RHYTHMXCHANGE

A project report submitted
In fulfilment of the requirements for the award of the degree of
Bachelor of Technology
In
Computer Science & Engineering

Submitted By:

UTSAV CHATTERJEE (17600120002)

ANTICK BHATTACHARJEE (17600120052)

GOURAB BHATTACHARYA (17600120057)

SUPRATIM MAJUMDER (17600120007)

Under the guidance of

Mrs. MOUSOMI ROY, Dept. of CSE

Department of Computer Science & Engineering

Hooghly Engineering & Technology College, Hooghly

Affiliated to

Maulana Abul Kalam Azad University of Technology, West Bengal

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HOOGHLY ENGINEERING & TECHNOLOGY COLLEGE

Vivekananda Road, Pipulpati, P.O. & Dist. Hooghly (WB), Pin-712103
(Affiliated to Maulana Abul Kalam Azad University of Technology)

CERTIFICATE

This is to certify that the project entitled **"Decentralized Music Streaming Platform"** has been submitted in partial fulfilment of the requirement for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering** by the following B.Tech (CSE) final year students under the supervision of **Mrs. Mousomi Roy**, **Assistant Professor,** CSE Department, during a period from **July, 2023 to June, 2024.**

Student Name (with University Roll No.)

1. Utsav Chatterjee	17600120002
2. Antick Bhattacharjee	17600120052
3. Gourab Bhattacharya	17600120057
4. Supratim Majumder	17600120007

Mrs. Mousumi Roy,
Department of CSE

Prof (Dr.) Biswajit Halder
HOD, Department of CSE

Dr. Smitadhi Ganguly
Principal in-Charge, HETC

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It gives us immense pleasure to announce the completion of our project on **"Decentralized Music Streaming Platform"** and we are pleased to acknowledge our indebtedness to all the persons who directly or indirectly contributed in the development of this work and who influenced our thinking, behaviour and acts during the course of study.

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Finally the team expressed their gratitude to our respected Principal **Dr. Smitadhi Ganguly** without his support our project would not have seen the light of success.

Student Name (with Roll No.)	**Signature**
1. Utsav Chatterjee (17600120002)	……
2. Antick Bhattacharjee (17600120052)	……
3. Gourab Bhattacharya (17600120057)	……
4. Supratim Majumder (17600120007)	……

4th Year, 8th Semester

Department of Computer Science & Engineering

Hooghly Engineering & Technology College

Academic Year: 2023-24

ABSTRACT

The Decentralized Music Streaming Platform (DMSP) is a cutting-edge project designed to revolutionize the music industry by leveraging blockchain technology. This platform addresses the current limitations of centralized streaming services, offering artists and users a more transparent, fair, and secure ecosystem. DMSP employs a decentralized architecture powered by blockchain, ensuring transparency in royalty distribution and eliminating intermediaries. Smart contracts facilitate automatic and equitable payment to artists based on real-time usage data, fostering a direct and trustful relationship between creators and consumers.

Moreover, the platform prioritizes user privacy and control. With a decentralized database, user data is securely stored, and individuals have greater control over their personal information. This shift empowers users to share or restrict access to their data based on their preferences, fostering a more user-centric streaming experience. The project's technical backbone involves utilizing blockchain's immutability and smart contract functionality to ensure the integrity of music ownership and licensing. Artists can register their work on the blockchain, establishing a verifiable and immutable record of ownership, while smart contracts automatically enforce licensing agreements. In addition to its technological advancements, DMSP places a strong emphasis on community engagement and curation. Users actively contribute to the platform's content discovery through token-based incentives, creating a vibrant and diverse music ecosystem.

In summary, the Decentralized Music Streaming Platform merges blockchain technology with a user-centric approach to redefine the music streaming landscape. By addressing issues of transparency, fairness, and user control, DMSP aims to empower artists and listeners alike, fostering a decentralized and innovative future for the music industry.

Key Terms: Blockchain, Token-Based, Smart Contract, Transparency & Ownership.

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INTRODUCTION

Decentralized music streaming platforms stand at the forefront of a revolutionary transformation in the music industry, poised to redefine the dynamics of content distribution, artist compensation, and user engagement. In an era where technological innovation drives rapid change, these platforms represent a departure from the conventional centralized models that have long dominated the streaming landscape.

