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An Intelligent Question Paper Generator System Using Blockchain Technology

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Abstract
The rapid growth of digital education has increased the demand for secure, efficient, and automated examination systems. Traditional question paper preparation is time-consuming and vulnerable to leakage and manipulation. This paper presents an Intelligent Question Paper Generator using Artificial Intelligence and Blockchain technology. The proposed system uses Natural Language Processing and large language models to automatically generate questions from uploaded syllabus documents based on Bloom's Taxonomy levels (L1–L5). Faculty members review and approve the generated questions, which are then securely stored in an immutable blockchain ledger using SHA-256 cryptographic hashing to ensure integrity and authenticity. The system automatically formats examination papers according to university standards and exports them as secure PDF files. Experimental results show that the system significantly reduces manual effort while improving security, transparency, and consistency in examination management.

Keywords: *Question Paper Generation, Artificial Intelligence, Bloom's Taxonomy, Blockchain, Educational Technology, Security.*

1. Introduction
The examination system is a fundamental component of educational institutions, playing a vital role in evaluating student learning outcomes. However, traditional question paper preparation methods are largely manual, requiring faculty members to spend considerable time selecting, organizing, and formatting questions from multiple sources. This process is not only time-consuming but also prone to human error, inconsistencies in question difficulty, and lack of systematic cognitive-level distribution. With the advancement of Artificial Intelligence (AI) and Natural Language Processing (NLP), automated content generation has gained significant attention in educational technology. AI-based question generation systems can analyze academic materials and generate relevant questions efficiently. When combined with Bloom's Taxonomy, such systems can ensure balanced assessment across multiple cognitive levels, ranging from basic recall to higher-order thinking skills. Despite these advantages, purely AI-driven systems may raise concerns regarding content accuracy and reliability without human supervision. At the same time, ensuring the security and integrity of examination materials remains a major challenge. Question papers are often stored in centralized systems or local storage, making them vulnerable to unauthorized access, tampering, and leakage. Blockchain technology, with its decentralized and immutable ledger, offers a promising solution for securing sensitive academic data. By storing cryptographic hashes of approved questions, blockchain ensures tamper-proof storage and transparent auditability. Motivated by these challenges, this paper proposes an Intelligent Question Paper Generator using Artificial Intelligence and Blockchain technology. The proposed system integrates AI-based question generation, Bloom's taxonomy-driven classification,

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human-in-the-loop validation, and blockchain-based secure storage. This integrated approach aims to reduce manual workload, improve assessment quality, and enhance security and transparency in modern examination management systems. [1]

This paper proposes a unified system that integrates:

- AI-based question generation
- Bloom's taxonomy-based cognitive classification [2]
- Blockchain-based secure storage

The objective is to design a scalable, secure, and intelligent examination system that modernizes question paper generation while preserving academic integrity. [3]

2. Ease of Use

The proposed Intelligent Question Paper Generator is designed with a strong emphasis on usability, ensuring that users with minimal technical knowledge can operate the system efficiently. The web-based interface provides a clean and intuitive dashboard for administrators, faculty members, and students, allowing each user to access only the features relevant to their role. Simple navigation, clearly labeled modules, and step-by-step workflows reduce the learning curve and make the system easy to adopt in academic environments. Faculty members can upload syllabus or lecture notes in PDF format through a straightforward upload interface. The system automatically extracts content and generates questions without requiring manual configuration or technical intervention. Generated questions are displayed in an organized manner, categorized by Bloom's Taxonomy levels, enabling faculty to quickly review, edit, or approve them. This significantly simplifies the question preparation process while maintaining academic control. Administrative tasks such as user management, subject configuration, and blockchain verification are also made user-friendly through dedicated dashboards. Visual indicators and logs allow administrators to verify question integrity and track system activities easily. Automated question paper formatting further reduces effort by generating ready-to-use PDFs that conform to institutional standards, eliminating the need for manual editing. For students and guest users, ease of use is achieved through secure access to year-wise question papers and study materials. The structured layout and search-friendly design enable quick retrieval of required documents. Overall, the system's simple interface, automation-driven workflows, and minimal user intervention ensure a smooth and efficient user experience for all stakeholders. [4]

