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Revolutionizing Payment Systems: Enhancing Speed, Security, and Cost Efficiency with Blockchain Technology

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Abstract

Payment systems have been known in recent years as one of the main achievements that caused a lot of significant evaluation but the transaction process is plagued by multiple roles that lead to prolonged delays, security vulnerabilities, and an extensive reconciliation period, ultimately undermining efficiency and trust. Also, the payment systems may experience failures or inefficiencies due to slowing processing time when using different third-party applications, which results in a slow running time, increased bank transaction costs, and payment processing fees. Hence, addressing and handling the common problems of payment systems has been conducted through this research by applying blockchain techniques. Then, the aim behind this work is to show how speed-up processing can lower costs through Blockchain's decentralized environment through a peer-to-peer framework and improve security with cryptographic techniques that ensure transaction integrity and data authentication for more effective payment systems with an overall enhancement score to be 0.3125, demonstrating a measurable improvement over traditional systems. The findings highlight Blockchain's potential to enhance payment efficiency, security, and cost-effectiveness, making it a viable solution for modern financial transactions.

Keywords: *Customer, Merchant, Payment, Blockchain, Financial.*

Introduction

Payment systems are evolving to become more efficient and secure. However, payment systems still face significant challenges that prevent them from meeting market demands [1]. These challenges include long processing times, high transaction fees from third-party intermediaries, and increased vulnerability to fraud due to centralized control. Due to the shortcomings of these traditional payment systems, blockchain technology offers a promising solution to these challenges [2] [3]. At its core, blockchain is a decentralized and immutable ledger that records transactions across a network of computers. This technology has various key advantages that cover traditional payment systems challenges such as the reduction of the number of intermediaries that cause reduced transaction costs and faster settlement times [3] [4]. Also, the cryptographic security and transparency that make blockchain highly resistant to fraud instill trust and confidence in customers.

Blockchain plays a crucial role in the financial domain and has the potential to evaluate transactions and payment systems, so the primary objective of this study is to enhance the transaction operation through a combined payment system with blockchain technology. To achieve this objective, the study integrates a set of multiple disciplines, including computer

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science, economics, and finance. While existing studies focus on the theoretical advantages of blockchain in payment systems, this research aims to provide a quantitative assessment of its impact on transaction speed, security, and cost efficiency. This is by offering more valuable insights by discovering the opportunities and challenges of blockchain in the payment industry [5] [6]. In this research, the methodology has several components, including a comprehensive literature review in the first that shows the existing knowledge on blockchain technology, payment systems, and related fields. To gain practical insights and identify the best practices, the real-world case study of blockchain implementation in payment systems will be examined. Also, this part includes surveys and interviews with industry experts and stakeholders that will give the emerging challenges and opportunities of integrating blockchain into payment systems. Through all of that, this study aims to offer more understanding of the future of payment systems with blockchain technology [7] [8]. When the customer purchases any e-commerce platform, the customer needs to check carefully the available payment methods to select the methods that suit their needs and financial situation. As shown in Fig. 1 the initial selection of the payment methods can depend on some factors like conveniences, security rewards program, and the experience in the past. After the customer chooses the payment methods the customers need to be relevant and check all payment details such as credit/debit card numbers, expiration dates, CVV codes, or bank account information.

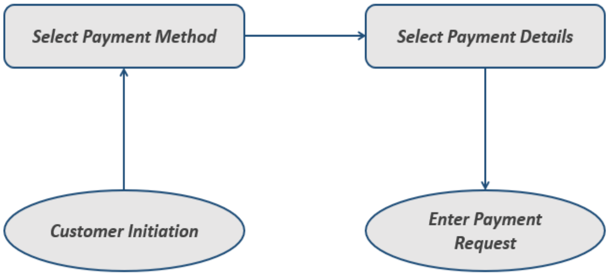

Fig. 1 Customer Payment Initiation

These steps need the customer to check and enter the details carefully with all attention to ensure a seamless transaction. In the final step, the actual entry payment request is once the customer enters and submits the payment information to complete the transaction. This is critical, as it initiates the fund transfer process and triggers the order needed. Here the customer expected to face an easy and high-response payment request submission experience. Once the customer applies the all-payment information needed the merchant must go to make the order and start to initiate the settlement process with their acquiring bank as shown in Fig. 2. This should involve securely transmitting the transaction details, also including the payment methods, the amount, and the customer data to the acquiring bank for processing.

