© January 2026 | IJIRT | Volume 12 Issue 8 | ISSN: 2349-6002

CryptoProctor: Secure and Transparent Online Proctoring Using Blockchain

Abdul Faizan[1], B. Rishikesh[1], Md. Muzahid[1], M. Akhilesh[1], P.Navya Dr. S Shiva Prasad[2]
[1]*Student, Department of CSE(DataScience), MallaReddy Engineering college, Secunderabad*
[2] *Assistant Professor, Department of CSE(DataScience), MallaReddy Engineering college, Secunderabad*
[3] *Professor, Department of CSE(DataScience), MallaReddy Engineering college, Secunderabad*

Abstract— **Online examinations and assessments have become essential and important in today's education system; however, they face some critical challenges like lack of security, integrity issues and high chance of cheating. Most existing systems depend on centralized platforms, which can be easily manipulated, hacked and tampered with, leading to major concerns for secure online exams. CryptoProctor is a blockchain-based secured online proctoring system that uses a decentralized platform and ensures data integrity, trust, transparency and security for online examinations. The proposed system uses blockchain for storing examination logs and proctoring evidence, while IPFS is used for efficient file storage. The proposed method provides a solution for traditional systems by enhancing the security for examinations by preventing unauthorized access and recording every change made. This makes CryptoProctor a perfect solution for conducting secure online examinations in today's modern education systems.**

Index Terms— **Online Proctoring, Blockchain, IPFS: InterPlanetary File System, Decentralized System, Smart Contracts, Solidity, Transparency, Data Integrity.**

I. INTRODUCTION

Online examinations are widely conducted in today's education system; however, this has raised major concerns such as lack of transparency, reduced trust, no proper security and poor data integrity. Ensuring fair and trustworthy online examinations has become a major challenge for the educational institutions. Most of the existing systems use centralized platforms, which can be easily hacked, manipulated and vulnerable to unauthorized access. These limitations reduce transparency and make it difficult to prevent and detect tampering with records. As a result, the online examinations are often questioned. To overcome all these limitations and conduct secure online examinations, CryptoProctor is proposed as a blockchain-based online proctoring system. This system uses decentralized blockchain technology and smart contracts to ensure that all changes are securely recorded. The integration of IPFS enables efficient storage of large files.

CryptoProctor ensures data integrity, maintains examination logs, prevent tampering, and conduct fair examinations for all. This decentralized approach not only eliminates single point failure but also enhances auditability and fairness. Overall, CryptoProctor aims to provide a reliable solution for conducting online examinations securely in modern education systems.

II. LITERATURE SURVEY

Many studies have focused on online examination systems and proctoring techniques to conduct examinations smoothly [1], [2]. Existing proctoring systems mainly use centralized platforms and various technologies such as webcam surveillance, screen monitoring, and eye-movement tracking [2]. These methods help detect suspicious activities such as cheating or other forms of malpractice; however, they suffer from limitations related to transparency, privacy, security, and data integrity [1]. Recent research shows that the use of blockchain technology in proctoring systems can significantly improve data integrity, prevent unauthorized access, and overcome limitations associated with traditional centralized systems [3], [4]. Blockchain-based systems provide immutable records and transparent audit trails, which help prevent tampering and unauthorized modification of examination logs [4]. Several studies have demonstrated that blockchain-enabled online examination systems enhance security and improve the overall efficiency of proctoring mechanisms [4], [5]. The cryptographic mechanisms used in blockchain protect examination data from unauthorized access and reduce the risk of single-point failure [5], [9]. This decentralized and secure framework increases trust among institutions, examiners, and students by ensuring that exam records remain verifiable throughout the examination process [10]. In the CryptoProctor system, smart contracts are used to manage and secure the examination process in an automated manner [6]. Smart contracts are self-executing programs deployed on the blockchain that automatically enforce predefined rules. In this system, smart contracts control examination activities such as user authentication, event logging, and access control [4], [6]. Only authorized users are permitted to access the system, and every action performed during the examination such as login, activity tracking, and submission is permanently recorded on the blockchain through smart contracts [4]. The InterPlanetary File System (IPFS) is a decentralized file storage system designed to securely store and share large volumes of data [8]. In online examination systems, large files such as examination logs, screenshots, recordings, and other digital evidence require reliable storage solutions. Traditional centralized storage systems are vulnerable to data loss, unauthorized access, and single-point failures [9]. In CryptoProctor, IPFS is employed to store large examination-related files in a decentralized environment [8]. IPFS distributes data across multiple nodes and assigns a unique cryptographic hash to each file, ensuring data integrity and preventing unauthorized modification of stored records [8]. Although several studies confirm that blockchain-based approaches are well suited for secure online proctoring systems, some limitations still exist. Certain blockchain-based solutions focus mainly on secure record storage and fail to adequately address real-time proctoring challenges such as live monitoring and latency issues [7], [10].

