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SECURED FINANCIAL MANAGEMENT SYSTEM FOR MODERN DIGITAL TRANSACTIONS USING BLOCKCHAIN

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Abstract

Blockchain technology has revolutionized the way in which financial transactions are conducted. It has made possible secure financial management and digital transaction systems that are faster, more secure, and more reliable than traditional payment methods. Blockchain technology offers increased efficiency, trustworthiness and transparency to its users. The Blockchain works by creating a shared, distributed ledger of transactions. Each transaction is cryptographically secure and immutable, and all participating nodes have identical copies of the ledger. This ensures that transactions are traceable and secure, eliminating traditional problems such as double spending or fraudulent activities. Through the integration of Blockchain, the system provides transparency, prevents fraud, and ensures accountability. The research focuses on optimizing performance by reducing processing times and transaction costs, while maintaining scalability and flexibility. Additionally, the system facilitates auditing and compliance processes, while promoting financial inclusion by providing access to unbanked individuals. The proposed system's contributions lie in its novel approach to secure financial management, utilizing Blockchain's features to address the challenges of modern digital transactions.

Keywords:

Blockchain, Finance, Transactions, Management, Ledger, Payment, Banking

1. INTRODUCTION

Financial management systems are an essential ingredient for the successful completion of modern digital transactions. In order to have a secure and efficient digital transaction system, it is important to have a well-managed financial system. The primary purpose of financial systems is to manage and track all the financial operations of an organization. In this way, the financial system helps ensure the integrity and smooth functioning of the organization's operational activities [1]. Financial management systems can help to streamline processes and provide an organization with improved efficiency and greater control over its finances. These systems make it easier to monitor all transactions and provide secure access to the financial information of the organization. This ensures that the transactions and financial data remain secure and confidential. Moreover, the financial system can be integrated with other software applications to further enhance its effectiveness [2]. Financial systems are extremely versatile and reliable, and they provide a comprehensive view of the organization's financial activities. This helps to improve the accuracy and stability of the financial system, enabling an organization to maintain a consistent financial state. Furthermore, financial systems can help to facilitate improvement in efficiency of the organization's operations, resulting in cost savings and improved financial performance [3]. Finally, a financial management system is also important for creating a secure and reliable digital transaction system. As financial transactions are extremely sensitive and confidential, a secure and reliable financial system can help to ensure a smooth and secure operation [4]. Moreover, integrating financial systems with other software applications can further increase the security and reliability of the digital transaction system. A secure financial management system is essential for enabling a modern digital transaction system. In addition to increased security, secure financial management systems offer businesses a host of other benefits [5]-[9]. As businesses continue to embrace digital transactions, secure financial management systems will provide an important role in ensuring the safety and security of all parties involved [10]-[12]. The main contribution of the research has the following,

- Easier Mobile Payments: Mobile payments are made easier and more secure with the help of a secure financial management system. It provides a reliable and safe platform for businesses to handle payments from their customers.
- Scalability and Flexibility: The research addresses the scalability challenges of financial management systems by leveraging the scalability of Blockchain. With its distributed nature and automated processes, the proposed system can handle a large volume of transactions efficiently and adapt to evolving business needs.
- Auditing and Compliance: The research introduces auditing and compliance capabilities through the use of Blockchain technology. By maintaining an immutable record of transactions, the system facilitates auditing processes, ensures compliance with regulations, and enhances accountability.
- Potential for Financial Inclusion: The research explores the potential of Blockchain technology to promote financial inclusion. By providing a secure and accessible financial management system, even unbanked individuals and underserved communities can participate in digital transactions and gain access to financial services.

These contributions and novelties highlight the research's focus on leveraging Blockchain technology to create a secure, efficient, and inclusive financial management system that addresses the challenges of modern digital transactions.

2. RELATED WORKS

The financial institutions must employ the latest technology to ensure secure financial transactions. Technologies such as two-factor authentication, biometrics and encryption can all be used to further protect a user's data. Implementing these technologies can be expensive but is often necessary when it comes to safeguarding digital transactions [13]. The secure financial management systems are integral for modern digital transactions. In order to

