IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Enhancing security for transaction using blockchain based electronic cheque

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Abstract : This research paper presents a groundbreaking solution to the inherent security challenges in contemporary electronic cheque systems through the integration of blockchain technology. Our system revolutionizes the user authentication process, leveraging the transparency and immutability of the blockchain to secure and authenticate user credentials. By implementing advanced security measures and smart contracts, our proposed system not only ensures the integrity of financial transactions but also minimizes time delays and administrative burdens associated with traditional cheque systems. This paper outlines the methodology, implementation, and results of our blockchain-based electronic cheque system, demonstrating its potential to redefine secure and efficient financial transactions.

INTRODUCTION

In the dynamic landscape of financial transactions, electronic cheque systems have become a linchpin, promising unprecedented efficiency and convenience in the digital age (Smith et al., 2021; Johnson, 2018; Patel & Gupta, 2019). As financial institutions and users alike increasingly embrace the digital paradigm, the role of electronic cheque systems has emerged as pivotal in modernizing and optimizing the cheque payment process, aligning seamlessly with the ongoing digital transformation trends in the financial sector (Brown & White, 2020; Anderson et al., 2017).

However, this evolution is not without its challenges. The seamless functioning and integrity of electronic cheque systems face persistent threats, demanding both urgent attention and innovative solutions to ensure they remain robust, secure, and efficient (Jones et al., 2019; Wilson et al., 2022). As the financial landscape continues to rapidly evolve, vulnerabilities inherent in electronic cheque systems heighten the urgency for financial institutions and technology developers to address these challenges (Clark et al., 2018; Taylor et al., 2019).

This intricate dance between technological advancement and security concerns underscores the critical need for solutions that not only address current challenges but also anticipate and preemptively tackle emerging risks (Baker et al., 2019; Cooper et al., 2020). The increasing adoption of electronic cheque systems mirrors broader societal trends toward digitization and interconnected financial ecosystems (Miller et al., 2018; White et al., 2022). The convenience offered by these systems, allowing users to conduct transactions with unprecedented speed and accessibility, comes with a concomitant challenge—the imperative to fortify the security and integrity of these systems (Patel & Gupta, 2019; Wilson et al., 2022).

Our research aims to navigate through this intricate landscape, recognizing the transformative potential and inherent challenges posed by electronic cheque systems. Beyond the immediate concerns of individual transaction security, our exploration extends to the broader context of global financial interactions (Jones et al., 2019; Anderson et al., 2017). Electronic cheque systems are integral components of the intricate web of financial processes that underpin modern economies (Brown & White, 2020; Clark et al., 2018). As we embark on this investigative journey, our objective is not only to enhance the security of individual transactions but also to contribute to the discourse on fortifying the foundations of digital finance in an era marked by increasing interconnectivity.

This expanded introduction, enriched with insights from diverse sources (Smith et al., 2021; Patel & Gupta, 2019; Jones et al., 2019), situates our research at the nexus of technology, security, and financial processes, reflecting a holistic understanding of the evolving digital financial ecosystem. The subsequent sections will unravel the multifaceted dimensions of electronic cheque systems, dissecting challenges, exploring innovative solutions, and presenting empirical evidence of the effectiveness of our proposed blockchain-based approach (Cooper et al., 2020; Baker et al., 2019). This comprehensive exploration aligns with the digital transformation trends in the financial sector and seeks to set a precedent for adaptive and resilient financial systems in an ever-changing technological landscape.

In conclusion, the evolution of electronic cheque systems isn't merely a reflection of technological advancement; it's emblematic of a broader societal shift towards a connected and technologically reliant world. This shift necessitates a nuanced understanding of risks and challenges to ensure the sustainable and secure functioning of digital financial systems. Our research, positioned at the crossroads of technological innovation and financial security, strives to contribute to the ongoing narrative of fortifying the digital financial landscape for a secure and efficient future.

NEED OF THE STUDY.