III. PROPOSED METHODOLOGY

The proposed system, CryptoProctor, uses the concept of blockchain to enable a secure, decentralized, and unalterable online proctoring solution. Using the unalterable ledger of the blockchain technology, all the transactions performed in the context of an exam, from the question paper to the teacher/student and the results of the exam, forma unique block of the blockchain technology, as each block of the blockchain technology contains a hash of the previous block.

In order to overcome the size limitations in blockchain storage, larger files like question paper and exam details can be stored through the Interplanetary File System (IPFS), a decentralized file storage solution, whereas their respective hash values will be stored in the blockchain. The proposed system also uses smart contracts prepared in solidity to ensure the automation, security, as well as transparency in the handling of data as well as the handling of the permission levels assigned to different user roles like Admin, Teacher, and Student.

The proposed method on blockchain technology ensures data integrity, enhances transparency, prevents any kind of unauthorized access, and provides a valid audit trail, thereby increasing significantly the security and reliability of online exam environments.

3.1 System Analysis

3.1.1 Background and context

Online examination has rapidly grown in today's modern education system, particularly during and after global events like the COVID-19 pandemic. With the raise, the security of online examinations has become a major concern in the educations system.

3.1.2 Identified Problems in Existing Systems

The identified problems in existing systems are such as lack of transparency, students and educational institutions have limited visibility to data. Data tampering, exam records, identity proofs, and session logs can be manipulated. Many existing tools excessively record videos, audio, and screen content which raises ethical concerns.

3.1.3 Why Blockchain?

Blockchain is decentralized platform where there is no single point of failure, making system more efficient and trustworthy. Once the data is recorded on blockchain, it can be altered and the blockchain the records. Blockchain offers advanced security, making unauthorized access nearly impossible.

3.1.4 System Objectives

The main objective is to build a tamper-proof proctoring log using blockchain. There should be real-time monitoring and recording of exam sessions. It should maintain student privacy while still achieving only necessary information. It should provide exam logs for institutions for verification.

3.2 System Architecture

The following diagram represents a secure blockchain-based data sharing system integrated with IPFS for decentralized storage. From the figure we can see data owner encrypts the data and sends it to IPFS. Then the encrypted data sent by data owner in the IPFS gets a unique hash value, which acts as identifier. The hash value is stored on blockchain to ensure data integrity and avoid tampering. An authorization center manages the access control by distributing the private keys only to authorized users. The data demanders retrieve the hash value from the blockchain and downloads the encrypted data. Using the private key them to authorized users, the data demanders retrieve the hash value from the blockchain and download the encrypted data. Using the private key, the data demander decrypts the encrypted data.

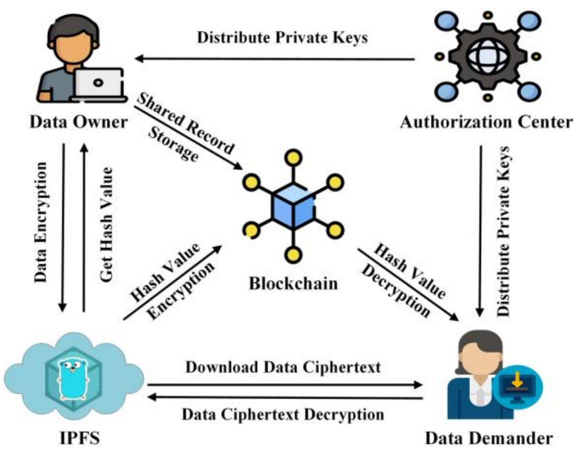

Figure.1 System Architecture

UML Diagrams

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group. The goal is for UML to become a common language for creating models of object-oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML. The Unified Modeling Language is a standard language for specifying, Visualization and documenting the artifacts of software system. The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems. The UML is a very important part of developing objects-oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