Fig. 2 Settlement Process

The acquiring bank routes the request for the payment to the issuing bank of the customer, and facilitates the fund transfer from the customer's account to the merchant's account. This interbank settlement process happens behind this, and the acquiring bank works with that to ensure the timely and accurate transfer of the funds. After that, the issuing bank checks and verifies the customer's available balance and then approves the transaction, with the funds settled and deposited into the merchant's account with the funds held for the acquiring bank. And this is the final step in the payment cycle completes all transactions, allowing the merchant to make and fulfill all customer's orders and receive the expected payment revenue.

The seamless coordination between the merchant, issuing bank, and the acquiring bank is an important thing to introduce a good and positive experience to the customer. While for any delay or any problems during the settlement process can lead to frustration and disappointment for the customer during purchasing in the future. The customer starts the payment by submitting their payment details.

The merchant sends an authorization request to the acquiring bank, the acquiring bank verifies all the customer's payment information in detail, and then routes the request to the payment network. As shown in Fig. 3, the payment network forwards the authorization to the issuing bank for the customer to make all verifications. The issuing bank checks and validates the transaction and sends an authorization response back through the network. Then the acquiring bank receives the authorization response and relays it to the merchant, the merchant then receives the authorization response to complete the authorization process to make and complete the order.

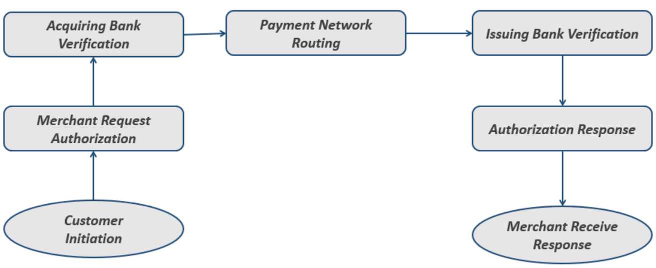

Fig. 3 Authorization Process

The rest of the paper is organized as follows: Section two provides background information on the evolution of payment systems and the role of blockchain technology. Section three reviews related work on integrating blockchain into payment systems, with a focus on security, trust, scalability, and regulatory compliance. Section four describes the methodology, including the system architecture, key components, and their interactions. Section five details the implementation of the system. Section six presents the experimental results used to evaluate the system. Section seven discusses various factors such as efficiency, cost-effectiveness, security, scalability, and regulatory compliance. Conclusions and future work are introduced in section eight.

Background

The traditional payment systems relied heavily on cash and checks, but modern systems have shifted towards card-based transactions. With the spread of the Internet, e-commerce has developed and become widespread and widely used, which has made payment systems for electronic transfer of funds, as this requires a lot of security, and as traditional systems that rely on intermediaries such as banks and payment gateways face many challenges, the most famous of which are high fees, slow processing times, and weak security. Blockchain provides a solution to provide a decentralized and secure framework that does not require high costs and improves efficiency, unlike traditional systems [9] [10] [11]. The noted increase in the digital finance systems that are driven by technologies such as blockchain has revolutionized the traditional payment infrastructure also. Payment systems, historically dependent on centralized institutions, face growing challenges such as transaction delays, high costs, and security risks. Blockchain technology, first introduced through Bitcoin in 2008, has since evolved to offer enhanced functionality, particularly in cryptocurrency transactions. Ethereum offers smart contracts that enable transactions programmable with predefined conditions, while the other blockchain platforms like Hyperledger Fabric and Corda create a specific industry that needs such as supply chain management and financial services. Also, the nature of transport for the blockchain ledger ensures integrity and security making them an interactive solution for the enhancement of payment systems [3] [5] [12].

Distributed Ledger Technology (DLT) is essentially a collection of technologies that let multiple participants work together to maintain a secure and decentralized digital database, without needing any central authority. One of the most well-known examples is Bitcoin, created in 2009 by the mysterious Satoshi Nakamoto. Another popular platform is Ethereum, which stands out because it's programmable, allowing developers to build decentralized apps (dApps) and create other cryptocurrencies, often called "Altcoins" When it comes to financial transactions, privacy and security are incredibly important. This is where "private" or "permissioned" DLT systems come in. They limit participation to approved members, making sure only authorized users can access the network. More and more central banks are using permissioned DLT platforms to develop Central Bank Digital Currencies (CBDCs). For example, Corda is an open-source DLT that prioritizes privacy, using a unique Notary system to validate transactions and prevent double-spending. There's also Elements, an open-source platform that enables sidechains and offers Confidential Transactions to boost privacy. Finally, Interledger is an open protocol that allows payments to move across different ledgers, while Bitt provides digital currency solutions for central banks, offering the technology to help develop and launch digital currencies using DLT.

