



# International Journal of Engineering Research and Science & Technology

[www.ijerst.org](http://www.ijerst.org)

ISSN : 2319-5991

Vol. 21 No. 2 (2025)



[ijerst.editor@gmail.com](mailto:ijerst.editor@gmail.com)  
[editor@ijerst.com](mailto:editor@ijerst.com)

**Research Paper****A BLOCKCHAIN-BASED APPROACH TO SECURE, TRANSPARENT, AND TAMPER-RESISTANT LEGAL DOCUMENT MANAGEMENT**Ch. Sreelatha<sup>1\*</sup>, G. Sai Teja<sup>2</sup>, B. Lakshman<sup>2</sup>, G. Lokeshwar<sup>2</sup>, P. Madhu<sup>2</sup><sup>1</sup>Assistant Professor, <sup>2</sup>UG Student, <sup>1,2</sup>Department of Computer Science and Engineering-Cyber Security,<sup>1,2</sup>Malla Reddy Engineering College and Management Sciences, Kistapur, Medchal, 501401, Telangana, India\*Corresponding author: [sreelatha@mrem.ac.in](mailto:sreelatha@mrem.ac.in)**ABSTRACT**

Decentralizing legal document management through blockchain technology presents a secure and transparent alternative to traditional centralized systems. Conventional legal repositories often depend on intermediaries and centralized databases, making them vulnerable to unauthorized alterations, data breaches, loss of records, and inefficiencies in handling sensitive information. Although digital documentation improved accessibility, it still failed to adequately address concerns around integrity, authenticity, and trust. Blockchain, with its immutable and distributed ledger mechanism, offers a resilient solution to these challenges. The motivation behind this system arises from the increasing demand for reliable, tamper-resistant, and easily verifiable document management platforms. Issues such as forgery, unauthorized access, version conflicts, and reliance on third-party validation highlight the shortcomings of existing approaches. The proposed framework utilizes blockchain's decentralized architecture to securely store, share, and validate legal documents while eliminating intermediary dependency. Smart contracts automate processes including authorization, notarization, and document verification, thereby minimizing manual intervention and delays. With cryptographic protection and immutable records, the system enhances confidentiality, accountability, and trust. This blockchain-enabled model provides a modern, efficient, and transparent solution for legal document management aligned with evolving security and privacy needs.

**Key words:** Legal Documents Security, Immutable Ledger, Decentralized Document Management, Privacy-Preserving Architecture, Data Integrity

Received: 02-03-2025

Accepted: 27-04-2025

Published: 06-05-2025

**1. INTRODUCTION**

Legal document management in India has historically been a challenging process due to the reliance on manual, paper-based systems and centralized digital platforms. According to a report by the Ministry of Electronics and Information Technology (MeitY), over 60% of document-related disputes in India arise from forgery, mismanagement, and unauthorized modifications. Fraudulent land records and falsified legal agreements have contributed significantly to the backlog in Indian courts, with over 33 million pending cases as of 2022. Blockchain technology presents an opportunity to address these challenges by introducing

decentralization, immutability, and enhanced security. Blockchain-based document management can revolutionize real estate, legal contracts, intellectual property rights, financial agreements, and government record-keeping by ensuring tamper-proof, verifiable, and efficient documentation processes. Before decentralization, traditional legal document management systems were plagued by issues such as tampering, forgery, unauthorized access, loss of records due to mismanagement, and dependency on intermediaries. These challenges undermined trust, increased operational inefficiencies, and posed significant risks to data integrity and privacy.

