Design and Develop Educational Chatbot using Large Language Model, Optical Character Recognition & Natural Language Processing

Submitted By
Name: Nikesh Bhandari
Student ID: 220277

Submitted To
Name: Manoj Shrestha
Module Leader

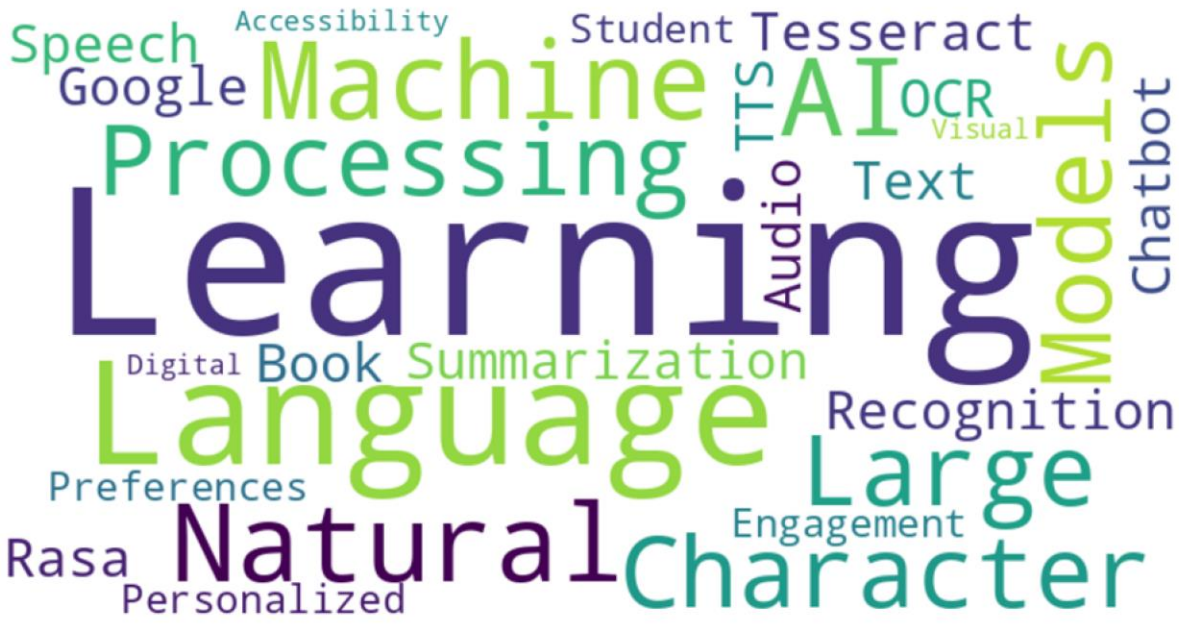

Figure 1: Keywords

Table of Contents

Introduction 5
Aim 6
Objectives 6
Justification 7
Research Questions 8
Desk Based Agile Strategy 8
Case Studies 9
Integration 12
Project Plan 13
Conclusion 13
References 14
Appendix 15
SWOT Analysis 15
Risk Plan 15

Table Of Figures

Figure 1: Keywords 2
Figure 2: Title Reflection 5
Figure 3: Problem Vs Solutions 7
Figure 4: Research Questions 8
Figure 5: Desk Based Agile Strategy 9
Figure 6: Duolingo and Khan Academy 10
Figure 7: News and Legal Industry 10
Figure 8: Audible and Microsoft 11
Figure 9: Integration 12
Figure 10: Project Plan 13
Figure 11: SWOT Analysis 15
Figure 12: Risk Analysis 15

Introduction

The education sector has advanced with the integration of technology. Youths nowadays have difficulty staying focused while reading complete books as social media takes away their attention resulting in short attention span. Reading textbook materials takes huge effort and lots of time to complete. Most of them like to study content either through brief outlines or audio presentations. So, Smart learning tools need to exist to support students who find traditional teaching methods hard and uninteresting.

