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An Innovative and Secure Platform for Leveraging the Blockchain Approach for Online Exams

Albert Manawar[1]
Universiti Utara Malaysia[1]
Sintok, 06010 Bukit Kayu Hitam, Kedah, Malaysia[1]
e-mail: albert02mw@gmail.com[1]

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Abstract

Numerous educational establishments now use the online platform to conduct tests, particularly for students at the secondary and tertiary levels. Candidates are given a username and password by the most popular online test program, and they then log in to the designated page to answer the questions. However, there are numerous flaws in this system, and cheating on the test can be done by misusing the password. This demonstrates the significance of implementing a secure system to avoid this issue. A blockchain framework that safeguards the online examination system is presented in this paper. An educational data-connecting data management system has been secured using the proposed framework. Without the need for a copy from the central servers, institutions can simply compile their data history. Data security is improved and any potential for cheating between users or third-party institutions that access applications and services is eliminated by the proposed blockchain framework. This study provides a secure framework for conducting and evaluating subject tests to guarantee consistency between students and servers and secure questionnaire delivery from servers.

Keywords: *Platform, Education, Blockchain, Technology*

1. Introduction

Like other nations around the world, Bangladesh's educational institutions are physically closed during the Covid-19 pandemic. As a result, more than four million Bangladeshi students have contracted the virus, forcing them to study online. Additionally, the examinations are conducted online[1]. However, proper evaluation of students' online learning has remained problematic. Particular concerns have emerged, including Secure Result Publication, Fake Identity, Question Distribution, Common Questions, Background Apps or Multiple Devices, Copy Answer-Script, and others[2]. Getting to the bottom of those significant problems becomes critical; If this is not done, many students will receive inferior education. Fortunately, communication technology use has significantly increased in Bangladesh in recent years. In this regard, educational institutions in Bangladesh, including schools, colleges, and universities, will benefit from an improved online examination procedure that is supported by a sophisticated and secure framework[3]. The primary objective of this study is to develop an effective method for resolving all major issues teachers and students encountered during the online exam. The issue of personal identity and uninvited network access by other users using various clients are the focus of this study. The research aims to (i)

examine the characteristics of a number of online programs that conduct online tests for a variety of purposes and (ii) create a secure blockchain-based online examination system for Bangladeshi educational establishments. The proposed system is expected to handle all operations, from IP-based login to blockchain-based result publication, making the exam process more secure, user-friendly, efficient, and time-saving[4].

2. Literature review

Cluskey, and others investigated the options for taking the online exam without the supervision of a proctor. The authors have gone into great detail about the typical student cheating scenario and the steps that can be taken to stop students from cheating[5]. They have offered some techniques for creating a plan for online testing as well as some online exam control procedures, such as using Respondus Lockdown Browser (RDL), verifying a student's identity, and so on. Teja and co. have proposed using Convolutional Neural Networks (CNN) to accurately identify a student on an online exam by observing their movement. However, CNN lacks the ability to analyze students' orientation and position, and it also requires too much data to preview the result. Mukta and co[6]. have contributed to the Fuzzy Logic Approach for E-Learning Adaptive Test Sheet Generation. In the area of e-learning, they suggested using an ambiguous approach to evaluate students' favorite tests. Jung and Yeom have talked about using group cryptography to protect an online exam management system. They explain how a secure online management system can be built with the help of the SECOND software system. A limitation of the system is that it necessitates the use of microphones and high-quality webcams. In evaluating the students' learning outcomes, Liu and Fan introduced the term "analytics." The authors argue that math should be taught in schools so that teachers can better understand what students need to learn and how to meet those needs. This could help students learn and progress. A method that allows the questionnaire's production manager to choose a percentage of the question's complexity has been proposed by Monjitha and colleagues. One can select random questions that meet the conditions based on the percentage selection system. Additionally, this program is able to produce the paper in accordance with the administrator's instructions. After production, the paper will be saved as a PDF and sent directly to colleges via email with one click[7]. Paul and co. suggested the design of a question paper template in accordance with the requirements for the input. In this regard, Zhen and Su proposed a few face recognition system methods. Algebraic characterization, Support Vector Machines (SVM), and neural networks (NN) have all been used in face recognition systems, as the authors have demonstrated. Jain and his colleagues discussed the significance of incorporating a blockchain network into the educational system. They have developed a blockchain-based online exam system. They used one of the best applications, dubbed "Smart contracts," and the public blockchain platform known as "Ethereal." Additionally, they have contrasted the cloud-based system's overall performance with that of the blockchain-based system. Using cutting-edge machine learning methods, Lee and colleagues proposed a system that uses head pose estimates and eye gaze estimates to classify the student's VFOA (visual focus of attention) data. When the student's VFOA from the screen varies more than X, a predetermined threshold time, the examiner is notified. When the person's VFOA is off the screen, the application will save their data and send it to the examiner for them to manually check and mark whether the student committed attempted malpractice or a minor lapse in concentration. An online signature or the display of a student's photo and fingerprint is used to detect user behavior in "Digitalization Online Exam Cards in the Era of Disruption 5.0 using the DevOps Method." They suggested methods for single and multiple biometric detections. They detected student online signatures,

