

MindVault — Your AI Study Companion

Upload. Understand. Interact. Evolve.

Front End Development (22CS021)

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ABSTRACT

MindVault is an AI-powered learning assistant designed to enhance students' study experience by converting raw educational materials into structured, actionable insights. The application allows users to upload documents such as PDFs, PowerPoint presentations, and images, which are then processed using AI APIs to generate concise summaries. The frontend, developed with React.js and Tailwind CSS, provides an intuitive and responsive interface that includes secure login/signup, a workspace for managing processed content, and interactive feature cards for summarization, MCQ generation, and mind map visualization. While the frontend is fully implemented, backend development is ongoing to enable dynamic mind map generation, voice note transcription, chat history storage, collaborative study features, AI-driven calendar planning, secure file management, and semantic search capabilities. Overall, MindVault aims to reduce cognitive overload, improve retention, and provide a centralized platform for effective, AI-assisted learning.

Project Report:
MERN Stack Web Application
Project Title:
MindVault — Your AI Study Companion

1. Introduction

1.1 Objective

The objective of **MindVault** is to create an AI-powered study assistant that helps users efficiently manage and learn from their study materials. By leveraging advanced AI, MindVault aims to streamline the learning process by transforming raw notes into valuable insights like summaries and quizzes.

1.2 Technology Stack

- **Frontend:** React.js with TypeScript
 - **Backend:** Node.js with [Express.js](#), Flask (Python)
 - **Database:** Potential for PostgreSQL or MongoDB for future features or Supabase
 - **Deployment:** GitHub CodeSpaces
-

2. Project Description

MindVault is a dynamic web application that provides users with the ability to:

- Upload and securely process notes in various formats (PDF, PPT, images).
 - Generate quizzes and flashcards from uploaded content.
 - Create summaries and mind maps of their study materials.
 - Interact with an AI chatbot that answers questions based on their notes.
 - Organize and save all their processed notes for easy access.
-

3. System Architecture & Design

3.1 High-Level System Architecture

MindVault utilizes a three-tier client-server architecture.

- **Presentation Layer (Frontend):** A React.js application handles all user interactions and the UI.
- **Application Layer (Backend):** A Flask application manages business logic, API requests, file processing, and communication with the AI models.
- **Data Layer (Database):** A database stores user information, file metadata, and processed content.

3.2 Detailed System Design

Frontend:

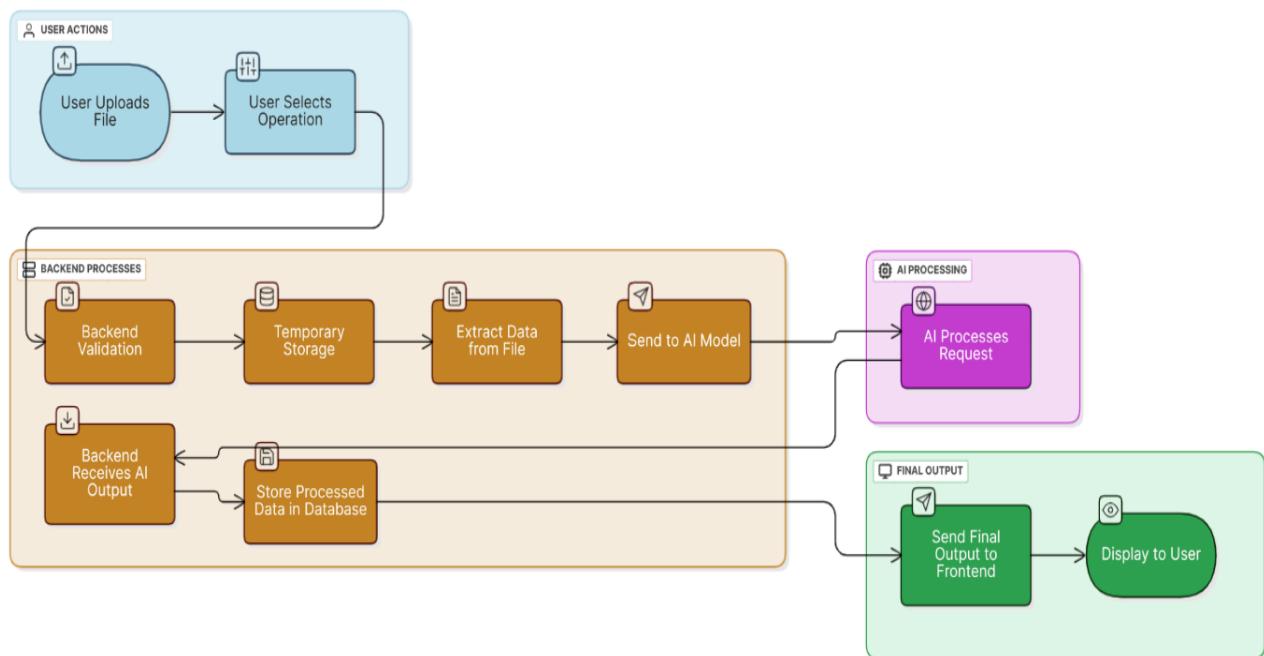
- Built using React.js with TypeScript for a robust and modular user interface.
- Manages the user experience for file uploads, including displaying progress bars or loading states while the backend processes the request.
- Sends asynchronous requests to the Flask backend's API endpoints and renders dynamic content, such as the summary text, mind maps, or quiz questions, based on the data received from the backend.

