

AI-Generated Online Examination

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Abstract—The AI-Generated Online Examination System is an intelligent web application that aims to automate and improve the conventional examination process by employing artificial intelligence techniques. The AI-Generated Online Examination System shows how the whole process of performing an examination, such as test creation, question generation, conducting an examination, and analyzing results, can be done in a single and closed-loop system. The main aim of the development of the AI-Generated Online Examination System is to demonstrate how AI can be effectively integrated with online examination systems. The application uses a renewed front-end stack that consists of React JS and Tailwind CSS implemented in TypeScript. It also uses Next.js for the backend.

The role played by artificial intelligence within this system is major as it offers functionality for auto-generation of questions and intelligent evaluation and AI-assisted invigilation services for detecting abnormal activities during an exam. The descriptive and subjective responses are analyzed with the help of Natural Language Processing techniques to provide unbiased and equal scores to students. The entire data from the exam session, including user information and results, is saved and processed within a MongoDB database. The system provides functionality to run independently without human invigilation assistance.

In this research work, a detailed description of the proposed AI-based online examination system has been incorporated in the article. The report will act as a reference or guideline for research scholars as well as developers who are trying to implement artificial intelligence in online examination systems.

Keywords—Artificial Intelligence, Online Examination System, Automated Question Generation, AI Based Evaluation, Natural Language Processing, Intelligent Proctoring, React JS, Next.js, TypeScript, MongoDB, Web Based Assessment, Educational Technology

I. INTRODUCTION

Artificial Intelligence (AI) has undergone rapid development from being merely a computer-aided tool to becoming an innovative technology with the

ability to perform complex tasks automatically. In the education sector, AI has received various accolades and recognitions for its ability to provide novel means to improve teaching and learning techniques. Being one of the most prominent sectors that have drastically transitioned due to these advancements is the examination sector, mainly due to prevailing drawbacks such as human opinion and scalability in conducting examinations through conventional means.

The conventional online examination portal, although convenient and user-friendly, has its shortcomings since the portal depends on fixed question databases and human monitoring. Problems like impersonation, the use of external resources, the delay in processing results, and the inconsistency in the evaluation of the descriptive answers have remained common. The problem has been worse due to the increased use of the online learning program. Aims to resolve these issues, a new *AI-Generated Online Examination System* will be introduced in this research to develop a compelling online platform for investigation and implementation purposes.

The proposed system utilizes the concept of question generation using Artificial Intelligence, smart proctoring, and evaluation to ensure equity, accuracy, and scalability during assessment. The proposed system is able to process and mark subjective answers to questions using Natural Language Processing.

The system is architected as a functional academic prototype to validate the practical use cases for AI in online examinations. It is composed of an updated frontend that uses React JS and Tailwind CSS with TypeScript and an AI-assisted Next.js backend for authentication, exam setup, and evaluation. The system uses a centralized database for storing data related to examinations and AI support for monitoring and performance functions.

The main aim of this system is to be used as a reference implementation for researchers, educators, and AI application developers interested in AI-powered examination platforms. By addressing those fundamental AI-application interaction loops like exam generation, proctoring, evaluation, and analysis, the proposed system gives a reproducible and extendable platform for those interested in exploring AI-powered online examination platforms. The proposed system, discussed in this paper, describes system architecture, design decisions, and AI approaches, thus forming a good foundation for further research and implementation of AI-powered examination platforms.

II. LITERATURE SURVEY

Sharma et al. (2021) investigated the application of large-scale language models in adaptive question generation during online testing. The authors were able to illustrate how AI-enabled systems can be utilized for creating adaptive questions according to the performance and learning needs of participants, thus making AI-enabled examination systems capable of personalized testing. The authors also pointed out issues concerning diversity during question generation in AI-enabled examination systems, which are very essential. The work serves as a pedestal for automating question generation in AI-enabled examination systems. [1]

A comparative study between human-written and AI-written multiple-choice questions in programming education was performed by Doughty et al. in 2021. It was concluded that learning objectives-aligned AI-written Multiple Choice Questions have the capability to produce equal-quality results compared to human-written Multiple Choice Questions. This research indicates the possibility of applying AI models to develop an automated question-writing system. This contributes to the model development of the AI-driven exam system.