photos, and fingerprints in that study; on the other hand, we are detecting student IP ads, face recognition, a 360-degree view, and a noise detection method. Hylton et al. conducted a study titled "Utilizing webcam-based proctoring to deter misconduct in online exams." used an online exam proctoring system with a webcam[8]. They gathered information from both the online exams that participants took and the survey that was conducted online. They came to the conclusion that online exam misconduct was prevented by webcam-based proctoring.

3. Proposed system

Educational institutions have been forced to move their learning platforms online as a result of the pandemic. However, this reveals some difficulties, the most significant of which is the fact that some students took unethical actions during the online exam. This study proposes AI and Blockchain systems to address these problems by taking into account secure result publication, cheating, and identification. Figure.1 depicts the conceptual workflow of the proposed system[9].

In the future educational system, it is anticipated that it will establish a new margin. A server connects the devices of both students and faculty agents. Through the database, all student and faculty data will be saved in the primary storage system. Through the database, students' data can also be temporarily stored in the faculty agent's temporary storage. To use the system, there is a graphical user interface (GUI) for each sector. The user identification interface data compilation interface date will be sent to the server's database from students' devices[10].

4. Methodology

4.1. Workflow diagram for the evaluation system

The picture in Figure 2 depicts the system's operational flow. A student will initially use an IP address to log in to the system. An AI-based face reorganization system, 360° AI view, and noise detection system will all be enabled following the login process. The system will then use an SSH connection to set up an RDP. It will then shuffle, specify each question for each IP/ID, and set a specific time to write the answer to each question. It will build a database and check each script for plagiarism once it has all the answers. If the answer script contains more than seventy percent plagiarism, it will simply forward the marks into the blockchain system and conclude that the script had human interaction with another answer script. The system will forward the answer script to mark distribution if it reveals less than 70% plagiarism. The marks will then be transmitted to the blockchain-based system. The system will come to an end in this manner[11].

4.2. Secure exam system control procedures (SESCP)

SESCP-A: Find each participant's IP address and assign that IP to future interactions. The student cannot alter the device, nor can any other individual or network disrupt their work[12].

SESCP-B: Using artificial intelligence, identify faces. It will recognize the participant's movement and face shape. Participants in parallel must maintain a 360-degree panorama view. The AI system will identify human faces and electronic devices there. Face detection makes use of YOLO algorithms. Its straightforward architecture improves detection speed, learning capabilities, and accuracy[13]. Regression analysis serves as its foundation. It divides the taken images into N grids, each of which is responsible for making decisions and has an equal dimensional region of S x S.

