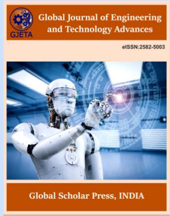
Global Journal of Engineering and Technology Advances

eISSN: 2582-5003

Cross Ref DOI: 10.30574/gjeta

Journal homepage: https://gjeta.com/



(Research Article)

Check for updates

Development of a blockchain-based organizational knowledge management system

Oluwasefumi Busola Famodimu [1], Adesoji Adedeji Adegbola [2, *], Olatilewa Raliat Onikoyi [1], Aderayo Maureen Adegbenro [1] and Oluwatoni Peter Adelegan [1]

[1] *Department of Computer Science, Babcock University, Ilishan, Nigeria.*

[2] *Department of Software Engineering, Babcock University, Ilishan, Nigeria.*

Global Journal of Engineering and Technology Advances, 2025, 24(01), 028-037

Publication history: Received on 12 April 2025; revised on 01 June 2025; accepted on 04 June 2025

Article DOI: https://doi.org/10.30574/gjeta.2025.24.1.0177

Abstract

As organizations encounter rapid and exponential growth in their knowledge assets, the effective management of these essential resources has become increasingly critical. Traditional knowledge management systems often prove inadequate in terms of both capacity and functionality, limiting their ability to sufficiently support the organization's knowledge needs. To overcome these limitations, this study explores the application of blockchain technology in developing a robust knowledge management system that emphasizes security, transparency, and the efficient handling of organizational knowledge assets. By integrating blockchain, we aim to enhance the integrity and accessibility of knowledge, ensuring that it continues to serve as a valuable resource within the organization. In the course of developing this system, smart contracts were implemented to automate key functions, such as user verification, data validation, and access control. This approach reduces dependence on intermediaries, mitigates the risks of data tampering, and prevents unauthorized access, ultimately fostering a more secure and efficient environment for managing organizational knowledge.

Keywords: Knowledge Management; System; Blockchain; Smart Contracts; Knowledge Asset

1. Introduction

The growing complexity and dynamism of organizational environments have heightened the need for effective knowledge management systems (KMS) to facilitate decision-making, innovation, and the efficient use of resources within organizations. Knowledge management involves capturing, distributing, and effectively using organizational knowledge (Davenport and Prusak, 1998). However, traditional knowledge management systems often face challenges ensuring data security, preventing unauthorized access, and promoting transparency and accountability in exchanging knowledge. The advent of blockchain technology, known for its decentralized, immutable, and secure features, presents an opportunity to address these limitations by providing a more robust and transparent framework for managing organizational knowledge (Narayanan et al., 2016).

Blockchain is a distributed ledger technology that allows for the recording of transactions in a secure, transparent, and tamper-resistant way. In organizational knowledge management, blockchain can offer several advantages, such as providing a transparent and auditable history of knowledge transactions and ownership (Tapscott and Tapscott, 2016). Using smart contracts on the blockchain can also automate various processes within KMS, ensuring that knowledge is shared per pre-defined rules and protocols and reducing human errors and biases (Christidis and Devetsikiotis, 2016). Moreover, blockchain's decentralized nature eliminates the need for a central authority, enhancing users' privacy and control over their knowledge contributions.

* Corresponding author: Adesoji Adegbola.

In recent years, blockchain application to knowledge management systems has gained significant attention. Organizations are exploring blockchain's potential to revolutionize how knowledge is stored, accessed, and shared within and across organizations (Zheng et al., 2017). One of the key benefits of a blockchain-based KMS is its ability to enhance trust among stakeholders by providing a secure and immutable record of knowledge transactions. This blockchain-based KMS can foster a collaborative environment where employees are more willing to share valuable insights, knowing their intellectual contributions are securely documented (Xie et al., 2019). Furthermore, blockchain can ensure that knowledge is only accessible to authorized individuals, thus minimizing the risk of data breaches and information leaks.

However, integrating blockchain into knowledge management systems presents several challenges despite its potential. Issues such as scalability, the energy consumption of blockchain networks, and the complexity of implementing blockchain in existing organizational frameworks require careful consideration (Crosby et al., 2016). Moreover, organizations must address concerns about user adoption, training, and the cultural shift required to implement blockchain-based KMS successfully. Therefore, developing a blockchain-based organizational knowledge management system necessitates a comprehensive understanding of blockchain technology and knowledge management practices and the ability to design solutions that align with organizational goals and user needs. This study aims to explore these challenges by developing a knowledge management system with blockchain technology.

2. Literature review

Knowledge Management (KM) refers to the systematic process of creating, sharing, using, and managing knowledge and information within an organization (Davenport and Prusak, 1998). It involves tacit knowledge (personal, experiential knowledge) and explicit knowledge (formal, documented knowledge). The key components of KM include knowledge creation, storage, sharing, and utilization (Nonaka and Takeuchi, 1995). Effective KM systems aim to ensure that the proper knowledge is available to the right people at the right time, thereby enhancing decision-making and operational efficiency (Alavi and Leidner, 2001). KM frameworks also emphasize collaboration and learning within organizations, enabling the transformation of knowledge into a competitive advantage.