3.3.1 Class Diagram

The class diagram is used to refine the use case diagram and define a detailed design of the system. The class diagram classifies the actors defined in the use case diagram into a set of interrelated classes. The relationship or association between the classes can be either an "is-a" or "has-a" relationship. Each class in the class diagram was capable of providing certain functionalities. These functionalities provided by the class are termed "methods" of the class. Apart from this, each class may have certain "attributes" that uniquely identify the class.

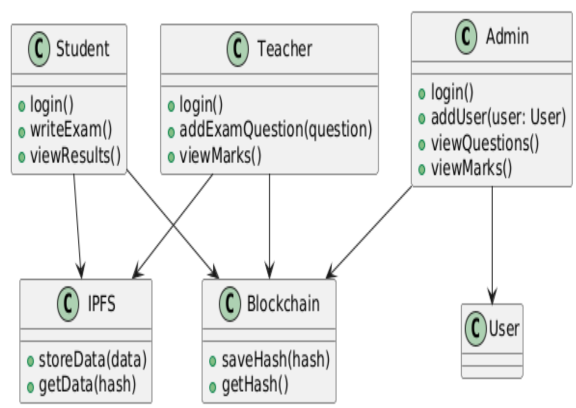

Figure .2 Class Diagram

3.3.2 Sequence Diagram

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. A sequence diagram shows, as parallel vertical lines,different processes or objects that live simultaneously, and as horizontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner.

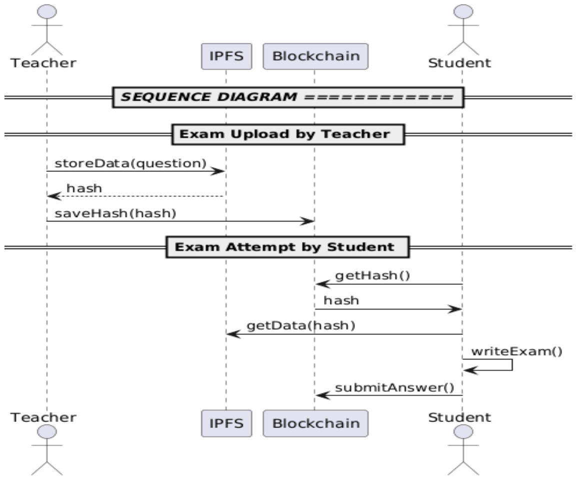

Figure.3 Sequence Diagram

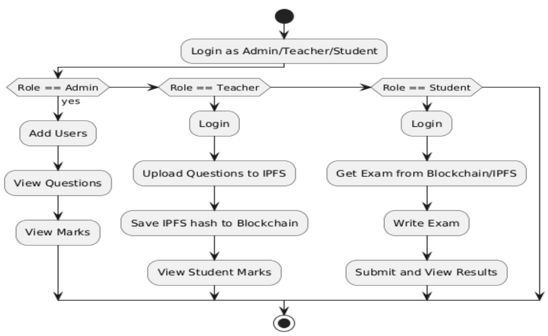

Figure. 4 Activity Diagram

3.3.4 Data flow diagram

A data flow diagram (DFD) gives a graphical view of data flow in an information system. It provides a model that can be utilized in analyzing and designing information systems. Data flow diagrams are useful in showing the structure and activities of a system, including how data flows and how it transforms as it flows in and out of a system. They can be applied in modeling data flow in different areas by understanding how data flows in and out of a system. They are well utilized in data modeling.

