

A Blockchain-Based Approach to Enhancing the Trustworthiness of Online Examination Results

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Abstract – The rapid growth of online classes and exams, driven by the COVID-19 pandemic, has highlighted the need for reliable and tamper-proof methods to store academic results. Traditional centralized databases, like MySQL, are vulnerable to hacking and unauthorized modifications. This paper proposes a blockchain-based framework to address these issues by leveraging blockchain's decentralized storage and tamper-resistant features. Blockchain's unique hashing technique ensures data integrity, while smart contracts facilitate secure data storage and retrieval. The framework integrates with the Moodle Learning Management System (LMS) to secure online exam results, replacing the default centralized storage with a blockchain-based solution. Our comparative analysis demonstrates that the blockchain ensures accurate, immutable, and secure exam data, offering a reliable and transparent system for assessing academic performance. This blockchain-driven approach enhances the security and credibility of online exam results, protecting them from manipulation and unauthorized access.

Keywords – Blockchain, Online Exams, Data Integrity, Decentralized Storage, Smart Contracts, Moodle LMS, Tamper-Proof, Security, Cryptographic Hashing, Proof of Stake, Academic Performance, Reliability, Transparent Assessment.

I. INTRODUCTION

The shift to online education, accelerated by the COVID-19 pandemic, has led to an increased reliance on Learning Management Systems (LMS) for conducting online classes and exams. However, a significant concern that arises with this shift is the reliability of online exam results. Traditionally, results are stored in centralized databases, such as MySQL, which are vulnerable to tampering. Internal administrators or malicious attackers can manipulate these databases, leading to unauthorized changes in exam results. As a result, ensuring the security and integrity of online exam data is critical.

To address these challenges, this paper proposes the use of Blockchain technology to manage and secure online exam results. Blockchain offers a decentralized storage solution, where data is distributed across multiple nodes. In case one node fails, the data remains accessible from other nodes, ensuring continuous availability. Additionally, Blockchain's inherent features of tamper-proof data storage and verification mechanisms make it a suitable technology for safeguarding exam results. Each record in Blockchain is stored as a block and is associated with a unique hash code. When new data is stored, the hash codes of previous blocks are verified, ensuring that any tampering with the data is immediately detectable through a hash mismatch.

The use of Blockchain in this framework ensures that online exam results are securely stored and cannot be altered without detection. Smart contracts, which are implemented using Solidity programming, facilitate the saving and retrieval of data on the Blockchain. These contracts provide an automated and secure way of handling exam data, reducing the risk of human error or unauthorized access. By incorporating Blockchain into the management of online exams, this paper presents a robust solution to improve the security, transparency, and reliability of exam results.

II. LITERATURE SURVEY

Alaa Zuhir Al Rawashdeh, Enaam Youssef Mohammed, Asma Rebhi Al Arab, Mahmoud Alara, Butheyra Al-Rawashdeh, Butheyra Al-Rawashdeh were developed A close-ended structured questionnaire was constructed to collect data from students. Frequencies and percentages were used to analyse the data collected. 81% students stated that e-learning provides scientific material in an interesting way. Similarly, 80% students have responded that e-learning increases the possibility of contact between students among themselves and between the students and the teacher. 73% students indicated that due to increasing social isolation, they spend more time in front of the technical means of social interaction account and face-to-face with others.

Zibin Zheng; Shaoan Xie; Hongning Dai; Xiangping Chen; Huaimin Wang were developed this paper presents a comprehensive overview on blockchain technology. We provide an overview of blockchain architecture firstly and compare some typical consensus algorithms used in different blockchains. Furthermore, technical challenges and recent advances are briefly listed. We also lay out possible future trends for blockchain.

Apoorv Jain; Arun Kumar Tripathi; Naresh Chandra; P. Chinnasamy were developed Decentralized Applications are the smart systems that are executed on a distributed computer network. Blockchain enables one of the most secure applications called Smart Contract. Smart Contracts are the computerized and secured distributed ledgers that enable secure, transparent, and tamper-proof transactions. Smart contracts create and verify the data with the help of hashing. It is a mathematical procedure that uses the most powerful algorithm cryptographic Hash Algorithm i.e.