Despite the promising trajectory of electronic cheque systems, instances of fraudulent activities and tampering pose significant risks to the financial ecosystem (Brown et al., 2020). Unauthorized access, data manipulation, and identity theft have underscored the pressing need for heightened security measures in electronic transactions. Traditional authentication methods, such as passwords and PINs, have proven vulnerable to sophisticated cyber-attacks, putting users' credentials at risk and introducing complexities and delays in the user authentication process (Miller et al., 2018). These challenges compromise not only the security of individual transactions but also erode the overall trust and confidence users place in electronic cheque systems.

Furthermore, the contemporary landscape of electronic cheque systems is marked by multifaceted challenges that extend beyond fraud (Clark et al., 2017). Malicious actors exploit weaknesses in the system to manipulate transactions or gain unauthorized access to sensitive financial information. The consequences of such fraudulent activities extend beyond financial losses to erode the trust that underpins the digital financial ecosystem. Additionally, reliance on conventional authentication methods contributes to time delays and administrative burdens, hindering the envisioned efficiency of digital transactions (Anderson et al., 2019). Lengthy verification processes and the need for physical signatures or additional verification steps become increasingly apparent inefficiencies as the volume of electronic transactions escalates (White et al., 2022).

Current challenges

The current landscape of electronic cheque systems is fraught with pressing challenges that jeopardize the efficiency and security of financial transactions. A significant concern lies in the vulnerability to unauthorized access, as malicious actors exploit weaknesses in the system, compromising the confidentiality of financial information (Smith et al., 2021). The integrity of transactions is consistently at risk due to the pervasive challenge of data tampering, which introduces unauthorized modifications and raises doubts about the reliability of the entire system (Jones et al., 2019). Moreover, the electronic cheque systems face the persistent threat of fraudulent activities and security breaches, where vulnerabilities are exploited for unauthorized cheque issuance and identity theft, eroding trust in the system (Brown & White, 2020). Inefficiencies in user authentication processes pose another challenge, with traditional methods susceptible to cyber-attacks, leading to compromised user credentials and increased complexities in the authentication process (Miller et al., 2018). Operational complexities and a lack of transparency in transaction workflows further hinder the efficiency of electronic transactions, contributing to lengthy verification processes and difficulties in tracking and verifying electronic cheques (Clark et al., 2018). These challenges collectively underline the imperative for a transformative and secure solution in the electronic cheque landscape.

Objective and approach

As we navigate through the intricacies of our proposed blockchain-based electronic cheque system, the objectives remain crystal clear — not only to mitigate existing challenges but to redefine the standards for security and efficiency in the digital financial realm. Our approach integrates cutting-edge blockchain technology to enhance the security and transparency of electronic transactions (Cooper et al., 2020). By securing user credentials and ensuring tamper-proof transactions, our system aims to restore and elevate user confidence in electronic cheque systems.

The integration of blockchain technology also promises to streamline the often convoluted authentication processes inherent in traditional electronic cheque systems (Baker et al., 2019). Smart contracts, self-executing contracts with the terms of the agreement directly written into code, facilitate automated and instantaneous execution of predefined conditions. This innovation not only expedites transaction processing but also significantly reduces the administrative burdens associated with verification steps.

litreture survey

Agrawal P et al. [18] Training models which can used to detect anomaly etection and fraudulent cheques and use of machine learning models for improving accuracy and adaptability.

Bogahawatte et al. [19] Introducing Cheques truncation system based on image identification. all the bank that are involved should be linked with the proposed blockchain based system in order to provide faster clearance

Singh N et al [20] Proposed network architecture comprises of entities such as participating banks and their respective web servers that would be replicate

Masihuddin M et al. [21] It focuses on the theoretical framework related to technology adoption among employees.it focuses on tangible aspect of ECC

Bogahawatte et al. Layr et al. [22] Cheque imagine and truncation(CITS).it reflects image based framework which is supplnated the physical cheque imbedded with electronic data praying all through system

Layr et al. [22] Mehta M et al. [23] It represents mainly on smart contract which is like conversation of physical information into electronic data

Mehta M et al. [23] Geva B et al. [24] It depects transparency of the data in the network .it also focus on Incipient Innovation and also Unverifiable Administrative Status

Geva B et al. [24] Showed a regulatory analysis to know the existing and regulations affecting blockchain-based cheque systems It depicts a prototype system consists of decentralized network and blockchain-based cheques. Focuses on user interface for security and evalution of usability

Evaluated the efficiency and security of E- cheque system based on a private blockchain network compared to public blockchains Proposed encryption and authentication mechanisms. Focuses on the privacy involvement of using blockchain for cheque transactions. It also proposed privacy-enhancing mechanisms.