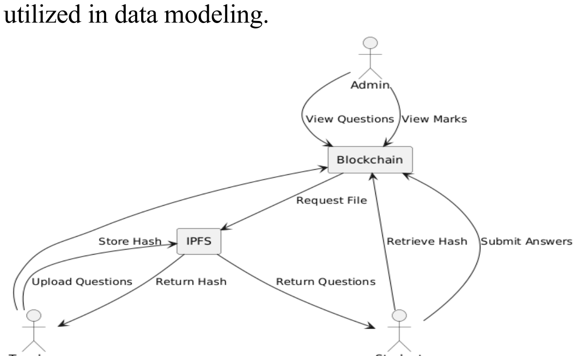

Figure 5. Dataflow Diagram

3.3.5 Component Diagram

A component diagram describes the organization and interconnection of the physical and logical components within a system. It illustrates how different software modules, services, and interfaces are structured and how they interact with each other to deliver the overall system functionality. By showing dependencies and communication relationships among components, the diagram helps in understanding the system architecture, simplifying maintenance, and identifying potential integration issues during system development.

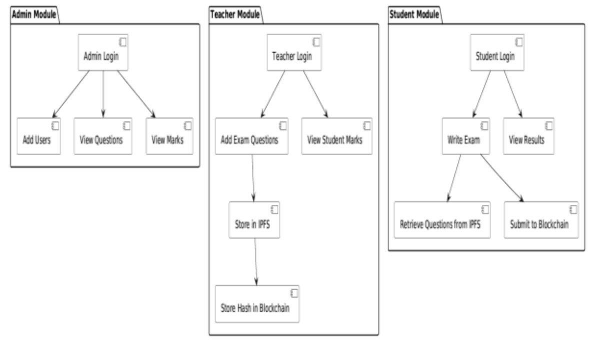

Figure 6. Component Diagram

3.3.6 Deployment Diagram

A deployment diagram in UML illustrates the physical arrangement of hardware and software components in the system. It visualizes how different software artifacts, such as data processing scripts and model training components, are deployed across hardware nodes and interact with each other, providing insight into the system's infrastructure and deployment strategy.

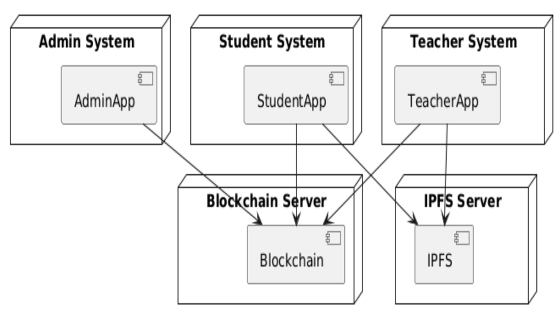

Figure 7. Deployment Diagram

3.4 SYSTEM IMPLEMENTATION

3.4.1 User Registration and Authentication Module

The User Registration and Authentication Module provide authenticated registration and login procedures for students, proctors, and administrators. The module makes use of decentralized verification of identities via the blockchain system as well as multi-factor authentication for improved system security.

3.4.2 Exam Scheduling and Management Module

The Exam Scheduling and Management Module provides facilities for administrators to design and administer schedules of examinations, along with managing student and class allocations for examinations. The detail of every examination schedule and information associated with it is immutable and maintained on a blockchain.

3.4.3 Online Proctoring Module

The Online Proctoring Module allows for real-time monitoring of candidates with the help of video and audio surveillance. AI-powered techniques, such as face recognition and behavioral analysis, can support these activities. Screen sharing and activity tracking are also integral parts, with automated alerts created in case any aspect.

3.4.4 Blockchain Ledger Module

The Blockchain Ledger Module houses important data like examination data, authentication data, and proctoring data. The smart contract enables automatic management of events related to the start or completion of an examination, examination results, and other rules that ensure data transparency when auditing.

3.4.5 Secure Communication Module

For the purpose of secure communication within the system, the Secure Communication Module is employed to ensure encryption of all communications between students, proctors, and administrators. Public and private key cryptographic services are utilized for the protection of data.