SESCP-C: Traffic analyzers, on the other hand, will function for any other network interaction. Establishing a Remote Desktop Protocol to restrict background apps. As a result, the examinee was prohibited from interacting with any other subject using his device.

SESCP-D: The system will divide the entire query into smaller pieces, encrypt, break, and shuffle them, create a unique hash, and distribute each hash to a specific IP. Each section of the question will have a predetermined duration[14].

SESCP-E: The participant will be required to hand over the system's public key. The system will then promptly collect the answer script and decrypt the question for each individual.

SESCP-F: The system will create a database in this section. The system will check for plagiarism in each answer script that is stored in the same database. Plagiarism is examined with the help of the paraphrasing tool. It is a Python-based tool that alters part of speech, grammatical structure, and synonym usage as techniques. Methods like semantic-based, grammar-based, grammar semantics hybrid and clustering are also used to check for plagiarism[15].

SESCP-G: Answer scripts will be eliminated and plagiarism will be defined in this section. We want to interact with people here. The teacher will receive answer scripts with a plagiarism rate of seventy percent or higher. They will evaluate and supervise those procedure-specific answer scripts. Additionally, the remaining response script will be sent for mark distribution.

SESCP-H: To maintain security, the marks will be kept in a blockchain-based system.

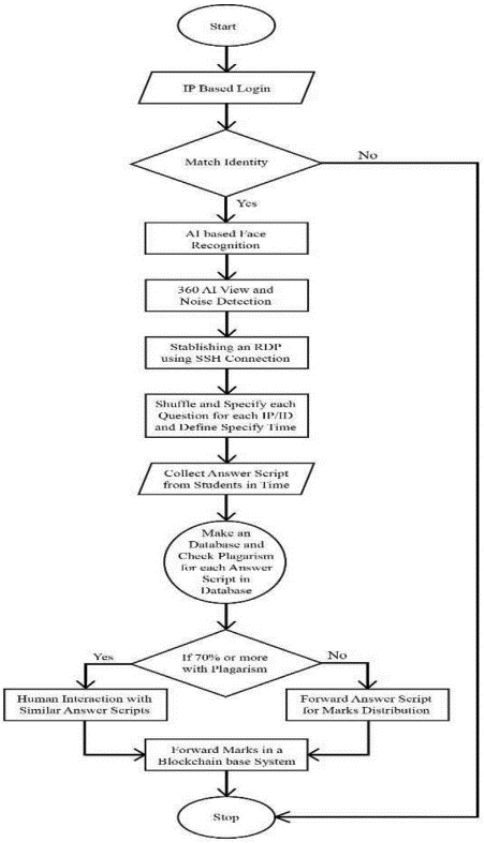

Figure 1. The Proposed System's Conceptual Framework Is Shown in

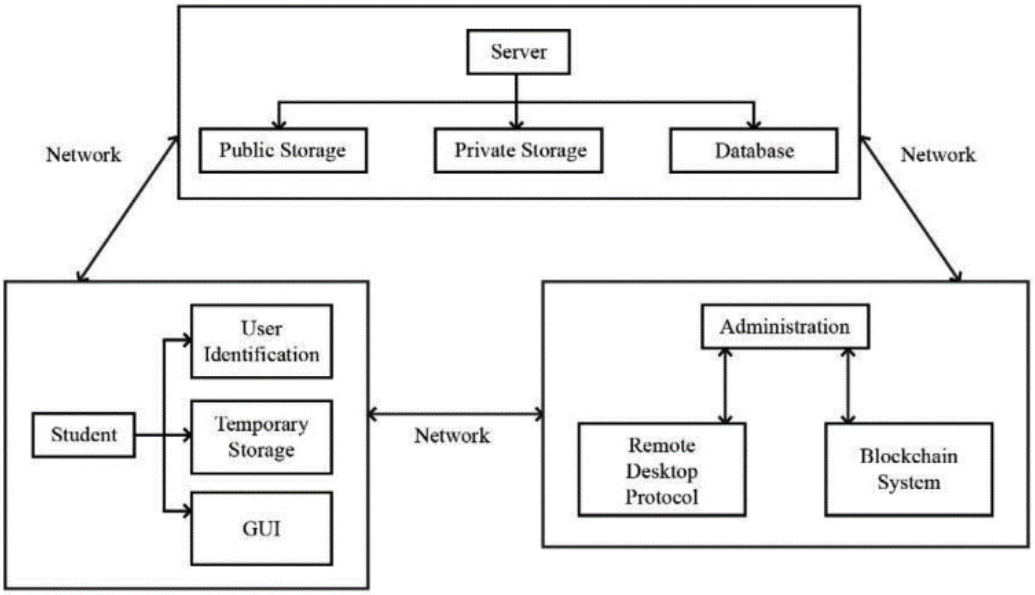

Figure 2. Diagram Showing the Suggested System's Flow.

4.3. Distribution of marks using blockchain

Blockchain is a computer database or a written and posted a database of any contracts for exchange that should be freely recorded. The fact that this computerized database is open with a few large PC numbers and will likely be stored in a single location is one of Blockchain's great features. The square series' dramatic reduction of the potential effects of the information break is the most encouraging aspect. Intriguingly, various shared