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Empowering Authors and Revolutionising Publishing: The Decentralised Approach Using Blockchain

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Abstract:
This study looks into how Blockchain technology can be used to establish a decentralised method to book publishing. Traditional publishing strategies can present authors with obstacles such as limited control over their work, money processing issues, and limited access to distribution outlets. The decentralised model afforded by Blockchain technology, on the other hand, has the potential to give authors more control over their work, smoother payment processing, and more distribution channels. The study investigates the advantages and disadvantages of employing Blockchain technology in book publishing and the possible impact on the sector as a whole. The study also includes a prototype of a decentralised publishing platform based on Blockchain technology, which allows authors to upload their work directly to the platform, receive real-time payment, and experience a more transparent and equitable publication process. The front-end of the platform was built with javascript. While writing the smart contract, solidity was employed. According to the findings of this study, Blockchain technology has the potential to transform the book publishing industry by empowering authors and boosting transparency and justice in the publication process.

Keywords: *Blockchain, publishing, books, decentralise and technology*

1. Introduction

1.1. Background to the Studies

Publishing, in general, refers to the actions associated with creating and disseminating books, music, software, and other copyrightable goods for free or for a price. It has traditionally been used to refer to the process of making and disseminating printed works such as books, journals, newspapers, and magazines. Publishers are institutions (organisations or persons) that make the publication process easier. Commercial/traditional publishers, self-publishers, and vanity presses are all forms of publishers (Daniel & Glatzer, 2021). The publisher chooses books based on their quality and market feasibility before managing editing, production, marketing, promotion, sales, warehousing, and delivery at its own expense in traditional publishing. In exchange, the publisher receives a percentage of the author's earnings. Self-publishing differs from traditional publishing in several ways. Self-publishing is a method in which the author is responsible for the entire distribution process and the associated costs, but the author retains all sales money (Daniel & Glatzer, 2021). Vanity press is a type of publishing that works similarly to traditional publishing in that the publisher receives an IBN, prints the book, and may promote it for a fee; however, it differs from traditional publishing in that the publisher can charge more without caring about the book's quality or even reviewing it. That is where the name 'vanity' derives.

With the rapid advancements in technology and the emergence of the internet, self-publishing has become a popular and favoured method for writers to share their work (Siegal & Cornish, 2013). Self-publishing is a type of publishing in which the owner of the copyrighted work publishes without the assistance of a traditional or vanity publisher. Until the emergence of digital self-publishing platforms, the terms self-publishing and vanity press were indistinguishable in meaning and method (Neary & Sepinwall, 2012). Third-party platforms such as Amazon's KDP, Ingram Spark, Smashwords, and Scribd are examples of self-publishing platforms (Finder, 2012). These platforms make it possible for writers who want to distribute their work to reach readers. These platforms provide readers with access to published books via multiple mediums, such as online or mobile applications and custom eBook readers. Furthermore, book-on-demand is another method for distributing a self-published writer's works to readers. With all of the different methods for self-publishing writers to distribute their work, it brought up a slew of advantages. The cost of publishing has decreased dramatically over time. The distribution of written content is much faster now. Writers have complete creative

control. Writers receive a larger share of royalties and have more control over pricing. These advantages contributed to the creation of a world in which accessing content is easier.

Blockchain is a decentralised network of computers that collaborate to serve as a distributed transaction ledger. The concept was developed in the early 1990s and 2000s as part of distributed computing (Bashir, 2017), with Christidis and Devetsikiotis proposing an actual use case of blockchain - which was eventually implemented - in 2016. This use case involves the usage of blockchain to support the development of Bitcoin, a cryptocurrency used for transaction payment (Bashir, 2017).

The concept of blockchain is based on encryption, peer-to-peer architecture, and distributed computing (Saini et al., 2020). These concepts are critical in developing a distributed ledger of transactions, which aids in the trust and integrity of data kept on the blockchain. According to Saini et al. (2020), a distributed ledger is like a database that is manually shared and synchronised across multiple nodes, sites, institutions, or geographies. It will facilitate transactions with public witnesses while making a cyber-attack more difficult. Furthermore, any modifications made to ledgers are reflected in real-time across all nodes on the network.

