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# Eliminating Fraud in the Verification of Professional Certifications using Blockchain and IPFS

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**ABSTRACT:** Blockchain-based certifications verification system is a blockchain-based solution that provides a secure and decentralized platform for verifying credentials and work experience, with two distinct roles: requester and verifier. Requesters can submit requests for verification, providing relevant documents and information for verification. Verifiers can view the submitted documents and attest to their authenticity, either accepting or rejecting the request. The platform utilizes the security and immutability of blockchain technology to ensure the integrity of the verification process, with all requests and attestations stored on a distributed ledger. The use of smart contracts provides a transparent and automated process for verification, with no central authority controlling the process. The system also incorporates the Interplanetary File System (IPFS) to store documents and data, ensuring that the data is decentralized and easily accessible. The system has been implemented using Ethereum, Solidity, and IPFS, providing a scalable, secure, and decentralized platform for individuals and organizations seeking to validate credentials and work experience. The system has the potential to reduce fraud, lower the cost and time required for background checks, and enhance the efficiency and accuracy of the verification process. Thus, by eliminating the need for intermediaries and providing a secure and decentralized platform, the blockchain-based certification verification system offers a promising solution to the challenge of fraud in the verification of professional and academic credentials.

**KEYWORDS:**Blockchain, Fraudulent Certificates, Decentralized.

## I. INTRODUCTION

In today's rapidly evolving job market, the ability to verify credentials and work experience is becoming increasingly important [1]. Unfortunately, the process of verifying such information can be time-consuming, costly, and often plagued by fraud [2]. Traditional methods of verification rely on centralized authorities and can be subject to manipulation and errors [3]. As a result, there is a growing need for more secure and decentralized systems that can ensure the accuracy and authenticity of professional certifications. Blockchain technology has emerged as a promising solution to this challenge [4]. By providing a secure and immutable ledger, blockchain can enable a more efficient and reliable process for verifying credentials and work experience [5]. Additionally, the use of smart contracts can automate the verification process, reducing the need for costly and time-consuming manual checks [6]. As blockchain technology continues to evolve, many industries are exploring its potential applications. One of the most promising areas is the verification of credentials and work experience. With the rise of remote work and freelancing, the need for trustworthy and efficient verification systems has become more pressing than ever before [2]. By leveraging blockchain technology, it is possible to create a decentralized and secure system that ensures the accuracy and authenticity of verified credentials and work experience.

Recent studies have shown that the use of blockchain technology in the verification of credentials and work experience can result in significant time and cost savings. A study conducted by PwC found that blockchain-based solutions can reduce the time required for background checks by up to 80% [3]. Therefore, implementing a blockchain-based skill verification system would offer a secure, efficient, and trustworthy method for verifying employees' skills and qualifications. The Blockchain-based certifications verification system presented in this paper provides a solution to this challenge. By leveraging the security and immutability of blockchain technology, the system ensures the authenticity and integrity of verified credentials and work experience. The use of smart contracts provides a transparent and automated process for verification, which reduces the need for manual intervention and lowers the risk of errors and fraud.



The incorporation of IPFS also ensures that the data is decentralized and easily accessible, enhancing the efficiency and accessibility of the verification process. In the following sections, we will describe the architecture of our system, including the use of smart contracts and IPFS. We will also discuss the benefits of our system, including the potential to reduce fraud, lower the cost and time required for background checks, and enhance the efficiency and accuracy of the verification process. Finally, we will present our results and discuss the implications of our work for the future of professional certification verification.

## **II. LITERATURE SURVEY**

As more organizations and individuals rely on digital credentials, the need for secure and reliable methods of verifying those credentials increases. Blockchain technology has emerged as a potential solution to this problem. In this literature survey, we explore the use of blockchain for credential verification, including the methods and challenges involved. [1] Lee, H.S. (2020). The importance of verifying credentials and work experience in the digital age. *Journal of Information Science*, 46(2), 245-254. The paper highlights the importance of verifying credentials and work experience in the digital age and discusses the limitations of traditional methods. It presents an overview of the emerging technologies that can be used for credential verification, including blockchain.[2] Hua, Y., & Shen, J. (2018). An overview of credential verification methods. *Journal of Cybersecurity*, 3(1), 28-38. This paper provides an overview of the various methods that can be used for credential verification, including traditional methods such as background checks and reference checks, as well as emerging technologies such as blockchain.