Figure 2: Title Reflection

Multiple recognized platforms have integrated Artificial Intelligence technology to enhance their educational systems. The learning platforms Duolingo and Khan Academy use AI to design personalized lessons that help students learn their subjects better. News companies, like Reuters and Bloomberg use AI technology to provide readers faster access to important news. Amazon, Google and Microsoft use text-to-speech technology which enables users to listen to books without physical reading. This project investigates how education can benefit from AI technology when it helps students receive better book summaries and automated responses with varied content delivery.

Aim

Design and develop educational chatbot using large language model, optical character recognition and natural language processing.

Figure 3: Aim

Objectives

- Learn and understand the root cause of the issues with learning activity among higher education students, existing educational tools about what they do well and where they lack.
- Look into how Large Language model, Optical Character Recognition and Natural Language processing are being used to process educational content.
- Investigate how text processing can enhance learning by extracting key insights from books and generate summaries.
- Explore how to turn book summaries into audio podcasts using text-to-speech technology.
- Get incremental feedback.
- Submit report.

Justification

Learners nowdays experience major issues when studying long academic texts because their attention periods have decreased plus they deal with digital disruptions and too much educational material. As these learners find it hard to quickly find important book facts and spend more time which ends with poor results. Traditional teaching depends strongly on students reading textbooks yet many learners find better learning happens through other methods. Students succeed with either short overviews or spoken content since it helps them learn and stay interested better. Educational systems today do not have an AI tool that can combine multiple automated tasks including book summarization. This project relvoves aroung how AI systems such as OCR, NLP, and TTS could make education more available while helping to teach and adapt better.

Figure 4: Problem Vs Solutions

Technologies with artificial intelligence now speed up news organizations and research groups to handle documents through automatic summary production and content search. News platforms use AI to find important details in their data while Google Amazon and Microsoft make information easier to access through Text to Speech technology. This project tests if AI educational tools support effective book condensation as well as create automated answers and audio-based materials to fit students different learning preferences and tests if it helps students study better by saving time while keeping knowledge strong and enhancing the way education feels. The results from it would update educational systems to follow modern student requirements in a technology focused setting.

