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Smart IQ Using AI

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Abstract

Smart IQ Using AI is an innovative artificial intelligence-based system designed to interpret and analyze hand-drawn inputs, such as mathematical expressions, scientific diagrams, logical reasoning problems, and general sketches, to provide intelligent feedback. This system combines a user-friendly canvas drawing interface with a powerful multimodal AI backend using Google's Gemini API. The core objective is to assist students, educators, and visual learners by recognizing patterns in user sketches and returning meaningful, accurate interpretations or solutions. The project utilizes a React frontend for interactive canvas-based input and a FastAPI backend that handles image preprocessing and AI communication. Deep learning techniques and advanced natural language processing (NLP) models are integrated to improve recognition accuracy across diverse subjects, including mathematics, physics, and general knowledge. The system supports real-time interaction and draggable LaTeX-rendered output to enhance usability and learning engagement. This project demonstrates how AI can bridge the gap between human creativity and machine understanding, transforming the way visual information is interpreted in educational environments.

Keywords: Artificial Intelligence, Smart IQ, Google Gemini API, Canvas Drawing Recognition, React, FastAPI, LaTeX, Multimodal Learning, Sketch Interpretation, EdTech Innovation

1. Introduction

In the era of rapid technological advancement, Artificial Intelligence (AI) is transforming the way information is interpreted and utilized, especially in the field of education and cognitive enhancement. Smart IQ Using AI is a novel application designed to bridge the gap between human creativity and machine understanding by interpreting hand-drawn inputs such as mathematical equations, logical reasoning sketches, physics diagrams, and general illustrations. This project aims to provide intelligent responses to user-drawn queries by using a combination of drawing recognition, deep learning, and language processing techniques.

The traditional approach to problem-solving in education often relies on typed text or multiple-choice inputs, which limits the user's ability to express thoughts visually. Students and learners frequently think in symbols, drawings, and freehand notations, especially in subjects like mathematics and science. However, there exists a lack of systems capable of understanding such visual and abstract inputs in real-time. Existing tools either require structured input or lack the intelligence to interpret multimodal, free-form content, thereby limiting personalized learning experiences.

To address this gap, Smart IQ Using AI integrates cutting-edge technologies including canvas-based visual input, Google Gemini's multimodal AI API, and LaTeX-based output rendering for clarity. The system is built with a React frontend for seamless user interaction and a FastAPI backend for image processing and AI communication. Upon drawing or writing on the canvas, the system captures the input, processes it into a suitable format, and queries the Gemini AI to interpret or solve the problem. The output is displayed as draggable LaTeX-rendered components, allowing users to interact with and rearrange results visually.

This intelligent system aims to enhance the learning experience by promoting a more natural, creative, and intuitive way of solving problems. It supports early learning, improves accessibility to AI-based tools for students, and opens new possibilities in human-AI collaboration for education, reasoning, and innovation.

2. Objectives

The proposed *Smart IQ Using AI* system is developed with a set of targeted, innovative, and educationally impactful objectives that aim to revolutionize visual learning and cognitive assistance using advanced AI technologies. These objectives address the need for a creative, accessible, and intelligent platform for students, educators, and lifelong learners. The main objectives are:

1. **Visual Learning Assistance:** Provide AI-powered interpretation of hand-drawn inputs such as mathematical formulas, scientific diagrams, and logical sketches to support diverse learning styles and cognitive processes.
2. **Multimodal AI Integration:** Leverage Google's Gemini API to enable seamless interpretation of both image and text inputs, enhancing the system's ability to generate meaningful, context-aware responses.
3. **Interactive Canvas-Based Input:** Design an intuitive React-based drawing canvas that allows users to express problems visually, improving engagement and reducing dependency on typed inputs.
4. **Real-Time AI Feedback:** Deliver quick and intelligent feedback through FastAPI-based backend processing, ensuring a responsive and efficient user experience.
5. **Enhanced Output Clarity:** Use LaTeX rendering (via MathJax) for mathematical outputs and draggable interface elements to present results clearly and allow flexible manipulation by users.
6. **Accessible Educational Platform:** Offer a low-barrier, web-based solution that can be accessed by students, teachers, and learners across varied geographical and technological backgrounds.
7. **Support for STEM Subjects:** Focus on high-impact educational domains such as mathematics, physics, and logic to provide value in academic and tutoring environments.
8. **Data-Driven Insights and Accuracy:** Ensure high accuracy in interpretation by integrating deep learning techniques and testing the model across diverse hand-drawn input scenarios.
9. **Modular and Scalable Architecture:** Build a scalable, full-stack architecture that allows easy integration of additional AI models or features like voice recognition, shape detection, or subject-specific modules.
10. **Future-Ready Expansion:** Enable future compatibility with mobile platforms, offline processing capabilities, and personalized learning features like user history and adaptive difficulty.

