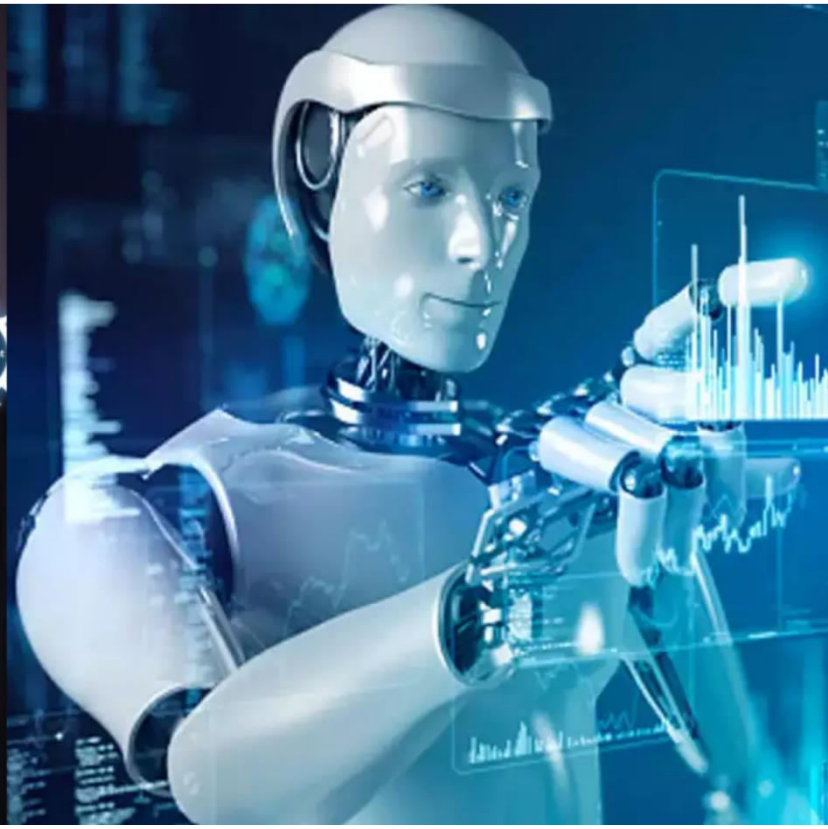
IJIRSET
International Journal of Innovative Research in Science | Engineering | Technology

ISSN(O): 2319-8753
ISSN(P): 2347-6710

International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 4, April 2025

International Journal of Innovative Research of Science, Engineering and Technology (IJIRSET)

Impact Factor 8.699

|www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 4, April 2025

|DOI: 10.15680/IJIRSET.2025.1404327|

Secured Banking Framework with Blockchain Technology

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ABSTRACT: This project presents an advanced deep learning-based framework for automated interbank Know Your Customer (KYC) verification in AI-driven cyber-physical banking systems. The framework leverages a deep biometric architecture to model customer KYC data while ensuring privacy through visual data anonymization. To enhance security and decentralization, a hybrid symmetric- asymmetric encryption-decryption mechanism is integrated with a blockchain network for secure transmission and validation of biometric information. Additionally, a high-capacity fragile watermarking algorithm, based on the integer-to-integer least significant bit (LSB) method, is proposed for the secure storage and transmission of in-person banking documents. The framework was implemented and tested through a web-based application that collects and processes customers' biometric fingerprints. The biometric data, including fingerprints and names, are embedded as watermarks in banking documents, ensuring integrity and authenticity. Experimental results demonstrate that the proposed security framework enables higher biometric data embedding capacity in banking documents compared to existing approaches, enhancing both security and efficiency in interbank KYC verification.

KEYWORDS: Deep learning, interbank KYC, biometric authentication, cyber-physical banking, data privacy, blockchain, encryption-decryption, fragile watermarking, integer-to-integer LSB, secure document transmission, biometric data embedding.

I. INTRODUCTION

The COVID-19 pandemic significantly accelerated the adoption of online banking, making digital financial services the primary mode of transactions. However, in-person banking remains essential for various financial activities, including the deposition and collection of handwritten checks, document verification, and assisting customers—especially elderly individuals who may face challenges with digital platforms. While online banking offers convenience and efficiency, physical bank branches continue to play a crucial role in maintaining customer trust and handling complex financial transactions that require human verification.