Knowledge Management (KM) is pivotal in enhancing organizational performance by optimizing knowledge use, leading to improved decision-making, innovation, and operational efficiency (Hansen, Nohria, and Tierney, 1999). By capturing and sharing knowledge, organizations can avoid duplicating efforts, ensuring valuable insights and best practices are widely accessible across teams (Cohen and Levinthal, 1990). Additionally, KM systems foster organizational learning, essential for adapting to changes in the market and driving innovation (Argote, 1999). In fast-paced industries, KM helps facilitate quick access to critical knowledge, supporting faster and more informed decision-making.

Traditional KM systems often rely on centralized databases and content management systems (CMS), such as Document Management Systems (DMS) and Enterprise Resource Planning (ERP) platforms, to store and disseminate knowledge (Laudon and Laudon, 2016). While these systems enable organizations to consolidate and share knowledge, they often struggle to address the dynamic and collaborative nature of modern knowledge sharing. Centralized systems also face significant security, access control, and transparency challenges, as they are vulnerable to breaches and lack effective tracking of knowledge usage (Bekkema et al., 2006; Jones, 2009). These challenges highlight the need for innovative, decentralized KM approaches, such as blockchain technology, which offers a more secure, transparent, and flexible solution to meet the evolving needs of organizations (Roberts, 2000; Tapscott and Tapscott, 2016).

2.1. Blockchain Technology Overview

Blockchain technology is a decentralized and distributed ledger system that allows multiple parties to securely record and verify transactions across a network of computers without a central authority (Nakamoto, 2008). The fundamental principles behind blockchain include decentralization, immutability, and consensus mechanisms. Decentralization ensures that no single entity controls the network, reducing the risk of fraud and manipulation (Tapscott and Tapscott, 2016). Immutability means that once a transaction is recorded on the blockchain, it cannot be altered or deleted, providing a permanent and verifiable history of actions (Buterin, 2014). Consensus mechanisms, such as Proof of Work (PoW) and Proof of Stake (PoS), enable participants in the network to agree on the validity of transactions, ensuring the integrity of the system (Narayanan et al., 2016).

Blockchain's key features, including security, transparency, and traceability, make it an ideal technology for knowledge management (KM) systems. Using cryptographic techniques, blockchain protects data stored in the ledger, preventing unauthorized tampering (Crosby et al., 2016). Transparency ensures all participants can access the same information, fostering trust and accountability in knowledge sharing (Peters and Panayi, 2016). Moreover, blockchain's immutability allows every action to be tracked and audited, essential for monitoring organization knowledge flow and usage (Tapscott and Tapscott, 2016). These characteristics provide organizations with a secure and efficient way to manage knowledge, particularly in sectors where data integrity and reliability are crucial.

Blockchain networks come in various types, including public, private, permissioned, and permissionless systems, each suited to different applications. Public blockchains, such as Bitcoin and Ethereum, are permissionless, allowing anyone to join and participate, offering high transparency and decentralization (Nakamoto, 2008). In contrast, private blockchains are permissioned, where access and transaction validation are controlled by a central authority, making them ideal for environments requiring more control and confidentiality (Crosby et al., 2016). Blockchain's potential spans many sectors, from finance, where it enhances security and reduces transaction costs (Catalini and Gans, 2016), to supply chain management, which benefits from enhanced traceability and fraud reduction (Kshetri, 2018). In healthcare, blockchain ensures secure patient data management and privacy, demonstrating its versatility across industries that require secure, transparent, and traceable data (Mettler, 2016).

2.2. Blockchain Applications in Knowledge Management

Blockchain enhances Knowledge Management Systems (KMS) by offering transparency and accountability through immutable records. Its distributed ledger ensures that all participants have access to the same information, improving the transparency of knowledge-sharing processes (Peters and Panayi, 2016). The immutability feature allows every action to be permanently recorded, creating an audit trail that tracks knowledge sharing and access (Tapscott and Tapscott, 2016). This transparency fosters trust among stakeholders and ensures that knowledge is used responsibly. Blockchain also facilitates secure collaboration by enabling only authorized parties to access sensitive information, reducing risks like data breaches and unauthorized access (Crosby et al., 2016). Its cryptographic security measures ensure that all interactions remain secure and private, benefiting organizations collaborating across departments or with external partners (Narayanan et al., 2016).

