

AI-Based Question Paper Generation

A Mini Project Report

*Submitted to the APJ Abdul Kalam Technological University
in partial fulfillment of requirements for the award of degree*

Bachelor of Technology

in

Computer Science and Engineering

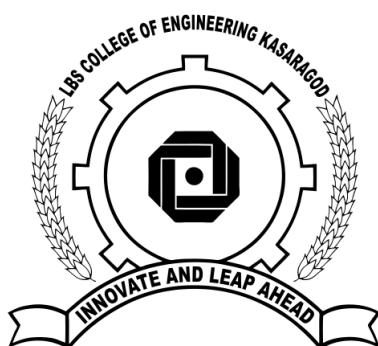
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LBS COLLEGE OF ENGINEERING KASARAGOD

KERALA

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CERTIFICATE

This is to certify that the report entitled **AI-Based Question Paper Generation** submitted by **Sreyarag K (KSD22CS120), Nandana V.M (KSD22CS098), Muhammed Minhaj V.S (KSD22CS090) & Sreelakshmi Sreedharan (KSD22CS117)** to the APJ Abdul Kalam Technological University in partial fulfillment of the B.Tech. degree in Computer Science and Engineering is a bonafide record of the project work carried out by him under our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

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DECLARATION

We hereby declare that the project report **AI-Based Question Paper Generation**, submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by us under supervision of Prof. Krishnaprasad P.K

This submission represents our ideas in our own words and where ideas or words of others have been included, we have adequately and accurately cited and referenced the original sources.

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Abstract

The "SmartQGen" is a web-based application designed to simplify the creation of customized exam question sets. It allows users, such as educators, tutors, and students, to input subject syllabus, modules, and previous exam questions. The platform automatically generates questions in three difficulty levels—easy, medium, and hard—based on the provided input. Key features include subject selection, syllabus/module upload, previous question input, and customization options such as difficulty adjustments, time constraints, and topic-specific question filtering. This tool aids in creating personalized practice sets, ensuring targeted and effective exam preparation. .

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Contents

Abstract	i
Acknowledgement	ii
List of Figures	vi
1 Introduction	1
1.1 Motivation	2
1.2 Scope	3
1.3 Problem Statement	4
2 Literature Review	5
2.1 AI-Based Question Generation	5
2.2 Rule-Based Question Selection	6
2.3 Database-Driven Question Selection	6
2.4 OCR-Based Question Extraction	6
3 Project Overview	7
3.1 Goals and Objectives	7
3.2 Features	8
3.3 Challenges	9
4 System Design	10
4.1 Introduction	10
4.2 Design Phases	12
4.2.1 Data Collection	13
4.2.2 Difficulty Selection	13

4.2.3	AI Processing	13
4.2.4	Dynamic Question Generation	13
4.2.5	User Editing & Refinement	13
4.2.6	PDF Generation & Download	13
5	Implementation	14
5.1	User Interface Tools	14
5.1.1	Visual Studio Code (VS Code)	14
5.1.2	HTML, CSS, JavaScript	14
5.2	Backend Tools	15
5.2.1	PHP	15
5.3	Database Tools	15
5.3.1	MySQL	15
5.4	Testing Tools	15
5.4.1	ThunderClient Extension of VS Code	15
5.5	AI Technology	15
5.5.1	Google Gemini AI	15
5.6	Key Feature Implementation	16
5.6.1	User Authentication System	16
5.6.2	Syllabus and Previous Question Upload	16
5.6.3	AI-Based Question Generation	16
5.6.4	Question Editing and Review	16
5.6.5	Question Paper Export	17
5.6.6	User-Friendly Web Interface	17
5.6.7	Security and Performance	17
5.6.8	API Testing and Debugging	17
6	Results	18
6.1	Authentication Section	18
6.2	Normal User Section	19
7	Conclusion And Future Work	21

List of Figures

4.1	ER-Diagram	10
4.2	Flowchart	11
4.3	UML Diagram	12
6.1	Authentication Pages	18
6.2	SmartQGen Homepage	19
6.3	Syllabus Upload and Difficulty Selection	19
6.4	Question Generation	20
6.5	Generated Question Paper	20

Chapter 1

Introduction

Education is a cornerstone of intellectual and professional growth, with examinations serving as a key method for evaluating students' understanding and analytical skills. Traditionally, educators manually create question papers, ensuring they align with the syllabus and difficulty levels. However, this process is time-consuming, labor-intensive, and prone to human errors such as question repetition, inconsistencies, and biases.

To overcome these challenges, we propose SmartQGen, a web-based system that automates the creation of question papers using artificial intelligence. This system leverages Google Gemini AI API, a powerful AI model, to generate relevant and structured questions based on uploaded syllabus documents. The AI analyzes the provided syllabus content and generates high-quality, syllabus-aligned questions that adhere to academic standards.

Our system is specifically designed to generate KTU-based question papers, following the structured examination format. It produces 10 three-mark questions per module and 2 seven-mark questions per module, ensuring that the generated questions align with university assessment criteria. This structured approach helps in maintaining consistency and fairness in examinations while reducing the manual workload of educators.