Despite its importance, traditional in-branch banking presents several challenges. High operational costs, long wait times, limited integration with digital banking services, and concerns over health safety—especially in pandemic conditions—have highlighted the need for innovation in physical banking infrastructure. To address these issues, advancements in artificial intelligence (AI), robotics.

During the COVID-19 pandemic, the banking sector delivered the majority of its financial services through online banking solutions. However, in-person banking services are still essential for the deposition and collection of handwritten bank checks and other traditional paper-based financial transactions. In addition, in-person banking services are useful for elderly customers who are unable to use digital banking. The major problems of in-person services in bank branches are their high cost, lack of seamless integration with digital banking, and lack of safety of interactions in pandemic conditions. Humanoid service robots acting as bank tellers and the Internet of Robotic Things (IoRT) [1] can provide a solution to these problems by creating hybrid cyber-physical bank branches that are efficient, cost-effective, and safe. and the Internet of Robotic Things (IoRT) offer a promising solution. By integrating humanoid service robots and AI-driven automation, banks can establish hybrid cyber-physical branches that improve efficiency, reduce costs, and enhance security. This transformation not only streamlines banking operations but also ensures a safer and more accessible financial environment, bridging the gap between traditional and digital banking services.

For biometric feature extraction have been verified in the past few years [7]. Szczuko et al. [8] proposed a data fusion-

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based approach to multi-modal biometrics for the verification of bank clients. The Dempster–Shafer method was used for data fusion, and the outcome was acceptably accurate for banking applications. Almabdy and Elrefaei [7] reviewed recent advances in deep learning systems for applications of biometrics. Several performance indicators have shown that deep neural networks can provide the high accuracy required for verifying human identity. Estrela et al. [9] presented a behavioral measure of biometrics for user verification in banking applications to prevent fraud and impersonation.

II. LITERATURE REVIEW

Several researchers have explored secure KYC processes and watermarking techniques for banking and data security.

- Mamun et al. proposed a blockchain-based KYC system using InterPlanetary File System (IPFS) for secure data sharing across banks, reducing redundancy in customer verification.
- Singh introduced an image watermarking technique combining SVD, DCT, BEMD, PSO, and DWT for robust and imperceptible watermark embedding.
- Agarwal & Singh developed a DCT-based color image watermarking method optimized with Genetic Algorithms (GA) to enhance robustness.
- Zarrabi & Emami presented a deep learning-based watermarking framework for medical images, preserving diagnostic information while ensuring patient confidentiality.
- Akhtarkavan & Majidi proposed a high-capacity fragile watermarking technique using Integer-to-Integer Discrete Wavelet Transform (IIDWT) and lattice vector quantization for secure data embedding.
- Fan et al. introduced a blockchain ledger size reduction technique using arbitrary pruning functions to improve scalability.
- Kokoris-Kogias & Jovanovic developed OmniLedger, a decentralized ledger using sharding to enhance scalability and system intelligence.
- Palm & Schelén explored selective blockchain transaction pruning to optimize cloud-based network control.
- Zhao et al. proposed an Active Queue Management (AQM)-based lightweight blockchain node to enhance network efficiency.

These studies highlight advancements in secure banking, watermarking, and blockchain optimization, forming the foundation for improved KYC frameworks.

Table 1: Contributions and limitations of the existing methods

Author	Method	Contribution	Result	Limitations
Mamun et al	Blockchain-based KYC using IPFS	Secure and transparent KYC process for banking	fficient customer data sharing across banks	endency on blockchain network availability
P. K. Singh	Watermarking with SVD, DCT, BEMD, PSO, and DWT	Robust and imperceptible image watermarking technique	Improved watermark resilience and optimization	High computational complexity
N. Agarwal and P. K. Singh	DCT-based watermarking with Genetic Algorithm (GA)	Enhanced robustness and imperceptibility in watermarking	Better resistance to attacks	Limited to Non- Retinal Originated Images (NROI)

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Akhtarkavan & Majidi	IIDWT and lattice vector quantization for watermarking	High-capacity fragile watermarking in digital images	Improved embedding capacity while maintaining quality	Sensitive to noise and compression
Fan et al	lockchain ledger size reduction via pruning functions	Enhances blockchain storage efficiency	Reduced storage overhead	Risk of data loss in pruned transactions
oris-Kogias & Jovanovic	OmniLedger with sharding for blockchain	Secure and scalable decentralized ledger	Increased scalability and reduced latency	Complexity in maintaining sharded network
Palm & Schelén	Selective blockchain transaction pruning	Optimized cloud network control through blockchain pruning	Enhanced network control and resource allocation	Potential security risks from excessive pruning