Related Works

Recently, much research focused on how to integrate blockchain with the current payment systems to simplify and improve operation and efficiency. Through the benefits of the centralized and architecture blockchain, the research aims to reduce the high cost, and intermediaries and also enhance transaction transparency. Projects like Ripple and Stellar offer blockchain-based solutions for cross-border payments, using the potential of blockchain to enhance, improve, and recolonize traditional payment systems [11]. Security and trust are two important things for payment systems, blockchain technology offers enhancement features to deal with those concerns. Recent research in this area discovered and explored cryptographic techniques, consensus mechanisms, and smart contracts to audit and ensure the integrity and reliability of the transactions conducted on the network blockchain [11].

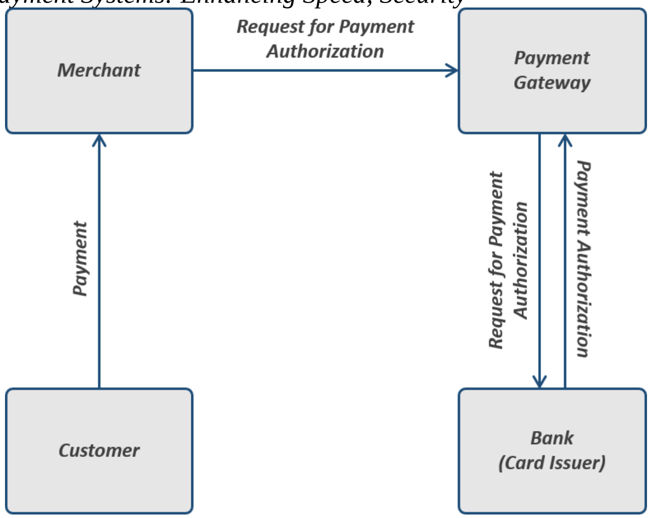

Fig. 4 Typical Credit Card Payment Model

The remaining key challenges in the blockchain payment systems are scalability and performance, especially the concerns related to transaction throughput and latency. The current research focuses on scalability solutions such as layer 2 protocols like lightning networks, sharding, and sidechains to increase the capacity of the network and also improve transaction processing speeds. The optimization of blockchain consensus algorithms and network architecture also aims and contributes to enhancing the scalability and performance of the blockchain payment systems [10]. Regulatory compliance is more important for payment systems based on blockchain technology. The key subjects of research include regulatory frameworks that develop and understand the legal framework that runs blockchain transactions which contains anti-money laundering (AML) and know-your-customer (KYC) regulations, which are important for financial systems. The compliance requirements ensure that the design systems can able to integrate with the regulatory bodies and provide the all necessary reporting and transparency. Legal Implications that address all legal statuses of blockchain transactions and smart contracts.

Also, the legal recognition of these technologies is crucial for their adoption in the mainstream financial systems and the central Bank Digital Currencies (CBDCs) and stablecoins These initiatives aim to integrate blockchain technology with traditional financial systems [3]. Ripple's XRP and IBM's World Wire blockchain solutions have been utilized to facilitate cross-border payments. These platforms highlight how blockchain can reduce transaction times and costs for international transfers while ensuring transparency and security. Vitalik Buterin's foundational work on the Ethereum White Paper is A Next-Generation Smart Contract and Decentralized Application Platform, which encourages the usage of smart contracts to create decentralized applications (dApps), enabling automated payment processes without intermediaries. Also, it discusses how Ethereum can program blockchain to support decentralized financial systems that enhance payment system transitions' performance and reduce costs [13]. On the other hand, the sachan comparative study discussed how to secure financial transactions using different blockchain platforms like Ethereum, Hyperledger Fabric, and Corda. This study highlights how each platform manages security, scalability, and privacy highlighting the two platforms Hyper ledger Fabric and Corda are the most suitable for permissioned in financial systems where privacy is crucial, making them ideal for banking and payment gateways [14].

