

Certificate Verification System Using Blockchain and QR Code Technologies

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ABSTRACT

The aim of this project is to design software that verify student certificate via block chain and quick response code technologies. The project was motivated based on high level of production and circulation of fake certificates, impersonation of certificate, certificate verification is stressful and time consuming and lack of real time authentication of certificates. The methodology adopted for this research is Object Oriented Analysis and Design on proposed study, a centralized system for authentication of certificates issued or tendered to Nigeria students on graduation. The proposed system used blockchain with quick response (QR) code technologies for authentication and implemented with python flask as web framework, SQLite database management system and bootstrap library. The expected result of system is to develop an online certificate verification system that checkmate certificate forgery, sanitize educational system, and simplify for organizations and recruiter's authentication of certificates.

Keywords: Certificate Verification, Blockchain, Quick Response Code

INTRODUCTION

Academic certificate fraud exists in practically every state and sector in Nigeria. Many incidents have been discovered because of several reports. This threat is detrimental to any society. Blockchain technology comes to mind to overcome this disadvantage. According to Spencer, (2015), A Blockchain is a list of encrypted digital record or transaction, called a block. Each block is then "chained" to the next block, in a linear, chronological order, using a cryptographic signature. So, why should you use Blockchain? Because under realistic conditions, the data in a Blockchain cannot be modified. Even if data is tampered with, it just takes a fraction of a second to notify the parties involved. Only when many parties approve a data or a node in Blockchain is it considered valid. As a result, the system would be Reliable and Authenticated at all times. Blockchain Technology's purpose is to establish a decentralized environment that provides security, reliability, authenticity, immutability, and transparency.

In recent years, several frauds have surfaced in which people use forged degrees and documents to obtain employment or admission to universities home and abroad. It is now important to have your educational certificates validated by the university where they were issued to reduce the cases of false educational documents. An educational certificate that has been verified ensures that the candidate has completed his or her education at the specified university.

As the velocity of domains, apps, devices, and certificate usage continues to ramp up - we need a better, scalable way to manage it all. Hence, full certificate discovery is the first step towards any strong security posture. An automated certificates scanning tool identifies and monitors rogue certificates by reviewing certificate activity logs Yackel, (2020). Educational establishments try to combat fraud and forgery in several ways, but most of the methods are time-consuming because they are manual, partly automated, or involve human-to-human interaction Osman & Omar, (2016).

Certificate verification has evolved. In recent times, Certificate verification has been automated with several technologies. However, there are still hanging questions on the strength of the security model of newly implemented automation which has led to the introduction of the concept of blockchain in certificate verification systems.

Rama, *et al.*, (2021), listed several parameters that can be checked before applying blockchain technology to solve any existing problem. These parameters are so linked up that if you answer yes to at least four of them, you should consider implementing blockchain. They are cryptography, decentralisation, consensus e.t.c.

Certificate Verification: It is the process of evaluating a university's certificate and guaranteeing that it is original and legitimate.

Blockchain: It is a digital transaction executed on serials of blocks encrypted by cryptography.

Quick Response Code: Refers to a machine-readable code consisting of an array of black and white squares, typically used for storing URLs or other information for reading by the camera on a smartphone.

In the paper by Peter et al, (2019), aimed at creating a web-based certificate verification system for Nigerian universities, the paper aimed at eliminating the manual system of certificate verification in Benue State University as a case study. The proposed system is aimed at developing a system that will verify and authenticate the validity of a certificate issued by the institution, offer a database for the institution's certificate records, construct a durable system that can sustain long periods of operation, develop a flexible system that can be altered depending on changing requirements, and develop a system that can increase operational efficiency. One of the system's drawbacks is that anyone with portal access can alter any document that has been uploaded.

