Smart Contract Enabled Online Examination System Based on Blockchain

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Abstract: The envisioned innovation, a Blockchain-fueled Online Assessment Framework empowered by Smart Contracts, endeavors to redefine conventional examination methodologies through cutting-edge blockchain technology. This pioneering concept envisions an infallible and open assessment ecosystem driven by smart contracts. It aims to grant students the flexibility to undertake exams globally, liberating them from physical test centers. By eliminating reliance on external invigilators, it ensures cost reduction and upholds integrity. The system's architecture comprises four integral facets: the blockchain, smart contracts, a user-friendly interface, and an authentication framework. The blockchain's decentralized ledger forms the bedrock, ensuring tamper resistance crucial for a foolproof examination structure. Smart contracts, programmed for impartial execution, safeguard the fairness and integrity of the examination process. The user interface grants students seamless access to examinations, while the authentication mechanism guarantees entry solely to authorized users. This revolutionary system promises heightened efficiency, fortified security, and unparalleled transparency in examination procedures. It offers educational institutions a robust, secure, and streamlined examination mechanism, augmenting the credibility imperative in today's competitive academic sphere. Moreover, it alleviates expenses linked with traditional exam setups, eradicating the need for physical centers and invigilators. The project's realization involves crafting a proof-of-concept system to demonstrate the proposed framework's viability. Leveraging the Ethereum blockchain and harnessing smart contract technology, this proof-of concept will manifest the system's functionality through simulated examination scenarios. In essence, the Smart Contract Empowered Online Examination System, harnessed by Blockchain, stands poised to revolutionize assessments by harnessing blockchain's prowess. Its merits span amplified efficiency, fortified security, and unwavering transparency, promising advantages for both students and institutions. The roadmap entails a proof-of-concept, crucial in validating the proposed system's feasibility.

Index Terms - Component, formatting, style, styling, insert.

Keywords: Blockchain, Secure, Smart Contract, Solidity, Metamask, Ganache.

I. INTRODUCTION

The rise of blockchain technology has sparked changes in various fields, including education. Among its potential applications, the examination system stands to benefit. A proposed online exam system, using smart contracts and blockchain, aims to bring transparency and security to assessments. Conventional exams often face issues like manipulation and lack of transparency. Blockchain can enhance the system, making it more effective and secure. Smart contracts, functioning on the blockchain, ensure that exam processes remain fair and immune to manipulation. This innovative system takes advantage of blockchain's decentralized nature to create an exam setup that's tamper proof and transparent. Students could take exams from anywhere without needing physical test centers or external invigilators, cutting costs and ensuring integrity. Decentralized Applications, running on distributed networks, include highly secure features like Smart Contracts, ensuring transparent and secure transactions. Implementing this smart contract-based online exam system won't just benefit students; it'll provide institutions with a secure way to conduct exams. It'll also boost the credibility of the exam process, crucial in today's competitive education landscape. This design holds immense promise for transforming exams, leading to a more transparent and secure future. Using machine learning, this model can provide instantaneous defense against phishing attempts, bolstering online safety during browsing. The suggested blockchain infrastructure fortifies data integrity, deterring fraudulent activities among users or entities utilizing various applications and services. Essentially, this research introduces a robust framework for administering and assessing examinations, guaranteeing the reliable and secure transfer of test materials while also mitigating plagiarism concerns.

II. Purpose

The purpose of the project is to revolutionize and enhance the existing examination system using blockchain technology and smart contracts. This aims to: Enhance Transparency and Security: By leveraging blockchain's decentralized and tamper-proof nature, the project seeks to bring transparency and security to the examination process. It aims to eradicate issues like manipulation and lack of transparency prevalent in traditional exam systems. Enable Global Access: The project aims to enable students to take exams from anywhere in the world without the necessity of physical examination centers. This not only provides convenience but also reduces the costs associated with establishing and maintaining physical test locations. Ensure Fairness and Integrity: Smart contracts, running on the blockchain, are designed to execute automatically and ensure the fairness of the examination process. This helps in preventing any form of manipulation or unfair practices during exams. Cost Reduction and Efficiency: Eliminating the need for third-party invigilators and physical examination centers reduces operational costs. Additionally, it aims to create a more efficient examination process through the use of technology, potentially streamlining administrative tasks. Improve Credibility in Education: By offering a secure and transparent examination system, the project aims to enhance the credibility of the examination process, which is crucial in today's competitive educational landscape. Demonstrate Feasibility: The development of a proof-of-concept using Ethereum blockchain and smart contracts will showcase the viability and functionality of the proposed system, providing a roadmap for its potential implementation. In essence, the project seeks to transform the examination system by leveraging blockchain technology, ensuring transparency, security, and accessibility while mitigating various challenges associated with traditional examination methods. 3 Objectives: 3.1. Ensure Safe and Seamless Online Exams: Create a secure and easy-to-use online exam setup. 3.2. Upgrade Exam Security by Shifting to Blockchain: Shift the current cloud-based exam system to blockchain for improved protection against tampering or hacking. 3.3. Create a Cost-effective and Manageable Online Exam System: Make online exams more affordable and simpler to maintain, reducing operational costs and administrative efforts.