To investigate the cases of further use for blockchain as a technology, the concept of decentralised applications (also known as DApp) enters the picture. According to Prusty (2017), a DApp is a type of Internet application whose backend runs on a decentralised peer-to-peer network and whose source code is open source. No single network node has complete control over the DApp. In essence, the decentralised application concept seeks to use blockchain as a universal computer over which no single organisation (person or company) has control. This is a necessary component in the development of Web 3.0. Web 3.0 is the successor to Web 2.0, the web version that emphasises end-user usability, participatory culture, and interoperability (Grant & Bianca, 2012). In terms of how data and content are handled, Web 3.0 differs from Web 2.0 (Mak, 2021). While data in Web 2.0 is saved and processed by centralised entities, data in Web 3.0 is dispersed and processed across multiple nodes that can be owned by any organisation. Furthermore, consumers accessing material and data on Web 3.0 is similar to a transaction, with user agreement required, which mitigates privacy concerns.
With the arrival of Web 3.0, the use case for blockchain is no longer restricted to cryptocurrencies alone. It resulted in the development of several decentralised applications that run on blockchain technology. With the concept of Web 3.0 arose the concept of tokenizing assets into a cryptographically encoded digital signature that represents such assets and can be readily traced in a trusted manner. This concept sparked widespread blockchain research and application in a variety of fields. These include but are not limited to finance, agriculture, government, health, and delivery. Furthermore, a long-studied use case for blockchain is the capacity to publish and receive payment for books and other works via blockchain platforms that assist this process (Nizamuddin et al., 2018).

Taking all of this into consideration, this research intends to investigate the Web 3.0 space by developing a decentralised application that will allow authors to publish their work and have complete control over how it is distributed, accessed, and paid directly without the involvement of any middlemen. Furthermore, the decentralised application that will be developed as part of this research will give readers access to the author's book that is stored on the blockchain.

This study aims to address these obstacles by developing a decentralised application that will allow authors to directly publish their work. This allows the author to retain control over their work, the validity of their intellectual property can be validated in a reliable manner, the risk of piracy is reduced, and lastly, the author receives remuneration for their work with no third-party cut by any publisher or platform.

1.2. Aim and Objectives

The study's goal is to develop a decentralised application that will allow authors to publish their work on the Blockchain for readers to access.

While the following are the research objectives:

- Develop a smart contract in Solidity for validating and granting readers access to the Blockchain-hosted books.
- Create a decentralised application that allows authors to upload their books to the Blockchain.
- Using Solidity, develop a smart contract that allows the author to produce a cryptographic digital signature for their work.
- To use the Interplanetary File System (IPFS) to house the author's huge uploaded files.

2. Literature Review

2.1. Blockchain Technology

Blockchain technology is a distributed database system that enables secure and transparent transactions without the use of a central authority. Blockchains allow us to create a decentralised peer-to-peer network in which members can communicate directly and verifiably with one another without the necessity of an intermediary (Christidis & Devetsikiotis, 2016). It is primarily recognised for its use in cryptocurrency, but it has also been used in various sectors and applications (Swan, 2015).

The core concepts of blockchain technology are distributed consensus, cryptographic hashing, and proof-of-work algorithms (Antonopoulos, 2014). Cryptographic hashing safeguards the integrity and immutability of data stored on the blockchain, while distributed consensus enables network participants to agree on the ledger's current state without the need for a central authority. Proof-of-work algorithms are employed to defend the blockchain from malicious attacks.

2.2. Non-fungible Tokens

A non-fungible token (NFT) is a one-of-a-kind digital asset whose ownership is recorded on a blockchain like Ethereum. NFTs can be used to represent claims on actual assets, like apparel or real estate, and claims on digital commodities, such as those found in virtual worlds. (Xie, 2021).

NFTs have the potential to be used in a variety of sectors and applications, including art, music, gaming, and sports. In the art sector, NFTs can be used to authenticate and track digital works of art, allowing creators to commercialise their works while still maintaining ownership and control (Lakhani & Lakhani, 2021). NFTs are used in many areas, including gaming, sports, fashion (where they are used to differentiate each product), and licences and certification. NFTs can be used to create unique in-game products that can be traded between players or sold on internet markets. In the music industry, NFTs can be used to create one-of-a-kind digital gems, such as concert tickets or premium items that can be sold to fans (Rehman et al., 2021).

2.3. Decentralised Publishing

Decentralised publishing is a new publishing paradigm enabled by Blockchain technology. This method of publishing allows authors to circumvent traditional intermediaries like publishers and distributors and interact directly with their audience. Many use cases have been investigated and deployed on the Blockchain since the emergence of blockchain networks that facilitate the creation of decentralised apps utilising smart contracts (Verma & Sheel, 2022). These cases are being actively investigated to build an active ecosystem and creative ways of solving problems using Blockchain.

A decentralised approach to book publishing based on Blockchain technology has been presented as a solution to improve the publishing process's efficiency, transparency, and security. Taking the goal of this research into consideration, there is a variety of research being conducted by many scholars to investigate this range of usage. Furthermore, these works serve as the impetus for this investigation. Almeida et al. (2020) conducted a thorough analysis of the available literature on the usage of Blockchain technology in the publishing sector. While there is growing interest in the potential of Blockchain technology in the industry, the authors discovered that there is currently a lack of practical application and implementation. Further research, according to the authors, is required to fully understand the potential benefits and challenges of implementing Blockchain technology in the publishing industry.

Decentralised publishing has a wide range of possible uses, including academic publishing, scientific publication, and self-publishing. Decentralised publishing in academic and scientific publishing can allow researchers to disseminate their work directly to a worldwide audience without the need for traditional intermediaries such as academic journals (Velasco et al., 2021).