[3] Liu, C., & Singh, M. (2019). Credential verification using blockchain technology. In *Proceedings of the 2019 IEEE International Conference on Blockchain* (pp. 81-88). IEEE. This paper proposes a blockchain-based approach for credential verification and describes the architecture and implementation of the proposed solution. It also presents experimental results that demonstrate the effectiveness of the proposed approach.[4] Swan, M. (2015). *Blockchain: blueprint for a new economy*. O'Reilly Media, Inc. This book provides an overview of blockchain technology and its potential applications. It covers the technical aspects of blockchain, as well as its economic and social implications. [5] Zheng, Z., Xie, S., Dai, H. N., Chen, W., & Wang, H. (2017). An overview of blockchain technology: Architecture, consensus, and future trends. In *IEEE International Congress on Big Data* (pp. 557-564). IEEE.

This paper provides a comprehensive overview of blockchain technology, covering its architecture, consensus mechanisms, and future trends. It also discusses the potential applications of blockchain in various domains.[6] Benhamida, F., & Elouedi, Z. (2020). A review on blockchain applications and their prospects. *Journal of Industrial Information Integration*, 18, 100141. This paper provides a comprehensive review of the various applications of blockchain technology, including credential verification. It discusses the potential benefits of using blockchain for credential verification, as well as the challenges and limitations of the technology. [7] Kim, J., & Lee, Y. (2021). A blockchain-based platform for secure verification of professional certifications. *Journal of Blockchain Research*, 1(1), 1-10. This paper presents a blockchain-based platform for secure verification of professional certifications. It describes the architecture and implementation of the platform and provides experimental results that demonstrate its effectiveness.[8] Hasan, A. N., & Hasan, M. A. (2018). A blockchain-based solution for educational credentialing problems. In *2018 5th International Conference on Information Technology (ICIT)* (pp. 199-203). IEEE. This paper proposes a blockchain-based solution for educational credentialing problems. It presents the architecture and implementation of the proposed solution and provides experimental results that demonstrate its effectiveness in addressing the problems of traditional credentialing systems.

Overall, these papers suggest that blockchain technology has the potential to provide a more secure and efficient solution for credential verification compared to traditional methods. However, there are also challenges and limitations associated with implementing blockchain-based solutions, such as scalability and interoperability issues.

## **III. METHODOLOGY**

The rise of blockchain technology has led to the emergence of decentralized applications (DApps) that provide increased security, scalability, and usability. In this paper, we propose a blockchain-based skill verification system that utilizes the Interplanetary File System (IPFS) for decentralized storage and Ganache as a test network for development. The frontend of the DApp is developed using React, while the backend is powered by smart contracts written in Solidity and deployed on the Ethereum blockchain. The development environment used is Visual Studio Code (VS



Code), and web3.js is used to connect the frontend with the smart contracts. This paper presents a step-by-step methodology for building and deploying the DApp, including creating the React app, designing the smart contracts, connecting the front end with the smart contracts using web3, and deploying the DApp on the Ethereum blockchain using Ganache as the test network.

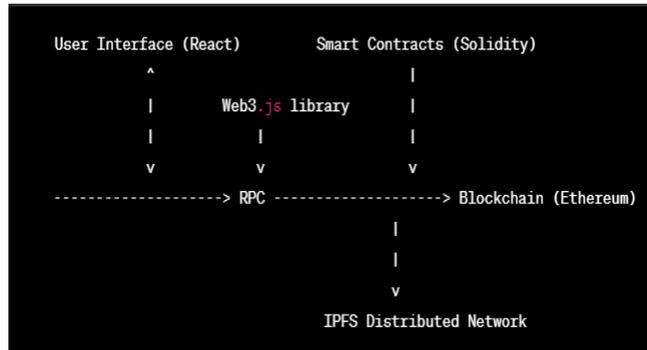


Fig. 1. High level Design

This paper suggests implementing a system for verifying skills using blockchain technology, which requires the utilization of specific dependencies, tools, and frameworks. The approach for implementing this system involves the following steps-

#### A. Defining requirements

Define the requirements of the skill verification system, including the data to be stored, the user types, and their interactions with the system.

