BLOCKCHAIN BASED ACADEMIC TRANSCRIPT EXCHANGE SYSTEM FOR HIGHER INSTITUTIONS

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SUBMITTED TO

THE DEPARTMENT OF COMPUTER SCIENCE AND MATHEMATICS,

COLLEGE OF BASIC AND APPLIED SCIENCES,

MOUNTAIN TOP UNIVERSITY, IBAFO, NIGERIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD

DEGREE OF BACHELOR OF SCIENCE (B.SC.) IN COMPUTER SCIENCE

AUGUST, 2022

DECLARATION

I hereby declare that this project has been written by me and is a record of my own research work. It has not been presented in any previous application for a higher degree of this or any other University. All citations and sources of information are clearly acknowledged by means of reference.

_____

MAKINDE, IFEOLUWA JOSIAH

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Date

CERTIFICATION

This is to certify that this project, “Blockchain Based Academic Transcript Exchange System for Higher Institutions”, was carried out by Makinde Ifeoluwa Josiah, a student of Mountain Top University with Matriculation Number **18010301037**, under the supervision of Dr. D. D Aleburu.

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DEDICATION

This is dedicated to first and foremost, the Almighty God and to the completion of my degree in computer science.

ACKNOWLEDGEMENT

Thanks be to Almighty God for His mercies, provision, and protection, as well as the fortitude and opportunity He gave me to complete my project successfully. May His blessings and protections abound upon us all (Amen).

I also want to express my gratitude to my supervisor, Dr. D. D. Aleburu, for her diligent supervision and smart guidance that helped the project to be successful.

Additionally, I would like to recognize Dr. M. O. Adewole, Head of the Department of Computer Science and Mathematics, and I give him my sincere gratitude for all of the academic and non-academic staff members' efforts, ongoing inspiration, direction, and support for the lessons that have shaped my character and given my stay purpose. I want to thank Mountain Top University for pushing me to new heights. God bless you, I pray. Finally, I want to thank my family, my parents and my siblings for their financial and emotional support. I am grateful for the money invested in my education and future. I would especially like to thank the students at the Department of Computer Science and Mathematics for making my time there worthwhile. May God keep graciously bless you all.

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ABSTRACT

The study aims to develop a decentralized transcript system that would be used to exchange transcript by highlighting requirements needed in the system's development, designing the system based on the highlighted requirements, developing and test running the system. In this age of development and technology, the need for a more advanced transcript system is urgent.

The system's outcome emphasizes the major advantage of adding blockchain technology into its architecture, which is to guarantee security and trust. In conclusion, if employed in the correct field, blockchain can help to secure data as well as increase system security. The system created for this project has so far addressed the majority of the problems in the outdated transcript system, although it still has room for improvement. Further study towards developing a better identifying system is strongly advised.

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CHAPTER ONE

INTRODUCTION

1.1 Background of Study

A transcript is a document that contains a copy of a student's academic records. When a student enrolls at a certain institution, it is expected that all of the student's academic achievements be documented, as this aids in deciding the different grades each student receives. When a report on a student's entire performance at a certain point in time is prepared, a transcript is created. A transcript is an academic record detailing a student's academic performance while at the University or higher institution of learning (Cadar, Teytelman, & Trusova, 2013) To put it another way, a transcript is a copy of a student's academic record. As a result, candidates must request transcripts the old-fashioned method and allow enough time for them to arrive via postal mail on time.

Occasionally students are required to submit their transcript request form due to the heavy workload that transcript officials are under. Most often, when a lot of forms are submitted for processing, some students may never find these forms again. There have been instances where students were unable to access their transcript request form after it had been submitted. Similar to this, transcripts are intended to be private documents, however due to the type of transcript processing system used in tertiary institutions, students, staff, and parents are constantly able to access this information. Following advances, blockchain can now be designed to automatically protect and verify transcript and also activate transactions (through smart contracts) (Lakhani, Iansiti, & R., 2017).

1.2 Statement of the Problem

The use of transcripts has had a huge impact on academic progress. Building computerized systems for improved academic transcript, record, and management has cost academic institutions a great deal of money. However, these systems struggle to develop continuous improvement recording by exchanging academic data across various institutions and suffer from a lack of privacy protection as a result of the mismatch in learning records.

1.3 Aim and Objectives

The aim of this project is to develop a blockchain based academic transcript exchange system. The specific objectives are to:

i. Design a blockchain based model.
ii. Develop the designed model in (i).
iii. Test the system.

1.4 Methodology

The system was built based on relevant technology. The Smart Contract would be created using Solidity Programming Language, and the academic transcript website will be programmed using HTML, JAVASCRIPT, CSS, PHP and Solidity.

The proposed system will be tested manually for validation, security, performance, and user experience

i. A review of the literature will be conducted in order to identify their benefits and limitations based on their existing systems.

1.5 Scope of the Study

This project will focus on developing a blockchain based academic transcript exchange system it will focus on developing System that primarily sends student academic profile to various graduates of Universities, Online courses & programs, and at the end of the day transcript forgers can be eliminated through this means. The project illustrates the use of blockchain technology in building an academic transcript exchange system.

1.6 Significance of the Study

The use of blockchain in the development of several systems in the modern world has been long encouraged and has been proven essential. Since the development of the first cryptocurrency; bitcoin (Nakamotoi, 2008), it has been widely used in various areas of the world. The crypto economics of the world ranging from bitcoin to Ethereum to dodge coin, are just the brief surface on which cryptography can improve. Another sector is the cyber-security area, here, trust is also the main goal to achieve in the system. Blockchain is a method of recording and verifying records that are distributed transparently by users of a specific network. In this analysis, the preferred network should be any individual who wishes to join such a network to determine the integrity. Blockchain gives students ownership of their personal records, allowing them to control their academic identity. This makes proving the accuracy of the credentials on their resumes much easier.

1.7 Definition of terms

i. **Blockchain:** A blockchain is a public ledger of transactions. The name comes from the database's structure, which consists of individual records called blocks that are linked together in a single list called chain.

ii. **Smart-contract:** A smart contract is a technique for digitally validating contract agreements.

iii. **Solidity:** Solidity is a programming language for creating smart contracts that was created with n Ethereum's Virtual Machine in mind.

iv. **Framework:** A software system is a physical or abstract platform that allows developers or users to specialize or avoid common code by using generic features.

v. **Transcript:** A transcript is proof of education.

vi. **Exchange:** that a partner institution accepts a student, but does not necessarily mean that the students have to find a counterpart from the other institution with whom to exchange.

vii. **JavaScript:** is a scripting language that enables you create dynamically updating content, control multimedia, animate images, often abbreviated **JS**, is a programming language that is one of the core technologies of the World Wide Web, alongside HTML and CSS

viii. **Database:** is information that is set up for easy access, management and updating.

CHAPTER TWO

LITERATURE REVIEW

2.1 Academic Transcript System

In education, a transcript is a certified record (inventory) of a student throughout a course of study having full enrollment history including all courses (or subjects) attempted, grades earned and degrees and awards conferred.

Why is Transcript Needed?

An academic transcript may be required for a variety of reasons, including professional, educational, or personal ones. Most people obtain their academic records when they want to apply for jobs or higher education opportunities overseas. This is due to the fact that a diploma or degree certificate is insufficient. The two documents only serve as verification of graduation; they don't reveal anything about the courses you took or the quality of your grades. Any university or employer can gain a comprehensive understanding of a student's academic performance and accomplishments from their academic transcript.

Here, are some reasons why students may require academic transcript:

i. Higher Studies
ii. Visa Applications
iii. Employment
iv. Transferring Colleges
v. Credit Transfer
vi. Personal Reasons

2.1.1 Types of academic transcript

I. Official Transcripts

An official transcript is a comprehensive record of your academic progress, including transfer work, credit earned by exam, and earned degrees. All official transcripts bear the University seal, are mailed in a special envelope, and are endorsed by the Registrar. In accordance with the Family Educational Rights and Privacy Act (FERPA) of 1974, transcripts are released to a student or a third party only upon receipt of a request that includes the student's official written signature.

II. Unofficial Transcripts

An unofficial transcript does not have the same level of security as an official transcript. Unofficial transcripts are printed on plain paper and do not have a college seal or Registrar's signature.

