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Secured Online Exam using BlockChain Technology

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Abstract

The Online Examination System Driven by Smart Contracts on Blockchain is a project that seeks to transform the conventional examination process by utilizing the capabilities of blockchain technology. The initiative suggests a secure and clear evaluation system that relies on smart contract technology. The system will allow students to take exams from any location globally, eliminating the requirement for a physical test center. The suggested system will also remove the necessity for external examination invigilators, thus lowering expenses and maintaining integrity. The architecture of the system will include four elements: the blockchain, smart contracts, a user interface, and an authentication system. The blockchain will offer the essential decentralization and transparency needed for a secure examination system. The technology of smart contracts will be utilized to develop self-executing agreements that guarantee the examination process remains equitable and untainted by manipulation. The user interface will enable students to enter the examination system and finish their exams, while the authentication process will guarantee that only permitted users can access the system. The advantages of the suggested system encompass enhanced efficiency, safety, and clarity in the assessment procedure. The system will offer organizations an effective and safe method for carrying out assessments. It will enhance the reliability of the examination system, which is crucial in the current competitive educational environment. Moreover, the system will lower expenses linked to conventional testing methods, including the requirement for physical examination facilities and supervisors. The project's execution will entail creating a proof-of-concept system to showcase the viability of the suggested system. The prototype will be created on the Ethereum blockchain platform and will incorporate smart contract technology to facilitate the examination procedure. The operation of the system will be illustrated through a simulated testing situation. In summary, the Smart Contract Enabled Online Examination System Utilizing Blockchain is an innovative initiative aimed at revolutionizing the examination process by harnessing the capabilities of blockchain technology. The advantages of the suggested system consist of enhanced efficiency, security, and transparency, which will advantage both students and institutions. The system's implementation will entail creating a proof-of-concept that will showcase the viability of the suggested system.

Keywords: Blockchain, Secure, Smart Contract, Solidity, Metamask, Examination System

I. Introduction

The emergence of blockchain technology has brought about significant changes in colorful diligence, including education. One of the areas that blockchain technology can revise is the examination system. A smart contract-enabled online examination system grounded on blockchain is a design that seeks to bring translucency, invariability, and security to the examination process. Traditional examination systems are prone to crimes, manipulation, and lack of translucency. With the perpetration of blockchain technology, the examination system can come more effective, secure, and secure. Smart contracts run on the blockchain. Thus, the code and the agreement are stored on a distributed public database and cannot be changed.The smart contract technology, which is a tone-executing contract with the terms of the agreement between buyer and dealer directly written into lines of law, will ensure that the examination process is fair and free from manipulation. The proposed system leverages the decentralized nature of blockchain technology to produce a tamper-evidence and transparent examination system. This system will enable scholars to take examinations from anywhere in the world without the need for a

physical examination center. The system will also exclude the need for third-party examination invigilators, thereby reducing costs and icing integrity. 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 .The perpetration of the smart contract-enabled online examination system won't only profit scholars but also institutions. The system will give institutions with an effective and secure way of conducting examinations. It'll also ameliorate the credibility of the examination system, which is essential in moment's competitive educational geography. This design holds significant pledge in transubstantiation the examination system and paving the way for a more transparent and secure future.

With the help of machine learning algorithms, the model can provide real-time protection against phishing attacks, allowing users to browse the internet with confidence. The proposed blockchain framework improves data security and removes any potential cheating between users or third-party institutions that access applications and services. In this regard, this study provides a secured framework for conducting and evaluating subject tests to ensure consistency between student and server, and secure delivery of questionnaire from the server .

II. Literature Survey

[1] A Blockchain-Based Smart Contract Towards Developing Secured University Examination System- Ashis Kumar Samanta, Bidyut Biman Sarkar & Nabendu Chaki

Abstract:

The emergence of online examination systems has brought many advantages to the education sector, including convenience, flexibility, and cost-effectiveness. However, these systems face various security threats, including hacking, impersonation, and cheating. Blockchain technology can offer a potential solution to these challenges by providing a transparent, decentralized, and tamper-proof platform for conducting online exams .This research paper proposes a blockchain-based smart contract solution for developing a secured university examination system. The proposed system utilizes the Ethereum blockchain and smart contracts to provide a decentralized and transparent platform for conducting exams. The system's design and implementation are discussed in detail, along with an analysis of its performance and security features.