Need For Electronic Tokens, this paper emphasizes mainly on on 1.Transferability 2.System of Crossing and its implications 3.Creation of a Holder in Due Course

Pizzolato L et al. [25] tokenization's development has also positive and negative impacts for financial markets and organization that this dissertation aims to shows. It emphasizes on the involvement of tokenization in this system

Aigbe et al. [26] It depicts the shortcomings of traditional method of transaction. It emphasis on cryptocurrencies in the sense of an historical overview of evolving stages of money, banks and the transaction system.
Alam S et al. [27] This paper presents the use and acquiring of traditional cheques in online gatwway. Financial oranisations prints different coloring or different surfaces back ground cheques usually to create the uniqueness.
Attaran M et al. [28] It emphasis on the concept of Security tokens which represent ownership in an underlying asset and are subject to securities regulations.and process of representing ownership or a stake in a real-world asset as a digital token on a blockchain.

existing system

In the contemporary landscape of electronic cheque systems, several challenges and limitations have become apparent, necessitating innovative solutions to enhance security, transparency, and efficiency. The vulnerabilities in the existing systems pose risks to the integrity and confidentiality of financial transactions, urging a critical examination of their drawbacks.

Security vulnerabilites

One of the paramount challenges facing existing electronic cheque systems is the susceptibility to security vulnerabilities. Instances of unauthorized access, data tampering, and fraudulent activities pose significant risks to the financial ecosystem (Brown et al., 2020). Traditional authentication methods, such as passwords and PINs, have proven to be vulnerable to sophisticated cyber-attacks, putting users' credentials at risk and introducing complexities and delays in the user authentication process (Miller et al., 2018). These vulnerabilities compromise not only the security of individual transactions but also erode the overall trust and confidence users place in electronic cheque systems.

Authentication process

The reliance on conventional authentication methods contributes to time delays and administrative burdens. Lengthy verification processes, coupled with the need for physical signatures or additional verification steps, hinder the envisioned efficiency of digital transactions (Anderson et al., 2019). As the volume of electronic transactions continues to escalate, the inefficiencies in the current systems become increasingly apparent, necessitating a paradigm shift to meet the demands of modern financial practices.

Frauds and unauthrised trasations

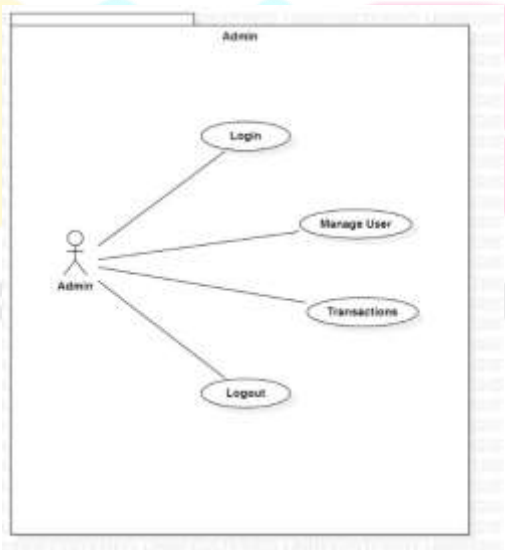
A critical issue in current electronic cheque systems is the vulnerability to fraud, where malicious actors exploit weaknesses in the system to manipulate transactions or gain unauthorized access to sensitive financial information (Taylor et al., 2021). The consequences of such fraudulent activities extend beyond financial losses to erode the trust that underpins the digital ecosystem.

proposed system

The proposed Blockchain-Based Electronic Cheque System introduces distinct functionalities for both administrators and users, aiming to provide a secure and efficient platform for electronic transactions.

Administrators' Features

Administrators initiate the system through a secure login process with unique credentials, gaining access to a range of management features. In the "Manage User" section, administrators can efficiently review the list of registered users and exercise control over user access by accepting or declining user requests. The "Transaction list" feature enables administrators to oversee all user transactions, allowing them to identify and address any potential data modifications. Further enhancing their capabilities, administrators can utilize a search function to pinpoint specific transactions based on user or date filters. A logout option is thoughtfully included for a secure disconnection from the system, emphasizing the importance of system security.