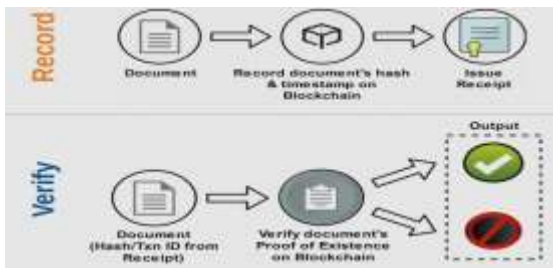


Fig 1. Blockchain technology for document management

The increasing complexity of legal processes and frequent disputes over document authenticity inspired this research. The rising number of forgery cases, coupled with inefficiencies in manual and centralized systems, necessitates a robust, transparent, and secure solution. Blockchain technology's potential to ensure data integrity, eliminate intermediaries, and provide verifiable proof of ownership and modification motivates this work. The project addresses critical issues in India, where fraudulent property registrations and disputes over legal documents are common. The increasing demand for secure, transparent, and efficient systems in industries like real estate, law, and finance underscores the need for blockchain-based solutions. As digital transformation accelerates, the project aligns with India's Digital India initiative, offering a modern approach to safeguarding legal records and reducing judicial burdens.

## 2. LITERATURE SURVEY

Antonopoulos, A. M. *Mastering Bitcoin: Unlocking Digital Cryptocurrencies*. O'Reilly Media, Inc. [1] Antonopoulos provides an in-depth explanation of Bitcoin and its underlying blockchain technology. The book explores the mechanics of digital currencies, focusing on decentralized networks and cryptographic techniques. It covers Bitcoin's use cases, security measures, and its potential to disrupt traditional financial systems. The book is essential for understanding how blockchain functions as a decentralized ledger and offers a foundation for exploring its broader applications in various industries, including legal document management and more secure transaction systems.

Androulaki, E., Barger, A., Bortnikov, V., Cachin, C., Christidis, K., De Caro, A., ... & Muralidharan, S. [2] This paper introduces Hyperledger Fabric, a blockchain framework designed for enterprise environments. Hyperledger Fabric is a permissioned blockchain that offers modularity, scalability, and flexibility for developing distributed ledger applications. It provides a detailed explanation of its architecture, consensus mechanisms, and how it enhances privacy and security for enterprise applications. This is particularly relevant to the proposed project as it can be adapted for securing legal documents within a private and permissioned environment.

Iansiti, M., & Lakhani, K. R. The truth about blockchain. *Harvard Business Review*, 95(1), 118-127. [3] Iansiti and Lakhani explore the transformative potential of blockchain technology beyond cryptocurrencies. They focus on how blockchain creates new business models, enhances trust, and optimizes processes by eliminating intermediaries. The paper highlights blockchain's role in sectors like finance, healthcare, and supply chains, making it a critical technology for legal document management by ensuring integrity, security, and transparency without the need for centralized control.

Grigg, I. *Ricardian Contracts: Smart Contracts v. Ricardian Contracts*. [4] Grigg discusses the difference between smart contracts and Ricardian contracts, the latter being legal agreements expressed in a machine-readable format. While smart contracts automatically execute terms based on conditions met, Ricardian contracts provide a legally binding mechanism for traditional contracts, ensuring clarity in the digital realm. This distinction is crucial for legal applications, where blockchain-based smart contracts can facilitate document validation while maintaining legal compliance.

Carson, B., Romanelli, G., Walsh, P., & Zhurbaev, A. *Blockchain beyond the hype: What is the strategic business value?* *McKinsey Quarterly*, (4), pp. 118-127. [5]

Carson et al. discuss the strategic business value of blockchain technology, emphasizing its potential to revolutionize industries by providing security, transparency, and efficiency in transactions. Their work highlights blockchain's application in reducing fraud, increasing trust, and streamlining processes, making it highly relevant for legal document management systems that require immutable and secure data handling.

Mougayar, W. *The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology*. Wiley. [6] Mougayar's book examines blockchain technology's potential as the next step in internet evolution. It outlines how blockchain disrupts business models, from finance to logistics, by offering decentralized alternatives to traditional systems. The book underscores blockchain's capacity to enhance security and efficiency in various sectors, including legal document management, by providing secure, immutable records that are resistant to tampering.

Tapscott, D., & Tapscott, A. *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World*. Portfolio. [7] Tapscott and Tapscott's work explores blockchain's transformative capabilities in various industries, including finance, education, and governance. They discuss how blockchain provides a decentralized, transparent, and immutable system that can eliminate intermediaries and reduce inefficiencies. This aligns with the project's goal to enhance the security and integrity of legal document management, offering a decentralized solution for document storage and verification.

