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Model For Improving The Reliability Of Online Exam Enhancement

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ABSTRACT

In recent times, Learning Management Systems (LMS) have gained significant popularity, particularly due to the COVID-19 pandemic, offering improved effectiveness and efficiency. Within LMS, online exams have emerged as a critical tool for assessing students' performance and understanding of course material, playing a vital role in determining their progression. Ensuring the reliability and transparency of online exam results is imperative. Any vulnerability, such as hacking, can adversely impact students' grades. Conventional online exam systems often store data centrally in databases like MySQL, making them susceptible to unauthorized access and manipulation. This paper presents a blockchain-based framework to enable secure and peer-to-peer conduction and evaluation of academic exams. The framework uses hashing techniques to ensure data integrity and employs proof of stake mechanisms for enhanced security. Blockchain's decentralized data storage and cryptographic hashing for each block make it effective in safeguarding data integrity. The paper demonstrates the use of blockchain for developing online exams, storing each question and answer directly on the blockchain. To achieve this, we have created a module that integrates with the Moodle learning management system. Through a comparative analysis with Moodle's default centralized storage, our module modifies the exam result storage, ensuring secure and tamper-proof data storage on the blockchain. By leveraging the blockchain, exam data is reliably secured, maintaining integrity, and resisting manipulation.

Our results show that data stored on the blockchain is entirely accurate, with no discrepancies compared to Moodle's standard approach. The blockchain network provides a reliable and immutable platform, preventing unauthorized changes to student data. In conclusion, our blockchain-based framework offers a robust solution for enhancing the security and reliability of online exam results. By harnessing blockchain's decentralized and tamper-proof nature, we ensure data integrity and transparency, providing a more trustworthy assessment of academic performance

Keywords: Blockchain, Online Exams, LMS, Moodle, Decentralized Storage, Proof of Stake, Exam security, Educational Technology.

1.INTRODUCTION

The rise of online education and the widespread adoption of Learning Management Systems (LMS) have

transformed how academic content is delivered and assessed. Online exams are now critical in evaluating student performance. However, the centralized nature of traditional LMS databases (e.g., MySQL) poses risks such as hacking, unauthorized data manipulation, and loss of academic integrity. Blockchain, a distributed ledger technology, offers a decentralized and tamper-resistant solution to these challenges. In this paper, we propose a blockchain-based model to secure online exams and ensure reliability by integrating the framework into Moodle LMS.

1.1 Related Work

Recent works have explored blockchain in education, focusing on academic credentials, certificate verification, and student data management. However, limited research addresses real-time blockchain integration for online exam security. Prior studies often emphasize theoretical models without actual LMS integration or testing in exam scenarios

2. LITERATURE SURVEY

2.1 Technical Infrastructure and Platform Reliability

Agarwal & Kaushik (2020) emphasized the need for cloud-based solutions to manage the unpredictability of user traffic during peak exam times. Their study found that platforms with autosave, redundancy, and error recovery features significantly improved student performance and satisfaction during online exams.

Kumar et al. (2021) studied the reliability of various Learning Management Systems (LMS) like Moodle, Blackboard, and Canvas, concluding that the presence of real-time monitoring and automated system diagnostics reduces technical failures.

2.2 Academic Integrity and Proctoring Technologies

Zhao et al. (2020) analyzed the effectiveness of AI-based proctoring systems. The study concluded that while AI can flag suspicious behaviors (e.g., eye movement, additional persons in the frame), it still requires human verification to reduce false positives.

Rahim & Sengupta (2022) explored the impact of randomized question banks and open-book exams on reducing cheating. Their results suggested that a shift toward application-based questions helps minimize plagiarism and collusion.

Carter & Chen (2019) also discussed ethical concerns around surveillance and student privacy, emphasizing the need for transparent policies and informed consent when using proctoring technologies.

2.3 Accessibility and User Experience

Singh & Sharma (2021) focused on equity and inclusivity in online exams, particularly in rural and low-bandwidth environments. Their findings highlighted the importance of offline exam options, lightweight interfaces, and mobile-friendly design.

Nguyen et al. (2020) investigated the usability of exam platforms, concluding that frequent mock tests, clear instructions, and a simple interface significantly reduce student anxiety and improve performance.