III. Literature survey

1. Kumar Tripathi, N. Chandra, and P. Chinnasamy, ''Smart contract enabled online examination system based in blockchain network,'' in Proc. Int. Conf. Comput. Commun. Informat. (ICCCI), Jan. 2021, pp. 1–7.
   Abstract:
   In today's world, data is one of the most important assets than any other. Every user wants to secure their data from the outer world. Blockchain is the prominent technology that can provide the security and loyalty of data. Initially, blockchain has been used for the cryptocurrency and all the data were available on the public distributed ledger. But now a days, private blockchain is widely used within the organizations for data security. Blockchain engenders decentralized systems in which data can be send and receive securely and efficiently over the network. It means there is everything is hidden from the outer world; only authorized users have the authority to read and write the data on the network. World's topmost industries; like Walmart, IBM, Google, etc. are adopting the blockchain technology to build the Decentralized Applications (DApps). 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. This platform is a public network platform, which is open to all and anyone can participate in this network to send and receives the transactions. Blockchain Technology is enabled in every sector like marketing, business, education and supply chain, etc. This paper carries out the study Ethereum Blockchain Platform in Education System. We have developed an application for the Online-Examination System using Blockchain Ethereum Platform with features of Smart Contracts that enables server runtime environment NodeJS and MongoDB database system. Blockchain-based system is truly more secure than all the Cloud based systems. We have also analysed that how blockchain based online examination is more trustworthy as compare the other systems.

2. Siddhi S. Shinde, Aniket B. Nimse, Krushna K. Ugale, Rushikesh K. Waghmare, Prof. Gagare S.M. "Online Examination System Based in Blockchain Network", IJCSPUB , Issue 2 May 2023
   Abstract:
   The distributed ledgers that are computerised, secure, and allow for secure, open, and unchangeable transactions are known as smart contracts. Data is created and verified via smart contracts with the use of hashing. It is a mathematical process that employs MD5, the most potent cryptographic hash algorithm. The input text generates a 256-bit signature as a result. An extremely popular platform for developing system is the Blockchain Platform. This platform is part of a public network that is accessible to everyone, and anybody can use it to make and receive transactions. Every industry, including supply chains, business, and education, has adopted blockchain technology. The Blockchain Platform in Education System is studied in this essay. With the help of the Blockchain Platform and its Smart Contract features, which enable the server runtime environments Java and MySQL database system, we have created an application for the Online-Examination System. The security of blockchain-based solutions exceeds that of all cloud-based systems combined. We have also examined how blockchain based online testing is more reliable than other approaches.

3. Rohan Sonpipare, Shubham Wasekar, Piyush Kadhikaye, Rushikesh Mule, Sumesh Patil, Akash Shinde "Online Examination System", IJRASET Issue 10 May 2022
   Abstract:
   The online Examination portal is a web-based application for technical evaluation. The online examination portal not only replaces paperwork but also releases the workload of faculty. Most of the e examination (Online Examinations) have fixed number of questions without randomizations, they have pool scalability. Online examination system is increasing rapidly

with the change in scenario due to the pandemic, also it seems to be an easy, flexible, and secure methodology to carry the examinations effectively.

4. MOHAMED ABDELSALAM, MARWAN SHOKRY, AND AMIRA M. IDREES "A Proposed Model for Improving the Reliability of Online Exam Results Using Blockchain", IEEE Access, Received 18 July 2023, accepted 3 August 2023, date of publication 14 August 2023