2.2 Blockchain

Blockchain technology aims at creating a decentralized environment where no third party is in control of the transactions and data (J. Yli-Huumo, Ko, & S. Park, 2016). In a pseudonymous article published in 2008, Satoshi Nakamato proposed blockchain technology as the Bitcoin cryptocurrency's core technology (Nakamoto, 2019) in the following year, it was used to create the cryptocurrency bitcoin. Without the requirement for a trusted third party, blockchain is an open, distributed ledger that may quickly record transactions between two parties in a verifiable and immutable (permanent) manner (disintermediation) a blockchain is a distributed, decentralized peer-to-peer network in which all member transactions are recorded in a single, permanent public ledger. To identify participants, encryption with public–private keys is utilized. The public key is used for public identification, while the private key is used to authorize transactions initiated by the owner or to claim an asset encrypted with their public key. A block

is essentially a data structure that consists of two parts: a block header that contains the preceding block's hash value, a timestamp, and a Merkle root, and a data component that contains pertinent transaction data. A transaction typically contains the sender's public key, data, and the previous transaction's hash value. The blockchain's data section allows it to hold various electronic assets such as records, certifications, transcripts, property rights, and licenses. The order of the hash value connects all of the blocks. The block's chain is duplicated across the distributed blockchain network and kept by minor nodes in the blockchain. Blockchain has been utilized or proposed for usage in applications other than cryptocurrency as a foundational technology (T. Arndt, 2018).

There are different types of blockchain systems now recognized, each with its own governance and architecture.

1. **Public blockchain:** Since all documents are accessible to the public, everyone can participate in the consensus process. This type of blockchain possesses a high level of immutability but is inefficient.

2. Private blockchain: belongs to a certain organization, and these are the only nodes that are permitted to take part in the consensus decision-making process. Private blockchains are more efficient, but they offer a lower level of immutability compared to public blockchains.

3. Consortium blockchain: In terms of immutability and efficiency, consortium blockchain represents a middle ground between decentralized public and centralized private blockchains. It is a hybrid of the two previous types of systems in which a predetermined number of people can participate in the consensus process and not all users are from the same firm. A permissioned blockchain is another name for this type of blockchain. Finally, this study shows how to construct a blockchain-based academic transcript exchange system that addresses privacy, security, data fragmentation, data isolation, and effective access to academic records.

4. Hybrid Blockchain:

In terms of immutability and efficiency, consortium blockchains represent a middle ground between decentralized public and centralized private blockchains. These blockchains are a mix of the two previous types of systems, in which a predetermined number of people can participate in the consensus process, and not all users are from the same firm in terms of centralization. A permissioned blockchain is another name for this particular variety of blockchain. In conclusion, this study reveals how to construct an academic transcript exchange system that is based on blockchain technology and addresses concerns regarding data privacy, data security, data fragmentation, data isolation, and efficient access to academic records.

2.2.1 Features of Blockchain

a**. Increased Capacity**

This is the first and most important quality that Blockchain possesses. The most impressive aspect of this Blockchain technology is the way in which it allows for the capacity of the entire network to increase. Because there are numerous computers working together, which gives higher power than a limited number of machines where everything is centralized, this system is called a distributed system.

b. **Better Security**

The blockchain technology is seen as being more secure than its competitors since there is no central point of failure. Data is always cycled by numerous nodes since blockchain runs on a distributed network of nodes. This ensures that even if one node is compromised by hacking or other faults, the integrity of the original data is not put at risk.

The production of unchangeable ledgers is one of the primary benefits offered by blockchain technology. Because it relies on a third party mediator for security, a centralized database leaves itself open to the risk of being hacked and subject to fraud.

d. **Faster Settlement**

Traditional banking systems are notoriously sluggish due to the fact that completing transactions often takes several days and requires a significant amount of settlement time. This is one of the primary reasons why these financial organizations, along with others like them, need to upgrade their banking systems. Because it can swiftly address issues with money transfers, blockchain technology may assist us in overcoming this challenge. In the end, this not only saves these establishments a significant amount of time and money but also provides the customer with an increased level of convenience.

e. **Decentralized System**

You are able to store your assets in a network without being subject to the supervision and control of a single person, company, or other body if you make use of decentralized technology. This is because decentralized technology eliminates the need for centralized servers. By doing so, the account holder will have direct control over their account by way of a key that is tied to their account. This will enable the account holder to transfer their assets to whoever they choose. The potential to decentralize the internet with the assistance of blockchain technology may amount to nothing less than a revolution in the world of the internet.

Uses of decentralization

i. **Less Failure**: Since a lot of actions on a blockchain are automated and do not involve much human oversight there is less probability of failures or errors.

ii. **User Control**: There is a lower risk of inconsistencies or mistakes occurring on a blockchain because many of the operations that take place on one are automated and do not require much scrutiny from humans.

iii. **No single point of failure**: Due to the decentralized nature of the system, every database is saved in a huge number of nodes that are dispersed all over the world. Since there is no central point of failure, the blockchain will remain secure even if a single computer is hacked..

iv. **No intermediaries**: Because of the technology's decentralized character, it is a system that does not rely on third-party businesses, which further reduces the probability of additional prices and expenses as well as hazards.

v. **Zero Scams**: Because of the way the system is built, there is no way for other people to con you out of anything because it is algorithm-driven. Nobody is allowed to use blockchain technology for their own personal gain.

vi. **Transparency:** Because of how decentralized technology is, it is possible to view transparent profiles of all participants. Every alteration that is made to the blockchain is observable, which increases its level of dependability.

vii. **Authentic:** It is possible for the system to be constructed in such a way that it is personalized for each different kind of person. And cybercriminals will have a difficult time breaking it.

f. **Distributed Ledger**

Details of transactions and participants are made accessible to the broader public through the use of public ledgers. These ledgers do not have any form of security or authority, in contrast to private or federated ledgers, both of which can be integrated into a blockchain system. This is done so that the ledger of the network may be maintained by all of the other users of the system. The processing power was distributed across the several computers so that the end output would be superior.

g. **Cannot be corrupted**

On every node of the network, there is a copy of the distributed digital ledger that is stored. Before adding a transaction, each node must first determine whether or not it is legitimate. The

transaction is only entered into the ledger if the majority of those present believe that it is lawful. This not only promotes transparency but also renders the system immune to corruption.

h. **Minting**

In essence, there are many different ways in which a problem of manipulation can be minted, all of which can be solved by using Blockchain technology. People and businesses in the west do exhibit a sense of trust in one another; for example, financial institutions and multinational technology behemoths like Google and Meta assure a sense of dependability and accountability.

The potential for blockchain technology is currently greatest in nations that have not yet achieved a certain degree of development but in which mining is the most common method. However, in recent times numerous new approaches have also been established, such as proof of work, which is one means by which an individual can demonstrate that he is engaged in a large amount of computation work. Proof of work is an example of such approach.

2.2.2 How Blockchain Works

The objective of blockchain technology is to make it possible to record and distribute digital information while preventing its modification in any way. In this sense, a blockchain serves as the basis for immutable ledgers, which are essentially recordings of transactions that cannot be changed, erased, or otherwise destroyed. Because of this, blockchains are also sometimes referred to as a form of distributed ledger technology (DLT).

The blockchain concept was first presented in 1991 as part of a research project, making it older than its first widespread application, Bitcoin, which was released in 2009. Since that time, numerous cryptocurrencies, apps for decentralized finance (DeFi), non-fungible tokens (NFTs), and smart contracts have been developed, which have all contributed to an explosion in the use of blockchain technology.

Blockchains are digital ledgers that can be used to record a variety of information, including financial transactions involving cryptocurrencies as well as other forms of information, such as the tracking of products and other data. Food products, for instance, may be traced from the moment they are shipped out, all the way through their voyage, and up until the point where they are delivered to their final destination. This information can be important since it makes it possible to readily pinpoint the outbreak source in the event that there is a contaminated outbreak. Blockchains provide organizations a wide variety of possibilities for storing essential data, and this is only one of them.

