AI-Supported Learning Environments for Static Analysis and Cybersecurity

Introduction

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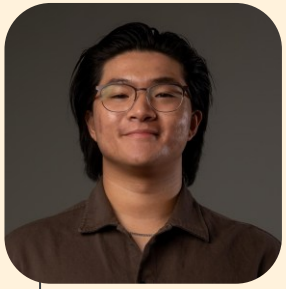

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Our Client

Client: Dr. Lan Zhang, teaches Software Engineering 450 incorporating binary analysis and Capture the Flag challenges.

Current Market:

- Growing gap complex coursework and available guidance
- Incomplete alignment between AI tools and course content
- Declining availability of dedicated instructional support

Problem Statement

Pain Points:

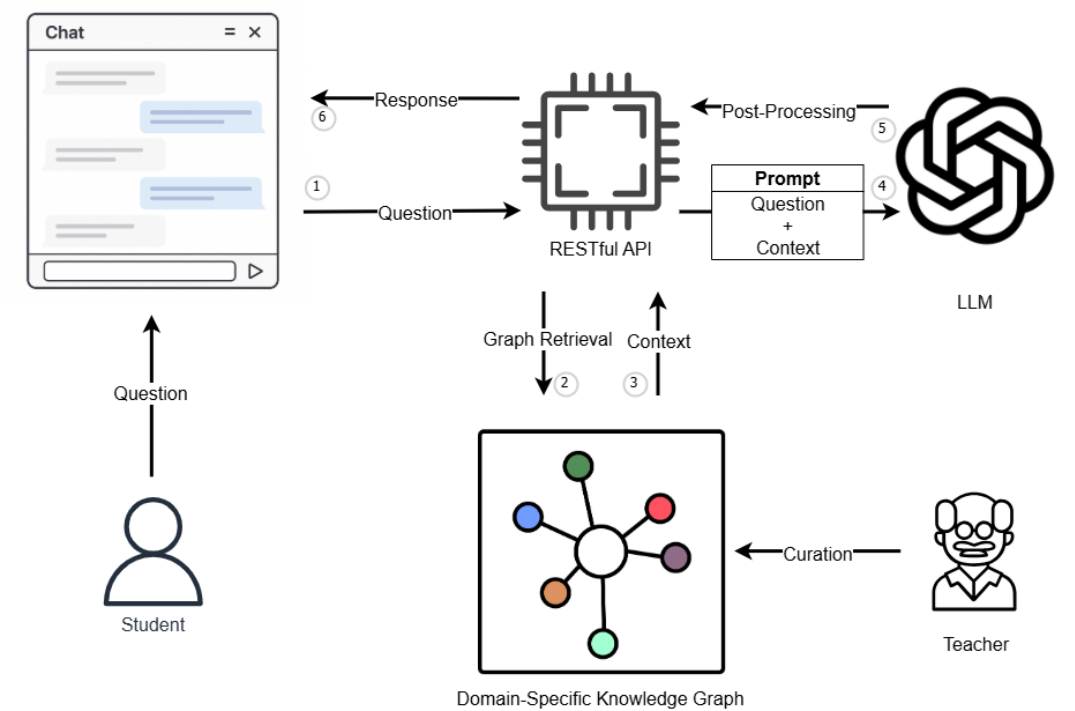
- No centralized repository of concepts, solutions, or explanations taught in class
- Limited guided resource
- Heavy instructor dependency
- Online tools give inaccurate, inconsistent answers

Motivation:

Mastering complex tasks is hard, and inconsistent tools plus limited instructor access slow progress. A structured AI tutoring system can fill this gap with scalable, accurate guidance.

Solution Overview

- An **education-oriented** chatbot which only **operates within** its **provided information**
- **Instructor** curates the domain-specific **concepts** in a **knowledge graph** format
- A **resource** that teachers can encourage **students** to use
- Strategic **prompt engineering** and **Retrieval-Augmented Generation (RAG)** will prevent hallucinations



Key Requirements

Requirements gathered through meetings with client and an analysis of SE450 course workflow and identifying pain points.

