Supernote: Crowdsource the Best Ideas and Democratize Class Notes

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***Abstract*—This paper presents the development and evaluation of Supernote, a novel application designed to address the common problem of students missing or having incomplete class notes. Recognizing that students often struggle to capture all the information explained by the teacher due to various reasons, such as reading writing disabilities, language barriers, absences, and difficulty in listening and taking notes simultaneously, Supernote offers a unique solution. The Supernote app utilizes a Large Language Model (LLM) architecture to compile incomplete notes from multiple students, compare captured points, and synthesize comprehensive notes that include missing information from the teacher's lesson. The app also assists with test preparation by generating flashcards and practice quizzes based on the compiled notes. Furthermore, Supernote aids non-English speaking students by translating notes into their comfortable language. The Supernote app has demonstrated promising results based on student and teacher feedback and also won awards at the District and State level Science competitions.**

***Index Terms*—AI in Education, Large Language Models, Collaborative Learning, Note-Taking, Test Preparation, Language Translation, Educational Technology, Youth Innovation.**

I. INTRODUCTION

A prevalent challenge students face in educational settings is the inability to capture comprehensive notes during class lectures. This can stem from various factors including learning differences, language barriers, or absences. The consequence is often an incomplete understanding of the subject matter, potentially leading to lower grades on assessments. Traditional classroom settings often lack the resources to provide individualized support for note-taking difficulties. The integration of advanced Artificial Intelligence, specifically Large Language Models (LLMs), presents an opportunity to develop intelligent systems that can enhance learning experiences. Inspired by the potential of AI to address educational challenges, we developed Supernote as a novel approach to improve access to complete and understandable class notes. Supernote aims to leverage the collective knowledge of students in a classroom to create a shared, comprehensive resource. This paper details the design, implementation, and evaluation of Supernote, focusing on its LLM-based architecture and its impact on student learning and potential benefits for teachers.

II. SYSTEM AND METHODOLOGY

The Supernote application is built upon a distributed LLM architecture designed to efficiently process and synthesize student-contributed notes.

A. System Design

The Supernote system provides a platform for students to upload their notes in various formats, including documents, PDFs, or images of handwritten notes. The core process is as follows:

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1. **Note Ingestion and Digitization:** Students upload their notes. Handwritten notes are converted to digital text using an OCR API (e.g., AWS Textract).
2. **Categorization and Labeling:** An LLM is used to categorize and label the uploaded notes by topic and timestamp, facilitating organization by class and subject.
3. **Vector Storage:** The categorized notes are stored in a vector store alongside other students' notes on the same topic.
4. **Comprehensive Note Synthesis:** Upon a student's request for a specific topic, Supernote utilizes LLM functions (e.g., GPT-4o APIs) to combine and compile notes from multiple students into a single comprehensive note.
5. **Test Preparation Material Generation:** Based on the synthesized comprehensive note, Supernote can generate study aids such as summaries, flashcards, and quizlets.
6. **Language Translation:** The LLM incorporates a feature to translate the notes into various languages, assisting non-English speaking students.

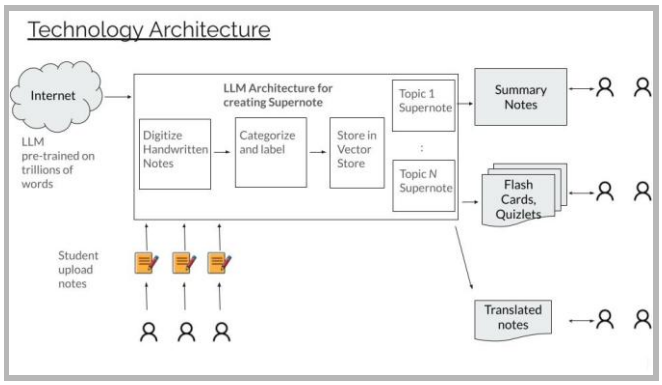

Figure 1Technology Architecture

The architecture supports decentralized note uploads from students. The LLM continuously refines its ability to capture the nuances of the teacher's lesson as more notes are uploaded. Supernote can also support teachers by helping create practice test materials based on the tracked class content.

User interface screenshots are included in the appendix

B. Participants and Procedures

Our research involved testing Supernote with 19 students from an 8th-grade science class focusing on Geology and rock formations. Students uploaded their notes and subsequently used the app for test preparation. Teacher feedback was also collected through surveys to assess the app's utility.

User Safety

To ensure privacy, all student data was anonymized, and no personally identifiable information (PII) was stored. The chatbot includes a moderator to prevent inappropriate language. Data is stored securely on a private server with access limited to the developers, and it will be deleted after the study.