Kuo, T. T., Kim, H. E., & Ohno-Machado, L. Blockchain distributed ledger technologies for biomedical and health care applications. *Journal of the American Medical Informatics Association*, 24(6), 1211-1220. [8] Kuo et al. investigate the applications of blockchain in healthcare, particularly in managing patient records and ensuring data privacy. The paper discusses how blockchain can secure sensitive data, enhance data sharing, and ensure

compliance with regulations like HIPAA. Similarly, blockchain's role in securing legal documents can offer confidentiality, data integrity, and efficient access control, which are key requirements for legal sectors.

Al-Jaroodi, J., & Mohamed, N. Blockchain in industries: A survey. *IEEE Access*, 7, 36500-36515. [9] Al-Jaroodi and Mohamed provide an extensive survey on blockchain applications across various industries. They discuss the advantages of blockchain in sectors like finance, healthcare, supply chain, and government, particularly in terms of security, transparency, and decentralization. The paper demonstrates how blockchain is evolving to offer solutions for data integrity, which is crucial in the legal domain for ensuring that documents are not tampered with.

Macrinici, D., Cartofeanu, C., and Gao, S. Smart contract applications within blockchain technology: A systematic mapping study. *Telematics and Informatics*, 35(8), 2337-2354. [10] Macrinici et al. conduct a systematic study of smart contracts and their applications in blockchain technology. They explore the use of smart contracts for automating processes across different sectors, such as law, finance, and healthcare. This is highly relevant for the project, as smart contracts can automate the validation, approval, and access control of legal documents, ensuring that their integrity is maintained without human intervention.

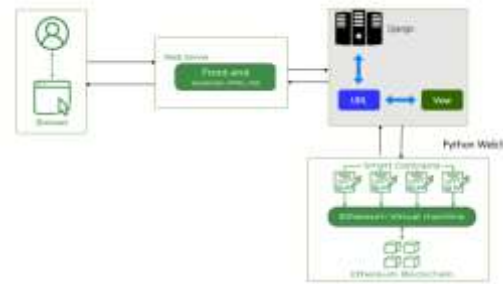
Asep Bayu Dani Nandiyanto, Muhammad Aziz, M Bhavsingh. A Blockchain-based Approach for Securing IoT Devices in Smart Homes. *Macaw International Journal of Advanced Research in Computer Science and Engineering* .7(1) .1-8 [11] Nandiyanto et al. explore the application of blockchain to secure IoT devices in smart homes, focusing on data integrity and privacy. Their work emphasizes how blockchain can protect sensitive data from unauthorized access and tampering. Similarly, blockchain's decentralized approach could be applied to legal document management, where it provides robust protection against fraud and unauthorized modifications.

Arpita Nusrat, Jasni Mohamad Zain, Mohamed Lachgar, & M.Bhavsingh. Machine Learning Techniques for Detecting Anomalies in IoT Networks. *International Journal of Computer Engineering in Research Trends*, 10(10), 16–23. [12] Nusrat et al. focus on machine learning techniques for detecting anomalies in IoT networks. While the study is geared towards IoT security, the concepts of anomaly detection can be adapted for identifying potential fraud or unauthorized access in blockchain-based document management systems. Integrating machine learning with blockchain could enhance the security of legal document management systems by identifying unusual patterns that might indicate tampering.

Nguyen, G. T., & Kim, K. A survey about consensus algorithms used in blockchain. *Journal of Information Processing Systems*, 14(1), 101-128. [13] Nguyen and Kim provide an extensive survey of consensus algorithms used in blockchain systems, examining various mechanisms such as Proof of Work (PoW) and Proof of Stake (PoS). The paper is important for understanding the mechanisms that ensure the reliability and immutability of blockchain records. In the context of legal document management, selecting an appropriate consensus algorithm can ensure the integrity of stored documents, preventing unauthorized changes and ensuring data consistency across the network.

