International Journal of Engineering and Information Systems (IJEAIS)
ISSN: 2643-640X
Vol. 10 Issue 2 February - 2026, Pages: 113-117

A Secure Blockchain Intergrated Web Framework For Digital Estate Planning And Automated Asset Succession

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ABSTRACT: *The rapid growth of digital assets such as cryptocurrencies, online financial accounts, intellectual property, and digital identities has exposed significant limitations in traditional estate planning systems, which often lack adequate security, transparency, and automation for effective digital asset succession. Existing approaches rely heavily on centralized intermediaries and manual legal processes, resulting in delays, vulnerabilities to data interference, and difficulties in allowing rightful access to beneficiaries. Furthermore, strong encryption and authentication mechanisms that protect digital assets during an owner's lifetime frequently create an access gap after death or disability.This study proposes and implements a secure blockchain-integrated web framework for digital estate planning and automated asset succession. The framework leverages blockchain technology to ensure data integrity, immutability, transparency, and controlled access to digital estate records. Smart contracts are employed to encode inheritance rules and automatically execute asset transfers upon the verification of predefined triggering events, such as a Dead Man's Switch or authenticated death confirmation. A user-friendly web interface is integrated to enable asset owners to manage digital assets, designate beneficiaries, and monitor succession processes without requiring advanced technical expertise.The findings demonstrate that the proposed framework reduces reliance on intermediaries, minimizes the risk of cheating and inheritance conflicts, and improves the efficiency, security, and reliability of digital asset succession. This research contributes to existing knowledge by illustrating the practical application of blockchain and smart contract technologies in digital estate planning, while also providing a scalable and adaptable foundation for future developments in secure digital asset management and inheritance systems.*

Keywords: Digital Estate Planning, Blockchain Technology, Smart Contracts, Digital Asset Succession, Automated Inheritance, Web-Based Framework, Data Integrity, Decentralized Systems, User-Friendly Interface, Digital Asset Management.

1.0 Introduction

The rapid growth of digital assets such as cryptocurrencies, online financial accounts, intellectual property, and digital identities has exposed significant limitations in traditional estate planning systems, which often lack the security, transparency, and automation required for effective digital asset succession. Blockchain technology offers a robust solution through its decentralized, immutable, and cryptographically secure nature, enabling trustworthy management and transfer of digital assets. This paper presents a secure blockchain-integrated web framework for digital estate planning and automated asset succession, where smart contracts encode inheritance rules and execute asset transfers automatically upon verified triggering events. The framework combines blockchain-based security with a user-friendly web interface to ensure data integrity, controlled access, and transparent execution, thereby reducing conflicts, administrative delays, and reliance on intermediaries while providing a scalable and legally adaptable approach to modern digital estate management.

1.1 BACKGROUND

The rapid digitization of financial and personal assets has transformed the landscape of inheritance, shifting it from tangible properties to complex digital holdings such as cryptocurrencies, online accounts, intellectual property, and social media profiles [1], [2], [25]. Traditional estate planning systems, designed primarily for physical assets, struggle to accommodate the security, accessibility, and automation required for effective digital asset succession [3], [7]. Digital assets are often secured through encryption and multi-factor authentication, which ensures protection during an owner's lifetime but creates access challenges for beneficiaries after death, resulting in an "access gap" [2], [6].

Existing centralized platforms provide limited legacy features; however, these solutions are often inconsistent, isolated, and subject to frequent changes in terms of service, leaving digital estate management fragmented and unreliable [3], [7]. These limitations have prompted researchers and professionals to explore decentralized technologies, particularly blockchain, as a means of establishing trust, transparency, and permanence in digital asset management [4], [12], [13]. Blockchain's immutable ledger and consensus mechanisms enable secure recording of ownership and asset transactions without reliance on a central authority, reducing the risk of cheating [15], [21].

In addition to data integrity, smart contracts offer a mechanism for automating inheritance rules. These self-executing programs can transfer assets to designated beneficiaries automatically upon the verification of specific triggering events, such as death confirmation or inactivity over a predetermined period [27], [9], [11], [20], [29]. This automation reduces dependency on intermediaries such as lawyers or trustees, minimizes human error, and accelerates the inheritance process.

User-centered design is another critical aspect of blockchain-based digital estate frameworks. Complex blockchain operations can be challenging for non-technical users; therefore, a user-friendly web interface is essential to improve adoption, usability, and confidence in managing digital assets [8], [16], [17], [18], [19]. Interfaces that provide visual dashboards, step-by-step guidance, and clear notifications help asset owners define beneficiaries, monitor succession processes, and ensure accurate execution of inheritance rules.

Furthermore, integrating decentralized storage solutions, such as IPFS, can overcome challenges associated with storing large digital assets off-chain while maintaining security and integrity [14], [28]. Combined, blockchain technology, smart contract automation, and intuitive web interfaces create a secure, reliable, and practical approach to modern digital estate planning [20], [21], [30].