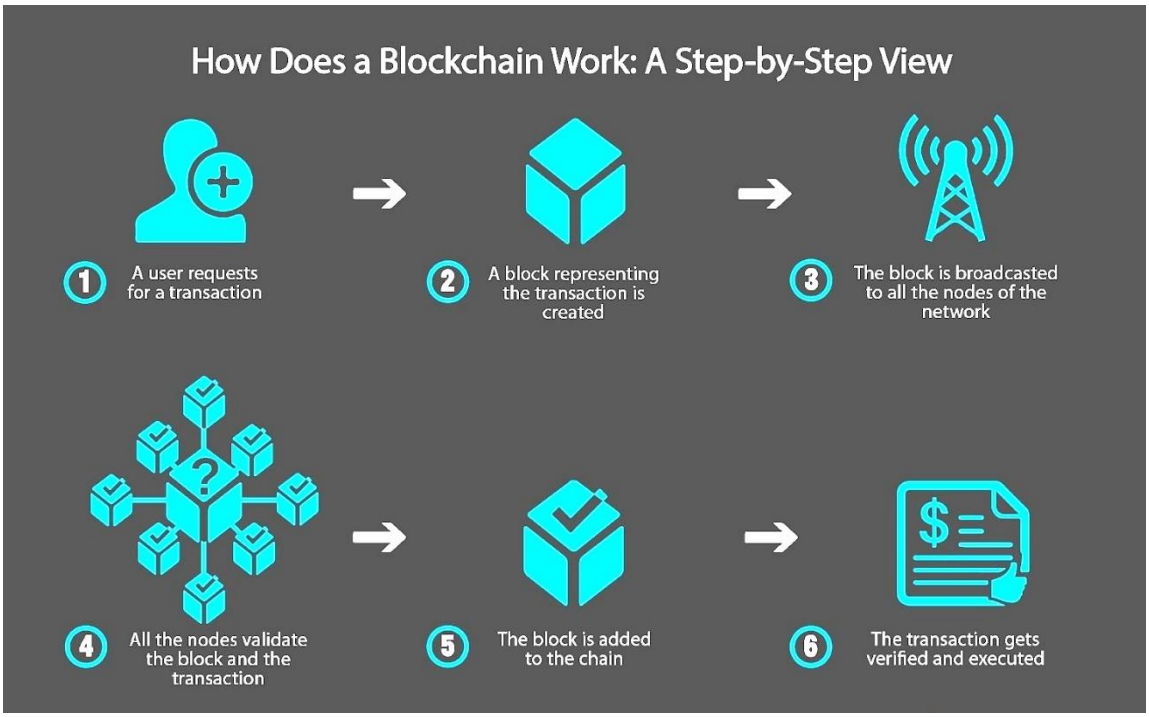

Figure 2-1: A step by step view on how blockchain works

2.2.3 Application of Blockchain

Many aspects of our day-to-day lives have already been adapted to make use of blockchain technology. This has primarily been done to promote transparency within any organization that

employs the technology or to answer the majority of concerns around safety and trust. We can also solve identity management and fraud prevention with blockchain technology. The use of bitcoin and other cryptocurrencies in the world of commerce has solely improved how people are able to enable transactions. The majority of financial institutions can use blockchain to pore over customers and combat these fraudulent activities. Blockchain can also be used to facilitate payments. The decreased costs that are paid on transactions that may take big sums in the banking system have enabled a larger interest in using crypto-currencies in transactions. This interest has enabled a higher adoption rate.

i. Banking and Finance

Banking could benefit the most from blockchain technology. Financial institutions are open Monday through Friday during business hours. If you deposit a check at 6 p.m. on Friday, the money won't touch your account until Monday. Even if you deposit within business hours, the process can take one to three days to verify based on bank activity. Blockchain works 24/7.

By successfully integrating into banks, users can have their transactions executed in as little as 10 minutes, regardless of holidays or day of week. Banks can trade funds more swiftly and securely with blockchain. In stock trading, the settling and clearing procedure can take about three days (or more if trading overseas), freezing money and shares.

Even a few days of money in transit can be costly and risky for banks given the amounts involved.

ii. Currency

Blockchain backs cryptocurrencies like Bitcoin. The Fed controls the USD. In this central authority arrangement, a user's data and currency are at the mercy of their bank and the

government. When a user's bank gets hacked, their sensitive information is at risk. If a client's bank fails or they live in an unsafe nation, their currency may be in danger. Several insolvent banks were bailed out with taxpayer money in 2008. These are the fears that inspired Bitcoin.

By using a system of computers, blockchain makes Bitcoin and other digital currencies decentralized. It also decreases risk and transaction expenses. It can give countries with weak currency or financial systems a much stronger currency with far more applicability and a bigger network of persons and organizations with whom to do business domestically and globally.

Those without state ID can use cryptocurrencies wallet for savings or payment. Many countries could be war-torn or lack an ID system. These countries may not have savings or brokerage accounts; thus, its citizens can't safely save wealth.

iii. Healthcare

Blockchain technology can be utilized by healthcare practitioners in order to safely keep the medical records of their patients. It is possible to write a medical record onto a blockchain once it has been generated and signed. This gives patients the proof and assurance that the record cannot be modified once it has been recorded into the blockchain. These sensitive medical files may be encrypted and secured on the blockchain using a private key, ensuring that only the appropriate parties have access to the information. This would protect the confidentiality of the data.

iv. Property Records

If you have ever spent time in your local Recorder’s Office, you will know that the process of recording property rights is both burdensome and inefficient. Today, a physical deed must be delivered to a government employee at the local recording office, where it is manually entered into the county’s central database and public index. In the case of a property dispute, claims to the property must be reconciled with the public index.

This process is not just costly and time-consuming—it is also prone to human error, where each inaccuracy makes tracking property ownership less efficient. Blockchain has the potential to eliminate the need for scanning documents and tracking down physical files in a local recording office. If property ownership is stored and verified on the blockchain, owners can trust that their deed is accurate and permanently recorded.

In war-torn countries or areas that have little to no government or financial infrastructure, and certainly no Recorder's Office, it can be nearly impossible to prove ownership of a property. If a group of people living in such an area is able to leverage blockchain, then transparent and clear time lines of property ownership could be established.

v. Smart Contracts

A smart contract is a computer code that can be built into the blockchain to facilitate, verify, or negotiate a contract agreement. Smart contracts operate under a set of conditions to which users agree. When those conditions are met, the terms of the agreement are automatically carried out.

Say, for example, that a potential tenant would like to lease an apartment using a smart contract. The landlord agrees to give the tenant the door code to the apartment as soon as the tenant pays the security deposit. Both the tenant and the landlord would send their respective portions of the deal to the smart contract, which would hold onto and automatically exchange the door code for the security deposit on the date when the lease begins. If the landlord doesn't supply the door if the code is submitted by the due date, the smart contract will automatically reimburse the security deposit. The fees and procedures that are generally connected with the use of a notary, a third-party mediator, or attorneys would be rendered obsolete as a result of this change.

vi. Supply Chains

To document the origins of the materials that they have purchased, suppliers can use blockchain technology, just like in the example given by IBM Food Trust. Not only the authenticity of the company's own products, but also the legitimacy of common labels like "Organic," "Local," and "Fair Trade," which would be made possible by this development.

According to a recent study by Forbes, the food sector is progressively adopting the use of blockchain technology to trace the course and safety of food along the whole food supply chain, from the farm to the consumer.

vii. Voting

As was just indicated, blockchain technology presents an opportunity to develop a new voting system. The use of blockchain for voting has the ability to eradicate election fraud and increase voter turnout, as was demonstrated in the midterm elections that took place in West Virginia in November of 2018. When implemented in this manner, blockchain would render vote manipulation extremely difficult to do. In addition, the blockchain protocol would keep the electoral process open and transparent, while simultaneously cutting down on the number of people needed to run an election and giving officials with practically instant results. Recounts wouldn't be necessary, and there wouldn't be any need to be concerned about election fraud happening in the first place.

2.3 Platforms for Developing Blockchain Applications

A lot of interest has been generated by the concept of using blockchain platforms to simplify supply chains, enhance traceability, make commerce more straightforward, and enhance financial transactions. A lot of people are interested because of the speculative frenzy that has surrounded Bitcoin, which would be built on an earlier blockchain network that has problems with power consumption and speed.