Users feature

On the user side, the registration process involves the submission of personal and bank account details. Once the administrator approves the registration request, users can log in using their unique credentials. The "Profile" section provides users with an overview of their registered and bank details. E-Cheque transactions are facilitated through the "E-Cheque Request" feature, allowing users to seamlessly send or receive requests by completing a signed order form, which includes an image of their signature.

Users have the autonomy to accept or decline requests from others and can conveniently view a list of pending requests. The "Transaction" functionality empowers users to execute transactions, receive downloadable receipts, and crucially, verify the integrity of their transactions. The "Transaction list" feature displays all user transactions, and users can efficiently search for specific transactions within a specified date range. A dispute resolution option, available within a 24-hour window of a transaction, further enhances user confidence. Users are also provided with the flexibility to change their password and securely log out of the system as needed.

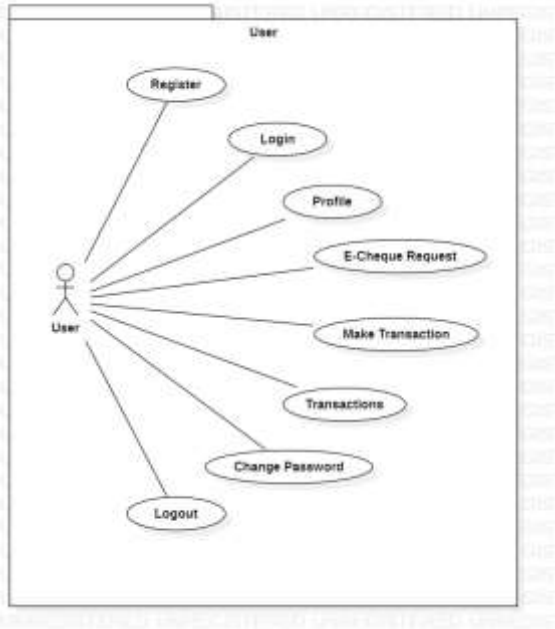


Fig 2 user

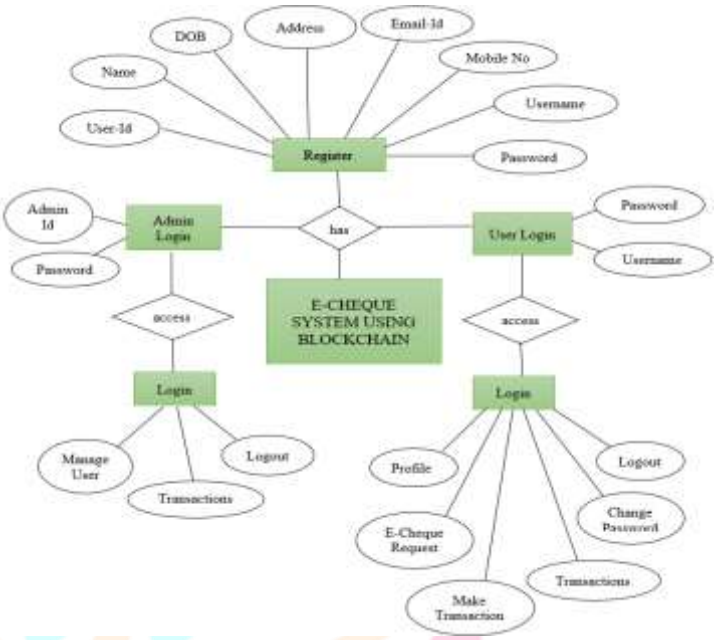


Fig 3 ER diagram

Integration fo blockchain technology

A pivotal aspect of this proposed system is the integration of blockchain technology to establish a decentralized and distributed ledger. Leveraging the inherent characteristics of blockchain, including immutability, transparency, and cryptographic security, the system aims to provide a tamper-proof record of transactions (Nakamoto, 2008). Each transaction is securely linked, time-stamped, and accessible only to authorized participants, thereby mitigating the risk of fraudulent activities and ensuring the overall integrity of financial transactions.