SHA-256. It engenders 256-bit signature for the input text. Ethereum Blockchain Platform is a widely used platform to build the DApps.

Yuan Zhenming is developed Web-based Examination System is an effective solution for mass education evaluation. We have developed a novel online examination system based on a Browser/Server framework which carries out the examination and auto-grading for objective questions and operating questions, such as programming, operating Microsoft Windows, editing Microsoft Word, Excel and PowerPoint, etc. It has been successfully applied to the distance evaluation of basic operating skills of computer science, such as the course of computer skills in Universities and the nationwide examination for the high school graduates in Zhejiang Province, China.

Xu, Lisi; Wang, Xuan; Wu, Yilu; Li, Chaoyang; Deng, Kuirong; Yan, Zhenhua were developed the fluorinated plasticizer of POSS-DOL@PI-F constructs robust LiF-rich solid electrolyte interphases and cathode electrolyte interphases, thereby dramatically enhancing the interface stability of Li metal anodes and LiNi_{0.8}Mn_{0.1}Co_{0.1}O₂ (NCM811) cathodes. POSS-DOL@PI-F enables stable, long-term (1200 h), and dendrite-free cycle of Li||Li cells. POSS-DOL@PI-F significantly boosts the performance of Li||NCM811 cells, which display superior cycle stability under harsh conditions of high voltage (4.5 V), high temperature (60 °C), low temperature (−20 °C), and high areal capacity. This work provides a rational design strategy for safe and efficient polymer electrolytes

III. PROPOSED METHODOLOGY

This paper presents a blockchain-based framework designed to secure online exam results by integrating Blockchain's decentralized storage and cryptographic features. The system stores each exam question and answer directly on the Blockchain, ensuring that data is tamper-proof and resistant to unauthorized modifications. Blockchain's inherent verification mechanisms, such as hash codes and proof of stake, guarantee data integrity and prevent any changes to the results without detection. This decentralized approach eliminates the risks associated with centralized databases, ensuring the continuous availability and security of exam data.

The proposed solution includes the development of a module that integrates Blockchain with the Moodle Learning Management System (LMS). This module replaces the traditional centralized MySQL database with a secure Blockchain-based storage system. Smart contracts, programmed in Solidity, are used to store and retrieve exam results, adding an additional layer of security and ensuring that only authorized users can interact with the data. By utilizing Blockchain technology, this framework offers a transparent, reliable, and tamper-proof method for managing online exam results, enhancing security and trustworthiness in academic assessments.

IV. SYSTEM ARCHITECTURE

The architecture of the proposed system for securing online exam results using Blockchain consists of three key components: the User Interface (UI), Blockchain Layer, and Moodle Integration Module. The UI allows students to access and attempt exams, while administrators manage and view results. The Blockchain Layer is the core of the system, ensuring secure, decentralized storage of exam data using hashing and smart contracts, which provide verification and tamper-proof storage. The Moodle Integration Module connects the Moodle LMS with the Blockchain, replacing the centralized MySQL database with Blockchain-based storage, ensuring seamless data submission and retrieval. This architecture guarantees the integrity, transparency, and security of online exam results by leveraging Blockchain's decentralized, immutable properties.



Fig.1. Proposed Design

4.1. Admin Module

1. Login: The admin logs into the system using a predefined username and password.
2. View Registered Students: Once logged in, the admin can view a list of all registered students, which includes their details and statuses.
3. View Grades: The admin can access the grades of all students, allowing them to monitor academic performance.
4. Storage Cost Graph: The admin can view a graph displaying the storage costs for the proposed blockchain and any extensions applied, helping assess financial implications.

4.2 Student Sign-Up Module

5. Registration: Students can register in the application by providing their details and uploading their biometric information. This biometric data is stored on the blockchain for secure identification.
6. Data Storage: Upon successful registration, the student’s details, along with their biometric information, are saved in the blockchain, ensuring data integrity and security.