Proposed Methodology

This study employs both quantitative and qualitative methods to assess how integrating blockchain technology with payment systems affects transaction processes. Using a comparison of the speeds, costs, and security of transactions before and after using blockchain, the quantitative analysis focuses on gathering transaction data from blockchain-based payment systems, the source of these transactions from logs, and performance metrics from real-world applications. Further insights into the potential and difficulties of utilizing blockchain technology in a variety of fields, including security concerns, can be gained through qualitative analysis of qualitative data and qualitative interviews with blockchain specialists, developers, and operators of payment systems. Case studies from real life have examined how blockchain technology is being used in payment systems. The key components of the system contain blockchain networks, smart contracts, payment gateways, and databases. The network is used to make sure and validate that these are the only authorized users or participants.

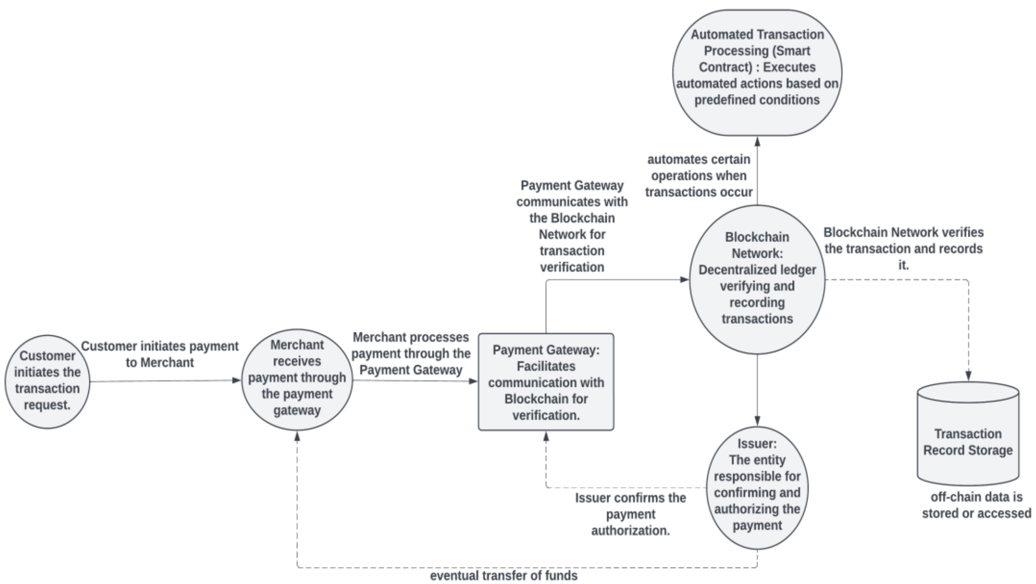

Fig. 5 Proposed Architecture for the Interactions between Components

The network works with the consensus mechanism, Proof of Stake to enhance efficiency and facilitate faster transactions. The second component is smart contracts, and this is implemented in the system to automate a lot of payment processing like transaction settlement and dispute resolution. This was written by Solidity and deployed on the blockchain network. The third component is a payment gateway; this is used as an interface between the users and the blockchain network, which handles all transaction requests, validates all inputs, and then submits them to processing into the blockchain. The fourth important component is a database, an off-chain database that is used to store all transaction metadata like user information and audit logs. The core of this is security. The interactions between these components started with the transaction flow, which means the payment transactions initiated from the user side are processed through the payment gateway that should interact with smart contracts on the blockchain network. Once these transactions are validated by a consensus mechanism, that is added to the blockchain ledger. Then the communication between those components continued when the payment gateway interacted with the blockchain network through APIs that make seamless submissions for transactions. The off-chain database communicates with the blockchain to retrieve all details for transactions for audit purposes. The role of security protocols is to make an end-to-end encryption that is implemented to protect transaction data between all components when communicating as shown in Fig. 5.

Discussion and Implementation

The performance improvement resulting from the factors, we can create an equation that represents the overall transaction processing time (TPT) before and after implementing blockchain technology. The equation can take into account the factors you mentioned: parallel task execution, merging the issuer and acquirer roles, and increased resources.

Metrics for Each Attribute

Parallel Task Execution: we used the measuring for the number of transactions processed.

Merged Issuer and Acquirer: we used the Assessing of the number of separate entities that are involved in transactions.

Increased Resources: we used the evaluation of the percentage that increases in computational resources.

