

Enhancing Student Learning Through Automated Assistance

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1. ABSTRACT

This project aims to create an automated Q&A system to assist students in finding answers to questions from course materials or textbooks, enhancing learning by providing instant, accurate responses. By leveraging AI and natural language processing (NLP), the system will allow students to query specific concepts or topics and receive answers drawn from predefined academic sources. This tool will facilitate a self-paced, interactive learning environment, ultimately helping students better understand and retain information. The expected outcome is a user-friendly AI tool that enhances accessibility to educational content, contributing to personalized and efficient learning experiences.

2. INTRODUCTION

2.1 Background/Context

In the education sector, students often face difficulties in quickly locating answers to specific questions within extensive course materials. Traditional search methods can be time-consuming, leading to frustration and interrupted study flows. AI, specifically NLP, can transform this experience by enabling automated question-answering capabilities that retrieve answers based on precise understanding of queries.

2.2 Problem Statement

Students struggle to efficiently find answers in extensive study materials, causing interruptions in their learning. This project seeks to resolve this by implementing a question-answering AI model.

The project addresses the challenge of providing students with an efficient means to retrieve answers from educational content. The goal is to automate the question-answering process to reduce the time students spend searching through textbooks and course materials.

2.3 Objectives

- To develop an AI-powered Q&A system for student assistance.
- To leverage NLP to interpret and respond to user queries with high accuracy.
- To create a user-friendly interface that integrates into educational resources.

3. LITERATURE REVIEW

This project builds on advancements in NLP, particularly in transformer models like BERT, GPT, and RoBERTa, which have demonstrated effectiveness in understanding and generating human-like text. Existing Q&A systems such as OpenAI's ChatGPT or IBM's Watson provide general-purpose assistance but lack the tailored focus needed for academic content. Current limitations include difficulty in adapting to specific educational materials and managing domain-specific language. This project aims to address these gaps by fine-tuning a Q&A model specifically for educational contexts, thereby enhancing accuracy and relevance for student users.

4. PROPOSED SOLUTION

4.1 AI Approach

This system will use a model adapted through transfer learning to handle specialized educational queries across various subjects, enabling accurate and relevant responses. By focusing on subject-specific adaptation, the model will provide tailored support for diverse learning needs.

4.2 Data Requirements

- Academic datasets containing textbooks, course materials, and question-answer pairs.
- Data preprocessing will include tokenization, filtering, and structuring of educational texts to optimize model performance.

4.3 Architecture/Design

- The system will consist of a front-end interface for inputting questions, an NLP pipeline for processing these queries, and a back-end response generator that leverages the trained model to retrieve or generate answers.
- A knowledge base containing course materials will be linked to the Q&A model for context-specific answer retrieval.

4.4 Technological Stack

- Programming Language: Python
- Libraries: TensorFlow, Scikit-learn, Pandas
- Tools: Jupyter Notebook, Google Cloud for model training and deployment

5. PROJECT PLAN

5.1 Timeline

	Month & Project Activity	October				November				December				January			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Research (literature review, data collection)																
2	Feasibility Study (model training, testing)																
3	Testing (validation and optimization of predictions)																
4	Deployment (final model deployment and user testing)																

5.2 Milestones

- Dataset Collection and Preprocessing
- Model Architecture Design and Initial Training
- Model Fine-tuning and Evaluation
- Final System Testing and Deployment

6. EVALUATION METHODOLOGY

6.1 Metrics

- Accuracy: The percentage of correct answers out of total queries.
- Precision and Recall: To measure the relevancy and completeness of retrieved answers.
- F1 Score: For a balanced evaluation of the system's effectiveness.

6.2 Validation Strategy

Cross-validation and real-user testing will be conducted to assess the model's performance. Feedback loops will be established to improve accuracy over time.

7. EXPECTED OUTCOMES

7.1 Impact

The Q&A system will significantly reduce students' search time for information, allowing more efficient and focused study sessions. It aims to provide a personalized learning assistant that empowers students to independently find answers to complex questions, fostering better learning outcomes.

7.2 Challenges

- Dataset limitations could affect the scope of topics the model can handle.
- Risk of model overfitting to specific types of questions.
- Addressing bias in the AI model, particularly in handling ambiguous or multi-faceted queries.

8. BUDGET AND RESOURCES

8.1 Cost Estimates

- Hardware:
5_Laptops: Rs.750 000
2_Routers: Rs.10000
- Miscellaneous:
Data packages: Rs.20 000
Electricity bill: Rs.5000

8.2 Resource Requirements

- Human Resources: library Wayamba University of Sri Lanka, Departments of faculty of Applied Sciences
- Tools: Python, TensorFlow.