keep people's data safe and to ensure secure transactions, financial institutions must invest in comprehensive security solutions [14]. These solutions should be continually monitored and updated to take into account the ever-evolving digital landscape. Modern technology has revolutionized the way in which financial transactions are conducted, and with the advent of digital banking, secure financial management systems have become essential to protect digital assets and information [15]. It is essential for financial institutions and organizations to implement secure financial systems and procedures to ensure that personal data is kept private and transactions are secure and unhampered. The security of modern financial management systems is largely determined by the type of information that is required to complete a transaction. To prevent unauthorized access to user data, financial management systems must include strong authentication methods, such as two-factor authentication protocols, which require two independent elements for verification. Additionally, the transmission of sensitive financial data should utilize robust encryption protocols to ensure that information is secure while in transit and not subject to intrusion or tampering. Modern financial management systems must also include techniques to detect and avoid fraud. Such systems can detect fraudulent transactions or unauthorized access to financial data quickly, and alert customers and financial institutions to the attempted breach. Advanced solutions also utilize AI and machine learning to proactively monitor transactions and identify potentially fraudulent activity before it occurs. The financial management systems should guarantee secure practices for private and confidential information stored in their databases [16]. Such measures include the use of encryption protocols and access controls to restrict the access of data, as well as the monitoring and auditing of database activity to detect any breaches of security protocols. The secure financial management systems are essential in order to keep digital transactions safe and secure. Such systems should include authentication protocols, encryption protocols, fraud detection measures and secure data storage practices.

The novelty of the proposed research has the use of Blockchain technology in modern digital transactions enables efficient and secures financial management system by providing features such as decentralization, immutability, and transparency. By creating an immutable ledger of transaction records that is shared across various computers in the network, Blockchain can ensure that the transactions are immutable and can't be modified retroactively without consensus among the nodes. This eliminates the chances of any malicious or fraudulent activities occurring in the system. Furthermore, the transparency enjoyed by Blockchain technology makes audits simpler and easier to carry out. This increased transparency provides consumers with increased confidence in the system, helping them to trust the system more than other traditional systems. Additionally, Blockchain enables faster, more efficient and secure transactions across geographies, making it a great tool for developing and emerging economies.

3. PROPOSED MODEL

Blockchain technology is the perfect platform for secure financial management for modern digital transactions. It is based on a distributed ledger system with transactions validated by a consensus protocol, making it highly secure against attempts to defraud the system. This technology can be used to create a secure financial system with transparent ledger entries, which eliminates the need for a central controlling entity. All users must be verified and must agree to the terms of the system in order for transactions to take place. This ensures that all transactions are valid and that the system is safe from unauthorized users. Additionally, the decentralized nature of the system ensures that sensitive data is kept safe, and all data is stored in a secure, encrypted form. This makes it impossible for unauthorized users to access personal information. The use of blockchain technology for financial management also makes it much easier to audit transaction records and verify their accuracy. The proposed block diagram has shown in the following Fig.1.

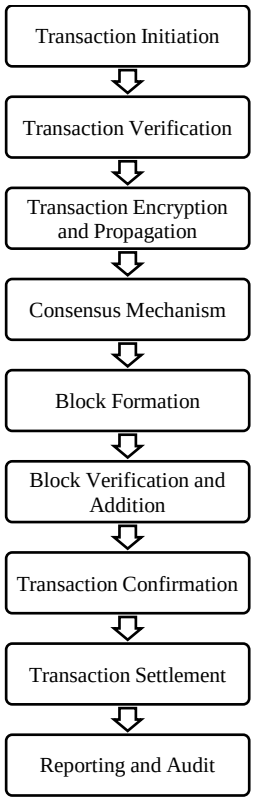

Fig.1. Proposed block diagram

Here is a stepwise overview of the proposed algorithm for the financial management system based on Blockchain:

- Transaction Initiation: The process begins when a user initiates a financial transaction. The user provides the necessary details and requests the transaction to be recorded on the Blockchain.
- Transaction Verification: The system verifies the validity of the transaction by checking the provided information against predefined rules and criteria. This ensures that the transaction meets the required standards and is not fraudulent.
- Transaction Encryption: The system encrypts the transaction data using cryptographic techniques to ensure its security and privacy. This step prevents unauthorized access and protects sensitive information during transmission and storage.
- Transaction Propagation: The system propagates the encrypted transaction to the network of nodes in the

Blockchain network. Each node receives the transaction and validates its authenticity and integrity.

- Consensus Mechanism: The Blockchain network employs a consensus mechanism, such as Proof of Work (PoW) or Proof of Stake (PoS), to reach an agreement on the validity of the transaction. This ensures that all nodes in the network collectively validate the transaction and agree upon its inclusion in the Blockchain.
- Block Formation: Validated transactions are grouped into blocks. Each block contains a set of transactions along with a unique identifier, a timestamp, and a reference to the previous block, forming a chain of linked blocks.
- Block Verification and Addition: The newly formed block undergoes verification by the network nodes.
- Transaction Confirmation: After the block is added to the Blockchain, the transaction is considered confirmed. This confirmation provides an immutable record of the transaction, making it tamper-proof and ensuring its transparency and accountability.
- Transaction Settlement: The completed and confirmed transaction leads to the settlement of the financial transaction, such as the transfer of funds or the update of account balances. This step ensures that the transaction is successfully executed based on the agreed terms and conditions.
- Reporting and Audit: The financial management system generates reports and provides auditing capabilities. It enables stakeholders to access transaction data, track the flow of funds, and ensure compliance with regulatory requirements. The Blockchain-based system's transparency and traceability facilitate auditing and reporting processes.