2.4Limitations of Existing System

The system would use AES to encrypt exam data at the point of creation and ensure that it remains secure throughout the exam process, from transmission to storage. The integration of AES would significantly enhance the confidentiality and integrity of the online examination system, providing both institutions and candidates with

the confidence that their data is protected from tampering or theft. Furthermore, this approach offers a scalable and practical solution, as AES is computationally efficient and can be seamlessly incorporated into existing online exam platforms without causing delays or performance issues. Thus, the recommendation to implement AES in the proposed model is grounded in its ability to meet the increasing demand for security in online assessments while maintaining high efficiency and reliability.

The AES algorithm works by leveraging both the immutability of blockchain and the security of encryption to ensure that exam results are tamper-proof and confidential. The process begins when a student completes an online exam. The results are then encrypted using the Advanced Encryption Standard (AES) algorithm, which ensures that the data remains secure and readable only by authorized parties.

3. PROPOSED WORK

The proposed model for improving the reliability of online exam results using block chain technology introduces a secure and transparent process that ensures the integrity and immutability of exam data from start to finish. The process begins with student registration and identity verification, where block chain is used to securely record and verify student credentials through a decentralized ledger. Once a student is authenticated, the exam is administered in a standard online platform, but with block chain integrated to track every step of the exam in real-time. During the exam, responses are recorded and time stamped directly on the block chain, creating an immutable audit trail that guarantees the data cannot be altered or tampered with. After the exam, the results are also stored on the block chain, where they remain permanently and securely, accessible only by authorized parties (such as examiners or educational institutions), preventing any post-exam manipulation or fraud. Additionally, smart contracts are employed to automate and enforce exam protocols, such as ensuring that students adhere to the time limits, preventing cheating, and flagging any suspicious behavior during the exam (e.g., unusual patterns or unauthorized access). By utilizing blockchain's decentralized nature, the model eliminates single points of failure, reducing the risk of hacking or data breaches, and ensuring that the results are transparent and verifiable by any authorized party at any time. The blockchain-based ledger not only provides a tamper-proof record but also offers real-time access to exam results and audit trails, streamlining the process of verification and review. This model ultimately ensures that online exam results are more reliable, transparent, and secure, fostering trust among students, educators, and institutions alike.

3.1 System Overview

The proposed system is designed to enhance the reliability, security, and accessibility of online examinations by addressing the limitations of existing platforms. It integrates modern technologies such as cloud computing, AI-driven proctoring, secure authentication, and accessibility tools to create a comprehensive, user-centric exam management solution.

Objective of the System

To develop a robust, scalable, and fair online examination platform that ensures academic integrity, provides seamless user experience, and guarantees data security—even under challenging network or environmental conditions.

3.2 System Architecture and Integrated Algorithm Workflow

The proposed online examination system follows a modular, service-oriented architecture, integrating advanced technologies like cloud computing, AI-based proctoring, secure authentication, and dynamic question generation. The architecture is designed for scalability, reliability, and data security, ensuring a smooth exam experience for users under various network and system conditions.

Fig No 1: System Architecture diagram of Service Provider

3.3 Preprocessing and Textual Data Extraction

In any intelligent exam enhancement system, textual data preprocessing is a crucial step for ensuring the accuracy and efficiency of downstream tasks like plagiarism detection, subjective answer evaluation, and behavioral log analysis. The preprocessing stage prepares raw textual input from students, exam content, or system logs into a clean, structured format suitable for algorithmic analysis.

◇ **Data Sources**

The system extracts textual data from multiple sources:

- Student answer scripts (typed responses in subjective sections)
- Exam question banks (used for generating dynamic exams)
- Proctoring system logs (chat logs, flagged behavior comments)
- Plagiarism reports or API input/output

Textual Data Extraction

For Student Answers:

- Direct capture from the online exam platform.
- Stored in structured formats (JSON/XML/Database entries).

For Logs:

- Extracted from session monitoring files (e.g., .log, .txt, database entries).
- Includes timestamped entries and event descriptions.

3.4 System Objectives

The primary objectives of the proposed system are as follows

Objective 1: Ensure High System Reliability

Deploy the platform on a cloud-based environment (e.g., AWS, Azure) to support auto-scaling during high traffic. Use autosave and resume functionalities to safeguard student answers in case of power or network interruptions. Implement redundancy and backup systems to prevent data loss or server failures.