3. Related Work

Automated question generation has been widely explored in educational technology, particularly with the advancement of Artificial Intelligence and Natural Language Processing. Early systems relied on rule-based and template-driven approaches, which were limited in scalability and adaptability. Recent studies show that Large Language Models (LLMs) such as GPT-4 and Cohere, Procine can generate high-quality descriptive and multiple-choice questions directly from academic content. However, purely generative models often suffer from hallucination and may produce questions that are not strictly aligned with the syllabus, raising concerns about academic reliability. To address this limitation, Retrieval-Augmented Generation (RAG)[1] has been introduced in educational applications. RAG-based systems retrieve relevant syllabus content before generating questions, significantly improving factual accuracy and syllabus compliance. Research demonstrates that hybrid approaches combining RAG with In-Context Learning[2] further enhance question diversity and alignment with Bloom's Taxonomy levels. These methods enable better coverage of cognitive skills but often lack structured mechanisms for assessment validation and long-term content management. Several studies have also focused on Bloom's taxonomy-based assessment, proposing automated methods to classify questions into cognitive levels. While these approaches achieve reasonable accuracy, they are frequently applied as post-processing steps and require substantial manual verification. Human-in-the-loop frameworks have been shown to improve the quality of higher-order questions, highlighting the importance of faculty involvement in AI-assisted examination systems. In parallel, blockchain technology has been investigated for securing examination data. Blockchain-based systems use cryptographic hashing and immutable ledgers to prevent unauthorized modification and ensure transparency. Although these systems

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effectively address security concerns, they generally do t integrate intelligent question generation or pedagogical frameworks. The proposed system addresses these gaps by combining AI-driven question generation, Bloom's taxonomy-based classification, human validation, and blockchain-based security into a unified examination management platform. [4]

4. Existing System

The current existing system is faculty members manually select and compile the questions from previous papers and course materials.Question papers are stored locally or on shared network devices with minimal version control. In the present existing system may lead to human errors like spelling mistakes, bloom's taxonomy not balanced and also leads to data leakages. So in order to overcome this limitation we prosed a system called intelligent question paper generator using blockchain technology.in the proposed system we introduced some modules they are given below. [5]

5. Proposed System Architecture

The current existing system is manual process creation of question paper generation, which the question papers are generated by previous papers, lecture notes and materials which leads to human errors and data leakages. In order to overcome these challenges, we proposed a system called Intelligent Question Paper Generator using Block Chain Technology. The proposed Intelligent Question Paper Generator System is designed as a modular, secure, and scalable architecture that integrates Artificial Intelligence, Bloom's Taxonomy, Blockchain security, and Cloud services. The architecture ensures automated question generation, faculty-driven validation, secure storage, and standardized question paper generation. [6] The proposed system consists of the following key modules:

5.1. Content Upload Module

Faculty upload syllabus or lecture notes in PDF format through a secure interface. The system validates and extracts textual content using PDF parsing tools. [7]

5.2. AI Question Generation Module

Extracted text is processed using NLP and LLMs to generate questions. The system applies prompt engineering and retrieval techniques to ensure relevance and accuracy. [8]

5.3. Bloom's Taxonomy Classification Module

Generated questions are categorized into Bloom's levels (L1–L5), ensuring balanced assessment across cognitive skills. [9]

5.4. Administrative Review Module

Faculty or administrators review, edit, and approve questions to ensure academic quality. [10]

5.5. Block chain Storage Module

Approved questions are hashed using SHA-256 and stored in a blockchain ledger, ensuring tamper-proof storage. [11]

5.6. Question Paper Generation Module

The system automatically assembles questions into JNTUK 1a–10b format and exports them as secure PDFs. Figure 1 shows Over all Workflow diagram

