

SECTION 2. INFORMATION TECHNOLOGY TRENDS AND INNOVATIONS

DOI <https://doi.org/10.30525/978-9934-26-597-6-12>

BLOCKCHAIN-BASED ACADEMIC RECORDS VERIFICATION: ANALYSIS AND FRAMEWORK DEVELOPMENT

Akil Arvinth Malayanadipattinam Vasudevan, Amit Joshi

ISMA University, Valērijas Seiles iela 1-korpuss 6, Rīga, LV-1019

**Corresponding author's e-mail: akilarvinth@gmail.com*

www.isma.lv

Abstract

Blockchain is being used in many sectors to storing data in decentralized way. this research is been done with aim of building a framework for a blockchain based system for verifying academic record. the main focus in this research is building framework which will be considering factors like user privacy, trying to minimize time requirement for verification. this research is done by studying existing traditional academic verification methods and blockchain based academic verification methods. while doing analysis there was few key problems such as scalability of the model, user data privacy, problems in adaption with educational institutions. for analysis on existing blockchain based solutions, system such as MITBlockcerts, CredenceLedger, University-of-Nicosia are taken into consideration. for comparison with traditional based system i have chosen PDF Signed e-certificates. with analyzing existing solution i was able to come with a framework. The proposed framework will be based on Hyperledger for certificate verification, It provides a permission based blockchain network where only authorized institutions can access it. smart contracts are used for automating and it will contain the rules for how certificates should be issued, verified, and maintained. After validation done with the smart contracts. this certificate will be crated via NFT. This NFT certificates will becomes a unique, non-duplicate digital asset on the blockchain.

Keywords: Blockchain, Academic Records, Hyperledger, smart contracts, NFT

1 Introduction

Verification of academic records is a vital process for educational institutions, for students who are enrolling for further studies. Companies often spend much time doing a background check before hiring new employees, one of the important verifications is checking employees' academic side. With the traditional centralized system, both educational institutions and companies suffer with long verification time. These traditional centralized-based systems are not efficient for maintaining the academic data for long time. There are possibilities of fraudulences with physical certificates. These problems can be tackled by using decentralized blockchain-based academic verification. There are many students who are travelling abroad for further studies and employees who will be interested in working abroad from them for verifying their certificates. They usually go to an advocate or a government agency to get notarized, this is a time-consuming process. This can make a student or employee application lag behind. The proposed decentralized block chain-based academic verification framework is an efficient solution to many of these problems. This framework is more scalable and it can be spread with multiple ledger nodes. As the system is built on blockchain, it removes chances of single point failure which is possible in a centralized ledger. With existing solutions like the Blockcerts portal put forth by MIT, it can be stated that blockchain's potential use in academic record verification. This framework is built on the basis of ensuring user's data privacy, reducing the cost of verification process and trying to make verification process less time consuming while comparing to traditional systems.

2 Literature Review

The blockchain technology is a tamper-proof solution and it provides more security for storing and verifying academic credentials. It is a decentralized ledger which ensures that if a record is written in chain, if it is being edited/alterd all other nodes will be reflected, this prevents manipulation of the record in the system (Bhavani, 2024) (MILI, 2024).

Traditional methods are time-consuming processes and prone to human error. Blockchain-based systems are more efficient as they make verification process instantaneous by using smart contracts and decentralized applications (DApps). For example, the CredChain system is built on Ethereum-based DApps and IPFS to give fast and secure verification processes (Ahmed et al., 2024).

The proliferation of counterfeit certificates and academic records is a big problem in the education field. Blockchain technology solves this problem as it is transparent and provides a secure way to verify academic credentials. For instance, the DIAR system uses a blockchain-based, multi-level secure architecture which focuses on immutability and traceability, this solves the

problem like fraudsters trying to make fake certificates (Rustemi & Dalipi, 2024).

Blockchain-based systems provides the students more control over their academic credentials comparing to traditional system. For example, it provides a chance for Students to make a digital copy of their academic certificate Using Blockchain and Non-Fungible Tokens (NFTs), letting them to share their credentials safe and securely with institutions or employers (Khatietal., 2023).

The traditional process of verification of academic credentials requires third party agencies to be involved, which is often be more time consuming and increase cost for verification. block chain based solution removes the need for third party agencies and automates the verification process. For instance, the Verify-Chain system uses ipfs as interlude storage which reduces the operation coast by directly storing the data in the block chain (Rahmanetal., 2023, Gopejenko., 2024).

systems such as Edu Trust and CredChain manages the administrative processes, reducing third party agencies and government overheads, which improves the efficiency of the academic records verification (Kumar et al., 2025) (Ahmed et al., 2024).

3 Research Methodology

To do this research literature review is done on blockchain technology, verifying academic records, usage of NFT, Hyperledger fabric, smart contracts and etc.. to come with a frame work for academic record verification i have taken existing solutions to analyse such as: MITBlockcerts, CredenceLedger, University of Nicosia. This research is a combination of a literature review and a detailed analysis of the leading blockchain platforms. This framework is designed to establish a hybrid blockchain system that employs both permission and public blockchains. This technique resolves the fundamental issues with other existing systems by adopting current methods of data privacy protection and automated contract executions. The main idea which is addressed in this framework maintaining users data privacy and easy verification process anywhere from the world.

4 Framework

This framework provides a better solution for the management of digital academic records. It solves problems like credential verification, privacy, and the exchange of academic records between instructions. By using the current advanced technologies of blockchain, the framework is built to be robust, secure, and flexible to access the academic record. The architecture built in this system specifically focuses on a current advanced mechanism of

decentralized identity management. In this current system, each student will receive a cryptographically secure digital identity (hash code for each student) stored on a blockchain network and is provided with specific access control to his/her academic details. Using self-sovereign identity, students can set certain access control mechanisms that would determine how their academic records can be accessed and who can verify them. The implementation of identity management is accompanied by advanced ZKP (Zero-Knowledge Proof) technologies, which change the traditional method of verification of credentials. the blockchain will be build using a Hyperledger and It only provides permission to authorized users to access the ledger.

