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Validation of Academic Credentials using Block chain

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Abstract - This paper provides solution for verification of academic documents by the third party using block chain technology. For verification of credentials data protection technique is used, which makes the access to documents easier by third party. Every new pass out student need not require carrying all digital identities. This work addresses the issue of fake academic qualifications in competitive job markets. The system implemented here makes the verification process very effective which contributes to reduce the fake credentials. This approach provides third party access for verification of academic documents. This verification process is implemented using web service Pinata which makes the process of sharing and storing files very easily on Interplanetary File System. Smart contracts are developed and deployed using Hardhat platform. Data security and testing is done using integrating tool like Meta mask by leveraging tamper proof nature of block chain. Hence globally the validation of student credentials and enhancement of trust building of new passed out student is ensured by this work.

Key Words: Block chain Technology, Smart Contracts, Credential Verification, Digital Identity, Trust.`

1. INTRODUCTION *(Size 11, Times New roman)*

Education is important for society because it helps people learn new things, get better jobs, and contribute positively to their communities. Countries that are doing well usually spend a lot on education because they know how much it helps everyone. But sometimes, people cheat the system by making up their education history to look better to employers. This is a big problem because it makes it hard to tell who is really qualified and who isn't, especially in jobs where being good at what you do is very important for safety and getting work done right. Blockchain can help by making it easier and faster to check if someone's degree is real, so everyone knows who is telling the truth about their education. In this project, the validity of the educational document will be determined utilizing block chain technology.

II. LITERATURE REVIEW

Blockchain technology is an advanced database mechanism that allows transparent information sharing in a business network. A blockchain database stores data in blocks that are linked together in a chain. A blockchain is like a highly secure digital ledger that stores information across a network of computers. This information, once added, cannot be easily changed, or removed, making it resistant for tampering. Because the data is replicated across many computers, it's always available and transparent for anyone to see. What is unique is that users can interact and agree on the validity of data without any need to trust a central authority. The paper [3] proposes a permissioned blockchain- based system for the transfer and verification of academic records. This system uses Hyper ledger Fabric and Hyper ledger Composer to retain the hash of the records on the blockchain for verification. the data storage system that this paper is proposing is decentralized, not centralized. This is because the blockchain technology it's using (Hyper ledger Fabric) operates on a distributed model where data is spread across multiple nodes or computers, and these nodes work together to achieve a common goal . This paper proposes a solution based on Hyper ledger for verifying academic records. Hyper ledger Fabric, the specific type of Hyper ledger technology mentioned in the paper, supports various pluggable options for data encryption, including SHA (Secure Hash Algorithm) and AES (Advanced Encryption Standard). The paper uses SHA256 for data encryption. SHA256, which stands for Secure Hash Algorithm 256-bit, is a cryptographic hash function thatproducesa256-bit(32-byte) hash value. It's commonly used in blockchain technologies for data verification. The paper proposes a system for verifying the authenticity of educational certificates using blockchain technology, specifically Hyper ledger Fabric. While the paper does not explicitly state which data encryption technique is used, it

mentions the use of Hyper ledger Fabric, a blockchain platform, and IPFS (Interplanetary File System), a decentralized storage system.

The three pillars of blockchain technology are Immutability, Decentralization, and Transparency. The "Development and evaluation of blockchain based secure application for verification and validating for academic certificates" this system uses public blockchain[4] .i.e. Ethereum blockchain. This blockchain is type of public blockchain open to anyone who wants to join and participate in the network. Fake passport detection using blockchain uses public blockchain such as Ethereum blockchain. This system was created for detecting fake passports [5]. Many research papers have been reviewed and comparison of various blockchain technologies such as Ethereum[8], Quorum, the Hyper ledger Fabric[3], and Hyper ledger Networking[10] have been done. Throughput (the number of transactions that are successful per second), latency (the time it takes to respond per transaction), scalability (the changes in latency and throughput when the number of nodes and concurrent workload is increased),and fault tolerance (the impacton speed and latency with node failure) are the parameters that were assessed.