By using Google Gemini AI API, the system ensures that the generated questions are diverse, free from repetition, and suitable for university-level assessments. The AI model processes syllabus documents to extract key topics and formulate well-

structured questions that match the learning objectives of each module. Additionally, the difficulty level of the questions can be adjusted to meet different academic requirements, ensuring balanced assessments.

This AI-powered approach significantly enhances efficiency by reducing the time and effort required for manual question selection while maintaining high academic standards. Educators can generate complete question papers within minutes, ensuring that the questions remain aligned with the curriculum. This project introduces a modern, technology-driven solution that streamlines the question paper generation process, providing a fast, reliable, and scalable method for academic assessment.

1.1 Motivation

The process of creating question papers has always been a crucial yet time-consuming task for educators. Traditionally, teachers manually draft questions based on the syllabus, ensuring that they cover all relevant topics while maintaining the required difficulty level. However, this method is highly inefficient, prone to human errors, and often leads to repetitive questions. Additionally, as the volume of students increases, the need for multiple sets of question papers grows, further burdening educators with the task of curating diverse and unbiased assessments.

With advancements in artificial intelligence, the potential for automating this tedious process has become a reality. The motivation behind this project is to leverage AI technology, specifically Google Gemini AI API, to streamline question paper generation, making it faster, more efficient, and more reliable. The ability of AI to analyze syllabus documents and generate meaningful, well-structured questions eliminates the need for manual intervention, reducing the workload of educators while ensuring high-quality assessments.

Another driving factor is the necessity to standardize question paper generation in academic institutions, particularly for KTU (Kerala Technological University). Our system follows the KTU format by generating 10 three-mark questions and 2 seven-mark questions for each module, ensuring that the papers are well-structured and aligned with the curriculum. This structured approach ensures that students are assessed fairly and comprehensively across different topics.

Furthermore, integrating AI into the education sector opens new possibilities for adaptive learning and personalized assessments. By automating question paper generation, educators can focus more on teaching and improving student engagement rather than spending excessive time preparing exams. Additionally, this system can be beneficial in remote and digital education environments, where question papers need to be generated efficiently for online exams. By implementing this AI-based approach, we aim to modernize the examination process, enhance efficiency, and provide a scalable solution that can be adopted by universities and educational institutions worldwide.

1.2 Scope

SmartQGen is an advanced AI-powered question paper generation system that leverages the Google Gemini AI API to automate the process of creating structured and relevant question papers. Designed specifically for academic institutions, SmartQGen aims to streamline the question paper generation process while ensuring efficiency, accuracy, and adherence to the Kerala Technological University (KTU) examination pattern. The system generates 10 three-mark questions and 2 sevenmark questions per module, aligning with the structured evaluation format of KTU.

The scope of SmartQGen extends beyond traditional manual question paper preparation methods by reducing faculty workload and eliminating redundancy in question formulation. Through AI-driven content analysis, the system intelligently extracts key concepts from syllabus documents, textbooks, and previous question papers to generate well-structured and relevant questions. This ensures that each question paper is unique, unbiased, and tailored to the specific requirements of a subject or course.

The system is designed to be scalable and flexible, making it suitable for various universities, colleges, and academic institutions. It can be expanded to support different educational boards with customized question paper formats. Furthermore, SmartQGen is adaptable to multiple disciplines, including engineering, science, humanities, and commerce, making it a versatile solution for educators and institutions.

In the future, SmartQGen can incorporate difficulty-based question selection,

multilingual support, and seamless integration with learning management systems (LMS). These enhancements will further improve the efficiency and accessibility of automated question paper generation, making SmartQGen a powerful tool for modern education systems.

1.3 Problem Statement

The traditional process of question paper generation is a tedious and time-consuming task that requires educators to manually select and frame questions while ensuring that they align with the syllabus, difficulty levels, and academic standards. This manual approach often leads to inefficiencies such as redundancy in questions, inconsistency in difficulty levels, and a lack of adaptability to curriculum changes. Furthermore, in large-scale educational institutions, generating multiple sets of question papers for different subjects and courses becomes an overwhelming process, increasing the workload of faculty members.

Many existing automated systems rely on predefined question banks or rule-based algorithms, which limit question diversity and fail to generate new, conceptually varied questions. These methods do not effectively adapt to syllabus updates and often require significant human intervention for reviewing and modifying the generated questions.

To address these challenges, SmartQGen utilizes Google Gemini AI to automate the process of question paper generation. The system is designed specifically for the Kerala Technological University (KTU) examination pattern, ensuring that each module includes 10 three-mark questions and 2 seven-mark questions. The AI dynamically analyzes uploaded syllabus documents and extracts key concepts to generate relevant, high-quality questions. This approach significantly reduces manual effort, enhances efficiency, and ensures that the generated question papers are diverse, unbiased, and aligned with academic requirements.

With SmartQGen, institutions can streamline question paper creation, maintain academic rigor, and provide faculty with a powerful tool to generate high-quality assessments while minimizing human effort and errors.