The framework's privacy is safeguarded by zkp (Zero-Knowledge Proof) technology, it authenticates the credentials without revealing sensitive personal data. This is added to this system to protect the user data. This method of cryptography permits institutions, as well as prospective employers, to validate a student's academic credentials while keeping their identity anonymous. The verification is done without exposing their private details. Smart contracts have been used in this whole process of credentialing by automating it completely. These contracts, which contain predetermined terms, allow for total automation of credentialing, including issuance, verification, and management. The removal of manual administrative tasks dramatically enhances efficiency, minimizes the possibility of human error, and allows for the real-time tracking of academic records of the student. To guarantee security from the manipulation of the data, an audit trail is assigned (Gopejenko., 2024).

This framework's most important feature is its multi-blockchain interoperability, which enables academic record recognition across different institutions and technologies. The system creates a chance to merge other university records to this blockchain, this ecosystem for academic credentialing that is not bound by the borders of individual institutions by using more than one blockchain protocol at the same time. This allows educational institutions from all corners of the globe to use this decentralized credentialing platform, thereby enabling the elimination of the long academic records verification process. Supporting and enabling the entire framework are various advanced distributed computing technologies such as Ethereum for smart contract execution, Hyperledger Fabric for enterprise-grade infrastructure, and NFT for creating digital certificates which will be more convenient to share. All these technologies integrate to deliver a resilient and extensible system that maintains high standards of security while remaining flexible to dynamic changes in educational and technological environments. Employing decentralized storage systems like the Interplanetary File System

(IPFS) means that the stored academic credentials remain verifiable and secure for effortless retrieval.

5 Performance Evaluation

There are notable changes added on the newly suggested framework, which was lagging in the current model. this system reduces the time of verification, usually it will take days in traditional method to verify the academic credentials that has been reduced to minutes by using smart contracts to verify the academic credential in this model. once the academic credentials is verified, a digital certificate can be made in form of NFT, which will be convenient way to share certificate with educational institutions and companies.

6 Conclusions

Implementing blockchain technology in academic record management will be huge improvement when comparing to the current traditional method. when analysed existing problems faced in verification of academic records, it can be concluded that A well-designed hybrid blockchain system can resolve most of those issues, this proposed framework is a both safe and secure method for sharing academic records in between institutions. the usage of blockchain technology enhances the transparency and security when comes to verifying the certificates and academic records. this research provides key insights in implementing blockchain based academic record verification for educational systems and companies. in future this research will be directed towards implementing this framework more globally and improving privacy-preserving methods.

Acknowledgments

I am sincerely grateful to Amith Joshi for his invaluable guidance and expert insights throughout the research development process. His continuous support and thoughtful suggestions have greatly contributed to the progress of my work.

Additionally, this study has been made possible through the essential resources, encouragement, and support provided by the faculty and staff of ISMA. Their assistance has played a crucial role in shaping my research.

References

[1] Bhavani, K. (2024). Academic Credentials Issuance and Validation System Using Blockchain. *Indian Scientific Journal Of Research In Engineering And Management*, 08(03), 1–5. <https://doi.org/10.55041/ijrsrem29435>

- [2] Ahmed, S., Rudro, R. A. M., Prity, A. J., Saha, S., Mansoor, N., & Nur, K. (2024). *CredChain: Academic and Professional Certificate Verification System using Blockchain*. 1–6. <https://doi.org/10.1109/icaccess61735.2024.10499520>
- [3] Rustemi, A., & Dalipi, F. (2024). *Academic Certificate Verification: A Practical Comparison between Centralized and Blockchain-Based Systems*. 1–6. <https://doi.org/10.1109/ciees62939.2024.10811200>
- [4] Khati, P., Shrestha, A. K., & Vassileva, J. (2023). *Student Certificate Sharing System Using Blockchain and NFTs* (pp. 61–70). Springer International Publishing. https://doi.org/10.1007/978-3-031-45155-3_7
- [5] Kumar, P., Dandin, C., Sumanth, A., Manoj, M., & Darshan, A. (2025). *EduTrust: A Blockchain-Powered Bridge for Seamless Academic Verification between Institutions and Employers*. 230–244. <https://doi.org/10.9734/bpi/mono/978-93-48859-98-3/ch15>
- [6] MIT Media Lab. (2016). Blockcerts: An Open Infrastructure for Academic Credentials on the Blockchain.
- [7] European Union Blockchain Observatory and Forum. (2020). Blockchain in Education: Potential and Challenges.
- [8] R Mukhamediev, Y Kuchin, N Yunicheva, Z Kalpeyeva, E Muhamedijeva, Viktors Gopejenko (2024) Classification of Logging Data Using Machine Learning Algorithms, Applied Sciences 14 (17), 7779 <https://doi.org/10.3390/app14177779>
- [9] Mukhamediev, R.I., Yelis, M., Yakunin, K., Gopejenko, V., Mussabayev, R. (2024) Exploring the health care system's representation in the media through hierarchical topic modeling Cogent Engineering, 2024, 11(1), 2324614. DOI: 10.1080/23311916.2024.2324614

Authors



AKIL ARVINTH MALAYANADIPATTINAM VASUDEVAN, 20th November 2002, INDIA
Current position, grades: Student at ISMA University
University studies: Bachelor of Information Systems (final year student)