At their core, decentralized music streaming platforms harness the power of blockchain technology, reshaping the traditional paradigm. Blockchain serves as the underlying infrastructure, enabling a decentralized, transparent, and secure ecosystem for music distribution. By leveraging distributed ledger technology, these platforms create a network of interconnected nodes, facilitating direct interactions between artists and listeners while eliminating the need for intermediaries.

The fundamental distinction lies in the restructuring of the relationship between creators, consumers, and platform providers. Conventional streaming services have faced criticism for their opaque royalty structures, where artists often receive meager compensation for their contributions. In contrast, decentralized platforms strive for fairness and transparency by employing smart contracts embedded within the blockchain. These contracts autonomously execute agreements, ensuring instant and equitable compensation for artists based on predefined terms, thereby circumventing intermediaries and ensuring fairer revenue distribution.

Moreover, decentralization fosters a peer-to-peer (P2P) architecture, diverging from the reliance on central servers. Through P2P networks, users access music directly from other users' devices, enhancing content availability and reducing dependency on centralized infrastructure. This approach not only improves accessibility but also minimizes downtime and the risks associated with centralized control, such as censorship and data vulnerabilities.

Beyond technological innovation, decentralization introduces a paradigm shift in governance and community involvement. Decentralized autonomous organizations (DAOs) play a pivotal role in these platforms, enabling stakeholders, artists, listeners, developers to actively participate in decision-making processes. DAOs facilitate a democratic approach to governance, empowering the community to propose and vote on platform changes, fostering a sense of ownership and inclusivity.

However, despite their transformative potential, decentralized music streaming platforms face challenges. Legal complexities surrounding copyright laws, licensing agreements, and regulatory compliance present hurdles that necessitate careful navigation and adaptation within established legal frameworks.

In essence, decentralized music streaming platforms signify a groundbreaking evolution in the music industry. By harnessing blockchain technology and promoting fairness, transparency, and community involvement, these platforms aspire to create a more equitable and engaging environment for artists and listeners alike. As they continue to evolve, their potential to revolutionize music distribution and consumption remains a compelling force in the digital entertainment landscape.

REVIEW OF LITERATURE

What is Blockchain and how does it Work?

Maintaining records, elaborating contracts, and carrying out monetary transactions are some of the basic and time consuming activities of any business. Introduced in October 2008 as the technology behind Bitcoin, blockchain has continuously been appointed as the biggest foundational technology since the internet, with the potential to transform our operational economic systems (Iansiti and Lakhani 2017). As a decentralized, peer-to-peer (P2P) network that acts as a distributive ledge recording transactions among parties, blockchain technology guarantees transparency, high level of security, efficiency and irreversibility to its users.

The Music Industry turning points:

During the pre-internet era, the music industry experienced a long stage of constant growth, with a hand full of record labels, known as the Majors2 , controlling a U$ 38.6 billion industry (IFPI 2001). Music was physically distributed (e.g. CDs in a retail music shop), a constraint that gave the record labels control over the entire supply chain. Due to this power, most of the value in the chain was captured by record labels, along with all the data from the transactions. This suggests that any possibility for data managing with innovation objectives would not be available for artists.

With the popularization of the internet, the physical distribution aspect became increasingly irrelevant. The industry's profits started to fall by 2000: 1.3% in value and 1.2% in units compared to 1999 (IFPI 2001). New and disruptive business models were created, such as the controversial NAPSTER, a P2P sharing music network that significantly increased music piracy. In the midst of an exponential decreased in the industry's sales, there was a clear demand for restructure regarding the traditional model.

One of the main turning points for the industry was the launch of the iTunes Store, an online platform created by Apple that would change how we, as a society, consume music. Songs were no longer a physical good, consumers would be able to purchase digital media through all their Apple devices, no extra restraints. Yet, record labels were unhappy with Apple's song pricing and musicians lamented not getting enough royalties from it (Bockstedt, Kauffman and Riggins 2005). Nevertheless, the industry, so threatened by online piracy, finally had a way to profit from digital media.

