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Paper Leakage Prevention Using Blockchain

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Abstract - *In today's world, online and digital exams are becoming more common, but many still face problems like question paper leaks, data tampering, and unfair result manipulation. These issues make it difficult to fully trust the current examination systems. To solve this, a new approach using blockchain technology can make exams more secure, transparent, and reliable. Blockchain is a digital ledger that stores data in a way that cannot be changed or deleted, ensuring every action in the exam process is recorded safely. The proposed Blockchain-Based Secure MCQ Examination System uses this technology to manage exams from question creation to result declaration. Each step—such as setting questions, submitting answers, and grading—is securely stored as a blockchain transaction. Smart contracts automatically check and grade answers, ensuring fairness and accuracy without human interference. This eliminates the need for a central authority and prevents manipulation. Overall, the system makes the entire examination process trustworthy, efficient, and tamper-proof for schools, universities, and certification bodies*

Key Words: **Blockchain Technology, Decentralized Architecture, Smart Contracts, Data Integrity, System Transparency, Immutable Ledger, Automated Evaluation, Secure Assessment, Cryptographic Validation, Tamper Resistance**

1.INTRODUCTION

In the modern digital education system, online examinations have become a common mode of assessment due to their convenience and scalability. However, many traditional online MCQ (Multiple Choice Question) examination systems still face major challenges such as data tampering, question paper leaks, unauthorized access, and manipulation of results. These issues raise concerns about fairness, transparency, and trust in the examination process. To overcome these problems, this project introduces a Blockchain-Based Secure MCQ Examination System that ensures transparency, immutability, and security throughout the examination process. The system uses blockchain technology to record every event, such as question creation, exam sub mission, and result generation, as a secure transaction on a distributed ledger. Smart contracts are used to automate grading and ensure that once data is recorded, it cannot be altered or deleted. This decentralized and tamper-proof structure eliminates the risk of unauthorized access or manipulation, ensuring a fair and trustworthy examination experience for both students and examiners

2. LITERATURE SURVEY

2.1 Transforming Education Through Blockchain: A Systematic Review of Applications, Projects, and Challenges — Wang et al. (2025)

- Provides a broad review of blockchain applications across various educational processes.
- Highlights benefits such as transparency, data integrity, and decentralized record storage.
- Limitation: Does not address online examination workflows, automated grading, or question paper security.
- Relevance: Establishes the overall potential of blockchain but lacks a targeted solution for examination management.

2.2 Blockchain-based Solutions for Education Credentialing System: Comparison and Implications for Future Development — Li, Liu, and Yu (2022/2023)

- Focuses on blockchain for secure academic credential verification.
- Compares public and private blockchain models for certificate authenticity and tamper resistance.
- Limitation: Scope is restricted to credential verification; does not handle exam data, leakage prevention, or automated evaluation.
- Relevance: Shows strong use of blockchain in authentication but exposes the need to extend it into exam security frameworks

2.3 The Use of Blockchain Technology in the Educational Domain — IEEE Blockchain 2023 Proceedings

- Presents multiple blockchain applications in educational environments, including assessment platforms and secure record-keeping.
- Emphasizes smart contracts and decentralized storage to enhance transparency.

- Limitation: Most contributions remain conceptual or partially implemented; lack a complete, end-to-end exam security and evaluation model.
- Relevance: Indicates promising directions but highlights that a fully integrated examination workflow is still missing.

2.4 Practices of Using Blockchain Technology in e-Learning — Lin et al. (2021)

- Demonstrates practical use of blockchain for authentication, learning activity tracking, and secure content distribution.
- Shows how decentralized verification improves trust and accountability in e-learning.
- Limitation: Provides limited discussion on exam security, question paper leakage prevention, or automated MCQ evaluation.
- Relevance: Reinforces the usefulness of blockchain in learning systems but underscores the need for comprehensive examination-focused solutions