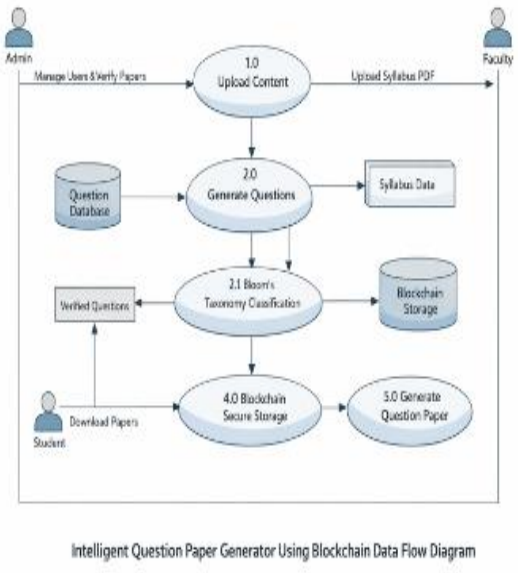

Figure 1 Over all Workflow diagram

6. System Implementation

The system is implemented using Python and Flask for backend development. Firebase Firestore is used for structured data storage and authentication. AI-based question generation is powered by large language models integrated through APIs. Blockchain functionality is implemented using a custom cryptographic ledger to store hashes of approved questions. The frontend is developed using HTML, Tailwind CSS, and JavaScript, providing role-based access for administrators, faculty, and

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students. PDF generation is handled using Report Lab, ensuring standardized and secure document output. (Figure 9)

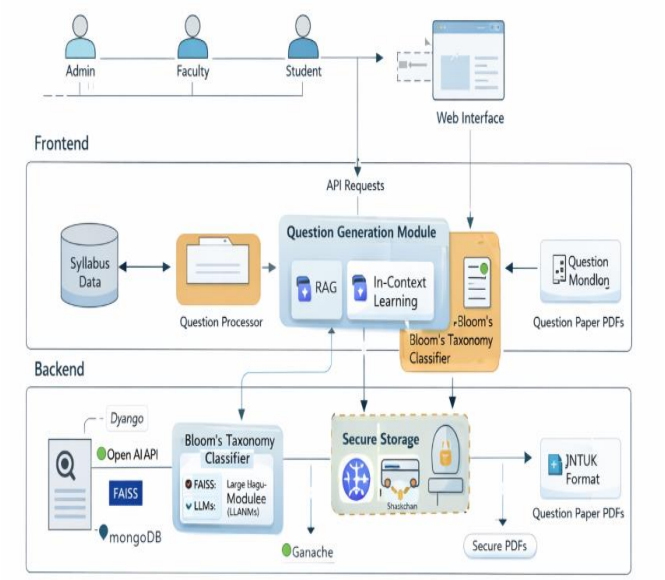

Figure 2 System Implementation diagram

7. Results and Discussion

The results of our project is given below.

Figure 3 Admin Dashboard

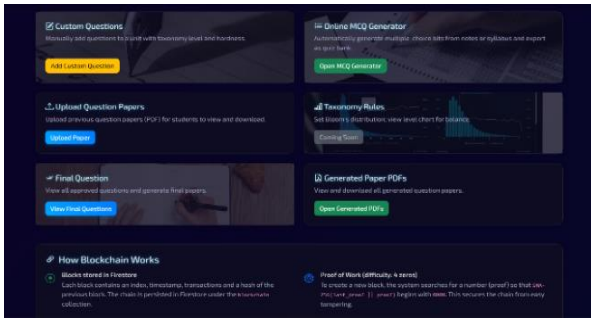

Figure 4 Admin Dashboard

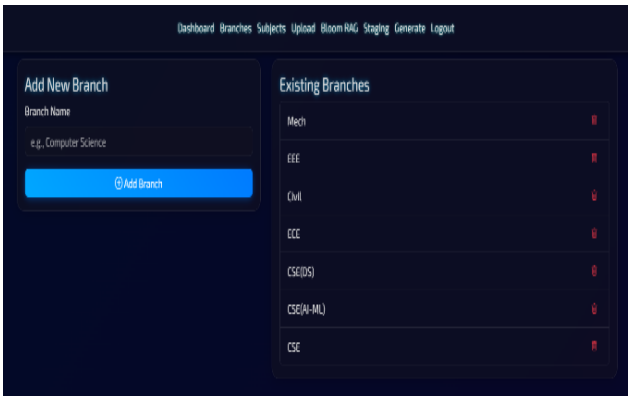

Figure 5 Branch Table

The proposed Intelligent Question Paper Generator using Blockchain was successfully implemented and evaluated using real syllabus documents. The system efficiently generated syllabus-aligned questions across Bloom's Taxonomy levels (L1–L5) with minimal human intervention. Faculty validation confirmed good question quality, with only minor edits required, resulting in a significant reduction in manual effort. [12]