duplicates of the same knowledge base make it difficult to pay for information attacks or digital attacks with standard equitable processes. The establishment of square chains can alter the variety of businesses and make the forms smarter, safer, simpler, and more effective than standard business forms due to the high-security features of the robbery [16].

- The data is stored in JSON format, which is simple to use and read. A block containing multiple data is used to store the data. Fingerprinting is used to identify other blocks by adding multiple blocks.
- The fingerprinting is carried out by means of a hash, specifically the SHA256 hashing algorithm. In order to prevent tampering with the system, each block contains its own hash as well as the hash of the preceding function.
- The blocks are joined together by using this fingerprinting. By providing its hash, each block is linked to the one before it, including the previous block.
- The solution to the proof of work is successfully discovered, which results in the mining of the new block. To create mining difficulties, the proof of work must be difficult to manipulate.
- The block will be counted in the chain if it is mined correctly.
- To prevent tampering with the blockchain, the chain's validity must be limited after mining several blocks.
- Flask is used to create the web app [17].

Blockchain/DLT are the building blocks of the "internet of value." They make it

possible to record relationships and transfer "value" from one peer to another without the need for a centrally corresponding entity. Value" refers to both the license of specific information and any record of an asset license (see Fig. 4)[18].

For scalability, we employ layer 1 blockchain scalabilities solutions like sharding, segregated witness (SEGWIT), and hard forking. Enhancing the block size limit or reducing the block verification time are two examples of Layer 1 solutions that target enhancing the fundamental characteristics of the blockchain network. Layer-1 solutions necessitate codebase modifications.among the top blockchain networks. In light of this, layer 1 solutions are appropriately directed as on-chain scaling solutions[19].

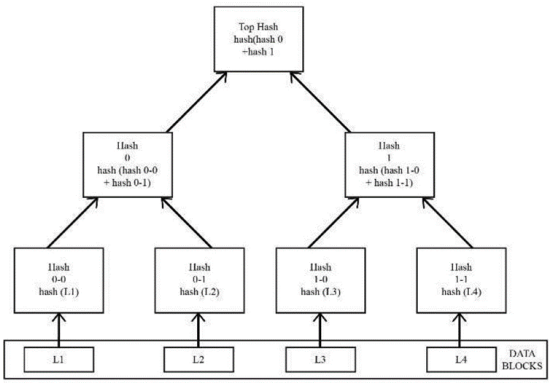

Fig. 3. Blockchain Technology's Organizational Structure.