2.4. Review of Related Works

Blockchain technology has helped to establish decentralised publishing as a new paradigm in the publishing industry. Much research has looked into the potential and challenges of this publishing method. These connected papers cover the many aspects of Blockchain publishing discussed in the preceding section.

Prusty (2017) advocated adopting a Blockchain-based strategy to publish books online and ensure digital document integrity. The author establishes authorship by maintaining the book/file hash and the owner's name in pairs. The author claims that preserving the hash of the file and the block timestamp as pairs demonstrates the document's or file's integrity. If the file's content is altered, the smart contract will be unable to access it, and its hash will change, confirming that the file's content has been altered.

The Alliance of Independent Authors (2018) investigated numerous approaches to blockchain as a revolutionary instrument in the self-publishing field. They discuss the concept of self-publishing 3.0, which tries to close the gap that self-publishing authors face. They call it "crowd sourced patronage/subscription/direct sales by authors to readers, with no intermediary other than an online purchasing mechanism."

Albanese (2018) presented a pre-existing platform with Android and iOS applications available in their respective app stores. The publication is a publishing platform that uses Blockchain and crypto-currency technologies to revolutionise how books are financed, distributed, acquired, and read. The company promotes its e-reader-wallet software, which works on any device, as giving "books without borders" for digital book ownership. Publication offers customised online storefronts with the option of using revenue models for content providers, and a global peer-to-peer Blockchain network encrypts book content and sales data. The publishing sector and its associated distribution industries are completely shut out of the book publishing process.

Nizamuddin et al. (2018) investigated the use of smart solidity contracts on the ethereum blockchain with the interplanetary file system (IPFS) to develop a solution that allows writers to trace how their work is accessed and used. This method generated a smart contract that serves as a binding force between all parties engaged in the publication process, including the publisher, authors, and readers. However, one weakness of this preliminary research is that it does not include how payment might be given to the content owner. To solve this, Nizamuddin et al. (2019) performed research and developed a system that leverages the Ethereum blockchain to manage the sale of digital assets and ensure that payments are paid to the author's wallet as soon as they are received.

Mackey et al. (2019) created a governance framework for scientific publication based on a consortium blockchain architecture to improve the publishing process. The foundation of this concept is a model that implements shared governance and validates inclusion through a Democratic Autonomous Organisation (DAO). A DAO is a system that uses smart contracts to implement and carry out organisational standards. The DAO will be made up of members from verified companies and individuals who are peer reviewers, editors, publishers, and citizen scientists to regulate and control the

framework. The format also closely resembles the stages involved in scientific paper publication, such as submission, peer review, handling, and final editorial decision-making. This framework intends to democratise publication while maintaining the established procedure common to scientific journal publishing, to encourage openness in the scientific publishing process, and to provide a 'pedigree' of a scientific manuscript's research life cycle.

Tappuni (2020) conducted in-depth research on Blockchain technology. She described the characteristics of several types of Blockchain networks. She also investigated how Blockchain technology can be used in numerous industries, such as finance, agriculture, and government. Finally, the study looked into the opportunities and methods for using Blockchain in the book publishing industry and the possible benefits to the industry. She mentioned new business models and revenue distribution approaches for publishers and authors, as well as serving as a means of managing contracts, rights, royalties, intellectual property, and copyright management and improving the supply chain process of the published content.

Ryan et al. (2020) as part of the 'no point in stopping' project, which aims to generate and sell new digital items based on a novella's draughts, revisions, and unpublished artwork. Furthermore, Ryan et al. (2021) asserted that there is significant scholarly interest in how blockchain may be employed in the publishing industry. Furthermore, he argued that existing models are mostly untested and typically author-centered models of intellectual property and royalties administration, with little focus by researchers on publisher-centered models. This study investigated a publisher-centered model that generates value for micro-publishers and the development of a prototype digital ledger that organises intellectual property agreements, royalty payments, and the tracking of both physical and in-store payments.

2.5. Research Gap

This study adopts a similar implementation strategy as (Nizamuddin et al., 2018) but wants to expand on it by examining concepts from the research conducted by (Ryan et al., 2020) under the 'no point in stopping' project, which involves developing a publisher-centric system. While (Ryan et al., 2021) used a closed Blockchain network, Hyperledger, for its implementation, this research will use an open Blockchain platform, Ethereum. Furthermore, the approach will allow readers to access the material without infringing on the author's copyright. In contrast to the approach outlined in the publication for payment processing by Albanese (2018), this research will include the capacity to receive payment directly in its smart contract. Mackey et al. (2019) conducted research that focused on the framework for scientific publishing utilising Blockchain, which entails the usage of a DAO to manage the activities involved. This study will take a more practical approach and will conclude with the delivery of a system.

Overall, the application of blockchain technology in the publishing sector has the potential to increase the process's efficiency, transparency, and security, but further study and development are required to fully realise these benefits.