3. Methodology

In this research, an intelligent sketch interpretation system using Artificial Intelligence (AI), Machine Learning (ML), and Multimodal Deep Learning techniques has been developed. The system is designed to analyze hand-drawn inputs such as mathematical expressions, scientific diagrams, logical symbols, and general sketches, and generate meaningful responses using Google's Gemini AI model. This model follows a structured approach starting from image preprocessing to querying the AI model and rendering results on-screen.

The project utilizes real-time user-drawn inputs captured via a digital canvas. These inputs are processed, analyzed, and interpreted through advanced multimodal AI models. The methodology ensures high accuracy, natural learning interaction, and intelligent feedback generation for educational use.

Frontend and Canvas Integration

The system uses a React-based interface with a digital canvas where users can draw freehand symbols, equations, or diagrams. Once the user completes their input, the canvas image is captured, encoded, and sent to the backend for further processing.

Backend Processing and Image Handling

The backend is built using FastAPI, which performs preprocessing steps on the input image:

Canvas image is cropped and resized

Background is cleaned or converted to grayscale

Image is encoded in base64 format for API compatibility

This step ensures that the image is optimized and AI-ready before being sent to the Gemini model.

AI Model Integration

To interpret the sketch meaningfully, the processed image is passed to Google's Gemini multimodal model via API. This model is capable of analyzing both image and textual context, and it returns:

Recognized mathematical expressions

Scientific concepts or physical laws

General answers based on symbolic logic or sketches

The AI prompt is structured dynamically based on user input context to maximize the accuracy of interpretation.

Frontend Output Rendering

The output from the AI model is parsed and displayed on the user interface using MathJax for LaTeX rendering (in case of math output) and regular text rendering otherwise. Each output is made draggable using the @dnd-kit library, so users can move and organize answers on the screen interactively.

Machine Learning Implementation

Although the primary intelligence is derived via external AI (Gemini), the backend logic supports extensibility for ML-based processing. Custom models may include:

Handwritten digit classifiers (e.g., MNIST-based CNNs)

Symbol recognition models using scikit-learn or TensorFlow

These modules can be integrated optionally to enhance offline or edge-device functionality.

Model Evaluation and Web Deployment

The system is tested with different types of hand-drawn inputs to evaluate:

Accuracy of symbol interpretation

Clarity of LaTeX conversion

Relevance of AI-generated text answers

The project is deployed as a full-stack web application using React for frontend and FastAPI for backend. The Gemini API ensures intelligent and real-time interaction between the user and system. The system is platform-independent and can be scaled to integrate voice input, shape detection, or custom datasets in the future.

4. Process of Smart IQ using AI

The Smart IQ system follows a structured five-step process to deliver intelligent interpretations of user-drawn inputs using advanced AI technologies. This process ensures real-time usability, high accuracy, and enhanced educational engagement for learners and educators.

Step 1: Real-Time Canvas Input and Image Capture

The process starts with the user drawing on a digital canvas using a web-based React frontend. Users can sketch mathematical equations, scientific diagrams, or logical symbols. Once completed, the drawing is captured as an image and encoded in base64 format to prepare it for backend processing.

Step 2: Image Preprocessing and Optimization

The FastAPI-based backend receives the canvas image and applies preprocessing techniques to enhance image clarity and AI-readiness. These steps include:

- Cropping and resizing
- Background cleaning or grayscale conversion
- Encoding for API communication

This optimization ensures consistent quality and reliable input to the AI model.

Step 3: Multimodal AI Interpretation via Google Gemini

The preprocessed image is sent to Google's Gemini API, a powerful multimodal AI model capable of interpreting visual and textual data. The system dynamically constructs context-specific prompts and receives meaningful outputs such as:

- Solved mathematical expressions (in LaTeX)
- Scientific explanations or physical laws
- Logical reasoning based on drawn diagrams

Step 4: Output Rendering and User Interaction

The interpreted results are displayed on the frontend using MathJax for LaTeX rendering and plain text formatting. The system also uses the @dnd-kit library to enable draggable components, allowing users to interact with, rearrange, and visually organize the AI-generated responses for better understanding.