Backend:

- Powered by Flask (Python), serving as the central hub for all application logic. It exposes secure RESTful API endpoints, such as /api/upload, /api/summarize
- The backend contains the logic to extract text from various file types (PDF, PPT, images). This extracted text is then securely sent to the Gemini API for processing.
- Implements a temporary storage mechanism. A background thread or timed job is responsible for deleting these files to ensure security, privacy, and efficient resource management.

Component	Description
Client (React)	React.js application that handles the UI, user interactions, and sends requests to the backend. (RESTful endpoints)
API Layer (Express)	A Flask backend that manages API endpoints for file processing and orchestrates communication with the AI service. (/api/upload, /api/summarize)
AI Integration	Leverages the Gemini API to generate summaries, quizzes, and other insights from user-uploaded files.
Database (MongoDB)	stores user data, file metadata, and the AI-generated content.

3.3 UML Diagram



4. Database Design

4.1 ER Diagram (Simplified)

Entities:

User: UserID (Primary Key), Name, Email, PasswordHash, CreationDate

File: FileID (Primary Key), UserID (Foreign Key), FileName, FilePath, UploadDate, Status

Summary: SummaryID (Primary Key), FileID (Foreign Key), SummaryText, GenerationDate

Quiz: QuizID (Primary Key), FileID (Foreign Key), QuizData, GenerationDate

The system requires a database to manage users and their files.

- **User:** user_id (PK), username, email, password_hash, created_at.
- **File:** file_id (PK), user_id (FK), filename, file_path, upload_date.
- **Summary:** summary_id (PK), file_id (FK), summary_text, generated_at.
- **Quiz:** quiz_id (PK), file_id (FK), quiz_data, generated_at.

4.2 Relationships

One-to-Many: One User → Many Files

- userId in the **File** entity is a foreign key referencing the UserID of the **User** entity.

One-to-Many: One File → Many Summaries

- FileID in the **Summary** entity is a foreign key referencing the FileID of the **File** entity.

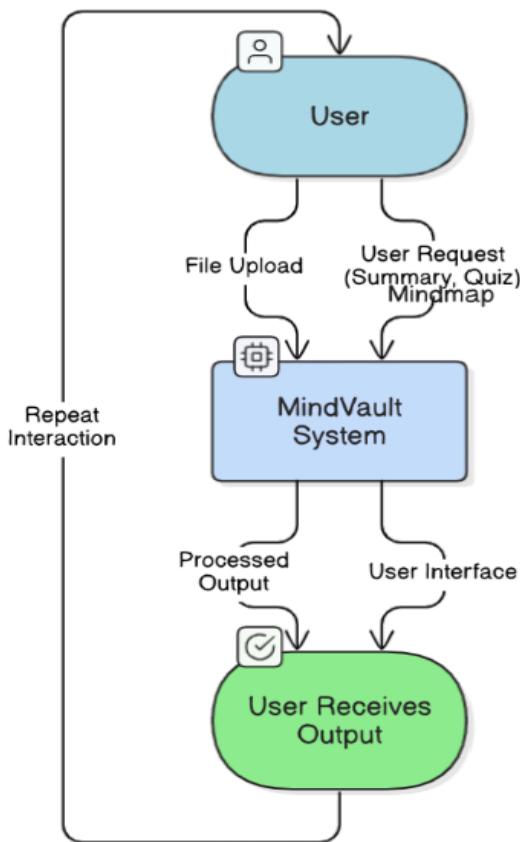
One-to-Many: One File → Many Quizzes

- FileID in the **Quiz** entity is a foreign key referencing the FileID of the **File** entity.
-