Chapter 2

Literature Review

Artificial Intelligence has revolutionized the process of question paper generation by automating the selection and creation of questions based on predefined patterns and syllabus content. Traditional methods require manual question selection, which is time-consuming and often lacks adaptability. To improve efficiency and accuracy, SmartQGen integrates AI-based techniques to dynamically generate KTU-based question papers.

Various approaches exist for automated question generation, including AI-based Question Generation and OCR-based Question Extraction. The table below highlights key techniques used in the domain:

In our project, SmartQGen, we leverage the Google Gemini AI API for KTU-based question generation. The system generates 10 three-mark questions and 2 seven-mark questions per module, ensuring a structured and syllabus-oriented question paper format. This AI-driven approach enhances efficiency, reduces manual workload, and improves the adaptability of the question paper generation process.

2.1 AI-Based Question Generation

S.K. Singh conducted a study on Automated Question Paper Generation using AI, highlighting how Google Gemini API extracts key concepts from syllabi to dynamically generate questions. This approach is scalable and automatic, ensuring unique questions, but accuracy depends on highquality training data.

2.2 Rule-Based Question Selection

Alsubait, R., Parsia, B., and Sattler, U. explored Generating Multiple Choice Questions from Ontologies, where questions are selected from a predefined question bank based on structured rules. This method ensures consistency but lacks adaptability to new question patterns, making it less flexible for evolving curricula.

2.3 Database-Driven Question Selection

Henrique B.M., Sobreiro V.A., and Kimura H. presented A Systematic Review of Machine Learning Methods for Automated Question Generation, which discusses the use of SQL/NoSQL databases for storing and retrieving questions. This system organizes questions efficiently but requires manual question entry, limiting automation and scalability.

2.4 OCR-Based Question Extraction

Smith, R., Antonova, D., and Lee, D. researched Google Tesseract OCR: Open-Source Optical Character Recognition, demonstrating how OCR technology extracts text from scanned question papers for digital archiving. While useful for digitization, accuracy depends on handwriting, print quality, and preprocessing techniques

Chapter 3

Project Overview

3.1 Goals and Objectives

Goals:

1. Automate Question Paper Generation – Utilize AI to generate structured question papers based on the KTU syllabus, reducing manual effort.
2. Enhance Customization – Allow users to select difficulty levels (Easy, Medium, Hard) for tailored question papers.
3. Improve Efficiency – Minimize time spent on question paper preparation by dynamically generating high-quality questions.
4. Ensure Adaptability – Enable users to edit generated questions before finalizing the question paper.
5. Facilitate Easy Access and Export – Provide options to download the final question paper as a PDF for seamless distribution.

Objectives:

1. Develop an AI-based Question Generation System – Integrate Google Gemini AI API to generate relevant questions from syllabus documents.
2. Provide a User-Friendly Interface – Allow users to upload syllabus files, select difficulty levels, generate questions, edit them, and export them as PDFs.
3. Ensure No Data Storage – Maintain privacy and flexibility by not storing generated questions in a database.
4. Enable Real-time Processing – Ensure that questions are generated dynamically

based on the provided syllabus content.

5. Enhance Question Relevance – Ensure AI-generated questions align with KTU's academic structure and difficulty levels.

3.2 Features

1. User Authentication

- Secure Login and Signup system.
- Ensures only authorized users can access the system.

2. AI-Based Question Generation

- Uses Google Gemini AI API for generating questions.
- Generates 10 three-mark questions and 2 seven-mark questions per module.
- Supports syllabus-based question generation.

3. Difficulty Level Selection

- Allows users to choose between Easy, Medium, and Hard question difficulty levels.

4. Syllabus and Module Upload

- Users can upload syllabus and module files (PDF, text). - The system processes the syllabus to generate relevant questions.

5. Real-Time Editing and Customization

- Users can edit, modify, or refine the AI-generated questions before finalizing the question paper.

6. PDF Export Feature

- Users can download the final question paper in PDF format.
- Ensures easy distribution and printing.

7. No Data Storage for Privacy

- The system does not store generated questions in a database, ensuring security and adaptability.

8. Interactive and User-Friendly Interface

- Simple and easy-to-use web interface for seamless navigation.
- Provides options to regenerate questions if needed.

3.3 Challenges

1. AI-Based Question Relevance

- Ensuring the AI generates syllabus-relevant and meaningful questions.
- Avoiding ambiguous or inaccurate question generation.

2. Difficulty Level Calibration

- Maintaining a clear distinction between Easy, Medium, and Hard difficulty levels.
- AI sometimes struggles to accurately classify question difficulty.

3. API Limitations and Costs

- Google Gemini API has usage limits, affecting scalability.
- Free-tier restrictions may require API key upgrades for high-volume generation.

4. Processing Uploaded Documents

- Extracting syllabus content accurately from PDFs.
- Handling formatting inconsistencies in syllabus documents.

5. Real-Time Editing and User Experience

- Ensuring a smooth editing experience for users modifying AI-generated questions.

- Maintaining a user-friendly interface with seamless PDF export.

6. No Data Storage Approach

- Since the system does not store generated questions, users must regenerate questions if lost.