This paper [10] proposes a blockchain-based solution that ensures confidentiality, integrity, and privacy of data. The use of blockchain technology, especially when combined with decentralized storage systems like the Interplanetary File System (IPFS), inherently provides these properties. Confidentiality is maintained because only authorized parties can access the data stored on the blockchain. Integrity is ensured because any attempt to alter the data will result in a completely different hash, making it evident that the data has been tampered with. Privacy is preserved because the data is not stored in a centralized location, reducing the risk of unauthorized access .This paper proposes a solution based on Federated Blockchain technology that allows specific organizations to submit candidates' original documents. It validates the student's submitted document hash value by comparing the existing cryptographic hash in the Blockchain. SHA-512 is used to generate the hash values for the documents This paper proposed a permissioned blockchain- based system that ensures confidentiality, integrity, and privacy of data. The use of blockchain technology, especially when combined with permissioned blockchains like Hyper ledger, inherently provides these properties. Confidentiality is maintained because only authorized parties can access the data stored on the blockchain. [10]Integrity is ensured because any attempt to alter the data will result in a completely different hash, making it evident that the data has been tampered with. Privacy is preserved because the data is not stored in a centralized location, reducing the risk of unauthorized access.

III. METHODOLOGY

This work proposes a blockchain-based solution for verifying academic credentials by the employer who employs a new pass-out student. Employer verifies the credentials with the institute from where the student has passed out which is challenging and time-consuming. This step of verifying credentials from the institute can be replaced by our proposed work. The steps for the proposed work are given in Figure1 Document Verification flowchart.

In our work currently, we are mainly dealing with two entities user and admin but when it comes to sharing the documents or certificates to third parties such as educational institutes or employers, etc we need to develop a service to deal with these third- party assets. This service mainly deals with the student and third party and this third party should get access to the credentials for verification. This work aims to address the problem of fake degrees and forged qualifications by leveraging the transparency and data integrity features of blockchain technology. By using the blockchain, the verification of academic credentials becomes more efficient and it provides a secure and transparent system for storing and verifying academic records, benefiting both educational institutions and individuals. By using blockchain the project will generate a unique hash value for every document that is shared or stored on the network which is an important aspect of data immutability and makes it promising solution for academic or document verification. The student will provide the hash value of the credential to the employer and the employer will match the same hash value with the hash value of the institute.

IV. IMPLEMENTATION

Some of the technologies implemented in our work are discussed here. In the field of Web3, services like Pinata simplify the process of storing and sharing files on the Interplanetary File System (IPFS), a distributed file system known for its resilience and censorship resistance. Pinata's accessibility ensures that decentralized applications relying on long-term data reliability can easily maintain access to their media and files on IPFS. Additionally, platforms like Hardhat

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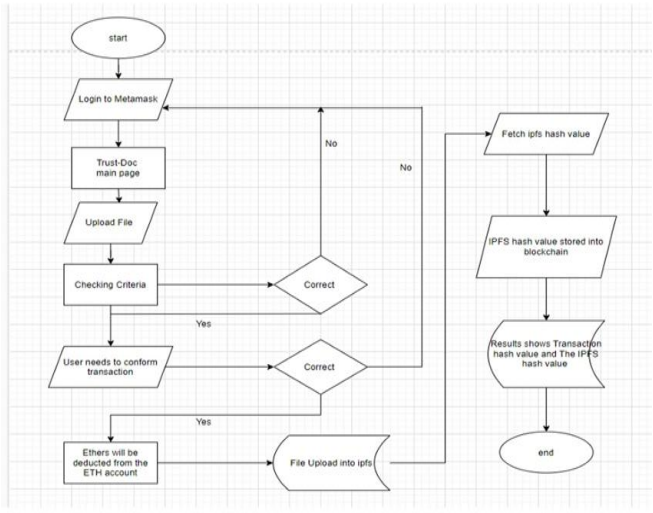

Fig 1 : Document Verification Flowchart

streamline the development, testing, and deployment of smart contracts on Ethereum, a vital component for decentralized app creation. By integrating tools like MetaMask into the testing phase, developers ensure seamless user interactions with their decentralized app. Beyond mere convenience, the scalability of these technologies holds promise for storing sensitive information securely, potentially revolutionizing data security by leveraging the tamper-proof nature of blockchain and IPFS. The fake document upload and the block chain architecture for document verification are as shown in figure2&3 This approach could redefine how we safeguard business-critical data, offering robust solutions to issues like data breaches and losses while establishing a more transparent and efficient system for processing and verifying vital information.