3. Methodology

A decentralised approach to book publishing using Blockchain technology is an innovative technique to increase the publishing process's efficiency, transparency, and security. One of the primary goals of this study is to examine the potential benefits and drawbacks of implementing Blockchain technology in the publishing sector.

The investigation will begin with a comprehensive examination of existing literature on the usage of Blockchain technology in the publishing sector. Studies addressing the possible benefits of decentralisation, smart contract automation, and the usage of public ledgers in the publishing process will be included. The assessment of literature will also uncover any obstacles or limits reported in earlier research.

Following that, the research will examine the current situation of the publishing sector, including the existing processes and intermediates in the publication process. This will provide context for understanding how Blockchain technology might disrupt and improve the current system.

Following that, the study will provide a theoretical model of a decentralised publishing system based on Blockchain technology. This model will outline the system's essential components and procedures, such as the use of smart contracts, digital rights management, and royalty distribution. The model will also take into account the system's potential obstacles and limitations.

To validate the suggested model, this study will perform a case study of a pilot project in the publishing business that uses Blockchain technology. The case study will shed light on the practical issues and constraints of implementing Blockchain technology in the publishing sector.

This research entails the development of a software system that will accomplish the aforementioned goal. The object-oriented philosophy was used in the construction of this software system in this study, while the agile methodology will be used in the development of the system. Because of the continuous integration and testing of features that would occur during the software development lifecycle, the agile methodology was chosen. Agile approach is a practice that encourages continuous iteration of development and testing throughout the project's software development life cycle. Unlike the Waterfall paradigm, both development and testing operations are carried out concurrently under the Agile methodology (Hamilton, 2022). Furthermore, the agile approach ensures that small projects are completed swiftly and that faults are corrected in a timely manner.

Extreme programming was used as the agile process model or methodologies for this investigation. Extreme programming guarantees that software is designed with the user in mind. Requirements are integrated into the system and released on a regular basis. Scenarios or user stories are used to express these requirements. When customers have constantly changing requests or requirements or when they are doubtful of the system's functionality, the extreme programming technique comes in handy (Hamilton, 2022). It encourages rapid development cycles and frequent 'releases'

of the product, which enhances system efficiency and creates a checkpoint where any client requirements may be immediately implemented.

Finally, the study will finish with a thorough examination of the potential benefits and drawbacks of employing blockchain technology in the publishing sector. The study will also include suggestions for future research and development in this subject.

Overall, this study aims to provide a full understanding of the potential of decentralised alternatives employing blockchain technology in the publishing sector, as well as practical advice for industry participants.

3.1. System Analysis

The system that will be built as part of this research will be used by two parties involved in the publishing process: authors and readers. Before diving into the low-level design of the system, it is critical to analyse the proposed system and how it will be used by all parties involved. Based on its needs, the suggested system can be divided into two broad components. First and foremost, the system under development will allow self-publishing authors to share their written work(s) directly with users via the Blockchain. Furthermore, the technology will allow readers to access the author's work via Blockchain.

The procedure by which the author obtains permission to upload their work to the Blockchain is known as 'minting' in Blockchain jargon. The minting process entails converting data into digital tokens via an encryption procedure (often based on the SHA-256 algorithm). The tokens have an address on the Blockchain where they reside. The address is a one-of-a-kind string of characters used to identify a particular wallet or account on a Blockchain network. These addresses, which are usually made up of letters and numbers, are used to send and receive digital assets (tokens). Each address is assigned a private key, which is a secret code that allows access to and management of the assets connected with that address. The private key is used to sign transactions, which allows the address's owner to spend or transfer assets linked with that address. Since the Blockchain network has a data limit, the real file will be uploaded to IPFS, but a pointer to the file will be hosted on the token's metadata, which will reside on the network.

A smart contract that will function as a mediator is required for the reader to access the uploaded books. The smart contract will be saved and replicated on the system, which will provide security, transparency, and immutability. Before access to the resource is allowed, the smart contract will ensure that the author's terms are met. Payments, access rights to the file housed on IPFS, and other criteria set by the author are examples of these terms.

Therefore, with all of this in place, the system will be able to provide writers with the benefits of decentralisation, allowing them to have control over their work and providing transparency for the publication process. All parties may see the content and its history, making it simple to trace the content's origin and distribution.

3.2. Requirements Analysis

At a high level, the necessity of this system is the creation of a decentralised publishing platform based on Blockchain technology that allows authors to publish their works directly without intermediaries and users to access the works without limitation. The study will also assess the platform's ability to assure the authenticity and integrity of published works. The system requirements can be divided into two categories: functional and non-functional.

3.2.1. Functional Requirements

The functional requirements of the system to be built during this research are as follows:

The system should allow authors to directly publish their works over the Blockchain.