5. Data Flow Diagrams (DFD)

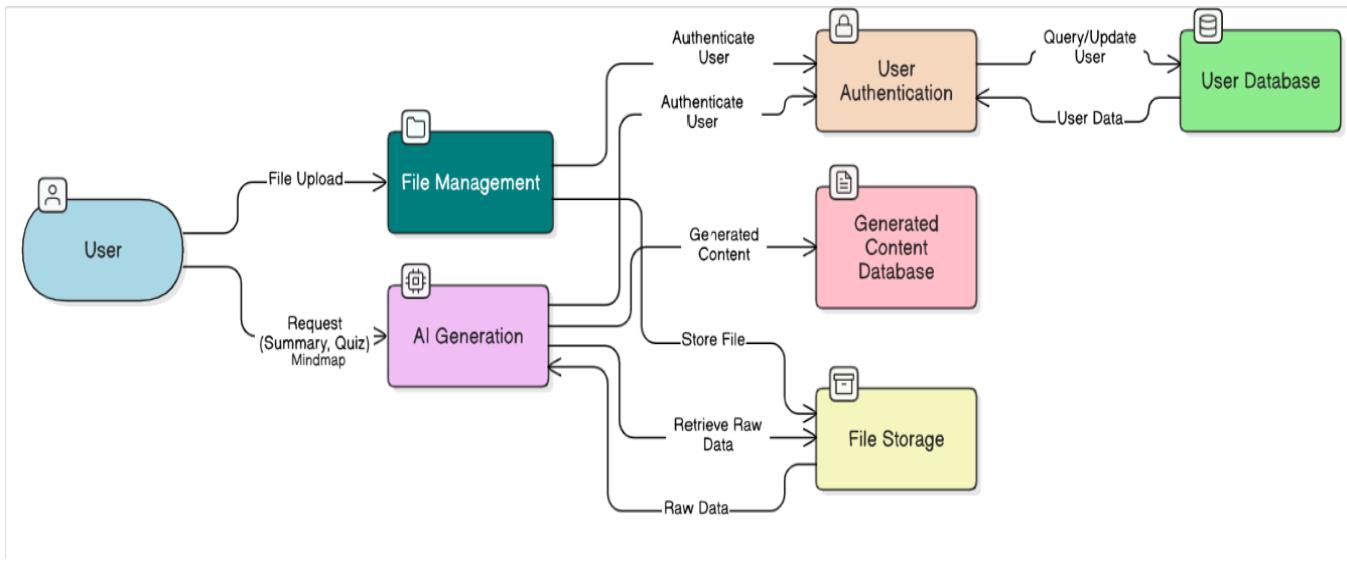
5.1 Level 0 DFD (Context Level)

- User → File Upload, User Request (Summary, Quiz) → **MindVault System** → Processed Output, User Interface



5.2 Level 1 DFD

- User → File Upload → **File Management** → Store File → **Temporary File Storage**
- User → User Request (Summary, Quiz, Mindmap) → **AI Generation** → Retrieve Data → Fetch API → **File Storage**
- **AI Generation** → Generated Content (using API) → **Generated Content Database**
- **File Management** and **AI Generation** also feed into **User Authentication** to ensure secure access.



6. Features Implemented

- File Uploads**

The system supports uploading multiple file types, including PDFs, PowerPoint slides, and images. This ensures students can use their existing notes without extra formatting. Uploaded files become the foundation for AI-powered summarization, quizzes, and mind maps.

- Summarization**

With the Gemini API, the app generates concise summaries from uploaded files. Instead of reading lengthy notes, users can quickly understand key points. This feature is especially useful for revision and exam preparation.

- User Interface:** Built with React.js and Tailwind CSS, the frontend is responsive and student-friendly:

- i. Login/Signup for secure access.
- ii. Summarize Page for direct file uploads and summaries.
- iii. Workspace (Get Started Page) with feature cards: Summarization, MCQ Generation, Mind Maps, and Save Notes.
- iv. Explore Section to showcase features visually.

- Generate MCQs (Planned)**

Users will be able to convert uploaded notes into auto-generated quizzes. These quizzes act as flashcards and help with active recall, reinforcing important topics during study sessions.

