

# Certificate Storage And Verification Using Blockchain

V. Senthil Kumar<sup>1</sup>, Rishakesh B<sup>2</sup>, Sibi Chandran D<sup>3</sup>, Kaviyarasan R<sup>4</sup>,

<sup>1</sup>Assistant Professor, Dept of Computer Science

<sup>2,3,4</sup>Dept of Computer Science

<sup>1,2,3,4</sup> Kumaraguru College of Technology, Coimbatore

**Abstract-** *Blockchain technology has the potential to revolutionize the way that certificates are verified and stored. By using a decentralized, secure, and transparent database, it is possible to create a system for verifying and storing certificates that is reliable, efficient, and resistant to fraud. In this research, a blockchain-based system for verifying and storing certificates, and evaluate its performance and security is created. This system is designed to be scalable and flexible, and can be applied to a variety of different certificate types and applications. To demonstrate the effectiveness of the system through a series of experiments, and discuss the implications for the use of blockchain in certificate verification and storage in the education sector is performed.*

## I. INTRODUCTION

Certificate verification and storage is an important issue in the education sector, as it is essential to ensure the authenticity and validity of educational certificates. Educational certificates are used to provide evidence of qualifications, credentials, or other achievements, and are often required for job applications, professional licensing, or other purposes. However, the traditional methods for verifying and storing educational certificates can be inefficient, costly, and prone to fraud. For example, paper-based certificates can be lost, damaged, or falsified, and the process of verifying their authenticity can be time-consuming and resource-intensive. Electronic certificates can be more secure and efficient, but they still rely on centralized databases that can be vulnerable to cyber-attacks or other forms of tampering.

Blockchain technology offers a potential solution to these problems. A blockchain is a decentralized, distributed database that uses cryptography to ensure the integrity and security of its data. It consists of a series of interconnected blocks, each of which contains a record of transactions or other data. These blocks are linked together in a chronological chain, and are secured using cryptographic hashes and consensus algorithms. This makes it difficult for anyone to alter or delete the data in the blockchain, and ensures that the data is transparent and verifiable.

There have been several research papers published on the use of blockchain for certificate verification and storage in

the education sector. These studies have demonstrated the potential benefits of using blockchain for this purpose, including increased security, efficiency, and transparency. However, there are also challenges and limitations to the use of blockchain in this context, including scalability, interoperability, and regulatory issues.

## II. LITERATURE SURVEY

Traditional paper certificates and electronic certificates have difficulties in conservation and management, not to mention other problems concerning discommodious verification, poor reliability, anti-counterfeiting, and anti-tampering. There can be a scheme designed to build a decentralized certificate system that is based on blockchain technology and smart contract, in which a set of blockchain certificate system aiming at providing blockchain certificate services for college students' innovation and entrepreneurship competition is developed. In this system, certain functions of the certificate about management, issuing, verification and revocation are realized via smart contract. Signer information, certificate template and certificate information are stored in a smart contract that adopts structured data, thereby discovering more convenient callings in querying and validating certificate.[4]

Certificates play an important role in education where individual learning records become necessary for people's professional careers. It is therefore important that these records are stored in extended available and fool-proof ledgers. Up until now, training facilities, educational institution or certification authorities issue paper-based certificates that can be easily destroyed and certification processes are not digitized, which can be much safer and faster to access. This is where blockchain technology could support the transformation of paper certificates to digital certificates and it could help to generate learning histories. We can present the Blockchain for Education platform as a practical solution for issuing, monitoring, validating, and sharing of certificates. The Blockchain for Education platform is based on the Ethereum blockchain and it uses smart contracts to support the certification process.[3]

In the digital world, each and everything is digitalized in which the certificate of Senior Secondary Leaving Certificate, Higher Secondary School Certificate, and academic certificate are digitalized in the educational institution and provided to the students. Students find it difficult to maintain their degree certificates. For the organization and institution, verification and validation of certificates are exhausting and debilitating. First, the paper certificates are converted into digital certificates. The chaotic algorithm is used to generate the hash code value for the certificate. After that, the certificates are store in blockchain. And these certificates are validated by using the mobile application. By using the blockchain technology we can provide a more safe, secure and efficient digital certificate validation.[1]

The problems that arise due to counterfeiting the Certificates is raising security concerns repeatedly. To overcome this problem the concept of Blockchain is used. A certain advantage of Blockchain is it will make the platform decentralized. A platform can be designed to store the Certificates in the block and generate a hash on the request of the student. Once the Certificates are stored in the block, they become impossible to tamper or to modify by anybody. Putting the information in the block will also reveal that only the admin or a staff is the only personnel who can access the information.[5]

