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Decentralized Music Marketplace: A Blockchain-Based Rights Management Approach

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Abstract
Historically, Traditional music rights management systems have favored the major record labels, leaving the creators underserved. By analyzing the current landscape, this paper introduces and implements a blockchain-based rights management system for the music industry with the goal to combat this issue. The system aims to establish a transparent licensing structure, ensure comprehensive rights metadata, and simplify fair royalty distribution. Utilizing blockchain, the system stores rights metadata on a public ledger, ensuring the transparency and immutability of the data. A consensus mechanism on a permissioned blockchain validates the integrity of the metadata, enhancing trust. The royalty payouts are enforced by Smart contracts, leveraging algorithms for fair and efficient distribution using cryptocurrency transactions. The proposed system addresses the historical shortcomings of traditional DRM and provides a more equitable solution for all music industry stakeholders.

Keywords: Blockchain, Music Licensing, Revenue Distribution, Smart Contracts

1. Introduction

The rise of blockchain technology represents an enormous potential for the music industry (Arcos, 2018). Creators can demonstrate ownership of their creations by taking advantage of blockchain's decentralized and tamper-proof ledger, supporting industry openness and accountability (Hollerith, 2018). Furthermore, blockchain improves economic transparency and fair compensation for artists by eliminating the influence of intermediaries, guaranteeing that royalties for music usage are dispersed evenly (Taghdiri, 2019). This research paper uses blockchain to impact the music industry by empowering the artist ensuring they receive a fair royalty for their work and shedding more transparency on the contracts.

2. Background

In recent years, the music industry as a whole has transformed from being dominated by physical media sales to a more streaming focused market. This has made music more accessible to consumers but has also exposed quite a few challenges about the fairness of the existing music royalty distribution system.

2.1. Key Issues in the Current Music Industry:

- Unfair Revenue Split: Disparity in financial benefits, where musicians receive a smaller share compared to streaming platforms, labels, and record labels (Moreira & Roche, 2020).
- Copyright Protection Challenges: Digital music storage has created difficulties for artists with unauthorized downloads and sharing of their work (Isaac et al., 2022)
- Opaque Licensing Structures: The evolution of streaming and the lack of a global rights database contribute to complex and error-prone licensing processes (Ciriello et al., 2023).
- Incomplete and Inconsistent Rights Data: Fragmented databases across music industry organizations lead to inconsistent and incomplete music metadata, further hindering efficient royalty distribution (Ciriello et al., 2023).
- Unclaimed Royalties: Delays in payouts due to the complexities mentioned above result in a significant amount of unclaimed royalties for rights holders (Ciriello et al., 2023).

The issues highlighted are some of the reasons why a new approach for the distribution and rights management of music using Blockchain technology is a potential solution with the core features of blockchain immutability, transparency, and security acting as its building blocks.

2.2. Potential of Blockchain for the Music Industry:

Blockchain offers several advantages over traditional systems, such as:

- Transparent and Efficient Royalty Distribution: Smart contracts can automate royalty distribution based on predefined rules, ensuring a fairer share for creators (Ciriello et al., 2023).
- Enhanced Copyright Protection: Blockchain can create tamper-proof records of ownership and track music usage, facilitating better copyright enforcement.
- Streamlined Licensing: Storing rights and licensing information on a blockchain can simplify licensing processes and improve data accuracy.

3. System Architecture

3.1 Overview

The music marketplace smart contract has been designed with the following design principles in mind:

- **User Roles:**

The system allows for different user roles with their own functionalities and privileges :

- Personal Users: These users represent individual customers who buy the songs for personal use. They can buy songs and access details of their purchased songs.
- Commercial Users: Commercial users in our context are entities such as businesses or organizations that purchase songs for commercial use, such as for the use of music at events, malls, and other commercial avenues.
- Record labels: Record labels are the entities responsible for managing and distributing songs. They have the authority to add new songs to the marketplace and track earnings from song sales.
- Artists: Artists are creators of the music available on the platform. They earn royalties from song sales and can access details about their earnings and associated songs.

