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Research Article

Application of Blockchain Technologies for Use of Cryptocurrency in Fees Payment Portal

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Abstract: Blockchain technology, which is known for being safe and decentralized, has attracted a lot of interest from a variety of sectors. The creative use of blockchain technology to integrate cryptocurrencies into fee payment websites for educational institutions is examined in this research study. This study intends to evaluate the viability, advantages, and difficulties linked to incorporating cryptocurrency as a means of payment for academic fees by utilizing the transparency, permanence, and effectiveness of blockchain technology. at order to pinpoint problems and opportunities for development, the research technique entails a thorough examination of the state of fee payment procedures at educational institutions. The design and development of a powered by blockchain fee payment gateway will next be the subject of the study, with an emphasis on the incorporation of cryptocurrencies like Bitcoin, Ethereum, and other pertinent tokens. This work gives a safe entry point with continuous transaction flow. Bitcoin is used to make the payment, which is then sent to the admin's wallet. Blockchain technology is utilized to store student data and course enrollment information, ensuring privacy and security. The information is kept in blocks that are unchangeable and make it simple to identify the person who changed the information. This work is being created with the intention of using cryptocurrencies as a payment mechanism in the future.

Keywords: Blockchain, Cryptocurrency, Fees Payment Portal

INTRODUCTION

The financial environment is not an exception to the revolutionary changes brought about by the widespread adoption of blockchain technology in recent years. As decentralized digital assets, cryptocurrencies have become well-known as a cutting-edge type of money that facilitates financial transactions with efficiency, security, and transparency. The field of fee payment portals, especially in educational institutions, is one interesting area where blockchain technology is being applied with remarkable success.

Conventional fee payment systems sometimes face difficulties including inefficiency, security issues, and delays. For companies trying to streamline and modernize their financial operations, processing bitcoin payments through

blockchain technology seems like a good solution. This study explores the possible advantages, difficulties, and ramifications for consumers and educational institutions as it dives into the usage of blockchain technologies to enable digital currency transactions within fees payment portals.
Blockchain is a decentralized ledger technology that powers cryptocurrency, which is best represented by the original Bitcoin and several altcoins Balakrishnan *et al.* [1]. Over a network of computers, the blockchain is an immutable, distributed ledger that keeps track of and validates transactions. Blockchain's decentralized architecture improves the privacy of financial transactions, guarantees transparency, and does away with the need for middlemen. Learning institutions are increasingly thinking about integrating blockchain technology to enable the smooth usage of cryptocurrencies on fee payments, taking advantage of these built-in benefits.

There are several different driving forces underlying this paradigm change. First off, transactions based on blockchain technology provide almost immediate processing times, eliminating the hold-ups caused by conventional payment systems. When it comes to paying academic fees, this quickness is especially important because pupils as well as schools frequently place a high value on punctuality. Second, a strong defense versus fraud and illegal access is offered by the security mechanisms built into blockchain technology Lundqvist *et al.* [2]. This takes care of the worries about how vulnerable sensitive financial data is in traditional payment methods. International students particularly benefit from the usage of cryptocurrencies for fee payment websites because they enable cross-border transactions. Students studying abroad face obstacles since traditional banking systems frequently charge exorbitant fees and take a long time to process cross-border payments. Payments with cryptocurrencies, made possible by blockchain technology, provide a more economical and effective option that promotes financial inclusion. Notwithstanding the possible benefits, there are drawbacks to using blockchain technology in fee payment websites for cryptocurrency payments Lu *et al.* [3]. Notable obstacles that must be overcome for widespread use include price volatility, regulatory uncertainty, and the requirement for user education. To clarify the implications and things to consider when educational institutions are negotiating this innovative financial environment, this research aims to thoroughly examine the subtleties of implementing blockchain innovations in relation to digital currency transactions for academic fees.

Literature Review

Using Blockchain to Process Online Payments: Cryptocurrencies are virtual currencies that are used in e-commerce and banking, among other applications. It is distributed among peers via a decentralized public ledger known as Blockchain. Specialized internet markets allow you to swap cryptocurrencies for fiat money. They have a fluctuating pace of trade with the major worldwide monetary standards, including the US dollar, the English pound, and the euro. There is very little of them left [4]. The Blockchain, which is an expert record for digital forms of money, monitors all exchanges and movement including those monetary standards along with proprietor subtleties. Miners oversee each node of the software network that powers cryptocurrencies. Each node stores identical copies of the Blockchain. By performing cryptographic tasks, the excavators recover exchange records, affirm their credibility, and make new blocks. The blocks are irreversible and are affixed to the previous blocks in the Blockchain. A confidential key is expected by every digital currency proprietor to trade their units and check their personality [5]. A disseminated record comprised of each cryptographic money exchange that has been finished inside an organization is known as a blockchain. It goes about as the organization's only wellspring of truth. A blockchain is comprised of a progression of blocks, or information bundles. A few exchanges make up a block. The beginning block is the name of the underlying block. There are a few hubs in a blockchain framework, and everyone has its own duplicate of the data set. The nodes speak with each other to get a consensus on adding a blockchain. Consensus building is the process of reaching this understanding. A chain is added and becomes part of the distributed database name when it is entered into the ledger across all nodes. A transaction record is irreversibly recorded to the Blockchain and cannot be deleted. This characteristic is known as immutability. In a blockchain, there are two models that govern the ability to conduct transactions: permissioned and permission-less. To conduct transactions in a permissioned blockchain, users must have been enrolled in the blockchain. As a result, there is more systemic trust. The Blockchain architecture eliminates intermediaries, which promotes data security.