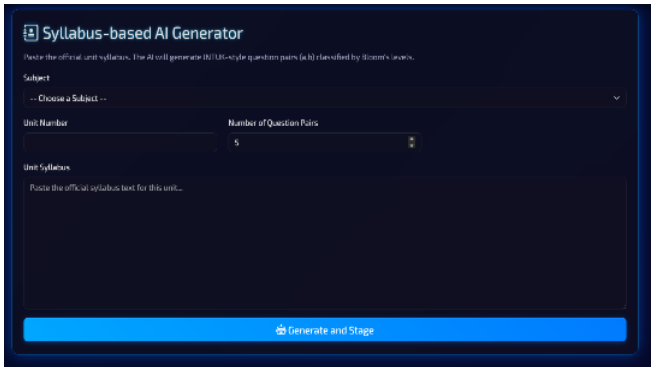

Figure 6 Syllabus -Based AI Generator

By clicking the "Analyze" button, the system automatically extracts text from the document and uses AI to generate syllabus-based questions without any manual effort. Each question is classified according to Bloom's Taxonomy levels (L1–L6) to ensure balanced cognitive assessment. Faculty can review, edit, approve, or reject the generated questions through a smooth interface. Approved questions are securely stored using blockchain-based hashing, and the system can automatically generate a complete question paper in the prescribed format as a downloadable PDF. [13]

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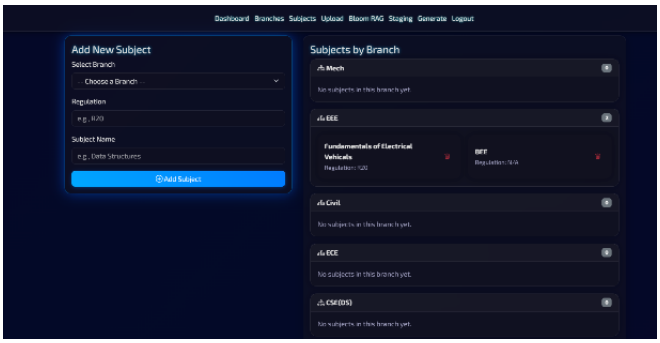

Figure 7 Subject Table

Figure 8 AI Generator

Figure 9 Review Questions

Approved questions were securely stored using SHA-256–based blockchain hashing, ensuring tamper-proof and verifiable storage. The system accurately generated question papers in the JNTUK standard format and exported them as secure PDF files. Overall, the results demonstrate improved efficiency, consistency, security, and transparency compared to traditional manual examination systems.