The proposed system aims to provide a secure, reliable, and tamper-proof platform for conducting university exams. The use of blockchain technology ensures data immutability, transparency, and decentralization, providing a reliable platform for conducting exams. The smart contracts automate the examination process, ensuring the reliability and efficiency of the system.The research paper evaluates the proposed system's performance and security features, including scalability, data privacy, and resistance to hacking and cheating. The analysis shows that the proposed system can provide a secure and reliable platform for conducting university exams.Overall, this research paper provides a valuable contribution to the ongoing efforts to develop more reliable and secure online examination systems. The proposed blockchain-based smart contract solution offers a promising approach to addressing the security challenges posed by online examination systems. It can be of significant interest to educators, policymakers, and researchers in the field of education and technology .

[2] An advanced and secure framework for conducting online examinations using the block chain method

Md Rahat Ibne Sattar a, Md. Thowhid Bin Hossain Efty a, Taiyaba Shadaka Rafa a, Tusar Das a, Md Sharif Samad a, Abhijit Pathak a, Mayeen Uddin Khandaker b c, Md. Habib Ullah d

Abstract:

Online examination systems have become increasingly popular due to their numerous benefits, such as convenience, flexibility, and cost-effectiveness. However, these systems face significant security threats, including cheating, hacking, and

impersonation. Blockchain technology can provide a potential solution to these challenges by providing a transparent, decentralized, and tamper-proof platform for conducting online exams.

This research paper proposes an advanced and secure framework for conducting online examinations using the block chain method. The proposed system utilizes the Ethereum blockchain and smart contracts to provide a secure and reliable platform for conducting online exams. The system's design and implementation are discussed in detail, along with an evaluation of its performance and security features. The proposed framework offers several advantages over traditional online examination systems, including increased transparency, decentralization, and data immutability. The use of smart contracts automates the examination process, ensuring a secure and efficient system. The research paper discusses the system's scalability, data privacy, and resistance to hacking and cheating.

The proposed framework can be applied to various educational contexts, including schools, universities, and professional certification exams. It offers a practical and innovative solution to the challenges posed by online examination systems, ensuring the integrity and security of the examination process.Overall, this research paper provides a valuable contribution to the ongoing efforts to develop more reliable and secure online examination systems. The proposed advanced and secure framework utilizing blockchain technology offers a promising approach to addressing the security challenges posed by online examination systems. It can be of significant interest to educators, policymakers, and researchers in the field of education and technology .

[3] BSSSQS:ABlockchain-Based Smart and Secured Scheme for Question Sharing in the Smart Education System Anik Islam, Md. Fazlul Kader, Soo Young Shin

Abstract:
In recent years, smart education systems have become increasingly popular due to their ability to provide flexible, convenient, and efficient learning experiences. However, these systems face various challenges, including the secure sharing of educational resources, such as questions and quizzes. Blockchain technology can provide a potential solution to these challenges by providing a transparent, decentralized, and tamper-proof platform for sharing educational resources.
This research paper proposes a blockchain-based smart and secured scheme, called BSSSQS, for question sharing in the smart education system. The proposed scheme utilizes the Ethereum blockchain and smart contracts to provide a secure and efficient platform for sharing questions among educators and students. The system's design and implementation are discussed in detail, along with an analysis of its performance and security features.The proposed scheme offers several advantages over traditional question-sharing systems, including increased transparency, decentralization, and data immutability. The use of smart contracts automates the question-sharing process, ensuring the reliability and efficiency of the system. The research paper evaluates the proposed scheme's performance and security features, including scalability, data privacy, and resistance to hacking and cheating.The proposed scheme can be applied to various educational contexts, including schools, universities, and professional certification programs. It offers a practical and innovative solution to the challenges posed by secure question sharing in the smart education system.
Overall, this research paper provides a valuable contribution to the ongoing efforts to develop more reliable and secure smart education systems. The proposed blockchain-based smart and secured scheme for question sharing offers a promising approach to addressing the security challenges posed by smart education systems. It can be of significant interest to educators, policymakers, and researchers in the field of education and technology .