- Mind Maps (Planned)**

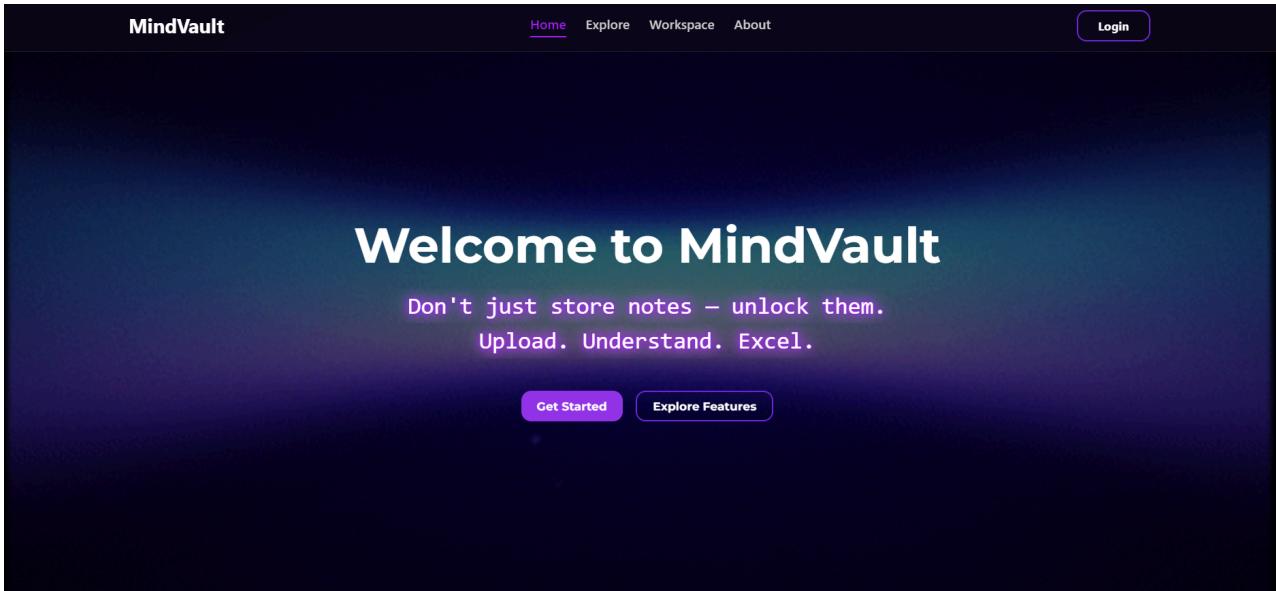
The system will generate interactive mind maps from notes. By visualizing content, students can better grasp relationships between concepts and improve long-term retention.

- Save Notes & Workspace**

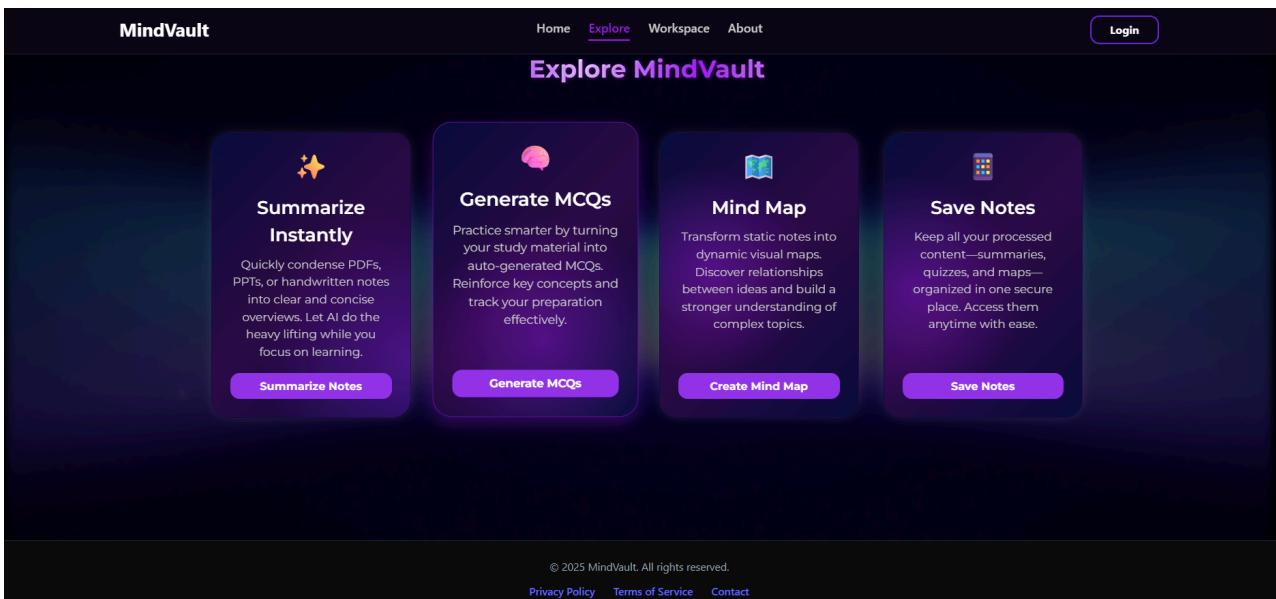
All processed outputs—summaries, quizzes, and maps—can be saved in MyVault. Users can organize them with labels, view history, recover from trash, and plan revisions. This turns the app into a personal knowledge management tool.