- **Contract Structure:**

The smart contract is structured based on the following key components:

- User Structs: These structs define the properties of each user type, such as userID, wallet addresses, and earnings.
- Song Structs: These contain information about each song, including its name, pricing for personal and commercial use, royalty percentage, and associated artists.
- Purchase Counts: This struct keeps track of the number of times a song has been purchased, distinguishing between personal and commercial purchases.
- Mappings: Various mappings connect users to their respective IDs and roles, songs to their record labels and artists, and track song purchase counts.
- Modifiers and Functions: Modifiers ensure that only users with the appropriate roles can execute certain functions, such as adding songs or purchasing them. Functions handle user actions like adding users, songs, and purchasing songs, while also facilitating earnings distribution.
- **Transaction Processes:**

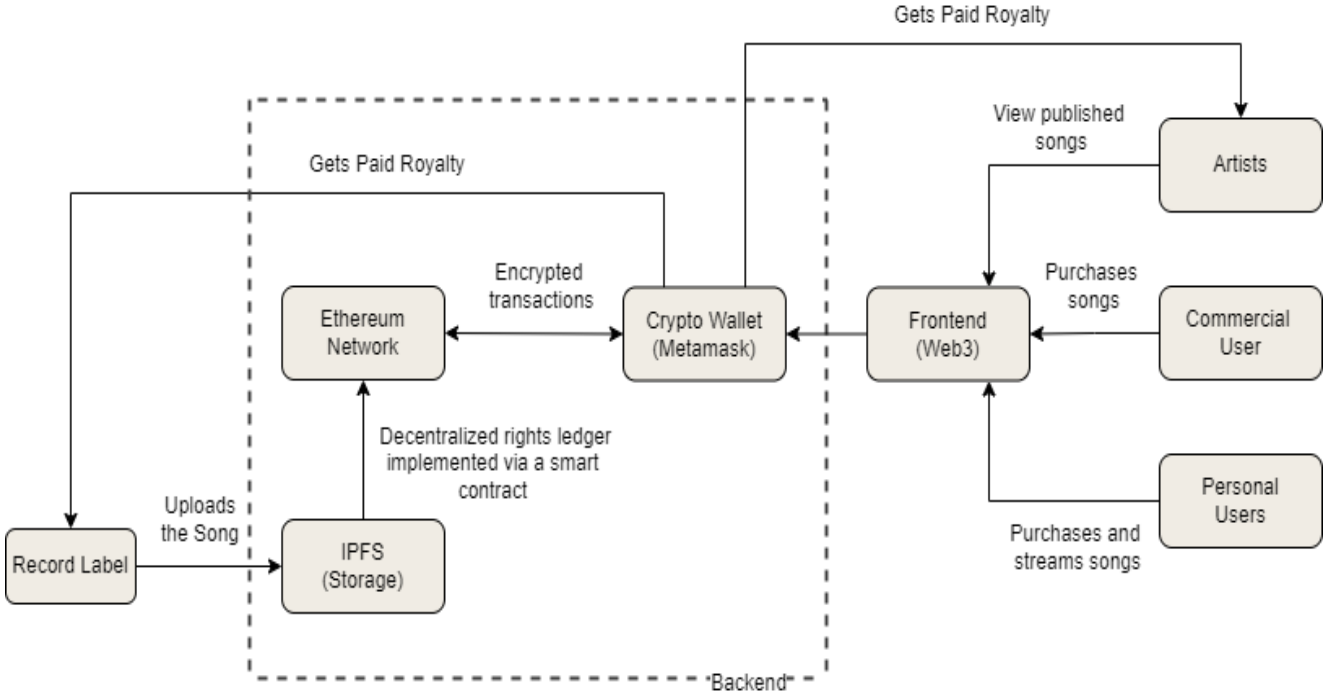
The interaction between users and the contract follows a set of defined processes:

- User Registration: Users register on the platform by specifying their role as personal, commercial, record label, or artist. Each user has a unique wallet address.
- Song Addition: Record labels add new songs to the marketplace by providing details such as song name, pricing, royalties, and associated artists. Upon addition, songs become available for purchase.
- Song Purchase: Personal and commercial users can buy songs by sending the required payment to the contract. The contract verifies the user's role and ensures they have sufficient funds before completing the purchase. Earnings are distributed to the record label and artists based on the specified royalty percentages.
- Earnings Distribution: When a song is purchased, the contract calculates and distributes earnings to the record label and the song's associated artists based on the defined royalty percentages.
- Accessing Details: Users are able to access various details such as their personal information, purchased songs, earnings, and the number of times a song has been purchased.

3.2 How it Works

1. **User Registration:** Users register with specific roles (personal, commercial, record label, or artist) to access different features and permissions within the platform.
2. **Song Upload:** Record labels upload songs to the platform, providing details such as song name, pricing for personal and commercial use, royalty percentage for artists, and artist information.
3. **Library Management:** Uploaded songs are organized into a catalog, segmented by user type. Users can browse and access songs based on their registered role.
4. **Song Purchase:** Users initiate song purchases using cryptocurrency. The system deducts the appropriate amount from their wallet; based on their userType; and distributes revenue among record labels and artists according to predefined royalty percentages.
5. **Revenue Distribution:** Record labels receive a share of revenue from song purchases, while artists earn royalties based on their contributions to the song.
6. **Sales Tracking:** The system transparently tracks sales and revenue using blockchain, ensuring an immutable and auditable record of transactions.
7. **User Access and Streaming:** Users can access purchased songs for streaming, providing a seamless experience for enjoying music within the platform.