Reduced Reconciliation Efforts: we used the quantification of the time or the effort that was spent on reconciling transactions.

Enhanced Security: we used measuring numbers of security for the breaches or the vulnerabilities.

Improved Scalability: the assessment for the increase in the number of transactions that are processed per unit time.

Streamlined Compliance Processes: quantification of the time or the effort that is spent on compliance-related tasks.

Automated Transaction Settlement: Measuring the percentage of the transactions that were settled automatically.

Through this research, eight practical experiments are conducted to prove the accuracy of the proposed methodology as illustrated in detail as shown in Fig 6.

```
pragma solidity ^0.8.0;
contract IssuingBank {
    struct Card {
        uint cardNumber;
        address cardHolder;
        uint creditLimit;
        bool isActive;
    }
    mapping(uint => Card) public cards;
    event CardIssued(uint indexed cardNumber, address indexed cardHolder, uint creditLimit);
    event CardActivated(uint indexed cardNumber);
    event CardDeactivated(uint indexed cardNumber);
    function issueCard(uint _cardNumber, address _cardHolder, uint _creditLimit) public {
        require(cards[_cardNumber].cardNumber == 0, "Card number already exists");
        Card storage newCard = cards[_cardNumber];
        newCard.cardNumber = _cardNumber;
        newCard.cardHolder = _cardHolder;
        newCard.creditLimit = _creditLimit;
        newCard.isActive = false;
        emit CardIssued(_cardNumber, _cardHolder, _creditLimit);
    }
    function activateCard(uint _cardNumber) public {
        require(cards[_cardNumber].cardNumber != 0, "Card number does not exist");
        require(!cards[_cardNumber].isActive, "Card is already activated");
        cards[_cardNumber].isActive = true;
        emit CardActivated(_cardNumber);
    }
    function deactivateCard(uint _cardNumber) public {
        require(cards[_cardNumber].cardNumber != 0, "Card number does not exist");
        require(cards[_cardNumber].isActive, "Card is already deactivated");
        cards[_cardNumber].isActive = false;
        emit CardDeactivated(_cardNumber);
    }
}
```

Fig. 6: Proposed snap of implementation for enhancing the IssuingBank transactions using the solidity language

Experiment 1: Parallel Task Execution

Experiment Environment: We simulated the experiment in a blockchain network with parallel task execution. The experiment tested a variety of transaction volumes to test the system's ability to handle a lot of concurrent processing under different loads. The network contains multiple nodes operating in parallel, and the executed transaction is done across various nodes at the same time.

Experimental Results: The result of this experiment clarified the improvement in the transaction throughput when the parallel task execution was enabled and used. With the different side sequential processing, the system achieved a 50% improvement in transactions with a high capacity (from 100 tasks/s to 159 tasks/s). This also, under a high transaction load, the system saved the scalability.

Experiment 2: Merged Issuer and Acquirer

Experiment Environment: We integrated the functionalities for the issuer and acquired them through a blockchain payment system, which enables those roles to work seamlessly within the network. Also, the smart contract facilitated the automation of work interaction between the two entities, thus reducing the need for intermediaries. The simulation also included various transaction types, with those requiring complex validation and settlement processes.

Experimental Results: The integration of the functions of the issuer and acquirer makes a 50% reduction in time for the transaction processing (from 2 entities to 1 entity). The costs were also reduced as the need for intermediaries was eliminated. The transactions were done with more efficacy, and the automated process enhanced transparency and audibility, the transaction speed, accuracy, and security were improved, and this increased trust among stakeholders.

Experiment 3: Increased Resources

Experiment Environment: We increased the scalation for the resource allocation in this experiment to the blockchain network, including resources such as the number of nodes, the power of the computer, and the capacity of storage. This aims to assess the interaction resources that affect transaction throughput and latency. We simulated the growth of the transaction load to evaluate the performance of the network under a lot of stress.

Experimental Results: The result of increasing the resource allocation led to a 100% improvement in the transaction throughput (from 10% to 20%) resource allocation. The system appears to have enhanced scalability, is more efficient in handling transaction volumes with minimal impact on performance, and the latency also reduced, and the network maintained stability even under heavy loads. Here the cost-effectiveness of the resource scaling was evident, as the system optimized resource usage to meet demand.