Table -1: Comparison of Literature Survey

SRNO	AUTHOR	FOCUS	LIMATIONS
1	Wang et al. (2025)	Blockchain in overall education	No focus on exams, automated grading, paper security
2	Li, Liu & Yu (2022/23)	Credential verification using blockchain	Only on credentials; no exam security or evaluation
3	IEEE Blockchain Proceedings (2023)	Blockchain in educational platforms	Mostly conceptual; not end-to-end solution
4	Lin et al. (2021)	Blockchain in e-learning systems	Limited exam security, no auto evaluation

3. THEORETICAL BACKGROUND

3.1 Blockchain-Based Examination Framework

The theoretical foundation of the proposed system lies in the integration of blockchain technology with online examination processes to ensure transparency, immutability, and decentralization. Traditional online examination platforms rely on centralized databases where question papers, student credentials, and results are stored on single servers. Such systems are prone to unauthorized access, data alteration, and internal manipulation, resulting in compromised examination integrity.

The blockchain-based framework addresses these challenges by distributing examination-related data across a peer-to-peer network. Each transaction—whether it involves question paper creation, encryption, result generation, or verification—is recorded as a block in the chain. These blocks are cryptographically linked, making retroactive data modification virtually impossible. This design ensures that every examination event remains verifiable and tamper-resistant. By incorporating smart contracts, the system further automates grading and result declaration, removing the need for manual intervention and enhancing fairness across all stages of the examination process.

3.2 Blockchain Architecture and Consensus Mechanisms

At its core, blockchain operates as a distributed ledger that maintains a continuously growing list of records known as blocks. Each block contains a unique cryptographic hash, timestamp, and transactional data. The integrity of the blockchain is maintained through consensus mechanisms such as Proof of Work (PoW) or Proof of Stake (PoS), which validate transactions across all participating nodes. This decentralized validation ensures that no single entity can alter or manipulate stored data without detection.

In the proposed examination system, consensus mechanisms serve as the foundation for maintaining trust among multiple educational stakeholders. When a teacher uploads an encrypted question paper or when student responses are recorded, these actions are verified and approved by network nodes before being permanently added to the blockchain. The consensus protocol thereby eliminates single points of failure and guarantees that all examination transactions remain authentic and transparent throughout the process.

3.3 Smart Contracts and Cryptographic Encoding Mechanisms

Smart contracts are self-executing digital agreements stored on the blockchain that automatically enforce predefined conditions. In the context of this study, smart contracts manage examination operations such as paper release scheduling, access authorization, and automated grading. Once deployed, these contracts function autonomously, ensuring that no participant can manipulate or bypass the examination rules. This automation reduces human bias and enhances the fairness and reliability of evaluations.

Cryptographic encoding mechanisms form the second crucial layer of security within the framework. Advanced algorithms such as SHA-256 are used to generate hash values for every uploaded question paper and submitted answer, creating an immutable digital fingerprint. These hashes prevent duplication, unauthorized modification, or deletion of stored data. Combined with blockchain's distributed nature, cryptographic encoding ensures end-to-end confidentiality, authenticity, and non-repudiation of all examination activities foundation of the proposed blockchain-based examination system is built upon three core principles: decentralization, automation, and cryptographic security. The distributed ledger structure eliminates the vulnerabilities of centralized systems by providing immutable data storage and transparent validation. Smart contracts enable autonomous and rule-based execution of examination tasks, while cryptographic hashing secures each transaction against unauthorized modifications.

Together, these mechanisms establish a robust and tamper-proof digital environment for academic institutions. The integration of blockchain technology into examination systems not only enhances trust and efficiency but also sets a foundation for future innovations such as cross-institutional verification, AI-assisted monitoring, and adaptive assessment management.

4. METHODOLOGY

The methodology begins with the creation and encryption of question papers by authorized teachers. Each paper is securely uploaded to the system, where it is encrypted to prevent unauthorized access or modification. Once uploaded, the encrypted file is converted into a blockchain transaction, generating a unique hash value that ensures the paper's authenticity and immutability. This information is then stored on a distributed ledger, making any tampering or deletion impossible.