1.2 PROBLEM STATEMENT

The increasing reliance on digital assets such as cryptocurrencies, online financial accounts, and digital intellectual property has revealed significant shortcomings in traditional digital estate planning systems [1], [2]. Existing approaches often lack adequate security, transparency, and automation, making digital assets exposed to unauthorized access, loss, or conflicts during succession [4], [5], [6]. Furthermore, traditonal systems rely heavily on centralized intermediaries and manual legal processes, which are prone to delays, data inability, and limited access control [3], [7], [21]. There is also an absence of reliable mechanisms to ensure data integrity and immutability of estate records, as well as automated enforcement of inheritance rules upon verified triggering events [11], [20], [29]. Furthermore, many current solutions provide complex or inadequate user interfaces, discouraging effective asset management and monitoring by asset owners [8], [16], [17], [18], [19]. These challenges highlight the need for a secure, transparent, and user-friendly blockchain-based web framework that can automate digital asset succession, ensure data integrity, and provide controlled access to digital estate [12], [13], [14], [28].

1.3 Objectives of the study

Main Objective of the Study

The main objective of this study is to design and develop a secure blockchain-integrated web framework that enables efficient digital estate planning and automates asset succession using smart contracts to ensure security, transparency, and reliability.

Specific Objectives of the Study

To analyze the limitations of traditional digital estate planning systems in managing and transferring digital assets securely.

To design a blockchain-based architecture that ensures data integrity, immutability, and secure access control for digital estate records.

To implement smart contracts that automate asset succession based on predefined inheritance rules and verified triggering events.

To develop a user-friendly web interface that allows asset owners to manage digital assets, define beneficiaries, and monitor succession processes securely.

2.0 Related Works

Several studies have examined the challenges associated with digital estate planning and the management of digital assets. Edwards and Harbinja discuss how traditional estate planning frameworks were not designed to accommodate digital assets, highlighting issues with legal recognition, asset accessibility, and security within existing inheritance procedures [2], [23]. Conway similarly explores the increasing complexity of managing cryptocurrencies and online accounts in estate contexts, emphasizing that dependence on intermediaries often leads to delays, increased costs, and potential disputes [1], [30].

To address these limitations, a body of research has focused on decentralized technologies. Zheng *et al.* provide a comprehensive overview of blockchain technology, describing how decentralization, immutability, and transparency can enhance trust and reduce reliance on intermediaries in transactional systems [4]**.** Christidis and Devetsikiotis further highlight the potential of blockchain to support automated and secure processes through smart contracts, allowing predefined rules to be executed without manual intervention [20]. Mazzoni *et al.* extend this perspective by demonstrating how decentralized identity and trust management can be integrated into broader application architectures, an approach relevant to securely managing and verifying digital asset ownership [3]**.**

Smart contract automation has attracted significant attention due to its relevance for rule-based execution. Buterin outlines the conceptual foundations of smart contracts and their ability to automate execution once conditions are met, a paradigm increasingly adopted in decentralized finance and automated systems [5]. Building on this, Goldston *et al.* and Zhang *et al.* illustrate how smart contracts can be tailored for complex workflows, motivating their use in tasks such as conditional transfers and asset succession [9], [11]**.**

Despite these advances, usability and accessibility remain critical concerns. Research in human-computer interaction shows that technical advancement alone does not guarantee adoption; systems with unintuitive interfaces tend to fail in real-world use [8], [16]**.** Consequently, some studies explore strategies for integrating Web3 components with user-friendly interfaces to abstract blockchain complexity while enabling secure interactions. Additionally, decentralized storage solutions such as IPFS have been investigated to address inefficiencies associated with on-chain storage of large files, as noted by Benet and Dinh [14], [28]**.**

Although the literature provides foundational insights into blockchain capabilities, smart contract utility, and usability issues, few studies propose integrated frameworks that combine secure blockchain architectures, automated asset succession, and intuitive web interfaces to comprehensively address the limitations of traditional digital estate planning systems. This gap motivates the need for

research that not only demonstrates technological feasibility but also ensures practical usability and reliable digital asset management objectives this study aims to achieve.

3.0 OBSERVATION

Traditional estate planning systems are not suitable for digital assets

It was observed that traditional estate planning systems were mainly developed to manage physical assets such as land, houses, and bank accounts. With the rapid growth of digital assets like cryptocurrencies, online accounts, and digital intellectual property, these systems are no longer sufficient. Digital assets are often protected by strong encryption and authentication methods, which make access difficult for beneficiaries after the owner's death. In addition, many digital assets are spread across different platforms with varying policies, creating confusion and delays during succession. This observation shows that traditional estate planning methods do not effectively address the complexity and security needs of modern digital assets [1], [2], [3], [7], [10].

Blockchain technology improves security, transparency, and data integrity

The study observed that blockchain technology provides a secure and reliable way to manage digital estate records. Because blockchain operates in a decentralized manner, no single party has full control over the data, which reduces the risk of fraud and unauthorized modification. Once records are stored on the blockchain, they become immutable and transparent, allowing all authorized parties to verify asset ownership and inheritance rules. Cryptographic techniques such as hashing and digital signatures further protect sensitive information. This observation confirms that blockchain significantly enhances trust, security, and data integrity in digital estate planning systems [4], [12], [13], [15], [21].