- While publishing, the system will allow the author to specify requirements such as pricing, etc.
- Using Blockchain, readers will be able to access the author's work.
- The system will use smart contracts to ensure that the reader meets the standards set by the author when the book is published.
- The system will ensure the author's work's authenticity and integrity.
- The author will have the option to accept payment when a reader accesses their work.

3.2.2. Non-Functional Requirements

Non-functional system needs include:

- Platform security and privacy,
- Platform scalability and performance and
- Platform usability and accessibility

3.3. System Design

The system that will be constructed will be known as BlockPub. It will enable authors to publish their works using Blockchain technology on a decentralised network. The network will be made up of nodes that will store books and validate transactions. The system will be safe, transparent, and impenetrable. Considering these, we may distinguish two types of users: author and reader. The front-end web application will be used by both groups of users to communicate with the system. The front-end web application will act as a portal for the user to access the Blockchain and interact with the smart contract, allowing the author's work to be published and accessed by the reader.

3.3.1. System Components

At a basic level, the system will be comprised of two key interacting components: the decentralised application that will be hosted on the user's device (front-end) and the Blockchain that will hold the author's smart contract and tokenized book (backend).

Breaking it down further, the system's key components are:

- Blockchain: The system will employ a Blockchain to securely store and confirm book publishing transactions.
- Nodes: The system will be comprised of nodes that will store the books and validate transactions. The Blockchain will be replicated on each node.
- The author client will be a component of the web application that allows authors to publish their works on the network. The author's client will also be used to follow the publishing process and collect book sales payments.
- Reader Client: The reader client is a component of the web application that allows users to look for and buy books on the network. The reader client will also be used to access and read books that have been purchased.
- Payment System: The system will include a payment system that will allow authors to be paid for book sales. Cryptocurrency or other digital payment methods will be used by the payment system.
- Consensus Mechanism: The system will use a consensus mechanism built within the smart contract to validate transactions and ensure network integrity. The consensus approach will guard against duplicate spending and other fraudulent practices.
- Encryption: The system will use encryption to preserve users' privacy and the security of their data. The encryption will also protect the books' content.
- Smart Contracts: The system will employ smart contracts to autonomously enforce the conditions of author-reader publishing agreements.
- The system will include a rating system that will allow users to rank and review books. This will aid in improving the quality of books and provide vital input to the authors.

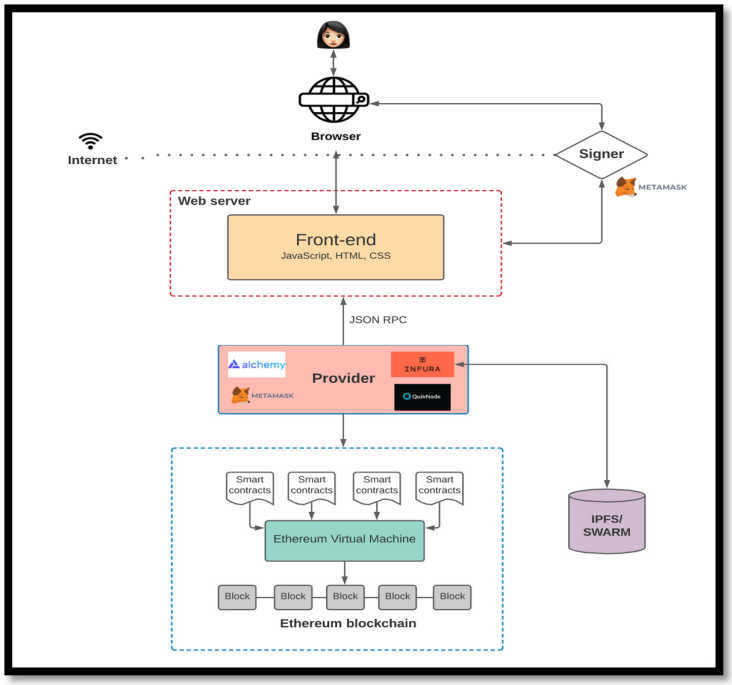

Figure 1: Architecture of a Decentralised Application

3.3.2. System Architecture

The system's architecture will be decentralised and distributed. Each network node will have a copy of the Blockchain and will be in charge of storing and validating transactions. To ensure network integrity, the system will employ a consensus process. To publish and acquire books, author and reader clients will communicate with the network. To enable seamless transactions, the payment system will be incorporated into the network.

3.3.2.1. Advantages

- Decentralised: The system's decentralised design will avoid censorship and allow for a more open and transparent publishing process.
- Secure: The use of Blockchain technology ensures the security of transactions and the network's integrity.
- Transparent: The system will keep a clear record of all transactions and prohibit tampering with the book's content.
- Tamper-proof: The implementation of a Blockchain and encryption will prevent anyone from tampering with the content of the books.

- Simple Payment: Authors will find it simple to collect payments for book sales thanks to the integrated payment system.