The Properties of Distributed Ledger Technology (DLT)

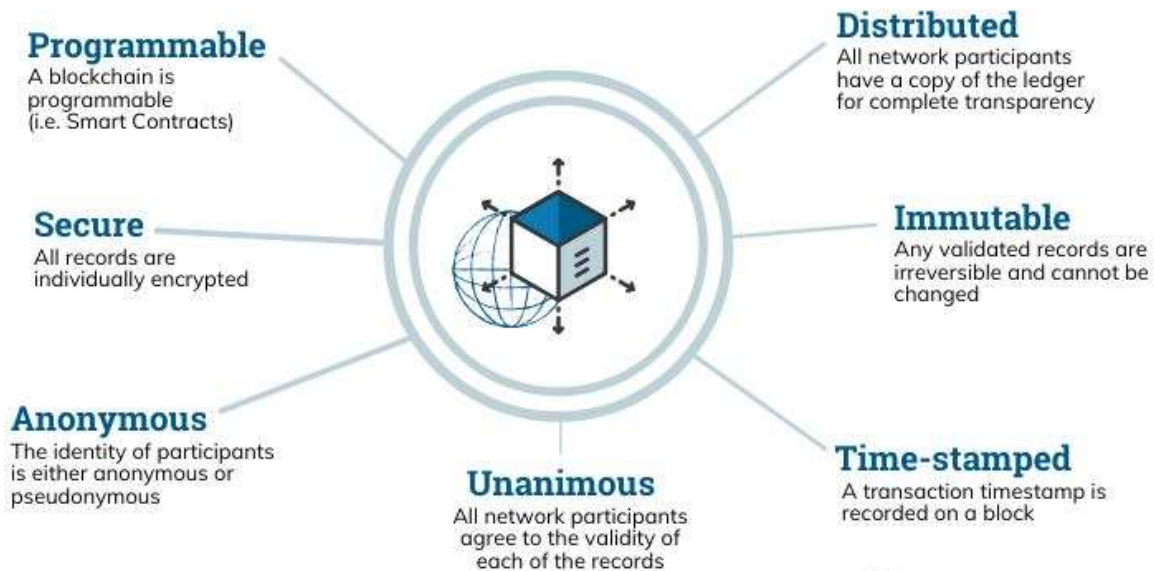


Figure 1: Properties of Distributed Ledger Technology

Source: Euromoney, (2020)

CLASSIFICATION OF BLOCKCHAIN TECHNOLOGY

Public Blockchain: Public blockchain is accessible to anyone willing to participate in the transaction. This type of blockchain is open-source and uses proof-of-work consensus.

Private Blockchain: Unlike the public blockchain, a private blockchain is not accessible to anyone. In it, nodes represent the computers which are controlled by one person who grants authority to participants during transactions.

Consortium Blockchain: This type of blockchain tries to remove the single authority in control of a network that the private blockchain provides. The consortium blockchain provides participants accessibility and control on the network through a group of individuals or organizations.

How Blockchain Works?

When a request is placed, a user or computer has an independent copy of the information in the blockchain ledger, which serves as a node. The transactions occur in the sequential order of blocks, which depends on the type of blockchain. Miners act as specific node evaluators who perform the block verification process before adding anything to the blockchain structure.