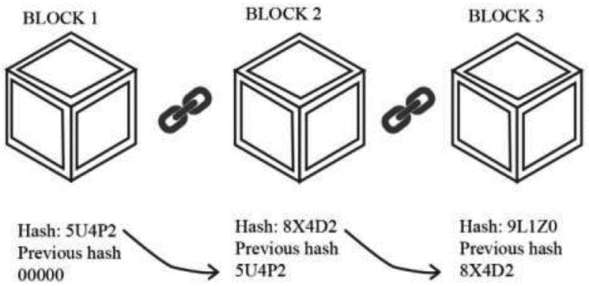

Figure 4. Data Organization Using Blockchain Technology.

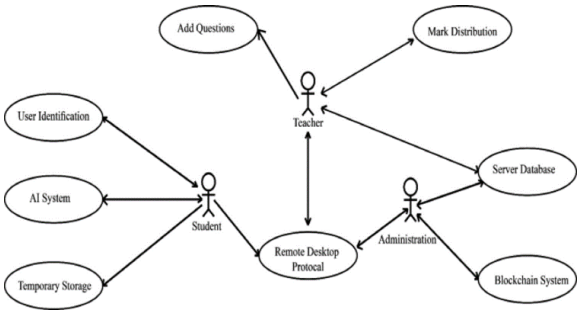

Fig. 5. UI Diagram

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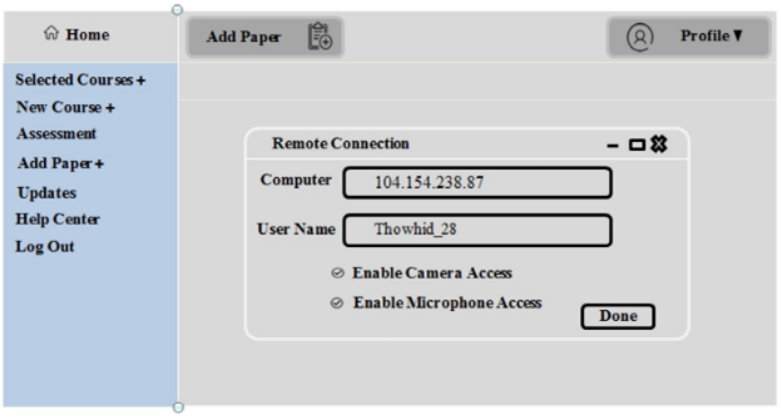
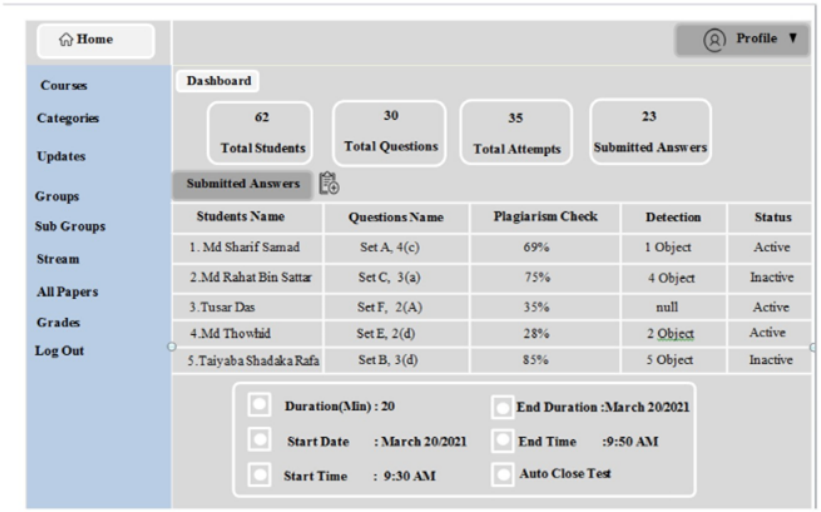


(a)