3.3.2.2. Disadvantages

- Complexity: Since the system is decentralised and distributed, it may be difficult for some people to understand and use.
- Performance: Due to the enormous number of nodes and the size of the Blockchain, the system may face performance challenges.
- Scalability: As the number of users and books increases, the system may need to be scaled.

4. Implementation

This section of the project discusses the many methodologies used during the system's development. It includes a full account of how the research was carried out, including the methodology and materials utilised and the findings. We also look at the testing strategy employed throughout the system's implementation. The final application is intended to be user-friendly, simple to learn and use.

This section will present our research approach in action, the findings of our analysis, and a discussion of the significance of our findings for the future of publishing.

4.1. System Implementation

This research's system implementation will include the development and deployment of a Blockchain-based platform for content distribution. The platform that will be constructed is called BlockPub. Smart contracts would be used on this platform to automate the distribution process and ensure secure, transparent transactions.

The following steps would be involved in the implementation process:

- Choosing the Right Blockchain Platform: There are various Blockchain platforms accessible, each with its unique set of features and capabilities. The right platform would be chosen based on the publishing industry's specific requirements.
- Creating smart contracts: Smart contracts would be created to regulate the distribution process, including payment and content delivery. These contracts would be intended to automate the procedure while still ensuring secure transactions.
- Designing the user interface: A user-friendly interface would be designed to allow publishers to submit their material and specify distribution terms. On the platform, users will be able to explore and purchase content.
- Testing and deployment: To ensure the platform's functioning and security, it would be rigorously tested. After testing is completed, the platform will be deployed and made public.
- The deployment of a Blockchain-based publishing platform has the potential to give content creators and consumers a more efficient, safe, and transparent distribution method. It would do away with intermediaries and lower transaction costs while also providing a decentralised platform for content distribution.

4.1.1. Choice of Development Environment

The development environment for a Blockchain-based publishing platform will be influenced by the platform's choice of BLOCKCHAIN platform, the level of experience of the development team, and the platform's specific demands. The programming language used to build smart contracts would also influence the development environment. Ethereum smart contracts, for example, are commonly written in Solidity, whereas Hyperledger Fabric supports various programming languages, including Go, JavaScript, and Java. Visual Studio Code, Ethereum Studio, Hyperledger Composer, and Truffle Suite are some of the blockchain programming environments available. Each environment has its own set of characteristics, capabilities, and constraints.

In addition, we will investigate the programming environment used in the development of the system in this research. They are as follows:

- Visual Studio Code (VSCode): This is a popular source code editor created by Microsoft that is available for Windows, macOS, and Linux. It is a small, open-source editor that supports various programming languages and frameworks. It is a popular choice among developers due to its simple debugging interface, huge extension library, integrated terminal, and Git integration. For this study, VSCode was used to write and debug the source code for the decentralised application that was created.
- Remix: A web-based integrated development environment (IDE) for developing and testing smart contracts on the Ethereum Blockchain. Its real-time compilation and testing features, variety of testing tools, and ability to connect to many networks make it a valuable tool for smart contract authors. Furthermore, Remix can support the seamless deployment of smart contracts with less effort than other smart contracts development packages such as truffle and hardhat. The smart contract for the system being constructed was written using Remix. Solidity was used to write the smart contract.
- React: This is a well-known JavaScript library for creating user interfaces. It was created by Facebook and has since become a popular tool for developing complicated online apps. React allows you to design reusable UI components and manage an application's state in a modular fashion. Its ability to render components rapidly, maintain an application's state, and have a robust ecosystem of tools and modules have made it a popular choice for developing sophisticated online applications. The application user interface was built using React and Next.js.

- Next.js: Next.js is a React-based open-source web development framework. Zeit, a cloud infrastructure business, created it and launched it in 2016. Next.js offers a suite of tools and capabilities that make it easier to create server-side rendered React applications with better speed and SEO. Its automatic code splitting, server-side rendering, and static site generation capability make it a popular choice for developing modern online applications. Next.js was used to create the web application with which the user will interact for the purposes of this study.

4.1.2. Justification for Programming Languages Used

- Solidity: Solidity is a high-level programming language that is used to create smart contracts on the Ethereum Blockchain. It is a statically typed language that is intended to be simple to learn and apply for developers. Solidity is an essential part of the Ethereum ecosystem, allowing developers to build decentralised apps and communicate with the Ethereum network. Solidity's ability to communicate with the Ethereum Virtual Machine (EVM) is one of its distinguishing features. The EVM is a virtual machine that operates on the Ethereum network and executes Solidity-based smart contracts. The EVM executes Solidity code after it has been compiled into EVM bytecode. Developers can use this to create decentralised applications that can run on the Ethereum network.
- JavaScript: JavaScript is a well-known high-level programming language that is used to develop interactive websites and web applications. Netscape first launched JavaScript in 1995, and it has since become one of the world's most popular programming languages. JavaScript is included in all modern web browsers and can be used for both client-side and server-side development. It is an essential tool for web developers due to its ability to interface with HTML and CSS, support for many programming paradigms, huge and active community, and continual improvement.