Abstract:
In recent times, Learning Management Systems (LMS) have gained significant popularity, particularly due to the COVID-19 pandemic, offering improved effectiveness and efficiency. Within LMS, online exams have emerged as a critical tool for assessing students' performance and understanding of course material, playing a vital role in determining their progression. Ensuring the reliability and transparency of online exam results is imperative. Any vulnerability, such as hacking, can adversely impact students' grades. Conventional online exam systems often store data centrally in databases like MySQL, making them susceptible to unauthorized access and manipulation. This paper presents a blockchain-based framework to enable secure and peer-to-peer conduction and evaluation of academic exams. The framework uses hashing techniques to ensure data integrity and employs proof of stake mechanisms for enhanced security. Blockchain's decentralized data storage and cryptographic hashing for each block make it effective in safeguarding data integrity. The paper demonstrates the use of blockchain for developing online exams, storing each question and answer directly on the blockchain. To achieve this, we have created a module that integrates with the Moodle learning management system. Through a comparative analysis with Moodle's default centralized storage, our module modifies the exam result storage, ensuring secure and tamper-proof data storage on the blockchain. By leveraging the blockchain, exam data is reliably secured, maintaining integrity, and resisting manipulation. Our results show that data stored on the blockchain is entirely accurate, with no discrepancies compared to Moodle's standard approach. The blockchain network provides a reliable and immutable platform, preventing unauthorized changes to student data. In conclusion, our blockchain based framework offers a robust solution for enhancing the security and reliability of online exam results. By harnessing blockchain's decentralized and tamper-proof nature, we ensure data integrity and transparency, providing a more trustworthy assessment of academic performance.
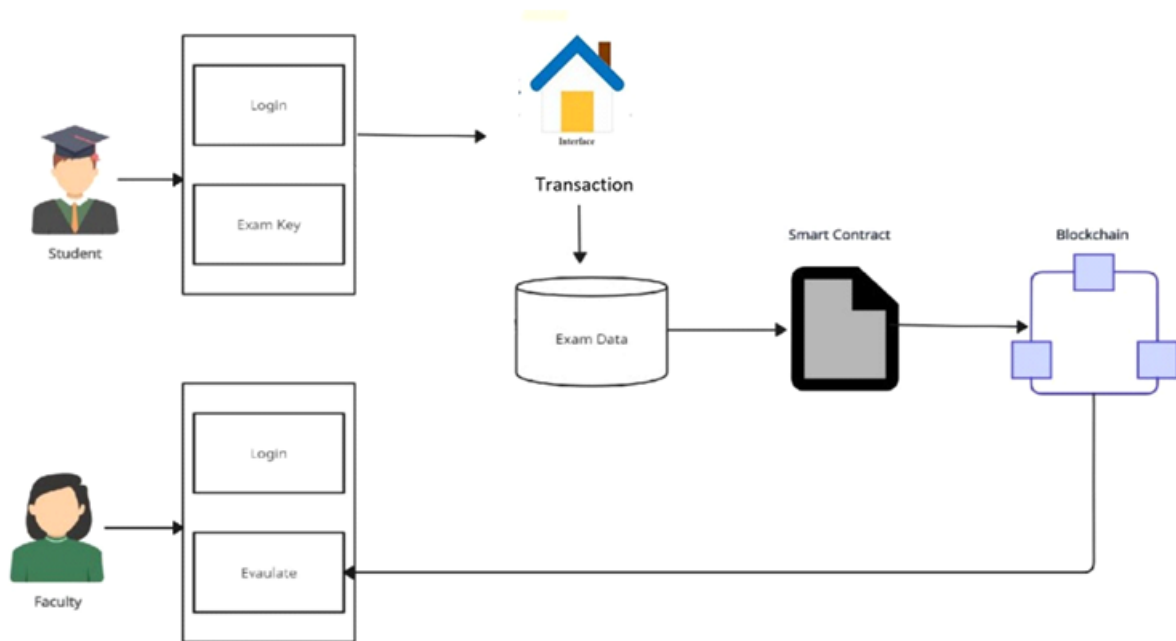
IV. SYSTEM ARCHITECTURE

Figure - The Process of the Proposed Method

The web app operates by allowing the owner to create user accounts for students and faculty. Faculty members log in using their login ID, password, and a security code, which directs them to their dashboard where they can create exams, each assigned a unique exam ID. They can also view and evaluate student submissions. Students log in with a security key and an exam ID to access and take specific exams. The exam interface presents multiple questions and a "Finish" button, which triggers a Metamask wallet popup for submitting the exam data to a smart contract for evaluation. This interaction ensures secure and accurate assessment, with the evaluation interface color-coding ticked answers in green and unanswered questions in red to facilitate quick feedback from faculty.

V. SYSTEM REQUIREMENT

Software Requirements
PHP
MongoDB (NoSQL)
MySQL
Blockchain Ethereum
Remix-IDE
Solidity
MetaMask
Ganache

Hardware requirements
RAM – 8GB or higher
Hard Disk – Minimum 128 GB
HDD/SSD
Processor – Intel i3 8th Generation or equivalent. (Better Efficiency if Higher) 64-bit System.

VI. CONCLUSION

This project introduces a secure online exam system using blockchain and smart contracts. Blockchain ensures exam integrity, and smart contracts automate grading and certification. It's user-friendly for faculty and students, removing the need for physical supervision and ensuring fairness. However, developing this system needs expertise in blockchain, smart contracts, and web tech, and integrating Metamask requires technical skill. Despite challenges, this system shows promise for online education, offering secure exams and certificate authentication. The current setup uses Ethereum's public blockchain, but a move to Hyperledger Besu is planned for cost efficiency. This system could revolutionize online exams, but technical know-how is essential for its implementation.

VII. REFERENCS

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2. Siddhi S. Shinde, Aniket B. Nimse, Krushna K. Ugale, Rushikesh K. Waghmare, Prof. Gagare S.M. "Online Examination System Based in Blockchain Network", IJCSPUB , Issue 2 May 2023 .

3. Rohan Sonpipare, Shubham Wasekar, Piyush Kadhikaye, Rushikesh Mule, Sumesh Patil, Akash Shinde "Online Examination System", IJRASET Issue 10 May 2022.

4. MOHAMED ABDELSALAM , MARWAN SHOKRY , AND AMIRA M. IDREES "A Proposed Model for Improving the Reliability of Online Exam Results Using Blockchain" , IEEE Access, Received 18 July 2023, accepted 3 August 2023, date of publication 14 August 2023.

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