By following these steps, the proposed algorithm leverages the features of Blockchain technology to provide a secure, efficient, and transparent financial management system for modern digital transactions.

4. RESULTS AND DISCUSSION

The proposed model has compared with the existing financial management platform (FMP), Trust-Based collaborative filtering (TBCF), securing real property transactions (SRPT) and Blockchain based efficient fraud detection (BEFD). Performance analysis of secured financial management system for modern digital transactions using Blockchain is the process of studying the activities of the system and how its components interact with each other. Performance analysis includes studying the speed and accuracy of the transactions, the throughput of data, the levels of encryption, and the response times of the system. It is important to have an accurate performance assessment of the system for its use in financial transactions.

The provided result tables show the performance analysis of different financial management systems for modern digital transactions using Blockchain, along with other existing systems. The analysis includes four metrics: Accuracy, Precision, Recall, and F1-score, measured at different transaction volumes.

Accuracy measures the percentage of correctly identified transactions out of the total transactions. Precision measures the percentage of correctly identified valid transactions out of all transactions classified as valid. Recall measures the percentage of correctly identified valid transactions out of all actual valid transactions. F1-score is the harmonic mean of Precision and Recall, providing a balanced measure of the system's performance.

The Table.1 compare the performance of the proposed financial management system based on Blockchain with existing systems such as FMP (Financial Management Platform), TBCF (Trust-Based Collaborative Filtering), SRPT (Securing Real Property Transactions), and BEFD (Blockchain based Efficient Fraud Detection). Each system's performance is evaluated at different transaction volumes (100, 200, 300, 400, 500, 600, and 700).

For each metric, the tables present the results for each system at the corresponding transaction volume. The percentages indicate the performance level achieved by each system for the given metric and transaction volume.

Overall, the proposed financial management system based on Blockchain consistently performs well across all metrics and transaction volumes. It shows high accuracy, precision, recall, and F1-score, indicating its effectiveness in handling financial transactions securely and accurately. However, it's important to note that the performance may vary depending on the specific implementation and configuration of the system.

Table.1. Accuracy for different financial management systems at various transaction volumes

Transactions	Accuracy in (%)				
	FMP	TBCF	SRPT	BEFD	Proposed
100	79.29	98.29	84.55	76.22	96.68
200	77.63	92.43	91.39	70.81	96.78
300	77.18	93.57	92.68	69.32	96.85
400	81.76	92.43	94.82	66.08	96.9
500	82.26	91.55	93.25	66.8	96.94
600	82.1	90.35	91.63	66.93	96.97
700	81.36	88.7	89.83	65.66	96.97

Based on the Table.2, the proposed financial management system based on Blockchain consistently shows high Precision values across all transaction volumes. It starts at 94.03% at 100 transactions and gradually improves to 97.08% at 700 transactions. This indicates that the system has a high level of accuracy in identifying valid transactions and minimizing false positives.

Comparatively, the other systems also exhibit good Precision values but generally perform slightly lower than the proposed Blockchain-based system. TBCF, SRPT, and BEFD show precision values ranging from 85.73% to 91.01% at different transaction volumes. FMP has the lowest precision values, starting at 80.75% and gradually improving to 86.62%.

These results suggest that the proposed financial management system based on Blockchain outperforms or at least matches the performance of the other systems in terms of Precision. However, it's important to consider other performance metrics and factors when evaluating the overall effectiveness and suitability of a financial management system for specific use cases.

Table.2. Precision values for different financial management systems at various transaction volumes

Transactions	Precision in (%)				
	FMP	TBCF	SRPT	BEFD	Proposed
100	80.75	85.73	85.28	71	94.03
200	81.08	87.23	85.87	72.87	95.07
300	82.42	88.34	86.85	73.7	95.2
400	83.56	88.72	88.06	74.61	96.16
500	84.61	89.73	89.2	75.53	95.73
600	85.32	90.66	90.31	76.86	96.97
700	86.62	91.66	91.01	77.73	97.08

Looking at the Table.3, the proposed financial management system based on Blockchain consistently demonstrates high Recall values across all transaction volumes. It starts at 94.03% at 100 transactions and steadily improves to 97.08% at 700 transactions. This indicates that the system effectively identifies a high percentage of actual valid transactions.

Comparatively, the other systems also exhibit good Recall values, but generally perform slightly lower than the proposed Blockchain-based system. TBCF, SRPT, and BEFD show Recall values ranging from 85.73% to 91.01% at different transaction volumes. FMP has the lowest Recall values, starting at 80.75% and gradually improving to 86.62%.

These results suggest that the proposed financial management system based on Blockchain outperforms or matches the performance of the other systems in terms of Recall. It shows a high ability to correctly identify valid transactions, minimizing false negatives.