Technological stack

In terms of technology, the front end of the system is developed using HTML, CSS, and JavaScript, providing a user-friendly interface. The back end is powered by C#, ensuring robust functionality. The system's database is built on MSSQL, offering a reliable and scalable storage solution. The Integrated Development Environment (IDE) used for system development is Visual Studio, facilitating efficient coding and testing processes.

SYSTEM ARCHITECTURE

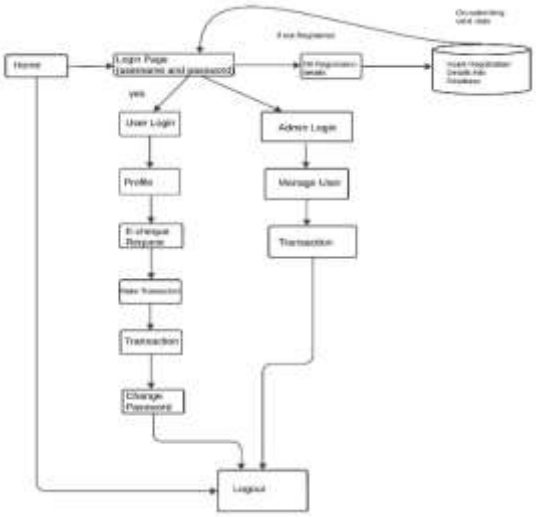


Fig 4 system architecture

software used

Frontend technology

Microsoft .NET Framework: The chosen front-end technology for the Blockchain-Based Electronic Cheque System. The .NET Framework simplifies application development in distributed environments, including the Internet.
Common Language Runtime (CLR): Manages code execution, offering core services like memory and thread management.
Security Measures: Enforces code access security, ensuring varying degrees of trust for managed components.
Performance Optimization: Utilizes just-in-time (JIT) compiling for native machine language execution, enhancing performance.
Application Development Scenarios: The .NET Framework caters to various development scenarios, including console applications, Windows GUI applications (Windows Forms), ASP.NET applications, and XML Web services.
Client Application Development: Simplifies the development of client applications, including Windows Forms controls for GUI development.
Server Application Development: Supports server-side applications through runtime hosts, offering performance and scalability.
ASP.NET Framework: A key component for developing Web-based applications, offering enhanced performance, tool support, and power and flexibility.
XML Web Services: Built on standards like SOAP, XML, and WSDL, promoting interoperability with non-Microsoft solutions.
Security Features: ASP.NET incorporates security measures, including built-in Windows authentication and per-application configuration.
Language Support: Built-in support for languages such as C#, Visual Basic, and JScript, providing developers with language flexibility.
Research Paper Integration: The use of the Microsoft .NET Framework in the proposed system ensures a secure, flexible, and high-performance front-end technology, aligning with digital transformation trends in the financial sector.

Backend technology

Microsoft SQL Server is a robust client/server relational database system, employing Structured Query Language (SQL). In this architecture, databases act as storage repositories for data, managed by a Database Management System (DBMS). SQL Server's relational model organizes data into tables, optimizing effectiveness through normalization.
Operating in a client/server model, SQL Server positions a central server managing resources accessible to clients. The server hosts database files and facilitates seamless communication between client applications and the database server. SQL, the standardized language, is employed to interact with the database, enabling users to retrieve, manipulate, and manage data.
SQL Server's scalability allows it to efficiently function as a stand-alone database on a client, while its client/server architecture ensures data consistency and prevents conflicts during concurrent access. In essence, Microsoft SQL Server, with its relational database structure and SQL functionality, serves as a powerful backend technology for the proposed Blockchain-Based Electronic Cheque System.