Research Questions

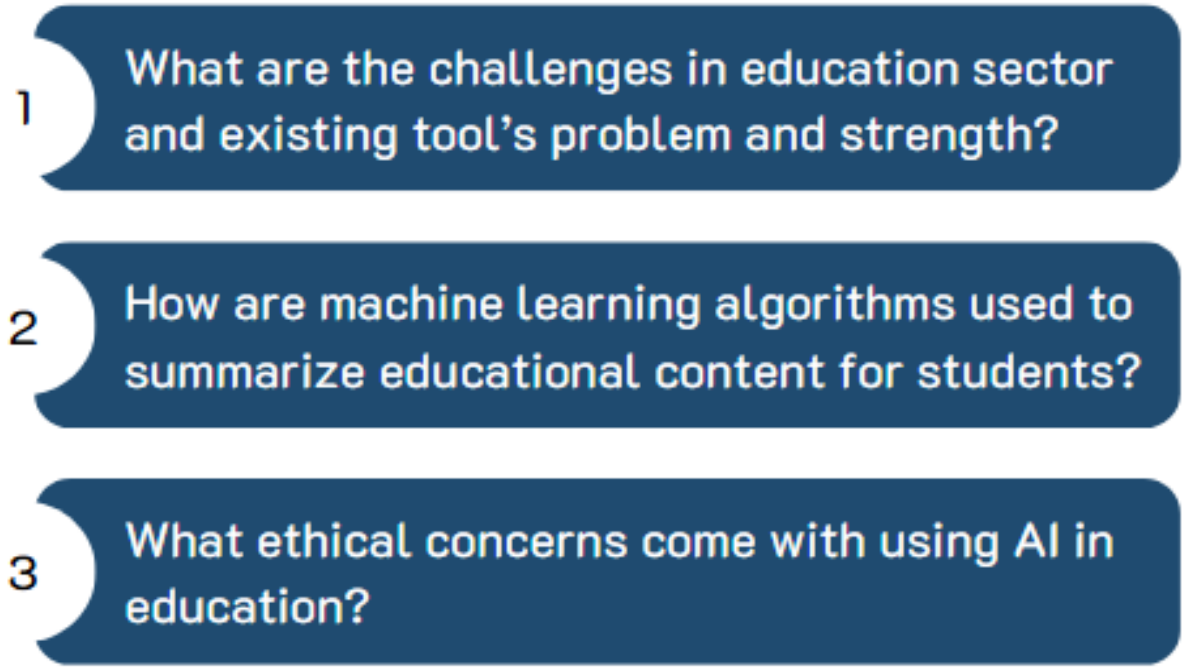

Figure 5: Research Questions

Desk Based Agile Strategy

The Desk-Based Agile Strategy has been integrated with the Institute of Analytics (IoA) Competency Framework to ensure a structured and systematic approach to the project. The research phase has been designed to analyze secondary sources such as academic journals, industry reports, and case studies, providing insights into how AI-powered educational tools like Duolingo, Khan Academy, and Audible have been utilized to enhance learning. This helps in understanding how technologies like Optical Character Recognition, Natural Language Processing, Large Language Models, and Text-to-Speech can be applied effectively to process educational content, summarize books, answer user queries, and generate podcasts. These sources will be carefully examined to ensure ethical and responsible AI implementation while maintaining relevance to industry practices.

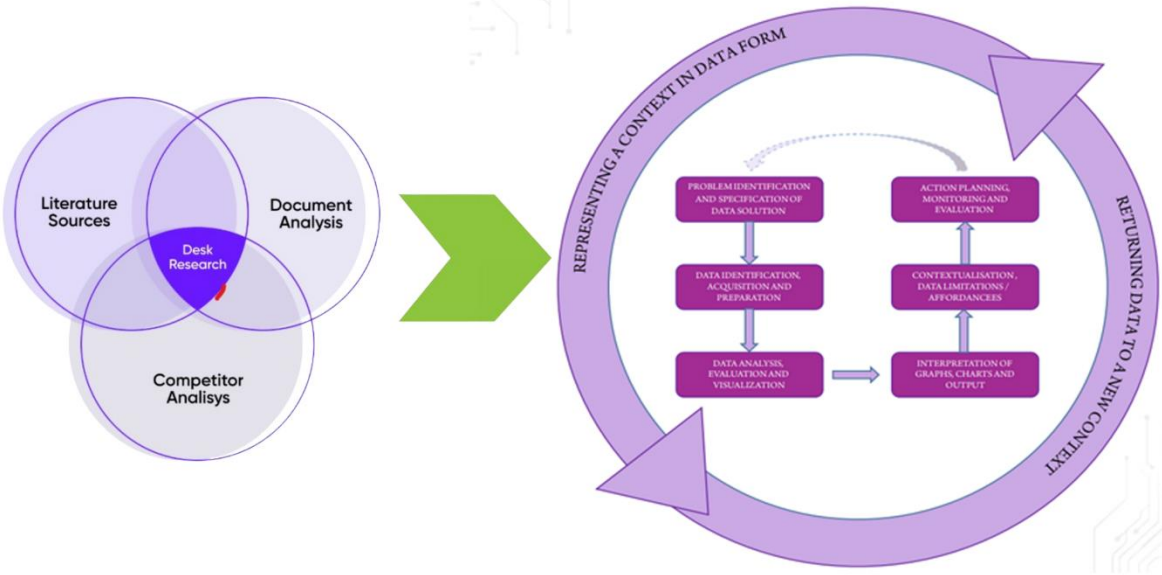

Figure 6: Desk Based Agile Strategy

The project will follow an Desk based research methodology to ensure flexibility and iterative improvements. The chatbot will be developed in phases, allowing for regular testing, feedback collection, and continuous refinements. Core features such as text extraction, summarization, and text-to-speech conversion will be implemented incrementally, ensuring that each function is optimized before progressing further. By integrating the IoA Competency Framework, the project will emphasize analytical thinking, ethical AI governance, and strategic decision-making. Regular reviews will be conducted to align development with best practices, ensuring that the chatbot remains adaptable and relevant. This combination of Desk-Based Research and Agile execution will result in an innovative, user-friendly solution that enhances student engagement with long-form educational content.

