

Applying Blockchain on Government Examination: A Study on Blockchain Technology, Benefits, and challenges

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Abstract: *The primary objective of this paper is to provide a blockchain-based framework for conducting and evaluating Government examinations. To perform the test as transparently as possible, we store the hash code of every question asked and answered directly on the Blockchain Network. This facilitates tracking how exactly a candidate received the score he or she received, adding more credibility & transparency to the obtained score. Most of the work in educational institutions is based on technology like blockchain, it can transform into a simplified, paperless manner. The advanced security mechanism of blockchain will ensure that the system can be immune to hacking. Data can not be manipulated with any other entity apart from the node owners.*

Keywords: Blockchain in Education; blockchain applications; educational technology; decentralized systems

I. INTRODUCTION

Blockchain is a specific type of database that stores data in blocks that are then chained together. Each block communicates with other nodes or blocks securely. Each update is informed to another node or block so that information across all nodes is synced and stable. Blockchain is becoming the new word for high security of digital data, which assures us high security of data by creating a secure and transparent environment through Smart Contracts, which automatically executes the agreements of code approved by the participants.

Government and competitive examinations are the tools used by the Institutions to check student's ability in education. In the early 2000s there have been many cases of fraud and corruption on the Government and Institutions on the leak of paper or Bribe taken by authority for giving jobs or admissions in the institutions. Deserving candidates were not selected, and people started losing their trust in the government. Recently, the government has ordered a CBI investigation into an alleged 'Staff Selection Commission (SSC) exam scam, candidates who've alleged that the question paper was leaked and database of the candidate are manipulated, in Bhopal too, the SSC had to cancel the exam after candidates allegedly found that several questions were already marked with answers. To solve this issue, the Government and Institute try to Digitalized the paper to select the deserving candidate. Still, regarding the efforts, it has been seen that nowadays people even bribe the system, which leads to manipulation in the marks of students in the database. Even after many efforts, there are cases of several servers being hacked and data being leaked, giving an advantage to the Undeserving Candidates.

So we came up with the idea of a framework for conducting decentralized examinations using Blockchain Technology for better evaluation and maintenance of examination records such that the documents are more credible, reliable, transparent, and secure concerning the current examination system. The current system of conducting examinations suffers extreme manipulation cases in the database either by students, external security breachers, or by insiders with administrative access. The proposed blockchain-based system can address these concerns.

II. RELATED WORK

The existing way for conducting the examination is through manual verification of the candidate and manual Evaluation with the centralized authority in power. Due to which there is a much higher chance of corruption and the undeserving candidate being selected.

In 2020, the Assam police arrested the most wanted proxy Candidate, Pradip Kumar, who had written the Joint Entrance (Mains) for Neel Nakshatra Das, who secured 99.8 percent marks and was one of the top rank holders in the all India

engineering entrance test [24].

There are many models for examinations that have come in these 2-3 years which use technology like AI models for conducting examinations, but these models are not so useful and secure for conducting examinations and can be bypassed easily by the candidate. The Video camera model was also proposed but it was also bypassed by the multiple software and was removed after some time. There are very few success rates in this model for catching the wrong candidate.

Another fundamental problem with the scorecard of the current examination system is that they do not provide enough data to represent the performance of a candidate taking up the test. The scorecards contain minimal information about the performance. It only accounts for the final score granted by one or two evaluators without disclosing the questions asked and how the questions were answered. With no idea of the types of questions asked to a candidate, correlating the score with the caliber of the candidate mostly leads to inaccurate conclusions. (recently seen in protest of students in ICAI Bhavan, Delhi) [27]

We also follow an existing pattern of vote-based consensus mechanism called the Delegated Proof of Stake. There is also an existing algorithm to store the fingerprint in the blockchain with the help of a “symmetric key algorithm” where the hash of the fingerprint is stored in a decentralized database which will help our model to make it more secure and transparent. There have also been many models used for student academic storage and verification which have been successfully executed.