4.3 Student Login Module

7. Authentication: Students log into the application using their credentials and biometric image. The biometric data is compared with the stored data for authentication.

4.4 Write Exam :

After login student will write exam and then system will check if student already wrote exam then error will appear and if not appear for exam then list of questions will be displayed and then student will write exam and all details will saved in Blockchain.

4.5 View Grade:

Student can view all his grades

V. METHODOLOGY

The proposed blockchain-based framework for securing online exam results was implemented and tested using a simulated environment. The primary evaluation criteria included data integrity, security, storage costs, and system performance. Emotion Recognition in Education

1. Dataset Collection

- **Student Information Dataset:**

- Collect student details, including **Name, Roll Number, Biometric Data (Fingerprint/Face ID), and Exam Credentials.**
 - Ensure biometric data is stored securely in Blockchain during the sign-up process.
 - **Exam Questions Dataset:**
 - Use a structured dataset containing **questions, multiple-choice answers, and correct answers.**
 - Format: JSON, CSV, or SQL database before storing in Blockchain.
 - **Student Exam Records:**
 - Each student’s answers and final scores are recorded and stored in Blockchain for security and integrity.
2. Blockchain Setup & Smart Contracts Development
- **Select Blockchain Platform:** Use **Ethereum or Hyperledger Fabric** for decentralized storage.
 - **Develop Smart Contracts** using Solidity to handle:
 - Student registration with biometric authentication.
 - Secure exam storage and retrieval.
 - Grade storage and verification.
 - **Deploy Smart Contracts** using tools like **Remix IDE, Ganache (for local testing), and Truffle.**
3. Biometric Authentication System
- **Fingerprint/Face Recognition:**
 - Use OpenCV for **face recognition** or **fingerprint scanning SDK.**
 - Convert biometric data into hash format and store in Blockchain.
 - **Verification Process:**
 - Match student’s biometric data at login before allowing them to take the exam.
4. Exam Module Implementation
- **Exam Creation:** Admin adds **questions and answers** to Blockchain.
 - **Exam Process:**
 - Students log in using biometric authentication.

- Questions are retrieved from Blockchain and displayed.
 - Answers are stored securely in Blockchain.
 - **Anti-Cheating Measures:**
 - Restrict students from reattempting exams.
 - Implement **timestamp verification** to track submission time.
5. Result Storage & Tamper-Proofing
- **Grade Calculation:** Smart contracts calculate and store student scores.
 - **Tamper-Proofing:** Blockchain ensures results cannot be altered by any unauthorized user.
6. Cost Optimization Using Data Compression
- **Compression Algorithm:** Use **Lossless Compression (e.g., Huffman Encoding, Gzip)** to reduce data size before storing on Blockchain.
 - **Cost Analysis:** Implement a **storage cost comparison module** to analyze **compressed vs. uncompressed** data storage.