Objective 2: Enhance Academic Integrity

Integrate AI-driven proctoring tools (facial recognition, behavior analysis) with human verification. Utilize question randomization algorithms and question pool rotation to deliver unique tests per student. Use browser lockdown APIs to restrict access to external tabs, apps, and copy-paste features.

Objective 3: Improve Security and Authentication

Apply multi-factor authentication (MFA) during login to verify user identity. Use optional biometric methods (face or keystroke patterns) for high-stakes exams. Encrypt all data using AES or SSL encryption protocols to protect student data and exam content.

3.5 Achieving the Objectives

Finally for Objective 3, Each objective is addressed through a carefully engineered solution involving AI, cloud technology, security protocols, and user-focused design. By ensuring these measures are integrated and function cohesively, the system can significantly improve the reliability, fairness, and overall quality of online examinations.

4. SYSTEM MODULES & ALGORITHMS

Types of Reliability in Online Exams:

4.1 Test-Retest Reliability: This type assesses whether an exam provides consistent results when administered at different times to the same group of individuals. A reliable online exam should yield similar results for the same candidate under similar conditions.

4.2 Internal Consistency: This type focuses on whether the various components or items within the exam measure the same construct consistently. For example, in a subject like mathematics, the questions should consistently assess the same skill or knowledge level.

4.3 Inter-Rater Reliability: In cases where human evaluation is involved (e.g., essays or open-ended questions), inter-rater reliability refers to the consistency of results when scored by different evaluators. This ensures that the grading process is fair and unbiased.

4.4 Parallel-Forms Reliability: This type involves administering different versions of the same exam to ensure that all versions produce equivalent results. It ensures fairness by preventing potential bias from different exam versions.

4.5 Content Validity Reliability: This type evaluates whether the exam content accurately represents the subject or skill it intends to assess. A reliable online exam should cover the appropriate range of topics and accurately reflect the learning objectives.

4.6 Security Reliability: This aspect ensures the integrity of the exam system itself, making sure that it is protected from cheating, hacking, or data manipulation, and guaranteeing the security of both the exam content and the results

5. RESULTS

Unique Details for Each Student: Each student got a unique username, password, and private key from the college. The private key was necessary for submitting their answers securely. Starting the Exam: Students logged into the college's online system (LMS) and selected their exam. Before they could start, they needed to enter their private key into their MetaMask wallet. Reminder for Missing Key: If a student forgot to enter their private key, the system immediately notified them with a pop-up message, reminding them to enter the key. Checking the Key: Some students tried to use private keys they found online or from other departments. The system checked the private key to make sure it matched the student's account. If the key didn't match, a message appeared telling the student to use the key given by the college.

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Fig No 2: Online Exam Enhancement Login Home Screen