Next, smart contracts are deployed to define the examination rules, including access control, timing, and evaluation logic. These contracts automate the process of distributing question papers only at the scheduled time and to verified users, effectively preventing early leaks or unauthorized access. During the examination, students log in through a secure portal to attempt the test. Their responses are recorded in real time and stored as blockchain transactions, ensuring the integrity and transparency of every submission.

Once the exam is completed, the smart contracts automatically evaluate the responses for multiple-choice questions. The results are calculated instantly and securely stored on the blockchain, eliminating the possibility of manual manipulation or human bias. Both teachers and students can later verify the question papers and results through their unique blockchain hash identifiers. This transparent and tamper-proof verification process ensures trust, fairness, and reliability throughout the entire examination cycle

5. MATHEMATICAL MODEL OF THE SYSTEM

5.1 Input Simplification in Model Design

The proposed Paper Leakage Prevention System Using Blockchain can be formally model as a deterministic transformation process that maps examination data into a tamper-proof blockchain ledger. The entire system can be represented mathematically as a triplet:

$$S = \{I, F, O\}$$

where:
S-represents the complete blockchain-based examination system,

I- is the set of all input parameters provided to the system,

F- denotes the set of functions or processes executed by the system, and

O-defines the verified and immutable outputs generated after blockchain processing.

The input set (I) is defined as:

$$I = \{I_1, I_2, I_3\}$$

where:

I_1 = Question paper generated by authorized teacher.

I_2 = Teacher credentials and institutional authorization data.

I_3 = Scheduled examination time and candidate access list.

Each input parameter represents a critical component of the examination process. The question paper is encrypted before being transmitted, and all access credentials are authenticated through blockchain validation to ensure security and legitimacy.

The function set (F) defines the sequence of logical operations performed by the system to transform inputs into immutable blockchain transactions:

$$F = \{f_1, f_2, f_3, f_4, f_5\}$$

where:

f_1 = Encryption Function — applies cryptographic algorithms such as AES or SHA-256 to secure the question paper before uploading.

f_2 = Blockchain Transaction Function — converts the encrypted question paper into a blockchain transaction, generating a unique hash value.

f_3 = Smart Contract Function — establishes predefined examination rules, including paper release timing and user verification.

f_4 = Distribution Control Function — ensures that question papers are accessible only to authenticated users at the scheduled time.

f_5 = Integrity Verification Function — validates the uploaded paper and detects any unauthorized modifications by comparing stored hash values.

Together, these functions form a continuous, rule-governed process that eliminates human dependency and enforces data confidentiality throughout the examination cycle.

5.2 Model Output Representation

The output set (O) defines all immutable records and validated outcomes generated by the system after the examination process is executed. It can be represented as:

$$O = \{O_1, O_2\}$$

where:

O_1 = Verified blockchain record of encrypted question paper transactions.

O_2 = Immutable audit log of question access, validation, and smart contract execution.

Each record in the blockchain is uniquely identified by a cryptographic hash, which guarantees that no paper can be altered, deleted, or redistributed without detection. The transformation relation between the sets can be expressed as:

$$F: I \rightarrow O$$
$$F(I_1, I_2, I_3) = (O_1, O_2)$$
$$F(\text{Encrypted Paper, Credentials, Schedule}) = \text{Immutable Blockchain Records and Audit Logs}$$

This mapping clearly illustrates that the input data (question papers, credentials, and timing) pass through a series of blockchain-based validation and encryption functions to produce secure, verifiable outputs stored permanently in the ledger.

5.3 Formal Summary

The complete model demonstrates that the proposed system operates as a deterministic and irreversible transformation process governed by blockchain consensus and cryptographic verification. Once a question paper is uploaded and verified, its corresponding hash value becomes immutable, ensuring that no unauthorized alteration or leakage can occur.