7. Screenshots

Home/Landing page :



Explore section :



About page :

MindVault

Home Explore Workspace About [Login](#)

Our Mission & Vision

At MindVault, our mission is to transform the way students learn by turning scattered resources into clear, connected, and interactive knowledge.

We aim to remove the stress of managing information, so learners can focus on what truly matters—understanding and applying it.

We envision a world where AI becomes every student's personal learning companion—making education more accessible, engaging, and effective.

How It Works

AI-Powered Transformation

MindVault leverages the Gemini API to turn your passive notes into dynamic learning tools.

- **AI-driven summarization**for quick review of large documents.
- **Automated quiz generation**to test your knowledge retention.



Transforming your study habits with intelligence and efficiency.

MindVault

Home Explore Workspace About [Login](#)

- **Automated quiz generation**to test your knowledge retention.
- **Mind map creation**to help visualize complex topics.



Engage with your notes through intelligent, conversational AI.

Transforming your study habits with intelligence and efficiency.

Seamless Interaction

Interact with your documents like never before. MindVault supports various file types and smart tools.

- **Interactive AI Chat** for instant answers.
- Transcribe **lectures & images** into text.
- **Chat History** saved for easy revisit.

MindVault

Home Explore Workspace About [Login](#)

Built for Collaboration

MindVault is designed for teamwork and intelligent planning to help you succeed.

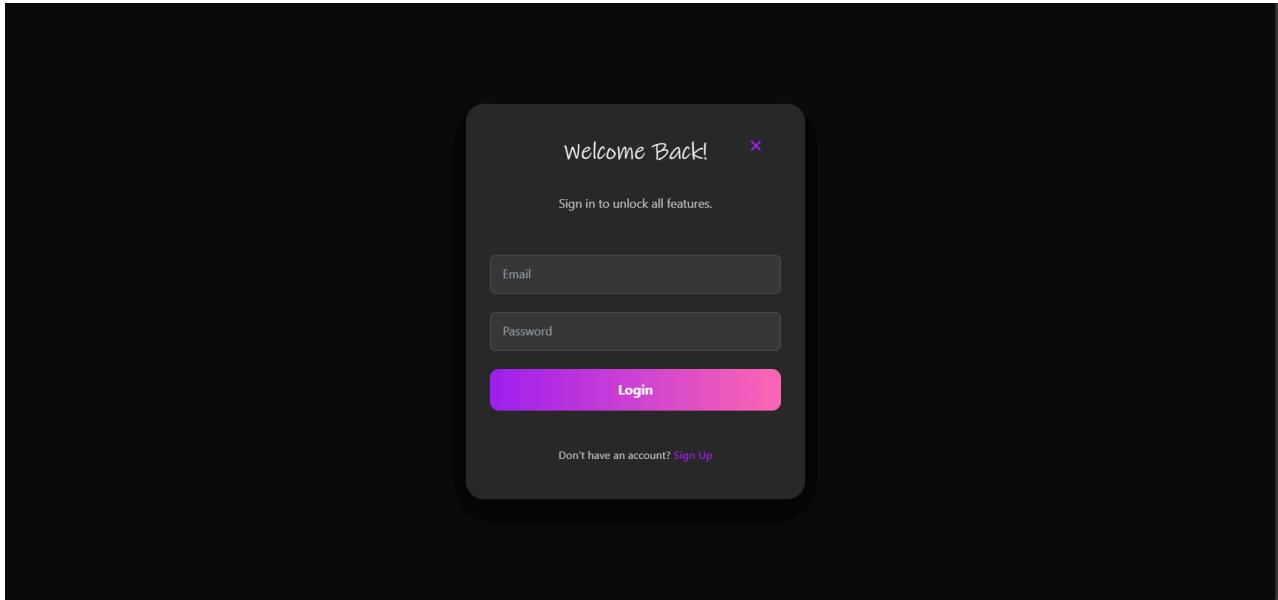
- Collaborate on notes & summaries in real-time.
- **AI-Powered Calendar** for optimized study schedules.
- A strong foundation for **academic success**.