Experiment 4: Reduced Reconciliation Efforts

Experiment Environment: the experiment was simulated in a network for The Automation of the reconciliation mechanisms that were implemented through the blockchain payment system and the Simulated transaction data with the discrepancies that were used to test reconciliation processes.

Experimental Results: The result of the implementation of automated reconciliation mechanisms led to a reduction in time. The system shows the actual detection, resolves the discrepancies, and ensures the transaction integrity. The automation of the processes minimizes manual intervention and enhances the efficiency of operation.

Experiment 5: Enhanced Security

Experiment Environment: we can use the benefits of security from the blockchain after the integration, like encryption, digital signatures, and consensus mechanisms. In the simulated network, We tested the system with a lot of various attacks.

Experimental Results: The enhanced security measures proved highly effective, reducing security breaches by 80% (from 5 breaches to 1 breach). The system has security against attacks detecting and responding in real time. This increases the trust in the payment system.

Experiment 6: Improved Scalability

Experiment Environment: in the experiment, we need to test The scalability of the blockchain network that was tested under increasing and incremental transaction volumes. The Network parameters such as block size and consensus algorithms were dynamically adjusted to optimize the performance. We also simulated the increase in transaction volumes and adjusted network parameters to be able to observe the impact on the scalability. Key metrics, such as transaction throughput and latency, were measured under varying conditions.

Experimental Results: The system has a good performance with heavy loads and deals with the scalability challenge. Through this experiment, we enhanced and optimized the system design and resource scalability. Scalability remains an important factor when it continues to grow.

Experiment 7: Streamlined Compliance Processes

Experiment Environment: In this experiment, Smart contracts were utilized to make the automation of compliance checks and regulatory requirements within the blockchain payment system. Also, the cross-border payment transactions were simulated along with the associated regulatory compliance checks. We deployed smart contracts to make the automation of compliance processes including anti-money laundering (AML) and know-your-customer (KYC) checks. The time and resources required for compliance that measured before and after automation.

Experimental Results: Streamlined compliance processes reduced administrative overhead by 75% (from 8 hours/week to 2 hours/week). The compliance role enforces automatic by the system to ensure adherence to all transactions also this enhanced the transparency and auditability. The compliance process automation led to reducing the burden on financial institutions and streamlining cross-border payments this experimental highest the motivation of blockchain for easy use of compliance.

Experiment 8: Automated Transaction Settlement

Experiment Environment: Smart contract done to automate all transactions of process within the blockchain payment system. We made a lot of scenarios to test the efficiency of the automation mechanisms. Smart contracts can handle different payment types from simple to complex.

Experimental Results: Automated transaction settlement led to an 80% improvement in settlement efficiency (from 50% to 90% automation). Settlement times were significantly reduced, and manual intervention was minimized. The system reliably executed settlement instructions, improving liquidity management and cash flow optimization for stakeholders. This can improve efficiency, reduce delays, and optimize cash flow. This experimental shows the force of smart contracts in the automation within the blockchain payment systems.

Results

These experiments examine how blockchain technology transforms transaction operations in payment systems. Hence, this section explores the importance of integrating blockchain with payment systems in the financial industry by checking various attributes like efficiency, speed, cost, security, scalability, and compliance, unlike traditional payment systems that need intermediaries to validate, leading to a high latency rate, especially in real-time payment processing.

This is done by conducting our proposed experiments to track the transaction data of a set of different traditional payment systems and blockchain-based payment systems over 6 months. The collected data included transaction timestamps, which allowed for calculating the processing time for each transaction. According to that, it is indicated that processing time after applying blockchain technology is shorter than it takes through traditional systems, with up to 40% enhancement. Where the improvement for each attribute i as Improve i, where i ranges from 1 to 8 (representing each attribute). Each attribute is assigned to an equal weight. The improvement for each attribute can be calculated using the equation 1 [15]:

$$\textbf{Improve}_i = \frac{After_i - Before_i}{Before_i} \quad (1)$$

Then, the overall enhancement score which is the average of all improvements is calculated using equation 2.:

$$Overall\ Enhancement\ Score = {}^1/_8 \sum_{i=0}^{8} \textbf{Improve}_i \quad (2)$$

The IssuingBank allows the creation, activation, and deactivation of credit cards on the blockchain. It uses a Card structure to store details like card number, cardholder address, credit limit, and activation status. The contract emits events (CardIssued, CardActivated, and CardDeactivated) to log these actions, ensuring transparency and traceability.