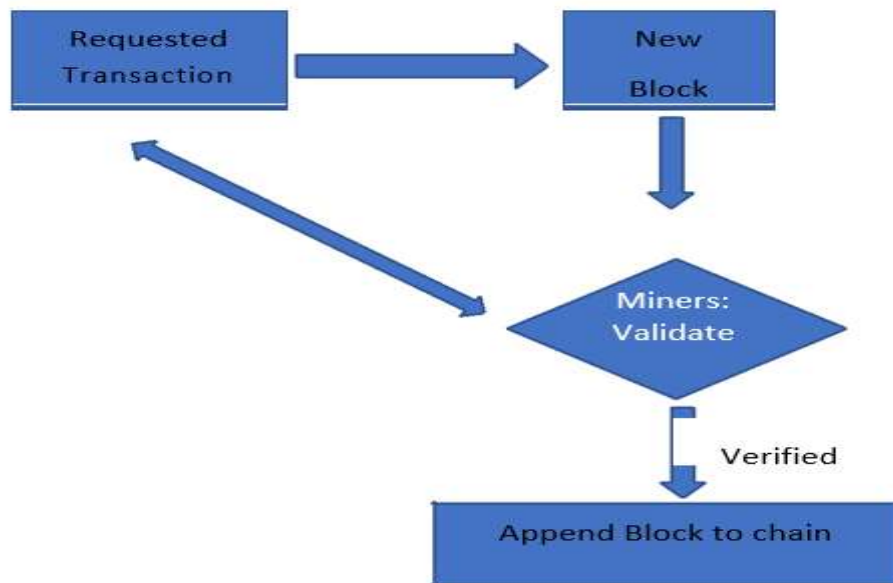


Figure 2: Process Flow for Blockchain Technology

SOME TECHNOLOGIES USED

Python Flask: Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries.

Bootstrap Library: Bootstrap is a versatile toolkit that includes HTML, CSS, and JavaScript tools for creating and developing web pages and applications.

SQLite: Is an embedded relational database management system. It is a self-contained, serverless, zero-configuration and transactional SQL database engine.

Quick Response (QR) Code Technology

The method of verification is to scan the embedded QR code through the laptop camera. Consumers can easily utilize their smartphones to scan a QR code to get information or instructions, thus avoiding the need to touch a shared surface.



Figure 3: Sample of Encrypted QR Code

METHODOLOGY

The procedures or strategies used to find, select, process, and analyze information on the Certificate Verification System using Blockchain and QR code technologies” adopted the Object-Oriented Analysis and Design methodology.

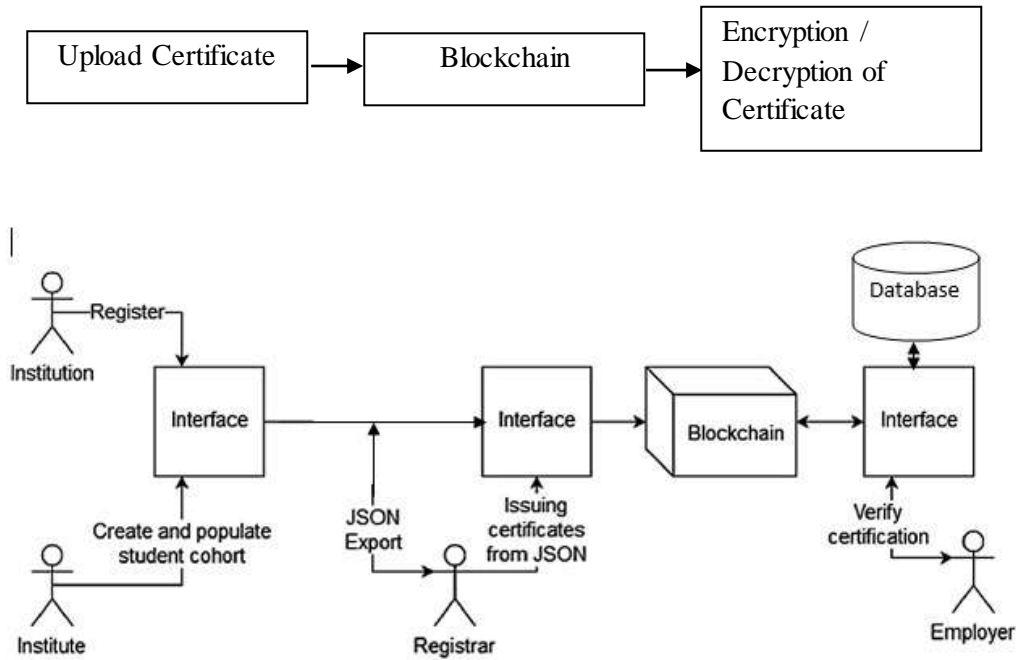


Figure 4 Complete Architecture of Certificate Verification

Fig 4 The institution connects with the blockchain and encryption to register students, upload results, and transform strings. The institution or employer verifies certificates.

RESULT

In this system, data is supplied by the user during registration which in turn is used to create login details and password of the user. The interface make use of GUI components such as textboxes to accept input from the user into the system.