- Some users might prefer saving and retrieving past question papers.

7. Performance Optimization

- Generating AI-based questions in real-time without delays.
- Handling multiple users generating questions simultaneously.

Chapter 4

System Design

4.1 Introduction

The proposed system design includes visual representations that illustrate the structure and flow of the SmartQGen project. These diagrams provide a clear overview of the system's architecture, data relationships, and operational workflows.

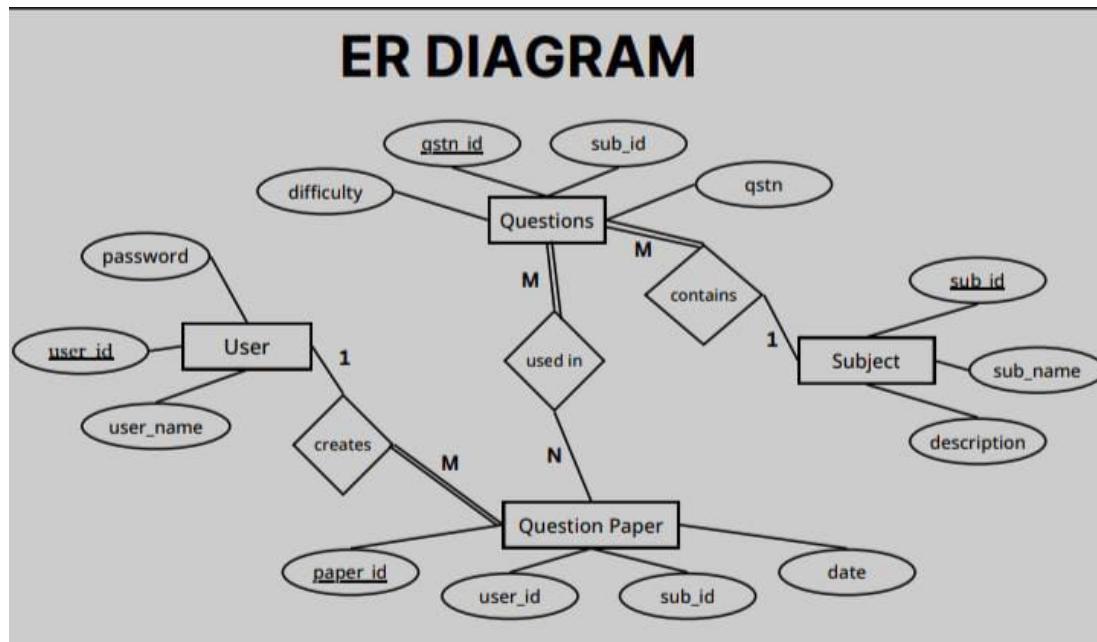


Figure 4.1: ER-Diagram

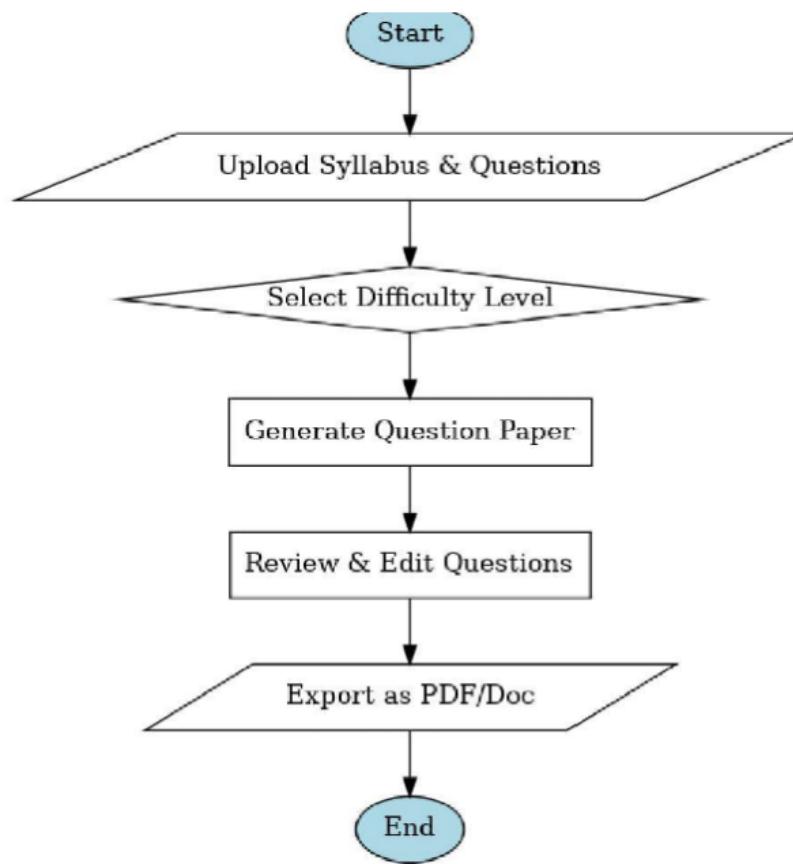


Figure 4.2: Flowchart

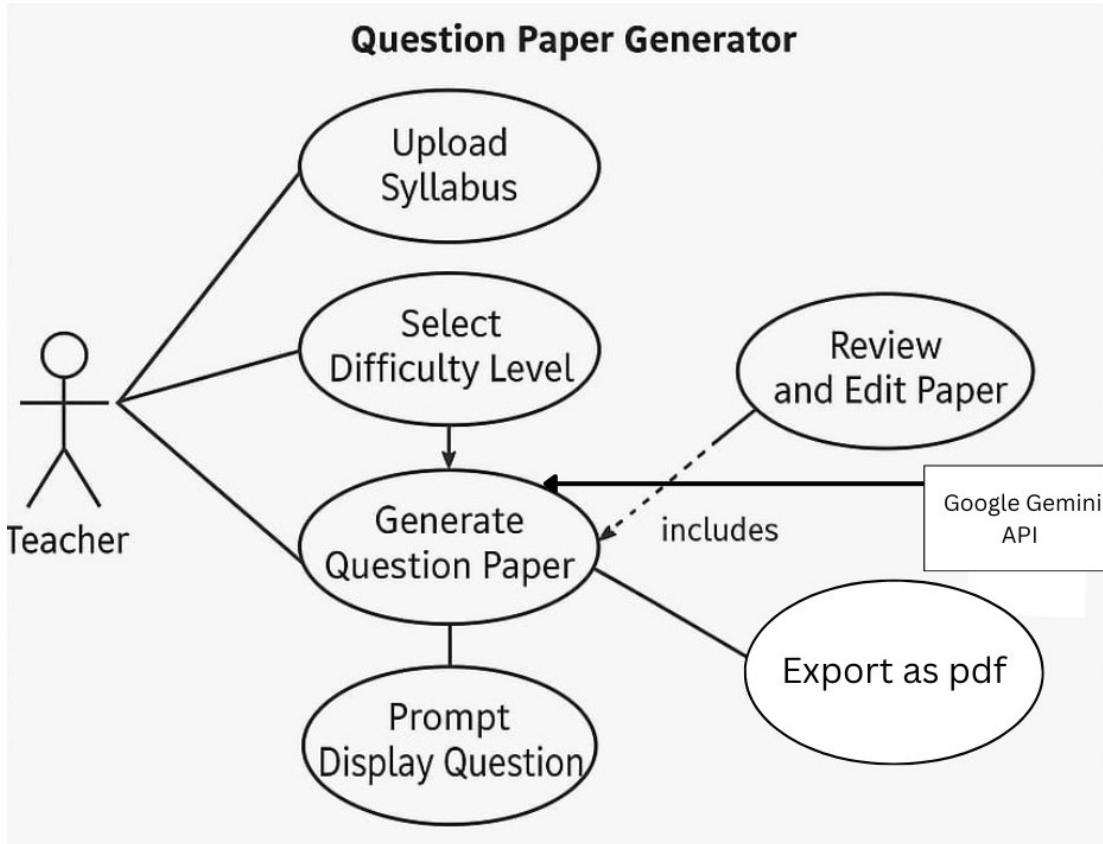


Figure 4.3: UML Diagram

4.2 Design Phases

The system follows a real-time processing model and consists of six main phases:

1. Data Collection: Users upload syllabus and module content.
2. Difficulty Selection: Users choose Easy, Medium, or Hard difficulty levels.
3. AI Processing: The syllabus is analyzed using Google Gemini API.
4. Question Generation: AI dynamically generates questions based on the selected difficulty level.
5. User Editing & Refinement: Users can edit the generated questions before finalizing the question paper.
6. PDF Generation & Download: Users can download the finalized question paper in PDF format.

4.2.1 Data Collection

Faculty or exam coordinators upload syllabus documents. These documents act as input for AI-based question generation.

4.2.2 Difficulty Selection

Before generating the questions, users must select the difficulty level. The AI adjusts question complexity accordingly.

4.2.3 AI Processing

The Google Gemini API extracts key topics from the syllabus and applies natural language understanding (NLU) to create meaningful, structured questions tailored to the selected difficulty.

4.2.4 Dynamic Question Generation

The AI dynamically generates 10 three-mark and 2 seven-mark questions per module, ensuring that the difficulty matches the user's selection.

4.2.5 User Editing & Refinement

Once the questions are generated, the user can edit and refine them manually before finalizing the question paper.

4.2.6 PDF Generation & Download

After finalizing the questions, users can export the question paper as a PDF for easy distribution and printing.

Chapter 5

Implementation

The implementation phase of the ShopEase project involved translating the proposed system design into functional software components. This section outlines key aspects of the implementation process, including technologies used, development methodologies, and integration of core features.

5.1 User Interface Tools

5.1.1 Visual Studio Code (VS Code)

Visual Studio Code (VS Code) was the primary Integrated Development Environment (IDE) used in this project. Its rich ecosystem of extensions, debugging capabilities, and integrated Git support facilitated efficient coding and collaboration.