Figure 1: Work flow of the system



4. Implementation

Figure 2: How Song is added to the blockchain

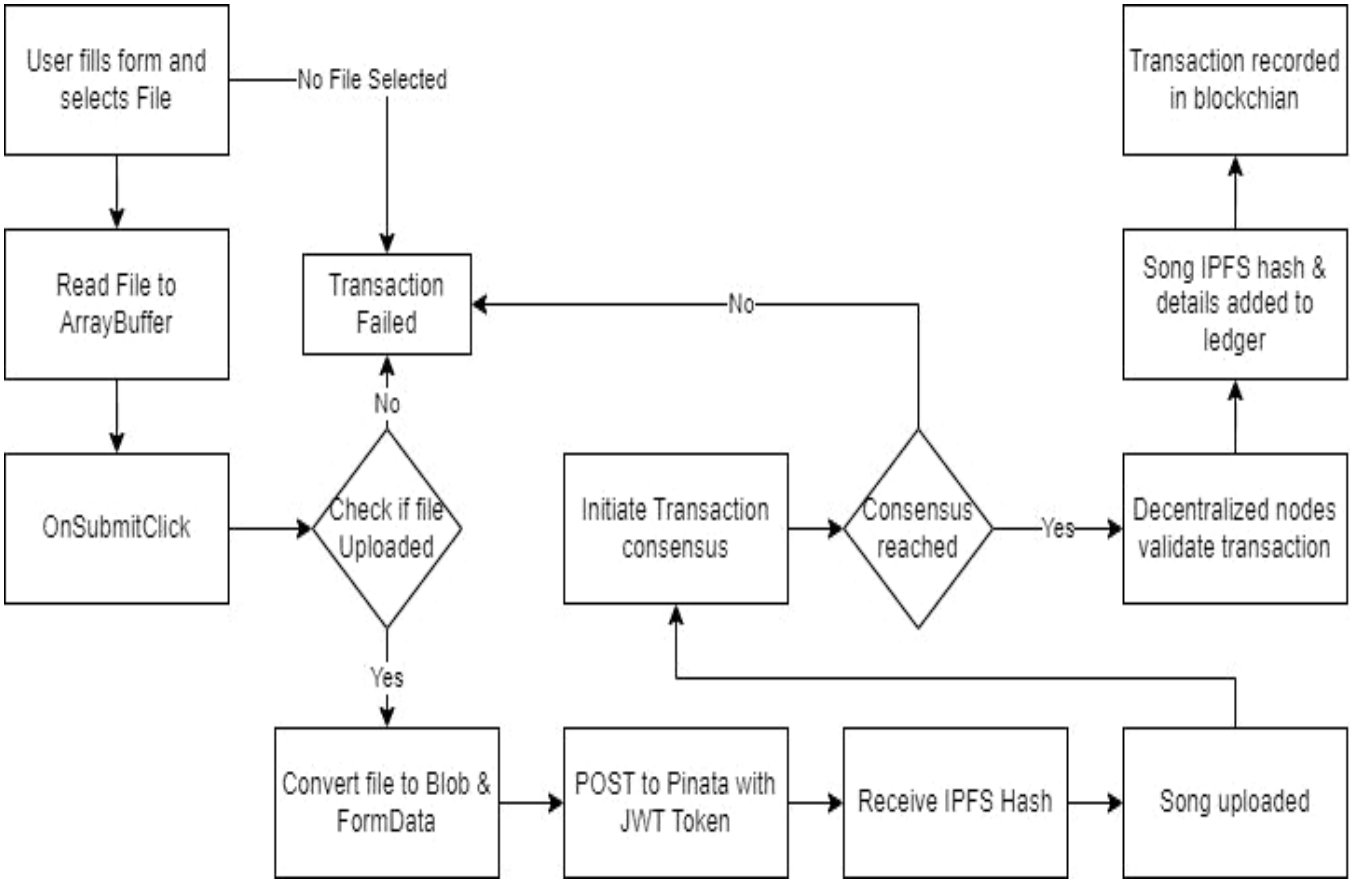


Figure 3: How a song is purchased on the web app

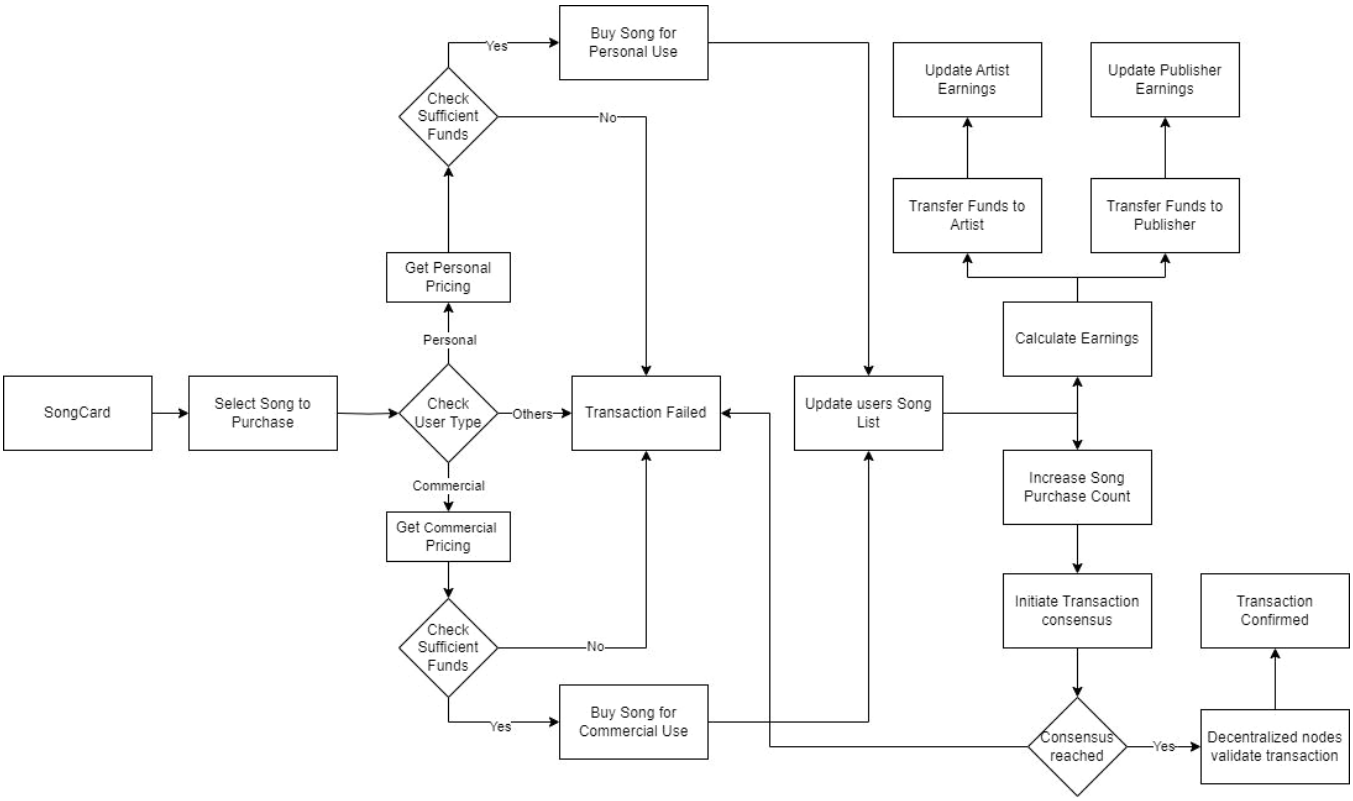


Figure 4: Login page

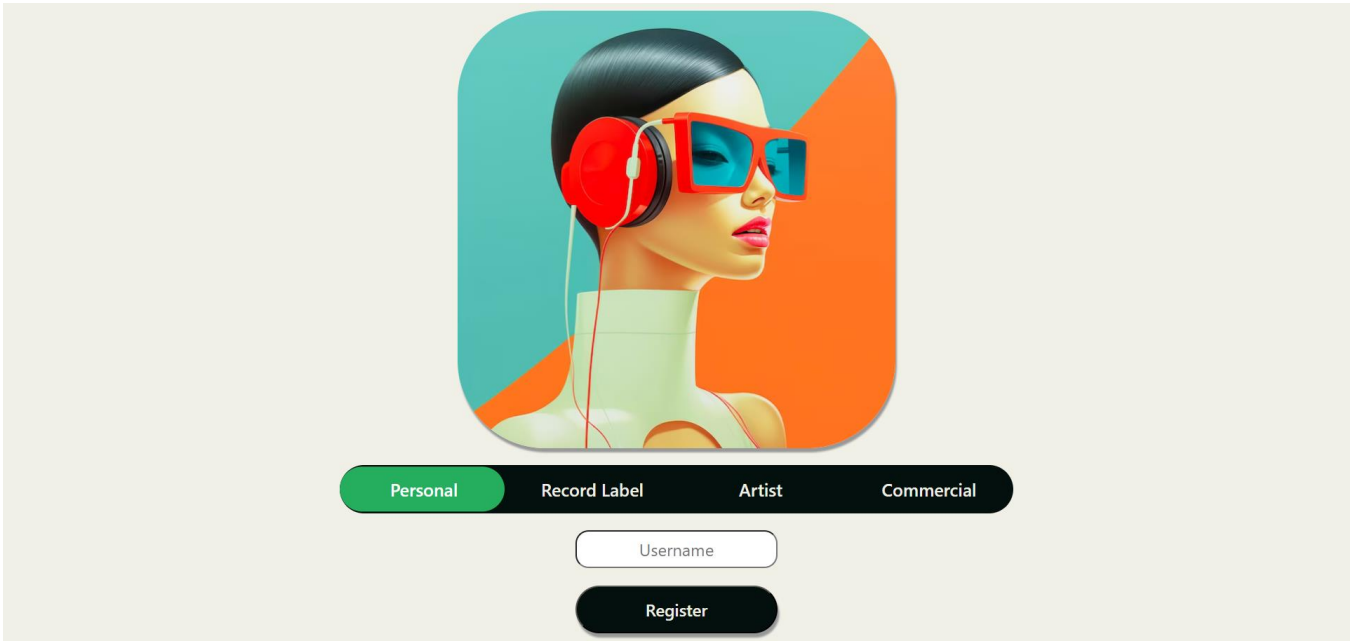


Figure 5: Home page for Record Labels

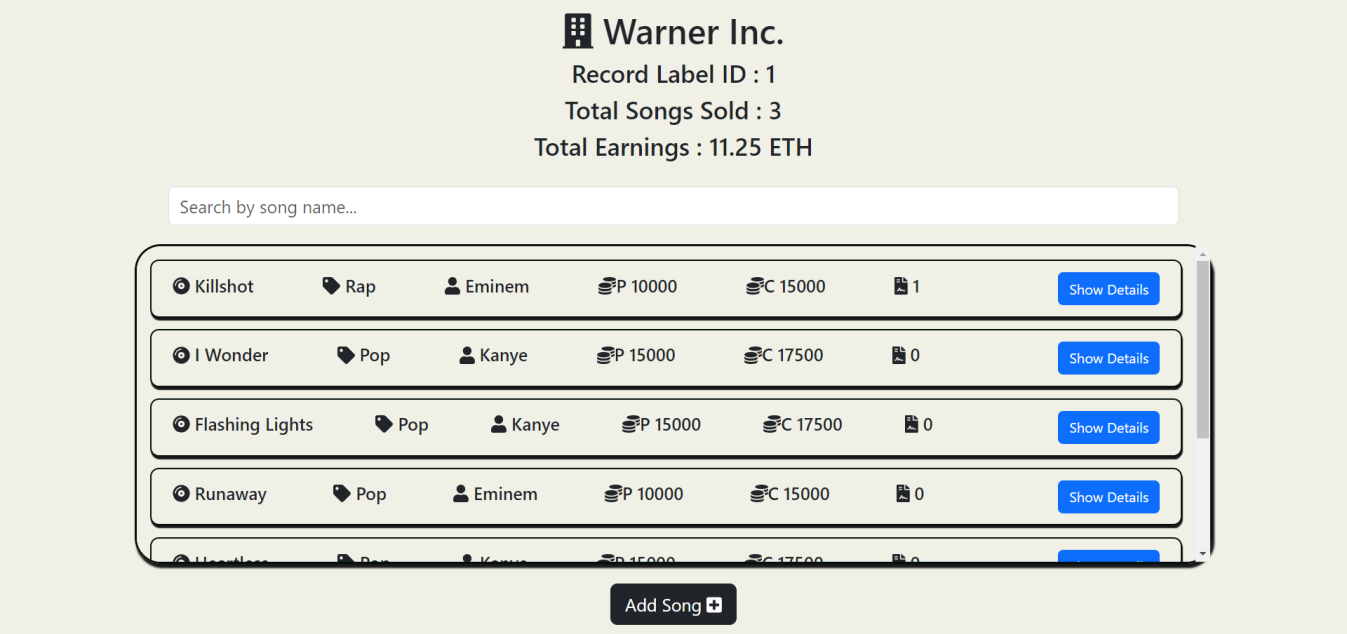


Figure 6: Add Song page for Record Labels

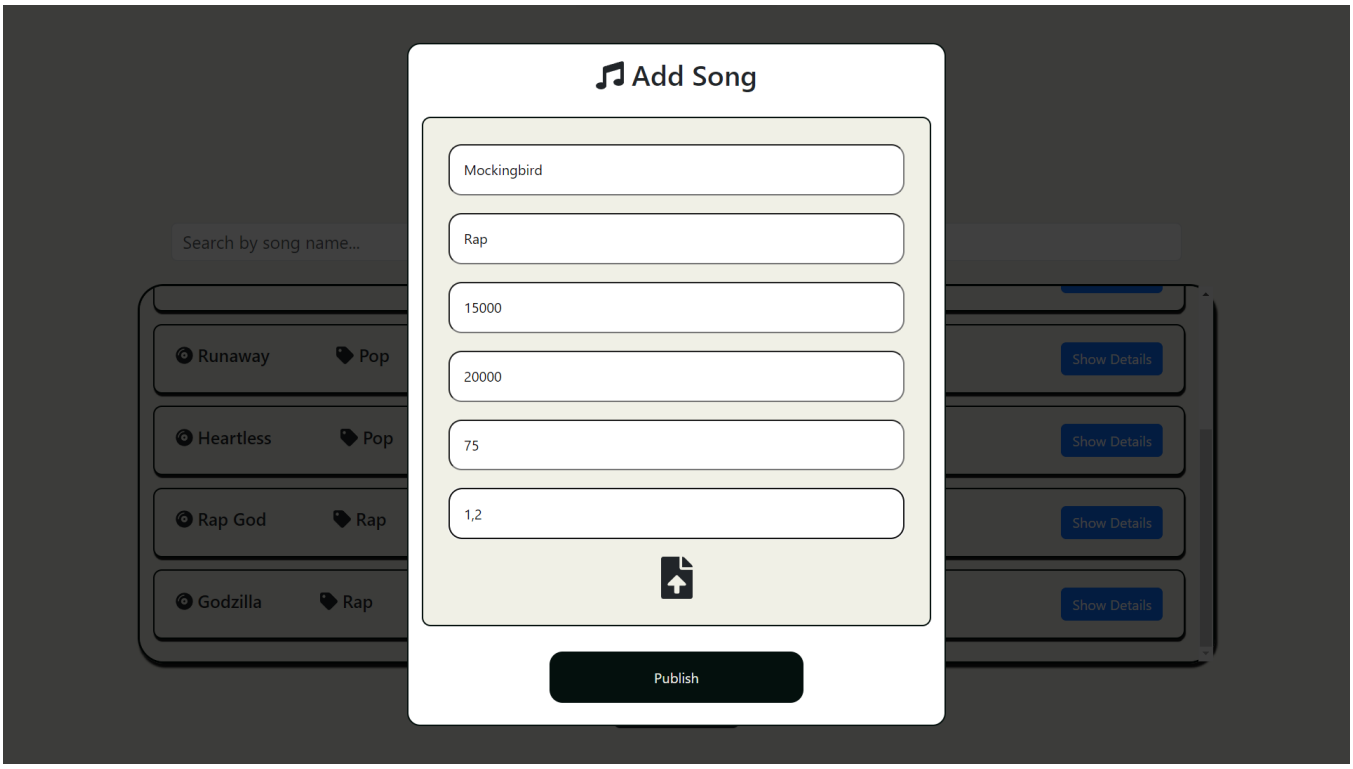


Figure 7: Home page for Artists

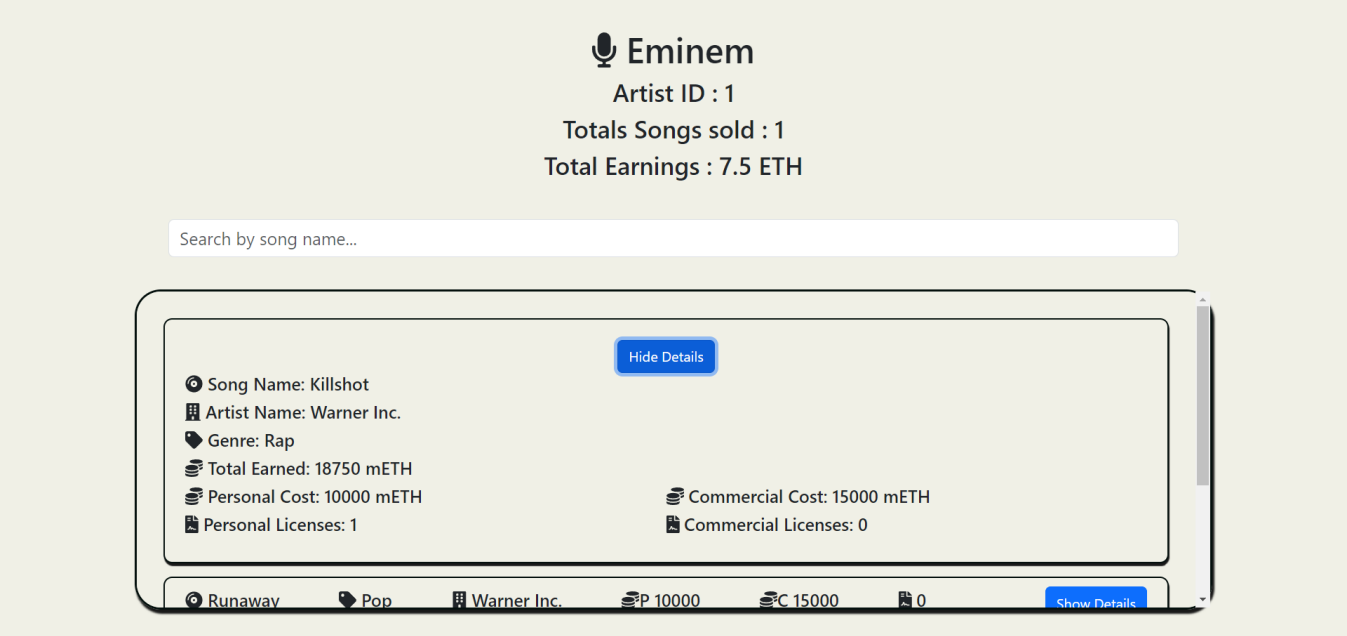


Figure 8: Store page for Personal Users

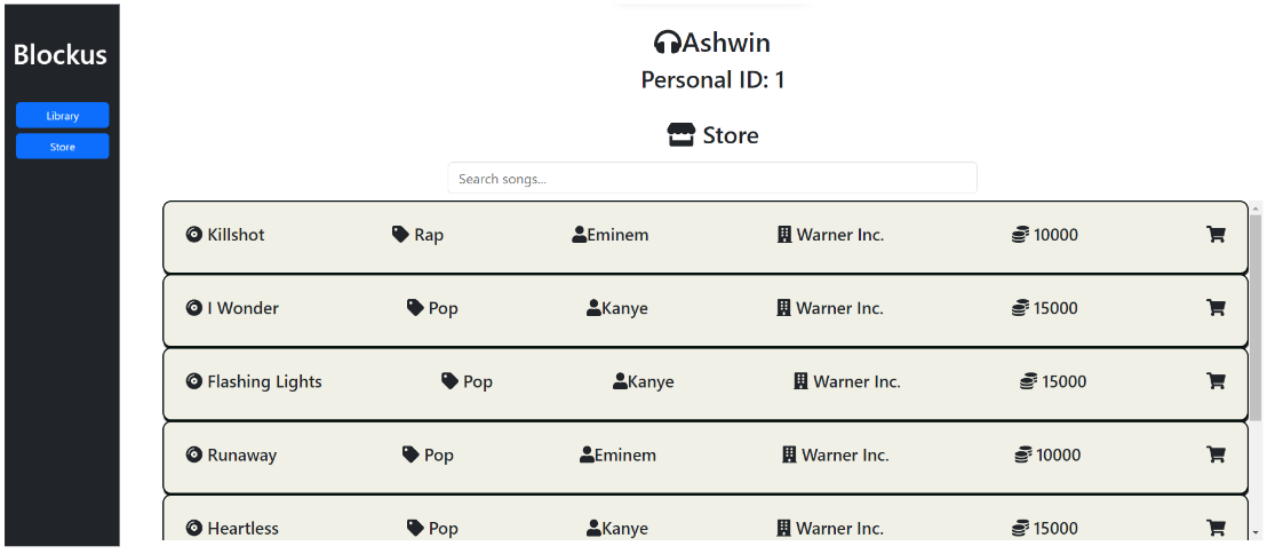


Figure 09: Buy Song Transaction

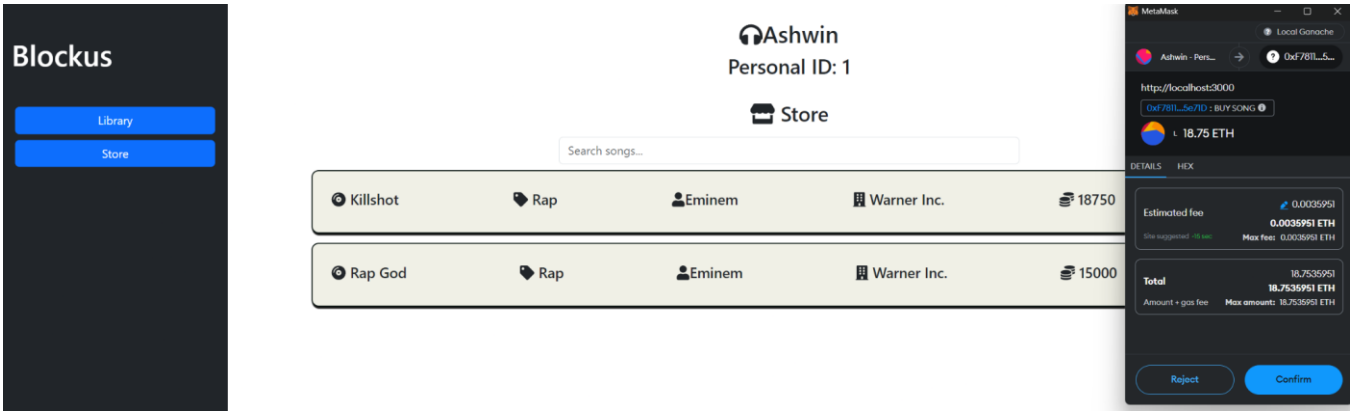
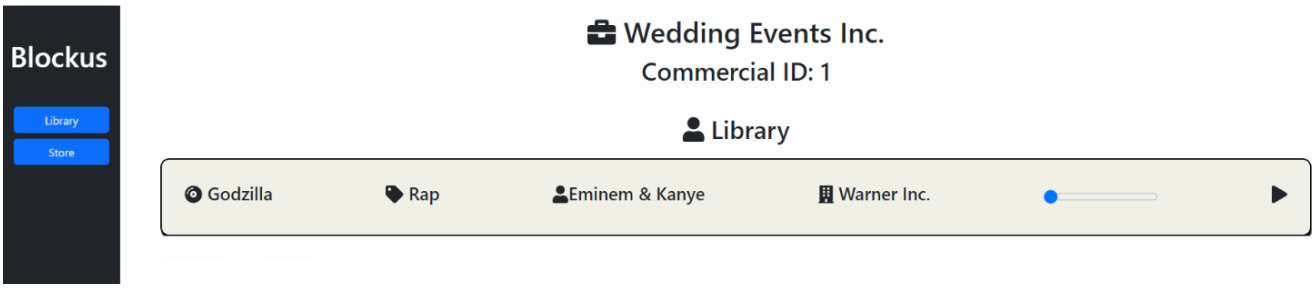


Figure 10: Library page for Commercial Users