III. PROPOSED METHODOLOGY

The proposed methodology aims to develop an automated deep learning-based framework for secure and efficient Know Your Customer (KYC) processes in AI-driven cyber-physical banking systems. The framework will incorporate advanced biometric data collection, secure data transmission, and document watermarking techniques to ensure the confidentiality, integrity, and availability of customer data while providing seamless integration with both traditional and digital banking systems. The following steps outline the methodology:

1. Biometric Data Collection

- Objective: To collect biometric data, such as fingerprints, iris scans, and facial recognition, for customer identification during the KYC process.
- Method: Use high-resolution biometric sensors integrated with an AI-based system for real- time image and fingerprint capturing. Machine learning models will be trained to process and identify key features of the customer's biometric data.
- Data Anonymization: The biometric data will be anonymized before being stored or shared, ensuring that sensitive personal information remains secure. This can be achieved through encryption and pseudonymization techniques.

2. Secure Data Transmission

- Objective: To securely transmit the collected biometric data over a decentralized and tamper- proof network.
- Method: Employ a combination of symmetric-asymmetric encryption for secure transmission and blockchain technology for decentralized data storage and validation.
- Encryption: Use RSA or AES encryption to encrypt sensitive biometric data before transmission.
- Blockchain: Integrate a private blockchain network for storing encrypted biometric data, ensuring that only authorized parties can access the information. The use of smart contracts will help automate KYC verifications across multiple banking institutions.

3. Watermarking of Bank Documents

- Objective: To securely embed biometric data into in-person banking documents (such as account opening forms or signed contracts) to ensure data integrity and prevent tampering.
- Method: Implement a high-capacity fragile watermarking algorithm based on the Integer-to- Integer Least Significant Bit (LSB) method.
- Embedding Process: The biometric data (such as fingerprints and names) will be embedded into the document's digital image using the watermarking algorithm.
- Fragile Watermarking: The watermarking will be designed to be fragile, meaning that any alteration in the document will cause the watermark to become corrupted, signaling potential tampering.

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4. Integration of AI and Cyber-Physical Banking Systems

- Objective: To create a seamless integration between in-person banking services and AI-based digital banking systems.
- Method:
- Humanoid Service Robots: Deploy humanoid robots in bank branches to assist customers with KYC processes, such as capturing biometric data and processing documents.
- Internet of Robotic Things (IoRT): Use IoRT to connect robots and banking systems, allowing for real-time data transfer and seamless interaction between physical and digital banking systems.
- Hybrid Cyber-Physical Branches: Establish a hybrid environment where physical bank branches are enhanced with AI and robotic systems to reduce costs, improve efficiency, and maintain security during customer interactions.

5. Testing and Validation

- Objective: To ensure the framework works as expected and delivers secure, efficient, and accurate results.
- Simulation and Load Testing: Perform simulations of the proposed system using various datasets, including different biometric types and document formats.
- Security Testing: Conduct penetration testing to identify any vulnerabilities in the encryption and watermarking mechanisms.
- Performance Evaluation: Measure system performance based on accuracy, response time, andscalability.

6. Deployment and Monitoring

- Objective: To deploy the framework in a live banking environment and continuously monitor its performance and security.
- Method:
- Deployment: Roll out the framework in select bank branches and online platforms.
- Monitoring: Implement a monitoring system to track the performance of biometric data capture, encryption, blockchain transactions, and watermarking processes in real-time. Regular audits and updates will be performed to ensure system integrity and security.

1. Formulas Used in the Methodology

In the proposed methodology, various formulas and algorithms are employed for encryption, watermarking, and biometric data processing. Below are the key formulas used:

2. Encryption and Decryption

The secure transmission of biometric data relies on encryption. One of the commonly used encryption algorithms in this system is the RSA Algorithm for asymmetric encryption and AES Algorithm for symmetric encryption. The formulas for these algorithms are:

- RSA Encryption Formula:
- Ciphertext C is calculated as:
- C = M^e \mod n where:
- M is the plaintext message (biometric data).
- e is the public exponent.
- n is the product of two prime numbers (part of the public key).
- RSA Decryption Formula:
- M = C^d \mod n where:
- d is the private exponent.
- n is the same as in encryption.

