A Systematic Literature Review On Blockchain-Based Systems For Academic Certificate Verification

Dr.R.M.R.Shamija Sherryl
Department of Computer
Science and Engineering
SRM IST, Ramapuram
Chennai,India
shamijar@srmist.edu.in

Pugazholi R
Department of Computer
Science and Engineering
SRM IST, Ramapuram
Chennai,India
Pr3376@srmist.edu.in

Harish S
Department of Computer
Science and Engineering
SRM IST, Ramapuram
Chennai,India

Kirubakaran J
Department of Computer
Science and Engineering
SRM IST, Ramapuram
Chennai,India
Kj1880@srmist.edu.in

Abstract—The project is a blockchain-based certificate verification system developed using the Truffle framework for Ethereum smart contracts. The configuration files provided outline the settings for different networks, compilers, and testing options within the Truffle project. The project leverages the Ethereum blockchain to create a secure and transparent platform for issuing, managing, and verifying digital certificates. By utilizing smart contracts written in Solidity, the system ensures the integrity and authenticity of certificates while reducing the risk of fraud. The configuration files include instructions for deploying the smart contracts to various networks, such as development, test, and private networks. Overall, the project aims to revolutionize the certificate verification process by harnessing the power of blockchain technology to enhance trust and credibility in certification systems.

Keywords—(EVM - Ethereum Virtual Machine, PoW - Proof of Work, PoS - Proof of Stake, PoA - Proof of Authority)

I. INTRODUCTION

In the evolving educational landscape, the assurance of the genuineness and legitimacy of educational certificates has become increasingly critical. Traditional methods of verification, however, are fraught with challenges such as forgery and human error. Blockchain technology emerges as a revolutionary solution to these persistent issues. By leveraging the decentralized and unalterable properties of blockchain, educational institutions can securely document and authenticate certificates. Each certificate is cryptographically linked to both the issuing institution and the recipient, establishing a transparent and tamper-resistant system. This innovative approach not only simplifies the verification process but also bolsters confidence and credibility in academic credentials. Furthermore, blockchain-based verification empowers individuals with greater control over their personal data, enabling selective disclosure while preserving privacy. As we progress into the digital era, blockchain stands out as a promising instrument to revolutionize academic certificate verification, paving the way for a future where integrity and transparency are upheld in education..

II. LITERATURE SURVEY

The integration of blockchain technology into various sectors, including renewable energy, document forwarding,

cybersecurity, vehicular energy networks, and notarization, has been explored extensively in recent years.

These studies highlight the potential of blockchain to enhance efficiency, security, and transparency across different applications.

[1] Tokenizing Renewable Energy Certificates (RECs):

A Blockchain Approach for REC Issuance and Trading In the realm of renewable energy, blockchain technology offers a decentralized and efficient solution for the issuance and trading of Renewable Energy Certificates (RECs). Traditional REC systems are centralized, highly regulated, and operationally expensive. Blockchain-based platforms for REC issuance and trading aim to reduce operational costs and increase transparency by tokenizing RECs. This approach allows for greater traceability and verification of transactions, enhancing the reliability and security of REC management. The proposed platform leverages blockchain's immutable ledger to record trustworthy information, making it accessible to all stakeholders for tracking and verification purposes. This innovation not only streamlines the REC trading process but also contributes to the broader goal of promoting renewable energy sources.

[2]Blockchain Document Forwarding and Proof Method Based on NDN Network:

The digitization of the national economy and the rapid growth of data volumes necessitate efficient methods for content storage and forwarding. Blockchain technology, combined with Named Data Network (NDN), offers a solution to optimize file forwarding processes and ensure the security and legality of data. This integration improves the overall performance of the forwarding network by incorporating data signature encryption, reverse path forwarding of content, and flexible routing. The use of blockchain decentralization technology ensures the security of the forwarding process, while smart contract rules restrict the forwarding process in the NDN network, enhancing the security of confidential files.