Platforms based on the modern distributed ledger technology have been developed in order to assist in overcoming these limits and providing value to a variety of applications and uses (Lawton, 2022). The following are a few of the most well-known platforms:

1. **Ethereum**: In 2013, Vitalik Buterin was the one who first introduced the open-source and public blockchain platform. "Gas" is a unit of computation that is performed by smart contracts (scripts) running on the Ethereum Virtual Machine. Ether is a token (cryptocurrency) that may be used to pay for "gas." Ether may be purchased with other cryptocurrencies (EVM). The Nakamoto consensus algorithm is used, albeit with some modifications, in Ethereum (which is used by Bitcoin). The creation of distributed or decentralized peer-to-peer (P2P) applications frequently makes use of Ethereum as a backend platform (Dapps).
2. **Hyperledger Fabric**: Consists of a modular design, smart contracts, and changeable consensus and membership services. Hyperledger Fabric differs from Ethereum in a number of ways, including the absence of a built-in token and a reduced degree of configurability. Hyperledger Fabric is one of several "Hyperledger" initiatives developed under the aegis of the Linux Foundation, and it is geared toward the enterprise, with a focus on Business to Business (B2B) applications.
3. **Corda:** It was established by the R3 blockchain technology enterprise. Corda is an open-source distributed ledger and smart contract platform built for the commercial sector. Corda is

permissioned and lacks a native token like Hyperledger Fabric, but it is more specialized, catering to the financial services industry's needs.

4. **Openchain**: CoinPrism's open-source blockchain technology allows enterprises to issue and manage digital assets in a secure and scalable manner. Support for smart contracts and divided consensus enables users to create different instances with a central authority. Bitcoin can be tied to Openchain tokens. Openchain employs a client-server architecture rather than the more prevalent P2P blockchain design. Because no miner is required for consensus, transactions are also instant and free.
5. **BigChainDB**: is an open-source distributed storage solution that intends to combine the advantages of NoSQL databases and blockchain technology (distributed storage, immutability, no central authority). BigChainDB consists of a collection of NoSQL database nodes (such as MongoDB instances) that store immutable information about transactions and maintain them synchronized using the Tendermint Byzantine Fault-Tolerance (BFT) consensus procedure. BigChainDB comes in three varieties: public, private, and permissioned.
6. **IOTA**

Iota is a public distributed ledger and cryptocurrency built for the Internet of Things (IoT). It uses a directed acyclic graph to store transactions on its ledger, as its scalability may be greater than blockchain-based distributed ledgers. IOTA does not rely on miners to validate transactions; rather, nodes that issue a new transaction must approve two previous ones. Therefore, transactions can be issued without fees, facilitating microtransactions. Currently, the network reaches consensus via a coordinator node managed by the IOTA Foundation. Currently, the network is centralized as the coordinator is a single point of failure.

IOTA has been criticized for its unconventional design, the viability of which in practice is uncertain. As a result, IOTA was completely redesigned for a network update named Chrysalis

or IOTA 1.5, which was released on 28 April 2021. In this update, contentious decisions, such as ternary encoding and quantum-proof cryptography, have been superseded by established standards. Late in 2020, a testnet for a further version called Coordicide, or IOTA 2.0, was deployed, with the goal of delivering a decentralized network that no longer requires the coordinator for consensus in 2021.

2.4 Transcript with Smart Contracts

A smart contract is a way to digitally formalize and secure relationships over a network (Bessa & Martins, 2019). Smart contracts' main purpose is to make it feasible to embed various forms of contractual obligations, collateral, bonding, and property rights in computer software or hardware that cannot be exploited by a hostile party. Contractual breaches are drastically reduced. (Szabo, 2019). In this context, a smart contract is defined as an application that runs on the blockchain network and is executed by all network participants (Liu, Muhammad, Lloret, Chen, & Yuan, 2019). Smart contracts are computer codes that govern the blockchain transactions and define the conditions of mutually agreed contracts (Modi, 2018). Many blockchain-based projects, such as the Ethereum platform and Hyperledger, have recently added smart contracts. They make it possible for anonymous entities to make trusted agreements and transactions without the need for a central authority or external enforcement methods. The

Ethereum platform allows for the creation of smart contracts that meet the system's specifications. In the context of adopting smart contracts in different systems, they enable the creation of scalable and dynamic criteria, terms, and conventions for exchanging and distributing academic transcripts in a secure manner.

2.5 Related Works

Previous studies on the sharing and verification of academic records, such as digital certificates and transcripts, have been conducted. We will look at some recent representative efforts in the application of blockchain technology in higher education in this part.

Academic institutions have spent a lot building electronic systems for better academic transcript, record and management. However, due of the mismatch in learning records, these systems suffer from a lack of privacy protection and challenges in establishing lifelong learning recording by transferring academic data across numerous institutions (Patrick, Brendan, Hiroshi, & Hiroaki, 2019).Solutions to such problems are based on blockchain, which can benefit the education systems by improving the security and the protection of creating and maintaining certificates, credentials and education records (Sharples & Domingue, 2016). Simultaneously, it would allow several parties to share and access data with high consistency, immutability, and transparency (Yumna, Khan, Ikram, & Ilyas, 2019) To our knowledge, only a few peer-reviewed studies have demonstrated comprehensive blockchain-based educational systems. Students' grades will be saved in an Ethereum-based system, and they will be compensated financially. Therefore, the authors of (Patrick, Brendan, Hiroshi, & Hiroaki, 2019) presented a blockchain-based system that maintains student learning activities and enables for the secure and verified transfer of learning data. In addition, (Bessa & Martins, 2019) proposes a blockchain-based educational record repository for securely distributing educational certifications across academic institutions and third-party experts. (Turkanović, Hölbl, Košič, Heričko, & and Kamišalić, 2018) based on the European Credit Transfer and Accumulation System, presented a blockchain credit transfer system (ECTS). There are other blockchain-based systems established by several colleges, such as the MIT system, which is an open-source system that allows anyone to securely produce and distribute official documents and academic transcripts. (Nazaré, Duffy, & Schmidt, 2019).

Blockcerts was created as an open standard for developing, issuing, accessing, and verifying blockchain-based certificates based on the MIT system.

Table 2.1 Review of Related Works

AUTHOR(S)	TITLE OF PAPER	PROBLEM STATEMENT	METHOD USED	CONTRIBUTION	LIMITATIONS
Ayomide Oluwafemi, 2013.	Computerized Transcript Management System A Case Study Of Caritas University	This project research was exclusively conducted in a caritas university located in a highly populated area that attends to too many students at a time, hence this research was able to track problem such as misplacement of student records, student's grades, slow and strenuous accessibility to students report	A survey of the Transcript Management system for Caritas University i.e. inputting data into the system.	A computer aided information management makes it more convenient, efficient and produces an accurate information management generally in all schools.	This research work is limited to providing a more reliable information management system that will handle electronically the record of both student and staff within the university.

		and record, inaccurate record keeping and poor information management within the schools.			
Udhaya Nila, Abalin Luther, Aathi Vignesh, 2019	Blockchain in fake product Identification system using QRCODE	The growth in medical industry is immense but also it has been developed in production of counterfeit drugs.	The Fake product identification system is developed using python and My SQL. provides awareness of counterfeit	The Problem Identified Existing Is System Is The Growth In Medical Industry Is Immense product	It is not Implemented on an android application

			drugs to the user		
JO Okoye, 2018	Computerized Transcript Management System A Case Study Of Godfrey Okoye University	Misplacement of student records, student's grades, slow and strenuous accessibility to students report and record.	With respect to the input of data, it has to undergo certain degree of data processing before it could give the required output with this at hand we can conclude that all input in this system needs to be processed.	All schools can benefit from more convenient, effective, and accurate information management thanks to technological assistance.	The focus of this study can be broadened to include other domestic airlines that still demand that customers pick their seats and pick up their boarding tickets at the airport.
Friðrik Þ. Hjálmarsson, 2022	Blockchain-Based E-Voting System	The Manual Voting system in problematic as Voter enters registration	Utilizes decentralized apps (dApps) for the user	In this paper work, they introduced a blockchain-based electronic voting system that utilizes	

		station and completes required forms relating to name, address, and other contact and identification information as deemed necessary. This data is used to create a Parent Record in a RegisteredVoter Data Base	interface of the system.	smart contracts to enable secure and cost-efficient election while guaranteeing voters privacy.	