The Music Industry value-chain:

Even though, the way we consume music has changed, the work division within the industry remained roughly the same: artists create music, fans consume it, and the intermediaries, such as the record labels and distributors, act as the powerful middlemen (Graham, et al. 2004). Imogen Heap (2017), a Grammy winning recorded artist and big blockchain supporter in this industry, points out that "A major pain point for creatives in the music industry — such as songwriters, producers and musicians — is that they are the first to put in any of the work, and the last to ever see any profit. They have little to no information about

how their royalty payments are calculated, and don't get access to valuable aggregate data about how and where people are listening to their music."

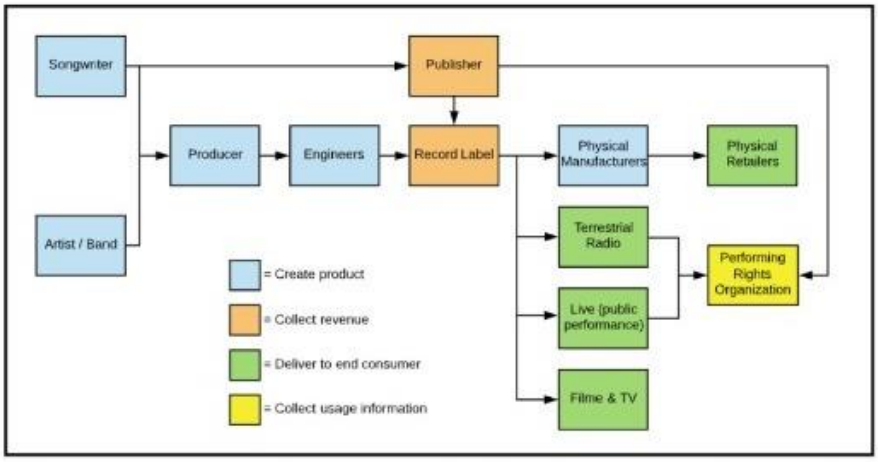


Figure 1. Recorded music supply chain before digital media – adapted from (Hosoi, et al. 2015).

For major artists, the revenue stream created by the Aggregators' business models decreased the total and flow of payment. For small and independent ones, even though created the possibility for publishing music online, royalties are commonly unpaid (De Leon and Gupta 2017, Gartner Inc. 2017).

How can Blockchain Revolutionize the Music Industry:

The 2017 Hype Cycle report (Gartner Inc. 2017) suggests that the technology is five to 10 years away to mainstream adoption. The report expects that during these time, some focus will be given to create convergence in architectural styles (private and public) resulting in all distributed ledgers having similar functional characteristics. Moreover, it is also states that "concerns remain about the viability of the technologies, security (software and hardware), scalability, legality and interoperability", especially given that public ledgers seem inappropriate for most enterprises internal information. However, even with the technology in its initial stages of development, for the purposes of disintermediation in the music industry, it shows great immediate potential. Two of the main issues identified in our research are:

1. the lack of access to transactional information; and
2. the inefficiencies associated to royalty payments;

Blockchain technology can solve both of these issues, while maintaining transparency throughout the entire chain. Not only that, as we will discuss in section 5, the possibilities for applications go beyond the traditional business models in the industry, enabling a closer relationship between Artists and Consumers.

PROPOSED WORK

Project Initiation:

a. **Define project objectives:** Clearly state the purpose and goals of the Music NFT project. Determine the desired outcomes, such as creating a platform for musicians to sell and trade NFTs or building a decentralised marketplace for music NFTs.

b. **Identify stakeholders:** Identify the key stakeholders involved in the project, including musicians, artists, collectors, developers, and potential users.

c. **Formula project scope:** Determine the boundaries and limitations of the project. Define the types of music NFTs to be supported, the platform features, and any specific technical requirements.