Formally, the overall process can be defined as:

$$S = \{I, F, O\}, \text{where} F(I) = O$$

This ensures that for every valid input and functional operation, the system consistently produces tamper-proof and verifiable outputs. By integrating blockchain's distributed validation and smart contract automation, the proposed model establishes a mathematically provable guarantee of data integrity, transparency, and leakage prevention within the examination ecosystem

5.4 Use Case Diagram Explanation

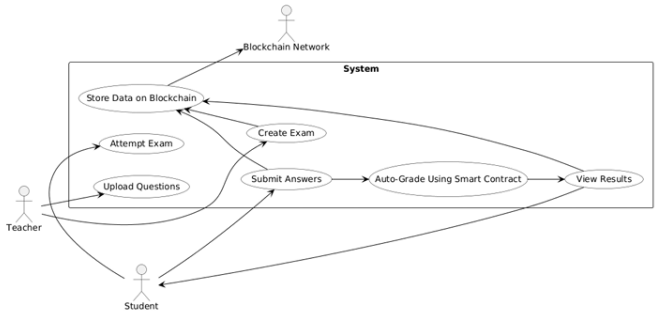

Fig-1: Use Case Diagram Explanation

This diagram is like a simple story map of the entire exam process. It starts with the teacher: they upload the questions, and those questions are immediately saved on the blockchain so nobody can ever change them. Then the teacher officially creates the exam. When the student is ready, they open the exam, answer all the questions, and hit "submit." The moment they submit, a smart little program on the blockchain automatically checks every answer, calculates the marks, and locks those marks on the blockchain forever. From that point on, neither the teacher nor anyone else can secretly alter the score. Finally, both the teacher and the student can open the "View Results" page and see exactly the same marks that are guaranteed to be real and unchanged.

5.5 Activity Diagram Explanation

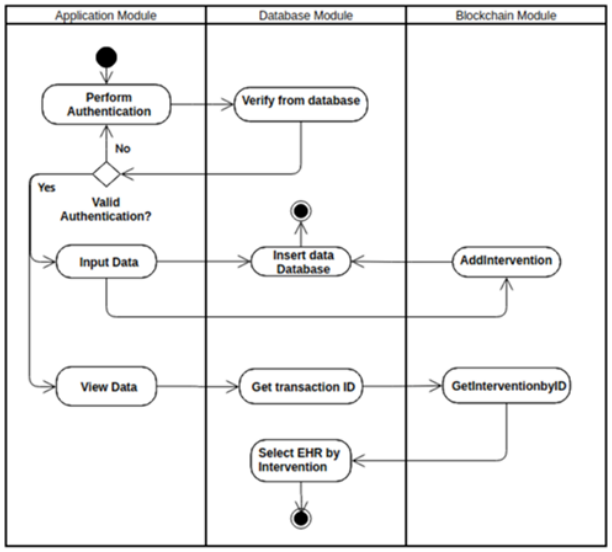

Fig-2 Activity Diagram

This diagram shows the three main parts that work together like three teammates. The first part is the app or website you actually see and click on – it's where you log in and type your answers. When you log in, it quickly asks the second part (a normal database) "Is this person allowed?" and the database says yes or no. The third and most important part is the blockchain – think of it as a giant, unbreakable notebook. All the really important stuff (the questions, your answers, and your final marks) gets written into this notebook. Whenever anyone wants to check results later, the system goes straight to the blockchain notebook, finds the page using a special ID, and shows the marks exactly as they were written the first time – no changes possible.

5.6 Sequence Diagram Explanation

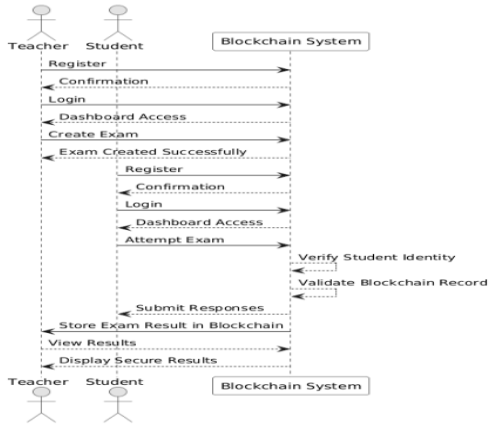

Fig-3 Sequence Diagram

The reading a text message thread between the teacher, the student, and the blockchain itself. First, both the teacher and student sign up and log in. The teacher creates an exam and the blockchain replies, "Exam created successfully!" The student signs up for that exam and gets a confirmation. When it's time to take the test, the student logs in and starts answering. As soon as they submit their answers, the system checks the student's identity, double-checks everything with the blockchain records, calculates the marks, and writes the final score onto the blockchain with a message like "Result stored forever." Later, when the teacher or student wants to see the marks, they just ask, and the blockchain sends back the exact same secure, unchangeable result for everyone to see. It's a complete, honest conversation that leaves no room for cheating or mistakes.