5. Setbacks

Blockchain-based rights management systems are a relatively new technology, and as such, there are a number of legislative challenges that they may face, such as:

- Scalability and Processing Time: Blockchain technology, particularly on platforms like Ethereum, still faces challenges regarding scalability and processing time, which can hinder its widespread adoption and real-world applicability.
- Legal Issues: There are legal uncertainties surrounding the validity of license contracts executed via blockchain technology, especially concerning different copyright laws and regulations across various jurisdictions. Clarification and adaptation of legal frameworks are necessary for blockchain-based applications to operate effectively within existing legal systems (Fink & Moscon, 2019).
- Data Storage Limitations: Ethereum-based applications encounter limitations in data storage, prompting the need for centralized third-party services like Google's Firebase for data storage. This reliance on centralized infrastructure contradicts the decentralization ethos of blockchain technology and introduces vulnerabilities. (Chen et al, 2020)
- Governance: Decentralized application (dApp) governance presents challenges, particularly in copyright registration processes where there is no centralized authority overseeing ownership claims. Without robust governance mechanisms, issues related to ownership and accountability may arise.
- Code Optimization: Continuous improvement in code optimization is essential for enhancing the efficiency and effectiveness of smart contracts. Gas-efficient Solidity code is crucial for minimizing transaction costs and maximizing performance. Additionally, ensuring validation and security measures within smart contracts is paramount to prevent unauthorized access and maintain data integrity.

6. Conclusion

This paper has explored the potential that lies in the utilization of blockchain in order to address one of the challenges that arise within the music industry, specifically those related to copyright management and royalty distribution. Our research has identified the shortcomings that arise in transparency, efficiency, and accessibility of copyright information. We proposed a decentralized application (dApp) built on the Ethereum blockchain to address these issues. The dApp streamlines royalty payments, increases transparency through public transaction records, and establishes a public registry for copyright information.

However, our project also revealed some of the limitations of blockchain technology, such as scalability, processing times, and storage costs. Additionally, the legal implications of copyright enforcement through smart contracts remain unclear. While our dApp functioned well in a local environment, further testing is

required to assess its efficacy in a real-world setting, with real record labels and artists, and their respective licensing agreements on the Ethereum Mainnet.

Future work should focus on these limitations and areas for improvement. Legal research is required to determine the validity of smart contract enforcement of copyright ownership. Additionally, a mechanism for user verification and copyright ownership needs to be developed to ensure the integrity of the system in order to verify if the uploader of the music is indeed the correct authorized user. Finally, ongoing code optimization and security audits are crucial for a robust and secure dApp.

This paper demonstrates blockchain's potential to revolutionize the music industry by empowering producers and ensuring they are properly compensated for their work. By addressing the identified limitations, blockchain-based solutions can be a viable path towards a more transparent and equitable music ecosystem.

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