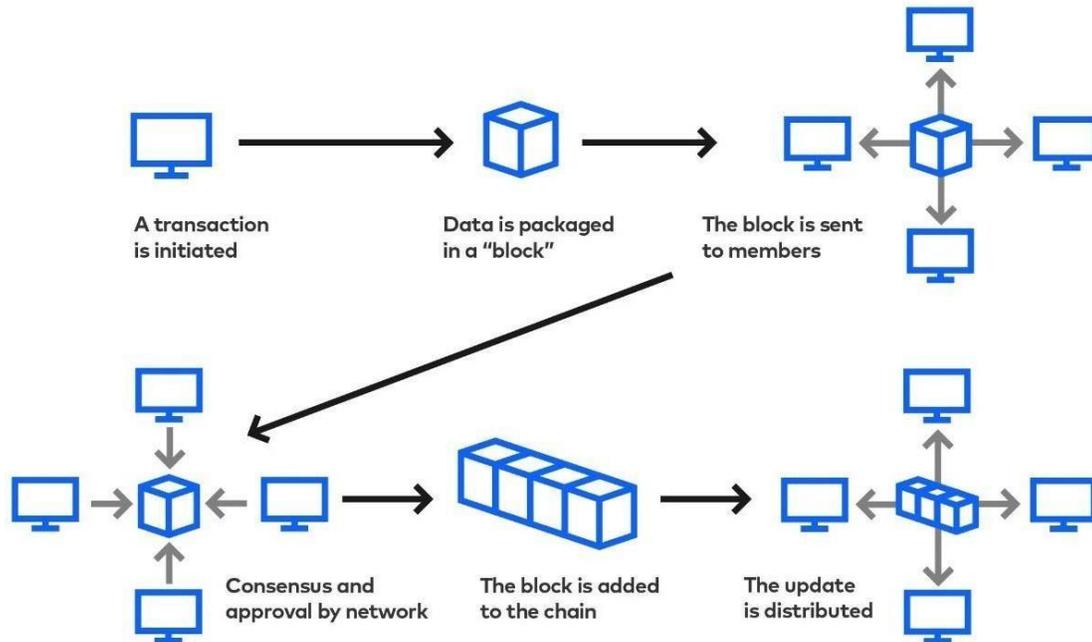


Fig 1: Decentralised Distributed Ledger

At first, blockchain was just utilized in the field of digital money and business [12]. Due to its unique and interesting features like decentralization, permanence, straightforwardness, and information uprightness, it has expanded the capability of blockchain-based applications in different regions [16]. The utilization of blockchain in education has acquired lots of consideration lately from specialists and professionals. Lots of articles have been distributed identifying uses of blockchain in the training area yet none of the articles discusses the utilization of blockchain in government examinations. Article [6] talks about the benefits of blockchain in education applications and proposes some open-source blockchain stages for its execution.

Article [1] gave a survey of exploration which researches blockchain-based instruction applications. In the article, an audit was conducted on three fundamental parts of blockchain: (1)

Education applications that have been created by utilizing blockchain innovation; (2) advantages that blockchain can provide for training framework; (3) difficulties of embracing blockchain innovation. A definite examination of these viewpoints was done and results were provided. That offers bits of knowledge about how other instructive regions could be profited by blockchain innovation.

Still, blockchain in the education area is in its beginning phase. A couple of instructive organizations have begun utilizing blockchain [33]. The organizations that began utilizing blockchain are essentially utilizing it with the end goal of "record-keeping of degrees, certificates, and diplomas". Blockchain for the instructive stage depends on Ethereum and it utilizes keen agreements for certificate measures [3].

This [4] paper discusses the advantages, dangers, and difficulties for the effective execution of blockchain-based arrangements in the field of instruction. They had analyzed the yields gotten by a few scientists and specialist networks to distinguish how blockchain could be applied in the schooling setting. This paper [5] focused on the potential application of the possible utilization of blockchain in taking care of instructive issues. It presents a few highlights and utilization of blockchain, as Innovative uses of utilizing blockchain in instruction framework alongside its advantages and challenges.

