Study Buddy

# MINI PROJECT REPORT

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# ABSTRACT

# Study Buddy is a web application built to help students revise smarter by turning their study materials into interactive quizzes and flashcards. The goal is to make studying more efficient and engaging by automating the process of question generation and organizing notes in a better way.

# The app lets users upload files like PDFs, PowerPoints, or text documents. Once uploaded, it processes the content and generates different types of questions—multiple-choice, fill-in-the-blank, true/false, or open-ended—based on the user’s preferences. Users can also choose the difficulty level and number of questions they want.

# A key feature of Study Buddy is the flashcard system. Users can either create their own flashcards or convert generated questions into flashcards. These can be grouped by topics, saved to the cloud using Firebase Firestore, and reviewed interactively with a flip animation. Users can mark cards as “known” or “unknown” to track their progress.

# The app also includes basic analytics—like how many questions were generated, accuracy in quizzes, and usage stats. The UI is clean and easy to navigate, with a left sidebar for navigation and a main panel for uploading files, selecting preferences, and viewing results.

# On the technical side, we used React for the frontend, Flask for the backend API, and Firebase for authentication, data storage, and media handling. The app structure is simple but powerful—frontend sends files to the backend, backend processes and saves results to Firebase, and the frontend fetches and displays data accordingly.

# In short, Study Buddy helps students turn messy notes into structured questions and flashcards, making revision easier and a lot more effective.

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# CHAPTER 1 INTRODUCTION

## Overview

Studying effectively requires organization, active recall, and consistent revision. However, students often face challenges when dealing with large amounts of study material, making it difficult to structure their learning efficiently. Traditional methods—such as manually creating questions or summarizing notes—are time-consuming and can lead to ineffective revision. **Study Buddy** is a web-based application designed to simplify this process by automatically generating quizzes and flashcards from uploaded study materials. By allowing users to upload PDFs, PowerPoints, and text documents, the platform extracts key information and converts it into various question formats, including multiple-choice, fill-in-the-blank, true/false, and open-ended questions. Users can also transform these questions into flashcards for efficient revision. The application features a user-friendly interface where students can customize their study sessions, track their progress, and review their learning history. With Firebase handling authentication and storage, and a backend powered by Flask, Study Buddy ensures seamless data management and accessibility. The goal is to enhance learning efficiency, improve retention, and make studying more engaging by integrating automation with smart revision techniques.

## Problem Statement

Students often struggle with organizing and revising large amounts of study material efficiently, especially when preparing for exams. Manually creating questions or flashcards from notes is time-consuming and often inconsistent. There is a lack of tools that can automatically convert study resources into structured, testable formats while also tracking progress and adapting to user preferences. Most existing educational tools focus either on static content delivery or require users to manually input data to create quizzes or flashcards. This not only consumes valuable study time but also fails to keep students engaged. Additionally, there is a lack of personalization and performance feedback in many learning platforms, making it difficult for students to monitor their improvement. **Study Buddy** aims to solve these issues by providing a platform that automatically generates questions and flashcards from uploaded materials, allowing users to interactively learn, test themselves, and track their progress—all in one place.

## Objective

The **Study Buddy** project aims to:

* **Automate Question Generation** – Convert study materials (PDFs, PowerPoints, text) into structured quiz questions to make revision easier.
* **Enable Interactive Flashcards** – Allow users to create and review flashcards for better retention and active recall.
* **Track User Progress** – Provide insights on study performance through analytics, helping students improve their learning strategies.

## Motivation

## The main motivation behind Study Buddy is to help students quickly absorb and retain large amounts of information before exams in a more efficient way. Traditional last-minute revision methods, such as rereading notes or passive studying, are often ineffective. Research has shown that active recall and spaced repetition, particularly through flashcards and quizzes, significantly improve understanding and memory retention. Study Buddy streamlines this process by automatically converting study materials into structured quizzes and flashcards. This allows students to focus on active learning rather than wasting time manually creating study aids. By making last-minute cramming faster, smarter, and more effective, the project aims to enhance exam preparation and overall learning outcomes.

# CHAPTER 2 BACKGROUND

## Active recall and flashcards

**Active recall** is a scientifically proven learning technique where students test their memory by retrieving information rather than passively reviewing it. Flashcards are commonly used for this purpose, as they allow repeated exposure to key concepts, reinforcing learning through **spaced repetition**. Study Buddy integrates these techniques by automatically generating quizzes and flashcards from study materials, helping students retain information more effectively.