Additionally, blockchain automates knowledge workflows using smart contracts, which execute predefined actions like knowledge validation and approval without manual intervention (Buterin, 2014). This automation streamlines knowledge sharing by validating and approving relevant contributions in real time (Tapscott and Tapscott, 2016), reducing administrative burdens and errors. Blockchain's decentralized nature makes it ideal for creating robust, secure, and scalable knowledge repositories resistant to censorship and data loss (Narayanan et al., 2016). Case studies show blockchain's potential in sectors like healthcare, where it secures patient records (Mettler, 2016), and education, which manages academic certifications (Zohar et al., 2020). Companies like IBM and Maersk have integrated blockchain into supply chain systems to enhance transparency and traceability (Kshetri, 2018). These examples illustrate blockchain's transformative role in improving security, transparency, and collaboration in KMS.

2.3. Blockchain-Based Knowledge Management System Design

The architecture of a blockchain-based Knowledge Management System (KMS) incorporates key elements distinct from traditional systems. These include decentralized networks utilizing distributed ledgers to securely store and manage knowledge resources. The major components are:

- Blockchain Ledger: A secure, immutable record-keeping system for storing knowledge assets (Tapscott and Tapscott, 2016).
- Smart Contracts: Automate KM tasks such as knowledge validation, access control, and rights management (Buterin, 2014).
- Nodes: Distributed participants that validate and store knowledge transactions, ensuring decentralization (Crosby et al., 2016).
- Consensus Mechanisms: Ensures the system's integrity by agreeing on the knowledge's state (Narayanan et al., 2016).

These components enable a decentralized, secure, and transparent approach to managing knowledge in organizations.

Integrating blockchain into traditional Knowledge Management frameworks presents challenges but also offers substantial benefits. Blockchain can significantly enhance data security, improve traceability, and enable decentralized access control mechanisms. However, organizations must adapt their existing KM systems to integrate the decentralized nature of blockchain, especially regarding data storage and retrieval processes. The integration process involves rethinking how knowledge is stored (e.g., using blockchain's immutable ledger) and how access rights are managed (Narayanan et al., 2016).

Implementing blockchain in organizational KM systems requires overcoming several technical hurdles:

- Scalability: Blockchain systems often face performance limitations as the volume of transactions increases. Optimizing blockchain protocols for scalability is necessary for managing large volumes of knowledge data (Narayanan et al., 2016).
- Interoperability: Blockchain systems need to be compatible with existing KM frameworks and other enterprise technologies, a challenge due to the decentralized nature of blockchain (Crosby et al., 2016).
- Privacy Concerns: While blockchain's transparency is an asset for security and auditability, it raises privacy concerns when dealing with sensitive knowledge. Solutions like off-chain storage or encryption are often used to protect proprietary data (Peters and Panayi, 2016).

2.4. Smart Contracts in KM Systems

Smart contracts enable automation within blockchain-based KM systems by executing predefined business logic automatically. They can be used for knowledge validation, knowledge approval workflows, rights management, and more (Buterin, 2014). For example, smart contracts could validate new knowledge contributions, ensuring that only high-quality, relevant information is shared (Tapscott and Tapscott, 2016). This automation reduces administrative burdens, enhances efficiency, and ensures compliance with organizational policies (Narayanan et al., 2016).

Blockchain's consensus mechanisms, such as Proof of Work (PoW), Proof of Stake (PoS), and Practical Byzantine Fault Tolerance (PBFT), are vital for ensuring trust and security in decentralized Knowledge Management Systems (KMS), with each model offering different trade-offs in terms of security, scalability, and energy efficiency (Narayanan et al., 2016). Governance in blockchain-based KMS is also crucial, requiring transparent structures to facilitate fair decision-making, which can be complicated due to decentralization (Tapscott and Tapscott, 2016). Additionally, the linear structure of blockchain's data can slow down knowledge retrieval, prompting hybrid models like off-chain storage, where only metadata or hashes are stored on-chain, improving security and retrieval efficiency (Crosby et al., 2016).

3. Methodology

Successful design and development of this project were achieved through a structured approach comprising the following key stages: thorough requirement elicitation and analysis, comprehensive system design with seamless integration of smart contracts, and meticulous implementation and rigorous testing of the system.

3.1. Requirement Analysis

The requirement analysis phase involved a thorough engagement with key stakeholders, including school management, lecturers, faculty members, students, and IT personnel. Through surveys, interviews, and observations, we identified the existing challenges and needs within current knowledge management practices. The gathered insights were systematically categorized into functional and non-functional requirements, providing a solid foundation for defining the system’s capabilities and ensuring alignment with stakeholder expectations and privileges.

3.2. Conceptual Framework for the KMS with Blockchain

As illustrated in Figure 1 below, users of the Knowledge Management System (KMS) interact with the system's frontend for tasks such as logging in, uploading knowledge assets, editing existing assets, or searching the knowledge repository. Each of these interactions is processed through the blockchain to facilitate several key functions: smart contracts for knowledge validation and access control, a blockchain ledger for secure and immutable record-keeping of knowledge assets, node validation to ensure decentralization by validating and storing knowledge transactions, and a consensus mechanism that upholds system integrity by reaching an agreement on the state of the knowledge.