II. METHODOLOGY

The work-flow of the proposed framework is as follows:

This paper proposed a new scheme for the smart result by utilizing blockchain-based on a two- phase encryption technique for encrypting the final result. In the first phase, question papers are encrypted using a timestamp, and in the second phase, the result is encrypted using question paper hashcode. These encrypted results are stored in the blockchain along with a smart contract which helps the user to unlock the result with the same question paper hashcode. Here we proposed a method for selecting a question paper for the exams, which randomly picks a question paper with a hash code. Moreover, a timestamp-based lock is imposed on the scheme so that no one can decrypt the question paper before the allotted time. Finally, the result gets stored in Blocks of the Blockchain, and security is analyzed by demonstrating various suggestions and the prevalence of the proposed scheme over existing. It is demonstrated through a comparative study based on the various features; it provides a persistent public record, safeguarded against changes to the institution or loss of its result records

Security Mechanism of Blockchain using Smart Contracts For Conducting Fair Examination.

Smart contracts[28] use blockchain technology to validate, verify, capture and enforce agreed- upon terms between multiple parties. In smart contracts, all the data stored is secure and immutable. The data of a smart contract is encrypted and exists on a ledger, which means that the information recorded in the blocks can never be modified, lost, or deleted.

Steps to verify the student/user attending the examination

1. Users register at the blockchain front-end examination by giving personal details and their fingerprint, which would be stored as a Hash code in Examiner's Blockchain verification database, and would be used to verify the user at the time of the examination.
2. At the time of the examination, the examiner needs to verify the user with the help of his details and the fingerprints which would send the information to the blockchain of the registered students and would confirm with the hashcode generated, if the Hash code generated matches with the database of the registered students, and it matches the conditions of the smart contract, the success message would be sent, and the user will be verified. This will decrease the chance of malpractice, and the eligible candidate would only be able to attend the examination.
3. For creating the hash code for the verification purpose, fingerprint templates and user identities are combined by passing them into the hash function and creating a unique hash code for the identification purpose.
4. As fingerprints are unique and individual to everyone, it's an excellent way to verify the users. The data of fingerprints are collected by encrypting the finger template into data sets. The users' identification details like name, age, address, etc., are collected and passed into the hash function with the fingerprint data sets, and a unique hash code is generated for each user for his identification purpose. As the organization verifies the user's data, then the data is stored in the Blockchain of the registered students.
5. After the verification, the organization will issue a smart contract to verify the contract needs.
6. Now we will use another blockchain that will connect personal detail's of candidate with the question paper which will ensure that every question paper id is assign to a candidate and it will also ensure that there is no leakage of question paper before the examination. because question paper would be only visible to those valid candidate which is meeting the criteria of smart contract.

7. Every candidate have a unique answersheet id which is connected to candidate id via blockchain through the has code of question paper which is already assigned to the candidate.
8. Now, Finally every candidate result is connected via blockchain of candidate detail so now candidate can see their result with 100% surety. In this way, a mutual trust and transparency will create between government and candidates who is giving any government exam. This advanced security mechanism of Blockchain technology would ensure that the system can be immune from hacking which means data can not be manipulated with any other entity apart from node **owners**.
9. Challenges of Adopting Blockchain Technology in Education and Conducting of Government examinations.
10. Despite the way that blockchain has extraordinary potential in an educational context, various difficulties should be considered before executing it. Like some other groundbreaking innovations, blockchain in its beginning phases of advancement faces a few difficulties. regardless of whether it be a mix with inheritance frameworks, HR requirements, cost of execution, and so forth.