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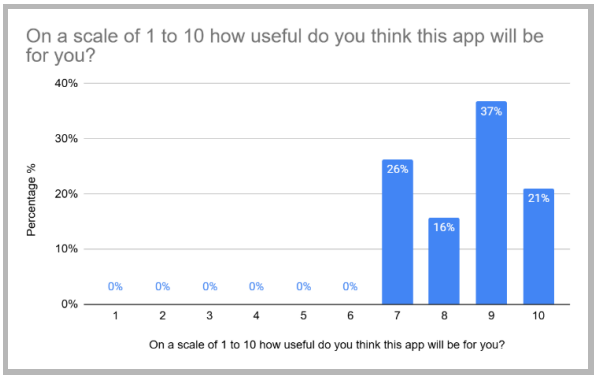
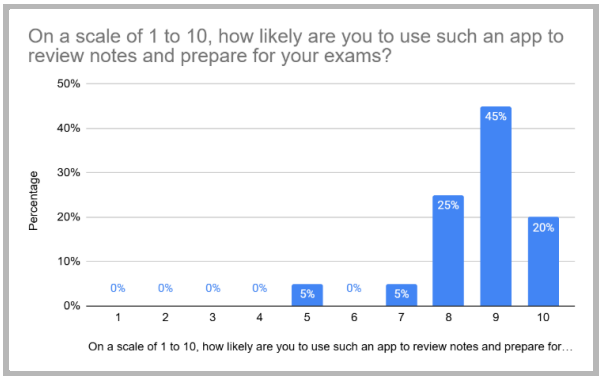
Human Participants Research

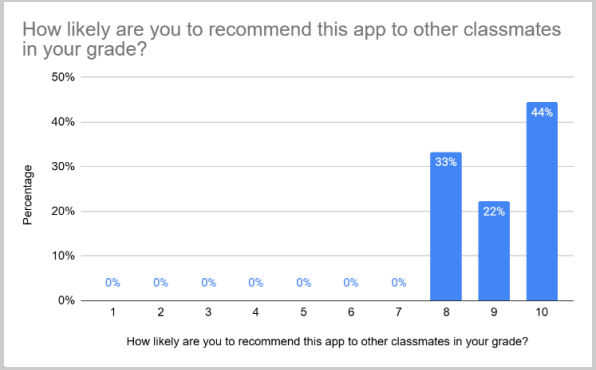
The project involved minor participants (12-14 years old). Participants were recruited by reaching out to classmates and requesting anonymous note uploads. An orientation was conducted to explain the study's purpose, participant activities, the voluntary nature of participation, and the right to withdraw. Parental permission was also taken. The project was deemed to have minimal risk, and data was handled anonymously.

III. RESULTS

Testing with the students demonstrated positive feedback regarding Supernote's usefulness for test preparation and note review. Students tried the app for uploading their class notes and then retrieving it for an upcoming test on Geology and Rock Formations. Student feedback was collected using surveys. Student surveys indicated a strong perception of the app's helpfulness, with a high percentage of students rating it favorably on a 10-point scale. Students also reported a high likelihood of future use for studying.







Teacher feedback was also positive, identifying Supernote as a significant time-saving tool. Verbatim comments from teachers (e.g: "*This app will be very helpful for my students in my class. There is a lot of material to cover in a short span of time and the app will help capture all the comprehensive notes"* and *"I have been a substitute teacher for 20 years. I feel this App will really help my students who may have missed classes as well as help me understand what the teacher had taught in the class.")* highlighted the app's value in providing comprehensive notes and assisting students who had missed classes.

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Supernote's impact has been recognized through winning district and state science competitions and receiving an invitation to a national competition. We are also exploring a pilot program with the School Superintendent's office to pilot this app in the Council Rock School District.

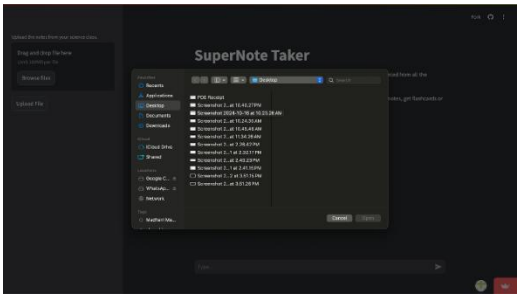
IV. CONCLUSIONS AND FUTURE WORK

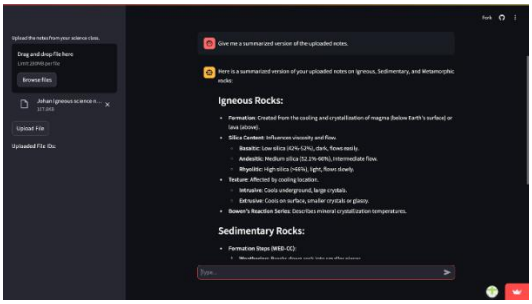
Supernote effectively addresses the existing problem of incomplete class notes through a novel approach leveraging crowdsourcing and LLM technology. The app provides students with access to comprehensive, synthesized notes and personalized test preparation materials, promoting an inclusive learning environment. The translation feature further enhances accessibility for non-English speaking students. By improving note-taking and test preparation efficiency, Supernote has the potential to allow teachers more time for instruction rather than reviewing missed concepts.

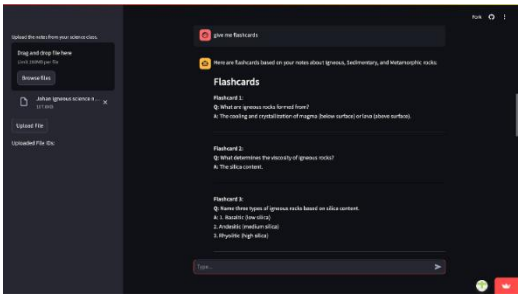
Future work for Supernote includes scaling its implementation across the school district. We could also potentially extend this app to college students and in the corporate setting. Developing a voice-based note creation feature is another planned enhancement. Expanding the app's scope to support preparation for standardized exams nationwide is also a future direction.

Appendix

Supernote App User Screenshots







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