RESULT

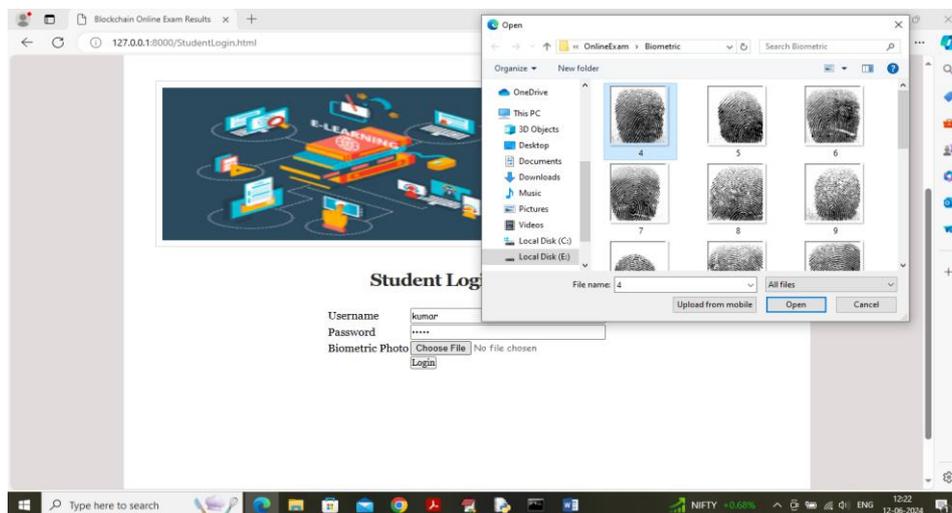


Fig 2. Student Login page

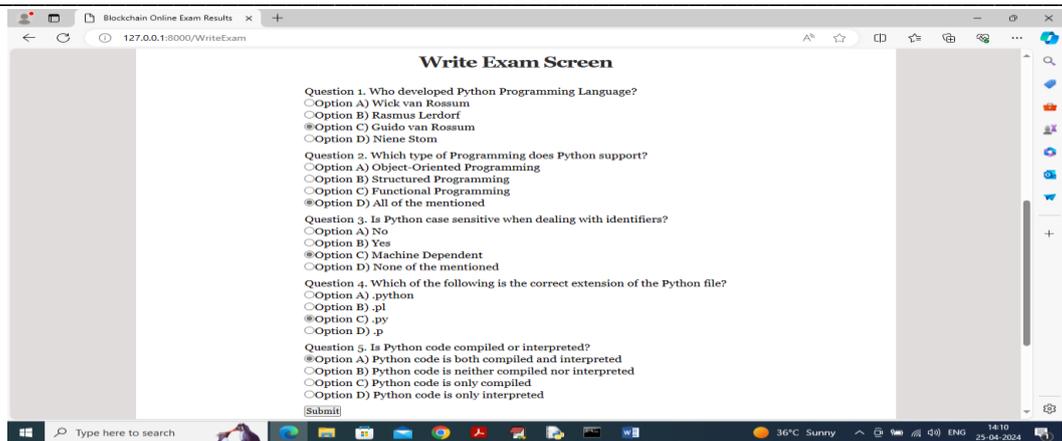


Fig 3. exam page

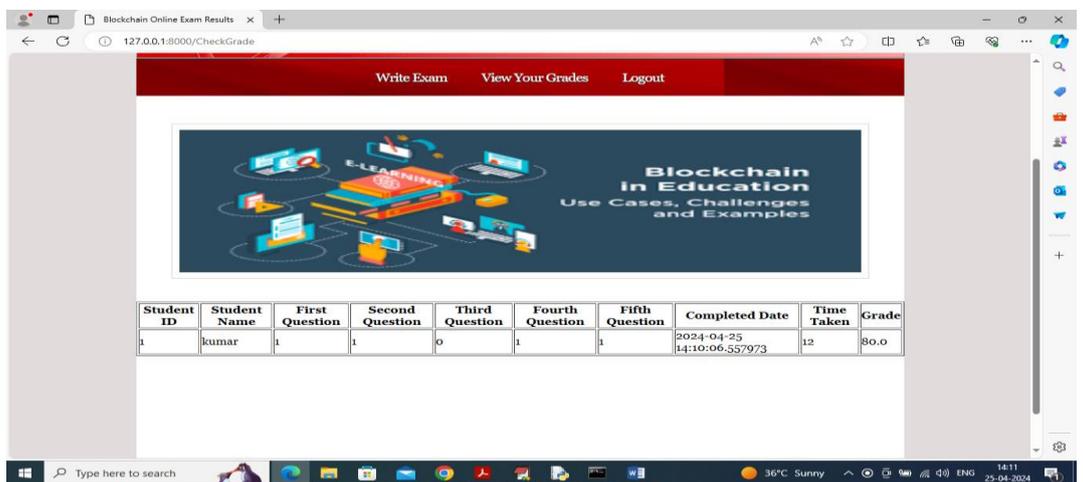


Fig 4. results page

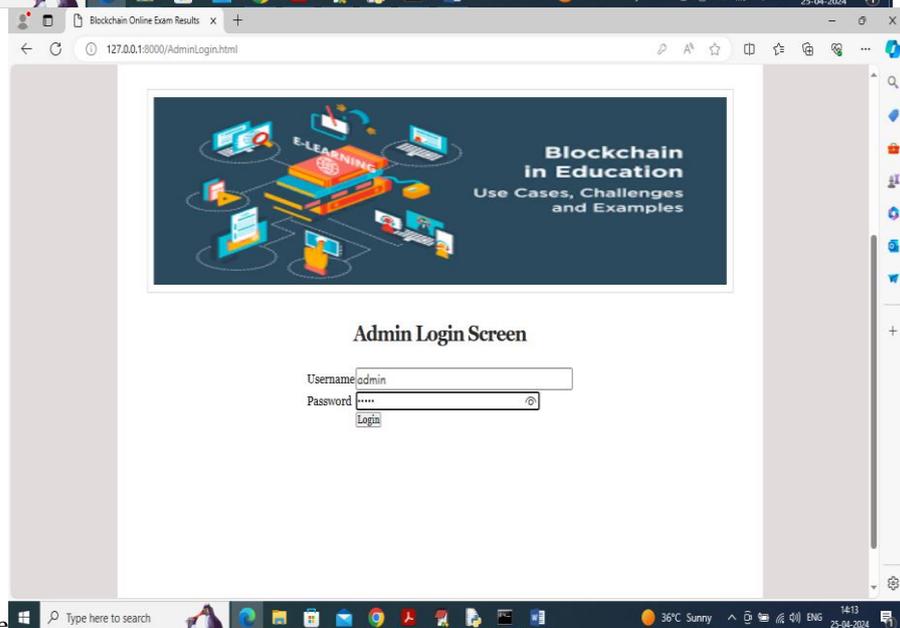


Fig 5. Admin login

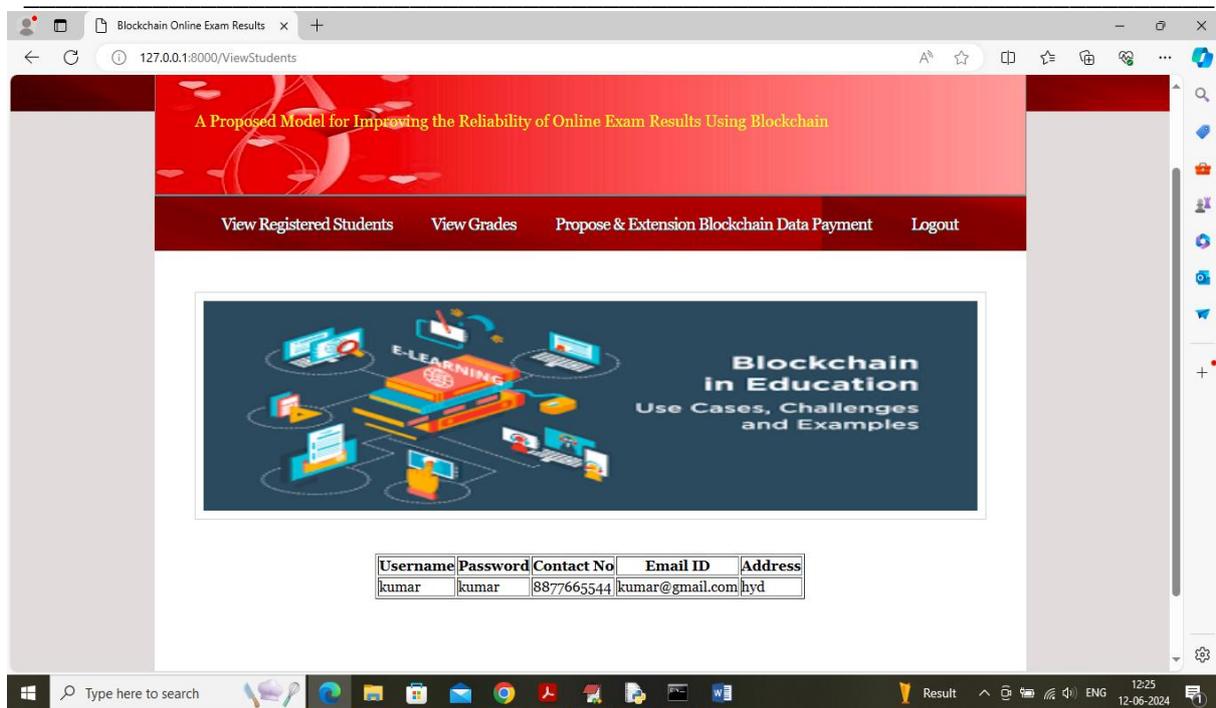


Fig 6. Verify students page

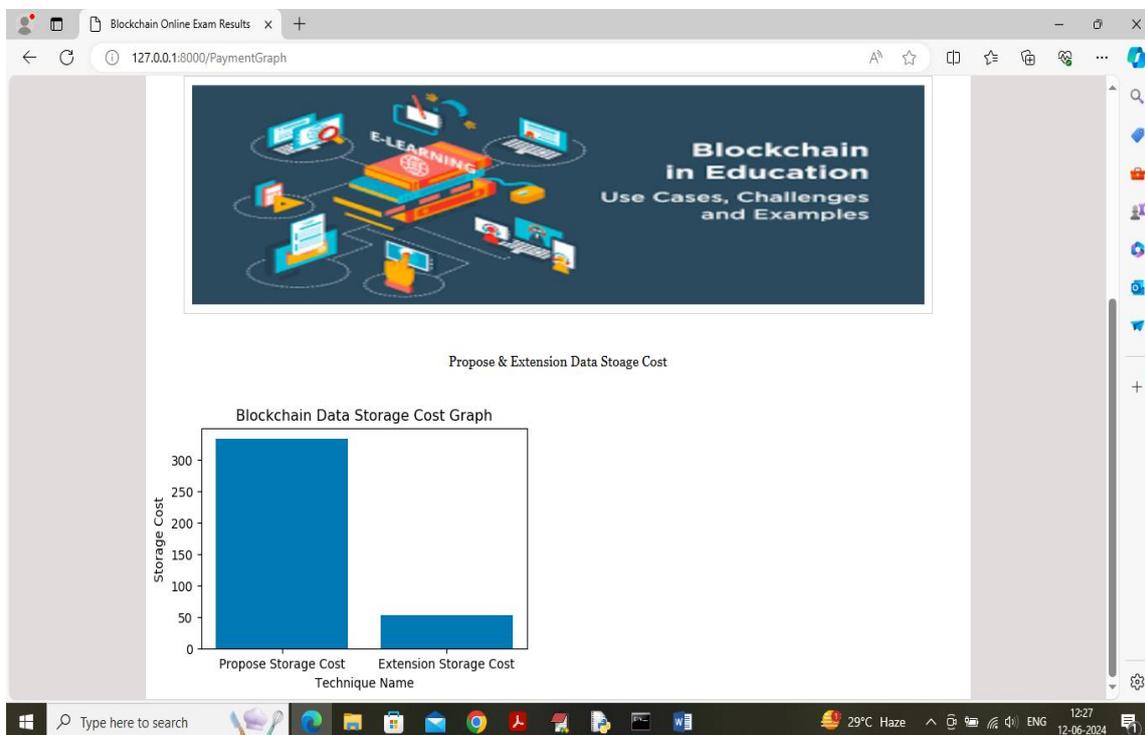


Fig7. Blockchain storage graph

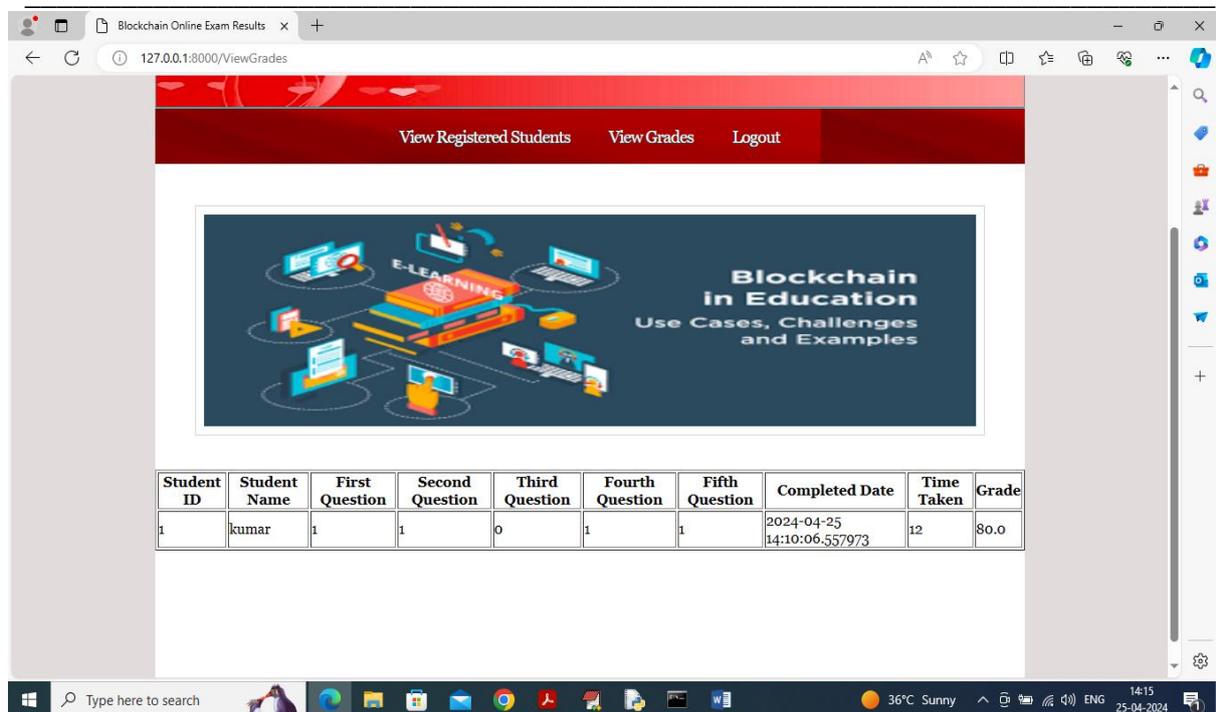


Fig 8. Student grades

VI. CONCLUSION

This paper presents a blockchain-based framework to enhance the security, integrity, and transparency of online exam results. By replacing traditional centralized storage with Blockchain’s decentralized and tamper-proof system, the proposed model ensures that exam data remains secure from unauthorized modifications. The integration of smart contracts and cryptographic hashing further strengthens data integrity, preventing manipulation. Through the implementation of a Moodle-based Blockchain module, the system effectively secures exam results while maintaining seamless functionality. The results demonstrate that Blockchain provides a reliable and immutable platform for storing academic records, making it a robust solution for securing online examinations and ensuring a trustworthy assessment process.

The proposed blockchain-based framework for securing online exam results can be further enhanced in several ways. Future work can focus on optimizing the performance of Blockchain storage to handle large-scale academic institutions efficiently. Integration with advanced consensus mechanisms like Proof of Authority (PoA) can improve transaction speed while maintaining security. Additionally, incorporating Artificial Intelligence (AI) for automated fraud detection and anomaly analysis in exam data can enhance reliability. Expanding the system to support multiple LMS platforms beyond Moodle can make it more versatile for global adoption. Furthermore, exploring privacy-enhancing techniques, such as zero-knowledge proofs, can ensure secure access control while maintaining student confidentiality.

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