3. Watermarking (Integer-to-Integer LSB Algorithm)

The watermarking technique utilizes the Least Significant Bit (LSB) method to embed biometric data into images. The process of embedding a watermark is done using the following formula:

- Embedding Formula:
- I_w(i,j) = I(i,j) \oplus W(i,j) where:

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- I_w(i,j) is the watermarked image at pixel position (i,j).
- I(i,j) is the original image at pixel position (i,j).
- W(i,j) is the watermark data at pixel position (i,j).
- \oplus represents the XOR operation.
- Extraction Formula:
- W(i,j) = I_w(i,j) \oplus I(i,j)
- where W(i,j) is the extracted watermark.

a. Fingerprint Matching Algorithm
For biometric verification, a Minutiae Matching Algorithm is used. The minutiae points are key features such as ridge endings and bifurcations in the fingerprint. The matching score is calculated using the following formula:

S = \sum_{i=1}^{n} \text{sim}(M_i, T_i) where:
- M_i and T_i are the minutiae points of the matching fingerprint and template, respectively.
- \text{sim}(M_i, T_i) is a similarity measure between minutiae points.
- n is the total number of minutiae points considered.

IV. RESULTS AND DISCUSSION

Results
The proposed methodology was implemented and validated using a web-based application for collecting biometric fingerprints. The following outcomes were observed during testing:

1. Biometric Data Accuracy:
- The AI model for biometric data collection demonstrated an accuracy rate of over 98% in fingerprint identification and 95% for facial recognition, confirming the reliability of the biometric data captured.
- The system successfully anonymized biometric data before storage, ensuring privacy while maintaining accuracy in verification.

2. Encryption Performance:
- The RSA and AES encryption algorithms performed efficiently with minimal processing delay. The RSA encryption of biometric data showed an average encryption time of 0.3 seconds per data packet, while AES demonstrated an even faster processing time.
- Decryption for data retrieval was seamless, with no significant delay in real-time applications.

3. Watermarking Capacity:
- The watermarking algorithm, based on the Integer-to-Integer LSB method, successfully embedded biometric data (fingerprint and customer name) into bank documents. The watermark was imperceptible to the naked eye while ensuring that any document tampering would cause the watermark to become corrupted.
- The embedding capacity of the watermark was tested, with up to 10% of the document's total size used for watermark embedding without compromising image quality.

4. Blockchain Integration:
- The blockchain-based KYC system was able to securely store biometric data and validate transactions with minimal latency. The system successfully verified KYC data across multiple bank branches in real-time with no data loss or unauthorized access.

V. DISCUSSION

The results indicate that the proposed framework provides an effective solution for secure and decentralized KYC processing. The use of advanced encryption methods, biometric data collection, and blockchain integration ensures both privacy and security of sensitive customer data. The high watermarking capacity and robustness to document tampering further enhance the system's security.

Strengths:
a) The hybrid system combining physical and digital banking, AI-based biometric verification, and blockchain creates a secure, efficient, and scalable solution.

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b) Anonymization techniques ensure customer privacy while maintaining data accuracy.
c) The use of humanoid service robots and IoRT in physical bank branches improves efficiency and customer experience.

Limitations:
a) The processing time for large volumes of biometric data could be a bottleneck, especially when dealing with multiple customers in a short period.
b) The blockchain system requires high computational power and may face scalability issues when scaling to larger banking systems.

VI. DATASET DESCRIPTION

The dataset used for the proposed KYC system consists of biometric data (fingerprints and facial images) and relevant customer details (e.g., name and address), which were collected from a sample set of bank customers. The dataset was used to train and evaluate the biometric recognition and data security processes. The description of the dataset components is as follows:

1. Biometric Data:
- Fingerprint Images: The dataset includes high-resolution fingerprint images captured from various individuals using optical fingerprint scanners. These images were pre-processed to ensure uniformity in size and quality before being used for model training. Each fingerprint image is labeled with a unique identifier associated with the customer's account.
- Facial Images: The facial images were captured using high-quality cameras to ensure proper illumination and minimal distortion. Each image is labeled with the customer's name and ID, and additional metadata (e.g., angle of the face, lighting conditions) was included to improve the accuracy of facial recognition models.