Requirements:

- AI-Driven Tutoring Interface
- Knowledge Graph Integration
- Retrieval-Augmented Generation (RAG)
- Instructor Editing
- User Management with Role-based Access
- Context-Aware Responses

Requirement Breakdown

Retrieval-Augmented Generation (RAG):

1. Retrieve relevant documents, code snippets, and challenge descriptions
2. Filter retrieved materials for accuracy
3. Provide retrieved context to the AI model during generation
4. Ground explanations in instructor-curated content

Risks and Feasibility

1

Accuracy & Misinformation

Narrow content to instructor-curated sources

2

Academic Integrity Concerns

Tutor-style responses, promoting reasoning rather than simply giving solutions

3

Technical Complexity

Modular architecture + early prototyping

4

Scalability & Performance

Efficient knowledge graph storage

Schedule

Completed Milestones:

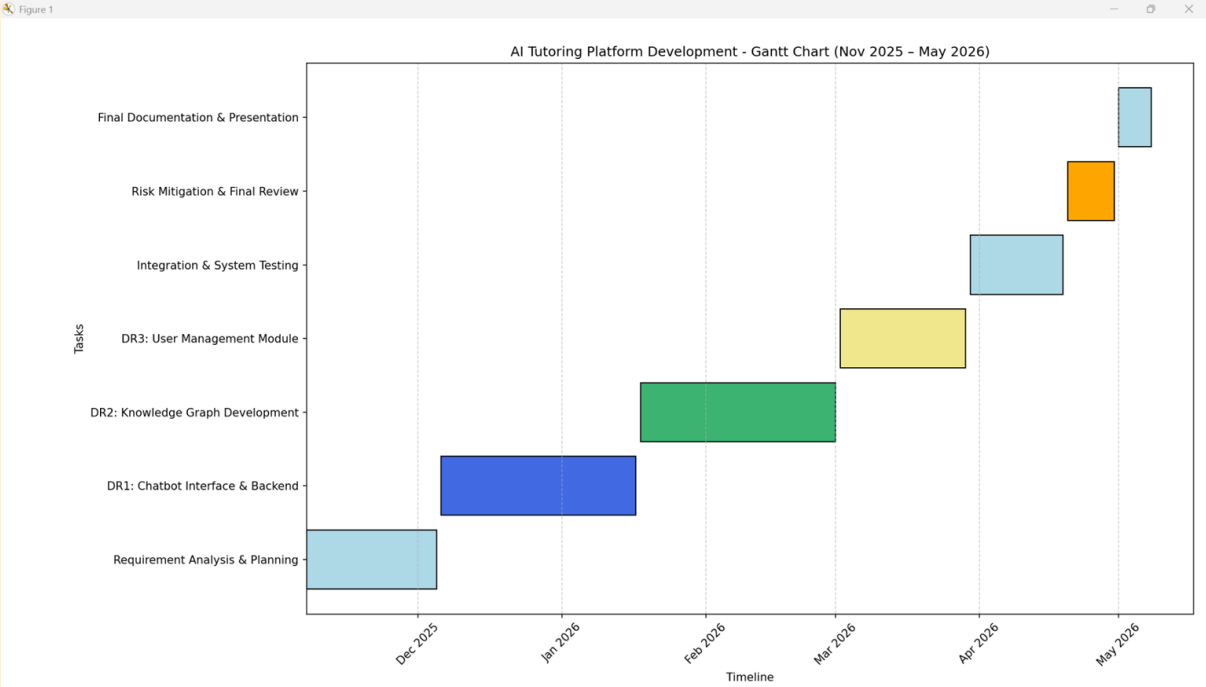
- Gathering client needs, identifying key frameworks/ requirements

In progress:

- Requirements document

Upcoming Tasks:

- Preparing for implementation



Conclusion

- Our solution aims to provide accurate, scalable, grounded and easy-to-use AI tutoring
- Deliver a scalable, intuitive platform that improves student learning and reduces instructor workload
- Long Term Goal: expand beyond SE450 into other courses and broader educational disciplines

Thank You!