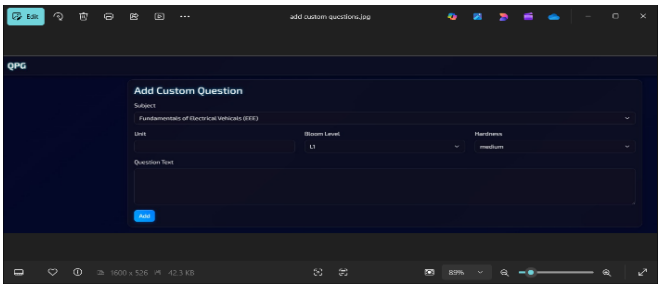

Figure 10 Add Custom Questions

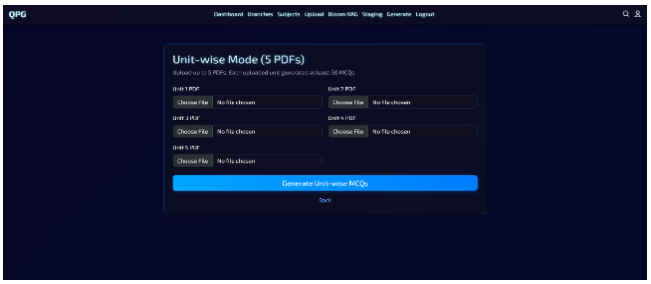

Figure 11 Unit Wise Mode

Figure 12 MCQ Generator

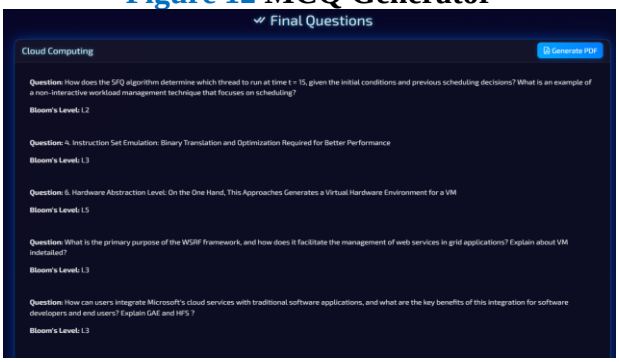

Figure 13 Final Questions

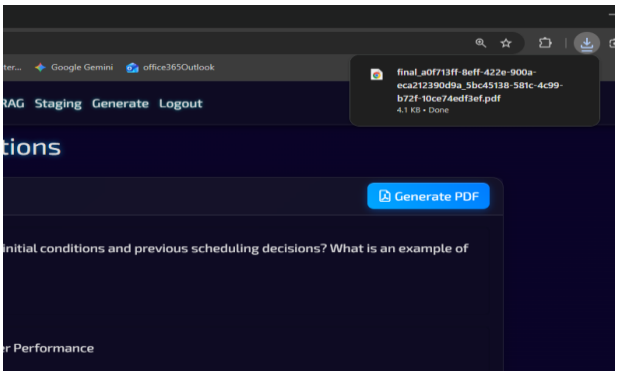

Figure 14 Final Output

The proposed system architecture comprises multiple interconnected modules designed to support intelligent question paper generation and administration. The Admin Dashboard (Sections 3.1 and 3.2) serves as the central user interface for

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administrators to manage core operations, including creating question papers, generating MCQs, and uploading previous question papers for reference and reuse. Sections 3.3 and 3.5 represent the Subject and Branch Management modules, which display the number of available branches and subjects and organize content accordingly, while Section 3.4 focuses on a syllabus-based question generator that aligns generated content with predefined curricular structures. Section 3.6 extends this capability by integrating syllabus-based AI-driven question generation using Cohere and Procine tools to automate and enhance question creation. Section 3.7 provides a review and staging environment where generated questions can be verified, edited, and approved before finalization. Section 3.8 allows administrators to manually add custom questions to ensure flexibility and domain-specific accuracy. Section 3.9 supports MCQ PDF uploads and automatically extracts and generates MCQs from uploaded documents. Finally, Section 3.10 consolidates all selected and approved questions into a finalized question paper, which is generated and exported in PDF format, completing the end-to-end workflow for intelligent assessment content creation. From Figure 2 to 14 the starting to ending process is showed.

Conclusion

This project successfully presents an Intelligent Question Paper Generator using Artificial Intelligence and Blockchain technology that addresses key challenges in traditional examination systems. By automating question generation from syllabus-based content and classifying questions according to Bloom's Taxonomy, the system ensures balanced cognitive assessment while significantly reducing the time and effort required for question paper preparation. The integration of a human-in-the-loop review mechanism maintains academic quality by allowing faculty to validate and refine AI-generated questions. Furthermore, the use of blockchain-based SHA-256 hashing provides secure, tamper-proof storage of approved questions, ensuring data integrity, transparency, and protection against unauthorized modification. Automated formatting and secure PDF generation further enhance the reliability and consistency of examination papers. Overall, the proposed system offers a scalable, secure, and user-friendly solution suitable for modern educational institutions. By combining automation, pedagogical structure, and strong security measures, the project establishes a future-ready framework for examination management and opens opportunities for further enhancements such as multilingual support, advanced analytics, and smart contract-based automation.

- Multilingual question generation
- Smart contract-based automation
- Advanced analytics for question quality assessment

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