Case Studies

Many well-known educational platforms and industries have successfully adopted AI-powered tools to improve accessibility, engagement, and efficiency. Duolingo demonstrates machine learning and NLP technology to customize language training. Duolingo tracks user actions to modify lesson difficulty and provides specific training paths that fit each individual student's learning path (Henry, 2025). Khan Academy makes learning more effective by letting its AI tutor answer student inquiries, simplify hard topics and explain subjects based on each student's learning requirements (Zaytsev, 2023). These AI-based tools show that tailoring learning experiences leads to higher student involvement and success which matches the main functions of our chatbot designed to explain and answer student questions about books.

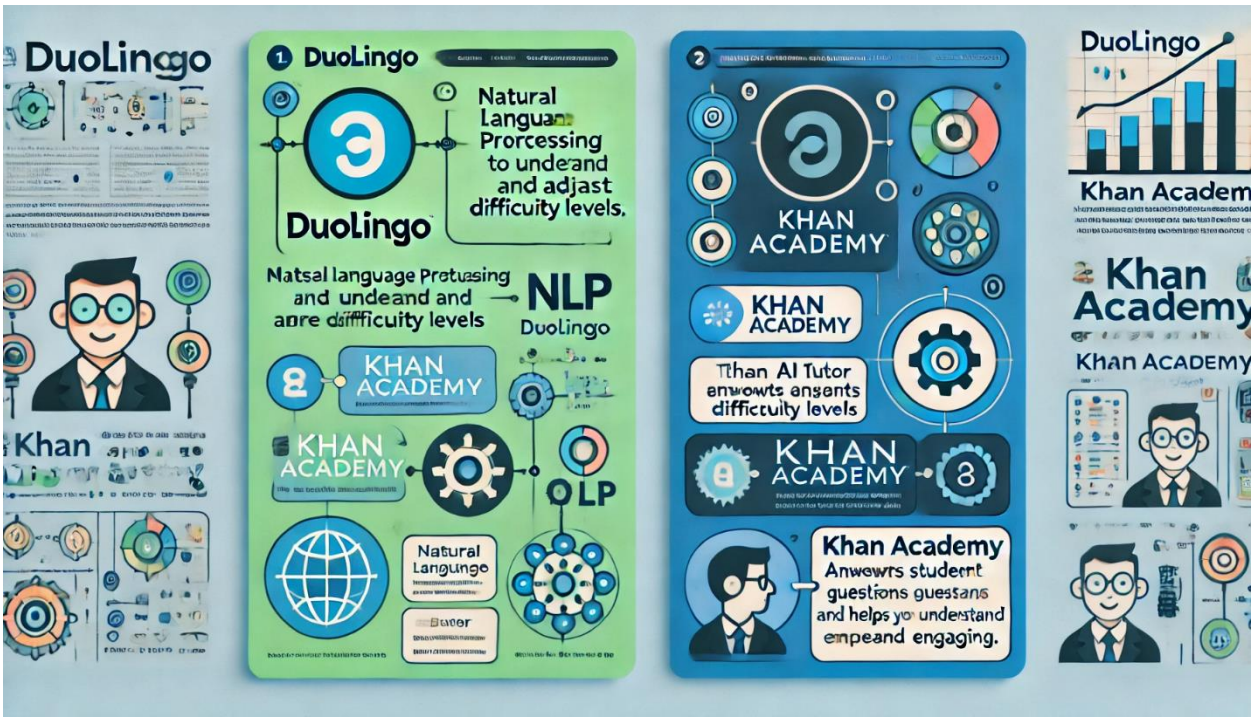

Figure 7: Duolingo and Khan Academy

On the other hand, News company like Reuters and Bloomberg have been using AI to summarize articles, making readers get important information quickly (Anurag Reddy, 2025). These AI models analyze large volumes of text and generate concise summaries, making news consumption more efficient. By using similar AI-driven summarization techniques, the chatbot will enable students to quickly learn the essence of lengthy academic materials, reducing study time while maintaining content accuracy.