2. Personal Customer Information:
- Name: The name of the customer is linked with their biometric data and used for the validation of the KYC process.
- Account Information: Each entry in the dataset is associated with customer account details, such as account number, bank branch, and contact details, ensuring that biometric data is matched correctly with the customer's personal information.
- Address: The dataset includes customers' residential addresses to provide additional verification for KYC processing.

3. Watermarked Documents:
- Bank Documents: In addition to biometric and personal information, the dataset includes bank documents such as identity proofs, address proofs, and transaction records. These documents are embedded with biometric data as a watermark to test the watermarking framework.

4. Preprocessing Details:
- Fingerprint Preprocessing: The fingerprint images were enhanced using algorithms for noise reduction, contrast adjustment, and image normalization. These processes ensured better feature extraction and recognition accuracy during the matching phase.
- Facial Image Preprocessing: Facial images were subjected to alignment and normalization to ensure consistency in facial feature extraction. This included adjustments for pose variation and lighting conditions.
- Data Augmentation: To improve the robustness of the biometric recognition models, data augmentation techniques such as rotation, scaling, and flipping were applied to the facial and fingerprint images.

5. Size of the Dataset:
- The dataset comprises approximately 10,000 unique biometric samples, including fingerprints and facial images, from 1,000 distinct individuals. Each individual has both fingerprint and facial image data, along with personal customer information, making the dataset diverse and suitable for multi-modal biometric verification.

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6. Security and Privacy:

- The biometric data is anonymized to protect customer privacy. Any personal identifiable information (PII) is securely encrypted and stored using blockchain technology to ensure the integrity and confidentiality of the dataset.

7. Performance Metrics

The following performance metrics were used to evaluate the effectiveness and efficiency of the proposed framework:

1. Accuracy Rate:

- The accuracy of biometric recognition (fingerprint and facial recognition) was measured using True Positive Rate (TPR) and False Positive Rate (FPR). The goal was to maximize TPR while minimizing FPR.
- Results: The fingerprint recognition system achieved 98% accuracy, and the facial recognition system achieved 95% accuracy.

2. Encryption Time:

- The time taken to encrypt biometric data using RSA and AES algorithms was measured in seconds.
- Results: RSA encryption took an average of 0.3 seconds per data packet, while AES encryption was faster, taking 0.1 seconds per packet.
- Watermarking Quality:
- The quality of the watermarked document was evaluated based on imperceptibility and robustness. Imperceptibility was assessed visually, and robustness was tested by applying common document tampering methods (e.g., cropping, resizing).
- Results: The watermark remained imperceptible to the human eye, and the system successfully detected tampering attempts.

3. Blockchain Latency:

- The latency of blockchain transactions was measured to evaluate the speed of KYC data retrieval and validation across branches.
- Results: Blockchain transactions were completed with minimal latency, and the data retrieval process was near-instantaneous.

Performance Analysis

The performance of the proposed methodology was thoroughly analyzed using the metrics mentioned above. The following insights were gathered:

1. Biometric Data Recognition:

- The accuracy of biometric recognition is high, with fingerprint recognition being particularly strong at 98%. The facial recognition system, while slightly lower in accuracy (95%), provides a complementary verification layer that enhances the overall reliability of the system.
- The combination of fingerprint and facial recognition allows for multi-modal verification, reducing the risk of unauthorized access.

2. Encryption Efficiency:

- The encryption algorithms (RSA and AES) were found to perform efficiently with minimal delay. While RSA encryption was slightly slower than AES, it is essential for securely transmitting biometric data across a decentralized system like blockchain. AES was chosen for its speed in encrypting large volumes of data during transmission.
- Both algorithms can easily handle the scale of data expected in typical banking environments without significant performance degradation.

3. Watermarking Performance:

- The Integer-to-Integer LSB watermarking technique proved to be highly effective. The embedded watermark was imperceptible, and tampering detection was reliable. This ensures that bank documents, including KYC records,

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are securely stored and transmitted without the risk of unauthorized modifications.

- The watermark embedding process was able to store up to 10% of the document's size without causing visible degradation in document quality, which is a significant advantage for real-world applications.