V. RESULTS & DISCUSSION

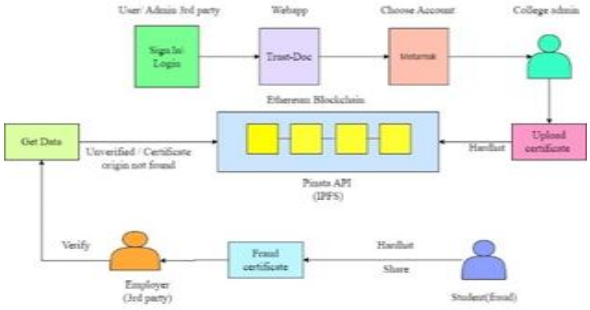

Fig 2: Fake Document Upload

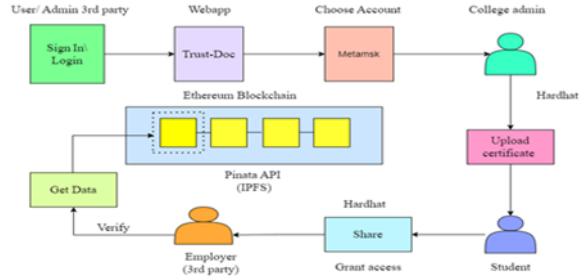

Fig3: Document verificationblockchain Architecture

Fig 4: Login page

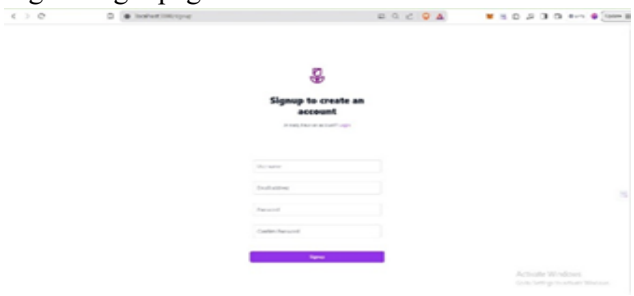

Fig 5: Sign In Page

The work successfully developed a block chain-based system for verifying academic credentials, addressing the key issues of inefficiency, error-proneness, and susceptibility to fraud in traditional document verification methods. The implemented Home page for Trustdoc is as shown in figure6. Before Home page the Login and Signup pages have also been created as shown in fig 4&5.. So, in our system we are going to login or signup based upon the role such as admin, student or third party. After login admin can upload the certificate. Upon successful uploading admin will receive popup of successful uploaded.

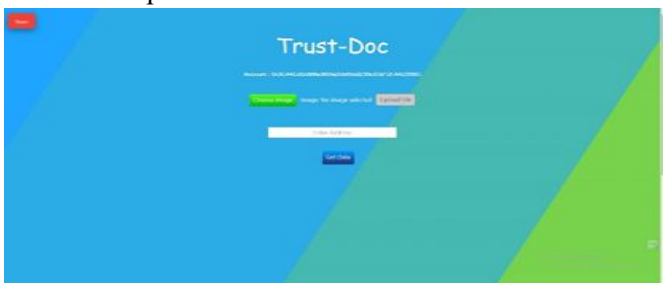

Fig 6: Home page

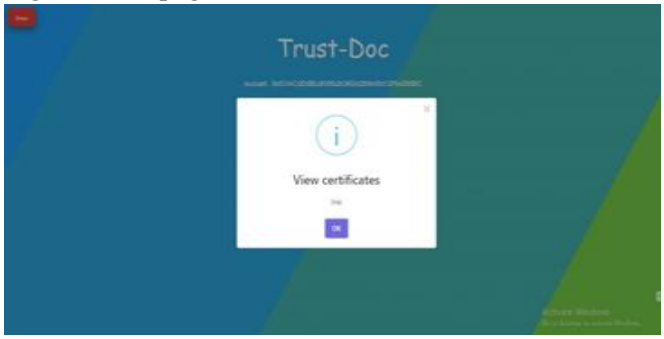

Fig 7: View certificate

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After login in home page we can view the certificate (fig7) or document and then the transaction as shown in figure8. Transaction is initiated which further asks the sharing option of document from figure9 share option. These uploaded documents are safely stored on Pinata. The fake document uploading and sharing fake data to employer is shown in figure10.