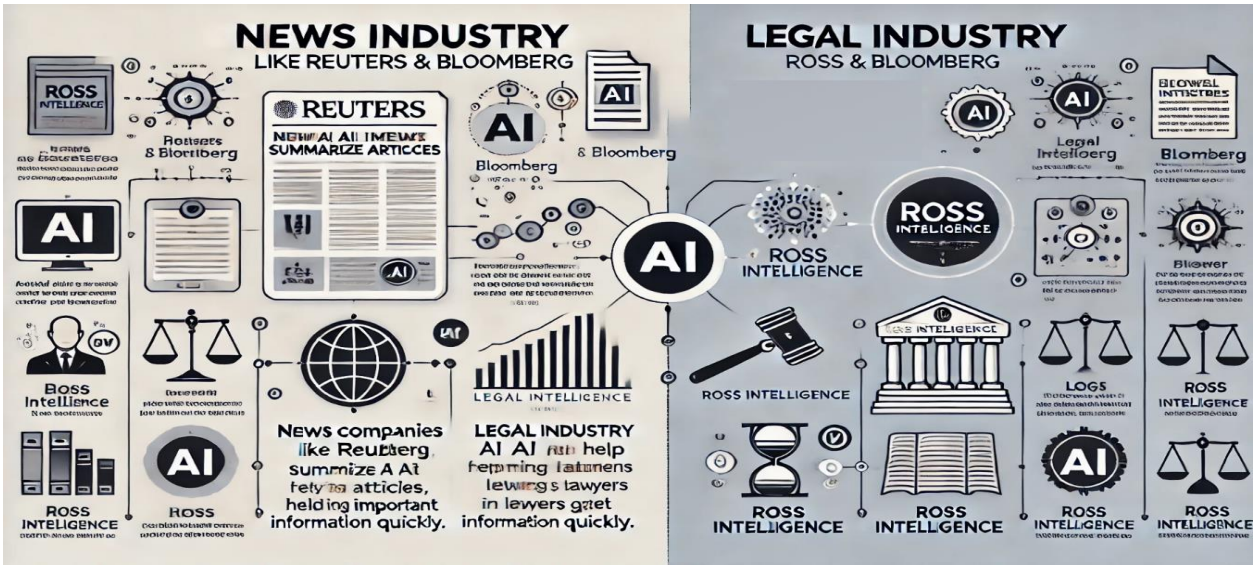

Figure 8: News and Legal Industry

In education sector, text-to-speech technology is important to converts written content into speech, improving accessibility for visually impaired users and students who prefer auditory learning. Platforms like Audible (Amazon), Google, and Microsoft have integrated AI driven TTS to transform written books into audiobooks, making content more accessible and convenient to consume.

Figure 9: Audible and Microsoft

Coursera recommends courses to students based on information like their subject and learning data. The system uses artificial intelligence to find learning material that matches each student's needs. This makes skill learning time more effective. Coursera uses student participation data to create better ways students can learn. Students use Grammarly to enhance their writing because this writing assistant combines NLP and deep learning to analyze and improve texts. The system detects grammar errors and offers suitable sentence patterns to improve content clarity which benefits students.

Similarly, Carnegie Learning creates intelligent math learning systems that adapt their lessons to student needs. Lessons on the platform adjust their level of challenge plus its teaching approach is based on what students show them. The system works like a personal teacher who detects errors making what exactly they need to learn better. Socratic by Google analyze student tasks with AI vision to offer better problem-solving answers. Students capture visual representations of their math issues or science questions and historical problems for the AI to deliver detailed answers with video guides plus content recommendations (Anchevska, 2023).