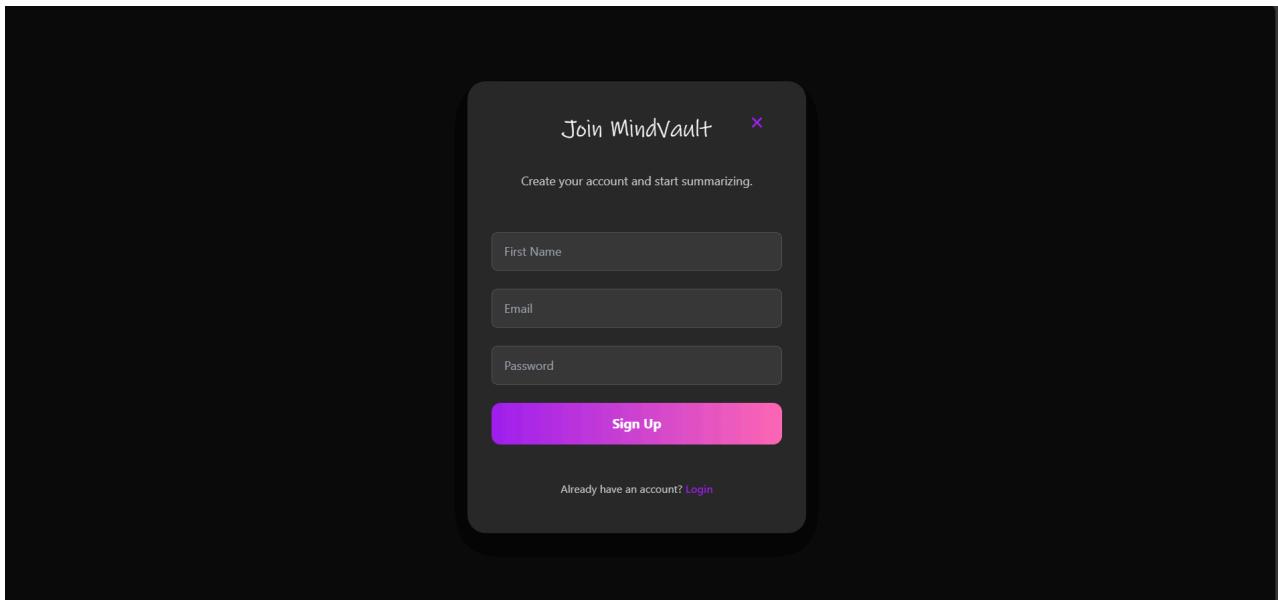
Learn together and plan your future with smart, shared tools.

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Login page :



Signup page :



Dashboard :

The screenshot shows the MindVault dashboard with a dark theme. On the left, a sidebar titled "Library" contains links for Dashboard, MyVault, Planner, VaultAI, History, and Trash. The main area features a "Welcome, User!" message and a "Create" section with four cards:

- Summarize Instantly**: Upload notes in PDF, PPT, or image formats for AI-powered summaries.
- Generate MCQs**: Turn study material into personalized multiple-choice questions.
- Mind Map**: Visualize notes as interactive mind maps.
- Save Notes**: Store processed notes, summaries, and quizzes in a secure vault.

A "Logout" button is in the top right corner, and a "My Account" link is at the bottom left.

Chatbot :

The screenshot shows a "Smart Chat" interface with a dark background. It features a message from the bot: "Hi there! Ask me anything about your studies." Below is a text input field with placeholder "Ask a question..." and a send button.

Summarize notes / Generate MCQs / Create mindmap :

MindVault

Home Explore Workspace About

Logout

Supported File Types

PDF PowerPoint Image Text

AI PDF Tools
Upload any PDF file and MindVault will instantly help you study smarter.

Drag & drop a PDF file to upload

Select Files



MindVault

Home Explore Workspace About

Logout

Supported File Types

PDF PowerPoint Image Text

AI PDF Tools
Upload any PDF file and MindVault will instantly help you study smarter.