Smart contracts enable automated and efficient asset succession

It was observed that smart contracts are effective tools for automating digital asset succession. Smart contracts are self-executing programs that enforce inheritance rules automatically once predefined conditions are met. For example, when a verified triggering event such as death or inactivity occurs, the smart contract transfers assets to beneficiaries without manual implementation. This automation reduces reliance on intermediaries such as lawyers and trustees, minimizes human error, and speeds up the inheritance process. The study observed that smart contracts ensure assets are distributed accurately according to the owner's intentions, making digital succession more efficient and reliable [5], [9], [11], [20], [29].

User-friendly web interfaces improve usability and system adoption

The study observed that the success of a blockchain-based digital estate planning system depends heavily on the usability of its web interface. Blockchain technology can be complex, especially for non-technical users, but a simple and intuitive interface makes the system easier to understand and use. Features such as clear dashboards, step-by-step guidance, and visual feedback help users manage digital assets and define beneficiaries with confidence. A well-designed interface also reduces user errors and increases trust in the system. This observation highlights that user-centered design is essential for encouraging adoption and effective use of digital estate planning platforms [8], [16], [17], [18], [19].

4.0 CONCLUSION

This study set out to design and implement a secure blockchain-integrated web framework for digital estate planning and automated asset succession. The findings from the literature review, system design, and observations confirm that traditional estate planning systems are not well suited to manage modern digital assets such as cryptocurrencies, online accounts, and digital intellectual property. These systems lack adequate security, transparency, and automation, which often results in delays, access challenges, and disputes during the inheritance process.

The study concludes that blockchain technology provides a strong foundation for digital estate management due to its decentralized, immutable, and transparent nature. By recording estate data and inheritance rules on the blockchain, the proposed framework ensures data integrity and reduces the risk of fraud or unauthorized modification. The integration of smart contracts further enhances the system by automating asset succession based on predefined rules and verified triggering events, ensuring that assets are transferred accurately and in a timely manner without heavy reliance on intermediaries.

Furthermore, the study highlights the importance of a user-friendly web interface in promoting usability and adoption. By simplifying interactions with complex blockchain functionalities, the framework enables non-technical users to manage digital assets and succession processes securely and confidently. Although legal and regulatory challenges remain in different authorities, the study concludes that a blockchain-integrated web framework offers an effective, secure, and scalable solution for modern digital estate planning. The proposed system provides a solid foundation for future research and development in secure digital asset inheritance and management.

5.0 RECOMMENDATION AND FUTURE WORKS

5.1 Recommendations

Based on the findings and observations of this study, several recommendations are proposed to enhance the effectiveness and practical adoption of blockchain-based digital estate planning systems. First, policymakers and legal authorities are encouraged to develop clear legal frameworks and regulations that recognize digital assets and blockchain-based inheritance mechanisms. Legal recognition would improve trust, enforceability, and real-world adoption of such systems.

Second, system developers should place strong emphasis on security testing and smart contract auditing before deployment. Regular audits and weakness assessments are essential to prevent coding errors, security violations, and unintended asset transfers. Implementing standardized security practices will increase the reliability of automated asset succession.

Third, user awareness and education should be improved. Many digital asset owners lack sufficient knowledge about digital estate planning and the risks of unmanaged digital assets. Providing user guides, tutorials, and support services within the system can help users understand how to securely manage their digital estates.

Finally, the system should be designed with compatibility in mind. Supporting multiple blockchain networks and integration with existing digital platforms can enhance flexibility, scalability, and long-term usability of the framework.

5.2 Future Works

Future research can extend this study in several important ways. One potential area is the integration of legal and institutional verification services, such as government registries or certified digital oracles, to improve the accuracy and trustworthiness of triggering event verification. This would strengthen the reliability of automated asset succession.

Another direction for future work is expanding asset support beyond cryptocurrencies and NFTs to include a wider range of digital assets, such as social media accounts, subscription services, and cloud-based intellectual property. Advanced encryption and decentralized storage solutions can be further explored to manage sensitive non-blockchain assets securely.

Future studies may also investigate the use of artificial intelligence to enhance user experience, risk assessment, and cheating detection within digital estate planning platforms. Furthermore, performance optimization and scalability testing on large user bases would help evaluate the system's readiness for real-world deployment.

In conclusion, while this study provides a strong technical foundation for secure and automated digital estate planning, continued research, legal development, and technological enhancements are necessary to ensure widespread adoption and long-term sustainability of blockchain-based inheritance systems.

6.0 ACKNOWLEDGEMENT

Maligisa Samweli, Yuda Arusha, Gidion Seleli, Emmanuel George, Georgina Ndondole, Furaha Mustafa, Imagi Ginori, Enock Myinga, George Adonatus would like to express our sincere gratitude to our supervisor, LUSEKELO KIBONA, for their guidance, advice, and continuous support throughout the duration of this project. Their help was invaluable in completing this research successfully.

We also thank the lecturers and staff of RUCU for providing the resources, knowledge, and encouragement that assisted us during this study.

Finally, we would like to acknowledge all authors and researchers whose work we referenced, as their studies provided essential information and guidance for the development of our project.

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