## Question generation techniques

The process of converting study material into quiz questions involves **Natural Language Processing (NLP)** techniques to extract key concepts and generate different question formats. While simple rules can be used for basic extractions, more advanced methods involve **text summarization, keyword extraction, and named entity recognition (NER)** to create structured questions from unstructured content.

## Frontend and Backend Technologies

Study Buddy is built using a **React** frontend and a **Flask** backend.

* **React**: A JavaScript library for building fast and interactive web interfaces, used to create Study Buddy’s clean and user-friendly UI.
* **Flask**: A lightweight Python-based web framework that handles backend logic, including file processing and question generation.

## File processing and text extraction

Uploaded study materials (PDFs, PowerPoints, text documents) must be processed to extract meaningful text before generating questions. **PDF parsing libraries** (such as PyPDF2) and **PowerPoint text extraction** methods are used to retrieve content, which is then structured for quiz generation.

## User Interaction and Experience

The platform is designed with a **simple and intuitive UI**, ensuring that students can quickly upload files, generate quizzes, and track their progress. A **dashboard** provides real-time analytics on study performance, allowing users to adjust their learning strategies based on their accuracy and retention rates.

# CHAPTER 3 METHODOLOGY

This chapter outlines the step-by-step process involved in the **Study Buddy** system, detailing how study materials are processed, questions are generated, and user interactions are managed. It describes the **system workflow**, from file upload and text extraction to quiz generation and performance tracking. The methodology also covers the **technologies used**, including **NLP for question creation, Firebase for data storage, and Flask for backend processing**. Additionally, the chapter provides a **detailed user flow**, explaining how students engage with the platform to generate flashcards, take quizzes, and track their learning progress. By automating study material conversion into interactive learning tools, **Study Buddy** enhances the efficiency of last-minute revision and active recall-based learning.

## System Workflow

The workflow of **Study Buddy** consists of five main phases:

1. **User Uploads Study Material**
   * Users upload files such as **PDFs, PowerPoint presentations, or text documents**.
   * The file is sent to the **Flask backend** for processing.
2. **Text Extraction and Preprocessing**
   * The backend extracts text from the uploaded file using **PDF parsing and PowerPoint text extraction libraries**.
   * Unnecessary data (headers, footers, special characters) is cleaned, and **important keywords and concepts** are identified.
3. **Question and Flashcard Generation**
   * Using **Natural Language Processing (NLP)** techniques, the extracted content is analyzed to generate different types of questions:
     + **Multiple-choice questions (MCQs)**
     + **Fill-in-the-blank**
     + **True/False**
     + **Short-answer questions**
   * The user can **customize** the number and type of questions.
   * Users can also **convert questions into flashcards** for later review.
4. **Storage and User Progress Tracking**
   * The generated questions and flashcards are stored in **Firebase Firestore** under the user’s account.
   * The system records user interactions, such as **quiz attempts, accuracy rates, and flashcard reviews**, to track learning progress.
5. **User Interaction and Review**
   * Users can take quizzes, mark answers, and view results.
   * The system provides a **dashboard with study analytics**, showing quiz performance and progress over time.
   * Flashcards can be revisited anytime, with an option to mark them as **"known" or "unknown"** to prioritize difficult concepts.

### Technology stack

 **Frontend:** **React.js** for building the user interface.

 **Backend:** **Flask** for handling API requests and processing text.

 **Database & Storage:** **Firebase Firestore** for saving user data and **Firebase Authentication** for login management.

 **File Handling:** Python libraries such as **PyPDF2, and python-pptx** for extracting text from study materials.

 **NLP for Question Generation:** Techniques like **Named Entity Recognition (NER), text summarization, and keyword extraction** to identify key concepts for question creation.

### User flow

* User logs in using Firebase Authentication.
* Uploads a file (PDF, PowerPoint, or text).
* The backend extracts and processes text.
* Study Buddy generates quiz questions and flashcards.
* User customizes and interacts with quizzes/flashcards.
* Progress is saved and tracked on a dashboard.
* User reviews flashcards and takes more quizzes as needed.

## Performance tracking and dashboard updates

Study Buddy continuously tracks the user's progress and updates the dashboard to provide insights into their study habits and performance. After each quiz attempt, the system records **quiz scores, accuracy rates, and response patterns** to identify strengths and weak areas. Flashcard interactions are also monitored, allowing users to mark concepts as **"Known" or "Needs Review"** for spaced repetition learning. The dashboard presents **visual analytics**, including accuracy trends, past study sessions, and mastery levels for different subjects. This real-time feedback helps students refine their revision strategy, ensuring **efficient learning and improved retention** before exams.