5.1.2 HTML, CSS, JavaScript

HTML, CSS, and JavaScript were fundamental to developing the user interface of ShopEase:

- **HTML:** Used for structuring web pages and content.
- **CSS:** Employed for styling and layout design to enhance user experience.
- **JavaScript:** A dynamic programming language that makes web pages interactive.

5.2 Backend Tools

5.2.1 PHP

- A server-side scripting language used for dynamic web development.
- Processes form data, manages sessions, and interacts with databases (MySQL,).
- Handles authentication, file uploads, and API integration.

5.3 Database Tools

5.3.1 MySQL

MySQL was chosen as the relational database management system (RDBMS) for its reliability, performance, and scalability. It efficiently managed data storage and retrieval for the SmartQGen project.

5.4 Testing Tools

5.4.1 ThunderClient Extension of VS Code

This extension provided a convenient tool for API testing directly within VS Code, enabling developers to validate API endpoints and responses efficiently.

5.5 AI Technology

5.5.1 Google Gemini AI

- A multimodal AI model developed by Google, capable of understanding text, images, and videos.
- Works through APIs for integration into applications, including AI-powered question generation.

5.6 Key Feature Implementation

5.6.1 User Authentication System

To ensure that only authorized users can access the platform, SmartQGen implements a secure login and signup system. Teachers and administrators can create accounts and log in using their credentials. Session management is also implemented to prevent unauthorized access, ensuring data security and controlled system usage.

5.6.2 Syllabus and Previous Question Upload

Users can upload syllabus documents in PDF format, which serves as the foundation for question generation. Additionally, users can upload previous question papers for reference. Instead of traditional OCR-based text extraction, SmartQGen uses the Google Gemini API to process the content from uploaded documents, ensuring accurate text extraction and efficient syllabus interpretation.

5.6.3 AI-Based Question Generation

The core functionality of SmartQGen is AI-driven question generation. Using the Google Gemini API, the system automatically generates KTU-based questions based on the uploaded syllabus. The questions are structured as:

- 10 three-mark questions per module
- 2 seven-mark questions per module

Users can choose the difficulty level (Easy, Medium, or Hard), ensuring that the generated questions align with their specific needs. Since the questions are generated dynamically, no questions are stored in the database, maintaining a fresh set for each request.

5.6.4 Question Editing and Review

After generating the questions, users can review and edit them before finalizing. This feature ensures flexibility, allowing modifications for better clarity or correctness. If needed, users can also regenerate the questions to get a new set.

5.6.5 Question Paper Export

Once the questions are finalized, the system allows users to download the question paper in PDF format. The exported question paper is properly formatted, including numbering and spacing, making it directly usable for exams without requiring further editing.

5.6.6 User-Friendly Web Interface

SmartQGen provides an intuitive and responsive web interface that ensures a seamless user experience. The interface is designed with:

- Easy navigation for teachers to upload syllabus and generate questions.
- Responsive design, making it accessible on desktops and mobile devices.
- Simple controls to select difficulty levels and edit questions efficiently.

5.6.7 Security and Performance

To maintain high performance and security, SmartQGen incorporates several optimizations:

- API Key Authentication: Ensures secure access to the Google Gemini API.
- Optimized processing to handle syllabus documents efficiently without delays.
- No database storage for generated questions, reducing the risk of data leaks.

5.6.8 API Testing and Debugging

To ensure smooth functionality, Postman is used for API testing. All API interactions, including question generation and syllabus processing, are tested thoroughly for performance and error handling. The system also includes error handling mechanisms to manage failed API requests and avoid crashes.

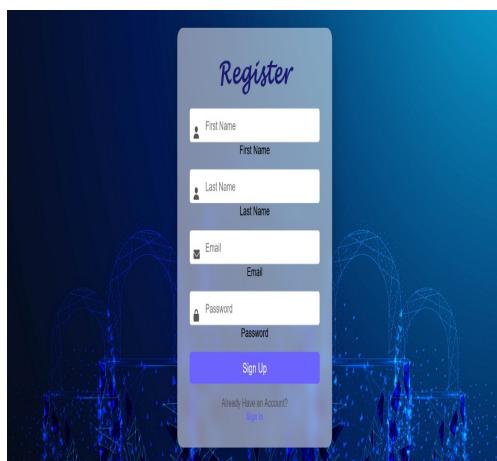
Chapter 6

Results

The Results section outlines the outcomes of the ShopEase project, highlighting the successful implementation and performance of key features.

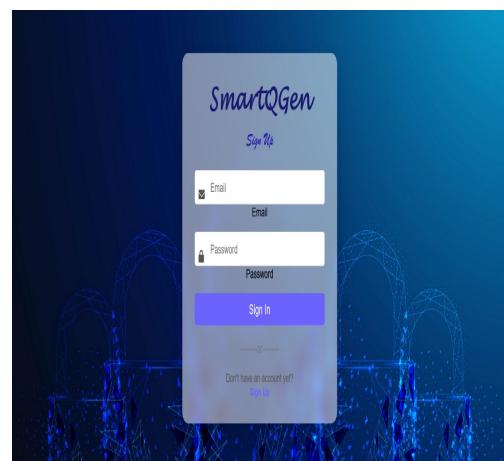
6.1 Authentication Section

The system implements a secure authentication mechanism, ensuring that only authorized users can access the platform. Users are required to log in using their credentials before uploading syllabus content or generating question papers. The authentication process is managed using PHP and MySQL, storing user credentials securely.