Development and Implementation:

a. **Platform development:** Build or customise a platform to support the creation, distribution, and trading of music NFTs. Consider the integration of blockchain technology for authenticity, transparency, and security.

b. **Smart contract implementation:** Develop and deploy smart contracts to facilitate the creation, ownership, and transfer of music NFTs. Ensure proper coding, testing, and auditing of the smart contracts.

c. **Collaborate with musicians and artists:** Engage with musicians and artists to onboard them onto the platform, educate them about the benefits of music NFTs, and assist in the creation and minting of their NFTs.

d. **Community building:** Foster a supportive and engaged community around the music NFT platform. Implement strategies to attract collectors, investors, and enthusiasts. Encourage active participation and feedback.

e. **Purchase NFT:** Anyone can buy an edition of a music NFT and the purchased price should be automatically added to the artist's wallet.

f. Transaction Transparency: If anyone buy a music NFT then all the transaction history or records (NFT ownership transfer) is visible to everyone and should be transparent. As the records are stored in blockchain, they are immutable.

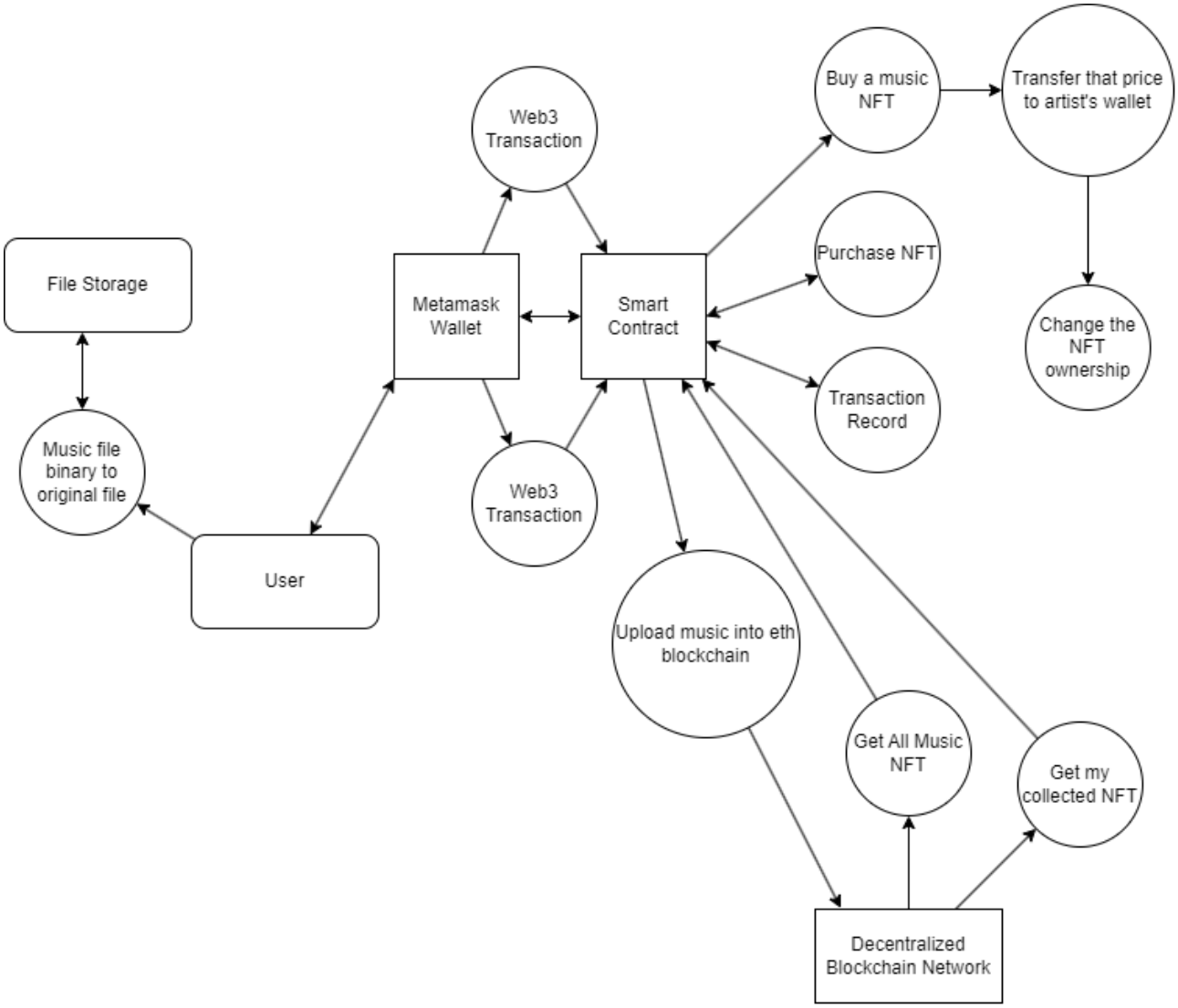


Fig 1: Data-Flow Diagram

PROJECT MODULES & FEATURES

Designing a decentralized music streaming platform involves various modules and features to ensure a comprehensive and user-friendly experience. Here is a breakdown of potential project modules and features:

Core Modules:

- User authentication via MetaMask
- Upload and manage music tracks
- Add metadata (artist name, genre, release date, etc.)
- Smart contracts for transparent royalty distribution
- Tokenization of music assets
- Cryptocurrency integration for payments
- Smart contracts for automated royalty distribution
- Integration with decentralized storage solutions (e.g., IPFS) for music file storage
- Redundancy and data integrity measures

User-Facing Features:

- Collect the music NFTs of their favourite artists
- Advanced search functionality
- Filters based on genre, artist, release date, etc.
- High-quality audio streaming
- Discover upcoming and minted tracks
- Minting and trading of music-related NFTs
- Exclusive content as NFTs

TECHNICAL DETAILS & APPLICATION

Tech Stack:

1. Smart Contract, Based On Ethereum Blockchain
2. Metamask wallet as an ether currency provider
3. Django for creating REST APIs
4. React JS for a client interactive UI

Smart Contract: Smart contracts are self-executing contracts with the terms of the agreement between the buyer and seller directly written into code. They run on blockchain technology, which ensures their decentralized and tamper-proof nature. Once deployed, these contracts automatically execute when predefined conditions coded into them are met, without the need for intermediaries. They enable secure, transparent, and trustless transactions across various industries, including finance, real estate, supply chain, and more.

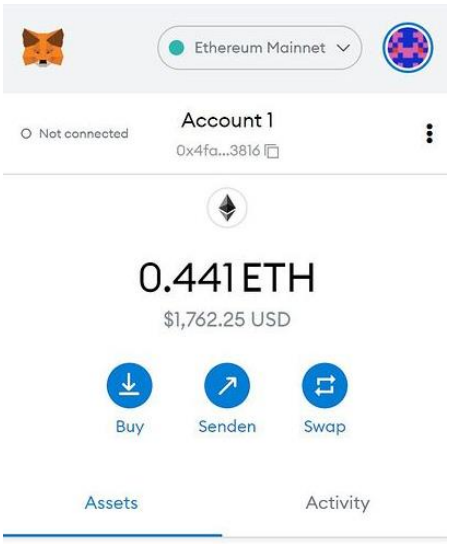
Smart contracts have a wide range of applications across various industries:

1. **Finance:** They facilitate peer-to-peer lending, automated asset transfers, and decentralized finance (DeFi) platforms without the need for traditional intermediaries like banks.
2. **Supply Chain:** Smart contracts can track and manage the movement of goods, verify authenticity, and automate payments at different stages, enhancing transparency and efficiency.

MetaMask Wallet: MetaMask is a cryptocurrency wallet and browser extension that allows users to interact with the Ethereum blockchain and Ethereum-based decentralized applications (dApps) directly from their web browser. It serves as a bridge between the user and the blockchain, enabling activities like sending and receiving Ethereum-based tokens, interacting with decentralized exchanges, participating in token sales (ICOs), and accessing various decentralized applications.
It provides a user-friendly interface for managing Ethereum-based assets, allowing users to create multiple wallets, import existing ones, and securely store private keys. Additionally, MetaMask enhances security by requiring users to confirm transactions and interactions with dApps, reducing the risk of unauthorized access to funds or activities. Overall, it's a popular tool for those engaging with the Ethereum ecosystem through their web browsers.

MetaMask serves as a gateway for users to access a wide array of applications and services within the Ethereum ecosystem:

1. NFT Marketplaces: It allows users to interact with NFT (non-fungible token) marketplaces, enabling buying, selling, and managing digital collectibles, art, and other unique assets.
2. Decentralized Applications (dApps): MetaMask enables interaction with various decentralized applications across different industries, from governance platforms to supply chain management tools, all powered by the Ethereum network.