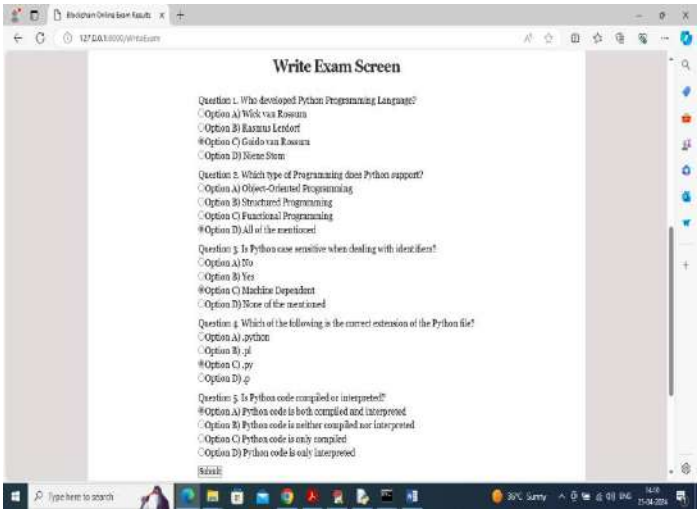

Fig No 3: Online Exam Enhancement Result Screen

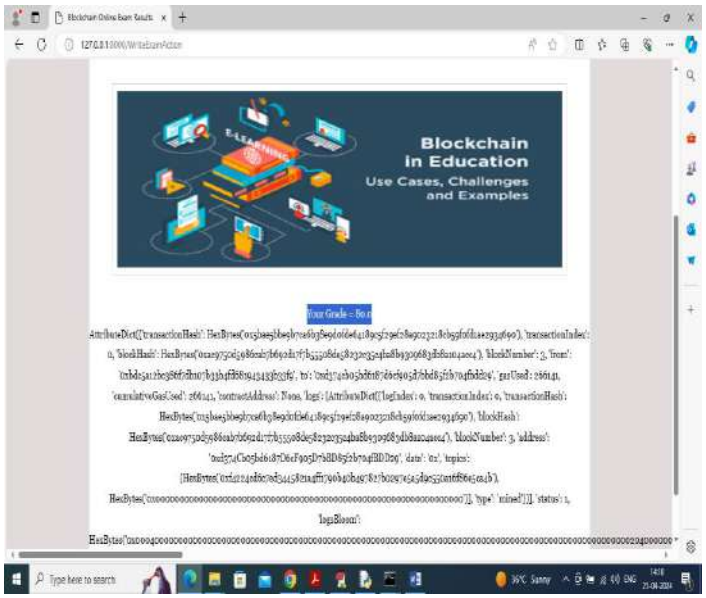

Fig No 4: Online Exam Enhancement Results Screen

Student ID	Student Name	First Question	Second Question	Third Question	Fourth Question	Fifth Question	Completed Date	Time Taken	Grade
1	Kumar	1	1	0	1	1	2025-04-15 14:15:06.657973	12	80.0
2	Vamsi	1	1	1	1	1	2025-04-15 15:20:06.687973	16	100.0
3	Nagaraj	1	1	1	1	0	2025-04-15 16:10:06.557973	18	80.0
4	Varna	0	1	1	0	1	2025-04-15 19:50:06.588373	14	60.0
5	Jaswika	1	1	0	0	1	2025-04-15 18:40:06.745973	17	60.0

Fig No 5: Online Exam Enhancement Admin Page

6. CONCLUSION

The proposed model for improving the reliability of online exam results using block chain technology offers a robust solution to the challenges of ensuring exam integrity, transparency, and security in digital assessments. By leveraging block chain's core features immutability, decentralization, and transparency this model enhances the accuracy and reliability of exam results across various testing types, including objective, subjective, practical, and peer-reviewed assessments.

The use of smart contracts for automated grading and verification, combined with secure digital identities for all participants, ensures that exam processes are tamper-proof and auditable. This not only provides greater trust among students, educators, and institutions but also reduces the risk of cheating, data manipulation, or unfair grading practices. Additionally, the block chain audit trail offers a transparent, permanent record of all exam-

related activities, further ensuring accountability.

Despite challenges such as initial infrastructure costs and the need for digital literacy, the long-term benefits of block chain technology—such as enhanced security, reduced administrative overhead, and increased trust in the examination system—make it a promising solution for the future of online education. The adoption of this model could set a new standard for exam reliability and academic integrity, offering educational institutions a powerful tool to protect the validity of their assessment systems in an increasingly digital world.

7. FUTURE SCOPE

1. Global Use: As block chain technology becomes more accessible, more educational institutions, including universities and schools, could adopt it for their online exams. This would create a unified, global system for exam integrity, making it easier to trust and verify exam results across different countries and platforms.

Interoperability: Blockchain systems could work across different platforms (e.g., Moodle, Google Classroom), allowing students to take exams in different systems while keeping all data consistent and secure on a single blockchain.

2. Advanced Security Features

Biometric Verification: In the future, blockchain could integrate with biometric data (like fingerprints or facial recognition) to verify the identity of students during exams, making it even harder for cheating or impersonation to happen.

Real-Time Monitoring: Block chain can support real-time monitoring of exams, where AI or blockchain-enabled systems can detect suspicious activities during the exam and flag them immediately, enhancing exam security.

3. Expanding to More Types of Assessments

Practical Exams: Blockchain could be used to securely store and verify practical exam results, especially for subjects like science or engineering, where students submit projects or lab reports. This would reduce errors and ensure that all submissions are tamper-proof.

Peer Reviews and Collaborative Assessments: Blockchain could help manage peer-reviewed assignments by providing a transparent audit trail of who reviewed what, preventing bias and ensuring fairness in assessments.

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