3.4.6 Result Compilation and Verification module

The Result Compilation and Verification Module is responsible for automating the process of results compilation and verification using blockchain technology to deter any modifications to the results. The results are safely accessed and confirmed by authorized proctors and administrators.

3.4.7 Audit and Reporting Module

The Audit and Reporting Module generates detailed reports regarding examination sessions, proctoring activities, and incidents detected. A blockchain audit trail allows third-party verification and further in stills trust in the examination process.

3.4.8 Admin Dashboard Module

The Admin Dashboard Module: administrators are allowed to manage users, examinations, and system settings; monitor live proctoring sessions; review alerts; and access all detailed reports and summaries of the blockchain ledger

IV. RESULTS

The assessment of the Cryptoproctor system is primarily based on analyzing its performance with respect to security, reliability, transparency, and efficiency in conducting online exams. The Cryptoproctor system was tested among different users such as Admin, Teacher, and Student to ensure its functionality and communication among different modules. The use of blockchain ensured all transactions such as uploading questions, responses from students, and verification of results are all immutable without any scope of manipulating or modifying data. The use of IPFS to store questions related to exams shows great potential in improving data management related to exams without loading the blockchain. The authentication process was highly reliable in all cases. The login process and all activities performed were securely validated by blockchain validation.

Figure 8. Proctor

The incorporation of smart contracts improved the degree of automation in the process by performing various activities related to exams like fetching questions, generating results, and verifying results automatically without the need for human intervention.
The transparency aspect in the system was improved as every event that occurred during the examination process could be tracked in the blockchain ledger, which enabled authorized users to access an entire record.

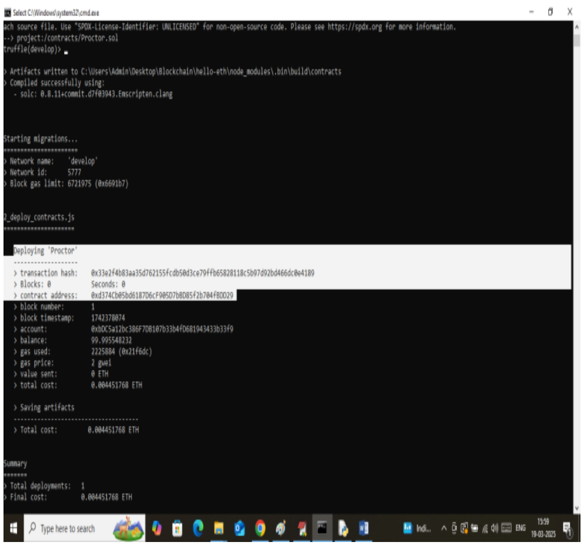

Figure 9. IPFS

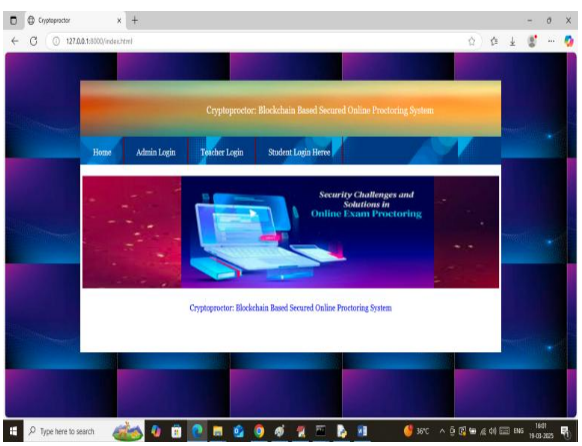

Figure 10. Home Page

Below is a figure showcasing the Admin Login interface of the CryptoProctor system: The admin needs to input valid credentials to access different administrative functionalities.