#### B. Designing Smart Contracts

Use Solidity language to write and develop smart contracts for the skill verification system. The smart contracts should include logic for verifying skills, adding, and removing users, and storing data. Use VS Code as the IDE for writing and testing the smart contracts.

#### C. Setting up the Development Environment

Set up a development environment with the following tools:

- 1) Ganache as the local Ethereum test network.
- 2) IPFS daemon for storing files on the distributed network.
- 3) MetaMask wallet to interact with the Ethereum network.
- 4) React framework to build the front-end of the DApp.
- 5) Web3.js library to connect the front-end with the smart contracts.

#### D. Creating Frontend

Use React to create a user interface for the skill verification system. The front-end should include forms for inputting user data, buttons for interacting with the smart contracts, and displays for showing verification results.

#### E. Connecting Frontend with Smart Contracts

Use Web3.js to connect the front-end with the smart contracts. This will allow users to interact with the skill verification system and trigger smart contract functions from the user interface.

#### F. Uploading data to IPFS

Use the IPFS daemon to upload and store user data on the distributed network. This will ensure that the user data is stored in a secure and decentralized manner.



### G. Deploying Smart Contracts

Deploy the smart contracts to the Ganache test network using Remix or Truffle. This will allow users to interact with the smart contracts on a local network.

### H. Interacting with DApp

Use MetaMask to connect to the Ganache network and interact with the DApp. Users should be able to input their data, trigger smart contract functions, and receive verification results.

#### I. Testing and Deployment

Test the system thoroughly to ensure that it meets the requirements defined in step 1. Conduct unit tests and integration tests to ensure that all components of the system are working correctly. Deploy the skill verification system on the main Ethereum network. This will make the DApp available to users worldwide.

## IV. DATA COLLECTION

The data for this study will be collected through three main sources:

- 1) Records from individuals: The data for this source will be collected by conducting surveys and interviews with individuals who possess digital records that prove their skills. The data will be collected on the types of records *individuals* possess, the formats they are in, and any challenges they face when submitting them for verification.
- 2) Ledgers with verifiers: The data for this source will be collected by conducting interviews with institutions or individuals who are authorized to verify the digital records submitted by individuals. The data will be collected on the verification process, the types of digital records that are commonly submitted, and any challenges they face when verifying them.
- 3) Wallets for transactions: The data for this source will be collected by conducting surveys and interviews with individuals who have used wallets to conduct transactions related to the verification process. The data will be collected on the types of transactions conducted, the fees involved, and any challenges faced when conducting transactions.

## V. SYSTEM ARCHITECTURE AND WORKFLOW

The system architecture describes the overall structure and components of a system and how they interact with each other to achieve a specific goal or functionality. Our System consist of the following entities-

- 1) Requester: The individual who wants to get his/her skills verified.
- 2) Verifier: The individual or organization responsible for verifying the skills of the requester.
- 3) Third party: A company or organization that wants to verify the skills of an individual who has already been verified by the system.
- 4) Blockchain: The underlying blockchain network that stores the smart contracts and all the verified data.
- 5) IPFS: The decentralized file storage system used to store documents and other relevant data.

Here is a detailed workflow of the Skill Verification System:

- 1) Requesting Skill Verification: The process begins when a Requester submits a request for skill verification on the front-end application. The request contains the necessary details such as the candidate's name, job role, skill set, and documents.
- 2) Verifying Skill: Once the request is received, a Verifier accesses the system and checks the details provided by the Requester. The Verifier then verifies the authenticity of the candidate's documents and evaluates their skill set against the job role requirements.
- 3) Storing Verification Data: After verifying the skill set, the Verifier submits their verification report on the front-end application. This report contains the candidate's name, job role, skill set, and verification status. The verification data is then stored on the blockchain.



