

SMARTSOLVER - AI Based Calculator

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Abstract

SmartSolver is an AI-based intelligent calculator application designed to perform mathematical problem solving using natural language processing (NLP), voice input, and image recognition. Built using Python and integrated with machine learning libraries such as TensorFlow and SymPy, the tool provides step-by-step solutions and dynamic visualizations, enhancing user experience for students and educators alike. SmartSolver integrates modules for text-based queries, speech recognition, optical character recognition (OCR), and symbolic math. The solution is built with a React frontend and Flask backend, delivering a user-friendly interface on desktop environments. This paper outlines the architecture, functionality, and practical utility of SmartSolver in modern education.

Key Words: AI calculator, SmartSolver, NLP, OCR, Speech Recognition, SymPy, Flask, React

1. INTRODUCTION

The integration of artificial intelligence (AI) into education and computational tools has revolutionized how students interact with mathematics. SmartSolver is a multifunctional calculator developed to not only solve mathematical expressions but also understand and respond to user input via voice and images. By combining advanced technologies like natural language processing and symbolic computation, SmartSolver is aimed at making math learning more intuitive and interactive.

2. SYSTEM ARCHITECTURE AND IMPLEMENTATION

SmartSolver is built with a modular architecture consisting of:

- Frontend (ReactJS): Provides an interactive user interface that mimics the look of a smartphone calculator with brown and beige themes.
- Backend (Flask): Processes API requests, handles NLP tasks, and returns results.
- Math Engine: Uses SymPy and custom logic for algebraic manipulation, calculus, and equation solving.
- Voice Module: Employs SpeechRecognition and Pyttsx3 for converting spoken queries into text and responding via audio.
- Image Module: Integrates OCR (Tesseract) to extract math expressions from photos and solve them.
- Step-by-Step Solver: Displays detailed breakdown of solution paths, aiding student learning.

3. KEY FEATURES

- Voice Input: Accepts spoken math queries and processes them.
- Image Recognition: Converts handwritten or printed math problems to solvable text.
- Autocomplete and NLP: Interprets incomplete or natural language math inputs.
- Graph Plotting: Visualizes equations and functions using Matplotlib or Plotly.
- Offline Support: Fully functional without internet.
- User-Friendly UI: Mimics mobile calculator aesthetics with a customized color palette.

4. RESULTS AND DISCUSSIONS

SmartSolver was tested on various use cases including algebraic simplifications, calculus operations, and solving real-time spoken and written queries. The application showed over 90% accuracy in OCR-based problem identification and was successful in step-by-step solving of standard academic problems. Voice recognition proved robust in controlled environments.

5. CONCLUSION

SmartSolver demonstrates the capability of AI to enhance traditional calculators by making them more accessible, intuitive, and educational. With further improvements such as multilingual support and extended mathematical domains, SmartSolver can serve as a powerful tool in both academic and personal learning contexts.

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REFERENCES

1. SymPy Development Team. (2024). SymPy: Python library for symbolic mathematics.
2. Python Software Foundation. (2024). Python Language Reference.
3. TensorFlow. (2024). TensorFlow: An end-to-end open-source platform for machine learning.
4. Tesseract OCR. (2024). Optical Character Recognition Engine.