Wecks et al. (2024) also investigated the effects that the use of generative AI can cause on the performance of students during examination periods and discovered some demerits related to the overdependence on AI tools. The empirical data obtained supports the need for prudent AI adoption in examination systems that prevent any negative effects that could hamper learning processes because of the adoption of AI technology. [3]

Kale et al. (2024) performed a survey of online exam software utilizing AI technology for intelligent monitoring and objective assessment. The authors emphasized the capabilities of AI-based solutions involving advanced computer vision and natural language processing algorithms in regards to malpractice prevention, as well as the assessment of subjective answers. The topic of AI-based online exam proctoring solutions again proves relevant. [4]

Wroblewska et al. (2024) analyzed the psychometric properties of question-answer tests designed by AI technology using item response theory and user opinion. The study demonstrated that question-answer tests designed by AI technology have the potential for high levels of discrimination and optimal difficulty similar to human-designed question-answer tests. This study proves the validity and use of AI technology-designed exams in academic assessment systems. [5] Rao et al. (2023) offered a detailed insight into the automated assessment question generation system based on supervised machine learning algorithms. The authors were engaged with different machine learning models such as decision tree models, support vector machine models, and neural network models for the purpose of question generation based on the curriculum. This research focus includes the integration of Natural Language Processing with supervised models for improved semantic significance and linguistic accuracy of questions. This research work has offered considerable insight for AI question generations regarding online assessment systems. [6]

Das et al. (2023) carried out a comprehensive survey on the state of the art in automatic question generation and automatic evaluation of answers. The authors have analyzed the existing approaches to the task that date back to the classical era of rule-based systems as well as the new trends associated with deep learning and transformer Encoder-Decoder models such as BERT and GPT. The authors stressed the capabilities of neural approaches to estimate the quality of the description responses based on semantic similarity and meaning comprehension. The results of the authors directly confirmed the applicability of the evaluation mechanisms based on NLP within AI-assisted online testing systems. [7]

A study carried out by Zeghouani et al. in 2022 focused on the feasibility and impact on education processes of using questions generated with the

help of Artificial Intelligence in educational setups. The experiment was carried out on both students and lecturers to assess the relevance, clarity, and educational impact of the automatically generated educational questions in academic assessment tools. The findings confirmed the ability of automatically generated questions to considerably lower the workload in education while upholding educational quality. [8]

III. PROPOSED SOLUTION

The proposed study introduces a system designed and developed using AI technology to conduct online exams with the aim of automation of the whole exam process by combining various AI solutions. The proposed system will help eliminate the shortcomings of the traditional exam system by offering a safe, scalable, and smart platform to conduct exams, monitor, analyze, and evaluate results with minimal human interference. The nucleus of this proposed solution lies in an examination engine powered by Artificial Intelligence, which can automatically generate and process examination questions. This examination engine employs Artificial Intelligence algorithms for automatically formulating examination questions with certain predefined variables like topic, level of difficulty, syllabus, and desired learning objectives. In the case of subjective and descriptive-type questions, this engine employs NLP tools for evaluating the answers submitted by the candidates and marking them on certain predefined criteria.

The application consists of a web-based implementation with a modular design. The frontend design, which has been developed using React JS and TypeScript with Tailwind CSS, ensures role-based access for administrators, instructors, and students. The instructors have the ability to create and manage exams, and the students have the facility to access and attempt exams securely using the user interface. The backend design, which has been developed using Next.js, handles authentication, exam scheduling, processing, and interaction with the AI-based evaluation modules. A central database has been designed to store the credentials of users, exams, responses, and results securely.

For academic integrity, a proposed solution incorporates AI-based proctoring technologies that monitor student activity during an exam. The

technologies check for possible wrong-doing based on facial presence, eye movement, tab switching, and irregular activity patterns. The exam activity and alert system of a proposed solution helps instructors address student activity when academic dishonesty is suspected.

The key functionalities below have been integrated into the proposed system:

- **AI-Based Question Generation:** It is able to create questions based on difficulty levels, subjects, and learning outcomes.
- **Automated Evaluation:** It applies AI and NLP processes in determining correct and subjective replies.
- **Intelligent Proctoring:** This feature allows the system to monitor student activity during an exam.
- **Secure User Authentication:** Supports role-based access control for administrators, lecturers, and students.
- **Performance analytics:** Enables the generation of comprehensive performance reports for students and classes.