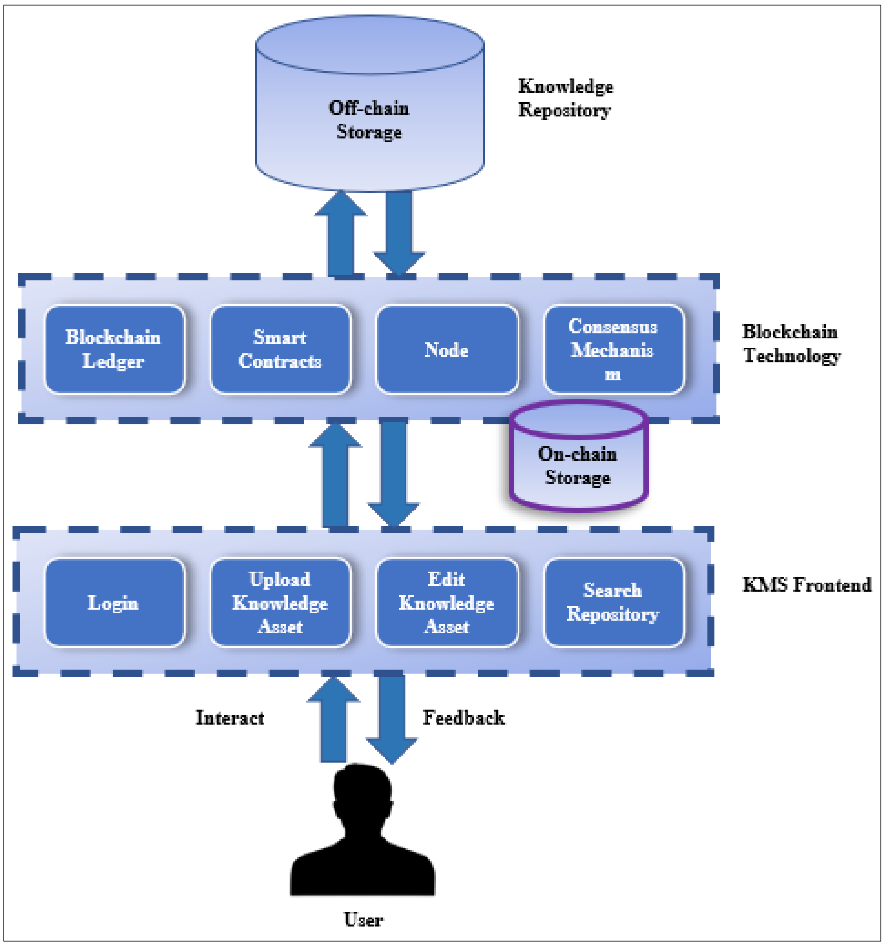


Figure 1 Conceptual Framework for the KMS with Blockchain

3.3. System Design

The project adopts a layered architecture approach, consisting of the following layers: the User Interface Layer, the Application Layer, the Blockchain Layer, the Data Layer, and the Security Layer.

The User Interface Layer allows users (e.g., employees, faculty, students) to interact with the Knowledge Management (KM) system. It provides access for submitting, viewing, and collaborating on knowledge. Key components include a web application (using HTML, CSS, and JavaScript), a mobile application for on-the-go access, and user authentication integrated with blockchain wallets or identity solutions for secure access.

The Application Layer (Back-End) manages business logic, processes user requests, and ensures secure interaction with the blockchain for storing or retrieving knowledge data. It includes Smart Contracts that control knowledge validation, access, and permissions based on predefined rules, and an API Layer that facilitates communication between the front-end and blockchain system, ensuring smooth data exchange and integration with other systems like databases or external knowledge sources.

The Blockchain Layer (Core Layer) is responsible for recording all knowledge-related transactions, ensuring immutability, traceability, and decentralization. It includes a Distributed Ledger that securely stores knowledge transactions, such as document submissions or edits. The Consensus Mechanism ensures agreement on transaction validity among participants, using models like PoW, PoS, or PBFT. Smart Contracts automate knowledge validation, permissions, and workflows, minimizing human error, while Blockchain Nodes form a decentralized network storing copies of the blockchain ledger.

The Data Layer (Storage and Retrieval) manages the storage and retrieval of knowledge assets, ensuring efficient access. While the blockchain maintains the integrity and immutability of metadata, large knowledge assets are stored in Off-

Chain Storage (e.g., IPFS or cloud services). On-Chain Storage holds essential metadata, including access history and permissions. A Search Engine enables efficient search and retrieval of knowledge assets based on their metadata.

The Security Layer ensures the protection of the entire KM system, focusing on data privacy, access control, and authentication to prevent unauthorized access to sensitive knowledge. It includes Blockchain Encryption to secure data with cryptographic techniques, Identity Management using blockchain-based solutions for secure user authentication, and Access Control managed by smart contracts to restrict access to authorized users only.