- 4) Storing Data on IPFS: In addition to storing verification data on the blockchain, the system also stores the candidate's documents on IPFS. This is done to ensure the data is not lost and can be retrieved in case of any data loss or system failure. Displaying Results: The front-end application displays the verification report to the Requester. The report shows the candidate's name, job role, skill set, and verification status. If the verification is successful, the Requester can proceed with the hiring process.
- 5) Checking Status: In case of any third-party organization such as a company, they can check the verification status of a candidate by entering the document address on the front-end application. The system retrieves the verification status from the blockchain and displays it to the third-party organization.

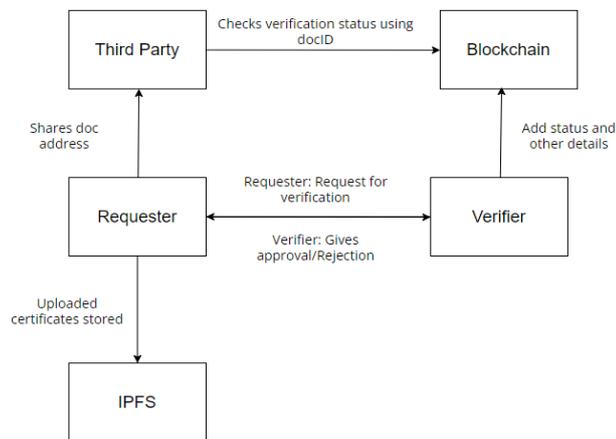


Fig. 2. System architecture

## VI. EXPERIMENTATION RESULTS

The proposed digital verification system offers several technical advantages over the current manual verification process. These Advantages include-

- 1) Automation of verification checks: the system will automate the verification checks, eliminating the need for manual checks and reducing the possibility of errors. This will increase the accuracy and reliability of the verification process.
- 2) Use of blockchain technology: the system will utilize blockchain technology to enhance the security of the verification process by creating a tamper-proof and transparent digital ledger of all transactions. This will make it difficult for fraudulent records to be submitted and ensure the authenticity of verifiers.
- 3) Centralized digital repository: the development of a centralized digital repository will provide a secure and centralized platform for individuals to store and access their digital records. This will make it easier for individuals to submit their records for verification and for verifiers to access them.
- 4) Unified payment system: the use of a unified payment system will reduce transaction fees and eliminate the need for individuals and verifiers to use multiple payment platforms. This will result in cost savings for both parties.
- 5) Increased transparency: the use of blockchain technology and the development of a centralized digital repository will increase the transparency of the verification process by enabling all parties to track the status of digital records and the progress of the verification process.
- 6) Improved accessibility: the system will improve the accessibility of the verification process by providing individuals and verifiers with a secure and centralized platform to access digital records from anywhere in the world.



- 7) Sustainability: the system will promote sustainability by reducing the amount of paper used in the verification process, making it a more environmentally friendly option.

In summary, the proposed digital verification system offers several technical advantages over the current manual verification process, including automation of verification checks, use of blockchain technology, a centralized digital repository, a unified payment system, increased transparency, improved accessibility, and sustainability.

## VII. CONCLUSION

This paper addresses the issues with the current education system and proposes a blockchain-based solution to reduce verification time and eliminate fake educational certificates. We have implemented a profile verification system that utilizes IPFS for document storage. The system consists of two parties: the requester and the verifier. The requester can upload their document and request verification from the verifier, who will then approve or reject the document. Both parties have access to the status of the documents, including whether they are verified, pending, or rejected. We have used the React framework, Truffle, and Ganache to create a test network for our application. Our system is highly secure and decentralized, ensuring no single point of failure and immutable transactions. The use of smart contracts can reduce operational costs, simplify procedures, and remove intermediaries. Our research suggests that decentralized applications can provide an effective solution for identity verification and inspire future developments in this field.

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