

Study Hub - AI-Powered Study Groups

Project Report

1. Introduction

Study Hub is a real-time collaborative study platform that enables students to join subject-specific study rooms, communicate with peers, and access instant AI-powered academic assistance. The system enhances the learning experience by combining group interaction with intelligent support, making studying more engaging and effective.

2. AI Features Used

- **Google Gemini AI Integration:** Provides intelligent, context-aware responses to student questions.
 - **Subject-Specific Assistance:** Automatically recognizes the subject of each study room (e.g., Mathematics, Science, English) to deliver relevant answers.
 - **Natural Language Processing:** Allows students to ask questions in everyday language using the `/ai [question]` format.
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3. AI Integration Process

The AI functionality was incorporated into the platform through the following steps:

1. **API Access Setup:** A Google AI Studio account was created and an API key obtained.
 2. **Server-Side Implementation:** The Node.js server was configured to process student queries and interact with the Gemini AI API.
 3. **Command System Development:** Special commands (e.g., `/ai What is photosynthesis?`) were introduced for students to request AI assistance.
 4. **Rate Limit Management:** Controls were added to prevent exceeding free-tier API quotas.
 5. **Fallback Mechanisms:** Default responses were created to ensure functionality even when the AI service is unavailable.
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4. Development Process

The development of Study Hub followed these key stages:

1. **Construction of the Chat System** using Socket.io for real-time communication.
 2. **Creation of Subject-Specific Study Rooms** to organize discussions effectively.
 3. **User Management Features** to track participants within each study room.
 4. **Integration of AI Assistance** through API connectivity.
 5. **Testing and Refinement** to ensure accurate and educational AI responses.
 6. **Implementation of File Sharing** to allow exchange of study materials.
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5. Technical Implementation

The AI feature operates through the following workflow:

- When a user types `/ai [question]`, the server identifies it as a special command.
 - The question is forwarded to Google's Gemini AI API.
 - The API generates a detailed educational response.
 - The response is broadcasted back to the study room for all participants.
 - Error-handling mechanisms ensure smooth operation even when the AI service is unavailable.
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6. Challenges and Solutions

- **Challenge:** API rate limits on the free tier.
 - **Solution:** Implemented rate limiting and caching mechanisms.
 - **Challenge:** Ensuring AI responses were educational and explanatory.
 - **Solution:** Applied custom prompts that instructed the AI to provide detailed explanations rather than short answers.
 - **Challenge:** Subject-specific responses for different study rooms.
 - **Solution:** Designed subject-aware response tailoring within the system.
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7. User Guide for AI Features

1. Join any available study room (e.g., Math, Science, English).
2. Type `/ai` followed by the question.
3. **Example:** `/ai Explain the Pythagorean theorem.`
4. The AI assistant generates a detailed response.

5. Both the question and response are visible to all participants in the study room.
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8. Conclusion

The integration of AI into Study Hub demonstrates how collaborative learning platforms can be enhanced with intelligent assistance. By combining peer-to-peer interaction with instant, subject-specific support, the system improves the efficiency and effectiveness of studying.

This project highlights the potential of AI-driven educational tools to provide immediate, personalized guidance while preserving the social and collaborative aspects of group learning.