6. RESULTS AND DISCUSSION

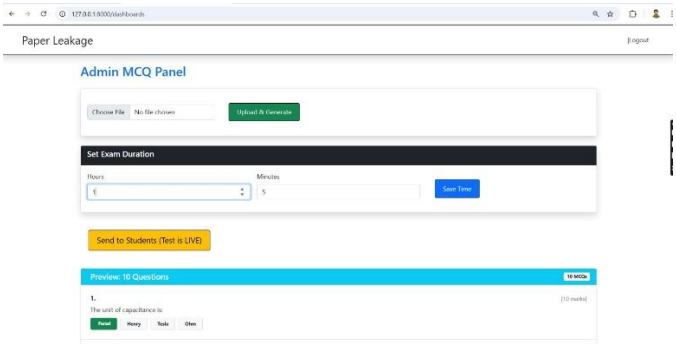

Fig-4 Admin MCQ Panel

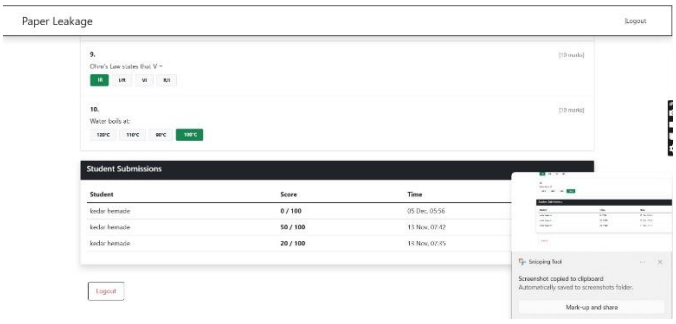

Fig-5 Dashboard

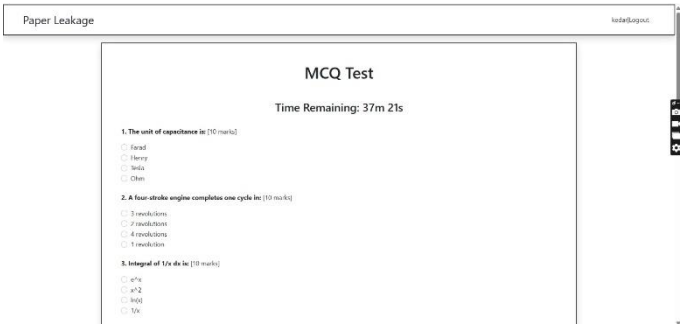

Fig-6 MCQ Test

The images collectively illustrate the key interfaces of the Blockchain-Based Examination System, showcasing the workflow from exam creation to student evaluation. The Admin MCQ Panel allows the instructor to upload question files, set the exam duration, preview the generated MCQs, and make the test live for students. Once the exam is activated, students access the MCQ Test Interface, where they view and answer questions within a time-bound environment, supported by a countdown timer that ensures strict control over exam duration. After submissions are completed, the system displays results on the Student Submissions Panel, where the admin can review each student's score and submission time along with a preview of the question set and correct answers. These interfaces together demonstrate how the platform streamlines exam generation, secure delivery, student participation, and automated evaluation in an efficient and user-friendly workflow

7. CONCLUSIONS

In conclusion, the Exam System Using Blockchain ensures secure, transparent, and immutable online examinations. It uses SHA256 hashing to store exam and result data in blockchain blocks, preventing any alteration or tampering. The Django framework simplifies system implementation and integration, while Bootstrap provides a clean, user-friendly interface. This system enhances the credibility of online assessments and provides a trustworthy examination platform for educational institutions.