Ready: cn st1.pdf

Summary MindMap Generate MCQs

MyVault (save notes) :

The screenshot shows the MindVault workspace interface. At the top, there's a navigation bar with links for Home, Explore, Workspace (which is underlined to indicate it's the active page), and About. On the far right of the nav bar is a Logout button. Below the nav bar is a search bar with the placeholder "Search for anything in your vault...". To the left of the search bar is a sidebar titled "Library" containing links for Dashboard, MyVault (which is highlighted in purple), Planner, VaultAI, History, and Trash. The main content area is titled "Files" and features a "Type" dropdown set to "PPT". It includes a "Select Multiple" button and a "+" button. In the center, there are three circular icons representing document, folder, and AI chat. Below these icons is a message: "Your Vault is empty! Upload files and boost learning with interactive study modes, practice quizzes and AI chat conversations." A prominent "Upload Files" button is located below the message. At the bottom left is a "My Account" button, and at the bottom right is a purple circular profile icon.

This screenshot shows the same MindVault workspace after files have been uploaded. The "Files" section now displays three items: "Aptified COMPLETE E-BOOK.pdf", "employability- kyc.pptx", and "History". Each item has a three-dot menu icon and a "Move to Trash" button. The rest of the interface remains consistent with the first screenshot, including the sidebar, search bar, and bottom buttons.

MindVault

Home Explore Workspace About Logout

Library

Search for anything in your vault...

Dashboard MyVault Planner VaultAI History Trash

My Account

Files

PPT

Aptified COMPLETE E-BOOK.pdf

employability- kyc.pptx

Select Multiple +

⋮ ⋮

This screenshot shows the 'Workspace' section of the MindVault application. The left sidebar includes links for Dashboard, MyVault (which is currently selected), Planner, VaultAI, History, and Trash. The main area is titled 'Files' and contains two items: 'Aptified COMPLETE E-BOOK.pdf' and 'employability- kyc.pptx'. The 'employability- kyc.pptx' file is highlighted with a blue border, indicating it is selected. A 'Select Multiple' button and a '+' button are located at the top right of the file list. A search bar at the top allows users to search for files in their vault.

← Back

employability- kyc.pptx

Name this chat Save

Library

Dashboard MyVault Planner VaultAI History Trash

Ask anything about this file...

Summarize Get MCQs Generate Quiz

Ask anything about employability- kyc.pptx

T

This screenshot shows a detailed view of the 'employability- kyc.pptx' file from the previous workspace. The top navigation bar includes a back button, the file name, and 'Name this chat' and 'Save' buttons. The left sidebar remains the same. The main area features a large text input field with the placeholder 'Ask anything about this file...'. Below this are three buttons: 'Summarize', 'Get MCQs', and 'Generate Quiz'. At the bottom is another text input field with the placeholder 'Ask anything about employability- kyc.pptx' and a send button with a 'T' icon.

Planner :

The screenshot shows the MindVault AI Planner interface. On the left, a sidebar menu includes Library, Dashboard, MyVault, Planner (which is selected and highlighted in purple), VaultAI, History, and Trash. Below the sidebar is a "My Account" button. The main area features a "Your AI Planner" header with the tagline "A goal without a plan is just a wish." A "Calendar" section displays a weekly view for Thursday, September 11, 2025, with fields for adding reminders and deadlines. To the right, a "Create a Study Plan" form allows users to input goals, key subjects, and time frames, with a "Generate Plan" button.

This screenshot shows the same MindVault AI Planner interface as the previous one, but the calendar view has been switched to a monthly view for September 2025. The "Plan for" date is now set to September 11, 2025. The rest of the interface, including the study plan creation form, remains identical to the first screenshot.

VaultAI :

The screenshot shows the MindVault application interface. At the top, there is a navigation bar with links for Home, Explore, Workspace (which is underlined in purple), and About. On the far right of the navigation bar is a Logout button. Below the navigation bar is a sidebar titled "Library" containing icons for Dashboard, MyVault, Planner, VaultAI (which is highlighted with a purple background), History, and Trash. To the right of the sidebar is the main content area. The main content area has a dark blue gradient background. At the top of this area is a section titled "VaultAI" with the sub-instruction "Use natural language to interact with your uploaded files." Below this is a large input field containing the placeholder text "e.g., Summarize my DBMS notes (dbms.pdf)". To the right of this input field is a purple send button with a white arrow icon. In the bottom right corner of the main content area is a purple circular button with a white speech bubble icon.

Chat history :

The screenshot shows the MindVault application interface. At the top, there is a navigation bar with links for Home, Explore, Workspace (underlined in purple), and About. On the far right of the navigation bar is a Logout button. Below the navigation bar is a sidebar titled "Library" containing icons for Dashboard, MyVault, Planner, VaultAI, History (which is highlighted with a purple background), and Trash. To the right of the sidebar is the main content area. The main content area has a dark blue gradient background. In the center of the main content area is a large white speech bubble icon. Below the speech bubble is the text "No history yet". Underneath this text is the instruction "Start a conversation with the AI Bot to see it here." In the bottom right corner of the main content area is a purple circular button with a white speech bubble icon. In the bottom left corner of the main content area is a "Clear History" button.