Quizlet uses machine learning algorithms to create adaptive learning and generate customized quizzes, flashcards and practice tests. Its smart revision feature helps students focus on weaker

topics by analyzing the previous answers and progress (Edwards, 2024). Similarly, Squirrel AI is a leading AI-powered education platform in China which does tutoring by providing tailored learning experience to individuals. It analyzes student responses and knowledge gaps in real-time, adjusting lessons accordingly to ensure targeted performance is achieved (Bloomberg Television, 2019).

Integration

The educational chatbot will combine different tools and technologies to ensure smooth functionality. A React interface will allow users to upload books, ask questions, and receive audio summaries, while Rasa will manage conversations. Tesseract OCR will be used to extract text from uploaded books, and Natural Language Processing and Large Language Models (LLMs) will process the text to generate summaries and answers. Google Text-to-Speech (TTS) will convert these summaries into audio podcasts.

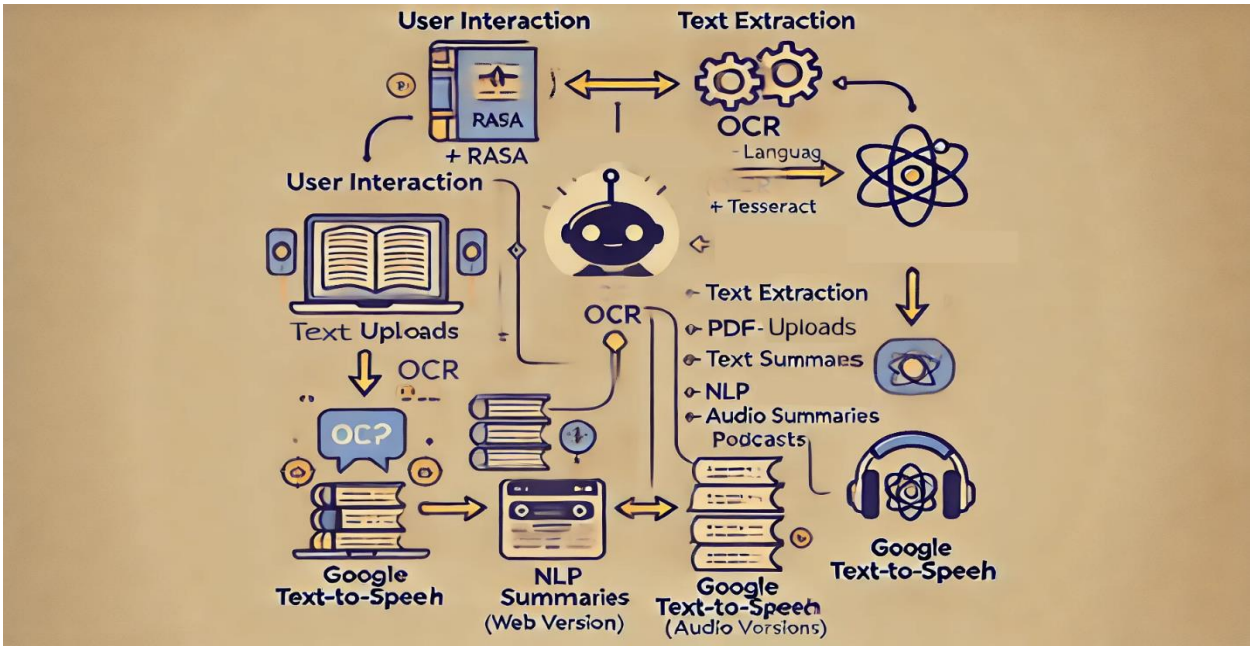

Figure 10: Integration

At first students will interact with the simple user interface where they can upload books in both PDF and image formats, then queries about it, access summaries or podcasts for the content. If the uploaded book is in image format, then it will use OCR technology to extract text, ensuring even digital resources like textbooks, research papers and notes in image format could be processed. Once the text is extracted, Natural language Processing and Large Language Models will analyze the content. These models will summarize the key points and answer out learner's queries, simplifying complex things into easy to understand format. This will help them to get essential information quickly by not wasting time and effort without going through long textbooks.

Additionally, Text to Speech technology will allow learners to listen to summaries through podcasts, making more accessible to those who prefer audio-based learning.