Overall, MetaMask serves as a versatile tool for users to securely manage their Ethereum-based assets and seamlessly engage with a wide range of decentralized applications and services available on the Ethereum blockchain.

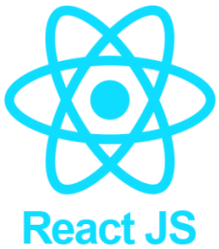
Django: Django is a high-level web framework for building web applications using Python. It provides a robust and pragmatic design, encouraging rapid development and clean, pragmatic design. Django follows the "Don't Repeat Yourself" (DRY) principle, aiming to minimize redundancy, promote reusability, and enhance productivity.

Application of Django:

1. **ORM (Object-Relational Mapping):** Django provides an ORM layer that allows developers to interact with the database using Python classes, abstracting away SQL queries.

2. **Content Management Systems (CMS):** Many CMS platforms are built using Django due to its robustness, security features, and the ability to handle content-heavy sites efficiently.
3. **API Development:** It's employed to build RESTful APIs and web services, facilitating communication between different applications or platforms.

React JS:



The top tier of the MERN stack is React.js, the declarative JavaScript framework for creating dynamic client-side applications in HTML. React lets you build up complex interfaces through simple components, connect them to data on your back-end server, and render them as HTML React's strong suit is handling stateful, data-driven interfaces with minimal code and minimal pain and it has all the bells and whistles you'd expect from a modern web framework, great support for forms, error handling, events, lists, and more. React is a free and open-source front-end JavaScript library for building user interfaces based on components. It is maintained by Meta and a community of individual developers and companies.

FUTURE SCOPE

As of my last knowledge update in January 2022, the decentralized music streaming space was already gaining attention, primarily driven by the blockchain and cryptocurrency technologies. However, keep in mind that developments in the tech industry are rapid, and new advancements may have occurred since then. Here are some potential future scopes for decentralized music streaming platforms:

1. **Blockchain and Smart Contracts:** The use of blockchain technology can ensure transparent and secure transactions for artists. Smart contracts can automate royalty payments based on predefined conditions, providing a fair and transparent revenue distribution system.

2. **Tokenization of Music Assets:** Tokenizing music rights and assets on a blockchain can enable fractional ownership, allowing fans and investors to buy and trade tokens representing a share in a musician's work. This could provide new funding avenues for artists and a novel way for fans to engage with their favorite musicians.

3. **Enhanced Copyright Protection:** Blockchain can be leveraged to create an immutable and timestamped record of ownership and copyright information. This can help in preventing unauthorized use and distribution of music, ensuring that artists receive fair compensation for their work.

4. **Improved Monetization Models:** Smart contracts can be programmed to enable more flexible and customizable monetization models. Artists may have the ability to set their own pricing structures, subscription plans, or even offer exclusive content to specific token holders.

5. **NFT Integration:** Non-Fungible Tokens (NFTs) could play a role in the decentralized music industry by representing unique and rare music assets, such as exclusive tracks, concert footage, or limited edition releases. This could create additional revenue streams for artists.

6. **Decentralized Storage Solutions:** Implementing decentralized storage solutions can enhance the security and availability of music files while reducing reliance on centralized servers.

CONCLUSION

For almost all of history, the only way you could enjoy music was live and in person. Artists performed for small audiences their art only capable of travelling as far as their feet could carry them. Since music had to be performed live, it could only be heard by those within earshot. It wasn't till little over a century ago that technology began to change the course of music history. The role of technology in music has always been to take the artist's work to a larger audience. The radio allowed musicians to reach anyone who could access the airwaves. The gramophone let music be replayed infinitely without the artist being physically present. Each incremental improvement advanced the fidelity and reach of music, always trying to recreate the experience of a live performance while, at the same time, conveying it to the widest possible audience. None of this was cheap and artists who wanted access to the larger audiences that technology offered had to enter into agreements with the radio companies and record labels who had made these technology investments. This is how all the biggest musicians of yesteryear were made their inherent talent enhanced by technology, to bring them before larger audiences than would have otherwise been possible. In exchange for the privilege of using this technology, artists agreed to share a significant proportion of their earnings with the record labels. For solving those problems and also for giving artist the royalty, we choose this project.

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