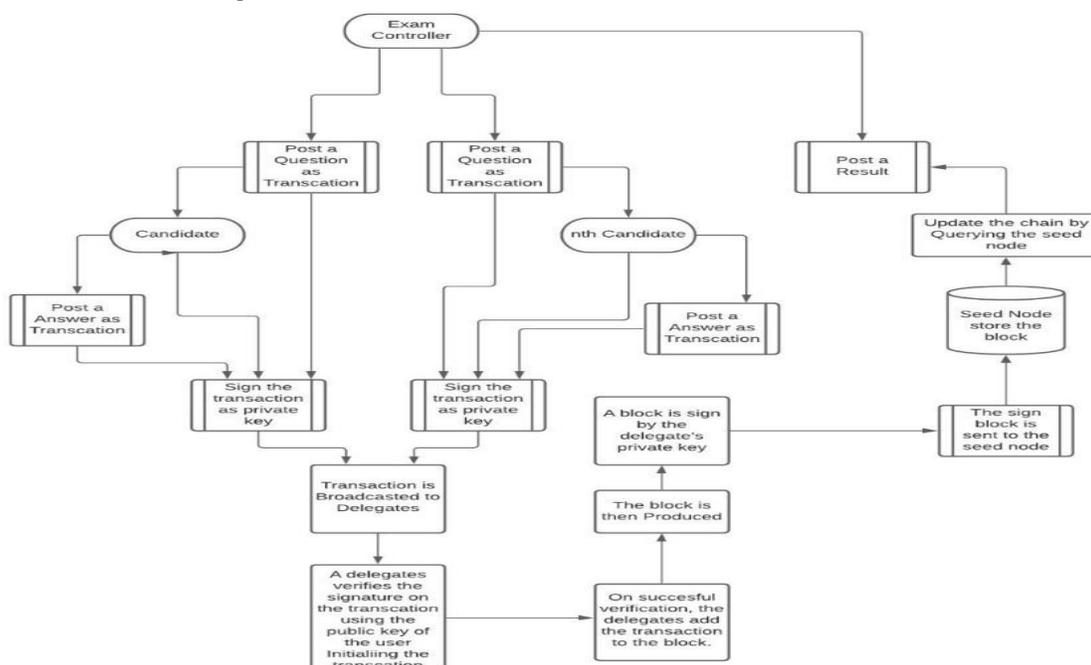


Fig 2: Online examinations using blockchain architecture diagram

IV. INCORPORATION WITH INHERITANCE FRAMEWORKS

There can be a few difficulties and dangers to change the conventional schooling framework with altogether innovation like blockchain. As it is hard to comprehend for training field clients, instruction policymaker, or another policymaker. They need to consider whether blockchain is solid for its drawn-out use. So early cooperation between the public authority or advanced education with private areas can help blockchain appropriation in training areas. This is an ideal opportunity to work together, examine, and offer encounters to understand the maximum capacity of building a new advanced education ecosystem. As Blockchain is probably the best development of current occasions it will require some time before the innovation is embraced generally.

4.1 Human Asset Limitations

An arising innovation, in its initial long periods of selection, requires bunches of information, abilities, and specialized skill for implementation. so, the imperative numbers for both variation and execution are in short at present in India. The absence of administrative vulnerabilities also discourages people from entering this area. Blockchain is an arising

innovation that should be incorporated with the current framework yet right now there is no standard government body or outsider that could evaluate these administrations and handle information on the specialized robustness of blockchain execution.

4.2 Absence of Cleanness

Another issue is the absence of cleanness on the phrasing and youthfulness of the blockchain innovation. Furthermore, there are numerous unpredictable settings that clients may need to store for security reasons, for example, essential key, public key, and recuperation seeds.

4.2 Cost of Execution

The cost of appropriation and execution of blockchain in instruction settings can be high. Aside from execution cost, the exchange or computational expense of numerous methods of blockchain is additionally high and right now the rural population doesn't have appropriate admittance to web and power supply. Apart From these issues, the country populace is likewise inexperienced with new technologies. so, the implementation of a blockchain-based training framework can be exorbitant in rural India.

4.3 Benefits that Blockchain could Bring to Government examinations

Blockchain has the potential to revolutionize the entire education sector. It is the only hope for the education industry to prevent fraud and provide quality education, considering that there are many benefits of blockchain because it offers a fast and secure alternative, which is very beneficial for the upcoming future.

4.4 Security

Several articles identified security as an essential benefit of integrating blockchain technology in education. Security includes data protection, privacy, and integrity. This technology is far more secure than other centralized database systems because this technology also comes with new security considerations and attack vectors, making this technology threat accessible.