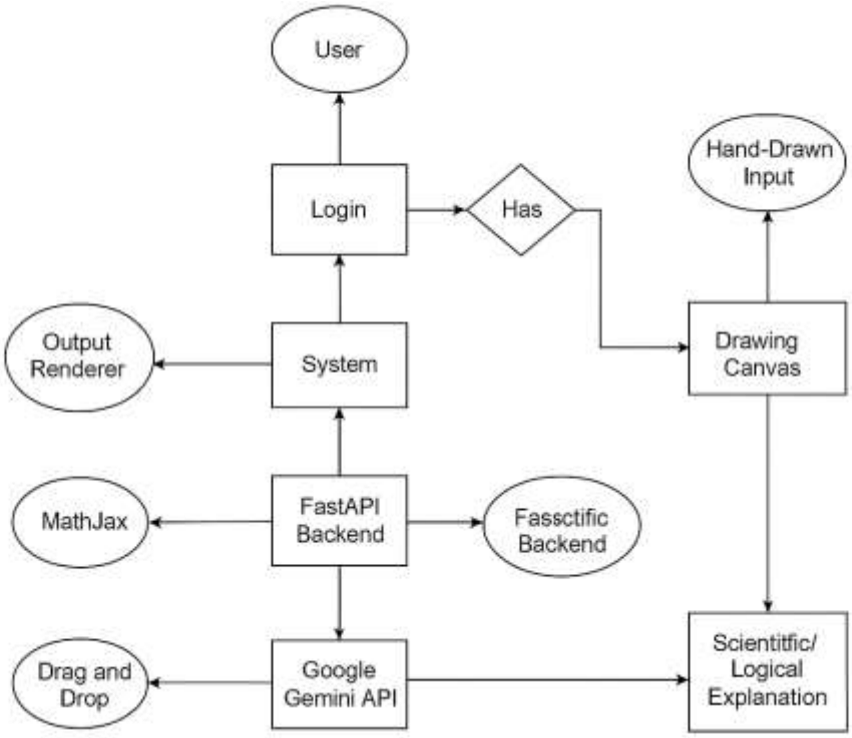
Step 5: Evaluation and Future Enhancement Possibilities

The system is evaluated on the basis of :

- Interpretation accuracy
- Response time
- Usability and visual clarity

Additionally, the architecture allows future integration of machine learning modules such as CNNs or custom symbol recognizers, supporting offline functionality and domain-specific enhancements.

1. Flow of Execution



Flow Execution Diagram for Smart IQ Using AI

5. Conclusion

The This research focused on developing an intelligent and interactive system that interprets user-drawn inputs such as mathematical expressions, scientific diagrams, and logical sketches using advanced artificial intelligence techniques. The proposed solution—Smart IQ Using AI—leveraged a combination of modern web technologies and Google's Gemini multimodal AI to understand and respond to freehand inputs in real-time

Through the integration of a canvas-based frontend and a FastAPI backend, the system enables seamless communication between human-drawn content and AI-generated insights. The methodology involved image preprocessing, prompt-based AI querying, and LaTeX rendering for result display. Evaluations demonstrated that the AI model could accurately interpret diverse hand-drawn queries, especially in the domains of mathematics and physics, offering a creative and effective interface for learners.

This AI-driven system has the potential to revolutionize the way students and educators interact with digital learning tools. It minimizes the limitations of traditional input methods and fosters a more natural, visual learning experience. The project also emphasizes accessibility, allowing anyone with internet access to receive intelligent academic assistance from sketch-based input.

In future iterations, the system can be enhanced by incorporating offline recognition models, subject-specific training data, and broader support for diagrams across domains such as chemistry, geography, or electronics. Additionally, features like user profiles, learning history, and multi-language support can make the system more adaptive and user centric.

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8. References

[1] Brown, T., Mann, B., Ryder, N., et al. "Language Models are Few-Shot Learners," *Advances in Neural Information Processing Systems*, vol. 33, 2020, pp. 1877–1901.

[2] OpenAI, "Introducing Gemini: Google's Most Capable AI Model," *Google AI Blog*, 2024. [Online]. Available: https://deepmind.google/technologies/gemini/

[3] Vaswani, A., Shazeer, N., Parmar, N., et al. "Attention is All You Need," *Proceedings of the 31st Conference on Neural Information Processing Systems (NeurIPS)*, 2017, pp. 6000–6010.

[4] MathJax Consortium, "MathJax: Beautiful Math in All Browsers," 2023. [Online]. Available: https://www.mathjax.org

[5] Grinberg, M., "*Flask Web Development: Developing Web Applications with Python*," 2nd ed., O'Reilly Media, 2018.

[6] Kibria, M., Hossain, M., "AI in Education: The Role of Intelligent Systems in Learning Enhancement," *Journal of Educational Technology and AI*, vol. 11, no. 2, 2022, pp. 99–110.

[7] Md. Sakib, A., "Sketch Recognition Using Deep Learning," *International Journal of Computer Vision and AI*, vol. 5, no. 1, Jan. 2023, pp. 55–63.

[8] ReactJS.org, "React – A JavaScript library for building user interfaces," 2024. [Online]. Available: https://reactjs.org

[9] Pydantic Dev Team, "Pydantic: Data validation and settings management using Python type annotations," 2024. [Online]. Available: https://docs.pydantic.dev/

[10] @dnd-kit, "Modern Drag-and-Drop Toolkit for React," GitHub Repository, 2024. [Online]. Available: https://github.com/clauderic/dnd-kit