Project Plan

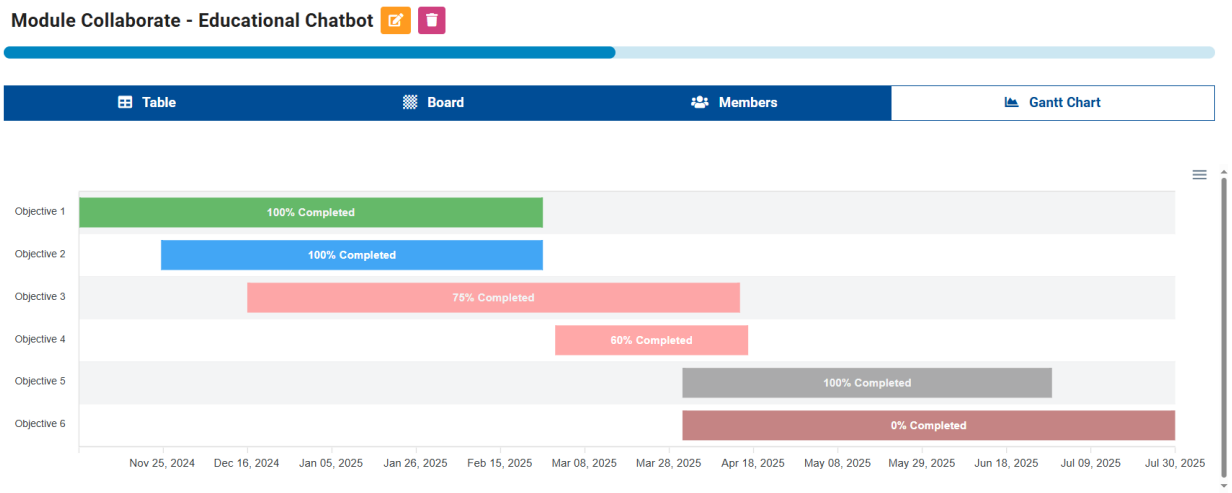

Figure 11: Project Plan

Conclusion

Modern technology and social media interrupts students from effectively read study materials because of their low attention span. This project analyzes how AI technology can work through a chatbot to assist students by converting books for easier reading plus answering their questions and turning text documents into spoken words. AI delivers helpful results yet faces difficulties with correctness as well as issues with user acceptance. This project checks if an AI-based system can work by choosing suitable models for integration while creating easy-to-use features. The research targets to show how AI technology enhances education systems and let learners get insightful knowledge based on their interest.

References

Ioa(2023) *Discussing the impact of Generative AI on Student Education | IoA - Institute of Analytics*. https://ioaglobal.org/blog/discussing-the-impact-of-generative-ai-on-student-education/.

Henry, P. (2025) *How Duolingo uses AI to create lessons faster*. https://blog.duolingo.com/large-language-model-duolingo-lessons/.

Ashodia, H. (2024) *Transforming Legal Research: The impact of ROSS intelligence and AI*. https://fxis.ai/edu/transforming-legal-research-the-impact-of-ross-intelligence-and-ai/.

Zaytsev, A. (2023) *Case Study: Khan Academy Blends Traditional Learning with AI*. https://aiexpert.network/case-study-khan-academy-blends-traditional-learning-with-ai/.

Anurag Reddy (2025) *AI-Generated News: Can we trust AI journalism?* https://www.analyticsinsight.net/artificial-intelligence/ai-generated-news-can-we-trust-ai-journalism.

Caplan, J. (2024b) 'Google NotebookLM: AI-Powered Document Analysis Tool,' *Wonder Tools*, 18 October. https://wondertools.substack.com/p/notebooklm-2024-update.

Edwards, L. (2024) *Quizlet: How to teach with it*. https://www.techlearning.com/how-to/what-is-quizlet-and-how-can-i-teach-with-it.

Bloomberg Television (2019) *How squirrel AI learning is shaking up education in China*. https://www.youtube.com/watch?v=eHab0NvT8FQ.