4.5 Transparency

It increases transparency because anyone can join the network, as a result, view all information on the network, in case of marks, it will offer the user an opportunity to look through the history of all altered marks if changed. Moreover, all parties in the network can see changes to public blockchains, thus ensuring transparency, providing a permanent, incorruptible historical record that stays in the system permanently.

4.6 Trust

According to several articles, blockchain can establish trust between all included parties and ease the communication between them. If the government stores the marks of lakhs of candidates, it will require a lot of space; saving this data on a single database brings us to centralize the data. Suppose somehow the database is damaged or compromised in any way. In that case, it will create many problems; a possible and best solution would be a blockchain-based cloud storage service that can't be altered and will increase the trust among candidates.

4.7 Fast

Recording and verifying candidate's credentials can be costly and time-consuming for NTA (National Testing Agency) which conducts various government exams across India. But using blockchain technology is quite easy because of the design of the blockchain-distributed database. Due to which server errors are next to impossible and data cannot be altered due to the decentralized nature of Blockchain Technology. It offers fast services by removing the monopolistic power of powerful intermediaries (e.g. banks in case of remittances[28] or large, centralized industry leaders (e.g. Flipkart, Byjus).

4.8 Identity

Instead of storing the student identity document, the blockchain stores information about that document. Using blockchain, students can identify themselves online while maintaining control over the storage and management of their data.

4.9 Future of Blockchain in Government Examination

Using Blockchain technology, we can solve the problem of Conducting fair examinations. NITI Aayog in 2020 has also generated the blockchain strategy for India towards ease of Business, living, and governance [29]. The Indian government has also started working on a “SuperCert” anti-fraud identity intelligence blockchain solution for educational certificates. As the examinations are going towards 100% digitalization, we need a secure system to conduct examinations. due to its very high security, blockchain will help both the Organisations and the candidate conduct fair examinations. Cyber Crimes also increase with the increase in technology, so conducting fair examinations is becoming very difficult nowadays.

1. The University Grants Commission (UGC) has been acting on several projects for conducting the digital examination. Blockchain examinations would also be cost- effective and easily scalable to any number of candidates throughout the world. But in India, it is impossible because there is still a lack of computer knowledge in many parts of India, and the Internet has not reached there. The research shows that the integration of blockchain technology is a promising trend in the development of online education.
2. The current approach can further be enhanced by integrating the web application with the blockchain. We can use a combination of blockchain and IPFS to achieve decentralization and secure peer-to-peer communication. We are encrypting question papers and our packets to ensure more safety & security.
3. Blockchain can be used to revolutionize the Education sector towards positive change. More and more collaborations and information exchange, verification use cases would come up in the education sector. Blockchain can help eliminate many barriers to make the process simpler and better for conducting examinations and in other applications.
4. The Initiative taken by the government for digital India should be taken seriously. Because digital is the future, and the technologies can only be implemented successfully if the whole country shifts towards digitalization.
5. Due to cybercrimes and corrupted people in organizations, the unfair candidates are being selected. Blockchain can help to stop these so that fine selection takes place. Candidates who study hard wait for the result, but people have started losing hope in the system due to unfair examination practices.
6. Blockchain guarantees the reliability of data management for conducting decentralized examinations and for better evaluation of the examination records with the most transparent means.

V. CONCLUSION

The blockchain technology used for digital currency has moved beyond in other fields such as healthcare, agriculture, the Internet of things, and Education. The benefits we get from the blockchain and smart contracts can be used in the education sector to conduct decentralized examinations and better transparency.

We try to make the current system of examination as transparent as possible by using the Security Mechanism of Blockchain using Smart Contracts for Conducting fair examinations recording the user's details and examination on the immutable public every operation in examinations is stored as a transaction in the blockchain. As blockchain is an emerging technology, a lot of research is still going on in this field. The idea can be complicated to be implemented, but it can solve a large problem globally. As the world is going fully digital, we need a security system for online examinations. The applications of blockchain in the education field are minimal. We are in the first generation of blockchain technology, and still, there is a lot to explore about it. Therefore, the potential for blockchain is still unexploited.

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