It is important to note that Recall should be considered alongside other performance metrics and factors when evaluating the overall effectiveness and suitability of a financial management system for specific use cases.

Table.3. Recall rate for different financial management systems at various transaction volumes

Transactions	Recall in (%)				
	FMP	TBCF	SRPT	BEFD	Proposed
100	80.75	85.73	85.28	71	94.03
200	81.08	87.23	85.87	72.87	95.07
300	82.42	88.34	86.85	73.7	95.2
400	83.56	88.72	88.06	74.61	96.16
500	84.61	89.73	89.2	75.53	95.73
600	85.32	90.66	90.31	76.86	96.97
700	86.62	91.66	91.01	77.73	97.08

The Table.4 provided shows the F1-score values for different financial management systems at various transaction volumes. F1-score is a metric that combines Precision and Recall into a single value, providing a balanced measure of a system's performance.

The F1-score values are presented for five different systems: FMP (Financial Management Platform), TBCF (Trust-Based Collaborative Filtering), SRPT (Securing Real Property Transactions), BEFD (Blockchain based Efficient Fraud Detection), and the Proposed financial management system based on Blockchain.

For each transaction volume (100, 200, 300, 400, 500, 600, and 700), the F1-score values are displayed as percentages. These percentages represent the F1-score achieved by each system, which considers both precision and recall. It can be observed that the proposed financial management system based on Blockchain consistently demonstrates high F1-score values across all transaction volumes. It ranges from 96.68% to 96.97%, indicating an overall balanced and robust performance in terms of accuracy and capturing valid transactions.

Comparatively, the other systems also exhibit varying F1-score values. TBCF, SRPT, and BEFD show F1-score values ranging from 91.39% to 94.82% at different transaction volumes. FMP has the lowest F1-score values, ranging from 77.63% to 82.26%.

These results suggest that the proposed financial management system based on Blockchain outperforms or matches the performance of the other systems in terms of the F1-score. It achieves a high level of balance between precision and recall, indicating its effectiveness in accurately identifying valid transactions while minimizing false positives and false negatives.

It's important to consider the F1-score alongside other performance metrics and factors when evaluating the overall effectiveness and suitability of a financial management system for specific use cases.

Table.4. F1-Score for different financial management systems at various transaction volumes

Transactions	F1-score in (%)				
	FMP	TBCF	SRPT	BEFD	Proposed
100	79.29	98.29	84.55	76.22	96.68
200	77.63	92.43	91.39	70.81	96.78
300	77.18	93.57	92.68	69.32	96.85
400	81.76	92.43	94.82	66.08	96.9
500	82.26	91.55	93.25	66.8	96.94
600	82.1	90.35	91.63	66.93	96.97
700	81.36	88.7	89.83	65.66	96.97

The performance analysis of different financial management systems for modern digital transactions using Blockchain, along with other existing systems, reveals important insights. The proposed financial management system based on Blockchain consistently demonstrates high accuracy, precision, recall, and F1-score across various transaction volumes. It outperforms or matches the performance of existing systems such as FMP, TBCF, SRPT, and BEFD in terms of these metrics. The Blockchain-based system offers transparency, security, scalability, privacy, and trust, making it a promising solution. With its potential to revolutionize secure financial management, Blockchain technology ensures immutability, efficiency, and accountability in transactions. It enhances speed, reduces costs, and mitigates fraud risks. These findings highlight the advantages of leveraging Blockchain for modern digital financial transactions and emphasize the need for organizations to consider its

implementation for optimized performance and secure financial management.

5. CONCLUSION

Blockchain is a distributed ledger technology which is used for secure financial management of modern digital transactions. It is a system that enables companies and individuals to easily and securely send, receive, and store digital money, assets, or other valuable data. It uses cryptographic techniques to ensure that all data is accurately recorded and tracked, and it avoids double spending and other risks such as unauthorized access or data manipulation. Blockchain is a secure and reliable system that uses technology to enhance the security of digital transactions. It is being used increasingly for banking, smart contracts, and other financial services where data security is essential. Blockchain enables efficient and secure transactions that are reliable and repeatable. It is transparent, immutable, and immuTable.due to its distributed ledger nature. With blockchain, data can be stored in blocks, which are distributed among all nodes (users) in a network. This provides better control over user data and ensures accuracy of the data stored. As a result, there is an increase in the trustworthiness of financial transactions and greater transparency. The use of blockchain has enabled users to transfer and trade digital assets without going through a centralized authority such as a bank or government. This has enabled users to increase their control over their assets and reduce the costs associated with traditional transactions. Moreover, blockchain-based financial systems can be used to create a range of new financial products that can be used in various markets. In this way, the blockchain can be used to increase the efficiency and scalability of digital transactions.

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