Carnegie Learning – 3 things you must know | Speechify https://speechify.com/blog/carnegie-learning-3-things-to-know/.

Anchevska, E. (2023) *What is Socratic and How to Use It?* https://neuralnetworkpress.com/what-is-socratic-and-how-to-use-it.

Appendix

SWOT Analysis

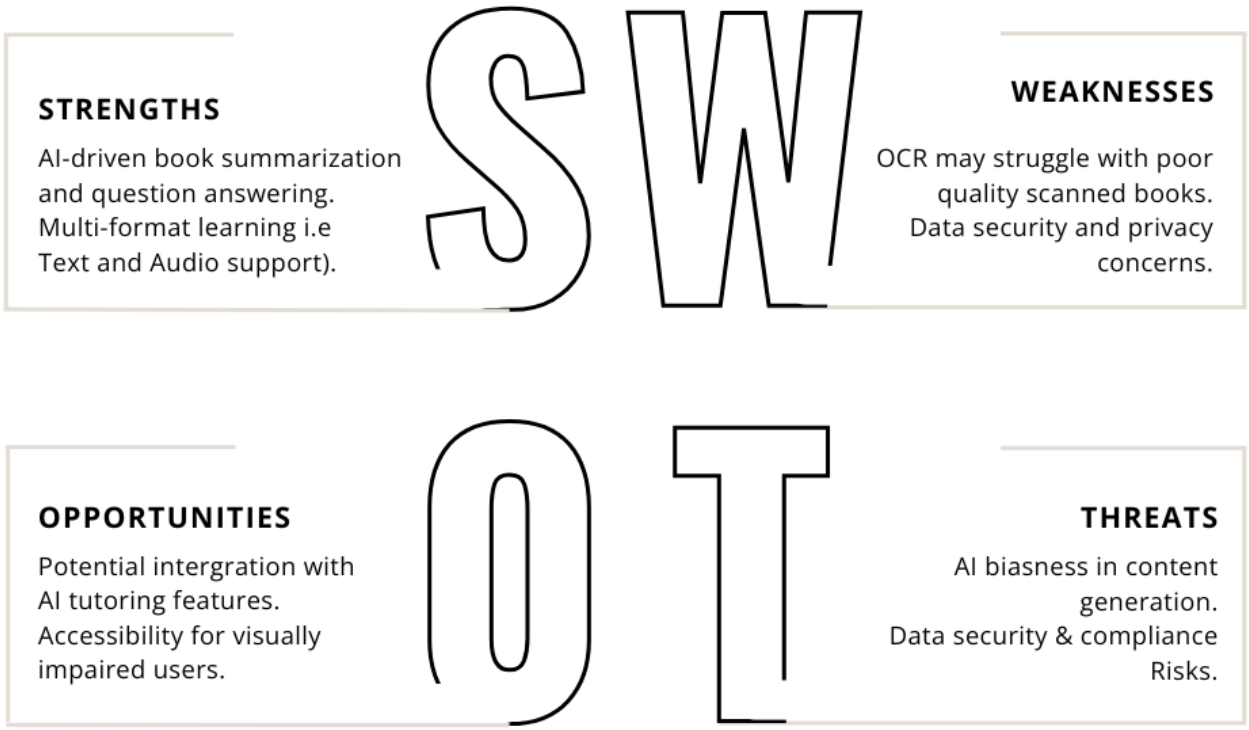

Figure 12: SWOT Analysis

Risk Plan

Risk Category	Risk	Description	Risk Level
Technology Risks	OCR Problems	If the images of book are low quality or use unusual fonts, OCR may not work properly leading to errors in text extractions and summaries.	High
Privacy and Ethical Risks	Data Privacy	Storing sensitive student data could raise concerns, especially if the data isn't handled properly.	High
Market Risks	Low Adoption	Students or teachers might not embrace the chatbot if they prefer tradtional methods or learning	Medium
Operational Risks	Resource Needs	Developing the chatbot system will require expertise, time and money.	Low

Figure 13: Risk Analysis