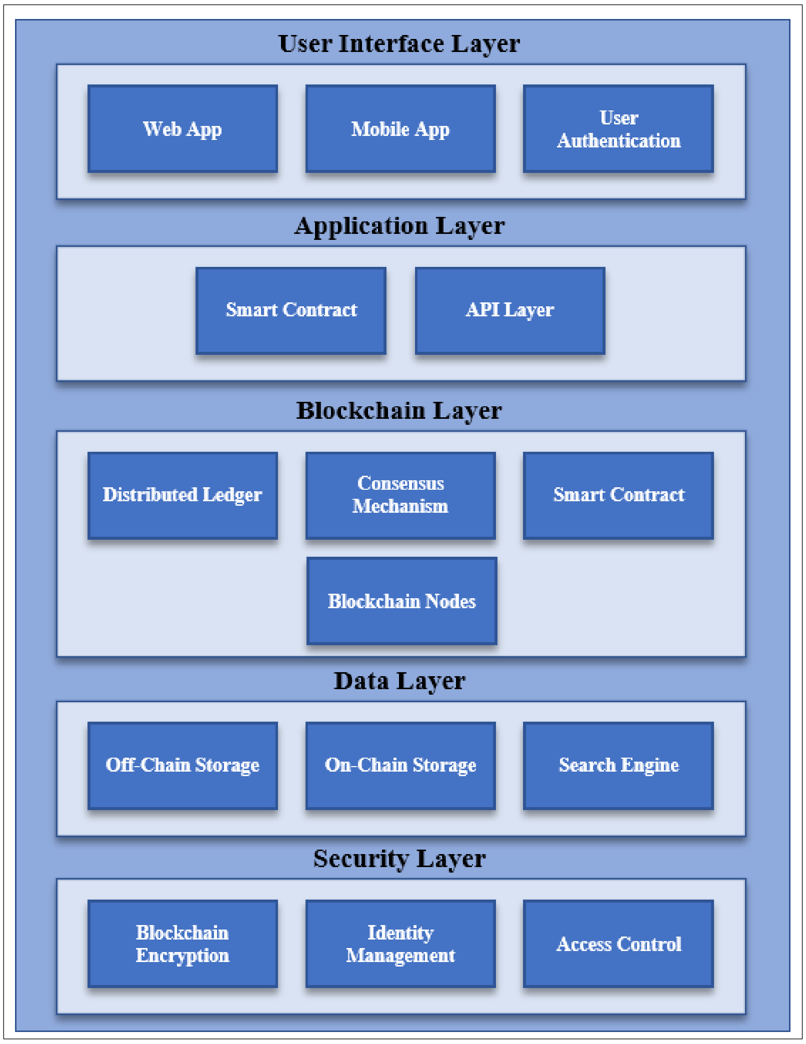


Figure 2 Layered Software Architecture for the KMS with Blockchain

The use case for the KMS involves four distinct actors' student, faculty, administrator, and community and seven key use cases, as depicted in Figure 2 below. These use cases include searching the repository, uploading knowledge assets, editing knowledge assets, reviewing and approving content, managing user roles and permissions, generating usage reports, and providing feedback.

Students use the system to access and contribute academic materials, while faculty members (professors/lecturers) contribute, review, and manage course-related content. Administrators oversee system operations, manage user access, and supervise the flow of content. The community, which includes departments, units, research groups, student organizations, and faculty groups, also contributes to, reviews, and manages course-related content.

The KMS includes several use cases that support its functionality. Users can search the knowledge repository to find specific articles, research papers, and course materials. They can upload academic content such as research papers, lecture notes, and project reports, as well as edit existing content. Faculty members are responsible for reviewing and approving content for accuracy and relevance. Administrators manage user roles and permissions, ensuring appropriate access to system features. The system also generates usage reports to provide insights into user engagement and popular resources, while users can provide feedback by rating content quality and offering suggestions.