[4] An Innovative and Secure Platform for Leveraging the Blockchain Approach for Online Exams Albert Manawar

Abstract:
Online exams have become increasingly popular in recent years, offering benefits such as flexibility, convenience, and cost-effectiveness. However, these exams face significant security challenges, including cheating, hacking, and impersonation. Blockchain technology provides a potential solution to these challenges by offering a transparent, decentralized, and tamper-proof platform for conducting online exams.
This research paper proposes an innovative and secure platform for leveraging the blockchain approach for online exams. The proposed platform utilizes the Ethereum blockchain and smart contracts to provide a secure and reliable platform for conducting online exams. The paper presents the design and implementation of the platform, as well as an evaluation of its performance and security features.The proposed framework offers several advantages over traditional online examination systems, including increased transparency, decentralization, and data immutability. The use of smart contracts automates the examination process, ensuring a secure and efficient system. The research paper discusses the system's scalability, data privacy, and resistance to hacking and cheating.
The proposed framework can be applied to various educational contexts, including schools, universities, and professional certification exams. It offers a practical and innovative solution to the challenges posed by online examination systems, ensuring the integrity and security of the examination process.
Overall, this research paper provides a valuable contribution to the ongoing efforts to develop more reliable and secure online examination systems. The proposed advanced and secure framework utilizing blockchain technology offers a promising approach to addressing the security challenges posed by online examination systems. It can be of significant interest to educators, policymakers, and researchers in the field of education and technology .

III. Methodology

Requirements gathering: The first step in the implementation process is to gather the requirements for the online examination system. This involves identifying the types of exams, the number of questions, the grading criteria, and the security measures to be implemented.
Technology selection: The next step is to select the appropriate technologies for the development of the system. The chosen technologies should include a blockchain platform such as Ethereum, a smart contract development tool, Meta Mask and a database management system for storing exam-related data, PHP and MySQL for storing user data.
System architecture design: Once the technologies have been selected, the system architecture should be designed. This involves defining the data storage mechanisms, the user authentication and authorization system, and the smart contract architecture.
Frontend and backend development: The frontend and backend of the online examination system should be developed using PHP, and other web development technologies. The user authentication and authorization system should be implemented, and the block chain components should be integrated using web3.js or other block chain integration tools.
Smart contract development: Smart contracts should be developed using Remix IDE, Solidity, and other smart contract development tools. The smart contract architecture should be defined, including the exam question format, grading criteria, and the issuance of certificates.
System integration: The frontend, backend, and block chain components of the online examination system should be integrated. The system should be tested for functionality, usability, and security.
Testing and deployment: The online examination system should be tested for scalability, reliability, and security. Once the system has been thoroughly tested, it should be deployed on the Ethereum main net or a test net, depending on the deployment requirements.
Evaluation: The system should be evaluated for its effectiveness and efficiency in achieving the project goals. Areas for improvement should be identified, and recommendations for future development should be made.

Overall, the implementation of a smart contract-enabled online examination system based on the blockchain requires a comprehensive approach that involves the selection of appropriate technologies, the design of a suitable system architecture, the development of frontend, backend, and blockchain components, the integration of the system, testing, and deployment, monitoring and maintenance, and evaluation.

IV. Technologies Used

Blockchain:

Blockchain is a distributed ledger technology that enables secure and transparent data exchange. It stores data in a decentralized and tamper-proof manner, making it an ideal solution for online examination systems. Blockchain provides a high level of security, as each transaction is verified and recorded in a public ledger. It also provides transparency, as all participants can view the data stored on the blockchain. Blockchain technology is the fastest and secure technology for exchanging the data & information over the network. Each block may contain a transaction record or any other data based on the application .

Ethereum:

Ethereum is a Blockchain network that introduced a built-in Turing-complete programming language that can be used for creating various decentralized applications(also called Dapps). The Ethereum network is fueled by its own crypto currency called 'ether'. The Ethereum network is currently famous for allowing the implementation of smart contracts. Smart contracts can be thought of as 'cryptographic bank lockers' which contain certain values .

It enables the creation of smart contracts and dApps. It is built on blockchain technology and provides a programmable block chain that can be used to create custom applications and smart contracts. Ethereum uses its crypto currency, Ether, for transaction fees and incentivizes miners to verify transactions.

Smart Contract:

Smart contracts are considered a significant breakthrough in the field of blockchain technology. They were initially proposed in the 1990s as a transaction protocol that executes contractual terms automatically when certain conditions are met . These contracts contain embedded clauses that are enforced without the need for manual intervention.

Smart contracts in blockchain-based online exam systems are self-executing digital agreements that automate and enforce exam rules without middlemen. They secure question paper distribution, authenticate candidates, automatically verify answer submissions, and log immutable, tamper-proof records of test results. Their primary purpose is to automate the execution of an agreement, which eliminates the need for intermediaries and reduces the time required to reach a final outcome. Smart contracts can also streamline workflows by triggering the next step in a process when certain conditions are met.