With the integration of automation, intelligence, and security features, the proposed system for the AI-generated online examination system is efficient and reliable for the assessment process conducted within both academic and professional settings

IV. MOTIVATION OF PROPOSED SYSTEM

The existing systems for ticket sales for current events use a conventional QR code and barcode-based validation systems. However, these have a number of shortcomings. They include the possibility of counterfeiting of the tickets, the lack of transparency with regard to the ownership of the tickets, and the management of the secondary markets. The centrally administered system means that the users of the services and the organizers put their trust in the middlemen, which leads to a number of issues.

For the purpose of secure and efficient ticketing, it is the need of the hour to make sure that the authenticity verification of the ticket is done instantly and the transfer of ownership is smooth between the involved parties. Unfortunately, the current infrastructure does not make use of the technology available to ensure the authentication of the ownership as well as make the records tamper-proof in an instant.

These challenges become more pronounced in large-scale events where manual tracking and reconciliation of ticket issuance, resale, and usage are inefficient, error-prone, and hard to scale. Blockchain provides a decentralized, immutable ledger that can permanently record ownership of a ticket and transaction history. Each ticket can be represented uniquely on-chain using Non-Fungible Tokens (NFTs) based on established standards like ERC-721, which guarantees authenticity, traceability, and duplication or tampering resistance.

The motivation for this system is to investigate how such a decentralized NFT-based ticketing framework can address these limitations with a minimalistic and developer-accessible approach to make it easily possible to develop and experiment with. By running on a local Ethereum development environment, this system can focus on core Web3 concepts without all the complexity of production deployment.

- Programmers can prototype NFT ticketing systems quickly and iterate on the workflow with a local development environment for a blockchain such as Hardhat.

This can save the expenses and latency associated with public chain deployments.

- The wallet integration service offered by MetaMask facilitates secure signing and authentication of transactions through user accounts within the blockchain.

V.METHODOLOGY

The existing ecosystem for event tickets has been dependent on a centralized system for the management of issuance, verification, and secondary sales of tickets using a proprietary database. However, this model has associated issues such as unclear ownership, issues with ticket fraud, lack of control over the secondary sales, and the need for third-party intermediaries. To eliminate these associated problems, the proposed system will utilize a decentralized approach that integrates blockchain-based ownership verification and a smart contract-based logic running on a local Ethereum dev environment.

System Architecture and Environment Configuration: A system is implemented as a decentralized application (dApp) on the local blockchain network based on the Ethereum platform

using the Hardhat toolset. In this context, the local blockchain network operates in such a manner that it mimics the entire mainnet network without any expenses, latency, or risk that would be experienced on the mainnet network upon its deployment. In addition, the pre-funded accounts offered by the Hardhat toolset help to simulate the role of various individuals involved in the system like the event organizer or the ticket purchaser.

Smart Contract Design and Implementation: The heart of the system is the Solidity smart contract that realizes the ERC-721 Non-Fungible Token standard using OpenZeppelin’s carefully reviewed and securely implemented libraries. In the smart contract, the events are fixed, and the contract facilitates the creation of non-fungible tickers for the fixed events. The tickers are unique on-chain assets that have proven ownership and provenance on the blockchain. Ticket information is kept on-chain and retrievable using the smart contract function tokenURI such that the information can be directly accessed from the wallet application, such as MetaMask, without the need for any storage solutions such as IPFS.

In order to avoid the possibility of a fraudulent re-use, the agreement keeps a boolean flag used for each ticket, to be updated by authorized event organizers to indicate ticket redemption upon entry. The basic functionality of an ERC-721 transfer is kept intact to enable secure ticket transfer between wallets.

Frontend Development and Wallet Integration: In terms of the frontend application, it has been implemented using React with TypeScript for enhanced type safety and maintainability. Vite has been utilized for efficient application bundling. In regard to user interface functionality, users can

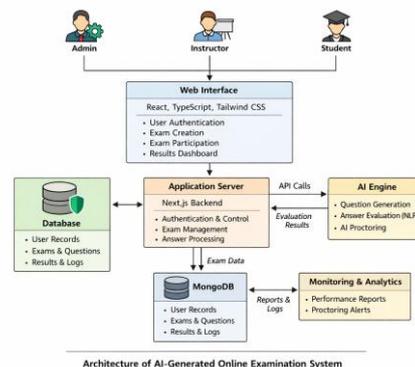


Fig. 1. Architecture Diagram

view various events, buy NFT tickets through the invoking of smart contract functions, view owned tickets, and transfer tickets to different wallet addresses.

