate and interact with digital objects using natural inputs such as text, voice, and hand gestures. The use of an acrylic sheet for holographic projection provides a visually immersive experience, allowing users to perceive virtual objects as part of the real world.

The platform streamlines the interaction process by combining AI-based object generation, interactive 3D rendering, touchless gesture control, and real-time system responsiveness within a single system. By improving interactivity, visualization, and user engagement, the solution delivers a more intuitive and futuristic experience. This approach demonstrates the potential of combining AI, gesture-based interfaces, and holographic visualization to transform digital interaction systems and create more immersive, efficient, and user-centric technological solutions.

REFERENCES

[1] Google Research, “MediaPipe Hands: Real-Time Hand Tracking”, Google AI Documentation, 2023.
[2] Ricardo Cabello et al., “Three.js – JavaScript 3D Library”, Official Documentation, 2024.
[3] OpenAI, “OpenAI API Documentation for AI Models and Chatbots”, OpenAI, 2024.
[4] Google DeepMind, “Gemini API Documentation for AI Integration”, Google, 2024.
[5] S. K. Saha, “Gesture Recognition and Its Applications in Human-Computer Interaction”, International Journal of Computer Applications, 2022.
[6] A. Kumar & R. Singh, “Real-Time Hand Gesture Recognition using Machine Learning Techniques”, IEEE Publication, 2022.
[7] J. Smith et al., “3D Visualization and Interactive Systems using Web Technologies”, International Journal of Advanced Computer Science, 2021.
[8] M. Brown, “Holographic Display Techniques using Pepper’s Ghost Illusion”, Journal of Visual Communication, 2021.
[9] P. Sharma & K. Verma, “AI-Based Chatbot Systems for Intelligent Interaction”, International Journal of AI Research, 2022.
[10] Node.js Foundation, “Node.js Documentation for Backend Development”, 2024.
[11] Meta AI, “MediaPipe Framework for Computer Vision Applications”, Technical Report, 2023.
[12] React Team, “React.js Documentation for Frontend Development”, Meta, 2024.