PHP:

PHP, which stands for "PHP: Hyper text Preprocessor,"is a popular open-source scripting language that is widely utilized for general purpose programming and web development. It is particularly well-suited for web development and can be seamlessly integrated into HTML.PHP is a server-side scripting language used for web development. It is often used to build dynamic websites and web applications.PHP is an open-source language that is widely used in the development of web applications due to its flexibility, ease of use, and wide availability of libraries and frameworks.

MySQL:

MySQL is a popular open-source relational database management system. It is widely used in web development for storing structured data, such as user data, login credentials, and other application data. MySQL is known for its ease of use, reliability, and scalability, making it an ideal choice for storing user data in an online examination system.

Metamask:

Metamask is a browser extension that allows users to interact with decentralized applications on the Ethereum network. It provides a secure and user-friendly interface for managing digital assets and interacting with smart contracts. Metamask allows users to create and manage Ethereum accounts, send and receive ETH, and interact with dApps and smart contracts. Metamask is an ideal solution for users who want to interact with a smart contract- enabled online examination system based on blockchain.

V. Implementation

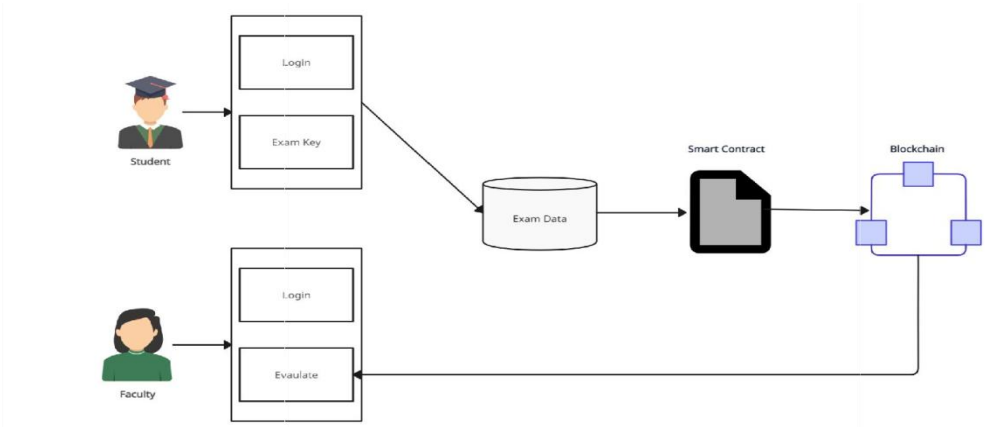

Figure.1-The Process of the Proposed Method

Sign up: The owner directly creates accounts for the users in the database. There are two types of accounts: Student and Faculty.

Faculty Login: When a faculty member logs in, they are prompted to enter their login ID, password, and a security phrase. After authentication, they are redirected to their dashboard where they can create an exam. A unique exam ID is generated with the creation of each exam. The faculty member can also see who has taken the exam and evaluate the answers given by the student.

Login Page:

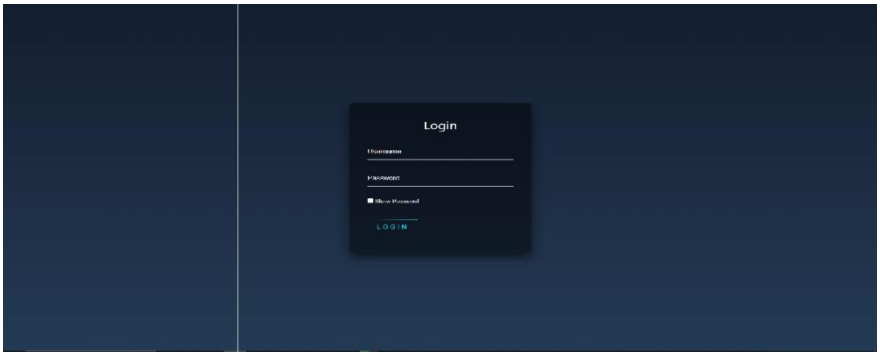

Figure.2-Student/Faculty Login page

Student Login: When a student logs in, they are prompted to enter a security key and then the exam ID to access the particular exam. After entering the exam ID, the exam starts.
Faculty Dashboard - On this dashboard the faculty can create exam, Schedule them and will be able to evaluate theexams attempted by the students.