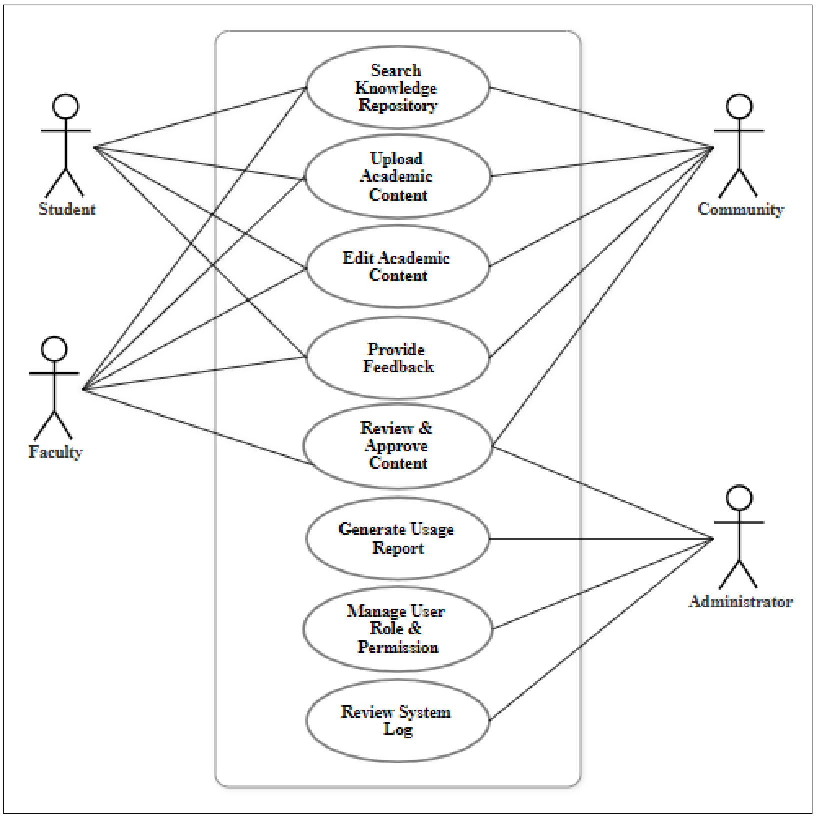


Figure 3 Use Case Diagram for the KMS

3.4. System Implementation

The development of the Blockchain-based Knowledge Management System utilized a range of advanced tools and technologies, including Python programming, the Streamlit framework for Python, JavaScript, web3.py for blockchain interaction, Solidity for smart contract development, and Truffle and Hardhat for blockchain testing and deployment. Additionally, SQLite was used for database management.

The implementation phase of the Blockchain-based Knowledge Management System (KMS) involved integrating all developed modules and deploying the system for use by faculty staff, lecturers, and students.

The system's front-end interface was developed using JavaScript, Hypertext Markup Language (HTML), and Cascading Style Sheets (CSS) to create a dynamic and responsive user experience. HTML serves as the structural foundation of the web pages, CSS provides styling for a clean and organized layout, and JavaScript manages interactivity while enabling communication between the front-end and the blockchain through Web3.js.

For the back-end, Python was chosen due to its power, flexibility, and widespread use in blockchain development. It offers robust libraries like web3.py, which simplify interaction with Ethereum-based smart contracts, enabling seamless blockchain integration. Python's clean syntax and readability accelerate development and debugging—crucial for blockchain applications. It also supports fast API development through frameworks such as Django, and provides strong cryptographic capabilities via libraries like hashlib and PyCryptodome, which enhance transaction and smart contract security. By leveraging these strengths, the back-end delivers secure, efficient, and scalable interaction with the blockchain, enabling users to perform transactions, store data securely, and interact with smart contracts effortlessly.

For this project, we adopted a hybrid data storage approach by utilizing blockchain (smart contracts) to store critical and verifiable information such as record IDs, ownership proofs, and transaction hashes, while using SQLite as off-chain storage for less sensitive data like user profiles, complaints, and metadata. This strategy effectively balances security and efficiency, offering scalability, cost-effectiveness, and a seamless user experience by leveraging the strengths of both blockchain and SQLite.

3.5. System Testing

The testing phase evaluated the performance, security, and user satisfaction across both employee and administrator interfaces. The administrator module, developed using Python and Streamlit, functioned seamlessly, facilitating efficient management of records, discussions, and complaints. The integration of blockchain technology ensured the security and immutability of transactions, while the implementation of smart contracts effectively automated access control and data verification processes. Shown below are some of the screenshots from the knowledge management system.