A prototype that allows the registration of academic institutions and its respective institutes, registration of student compatriot and issuing of certificates can be created. The issued certificates are registered on the blockchain so that any third party who would need to verify the authenticity of a certificate can do so, independently of the academic institution, even if such institution has closed. The next phase of this research aims to extend the instance to the registration of medical records on the blockchain with a focus on the privacy of sensitive data and allowing the owner of the information to control user access to the documents. [9]

Blockchain technology allows multiple users to verify, preserve, and synchronize a shared data sheet, also known as a transaction ledger. This technology has offered significant benefits and incentives to various industries by improving services. A study was conducted as a systematic literature review and involved the analysis of 168 articles out of a total of 1976. The articles were classified based on three main dimensions: benefits, challenges, and functionalities. The results were organized into categories including informational, technological, economic, organizational, and strategic benefits, technological, organizational, adoption, operational, and environmental and sustainability challenges, and point-to-

point transmission, data ownership, data protection, and transaction processing functionalities. This review was aimed to provide guidance to professionals, practitioners, and stakeholders considering the implementation and management of blockchain projects in their sectors. It helped potential blockchain users understand the factors involved in making decisions about using blockchain in their organizations.[10]

Blockchain is being acclaimed as a technological advancement which allows to change how society trades and interacts. This influence is determinable to its properties of allowing mutually mistrusting entities to exchange financial value and interact without relying on a trusted third party. A blockchain moreover provides a probity protected data storage and allows to provide process transparency. By choosing blockchain, it provides the appropriate technical solution for a particular application scenario. It provides a structured analysis to determine the appropriate technical solution to solve a particular application problem. Through this analysis, there can be experiment in depth for the three use cases – certificate storage, validation of the stored certificate and anonymity of the user and the admin, and conclude the article with an outlook for further opportunities.[7]

The opportunities and challenges of applying blockchain technologies in the education precinct is to be provided view. The key blockchain-in-education applications discussed are the digitalization and decentralization of educational certifications and the enhancement and motivation for easy use for the users and admin. Some of the key challenges explored are data protection, which pose defects for application developers and scalability challenges that arise because of slow-speed blockchain transactions and the Scaling Trilemma. Additionally, market adoption and innovation challenges highlight that blockchain-in-education is a relatively inexperienced innovation that governance bodies within educational institutions often neglect or distinguish cautiously.[8]

Blockchain has gained significant attention in various fields, including education, due to its decentralized, transparent, traceable, secure, and reliable characteristics. However, despite its benefits, blockchain adoption in education is still low and faces several challenges. A study was done to review published articles discussing the challenges of adopting blockchain in education, covering the period from 2017 to 2022. Of the screened records, 32 articles were analyzed in full-text form. Based on the technology-organization-environment (TOE) framework, 14 challenges were identified and classified. The review also found that organizational and environmental barriers received less

attention in the literature compared to technological barriers.[11]

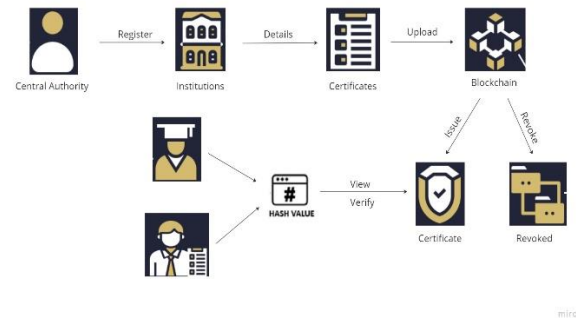
According to statistics from the Taiwan Ministry of Education, about one million students graduate each year, with some going on to further education and others entering the workforce. During their studies, students' various academic achievements, transcripts, diplomas, etc. become important references for enrolling in new schools or securing new jobs. However, due to a lack of effective anti-counterfeit measures, instances of forged graduation certificates often come to light. To address this issue, a digital certificate system based on blockchain technology is proposed. This system would use the unchangeable nature of blockchain to create digital certificates that are resistant to counterfeiting and can be verified. The process of issuing a digital certificate in this system involves generating an electronic file of a paper certificate along with other relevant data and storing it in a database, calculating the electronic file's hash value, and storing the hash value in the blockchain. The system also creates a related QR code and inquiry string code to be affixed to the paper certificate. This allows the verifying party to use a mobile phone or website to confirm the authenticity of the paper certificate. The unchangeable nature of the blockchain not only enhances the credibility of various paper-based certificates but also reduces the risk of loss for these types of documents.[12]

The identification of objects and places in the real world is important, and 2D printing codes can be used to store identifiers for these entities. Any mobile device with a camera and capture function can read the content of a barcode tag directly. However, when a barcode contains important or sensitive information, there is a risk of security breaches. QR codes, which are square barcodes with unique patterns, can be easily manipulated, leading to the possibility of being directed to malicious websites or information. In this paper, we will discuss the different types of data that can be encoded in QR codes, attacks that can occur through QR codes, and potential security solutions. However, it is also important to verify that the identifier written in the 2D code has been issued by an authorized organization, as the content stored in these codes can be easily modified.[13]