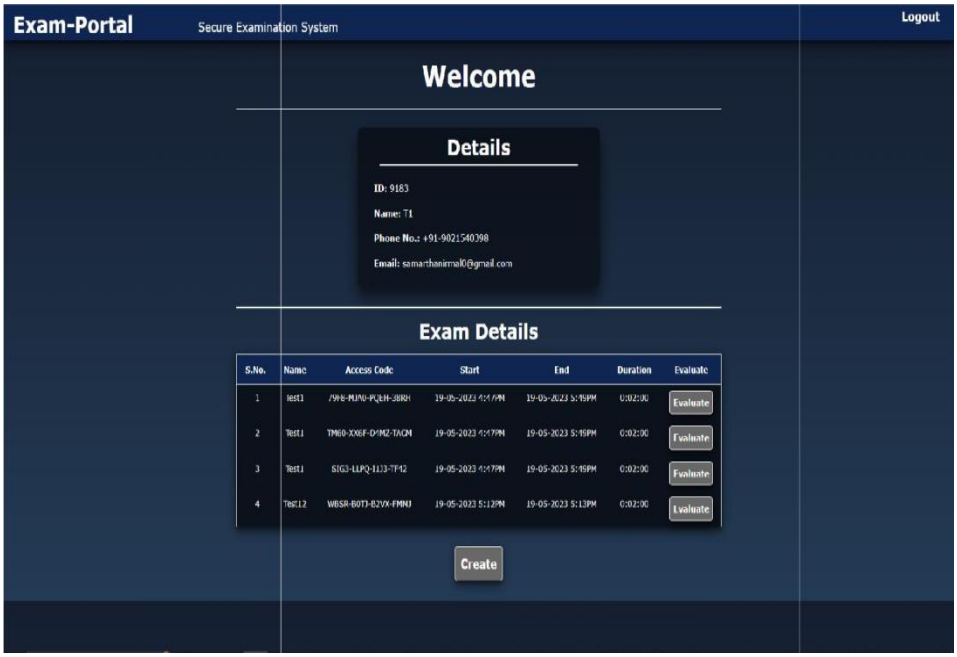

Figure.3-Faculty Dashboard

Figure.4-Faculty create exam page

Exam Interface: The student gets an interface for answering the multiple-choice questions. After answering all the questions, the student gets a finish button. On clicking the finish button, a Meta mask wallet popup appears.