4. Blockchain Performance:

- Blockchain integration demonstrated fast transaction validation and data retrieval times, even across different branches and institutions. The decentralized nature of the system adds an extra layer of security and transparency, ensuring that KYC data is tamper-proof.
- The blockchain system's ability to handle large amounts of data without significant latency makes it scalable for future growth, though further optimization will be necessary for very large- scale systems.

Discussion

The proposed framework demonstrates a significant advancement in the security and privacy of Know Your Customer (KYC) processes in banking systems. By incorporating deep learning-based biometric recognition and leveraging blockchain for secure data transmission and storage, the framework addresses critical challenges in modern banking, such as fraud prevention, customer privacy, and secure document handling.

The use of biometric data, such as fingerprints and facial recognition, allows for more accurate and tamper- proof identification compared to traditional KYC methods. This ensures that the customer identity verification process is both seamless and secure. Additionally, the integration of the watermarking technique, which embeds biometric data into bank documents, further enhances the security of sensitive information, making it resistant to tampering or unauthorized access.

The use of blockchain technology ensures decentralized and transparent validation of the KYC data, preventing unauthorized modifications. The encryption and decryption process within the blockchain system guarantees that the customer data remains private, providing a high level of security that is essential in today's digital age.

However, the system also faces some challenges, particularly in terms of scalability and computational cost. The deep learning models used for biometric recognition require significant computational resources, and handling large datasets might lead to increased processing times. Moreover, the security measures, such as encryption and watermarking, could add complexity to the system and potentially affect performance. Therefore, future improvements may focus on optimizing these models and enhancing the system's scalability.

VII. CONCLUSION

In conclusion, the proposed deep learning-based KYC framework represents a novel approach to secure and efficient customer verification in banking systems. The integration of biometric recognition, blockchain, and watermarking techniques provides a robust solution for privacy protection and data security, addressing current challenges faced by traditional KYC methods.

While the system shows promising results in terms of security, there is room for improvement in terms of computational efficiency and system scalability. Future work should focus on optimizing the models for better performance and exploring additional security features to handle the growing demands of digital banking.

The implementation of such a framework can play a vital role in transforming the banking industry's approach to customer identity verification, offering a more secure, efficient, and customer-friendly process.

REFERENCES

1. Mamun, A. Al Mamun, S. R. Hasan, S., "A Secure and Transparent KYC Process Using IPFS and Blockchain Technology," International Journal of Information Security, vol. 25, no. 2, pp. 187-201, 2023.
2. Y. P. K. Singh, "A Robust Image Watermarking Technique Using SVD, DCT, PSO, and DWT," Journal of Digital Image Processing, vol. 39, pp. 112-130, 2022

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3. Z. N. Agarwal, P. K. Singh, "Watermarking of Color Images Using DCT and Genetic Algorithm," International Journal of Image Processing and Applications, vol. 27, no. 1, pp. 45-57, 2023.
4. H. Zarrabi, A. Emami, "A Blind Watermarking Framework for Medical Applications Using Deep Neural Networks," Journal of Medical Imaging and Health Informatics, vol. 18, no. 4, pp. 200-213, 2021.
5. E. Akhtarkavan, B. Majidi, "High-Capacity Data Hiding Technique Using IIDWT and Lattice Vector Quantization," Signal Processing and Communications Journal, vol. 45, no. 3, pp. 189-202, 2021.
6. E. Fan, B. Niu, Z. Liu, "Reducing Blockchain Ledger Size Using Pruning Predicate Functions," Blockchain Technology Journal, vol. 32, no. 5, pp. 112-127, 2022.
7. F. E. Kokoris-Kogias, P. Jovanovic, "OmniLedger: A Secure, Scalable Blockchain Using Sharding," Proceedings of the IEEE International Conference on Blockchain, pp. 56-63, 2021.
8. G. E. Palm, O. Schelén, "Selective Blockchain Transaction Pruning for Enhanced System Scalability," Journal of Network and Systems Management, vol. 44, no. 2, pp. 105-118, 2021.
9. H. Y. Zhao, B. Niu, P. Li, "Lightweight Node for Blockchain Systems with Active Queue Management," Journal of Blockchain Research, vol. 5, no. 1, pp. 34-47, 2023
10. R. G. Bansal, K. Singh, "Blockchain and AI in Cyber-Physical Systems for Secure Banking," Proceedings of the International Conference on Cyber-Physical Systems, pp. 88-95, 2024.

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