Trash :

The screenshot shows the MindVault application interface. At the top, there is a navigation bar with links for Home, Explore, Workspace (which is underlined to indicate it's the active page), and About. On the far right of the navigation bar is a Logout button. Below the navigation bar is a dark sidebar on the left labeled "Library". The sidebar contains icons for Dashboard, MyVault, Planner, VaultAI, History, and Trash. The "Trash" item is highlighted with a purple background. To the right of the sidebar, the main content area has a title "Files in Trash" at the top. Below the title, there is a card-like box containing a small thumbnail of a presentation slide with the text "employability- kyc.pptx (PPT)". To the right of the card are two small buttons: one with a trash can icon and another with a refresh/circular arrow icon. In the bottom right corner of the main content area, there is a purple circular icon with a white speech bubble symbol.

This screenshot shows the same MindVault interface as the previous one, but the Trash folder is currently empty. The main content area displays a large trash can icon in the center. Below the icon, the text "Trash is empty" is written in bold capital letters. Underneath this text, a smaller message reads: "When you remove files from your Vault, they'll appear here." The rest of the interface, including the sidebar and navigation bar, remains the same as in the first screenshot.

8. Challenges Faced

Challenge	Solution
Temporary File Storage	Implemented a timed file deletion script on the backend to automatically remove files after a set duration, ensuring data security and preventing resource overload.
API Data Fetching & Integration	Integrated robust error handling and managed API latency with loading indicators. We also developed a data parsing logic to format the raw AI output for the frontend.
Login/Signup Errors & Validation	Invalid emails, weak passwords, or duplicate accounts caused frequent user complaints. Added frontend form validation and backend validation to ensure robust input handling.

9. Pending Tasks

- **Smart Chart Generation:** The backend will be extended to automatically analyze uploaded content and generate smart visual charts. These charts will allow students to quickly grasp trends, comparisons, or topic structures without manually creating diagrams.
 - **AI-Powered Planner:** An intelligent study planner will be integrated, where the backend algorithms analyze user notes, deadlines, and learning patterns to suggest personalized study schedules. It can also adapt dynamically as the student progresses.
 - **Chat & Activity History:** A backend-driven history feature will ensure all AI interactions, summaries, quizzes, and uploaded files are securely stored. This will allow students to revisit previous study sessions and track their learning journey over time.
 - **Advanced Summarization:** The summarization engine will be enhanced at the backend to handle not just text-heavy PDFs but also PPTs, scanned documents, and images. The system will provide more context-aware summaries, highlighting the most relevant information.
 - **MCQ & Quiz Generation:** The backend will be developed to create dynamic quizzes from user content, with adjustable difficulty levels. It can also generate flashcards for quick revision, making practice more interactive and personalized.
 - **Mind Map Visualization:** Backend pipelines will be built to extract key concepts, relationships, and hierarchies from uploaded material. These will be rendered as interactive mind maps on the frontend, allowing users to expand, collapse, or customize nodes.
 - **Secure File Management:** Enhance backend to handle encrypted file uploads, secure storage, and safe retrieval.
-

10. Conclusion

The frontend development of *MindVault* demonstrates how an AI-powered learning assistant can be transformed into an intuitive and user-friendly platform. The project successfully integrates core functionalities such as file uploads, AI-driven summarization, and a structured user interface, ensuring that students can interact with their study materials more effectively. By using React.js for building a dynamic and responsive UI, coupled with Tailwind CSS for styling, the system ensures accessibility across different devices while maintaining a modern design.

The use of the Gemini API for summarization highlights the practical application of AI in real-world educational contexts, converting static notes and documents into concise, meaningful insights. Features like secure login and signup enhance usability by offering personalized access to resources, while the modular structure ensures that future enhancements—such as MCQ generation, semantic search, personalized dashboards, and mind maps—can be easily integrated.

Overall, this implementation provides a solid foundation for an extensible learning platform. It not only demonstrates technical proficiency in frontend design and API integration but also reflects a strong alignment with the project's larger vision: reducing cognitive overload, improving learning efficiency, and empowering students with smart, AI-powered study tools.

11. Appendix

- **GitHub Repo:** <https://github.com/vijvaidehi20/MindVault-fed>
-