The registration page is titled "Register". It contains four input fields: "First Name", "Last Name", "Email", and "Password". Below these fields is a blue "Sign Up" button. At the bottom, there are links for "Already Have an Account?" and "Sign In".

(a) Registration Page



The login page is titled "SmartQGen". It has two input fields: "Email" and "Password", each preceded by an icon. Below the fields is a blue "Sign In" button. At the bottom, there is a link for "Don't have an account yet? Sign Up".

(b) Login page

Figure 6.1: Authentication Pages

6.2 Normal User Section

Normal users, such as teachers and exam coordinators, can access the platform to upload syllabus details, select difficulty levels, and generate question papers. The user-friendly interface (HTML, CSS, JavaScript) allows smooth interaction with the system. After uploading the syllabus, the AI model (Google Gemini AI) processes the content and generates structured question papers based on predefined difficulty levels. Users can download the generated papers in PDF or Word format for further use.

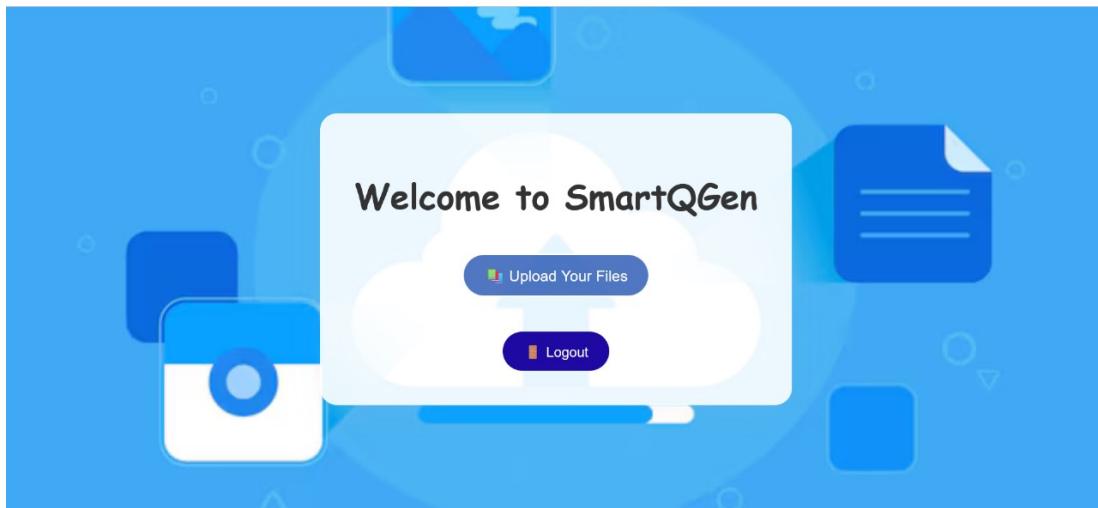


Figure 6.2: SmartQGen Homepage

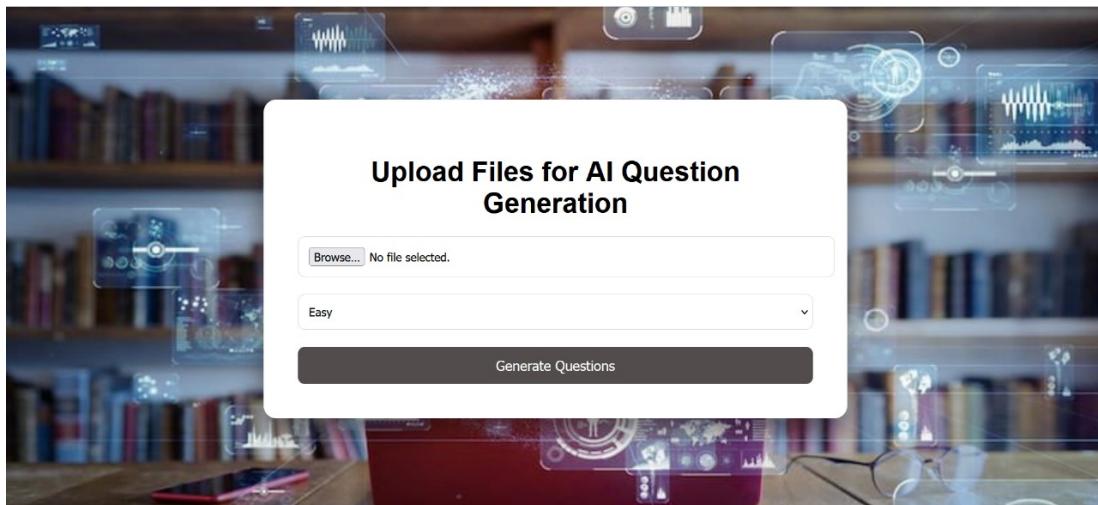


Figure 6.3: Syllabus Upload and Difficulty Selection

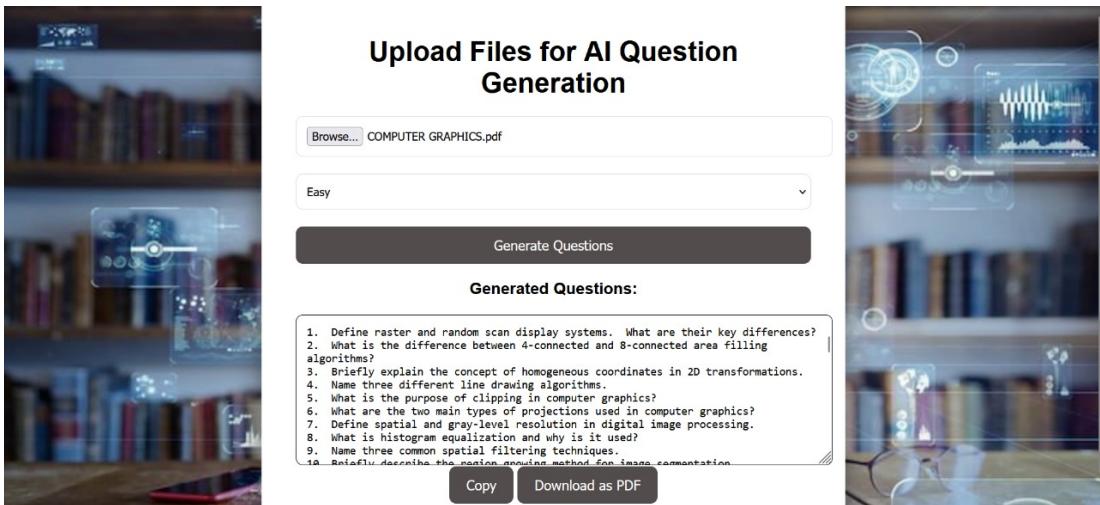


Figure 6.4: Question Generation

<p>Generated Question Paper</p> <p>Here are some easy three-mark and seven-mark questions based on the provided syllabus. Remember that "easy" is subjective, and the actual difficulty might vary depending on student background.</p> <p>**10 Three-Mark Questions:**</p> <ol style="list-style-type: none"> 1. Define raster and random scan display systems. What are their key differences? 2. What is the difference between 4-connected and 8-connected area filling algorithms? 3. Briefly explain the concept of homogeneous coordinates in 2D transformations. 4. Name three different line drawing algorithms. 5. What is the purpose of clipping in computer graphics? 6. What are the two main types of projections used in computer graphics? 7. Define spatial and gray-level resolution in digital image processing. 8. What is histogram equalization and why is it used? 9. Name three common spatial filtering techniques. 10. Briefly describe the region growing method for image segmentation. <p>**Seven-Mark Questions (Two per module):**</p> <p>**Module 1: Basics of Computer Graphics and Algorithms**</p> <ol style="list-style-type: none"> 1. Describe the working principles of a raster scan display system. Compare and contrast it with a random scan display system, giving examples of their respective applications. 2. Explain the DDA line drawing algorithm in detail. Illustrate with an example, highlighting the steps and the use of integer arithmetic for improved efficiency.