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The systems development strategy is explained in this part, along with the development phases the project underwent. A reuse-oriented software development process paradigm was used to create the system. A system prototype was made to discover flaws in a centralized transcript system in order to identify requirements. Using these faults, a new requirement specification was established, and the requirements were then validated using the test cases provided for the new system model.

3.2 System Development Process

The requirement in this system is the statement in domain-specific terms which specifies the verifiable constraint on the implementation that it should meet. Some of the needs came from creating a prototype system that makes use of a centralized database; after making changes to the system's shortcomings, a new system was created using the requirements acquired. The system would go through the following development phases:

3.2.1 Requirements Gathering

The requirements are divided into two categories; Hardware requirements and Software requirements.

a) **Software Requirements**

Are regarded as the information or things necessary for the project's complete operation, in this case, the transcript website. These specifications include the following: institution, student, or matriculation number, email, password, and web browser.

b) **Hardware Requirements**

Are the hardware requirements necessary for the project to function successfully. An internet-capable device with good performance, whether it be a PC or a mobile device, is a prerequisite.

c) **User Requirements**

The services that the BBates system offers to system users and the limitations under which it functions are stated in the project's user requirement. The BBates system's user requirements are as follows:

i. Users should be able to request transcripts from BBates on various instances.

ii. Only authenticated and authorized users should be able to request transcripts on BBates.

What the system must provide for its users is outlined in the above requirements. Users should be able to request their desired institute from the prerequisites given above.

d) **Functional Requirements**

The functional requirements for this system outline the services the system provides, how it reacts to various inputs, and how it functions under various conditions. For the system's intended use, the following specs were written down:

i. A new user must register before they can access the transcript as a registered user can.

ii. A new user must fill out a form with fields for his or her name, address, phone number, gender, email, age, user id, and password.

iii. The system will request user confirmation after receiving all the information.

iv. The user must supply the requested information in order to cancel the request.

e) **Non-functional requirements**

The following non-functional requirements were addressed in the application's development.

i. The system's performance is influenced by both the hardware itself and the internet's bandwidth.

ii. The confidential Information is only visible to only one authorized person. The administrator is the only one with access to the user's information.

3.3 System Architecture

3.3.1 Use Case diagram

Users of this system and the various actions they can do on the system are shown in the use case diagram figure 3.1 mentioned below. It also discusses their diverse responsibilities and the prerequisites for each actor to carry out certain tasks and for those tasks to be deemed successful.

3.3.2 Sequence diagram

In the area of software engineering, a sequence diagram, also known as a system sequence diagram (SSD), illustrates process interactions grouped in list form. It illustrates the processes involved and the order in which messages must be exchanged for the processes to provide the functionality.

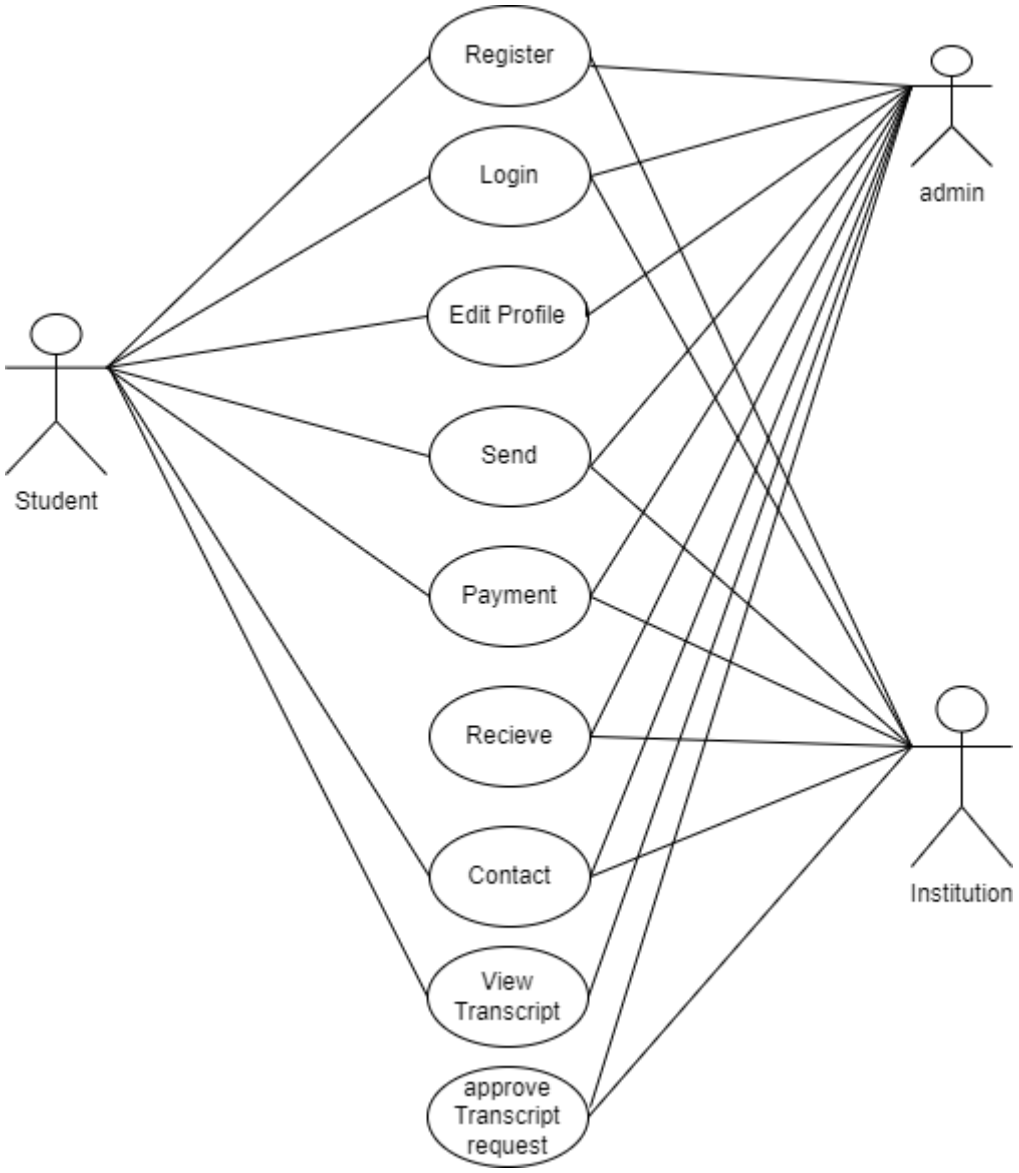

Figure 3-1 *Use case diagram showing how user interacts with the system*

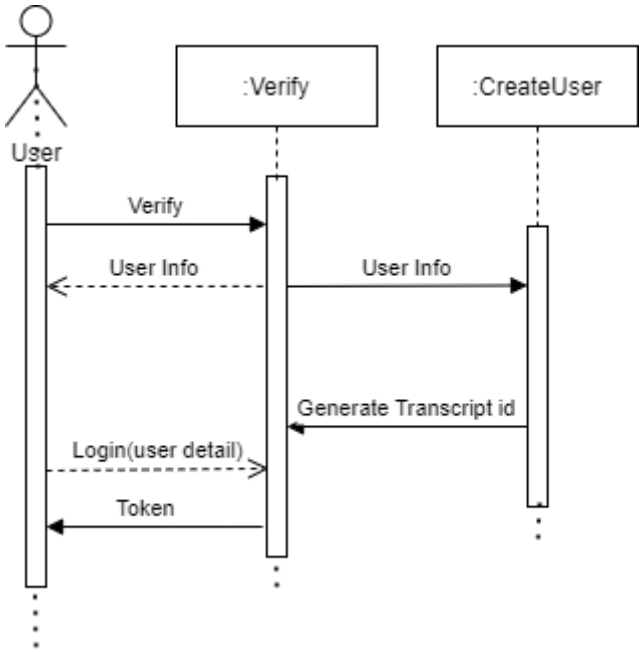

Figure 3-2 Seqence diagram showing login/registration process

3.4 System Implementation

i. The moment the developer receives the design document, implementation and coding begin. The source code is converted from the software design. In this phase, every software component is put into use

ii. A small project might only require one developer to write it, whereas a large project might require multiple teams to work on it.

iii. This project's coding consists of two parts: the front end and the back end.

