1. Project Title

Intelligent Math Exercise Management Platform

2. Project Summary

The Intelligent Math Exercise Management Platform is an AI-driven platform designed to assist students by providing personalized math exercises. By analyzing the content of student questions, the platform recommends related math concepts and automatically generates exercises tailored to the user's needs. This system helps streamline the learning process by offering both conceptual explanations and practice problems, allowing students to focus on mastering mathematical skills more effectively.

3. Description of the Application

The primary problem this platform solves is the challenge students face in finding relevant math exercises and understanding related concepts. Students often spend too much time manually searching for exercises that match the concepts they are trying to learn. The platform allows users to select math concepts corresponding to their questions. Then use SQL search for a scope of questions, and finally recommend the most suitable exercise in the scope based on AI response. Additionally, the platform supports users in adding new exercises or removing outdated ones, offering comprehensive database management functionality.

4. Creative Component

One innovative aspect of this platform is the use of NLP to understand student inquiries and recommend relevant math concepts in real-time. The system integrates machine learning algorithms that not only generate math problems tailored to the user's needs but also adjust problem difficulty dynamically based on the student's progress. Additionally, the platform offers detailed solutions and step-by-step explanations for each generated exercise, making it more than just a problem generator but also a comprehensive learning tool.

5. Usefulness

The platform is highly useful for students, teachers, and self-learners. Students can input math-related questions and receive instant concept recommendations and practice problems, while teachers can use the platform to generate customized worksheets for their students. Key features include:

- Automatic concept recommendations based on user questions.

- Problem generation according to specified types (e.g., multiple-choice, fill-in-the-blank, problem-solving).

- Step-by-step solutions and explanations for all problems.

- Dynamic difficulty adjustment based on user performance and progress.

- The ability to add new exercises to the platform and remove outdated ones, ensuring that the exercise library remains relevant and useful.

There are similar platforms, such as Photomath and Socratic, but they mostly focus on problem-solving rather than generating custom exercises and explaining concepts. Our platform stands out by offering an integrated system that combines problem generation, concept recommendations, and personalized learning paths.

6. Realness

This project will utilize the following data sources:

- MATH dataset: The dataset contains 12,500 exercises at various difficulty levels and types. Its difficulty ranges from 1 to 5, and includes algebra, counting and probability, geometry, intermediate algebra, number theory, pre-algebra, precalculus.

- Math QA dataset: The dataset contains about 35,000 math multiple choice questions. It not only includes the final answer but also the rationale and final answer formula of the question. The property is suitable for our educational purpose.

Data will be stored in formats like CSV and JSON, and the system will generate problems and feedback in real-time using GPT API.

7. Functionality

A low-fidelity UI mockup

- Question Input Box: Students can enter math questions, and the system will analyze the input to recommend related concepts and exercises.

- Concept Recommendation Section: Displays math concepts relevant to the user’s inquiry along with additional learning resources.

- Exercise Generation Section: Allows users to specify the type of problem they want (multiple-choice, fill-in-the-blank, etc.) and generates appropriate exercises.

- Problem-Solving Section: Students can solve the generated problems and receive immediate feedback with detailed solutions.

- Database Management: Users, especially teachers, can add new exercises to the system through a user-friendly interface, enabling them to tailor the platform to their needs. Additionally, they can remove obsolete exercises, ensuring content stays up-to-date and relevant.

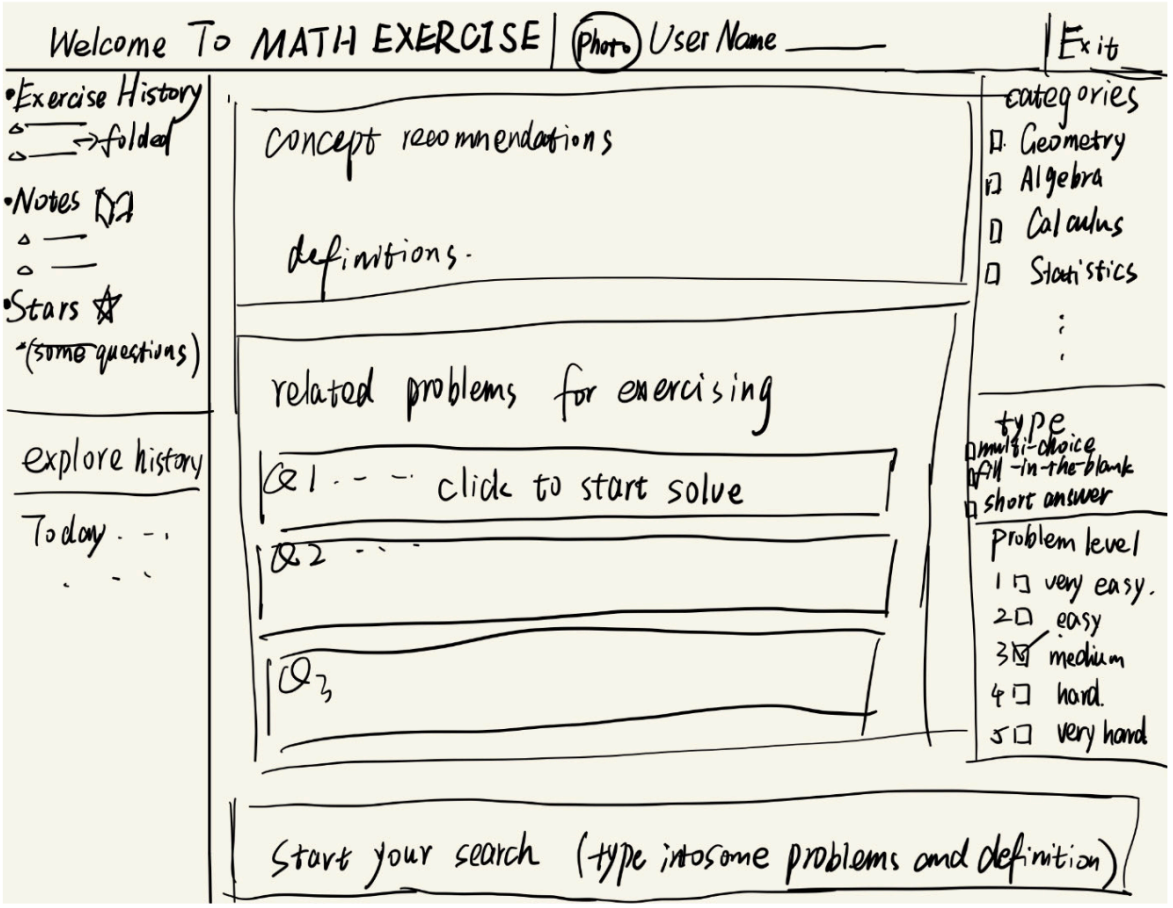

figure 1: UI mockup

Project Work Distribution:
Backend Development:

AI system control: Cheng Wang, Chengyi Wang.
Data Collection and Cleaning: Cheng Wang
SQL filter search: Haojun Li, Ruichao Chen
Frontend-backend interation: Haojun Li, Ruichao Chen

Frontend Design and Development: Cheng Wang, Chengyi Wang.

This Intelligent Math Exercise Management Platform will offer personalized support to students, helping them better understand mathematical concepts and improve their skills through tailored exercises.