Figure 6.5: Generated Question Paper

Chapter 7

Conclusion And Future Work

SmartQGen is an innovative AI-powered question paper generator designed to automate the creation of KTU-based question papers efficiently. By integrating Google Gemini API, the system dynamically generates module-wise questions based on the uploaded syllabus, eliminating the need for manual question selection. Users can select difficulty levels (Easy, Medium, Hard), edit questions, and download the final question paper in PDF format , ensuring flexibility and ease of use.

The system enhances efficiency, accuracy, and adaptability in academic question paper generation, reducing the workload for educators while maintaining a structured and syllabus-oriented approach. With a user-friendly web interface and secure API integration, SmartQGen provides a seamless experience without the need for database storage of generated questions, ensuring data privacy and fresh content generation for every session.

Future Work

While SmartQGen successfully automates question paper generation, several enhancements can be implemented to further improve its capabilities:

- Multilingual Question Generation– Expanding support for multiple languages to cater to a broader range of users.
- Adaptive AI-Based Question Selection – Enhancing AI to generate questions based on user feedback and difficulty analysis.
- Integration with Learning Management Systems (LMS) – Allowing direct export and usage of generated questions in online assessments.

- Support for Additional Question Types – Including multiple-choice questions (MCQs), fill-in-the-blanks, and descriptive questions for more diverse assessments.
- Advanced Formatting Customization – Enabling users to modify question numbering, fonts, and styles in the generated PDF.
- Enhanced AI Training – Using more advanced AI models to generate even more refined and syllabus-specific questions.
- Cloud-Based Storage Collaboration – Allowing teachers to save, share, and collaborate on question papers online.

With these future enhancements, SmartQGen aims to evolve into a comprehensive AI-powered educational tool, offering more intelligent, customizable, and efficient question paper generation solutions for educators worldwide.

References

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