4.2. Test Plan

A test plan specifies a software testing project's approach, objectives, scope, resources, and schedule. It describes the full testing process, including the testing strategy, test cases, testing environment, and testing tools. A test plan's objective is to guarantee that the testing process is methodical, organised, and efficient and that it covers all areas of the software system to be tested. It serves as a communication tool between the testing team, developers, and stakeholders and a roadmap for the testing team to follow. Before making the programme available to end users, a well-defined test strategy can help to ensure that it has been thoroughly tested and that any flaws or problems have been identified and corrected.

4.2.1. Unit Testing

Unit testing is a software testing technique in which individual units or components of a software system are tested separately from the rest of the system. A unit is any piece of code that performs a certain function or action, such as a function, method, class, or module.

Unit testing ensures that each unit of code functions as intended and meets the requirements given. Developers often conduct it throughout the development phase of the software development lifecycle.

Each unit is tested using a range of test cases to ensure that it behaves as expected under various input situations and generates the expected output. Positive and negative test cases, boundary value analysis, and equivalence partitioning are examples of test cases that are often produced based on the unit's requirements and design specifications.

Jest, a Javascript testing library, was utilised for unit testing. Given the React library's component model, unit testing in the system being constructed entails testing individual components. Furthermore, various utility functions for dealing with the blockchain were unit tested.

4.2.2. System Testing

System testing is a sort of software testing that assesses the behaviour and performance of an entire software system rather than individual components or units. It is often performed following the completion of unit and integration testing.

System testing ensures the software system meets its criteria and functions as expected in the production environment. It entails testing the entire system to ensure that all components and subsystems perform properly and that the system as a whole meets its functional and non-functional requirements.

Rather than the engineers who authored the code, system testing is often handled by a dedicated testing team. Depending on the complexity and size of the software system being tested, it may contain a combination of manual and automated testing methodologies.

4.3. Results

This section summarises the findings and inferences drawn from a study that investigated how blockchain technology could be utilised to create a decentralised platform for book publication. The purpose of this research is to determine whether or not it is possible to use blockchain technology to create a decentralised publishing platform that can be used by both authors and readers. It is anticipated that the findings of this study will provide useful direction for the continued development of decentralised publishing systems and illustrate the functionality of the system that has been presented. These findings have been gathered as part of this investigation.

4.3.1. Smart Contract

The application includes something called a smart contract, which is a computer programme that can run on its own and can automatically enforce the terms of a contract that was made between two or more people. The deployment of smart contracts normally takes place on a Blockchain platform, and cryptographic methods are utilised to ensure the stability and security of the smart contracts. A smart contract can perform a number of roles, some of which include automating and enforcing the conditions of a contract. This helps to ensure that all parties comply with their duties and that the contract is carried out as intended.

The ERC-721 standard, which allows for generating non-fungible tokens on the Ethereum network, serves as the foundation for the smart contract underpinning this application. The ERC-721 standard makes it possible to create one-of-a-kind digital assets, making transactions more safe, transparent and accessible while also opening up new avenues for ownership and monetisation opportunities. Additionally, the ERC721URI Storage and Ownable interfaces were used in this experiment.

4.3.2. Publishing Module

The publishing module is in charge of providing a user interface that the author can utilise to publish their work to the Blockchain. This is the module's responsibility. The first iteration of the user interface is depicted in figure 2. The meta-mask wallet extension is triggered when the user types the details into the form and clicks the submit button. This extension displays the specifics of the transaction as well as the gas fee for publishing the tokenized book to the Blockchain.

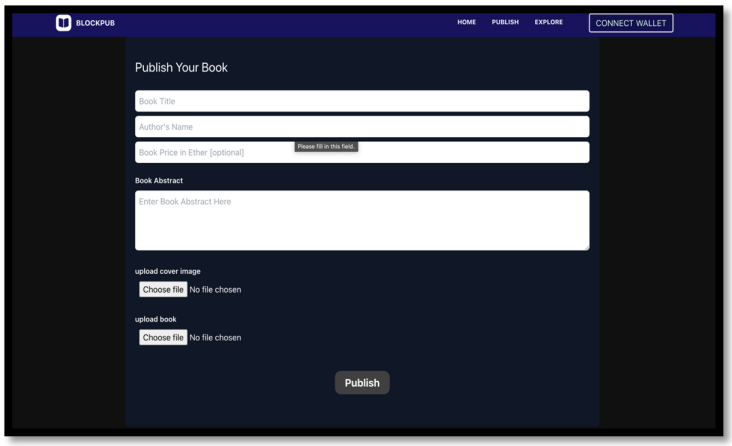

Figure 2: The Publishing Interface

4.3.3. Reading Module

Aside from facilitating publication, the site also enables readers to browse already published books and access them from within the interface of the platform itself. This is accomplished by accessing the reading module of the platform through a dynamic URL scheme. The module is responsible for accomplishing this goal. The URL structure looks like this: 'DOMAIN/open/[tokenID]' where:

- DOMAIN is the name of the platform's domain name.
- [tokenID] is a stand-in for the actual identifier of the tokenized book that is hosted on the Blockchain.