Fig 8: Transaction

Fig 9: Share option

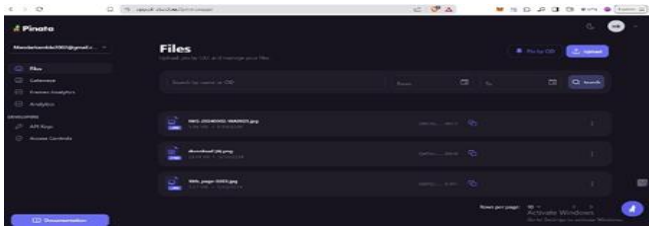

Fig 10: Pinata

The third party cross verifies thes hash value, and finds that the uploaded document is fraud document, and also its not available on other scan website as shown in figure11. Also, employer can check hash value generated is by college admin or by some other party.

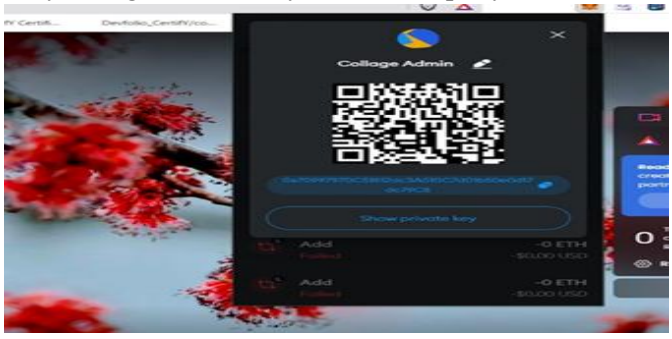

Fig 11: Admin wallet address

Figure 11: Fraud students

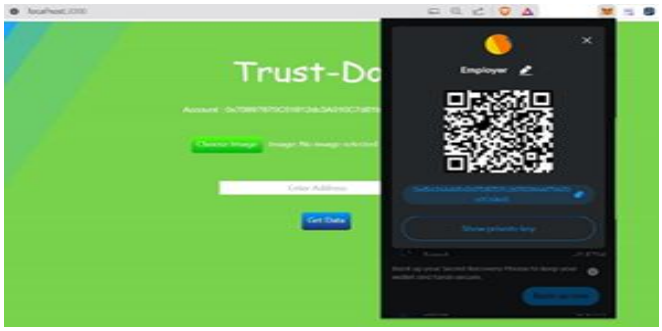

Fig 13: 3rd party Wallet address

The project leveraged the unique properties of block chain technology, including decentralization, immutability, and transparency, to create a secure, efficient, and user-friendly solution for academic credential verification. The system can be deployed at institute/university level where institute/university admin will manage and handle the system as a primary ontributor. The third party as another university's admin can verify the documents from the primarycontributor.

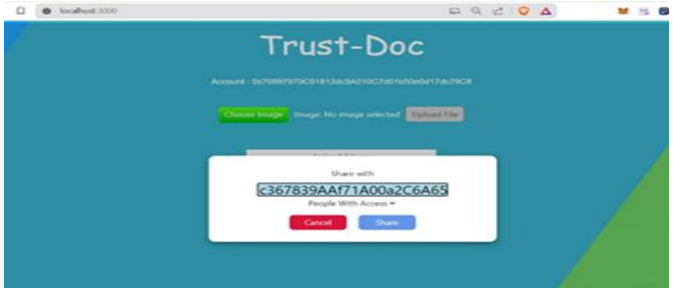

Fig 14: Student shared Fraud certificate to Employer

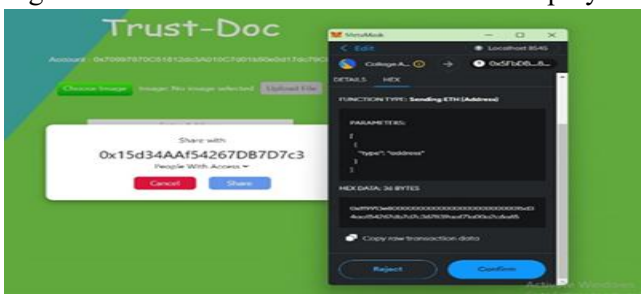

Fig 15: Third party generated hash value through Own account

Performance Parameters of the System

Scalability: The system demonstrated good scalability by handling a large number of transactions efficiently. Integration with decentralized storage systems like IPFS ensured that the system could manage large datasets without compromising performance.