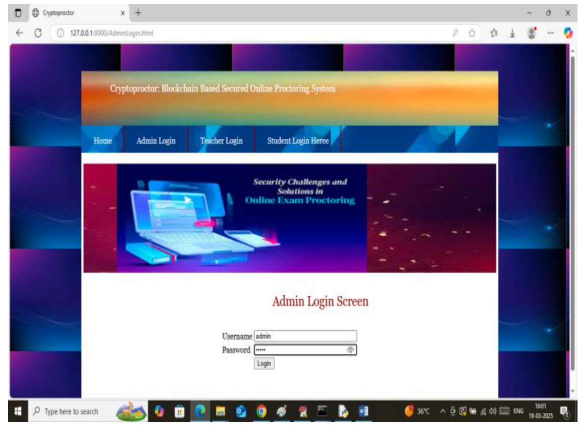

Figure 11. Admin Login Page

Figure illustrates the admin module where the addition of users to the system is shown. The admin would be required to enter the personal information of the teachers or students, including the login name, password, contact number, email, and role.

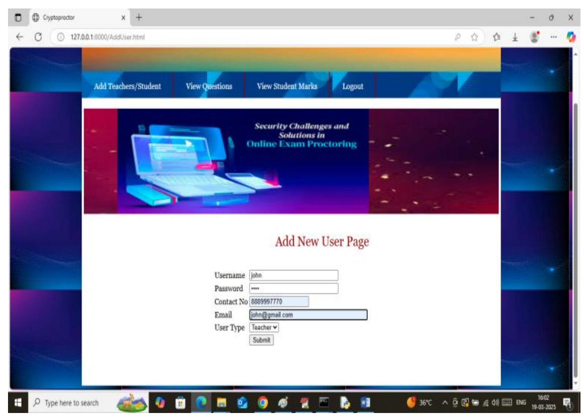

Figure 12. Add New User Page

This figure represents the Teacher Dashboard after successful authentication.

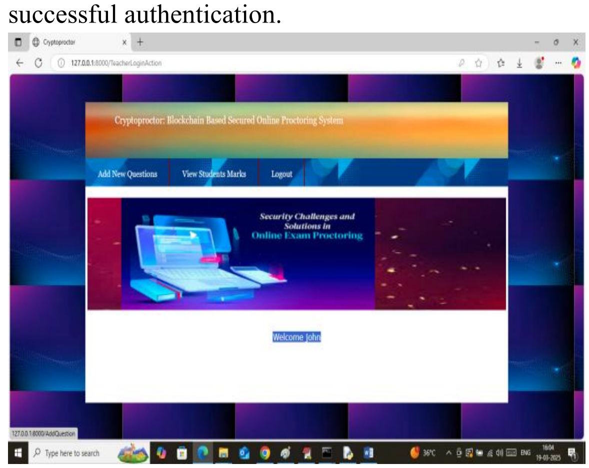

Figure 13. Add New Question

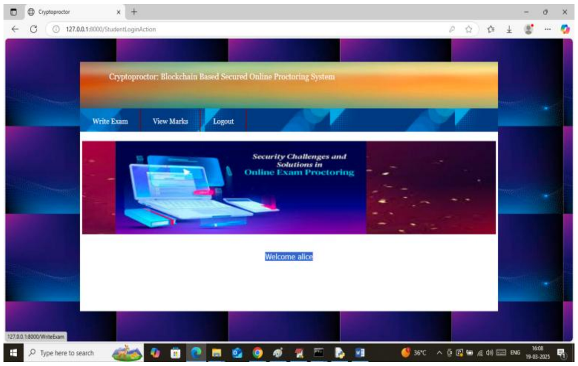

Figure 14. Student Dashboard

This figure represents the Student Dashboard after successful authentication. The options provided on the dashboard allow the student to write examinations, view results, and securely log out.

In below screen student will select correct answer radio button and then press 'Submit' button to get below page.

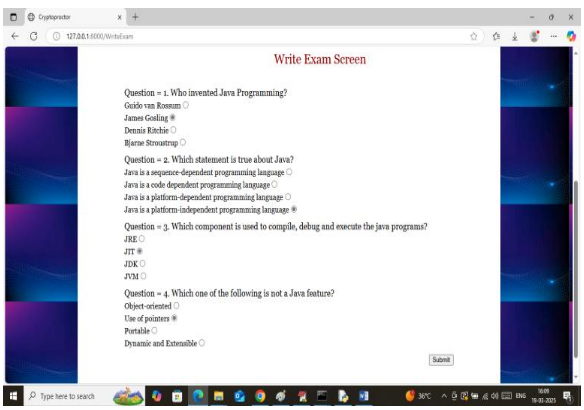

Figure 15. Write Exam page

In above screen student will select correct answer radio button and then press 'Submit' button to get below page.