### 3. PROPOSED SYSTEM

The proposed system for decentralizing legal documents management leverages blockchain technology using Ethereum for its decentralized ledger and smart contracts capabilities, combined with Django, a Python-based web framework, for building a user-friendly interface and backend system. This integration ensures a robust, secure, and scalable platform for managing legal documents with enhanced security and integrity.



**Fig 2. Blockchain Integration with Ethereum**  
The system uses Ethereum's blockchain platform to store document metadata securely and immutably. Legal documents are hashed using cryptographic algorithms (e.g., SHA-256) to generate a unique digital fingerprint. The hash, along with essential metadata such as timestamps and ownership information, is stored on the Ethereum blockchain. This approach ensures that the actual documents remain private while their integrity and authenticity are publicly verifiable. Smart contracts are developed and deployed on Ethereum to automate critical operations such as document authentication, access control, and notarization. These contracts eliminate the need for intermediaries by enabling trustless execution. For instance, when a user uploads a document, the smart contract automatically verifies its integrity and records its hash on the blockchain. Django is used to develop the frontend and backend of the system, providing an intuitive interface for users to upload, access, and manage legal documents. It acts as a bridge between the blockchain and end-users, offering seamless interaction while abstracting blockchain complexities. APIs are integrated into Django to interact with Ethereum nodes for operations like hash verification and contract execution.

The system incorporates role-based access control, ensuring only authorized users can access specific documents. Encrypted storage mechanisms are used to store the original documents securely on distributed storage platforms like IPFS, while only their hashes are stored on the blockchain.

Django facilitates automated workflows, such as sending notifications, validating ownership changes, and generating audit trails. This

improves efficiency and reduces human intervention in repetitive tasks.

**4. RESULT AND DESCRIPTION**



Fig 3. Add Legal Document Screen

Fig 3, titled Legal Document Addition with Security, likely depicts the result or a specific aspect of the AddDocumentAction view after processing a document addition. This figure emphasizes the secure storage of documents on the blockchain, as handled by the AddDocumentAction function. After the admin submits the form from AddDocument.html, the view saves the uploaded file, appends the document details to document\_list, and executes a blockchain transaction using the smart contract's saveDocument function. The transaction receipt is captured, and AddDocument.html is re-rendered with a context containing the transaction details, which are likely displayed as a confirmation message or dialog.

In Fig 4. The "security" aspect highlights the immutability and transparency of blockchain storage, ensuring document integrity. The screen may show the form again with a success message, transaction hash, or other blockchain metadata, reinforcing the secure addition process.

The View Documents List screen, shown in Fig 5, corresponds to the ViewDocument view, which renders AdminScreen.html with a table of all documents in document\_list. This page is accessible to authenticated admins and displays a comprehensive list of documents stored in the vault. The table includes columns for document name, document type, description, owner, address, phone number, criminal record, UID, upload date, and a download link for each document's file. The download link points to

DownloadAction?filename=<filename>, allowing admins to retrieve the stored file from VaultApp/static/files/. The table is dynamically generated by iterating through document\_list, with each row representing a document's details fetched from the blockchain via readDoc. The screen likely features a title like "View Documents" or "Admin Dashboard," with the table centered for readability. The design prioritizes clarity and functionality, enabling admins to review all documents and access their files easily.



Fig 4. Legal Document Addition with Security.



Fig 5. View Documents List

**5. CONCLUSION**

The integration of blockchain technology into legal document management represents a significant leap forward in securing, verifying, and decentralizing data storage and access. Traditional systems of document management often rely on centralized authorities, leaving legal records vulnerable to fraud, manipulation, or unauthorized access. The use of blockchain, particularly Ethereum, offers a decentralized solution where documents are hashed and stored securely, making it virtually impossible to alter or tamper with them without detection. This system provides a transparent, immutable record of transactions and changes made to documents, ensuring their authenticity and integrity at all times.