[3] Use Chains to Block DNS Attacks:

A Trusty Blockchain-Based Domain Name System Cybersecurity remains a critical concern in the digital age, with phishing attacks posing significant threats to user data. Blockchain technology presents a novel mechanism for verifying websites, offering enhanced security against phishing attempts. By recording the URL and IP address of permissioned websites on blockchain through specific smart contracts, this mechanism prevents URL redirection attacks. The immutable nature of blockchain ensures the detection of phishing websites, providing tamper-proof functions without adding any load to users. This innovative approach to domain name service enhances security and resilience against various attacks, demonstrating the potential of blockchain in cybersecurity applications.

[4] Secure Message Handling in Vehicular Energy Networks Using Blockchain and Artificially Intelligent IPFS:

Vehicular Energy Networks (VENs) face challenges related to security, identity breaches, and trust issues among vehicle owners. A blockchain-based announcement system for VENs addresses these problems by ensuring secure and reliable announcement dissemination. This system comprises a three-layered structure, including a message dissemination layer, a storage layer, and a blockchain layer. The integration of artificial intelligence-based Interplanetary File System (IPFS) with Road Side Units (RSUs) reduces storage costs and ensures data availability while maintaining vehicle owner privacy. The hashes of stored data are then recorded on the blockchain, enhancing the system's efficiency and security.

[5] Blockchain-Based Autonomous Notarization System Using National eID Card:

The advent of e-government and the compatibility of blockchain technology with e-government services have led to the exploration of blockchain for notarization processes. A fully automated notarization system, combining a national eID card with Public Key Infrastructure and smart contracts, offers a solution for fixed-date notarizations. This system authenticates the creator and the document for electronically signed documents, using the transaction receipt generated when the information is stored on the blockchain as a certificate of notarization. The verification of signed data within the blockchain by smart contracts eliminates the need for a verification authority, showcasing the potential of blockchain in automating notarization processes.

These literature surveys illustrate the multifaceted applications of blockchain technology across various domains, highlighting its potential to revolutionize traditional systems by enhancing efficiency, security, and transparency.

III. EXISTING SYSTEM

The current system for verifying academic certificates relies heavily on manual processes and centralized databases. This approach is inherently susceptible to errors, security vulnerabilities, and inefficiencies. The reliance on centralized databases means that the verification process is not only slow but also prone to manipulation and fraud. Additionally, the lack of a standardized, secure method for issuing and verifying certificates raises concerns about the authenticity and integrity of academic credentials. This fragmented system not only introduces delays and inconsistencies but also undermines the trustworthiness of certificates, affecting the credibility of educational institutions and the job market.

IV. PROPOSED FRAMEWORK

To address the limitations of the existing system, the proposed solution introduces a blockchain-based framework for academic certificate verification. This innovative approach leverages the inherent strengths of blockchain technology, such

as decentralization, transparency, and immutability, to create a secure, efficient, and tamper-proof system for issuing and verifying academic certificates.

A) Blockchain-Based Framework Overview

The proposed system utilizes smart contracts on a blockchain platform to manage the entire lifecycle of academic certificates. Smart contracts automate the verification process, ensuring that certificates are issued and verified in a secure, transparent manner. This decentralized approach eliminates the need for centralized authorities, reducing the risk of fraud and errors.

B) Key Features of the Proposed System

Decentralization: By utilizing blockchain technology, the proposed system decentralizes the certificate verification process. This means that no single entity has control over the entire process, reducing the risk of manipulation and fraud.

Transparency: The blockchain's transparent nature allows all stakeholders to view the verification process in real-time. This transparency enhances trust and credibility in academic credentials.

Security: The use of encryption and digital signatures ensures that certificates are secure from unauthorized access or tampering. Once a certificate is issued and verified on the blockchain, it cannot be altered or forged.

Efficiency: The automation of the verification process through smart contracts streamlines the certificate issuance and verification process, reducing delays and inconsistencies associated with manual processes.

C) Implementation Details

The proposed system is designed to be modular and scalable, allowing for easy integration with existing academic institutions' systems. The implementation includes:

Smart Contracts: These are self-executing contracts with the terms of the agreement directly written into code. They are used to automate the issuance and verification of academic certificates.

Blockchain Platform: The system utilizes a blockchain platform that supports smart contracts. This platform ensures the security, transparency, and immutability of the certificate verification process.

User Interface: A user-friendly interface allows academic institutions, students, and employers to interact with the system easily. This includes features for uploading certificates, initiating verification requests, and viewing verification status.

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