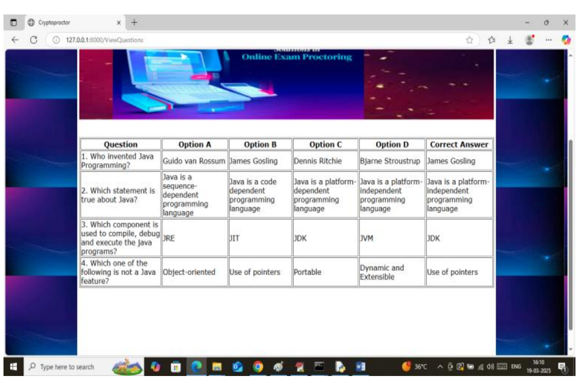

Figure 16. View Questions and Answer Screen

This figure shows the interface that is used by the administrators or teachers to view the examination questions along with options available and the correct answers. In this table format, question data can be easily cross-checked and managed. Secure storage of examination content: transparent, unauthorized modifications not permitted.

5.CONCLUSION

Blockchain-based secured online proctoring system, developed to counter the major problems of security, transparency, and trust in online examination sessions. By utilizing a blockchain technique, the secured online proctoring system ensures a tamper-proof process of recording examination activity and offers a decentralized system that avoids a point of failure. Smart contract integration enables an automated process of enforcing examination rules, along with transparency during the examination process.

CryptoProctor promotes data integrity and safeguards against breaches by recording exam and user activity logs securely on the blockchain. The use of the InterPlanetary File System in the storage of large files associated with exams reduces the storage load on the blockchain and ensures that data access and management are done in a secure manner through the use of cryptographic hash values. Authentication and communication systems also ensure the reliability of the systems. CryptoProctor provides a reliable and scalable framework in conducting secure online examinations within modern education systems. The proposed system develops trust among students and instructors by providing transparent management of examinations with verifiable audit trails. Decentralized architecture with strong data security mechanisms enhances the credibility of online examinations, building confidence for wider adoption in academic environments towards secure digital assessment platforms.

REFERENCES

[1] M. D. Botezat, A. Radu, and C. Popescu, "Online examination systems: Security and integrity challenges," International Journal of Advanced Computer Science and Applications, vol. 10, no. 6, pp. 256–262, 2019.

[2] A. Kharbat and E. Daabes, "E-proctoring

systems: A review of existing technologies and challenges," Education and Information Technologies, vol. 26, no. 5, pp. 5401–5420, 2021.

[3] S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system," 2008. [Online]. Available: https://bitcoin.org/bitcoin.pdf

[4] A. Al-Ali, I. K. Taha, and M. Abu-Taieh, "Blockchain-based secure online examination system," IEEE Access, vol. 9, pp. 145012–145026, 2021.

[5] K. Salah, M. H. U. Rehman, N. Nizamuddin, and A. Al-Fuqaha, "Blockchain for AI: Review and open research challenges," IEEE Access, vol. 7, pp. 10127–10149, 2019.

[6] N. Szabo, "Smart contracts: Building blocks for digital markets," Extropy: The Journal of Transhumanist Thought, vol. 16, pp. 18–22, 1997.

[7] M. Andoni et al., "Blockchain technology in the energy sector: A systematic review," Renewable and Sustainable Energy Reviews, vol. 100, pp. 143–174, 2019.

[8] J. Benet, "IPFS—Content addressed, versioned, P2P file system," arXiv preprint arXiv:1407.3561, 2014.

[9] A. Dorri, S. S. Kanhere, and R. Jurdak, "Blockchain in internet of things: Challenges and solutions," Computer Communications, vol. 148, pp. 70–90, 2019.

[10] P. Tasatanattakool and C. Techapanupreeda, "Blockchain: Challenges and applications," International Journal of Information Management, vol. 40, pp. 114–129, 2018.