REFERENCES

[1] X. Wang, M. Younas, Y. Jiang, M. Imran, and N. Almusharraf, "Transforming Education Through Blockchain: A Systematic Review of Applications, Projects, and Challenges," IEEE Access, vol. 13, pp. 13264–13284, 2025.

[2] Z. Z. Li, J. K. Liu, and J. Yu, "Blockchain-based Solutions for Education Credentialing System: Comparison and Implications for Future Development," in Proc. IEEE International Conference on Blockchain, 2022/2023.

[3] (Various authors), "The Use of Blockchain Technology in the Educational Domain," in Proc. IEEE International Conference on Blockchain, 2023.

[4] J. Lin, B. Li, L. Cui, and C. Miao, "Practices of Using Blockchain Technology in e-Learning," in Proc. 16th International Conference on Computer Science and Education (ICCSE), 2021, pp. 55–60.

[5] H. Precht, F. Schwarm, and J. M. Gómez, "Enhancing Smart Contract Quality Through Continuous Integration Pipelines," in Proc. IEEE Blockchain Conference, 2022.

[6] X. Larrucea and C. Pautasso, "Blockchain and Smart Contract Engineering," IEEE Software, vol. 37, no. 4, pp. 23–29, 2020.

[7] B. Do, V.-T. Nguyen, H.-N. Dinh, and N. Nguyen, "Blockchain for Education: Verification and Management of Lifelong Learning Data," Comput. Syst. Sci. Eng., 2022.

[8] Z. Wang, Y. Chen, and Q. Li, "Graph Neural Network Enhanced Smart Contract Vulnerability Detection for Educational Blockchain Platforms," in Proc. IEEE Blockchain Conference, 2023.

[9] A. Das and N. Roy, "Decentralized Learning Assessment System Using Blockchain," in Proc. IEEE International Conference on Blockchain, 2021.

[10] M. Li, X. Chen, and H. Li, "Decentralized Online Examination Framework Using Smart Contracts," IEEE Transactions on Learning Technologies, 2022.

[11] S. Tanwar, R. Sharma, and N. Kumar, "Blockchain-Based Framework for Examination Security," IEEE Systems Journal, vol. 15, no. 4, pp. 5671–5682, 2021.

[12] A. S. Albahri, A. A. Zaidan, and B. B. Zaidan, "Blockchain-Based Architecture for Secure Academic Assessment," IEEE Access, vol. 10, pp. 9153–9170, 2022.

[13] R. Jayaraman and P. Mohanty, "Secure Question Paper Distribution Using Blockchain," IEEE Access, vol. 8, pp. 205720–205731, 2020.

[14] C. Manogaran, R. Varatharajan, and Z. H. Khan, "Blockchain and AI-Based Automated Student Assessment System," IEEE Access, vol. 9, pp. 124860–124872, 2021.

[15] H. Hu and W. Xie, "Optimized Decentralized Content Storage for E-Assessment Systems," IEEE Access, vol. 11, pp. 11242–11255, 2023.

[16] R. Bose and K. Ghosh, "IPFS-Integrated Blockchain Framework for Secure Examination Data Storage," in Proc. IEEE INFOCOM Workshops, 2023.

[17] X. Zheng, S. Garg, and J. Chen, "Blockchain Challenges and Opportunities: A Technical Review," IEEE Internet of Things Journal, 2020.

[18] P. Vora and M. Dave, "Secure Data Recording Using SHA-256 and Blockchain for Academic Applications," Proc. IEEE ICCSP, 2023.

[19] T. Mehta and R. Gupta, "Hash-Based Authentication for Examination Systems Using Blockchain," in Proc. IEEE International Conference on Computing, Communication and Security, 2024.

[20] L. Chen, M. Santos, and D. Park, "Design and Deployment of Decentralized Examination Portals Using Blockchain and Python," Proc. IEEE International Conference on Smart Computing, 2024.