As shown in Table 1 the comparison between before and after values to determine the percentage change using the formula (After−Before)/before×100. For the parallel task execution, it's improved by 50% (from 100 tasks/s to 150 tasks/s), meanwhile merging issuers and acquirers the percentage decreased by 50% (from 2 entities to 1 entity). When increased resources show a 100% rise (from 10% to 20%). While reduced reconciliation efforts the percentage decreased by 75% (from 4 hours/week to 1 hour/week).

Whereas enhanced security showed an 80% rise (from 5 breaches to 1 breach). Also, scalability shows a 400% rise (from 1000 tx/s to 5000 tx/s). When Streamlined compliance processes decreased by 75% (from 8 hours/week to 2 hours/week), while automated transaction settlement improved by 80% (from 50% to 90%).

Calculating Overall Enhancement Score

On the other hand, the overall enhancement score has been calculated by averaging all improvements as shown in equations 3,4, and 5:

$$\text{Overall Enhancement Score} = {}^1/_8\ (0.5 - 0.5 + 1 - 0.75 - 0.8 + 4 - 0.75 + 0.8) \quad (3)$$

$$\text{Overall Enhancement Score} = {}^1/_8\ (2.5) \quad (4)$$

$$\text{Overall Enhancement Score} = 0.3125 \quad (5)$$

Attribute	*Before*	*After*	*Improvement*
Parallel Task Execution	100 tasks/s	150 tasks/s	$\frac{150-100}{100}$=.5
Merged Issuer and Acquirer	2 entities	1 entity	$\frac{1-2}{2}$=-.5
Increased Resources	10%	20%	$\frac{20-10}{10}$=1
Reduced Reconciliation Efforts	4 hours/week	1 hour/week	$\frac{1-4}{4}$=-.75
Enhanced Security	5 breaches	1 breach	$\frac{1-5}{5}$=-.80
Improved Scalability	1000 tx/s	5000 tx/s	$\frac{5000-1000}{1000}$ =4
Streamlined Compliance Processes	8 hours/week	2hours/week	$\frac{2-8}{8}$=-.75
Automated Transaction Settlement	50%	90%	$\frac{90-50}{50}$=.75

Table 1 Comparison of Key Metrics: Pre- and Post-Blockchain Implementation

So, the overall enhancement score is 0.3125, indicating a moderate level of improvement across all attributes. Adjusting the weights assigned to each attribute or the metrics used for improvement calculation can lead to different overall scores as shown in Fig.7.

Then, it indicated that the average time to process transactions was about 10 minutes, and after using blockchain technology, the time for multiple transactions was about 6 minutes as shown in figure 8, and 9. Therefore, the analysis of transactions for various cupping transactions showed that the platforms built using blockchain technology maintained their performance level even when the transactions were high and varied, indicating the scalability and reliability of blockchain technology in dealing with large Hajj agreements and maintenance standards in central processing. As the use of blockchain technology spreads in different fields, payment systems can also benefit from this technology to significantly improve efficiency and performance, which ultimately improves the overall user experience and enables the user to transact faster and easier.