Figure 2 illustrates the addressing system by displaying it in the address bar of the picture. This scheme is known as the Dynamic URL scheme. This time around, 'localhost' will serve as the domain name. In addition, the graphic in Figure 3 depicts the tokenized book that is hosted on the Blockchain being retrieved and shown when the user has satisfied all of the requirements that were established by the author who originally published the book.

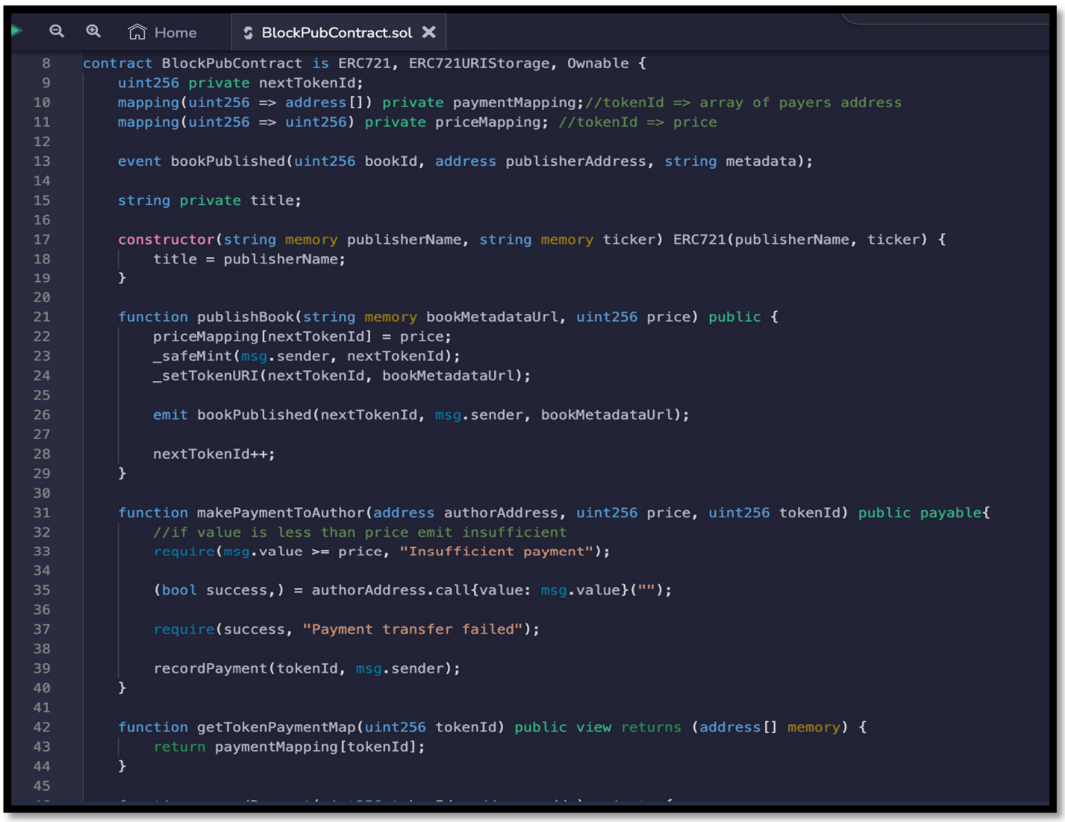

Figure 3: Tokenization Snippet

5. Conclusion

The primary objective of this project is to create a decentralised application that will provide authors with the ability to publish their work by utilising the Blockchain. In addition, consumers will be able to search through the books and access them through the site. The research project was successful in developing a decentralised application that makes it possible for authors to publish their work on the Blockchain so that it may be accessed by readers.

Validating the originality of published works and establishing ownership of those works through the use of smart contracts and digital signatures is an approach that is both safe and open to public scrutiny.

The installation of the Interplanetary File System (IPFS) ensures that huge contents be hosted in an efficient and a decentralised manner, which decreases the danger of data loss or manipulation. IPFS was developed by NASA and is known as the Interplanetary File System.

The application that is being presented has the potential to completely transform the publishing industry by delivering to authors and readers a platform that is more democratic and open to their participation.

The study emphasises the significance of resolving potential issues, such as scalability and user acceptance, to assure the application's continued viability and success over the long term.

In general, the findings of this study provide a contribution to the expanding body of research that has been done on blockchain technology and the possible uses that it could have in a variety of fields, including publishing. Future studies could build on this research to better investigate the decentralised application's potential and limitations. The decentralised application offers a viable approach for addressing some of the existing problems that are plaguing the traditional publishing sector.

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