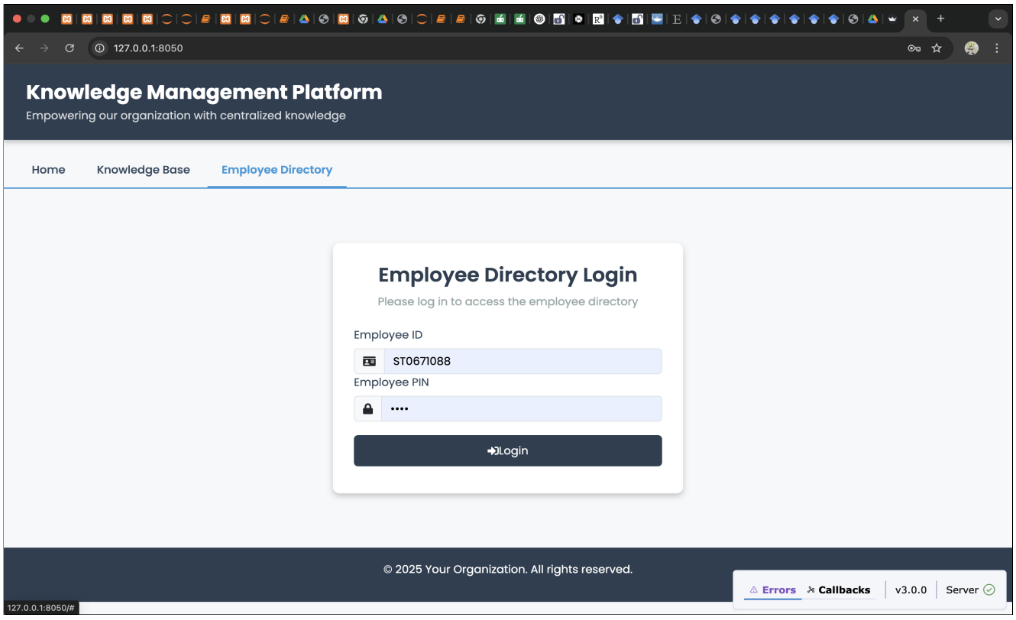


Figure 4 Employee Login page – The Login page enables employees to access the KMS

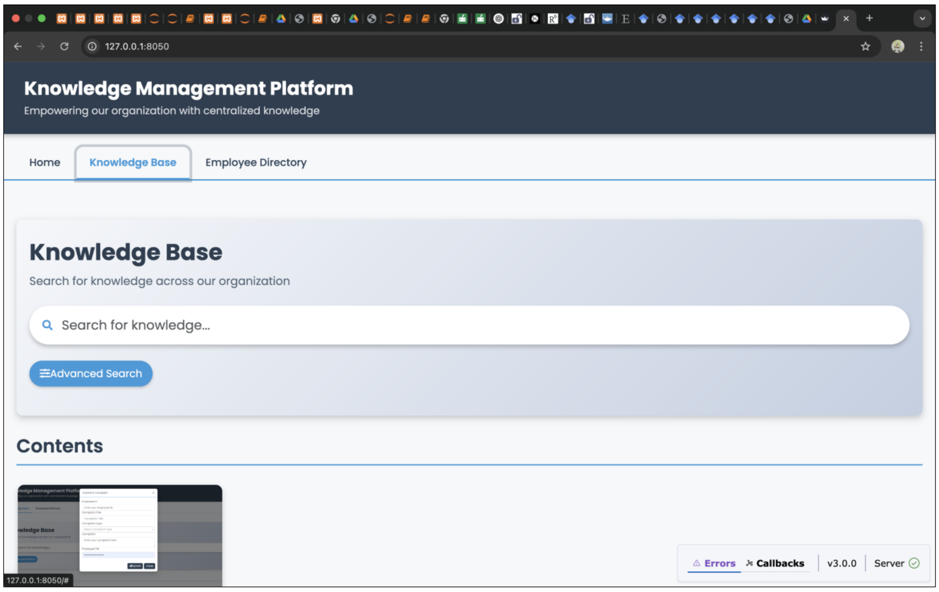


Figure 5 Search interface for the KMS – This page allows users to search the knowledge repository for knowledge assest

4. Result and Discussion

The blockchain-based Knowledge Management System (KMS) developed in this study successfully addressed key limitations of traditional KM platforms by integrating blockchain's decentralized, immutable, and secure framework. Through implementation and testing, the system demonstrated improved data integrity, transparency, and access control.

Smart contracts automated critical operations such as content validation and user access, significantly reducing the potential for human error and administrative delays. The use of blockchain's distributed ledger ensured that knowledge assets were tamper-proof and reliably traceable, thereby fostering trust among users. System testing with faculty and students confirmed the effectiveness of the interface and backend functions, highlighting the seamless integration of off-chain (SQLite) and on-chain data storage.

A hybrid architecture combining conventional databases for less sensitive data and blockchain for critical transactions proved efficient and scalable. Users were able to search, upload, and manage knowledge assets with ease, while administrators could monitor usage and enforce permissions securely. Although blockchain's implementation posed challenges—such as scalability and the need for user orientation—its advantages in security and automation made it a viable solution for modern knowledge management.

5. Conclusion

The conclusion of this study reinforces the transformative potential of blockchain technology in reimagining knowledge management systems. Through a detailed exploration of the system's architecture, the integration of smart contracts, and the rigorous evaluation of administrative and employee functionalities, it has become clear that the blockchain-based solution offers substantial improvements over traditional centralized models.

The project demonstrated that decentralization, immutability, and enhanced security can be achieved through innovative technological integration, thereby ensuring data integrity and fostering trust among users. The implementation not only addressed prevalent challenges such as unauthorized data modifications and single points of failure but also established a robust framework for future scalability. The adoption of smart contracts played a pivotal role in automating processes, reducing human error, and streamlining operations across the system.