3.4.1 Front-end Implementation

The creation of a website's graphical user interface using HTML, CSS, and JavaScript is known as front-end web development. This allows users to view and interact with the website.

3.4.1.1 Tools used for front-end development

WordPress, HTML, CSS, and JavaScript are just a few of the platforms and technologies that can be used to build a website's front end (Codesido, 2019).

a. Hypertext Markup Language

Hypertext Markup Language (HTML), without which a web page would not exist, is the basis of any website building process. Writing with links, also referred to as hyperlinks, is referred to as hypertext. When a user clicks on a word or phrase containing a hyperlink, they are transferred to another online page. Text can be represented as pictures, tables, links, and other things by using a markup language. The overall structure of the website is provided by the HTML code. The HTML code used in this project is given in Appendix 1

b. Cascading Style Sheets (CSS)

With the use of CSS, which controls how the site is displayed, you may give it a uniquely personalized look. It achieves this by storing style sheets that, when activated, sit on top of current style rules and are triggered by inputs like the screen size and resolution of the device. Externally, internally, or as an HTML tag embedding, CSS can be added. (Abed, 2019).

c. JavaScript

JavaScript, an event-based imperative programming language (as opposed to HTML's declarative language model), transforms a static HTML page into a dynamic interface. JavaScript code can make use of the Document Object Model (DOM), which is made available by the HTML standard, to alter a web page in response to various events like user input.

Although web development frameworks require JavaScript, we used both the Jquery library and the bootstrap JavaScript library for this project.

3.4.2 Backend Implementation

The backend Development is the server-side of development, where the functionality of the website is the main focus. Monitoring the website's functionality and making changes and modifications will be the key responsibility. In this type of web development, three elements are frequently present: a database, a server, and an application (Stewart, 2021).

One of the most dependable server-side programming languages right now is PHP. Developers still regularly use it nowadays despite the fact that it was first launched in 1995, particularly when creating online applications. Because this system is connected to a blockchain, it also employs Solidity to build the smart contract on the back end of this project. The Blockchain Solidity development environment screenshots and the solidity code for the smart contracts are provided below.

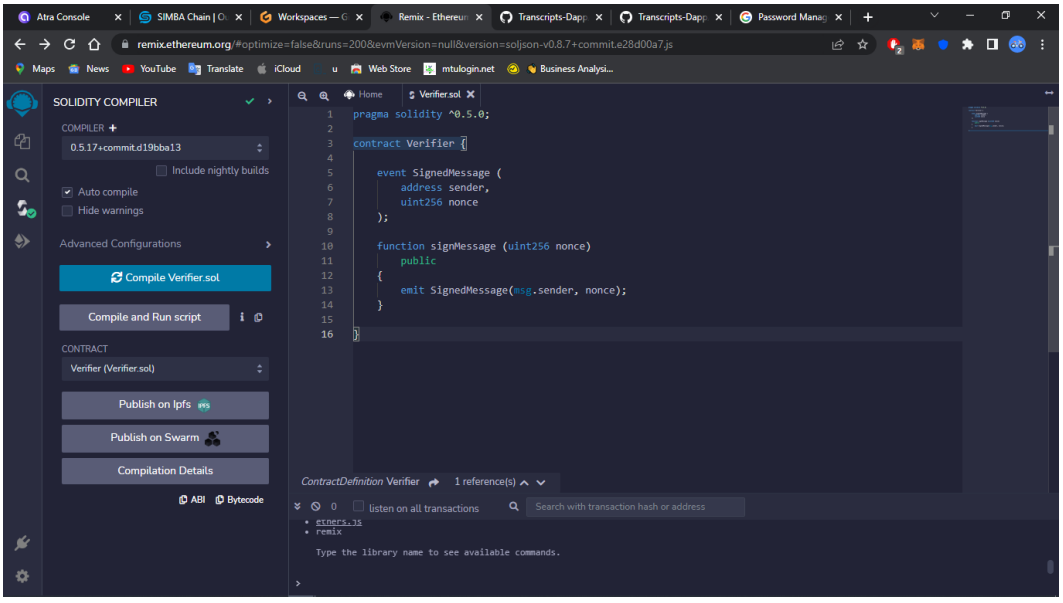

Figure 3-4-1 Remix IDE

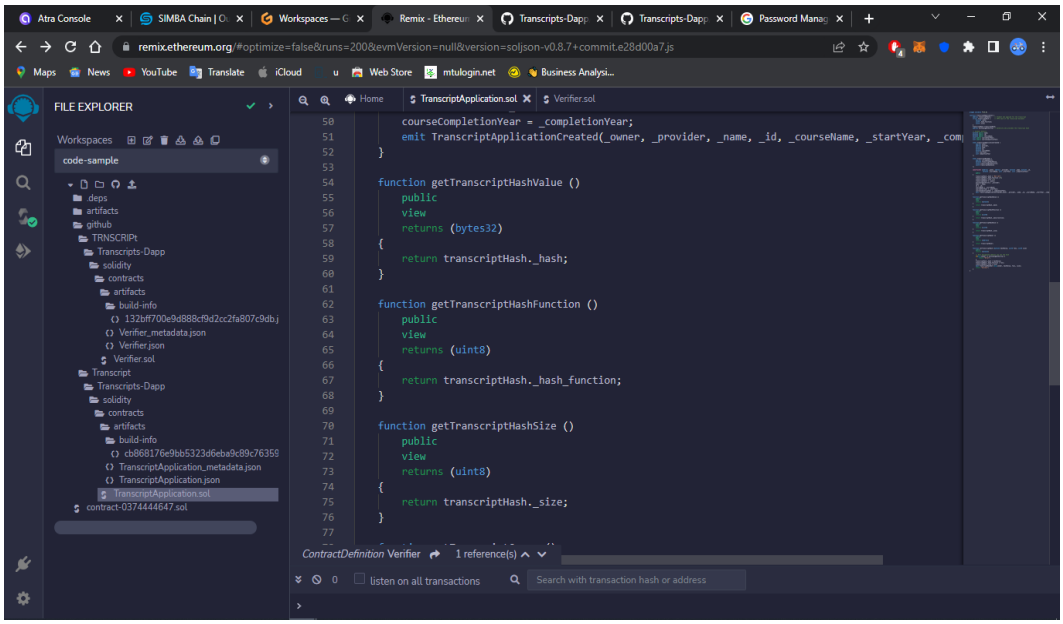

Figure 3-4-2 Solidity code

3.5 System Testing

As soon as the modules are ready for testing and the code is complete. During this phase, the program is thoroughly assessed, and any defects are given to developers to be fixed. Up till the program satisfies customer expectations, retesting and regression testing are conducted. To get rid of any processing hangs or lags, performance testing on the program's various components should be done. The testing phase helps to reduce the number of errors and glitches users encounter. This leads to improved utilization rates and higher user satisfaction.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Software and Hardware Requirements

In other to run this application, computer systems would need the following applications and software installed on their system.