Main Security Problems with Blockchain Technology for Online Payments

Vyas and Lunagaria [6] and "Distributed Ledger Technology in Payment, Clearing and Settlement" (2017) both mention the possibility of security problems while using Blockchain for online payments. These risks include:

- **Resilience and reliability:** To ensure dependability and uninterrupted operation, multiple nodes are offered. On the other hand, this might potentially provide bad actors more opportunities to get access, jeopardizing the ledger's security and integrity

- As technology develops further, the instruments used in cryptography today may become antiquated and useless. Intrusions and security risks may arise from the integration of decentralized ledgers into the current infrastructure
- When a bitcoin miner or group of miners acquires computing power larger than 50% and has the capability to reverse transactions, it is known as a ">50%" attack
- Spending double happens when a hacker conducts multiple transactions using a single coin
- Selfish mining, in whicha user group's earningsexceedstheirmining capacity
- Blockchain payment solutions include security risks and issues just like any other payment mechanism. The following is an overview of the security issues [7]
- **Wallet Software Hacking Attempts:** Users of cryptocurrencies utilize wallets to manage the currency they possess. For this reason, they need to have an offline backup and be encrypted. Attacks known as distributed denial of service (DDoS) might potentially affect online wallets
- **Time Jacking Attacks:** In these attacks, a hacker changes a node's network time counter, tricking the node into accepting a false blockchain. The outcome is double-spending and wasted computing resources
- **">50%" Attack:** One of the largest threats to a Blockchain network is when an individual or group of individuals seizes control of more than 50% of the processing power utilized for mining. They achieve this by finding the "nonce" value of a block. Subsequently, they can halt the mining of valid blocks and execute, modify, and reverse transactions

Two transactions with identical input will not be accepted by peers on the blockchain. The fraud transactions will be confirmed, and the initial transaction won't be confirmed because they will only validate the first one that reaches them, Kim [8].

- **Selfish mining:** It enables a big enough pool to make more money than it can through mining. Sincere miners will have to make unnecessary calculations because of the attacking miners. The self-centred miner will split their Blockchain covertly, keep each block private, and profit more
- **Fork Issues:** A fork occurs when there is a disagreement over the version agreement of a decentralized node during software upgrades. This is a significant issue since it touches on many different Blockchain applications. The consensus mechanism in nodes also varies when a new version of the Blockchain software is implemented. Old and new nodes, issues occur when they try to reach a consensus. The consensus or agreement between the new and old nodes is incompatible Adewole *et al.* [9]

MATERIALS AND METHODS

This section contains a discussion of the strategies that were applied to this work. Additionally, this system employs Dapps and smart contracts on blockchain to store student data Balakrishnan *et al.* [1].

Proposed Architecture

Figure 1 depicts the suggested system architecture's work. The students can use this technology to construct a secure payment site using cryptocurrencies. The student data is kept in a public ledger and the payment is incorruptible; authentication is required through an agreement. Students can use this work to pay their educational expenses with any

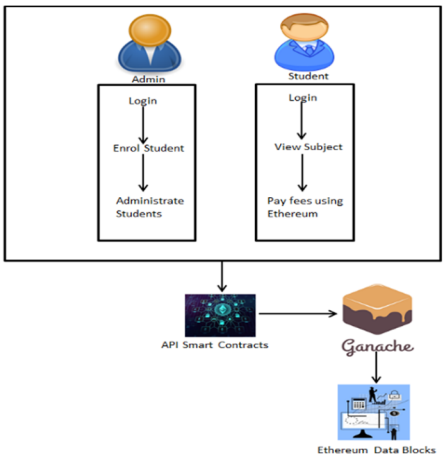

Figure 1: Payment System for Digital Currency Fees

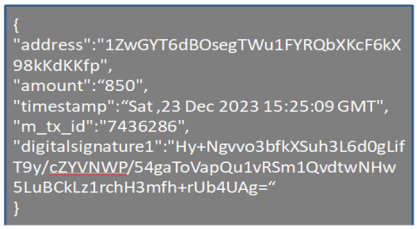

Figure 2: Information from QR Codes in JSON Format

kind of digital currency. In this study, smart contracts are used to maintain and retrieve data on a blockchain. The genesis block with administrator access is delivered, and the admin inputs the student data and generates the blocks. The admin, student, and transaction modules are the three primary parts that comprise the system architecture. Students are enrolled and their personal data is stored in blocks in the admin module, which is the first layer of the architecture. The "student module" sub layer enables students to view their fee information and semester receipts. This layer can only be read. A secure blockchain consensus process is used to make digital payments, and the transaction component is the last layer of the architecture used by the system to achieve the main objective of the project. The admin, student, and transaction modules are the three primary parts that comprise the system architecture. The administration module, the student module, and the transaction module make up the three tiers of the architecture.