Figure 6: Admin Sign in Module

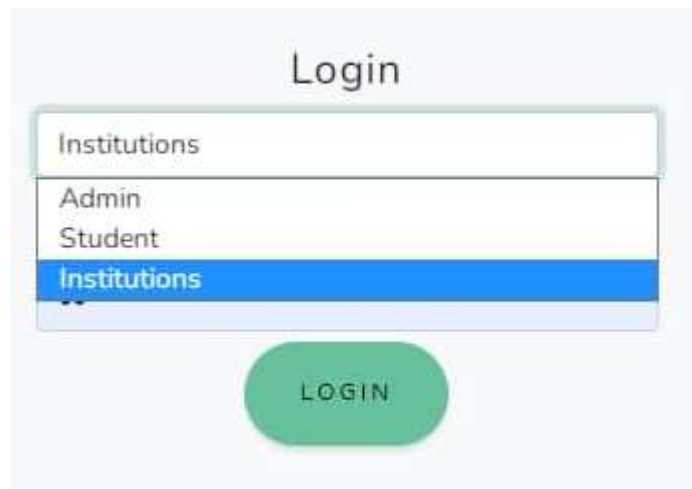


Figure 7: Login for Student and Institution

Welcome to Admin Portal; Register Universities with NUC number and Verified Certificates

Registered Universities

#	University Name	NUC Number	State	Uni. City	Date	Email	
1	Mouau	NUC-K3PP20	Abia	Umuahia	2023-02-17	movau@gmail.com	
2	Imo State University	NUC-LBTS0T	Imo	Owerri	2023-02-18	imouni@gmail.com	
3	Yobe State University	NUC-GL4GBV	Abia	Damaturu	2023-03-20	admin@gmail.com	
4	Abia State University	NUC-HGLA38	Abia	Okigwe	2023-03-22	absu@gmail.com	
5		NUC-SMK811	Imo	Owerri	2023-03-22	futo@gmail.com	

Figure 8: Admin Dashboard

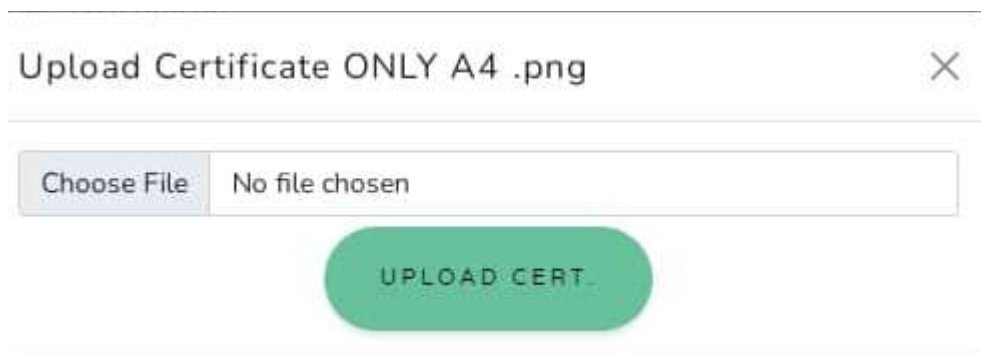


Figure 9: Certificate Upload



Figure 10: Verified Certificate with QR Code



Figure 11: Verified Certificate Confirmation

In summary, any student or institution certificate that have been verified through this system, when validated, will have a “Yes” in the Validate Certificate icon, otherwise it was show “No” in the Validate Certificate Icon.

CONCLUSION

One of the key values of Blockchain is the creation of immutable ledgers. This characteristic aids us in creating a system in which all processes are transparent and immutable. Our system streamlines the process of creating certificates and decreases the amount of manual effort required to verify them. Students also have a low chance of losing their certificate. We can reduce the percentage of data that is tampered with by utilizing an additional hashing technique. The certificate's hash is kept in the blockchain, while the original document is kept in the secured repository. This will aid in data preservation and transparency.

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