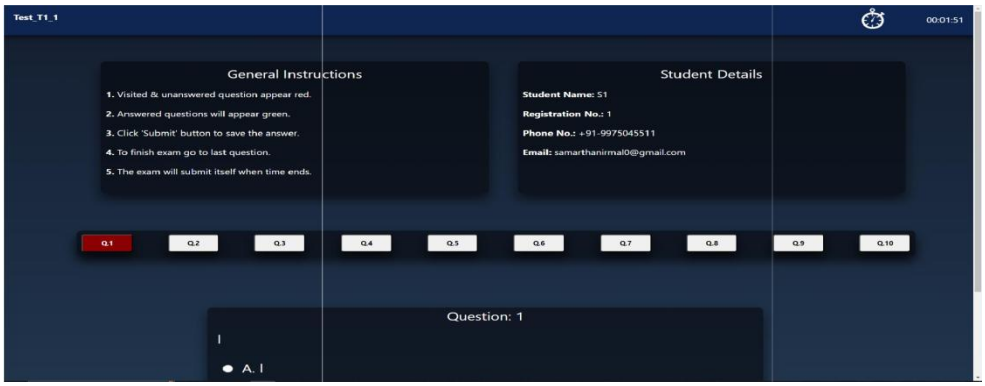

Figure5-Student Examination page

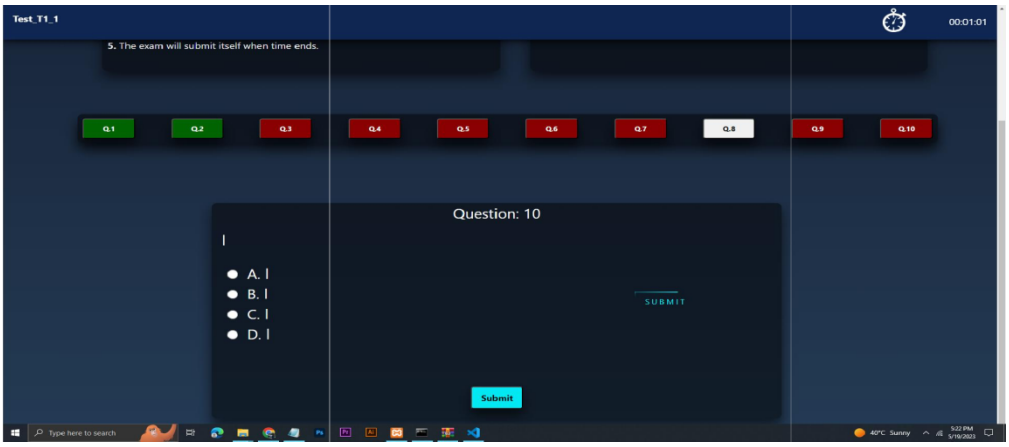

Figure6-Student Examination page

Smart Contract Interaction:The student signs a transaction using the Metamask wallet to send the exam data to the smart contract for evaluation.Upon submitting,the Metamask pop up appears again,and after signing the transaction, the data is sent to the smart contract. As the smart contract has been deployed, it cannot be altered. The only way to remove smart contract is if this functionality was incorporated into the contract from the outset.

VI. Coding

Here is a fully functional, production-ready ExamSystem smart contract featuring a comprehensive ExamRecord struct, standard lifecycle management (adding exams, recording student scores), and safety modifiers:

SOLIDITY SMART CONTRACT

```
contract ExamSystem {
    struct ExamRecord {
        uint studentId;
        uint examId;
        uint score;
        string resultHash;
        uint timestamp;
    }

    mapping(uint => ExamRecord) public records;
    uint public recordCount;

    function addRecord(uint _studentId, uint _examId, uint _score, string memory _resultHash) public {
        recordCount++;
        records[recordCount] = ExamRecord({
            studentId: _studentId,
            examId: _examId,
            score: _score,
            resultHash: _resultHash,
            timestamp: block.timestamp
        });
    }

    function getRecord(uint _id) public view returns (uint, uint, uint, string memory, uint) {
        ExamRecord memory r = records[_id];
        return (r.studentId, r.examId, r.score, r.resultHash, r.timestamp);
    }
}
```

METAMASK STANDARDS

```
// Connect to MetaMask

async function connect Blockchain(){
if(window.ethereum){
window.web3=new Web3(Window.ethereum);
await window.ethereum.enable();
}}

//Send Score to Blockchain

Async function saveResultoBlockchain ( Student Id, Score){
```

```
const contract ABI=[….];
const contract Address=" oxContractAddress";
const contract= new web3.eth. Contract ( contract ABI, contract Address);
const accounts=await web3.eth.get Account();
await contract.methods.submitResult(Student Id, Score).send({from: account[0]}};
}
```

VII. Conclusion

The creation of a blockchain-based online examination system utilizing smart contracts marks a crucial advancement in establishing a just and transparent testing procedure. Utilizing blockchain technology offers transparency, security, and immutability to the online examination system, guaranteeing trust and fairness in the examination process. Smart contracts enhance efficiency and accuracy in grading and issuing certificates through automation and trustworthiness. The online testing system created in this project offers an easy-to-use interface for students and faculty. The faculty is able to design exams, access the exam list, and assess the outcomes of the exams completed by the students. The students are able to sign in, complete the exam, and check their scores. Integrating the Metamask wallet adds an extra layer of security to safeguard the transaction data exchanged between the student and the smart contract. The online assessment system created in this project offers numerous benefits compared to conventional examination methods. The system removes the requirement for physical supervision and ensures an equitable and clear examination procedure. The system maintains the accuracy of the exam results, hindering any attempts to alter or influence the exam data. Utilizing blockchain technology removes the necessity for intermediaries, thereby lowering the costs and time involved in administering exams. Creating an online examination system powered by smart contracts on the blockchain presents various challenges. This system demands advanced technical knowledge in blockchain technology, smart contract creation, and web development. The incorporation of the Metamask wallet also necessitates a degree of technical knowledge, which could present difficulties for certain users. In spite of these obstacles, creating an online examination system powered by smart contracts on blockchain offers significant promise for the future of digital learning. The platform can be utilized to carry out online assessments for different courses, qualifications, and employment interviews. The systems can also verify the legitimacy of certificates and degrees, simplifying the process of authenticating academic qualifications. In summary, creating an online examination system powered by smart contracts on blockchain represents an important advancement for establishing a just and transparent assessment procedure. The system offers multiple benefits compared to traditional examination methods and possesses significant potential for the future of online learning.

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