Blockchain

Blockchain is a dispersed, encrypted ledger that serves as a public repository for unchangeable, incorruptible information. Blockchain is a public ledger that is distributed. Every trade or digital event in the general ledger requires the approval of more than 50% of the network's users to be verified. First-time participants can agree on how a particular transaction or virtual event can happen using the Blockchain without the need for a central authority. The owner's digital signature authenticates every transaction in this ledger and guards against tampering Lundqvist *et al.* [2].

Smart Contract

On a blockchain platform, smart contracts have been programs that only execute when certain criteria are met. They are generally employed to put agreements into action among participants, providing them with instant results and avoiding time wastage or the need for an intermediary. When certain requirements are satisfied, smart contracts employ computerized algorithms that carry on the workflow by expediting the subsequent task [7].

DApps

The part of the application that interacts with the blockchain and manages every user's state on the network is called a DApp. The basic principles of a decentralized application are shown via smart contracts. DApps' user interface is the same as that of any other standard website or application for mobile devices. A decentralized application's back end is designed to support all business logic, while its front end is designed to reflect what consumers would see Sekar *et al.* [10].

Digital Money

An unreadable string representing an ounce of currency is called a cryptocurrency. It serves as a safe record of transactions, including buying, selling, and transferring, and is monitored and controlled by a peer-to-peer network called a blockchain. Cryptocurrencies are not issued by nations or other financial entities, in contrast to fiat money, because they are decentralized Adewole [9].

Gateway for payment with cryptocurrency

A gateway for cryptocurrency payments is a processor for digital currencies, much like how bank credit cards are obtained and payment processors and gateways are utilized. By using cryptocurrency gateways, you may take digital payments and get paid in fiat money right away. Payment gateways are companies that take on the perceived risk of bitcoin payments by using their wallets to process transactions between retailers and their clients.

Empirical Results

Figure 2 displays the QR code's data format, which contains digitalsignature1 information and the value obtained from the online fee portal using their address to digitally sign the message "address=1ZwGYT6dBOsegTWu1FYRQbXKcF6kX98kKdKKfp, amount = 850, timestamp = Fri, 23 Dec 2023

Figure 3: Payment details for Students in JSON format

Table 1: Information in the Digital Signature2 and QR code

Element	Size in bytes	Details
M_Address	36	obtained by use of the QR code scan
Fees	String	obtained by use of the QR code scan
Date and time	30	obtained by use of the QR code scan
M_TX_ID	8	obtained by use of the QR code scan
digitalsignature1	90	obtained by use of the QR code scan
digitalsignature2	90	Created using the function signmessage (student's address, digitalsignature1)

15:25:09GMT, m_tx_id=7436286." To facilitate the customer's simple payment, the Institution's online store displays a QR code with the digitalsignature1 parameters as well as M_Address, Amount, Date and time, and M_TX_ID.

To purchase a course or syllabus using the institution's online fee payment gateway, the student fills out the enrolment form. The student hits the "QR Code Scan" option to read the QR code on the online fee payment portal screen. The QR code will be scanned and analyzed to obtain the values of M_address, Value, Date and time, M_TX_ID, and digitalsignature1. Additionally, the program creates digitalsignature2 by using the student's private key and digitalsignature1 in the sign message () method when the student clicks the "Payment" button, as seen in Table1. Subsequently, the blockchain system receives the parameters from the student application, which include M_Address, Value, Date and time, M_TX_ID, digitalsignature1 and digitalsignature2. The data structure of the payment details that the consumer sends to the blockchain platform is displayed in Figure 3 Table 1.

CONCLUSION

The student fees payment portal made possible by this work gives a safe entry point with continuous transaction flow. Bitcoin is used to make the payment, which is then sent to the admin's wallet. Blockchain technology is utilized to store student data and course enrolment information, ensuring privacy and security. The information is kept in blocks that are unchangeable and make it simple to identify the person who changed the information. This work is being created with the intention of using cryptocurrencies as a payment mechanism in the future. Blockchain technology is now an emerging payment method. This leads to the more effective method of storing, retrieving, and changing data in smart contract storage. An array of technological, legislative, and user-related factors is expected to impact the outcomes of utilizing blockchain-based technologies enabling digital currency transactions in fees payment portals. Policymakers, stakeholders, and educational institutions attempting to negotiate the changing terrain of financial transactions having the education sector will find great value in a thorough examination.

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