Operating system	Windows 10, Linux distros, Mac OS
Web browser	Mozilla-Firefox, Google Chrome(recommended), Google-Chrome, Safari
Extension	Metamask

4.2 User Module Design

4.2.1 Registration/Login

To be able to access the page, or a first-time visitor, you must register by clicking on the sign up link on the website

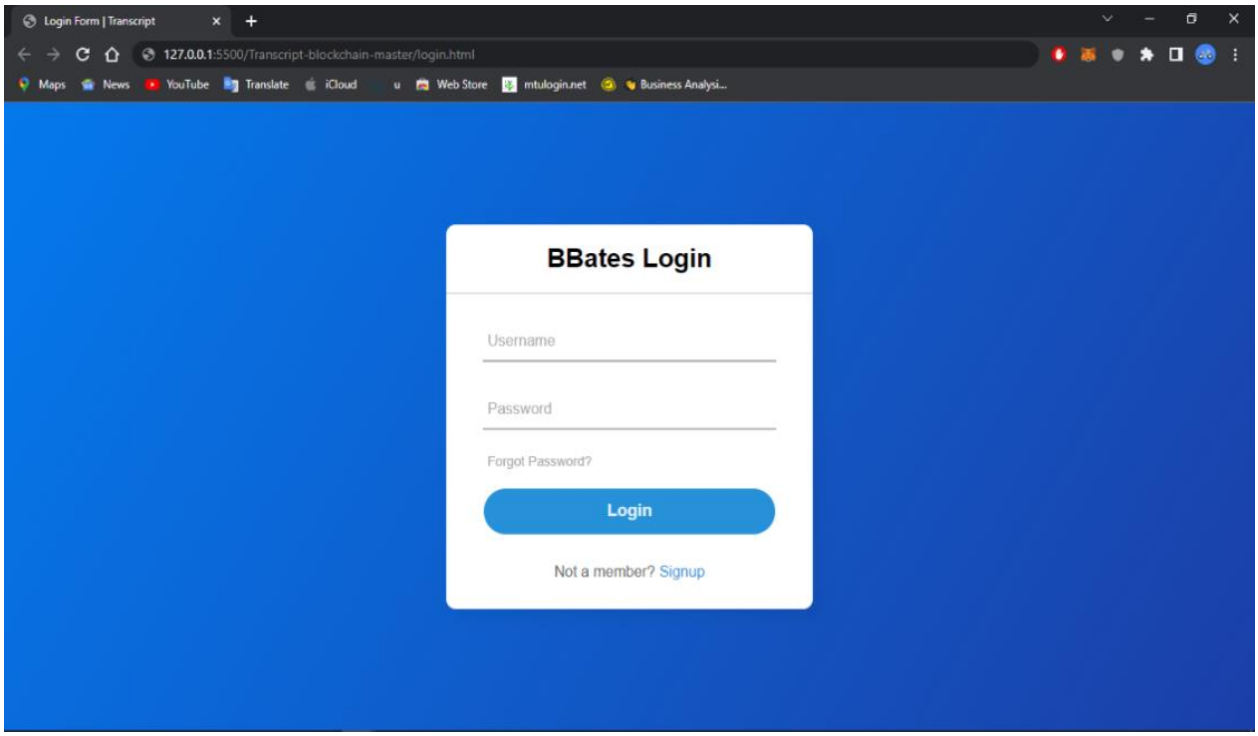

Figure 4-1: Login Page

On this page, if the users already has an account on the system, they would be required to login with their password. A link to activate your account will be given to the registered email address you supplied after registration is successful.

4.2.2 Home Page

After the user successfully logs in the site then he can access the the front page

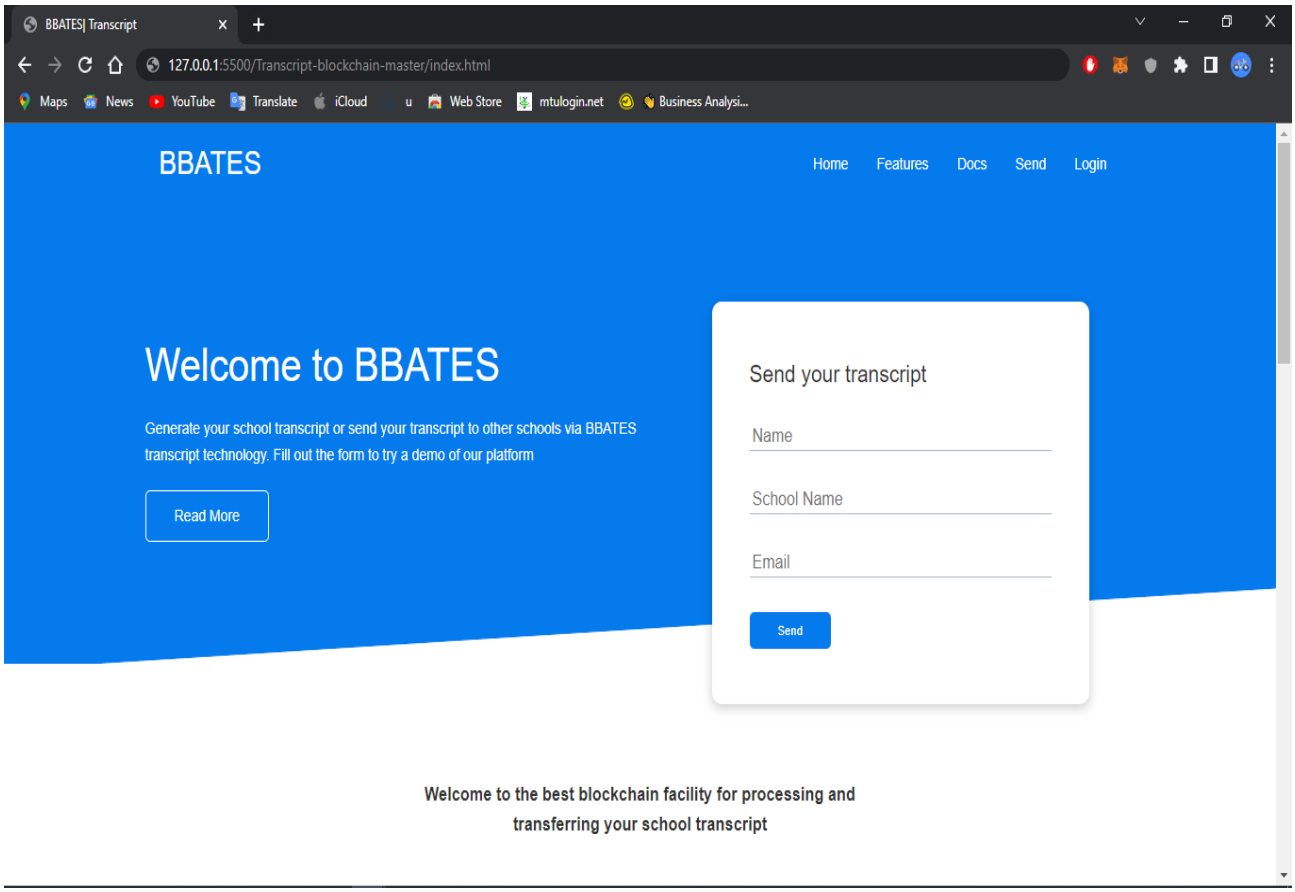

Fig 4-2: Homepage

4.2.3 Upload Page

After the user visits the main page of the Transcript System website, he can begin to peruse the links available on the front page of the application. The main goal of this page is to allow the user upload the transcript he/she wants to send to the other institution after filling up the required information.