# CHAPTER 4 RESULTS AND ANALYSIS

## Platform Feature Evaluation

This section evaluates the core functionalities of the Study Buddy application — file upload, question generation, flashcard creation, and quiz performance tracking. Each feature was tested on multiple document formats (PDFs, text files) to ensure smooth performance and reliable results. The system was assessed based on:

* **Accuracy and relevance** of generated questions
* **Speed and stability** of flashcard creation
* **Smooth user interaction** throughout the process
* **Consistency in data storage and retrieval** via Firebase

**Fig 1. Dashboard**

A screenshot of a computer

AI-generated content may be incorrect.

**Fig 2. Flashcards generated**  
A screenshot of a computer

AI-generated content may be incorrect.

## Effectiveness of AI based content creation

Study Buddy leverages natural language processing (NLP) to automatically convert raw study material into revision tools. The AI extracts key concepts using Named Entity Recognition and text chunking, then formulates:

* **Multiple-choice questions (MCQs)**
* **True/False questions**
* **Fill-in-the-blank items**
* **Short answer questions**

This AI-based system reduces manual effort and increases study efficiency. Compared to traditional note-making or passive reading, this approach helps users **retain information faster using active recall**.

**Fig 3. Quiz interface**



## Impact of Flashcards and Recall Testing in Learning Efficiency

The use of flashcards and regular recall testing has a direct positive impact on memory retention. Study Buddy facilitates this by:

* Allowing users to **review key concepts quickly**
* Supporting **repetition of difficult questions**
* Enabling tagging of flashcards as **"Known" or "Needs Review"**

Feedback collected from users suggests a major boost in their ability to **cram smarter before exams**, with focused revision of weaker areas. The format encourages deep learning in short bursts, making it ideal for last-minute preparation.

## Data Storage and Firestore Integration

Study Buddy uses **Firebase Firestore** to store all user data securely and efficiently. It follows a clean flat-structure design with top-level collections:

* **/users – Basic user details and authentication data**
* **/files – File metadata and document details**
* **/questions – Questions generated from each file**
* **/flashcards – User-reviewed flashcards, tagged with review status**

Each document in Firestore is associated with user IDs and file IDs for seamless linking, ensuring that **user data is safe, scalable, and easily retrievable**.

**Fig 1. Firestore Console view**

A screenshot of a computer

AI-generated content may be incorrect.

**4.5 User analytics and progress monitoring**

To maximize learning outcomes, Study Buddy includes a smart **Analytics Dashboard**. This tab presents visual feedback and actionable insights to help users:

* **Monitor quiz performance across sessions**
* **Track "Known" vs. "Needs Review" flashcard statistics**
* **View study history and session time**
* **Identify subjects that require more focus**

This dashboard empowers students to **self-assess and continuously improve** their learning strategy.

**Fig1. Analytics tab**

A screenshot of a computer

AI-generated content may be incorrect.

# CHAPTER 5 CONCLUSION AND FUTURE WORK

## Interpretation of Results

The **Study Buddy** application successfully demonstrates how artificial intelligence can be leveraged to enhance last-minute exam preparation through intelligent question generation, flashcard-based active recall, and personalized analytics. By automating the conversion of raw text into structured study materials, the app minimizes student effort while maximizing retention and learning outcomes.

Key outcomes of this project include:

* A working web-based platform that takes PDF/text files and generates MCQs, short answers, and flashcards.
* Real-time Firestore storage and retrieval of user data, questions, and revision materials.
* A responsive UI and analytics dashboard that help students monitor their progress and focus on weaker topics.

The integration of smart revision tools, user-friendly design, and backend data management has created a comprehensive solution for students who need to study fast and effectively — particularly in high-pressure academic environments.

* 1. Limitations and Considerations
* **Limited Contextual Accuracy**: The question generation may not always capture deeper or technical meanings from complex documents.
* **Dependent on Input Quality**: Poorly formatted or scanned files can lead to incorrect or incomplete question extraction.
* **No Personalization Yet**: The app does not currently adapt to individual learning patterns or difficulty levels.
* **Requires Internet Access**: All features rely on cloud services, so a stable internet connection is essential.
* **Privacy Concerns**: Uploaded notes are stored for processing, so user data privacy must be considered for future scaling.

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