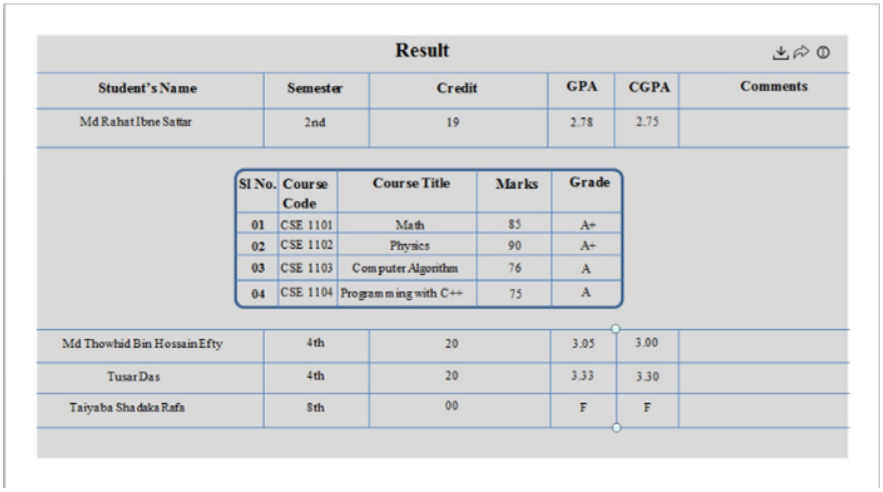


Figure 6. Snapshots of the Proposed System; (a) UI Student Panel (b) UI Teacher Panel and Result Panel.

4.4. (UI) User interaction

The interaction mechanism in Fig. 5 is depicted in the diagram.
Students, teachers, and administrators are the three different user categories shown in the user interaction diagram (Fig. 5). Teachers can interface with the server database, distribute grades, and add questions to the system. On the other hand, temporary storage, an AI-based system, and a user identification protocol are how pupils communicate with the system. Additionally, the administrator works directly with the blockchain-based system, mark distribution mechanism, and server database. RDP (Remote desktop Protocol) is used by administrators, teachers, and students.

5. Results and Discussion

Online exams include MCQs, checkboxes, fill-in-the-blanks, short answers, long answers (that must be evaluated separately by the instructor), coding simulators, case studies, and other types of questions. Both the components of the education system and the system itself are always changing. A few snapshots of our system are shown here in Figure. 6 .
Candidates should complete the questions on an online test within the allotted time. When the test is finished, the test window closes and facilities get real-time reports. The proposed automated system may thoroughly examine the answer scripts and deliver results as quickly as possible. The examiners compared and contrasted the responses. The testers examine the responses and make the appropriate calculations for long-type questions whose outcomes are not random. Candidates can take the tests via email or a website that are administered online.
There are two main ways the system can be made significantly better. A teacher-labeled question level is the first place to start getting better. While submitting, the teacher is required to include a question tag under the proposed system. We want to make this process mechanical in future development, which will make teaching easier. The complete automation of descriptive questionnaires is the second area in which this system can be improved.

6. Limitation

Despite its numerous benefits and features, there are some potential drawbacks that we cannot ignore. To record students' activities from the device they use to attend the exam, this system needs permission from the student's camera, microphone, and GYRO. If the system experiences a significant failure, it could prevent students from accessing their private, confidential information. The majority of Bangladeshi homes lack an internet connection, so this system needs a reliable connection. During the exam, an imbalance in the learning management system of individual students may result from the internet outage. For many institutions and authorities in developing nations like Bangladesh, the average cost of building the system and keeping it up is a little bit high.

7. Conclusion

In terms of internet metaphors, developing an effective e-learning system to deal with the COVID-19 outburst remains a challenge for nations like Bangladesh. An e-exam is a major obstacle to e-learning, and this work may help overcome it. With the assistance of artificially intelligent, blockchain, RDP, and smart login systems, the drawback of online exams can be overlooked. An AI-based blockchain framework that safeguards the online examination system is presented in this paper. It is anticipated that the method we have proposed will have a significant impact on the development of e-learning, where instructors will be able to take legitimate exams just like when they are physically present in the classroom.

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