

Feasibility Study

EduGenius

7 Jul 2024

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1. Introduction

1.1. Overview of the Project

EduGenius is an interactive math tutoring platform designed to guide O/L students through mathematical problems. The platform offers tutoring sessions, and provides means to track students' progress.

Students can get interactive guidance through mathematical problems. Thus, students not only get guidance but also get a way to measure their mathematical problem solving skills. It would be useful for them to get prepared for the exams.

1.2. Objectives of the Project

The primary objectives of the EduGenius project are to:

- **Design and Implement an Interactive Tutoring Platform:** Develop a web-based application that offers math tutoring for exam questions.
- **Provide Interactive Learning Experiences:** Incorporate features such as getting hints and elaborations about the problem.
- **Automate Tutoring:** Automate providing guidance to approach mathematical questions from exam point of view and performance tracking.

1.3. The Need for the Project

Traditional teaching is considerably less interactive and less flexible. There is a high chance that students might not be interested in learning via static resource materials. Further, students need to prepare themselves for exams.

Students need a platform that helps them understand mathematical concepts deeply rather than just memorizing procedures. Further, They need practice with exam-style questions and the ability to see where they need improvement. Instead of having static resources, engaging with interactive contents and points systems can keep students motivated and interested in solving math problems.

In that way, EduGenius provides an interactive guide through the problems based on exam point of view, a point system to track performance, and explanation of the math concepts. Thus, EduGenius will be a useful product for students to improve their learning experience.

1.4. Overview of Existing Systems and Technologies

1.4.1 Existing systems

Several math tutoring systems partially achieve the goals of the proposed RAG-based system:

- **LLM Intelligent Agent Tutoring in Higher Education Courses using a RAG Approach[9]:** Research focused on teaching Higher Education Courses, but does not evaluate user answers and provide marks accordingly.
- **Mathway :** Mathway solves math problems and offers step-by-step explanations, but it doesn't provide personalized learning paths or adapt to student progress. There's no human interaction or feedback loop.

1.4.2 Existing Technologies

Developing the proposed math tutoring application with a RAG system will involve several technological aspects.

- **Software Development Tools and Libraries:**
 - **Streamlit :** python library for building web applications.
 - **Langchain:**library to create RAG applications.
 - **Langsmith:** library to evaluate RAG applications and LLMs.
 - **Langfuse:** library to handle user feedbacks
 - **Gemini flash:** Computer vision model for OCR
 - **Gemini 1.5 Pro:** LLM tool that is Pay-as-you-go which has 360 RPM,2 million TPM and 10,000 RPD
 - **Wolfram Alpha Show Steps API:** API tool to solve mathematical questions.1000 queries costs \$100
- **Database Systems:**
 - **MongoDB:** NoSQL database to handle user accounts [3].
 - **ChromaDB:** vector database to store data sources[2]

1.5. Scope of the Project

The EduGenius project aims to deliver a whole new level of interactive experiences through its various user roles and their functionalities.

- **Students:**
 - Practice on a set of interactive mathematical quizzes.

- Use the facility to upload handwritten answers or to draw on the provided canvas to answer.
 - Receive hints, step-wise explanations, ways to further improve the provided answer and some similar problems with solutions.
 - Clarify doubts regarding math problems through the chat facility.
- **Administrators:**
 - Oversee platform operations and manage user accounts.
 - Ensure system security and performance.
 - Generate reports and manage platform settings.

1.6. Deliverables

The primary deliverables of the EduGenius project are:

- **A Web-Based Tutoring Platform :** A fully functional online application for interactive learning.
- **User Interfaces:** A user-friendly GUI for students and administrators.
- **Interactive Features:** Quizzes, and performance tracking by providing hints, step-wise explanations, ways to further improve the provided answer and some similar problems with solutions.
- **Administrative Tools:** Features for quiz management, user administration, and system maintenance.
- **Documentation:** Comprehensive set of technical documentation and user guide.

2. Feasibility Study

2.1. Financial Feasibility

The financial feasibility of the EduGenius project involves analyzing potential costs and expected returns. Initial costs include:

- **Development Costs:** Expenses for software development, and for tools.
- **Infrastructure Costs:** Costs for web hosting, domain registration, and server maintenance.
- **Operational Costs:** Ongoing expenses for platform maintenance, updates, and customer support.

Potential revenue sources include:

- **Subscription Fees:** Monthly or annual fees for premium features.
- **Advertising:** Revenue from ads displayed on the platform.

A detailed financial analysis will be conducted to ensure that the expected revenue exceeds the costs, making the project financially feasible.