Blockchain technology has seen rapid growth in recent years, providing opportunities to address weaknesses in the field of online education, such as the complexity of e-learning assessment, the lack of a unified e-learning assessment standard, and the insecurity of digital education certificates. A blockchain system for e-learning assessment and certification that combines public and private blockchains and includes four specific smart contract schemes for e-learning assessment and credit exchange, the issuance and

secure storage of digital certificates, the verification of digital certificates, and the allocation of e-learning vouchers was implemented. The proposed system has the potential to create a fairer, healthier, and more open e-learning and online education environment. [14]

### III. INFERENCE



### IV. CONCLUSION

In summary, blockchain technology has the potential to revolutionize the way that certificates are verified and stored in the education sector. By using a decentralized, secure, and transparent database, it is possible to create a system for verifying and storing educational certificates that is reliable, efficient, and resistant to fraud. A model can be presented for blockchain-based system for verifying and storing educational certificates, and evaluate its performance and effectiveness in the education sector. This system is designed to be scalable and flexible, and can be applied to a variety of different certificate types and applications. A certificate storage and verification using blockchain ensures that all the students who pursued their education in their respective universities are the ones who hold the proper certificate that identifies them as the university's student and provides them with proof of completing their education and earning the certificate of completion. Forgery of duplicate certificates can be prevented and future online learning can benefit from the implemented system.

### REFERENCES

- [1] Gayathiri, A., Jayachitra, J., & Matilda, S. (2020, July). Certificate validation using blockchain. In *2020 7th International Conference on Smart Structures and Systems (ICSSS)* (pp. 1-4). IEEE.
- [2] Vidal, F. R., Gouveia, F., & Soares, C. (2020, June). Revocation mechanisms for academic certificates stored on a blockchain. In *2020 15th Iberian Conference on Information Systems and Technologies (CISTI)* (pp. 1-6). IEEE.

- [3] Kolvenbach, S., Ruland, R., Gräther, W., & Prinz, W. (2018). Blockchain 4 education. In *Proceedings of 16th European Conference on Computer-Supported Cooperative Work-Panels, Posters and Demos*. European Society for Socially Embedded Technologies (EUSSET).
- [4] Xie, R., Wang, Y., Tan, M., Zhu, W., Yang, Z., Wu, J., & Jeon, G. (2020). Ethereum-blockchain-based technology of decentralized smart contract certificate system. *IEEE Internet of Things Magazine*, 3(2), 44-50.
- [5] Gundgurti, P. E., Alluri, K., Gundgurti, P. E., & Vaishnavi, G. (2020, July). Smart and Secure Certificate Validation System through Blockchain. In *2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA)* (pp. 862-868). IEEE.
- [6] Yan, J., Yang, B., Su, L., & He, S. (2021). Storage optimization for certificates in blockchain based PKI system. In *CCF China Blockchain Conference* (pp. 116-125). Springer, Singapore.
- [7] Wüst, K., & Gervais, A. (2018, June). Do you need a blockchain?. In *2018 Crypto Valley Conference on Blockchain Technology (CVCBT)* (pp. 45-54). IEEE.
- [8] Apa: Steiu, M. F. (2020). Blockchain in education: Opportunities, applications, and challenges. *First Monday*.
- [9] Curmi, A., & Inguanez, F. (2019). Blockchain based certificate verification platform. In *International Conference on Business Information Systems* (pp. 211-216). Springer, Cham.
- [10] Ali, O., Jaradat, A., Kulakli, A., & Abuhlimeh, A. (2021). A comparative study: Blockchain technology utilization benefits, challenges and functionalities. *IEEE Access*, 9, 12730-12749.
- [11] Mohammad, A., & Vargas, S. (2022). Challenges of Using Blockchain in the Education Sector: A Literature Review. *Applied Sciences*, 12(13), 6380.
- [12] Cheng, J. C., Lee, N. Y., Chi, C., & Chen, Y. H. (2018, April). Blockchain and smart contract for digital certificate. In *2018 IEEE international conference on applied system invention (ICASI)* (pp. 1046-1051). IEEE.
- [13] Narayanan, A. S. (2012). QR codes and security solutions. *International Journal of Computer Science and Telecommunications*, 3(7), 69-72.
- [14] Li, C., Guo, J., Zhang, G., Wang, Y., Sun, Y., & Bie, R. (2019, August). A blockchain system for E-learning assessment and certification. In *2019 IEEE International Conference on Smart Internet of Things (SmartIoT)* (pp. 212-219). IEEE.