Communication in the blockchain component is achieved through the use of ethers.js v6. MetaMask is incorporated in the solution to enable wallet connections, signing of transactions, as well as user authentication in line with the EIP1193 provider. The user interface acts in a dynamic manner in relation to changes in the blockchain state and confirmations of transactions to offer a timely user response in relation to the results of the transactions and ticket ownership.

Testing, Deployment, and Scalability: Considerations Comprehensive testing of the scripts is carried out through the Hardhat testing framework to enable the automation of smart contracts. Testing scenarios range from ticket minting, transferring, and usage to deeper edge situations to ensure reliability. The advantage of the local blockchain lies in the ability to debug and re-run the tests.

Although the proposed system is intended mainly for local development and learning purposes, it is still extendible. With little modifications, it is possible to deploy the smart contract and the frontend onto public Ethereum testnets, mainnet, and Layer-2 scaling solutions. This will give it more feasibility and scalability for use with real-life event ticketing systems.

VI.SYSTEM ANALYSIS

A. Architecture Diagram

Fig. 1 shows the architecture of the AI-Generated Online Examination System, realizing the interaction between system components that take part in exam creation, conduction, monitoring, evaluation, and result generation. The system architecture design ensures the system is modular, layered for scalability and security, and efficient in data flow across the platform.

- The Web-Based Frontend Interface provides a means of interaction for all users. Using the latest web development technology, the frontend provides functionality such as exam setup, student enrollment, taking an exam, and viewing results. This can be accessed

through a user- friendly interface.

- User requests from the Frontend are routed to the Back- end Application Server, which is developed by using Next.js. Backend functionality includes authentication, role-based access control, management of exam scheduling, data validation, and management of AI evaluation modules.
- The AI Processing Module This module is involved in the auto-generation of some questions to the students. This process makes use of AI. This module undertakes the task of descriptive answers and identifies irregularities when students take exams. This module makes use of Natural Language Processing.
- All crucial data like user details, examination information, question banks, student responses to questions, and results will be stored in a centralized Database Server. Secure data storage will ensure data integrity and easy data retention for examination purposes.
- Throughout the examination process, the Proctoring and Monitoring Component is responsible for monitoring student activities, such as session activities, which are then highlighted in cases where anomalies are noticed by the backend system.
- The backend analyses results of evaluation returned from the AI module and provides performance analytics, which are then relayed back to the frontend for display to instructors and students.
- The end results such as grades, feedback, and analytics outputs are delivered by the system frontend, making it transparent while ensuring the safe handling of data during the whole process of the examination.

B. System Workflow

The AI-Generated Online Examination System does not follow an intricate process for the management of the examination in an automated or secure environment.

Step 1: Exam Setup The instructor can design the exam by providing information such as the subject matter, number of questions, difficulty level, time limit, and marks.

Step 2: Student Login The students log into the system through their registered credentials to sit for the examination.

Step 3: Question generation The system uses AI to produce questions based on the configuration of

exams.

Step 4: Exam Attempt Students access the examination process via the online interface provided within the stipulated time limit.

Step 5: Monitoring It also monitors student activities in the examination process to ensure exam integrity.

Step 6: Submission Answers are entered automatically when the form is finished or when the time for the exam runs out. Step 7: Evaluation and Results The system analyses the answers and provides results, which can be viewed by the students and lecturers.