2.2 Technical Feasibility

The technical feasibility of EduGenius involves evaluating the technologies required for development and their potential for success. The project will use:

- **Web Development Framework:** Streamlit for building a responsive and interactive user interface.
- **LLM Frameworks:** LangChain for creating RAG applications, LangSmith for evaluating RAG applications and LLMs, and LangFuse for handling user feedback.
- **LLM Tools:** Gemini Flash and Gemini 1.5 Pro for enhanced language processing capabilities.
- **API Tools:** Wolfram Alpha Show Steps API to solve mathematical questions step-by-step
- **Database Systems:** MongoDB for storing user details and ChromaDB for storing vector data sources.

These technologies are well-established and widely used in the industry, providing a solid foundation for the development of EduGenius. Thus, EduGenius is technically feasible.

2.3 Resource and Time Feasibility

2.3.1 Software/Hardware Resource Requirements

- **Hardware Resources**
 - Laptop/ Computer that is capable of handling current technologies involved in software development and latest browser versions.
- **Software Resources**
 - VScode editor
 - Python 3.11 or above
 - Database management systems: ChromaDB 0.5 or higher, MongoDB (optional: MongoDB Compass 1.12 or later)

Above software resources are available online. Hardware resources are available at this time period. Thus, this project is feasible with regards to hardware and software resources.

- **Time feasibility**

- **Project start date:** 27/06/2024
- **Expected Duration:** 11 weeks
- **Phases:**
 1. Phase 0 - (week 1, 2): Finalizing scopes of the project
 2. Phase 1 - (week 3): Analyzing feasibility of the project and project scheduling.
 3. Phase 2 - (week 3, 4): Identifying system requirements and design system architecture.
 4. Phase 3 - (week 4, 5, 6, 7, 8, 9, 10) : Implementation of the system.
 5. Phase 4 - (week 11): Evaluation and Tuning.

According to the timeline mentioned above, workload is manageable among development team members. Thus, this project is viable according to time resources.

2.4 Risk Feasibility

Risk feasibility involves identifying potential risks and developing mitigation strategies. Key risks include:

- **Technical Risks:** Issues with integrating new technologies or software bugs.
 - *Mitigation:* Conduct thorough testing and use proven technologies.
- **Financial Risks:** Insufficient funds or unexpected expenses.
 - *Mitigation:* Develop a detailed budget and seek funding sources.
- **Operational Risks:** Challenges in maintaining the platform or managing user expectations.
 - *Mitigation:* Implement robust support systems and regular maintenance schedules.

As identified risks have feasible mitigations, this project can be done. Thus, EduGenius is feasible with respect to possible risks.

2.5 Social/Legal Feasibility

EduGenius will ensure compliance with:

- **Data Privacy Laws:** Adhering to regulations such as General Data Protection Regulation (GDPR) for handling user data.

- **Content Copyright Laws:** Respecting intellectual property rights for educational materials.

As EduGenius complies with above laws and terms, it can be accepted by society and be continued to be used. Thus, EduGenius is socially feasible given that it complies with GDPR.

3. Considerations

Several considerations will guide the development of EduGenius:

- **Accuracy:** Ensuring the accuracy of the tutorings.
- **Performance:** Ensuring the platform operates efficiently under varying loads.
- **Security:** Implementing measures to protect user data and prevent breaches.
- **Usability:** Designing an intuitive interface for users of all ages.
- **Scalability:** Building a system that can grow to accommodate increasing numbers of users and content.


4. References

[1] "Introduction |  LangChain." <https://python.langchain.com/v0.2/docs/introduction/> (accessed Jul. 07, 2024).

[2] "Chroma Docs." <https://docs.trychroma.com/> (accessed Jul. 07, 2024).

[3] "What is MongoDB? - MongoDB Manual v7.0." <https://www.mongodb.com/docs/manual/> (accessed Jul. 08, 2024).

[4] "Gemini API Developer Docs and API reference," *Google for Developers*. <https://ai.google.dev/gemini-api/docs> (accessed Jul. 08, 2024).

[5] "Get started with LangSmith |  LangSmith." <https://docs.smith.langchain.com/> (accessed Jul. 08, 2024).

[6] "Langfuse documentation - langfuse." <https://langfuse.com/docs> (accessed Jul. 08, 2024).

[7] "Get started with Streamlit - Streamlit Docs." <https://docs.streamlit.io/get-started> (accessed Jul. 08, 2024).

[8] "Wolfram|Alpha Show Steps API: Reference & Documentation."
<https://products.wolframalpha.com/show-steps-api/documentation> (accessed Jul. 09, 2024).

[9] Modran, H., Bogdan, I. C., Ursuțiu, D., Samoila, C., and Modran, P. L., "LLM Intelligent Agent Tutoring in Higher Education Courses using a RAG Approach," *Preprints*, 2024. [Online]. Available: <https://doi.org/10.20944/preprints202407.0519.v1> (accessed Jul. 10, 2024).

[10] "Build a Q&A App with Multi-Modal RAG using Gemini Pro | Google Codelabs," *Google Codelabs*. <https://codelabs.developers.google.com/multimodal-rag-gemini#4> (accessed Jul. 10, 2024).