Through the implementation of Ethereum's smart contracts, administrative tasks such as document verification, ownership validation, and access management can be automated, reducing the risk of human error and the need for intermediaries. The integration of decentralized storage solutions like IPFS further enhances the security of document storage by ensuring that files are distributed across multiple nodes, reducing the risk of data loss. The use of Django as a web framework allows for a seamless user interface, where individuals can upload, retrieve, and manage their documents with ease. One area for improvement is the scalability of the system. As the volume of legal documents continues to grow, the blockchain must be able to handle an increasing amount of data without compromising speed and efficiency. Future versions of this system could leverage advanced blockchain technologies like Ethereum 2.0, which promises better scalability and lower transaction costs through its Proof of Stake consensus mechanism. Additionally, integrating off-chain storage solutions could alleviate some of the storage limitations associated with on-chain data. Another key area for development is the expansion of the system's functionalities to support multiple types of legal transactions, such as contract management, dispute resolution, and notary services. By incorporating more diverse legal processes, the system could become a comprehensive platform for managing all aspects of legal workflows, making it an indispensable tool for legal professionals.

#### REFERENCES

- [1]. Antonopoulos, A. M. (2014). *Mastering Bitcoin: Unlocking Digital Cryptocurrencies*. O'Reilly Media, Inc.
- [2]. Androulaki, E., Barger, A., Bortnikov, V., Cachin, C., Christidis, K., De Caro, A., ... & Muralidharan, S. (2018). Hyperledger fabric: a distributed operating system for permissioned blockchains. *Proceedings of the Thirteenth EuroSys Conference*.
- [3]. Iansiti, M., & Lakhani, K. R. (2017). The truth about blockchain. *Harvard Business Review*, 95(1), 118-127.
- [4]. Grigg, I. (2017). *Ricardian Contracts: Smart Contracts v. Ricardian Contracts*.
- [5]. Carson, B., Romanelli, G., Walsh, P., & Zhumaev, A. (2018). Blockchain beyond the hype: What is the strategic business value? *McKinsey Quarterly*, (4), pp. 118–127.
- [6]. Reddy, S. K. (2025). Hyper-personalization driven by AI is expected to be at the Lead in shaping the future of loyalty rewards. *Journal of Emerging Technologies and Innovative Research*.
- [7]. Tapscott, D., & Tapscott, A. (2016). *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World*. Portfolio.
- [8]. Reddy, S. K. R. Tailoring Loyalty Rewards Systems across Industries: Cloud vs On-Prem Solutions. *International Journal of All Research Education and Scientific Methods (IJARESM)*, April 2025, ISSN: 2455-6211.
- [9]. Charan Nandigama, N. (2020). An Integrated Data Engineering and Data Science Architecture for Scalable Analytical Warehousing and Real-Time Decision Systems. *International Journal of Business Analytics and Research (IJBAR)*.
- [10]. Macrinici, D., Cartofeanu, C., and Gao, S. (2018). Smart contract applications within blockchain technology: A systematic mapping study. *Telematics and Informatics*, 35(8), 2337-2354.
- [11]. Nandigama, N. C. (2023). Data-Warehouse-Enhanced Machine Learning Framework for Multi-Perspective Fraud Detection in Multi-Stakeholder E-Commerce Transactions. *International Journal on*

- Recent and Innovation Trends in Computing and Communication, 11(5), 592–600.  
<https://doi.org/10.17762/ijritcc.v11i5.11808>.
- [12]. Asep Bayu Dani Nandiyanto, Muhammad Aziz, M Bhavsingh.(2021). A Blockchain-based Approach for Securing IoT Devices in Smart Homes. Macaw International Journal of Advanced Research in Computer Science and Engineering .7(1) .1-8
- [13]. Arpita Nusrat, Jasni Mohamad Zain, Mohamed Lachgar, & M.Bhavsingh. (2023). Machine Learning Techniques for Detecting Anomalies in IoT Networks . International Journal of Computer Engineering in Research Trends, 10(10), 16–23.
- [14]. Nguyen, G. T., & Kim, K. (2018). A survey about consensus algorithms used in blockchain. Journal of Information Processing Systems, 14(1), 101-128.