Efficiency: By automating the verification process through smart contracts, the system significantly reduced the time required to verify academic credentials compared to traditional methods.

Security &Immutability: The block chain's immutable ledger ensured that once academic credentials were recorded, they could not be altered or tampered with, providing a high level of data integrity & security.

Decentralization: The decentralized nature of the block chain distributed the data across multiple nodes, reducing the risk of data breaches and unauthorized access.

Encryption: Using SHA256 for data encryption ensured that the credentials were stored securely and could only be accessed by authorized parties.

User Experience

Students:

1) Ease of Use: The user-friendly interface allowed students to easily upload their credentials and manage their profiles. The integration with MetaMask wallet simplified the process of interacting with the blockchain.

2) Privacy: Students had control over their data, deciding what information to share with potential employers, thus maintaining their privacy.

Employers:

1) Instant Verification: Employers could verify the authenticity of academic credentials instantly through the platform, eliminating the need to contact the issuing institutions directly.

2) Trust: The transparency and immutability of the blockchain increased employers' trust in the authenticity of the verified credentials.

Traditional Verification Methods

- **Time-Consuming**: Traditional methods required significant manual effort and time, often taking weeks to months for verification.
- **Error-Prone**: Manual verification was susceptible to human errors, leading to potential inaccuracies and delays.
- **Fraud Vulnerability**: Traditional methods were more prone to fraud due to the ease of forging paper documents.

Blockchain Based Verification

- **Efficiency**: The blockchain-based system automated the verification process, significantly reducing the time and effort required.
- **Accuracy**: The use of smart contracts and cryptographic hashing ensured a high level of 99 % accuracy and data integrity.
- **Security**: Blockchain's inherent security features made it difficult for unauthorized parties to tamper with or forge credentials ensuring 100% data security.

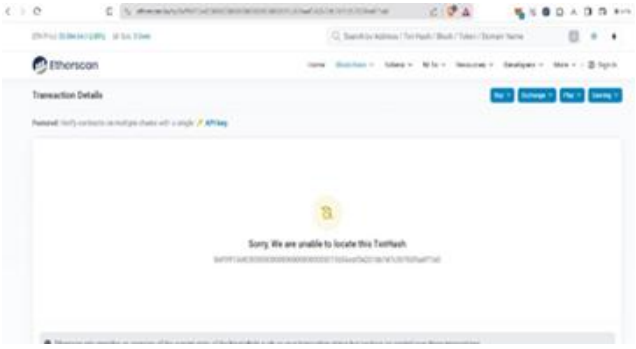

Fig 16: Scan this transaction hash in ether scan website

Fig 17: Verifying certificates then you will get this error hash as it is generated by admin or other person

So, in our system we are going to login or signup based upon the role such as admin, student or third party. After login admin can upload the certificate. Upon successful uploading admin will receive popup of successful uploaded. This certificate hash is shared by admin to student to his/her wallet (fig 9). Then student can login into the system and view their document (fig. 7). These uploaded documents are safely stored on Pinata (fig 10). For fraud document verification student uploaded his fake document and generated fake hash. And this hash shared to employer. When employer cross verifies this hash value, which can see in figure 14, employer will view this document is fraud document, as its not available on other scan website (fig. 16). Also, employer can check hash value generated is by college admin or other party. (fig. 17).

Though In our work there isn't any way that a duplicate or fraud certificate can be shared over system however we can ensure using above implementation that the cent percent academic document verification and fraud tolerance is achieved in our system.

VI. CONCLUSION

In conclusion, this project aims to leverage blockchain technology to revolutionize the document verification process in academic institutions. By providing a secure, efficient, and transparent system for document verification, this work is poised to address the challenges associated with traditional document verification methods,

which are often slow, error-prone, and susceptible to fraud. The project's 99% success will contribute to a more trustworthy and efficient academic environment, while also demonstrating the potential of blockchain technology in various sectors. The system can be deployed at institute/university level where institute/university admin will manage and handle the system as a primary contributor and the third party as another universities admin or employers can verify the documents from the primary contributor. This system can be implemented as an efficient tool for verification of academic credentials/documents by the institutes/universities and the employers.

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