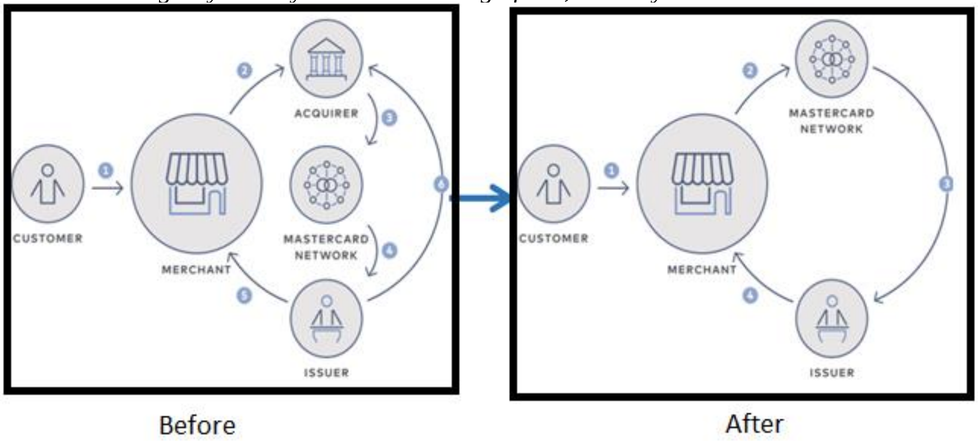

Fig 7: The process of enhancing the Payment Process

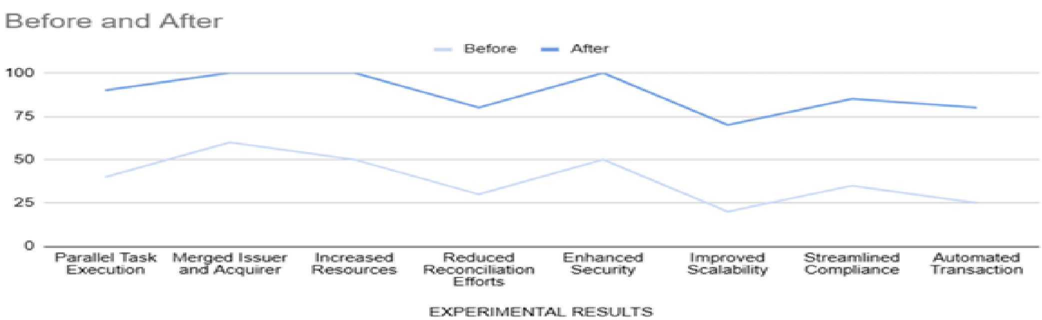

Fig. 8 Overall System Performance Enhancement Char

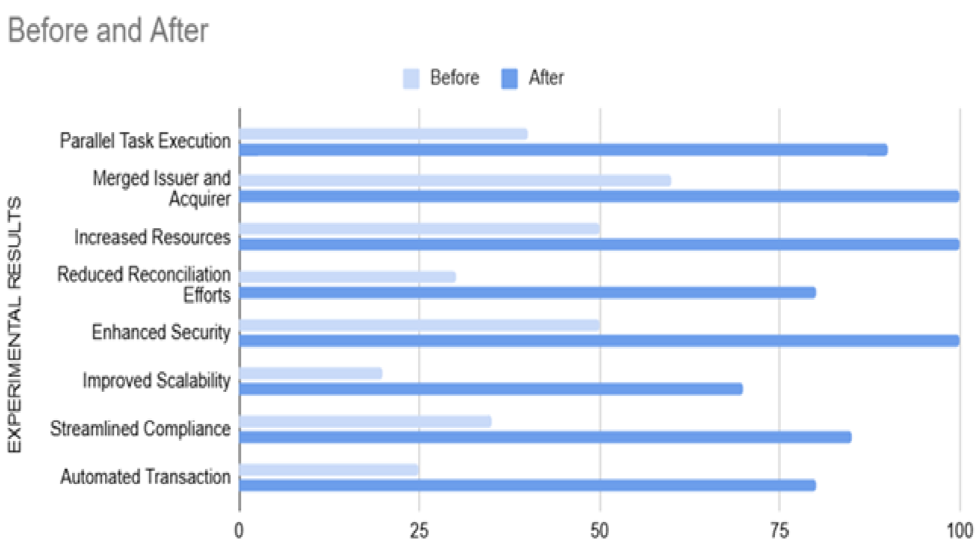

Fig. 9 Show the Payment Process Before and After the Improvement

Conclusion and Future Works

This paper discussed the way blockchain technology enhances the transactions of payment systems through two phases of methodology. The main finding was using blockchain technology through payment systems to enhance the speed of transactions and their security, which are the most important metrics of any payment system. The nature of the decentralization of blockchain technology makes the payment systems more secure, reduces the risk of single points of failure, and enhances data integrity. Also, using smart contracts increases the ability to automate transactions; this saves costs and increases the efficiency of the operation, reducing the manual steps in transaction processing. The biggest challenge in traditional payment systems is scalability, and the blockchain's ability to handle a large volume of transactions without compromising speed or security. However, this research also determined the negative impact, especially on merging the roles of issuer and acquirer. These challenges appeared after these changes: a lot of operational complexity that required adjustment in an exciting workflow. This paper reached the overall enhancement score, which was calculated to be 0.3125. This is an indication to improve the most important areas like security, scalability, and resource utilization. In the future, the interoperability between different blockchain networks when using smart contracts in the integration to increase the automation of payment processes considering the security and privacy in transactions is one of the challenges that may be achieved.

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