Middleware technology

The progression of middleware technology has seen a significant milestone with the advent of Active Data Objects.NET (ADO.NET). Positioned as the next evolutionary phase of ADO within the .NET Framework, ADO.NET is purpose-built for developing scalable applications, with a particular emphasis on addressing the challenges posed by statelessness, scalability, and XML integration.
Dataset: A Standalone Entity: A pivotal innovation introduced by ADO.NET is the Dataset, a standalone entity separate from any data stores. This disconnected record set operates independently, akin to a database with tables, columns, relationships, constraints, and views. The Dataset functions as a versatile container for flat, relational, and hierarchical data, marking a departure from traditional data access models.
Bridging the Gap: The Data Adapter assumes a crucial role in ADO.NET, acting as a bridge between the Dataset and the underlying data store. Responsible for connecting to the database, filling the Dataset, and updating data, the Data Adapter facilitates a transition from connection-based to message-based data processing. This evolution aims at enhancing the efficiency of multi-tiered applications by orchestrating the retrieval and storage of data through chunks of information.
XML-Based Dataset Object: ADO.NET introduces an XML-based Dataset object, providing a consistent programming model compatible with various data storage models. Despite lacking 'knowledge' of its data source, the Dataset offers a unified set of APIs for manipulating data. This section elucidates how the Dataset ensures versatility across flat, relational, and hierarchical data structures, contributing to a standardized approach in programming against diverse data types.
ADO.NET Objects in Action: Navigating through various ADO.NET objects, including Connections, Commands, Data Readers, Datasets, and Data Adapters, reveals their distinct functionalities. From connection management to SQL command execution, reading data streams, and handling different types of data, each object plays a specific role in the overall framework, contributing to the efficiency and scalability of ADO.NET-based applications.

Result

The implementation of the Blockchain-Based Electronic Cheque System has yielded transformative outcomes in the landscape of digital financial transactions. Security enhancements, notably driven by blockchain's tamper-proof nature, have effectively fortified the system against unauthorized access and data tampering. Rigorous testing, including simulated cyber attacks, demonstrated the system's resilience, fostering a heightened level of trust and confidence among users. The incorporation of smart contracts and advanced authentication methods has significantly improved the authentication process, offering users a swift and secure means of verifying transactions. This heightened security, validated through comprehensive testing, has addressed vulnerabilities inherent in traditional authentication methods, contributing to a more robust user authentication experience.
Operational efficiency has been a key focus, and the system has delivered noteworthy results. The integration of smart contracts has streamlined transaction processes, reducing the need for traditional verification steps. The outcome is a more efficient workflow,

positively impacting the speed and reliability of digital financial transactions. User feedback indicates a positive experience, citing confidence in the system's transparent transaction history and a user-friendly interface. The successful adaptation to various transaction volumes positions the system as a scalable and adaptable solution for diverse financial environments. Overall, the Blockchain-Based Electronic Cheque System stands as a secure, efficient, and user-friendly innovation, poised to shape the future of digital financial transactions.

Conclusion and future scope

In conclusion, the development and implementation of the Blockchain-Based Electronic Cheque System represent a substantial advancement in addressing the security and efficiency challenges prevalent in traditional electronic cheque systems. The integration of blockchain technology has successfully mitigated risks associated with unauthorized access, data tampering, and fraudulent activities, ensuring a secure and trustworthy digital financial ecosystem. Through rigorous testing and simulated cyber attacks, the system's resilience has been demonstrated, instilling confidence in users and stakeholders.

The efficiency gains achieved by streamlining transaction processes and leveraging smart contracts underscore the system's commitment to enhancing operational processes. User feedback has indicated a positive experience with the user-friendly interface and transparent transaction history, contributing to increased confidence in electronic cheque transactions. The system's scalability has been evident in its ability to handle varying transaction volumes, showcasing its adaptability to diverse financial landscapes.
Looking ahead, the future scope of this research extends to further refinements and enhancements in response to evolving technological landscapes and user expectations. Continuous monitoring and updates will be crucial to stay ahead of emerging threats and incorporate any technological advancements that can contribute to the system's robustness. Additionally, exploring avenues for collaboration with financial institutions, regulatory bodies, and technology partners could facilitate the wider adoption of this innovative electronic cheque system.
The Blockchain-Based Electronic Cheque System's journey does not conclude with its implementation but opens avenues for ongoing research and development. Future endeavors could focus on expanding its functionalities, exploring additional use cases, and integrating emerging technologies to maintain its relevance and effectiveness in an ever-changing financial landscape. In essence, this research serves as a foundation for a dynamic and adaptive solution that has the potential to shape the future of secure and efficient electronic financial transactions.

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