Furthermore, the project provided that a hybrid approach—merging conventional databases with blockchain elements can effectively balance performance and security requirements. In synthesizing the various dimensions of the study, it becomes apparent that while the system has achieved its core objectives, continuous monitoring and iterative enhancements will be crucial to adapt to evolving industry demands and technological advancements.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Christidis, K., and Devetsikiotis, M. (2016). Blockchains and Smart Contracts for the Internet of Things. IEEE Access, 4, 2292–2303. https://doi.org/10.1109/ACCESS.2016.2566339

[2] Crosby, M., Pattanayak, P., Verma, S., and Kalyanaraman, V. (2016). Blockchain technology: Beyond bitcoin. Applied Innovation Review, 2, 6–10. https://www.appliedinnovationreview.com

[3] Davenport, T. H., and Prusak, L. (1998). Working Knowledge: How Organizations Manage What They Know. Harvard Business Press.

[4] Narayanan, A., Bonneau, J., Felten, E., Miller, A., and Goldfeder, S. (2016). Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press. ISBN:9780691171692

[5] Tapscott, D., and Tapscott, A. (2016). Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World. Penguin. ISBN: 9781101980156

[6] Xie, X., Shi, X., and Liu, W. (2019). Blockchain technology and its applications in the Internet of Things: A survey. IEEE Internet of Things Journal, 6(5), 8336–8346. https://doi.org/10.1109/JIOT.2019.2904599

[7] Zheng, Z., Xie, S., Dai, H., Chen, X., and Wang, H. (2017). Blockchain challenges and opportunities: A survey. International Journal of Web and Grid Services, 13(4), 282–305. https://doi.org/10.1504/IJWGS.2017.10009089

[8] Alavi, M., and Leidner, D. E. (2001). Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. MIS Quarterly, 25(1), 107-136. https://doi.org/10.2307/3250961

[9] Argote, L. (1999). Organizational Learning: Creating, Retaining, and Transferring Knowledge. Springer Science and Business Media.

[10] Bekkema, H., Dijkstra, R., and Van Der Meer, P. (2006). Knowledge Management: Security Issues in Knowledge Sharing. International Journal of Information Management, 26(1), 35-48.

[11] Cohen, W. M., and Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. Administrative Science Quarterly, 35(1), 128-152. https://doi.org/10.2307/2393553

[12] Grant, R. M. (1996). Toward a Knowledge-Based Theory of the Firm. Strategic Management Journal, 17(S2), 109-122. https://doi.org/10.1002/smj.4250171109

[13] Hansen, M. T., Nohria, N., and Tierney, T. (1999). What's Your Strategy for Managing Knowledge? Harvard Business Review, 77(2), 106-116.

[14] Hinds, P., and Pfeffer, J. (2003). Why Organizations Don't Learn. Organizational Science, 14(3), 74-85. https://doi.org/10.1287/orsc.14.3.74.15157

[15] Jones, M. C. (2009). The Role of Knowledge Management in Knowledge Sharing in the Public Sector. International Journal of Public Sector Management, 22(5), 452-469. https://doi.org/10.1108/09513550910982365

[16] Laudon, K. C., and Laudon, J. P. (2016). Management Information Systems: Managing the Digital Firm (15th ed.). Pearson.

[17] McKinsey and Company. (2012). The Social Economy: Unlocking Value and Productivity through Social Technologies. McKinsey Global Institute.

[18] Nonaka, I., and Takeuchi, H. (1995). The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. Oxford University Press.

[19] Roberts, J. (2000). From Know-How to Show-How? Questioning the Role of Information Technology in Knowledge Management. Journal of Knowledge Management, 4(2), 145-156.

[20] Buterin, V. (2014). A next-generation smart contract and decentralized application platform. Ethereum White Paper. https://ethereum.org/en/whitepaper/

[21] Catalini, C., and Gans, J. S. (2016). Some Simple Economics of the Blockchain. MIT Sloan Research Paper, 5191-16. https://doi.org/10.2139/ssrn.2744751

[22] Kshetri, N. (2018). Blockchain's Roles in Strengthening Cybersecurity and Protecting Privacy. Telecommunications Policy, 42(5), 381-389. https://doi.org/10.1016/j.telpol.2018.02.003

[23] Mettler, M. (2016). Blockchain Technology in Healthcare: The Revolution Starts Here. Blockchain Healthcare Review, 1(1), 1-9.

[24] Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. https://bitcoin.org/bitcoin.pdf

[25] Peters, G. W., and Panayi, E. (2016). Understanding Modern Banking Ledgers Through Blockchain Technologies: Future of Payment Systems. In Banking Beyond Banks and Money (pp. 239-278). Springer, Cham.

[26] Mettler, M. (2016). Blockchain Technology in Healthcare: The Revolution Starts Here. Blockchain Healthcare Review, 1(1), 1-9.

[27] Zohar, O., Shneor, R., and Barros, M. (2020). Blockchain in Education: A Systematic Review. Journal of Educational Technology Systems, 49(3), 280-306. https://doi.org/10.1177/0047239519888629