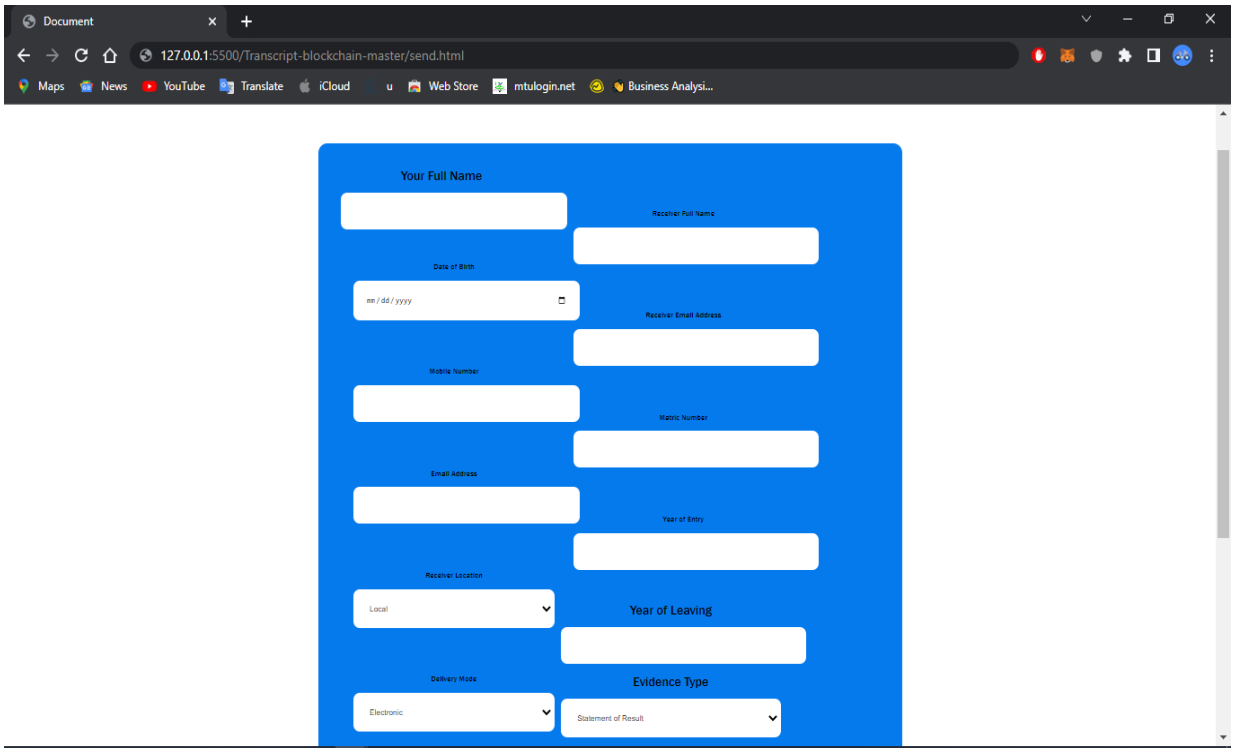

Figure 4-3: Upload Page

4.2.4 Submit Button

After the user is done with the upload then he or she can submit with the send button, once submitted, our systems will automatically submit your payment and request details to your school for processing.

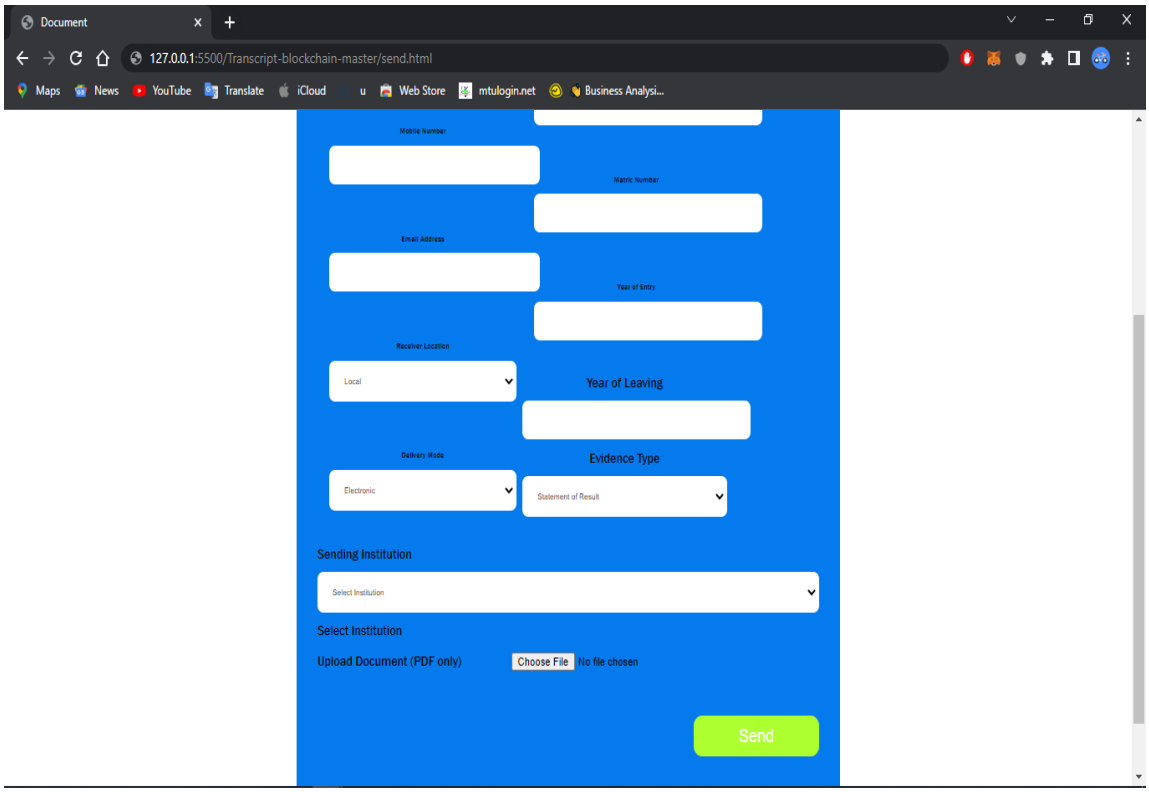

Figure 4-4: Submit Button

4.3 Adminstrator Module

4.3.1 Admin Dashboard

The Admin dashboard is a section For the Admin User which allows the Admin to view all the Users that have registered with the system. The admin can view all sent and requested transcript including delete a user and update information.

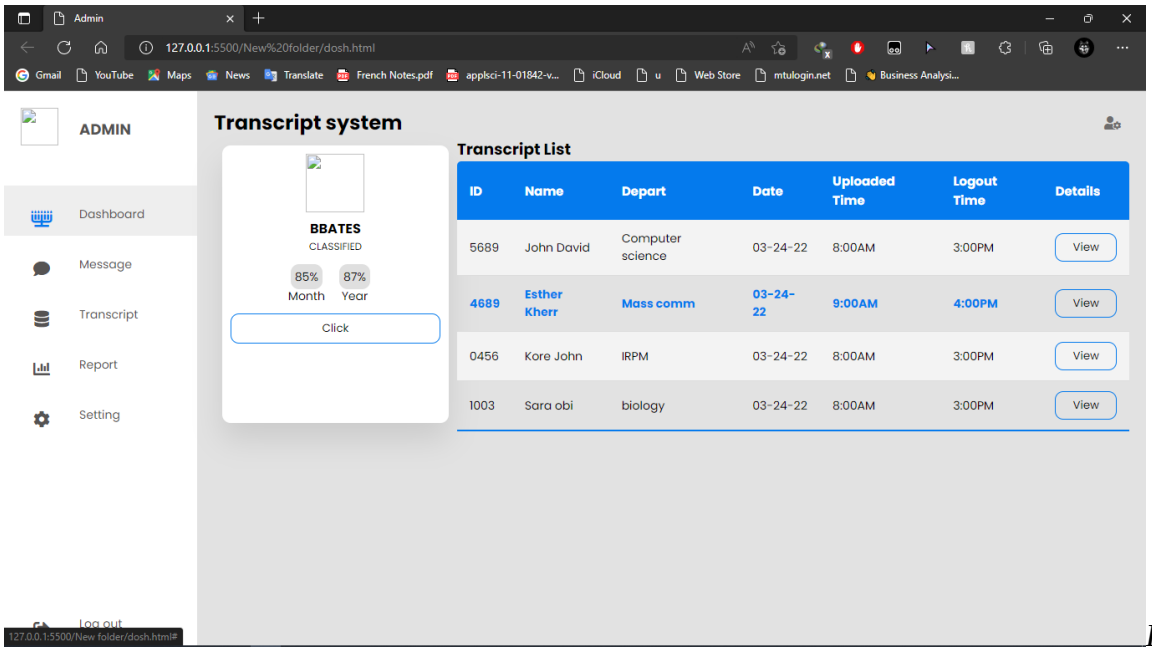

Figure 4-5 Admin Dashboard

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The main goal of this system is to improve transcript quality; adding blockchain to the existing transcript systems is primarily meant to increase user trust in the platform and aid in application security.

5.2 Limitation

As this project was being developed, certain restrictions were encountered. One of these limitations was unable to view a transcript or acquire information about a transcript system functionality. Unstable blockchain networks Despite recent developments in distributed ledger technology, no reliable network has yet to be established.

5.3 Conclusion

In conclusion, this system also demonstrates how blockchain may be used in various areas of daily life and how it can be integrated into the academic world. The system itself has some limitations on its' implementation, the system uses a manual way of registering users for particular instances.

5.4 Recommendation

Based on my project-related experience, I would advise more study into blockchain. In order to achieve the project's intended goal, I advise that the system be adopted by numerous organizations, both public and private, as well as the government, as a decentralized software for both national and international transcript system after the system has been properly constructed and tested in order to realize the project's stated aim.

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