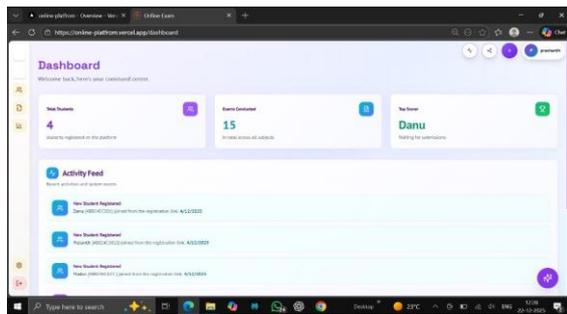


Fig. 2. Analytics Dashboard Showing Overall Examination Statistics

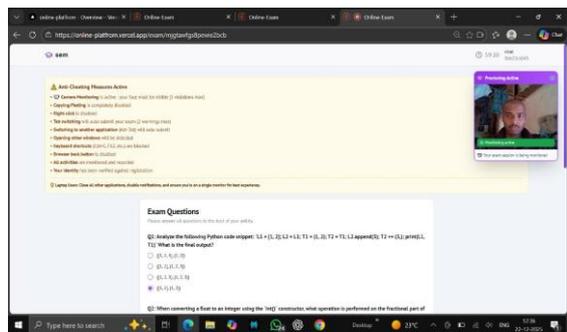


Fig. 3. Cheating Detection and Integrity Monitoring Report

VII.RESULT

A. Analytics Dashboard

Fig. 2 shows the analytics dashboard of the AI-Generated Online Examination System. It provides a real-time summary of registered students, total exams conducted, completed submissions, and average performance percentage, enabling instructors and administrators to evaluate overall system usage and student performance.

B. Cheating Detection Report

Fig. 3 displays the cheating detection report generated by the system. Students flagged for suspicious activities such as tab switching are

highlighted along with exam details, scores, and timestamps. This feature contributes to preserving examination integrity.

C. Live Examination and Proctoring

Fig. 4 illustrates the live examination interface with active AI-based proctoring. Anti-cheating mechanisms such as keyboard shortcut blocking, tab-switch detection, and camera monitoring are enforced. The proctoring panel verifies student identity and monitors behavior throughout the examination.

D. Dashboard and Activity Feed

Fig. 5 presents the main dashboard displaying recent activity logs, registered students, exams conducted, and top performers. The activity feed records system events and student registrations in real time, providing transparency and efficient monitoring for administrators.

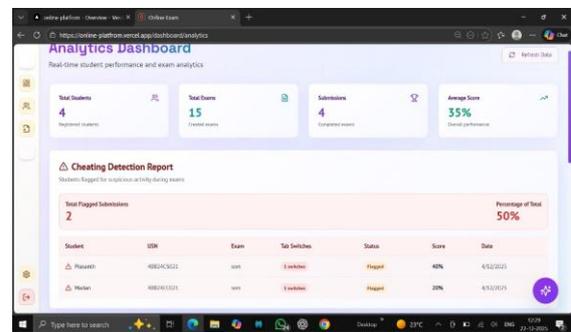


Fig. 4. Live Examination Interface with AI-Based Proctoring

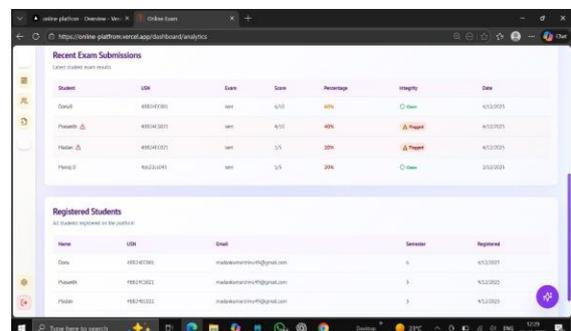


Fig. 5. Admin Dashboard Showing Student Activity and System Events

VIII.CONCLUSION

The AI-Generated Online Examination System offers a comprehensive and standalone solution for intelligent examination system implementation to automate and enhance the conventional examination process. The system concentrates on the primary

interactions between the interface component and AI modules and focuses on making the examination process more manageable and accurate for administrators, teachers, and candidates alike.

The system proves the feasibility and efficacy of examination AI solutions. This is because the system uses various AI technologies like Artificial Intelligence, Natural Language Processing, React JS, TypeScript, Next JS, and MongoDB. This ensures that the system is free from human errors and biases as a result of automated question generation, AI-assisted evaluation, and intelligent monitoring. Additionally, authentication and handling of data in real time enhance the accuracy and authenticity of the system.

Despite the fact that the existing implementation is de-veloped as a research prototype, it still lays a solid ground for further improvements with respect to advanced proctoring technology integration, adaptive testing, development for the mobile app, and massive scalability. In summary, the AI-Generated Online Examination System is a reference prototype for the development of online examination systems that are secure, scalable, and intelligent based on AI technology.

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