The Decentralized Non-Fungible Token Exchange with Secure Connections

Sharath M S[1*], Shreedhara N Hegde[1], Lai Mei Yoon[2**]

[1]Dayananda Sagar Academy of Technology andManagement, Karnataka, India.
[2]Faculty of Data Science and IT, INTI International University, 71800 Nilai, Malaysia

Email: sharathmskadur123@gmail.com*, meiyoon.lai@newinti.edu.my**

Abstract

During the COVID-19 outbreak, due to the lockdown, all museums and galleries were closed for more than a year. So, the buying and selling of physical arts have dropped. This project aims to overcome this challenge by developing a decentralized application called Decentralized NFT Exchange. The decentralized non-fungible token (NFT) exchange includes features such as secure wallet connections, NFT creations, buying, selling, and profile management. The back-end of the decentralized NFT exchange is implemented using Solidity-based smart contracts, while InterPlanetary File System (IPFS) is used for decentralized storage. Front-end development of decentralized NFT exchange is implemented using React JSX and framework web3.js that helps developers connect to the Ethereum network. Decentralized NFT can help art creators sell their artworks using a smart contract system where the ownership of the work will become the property of the new owner with proof of a digital certificate. The project demonstrates the practical application of blockchain technology in developing decentralized applications (DApps) for secure and decentralized digital asset management. Overall, Decentralized NFT might be a solution for the copyright of work in the future and the project contributes to secure and decentralized digital asset management.

Keywords

Blockchain, Digital Assets, Non-Fungible Tokens, DApp, Smart contract.

Introduction

Recently, in the digital era, almost all sectors have been based online, from education, government, and tourism to companies using social media as a medium of information. The decentralized non-fungible token, often called NFT, is one of the cryptographic digital assets. This asset is widely used by artists and content creators to sell their works (Batra et al., 2023).

A decentralized non-fungible token (NFT) is an ownership record stored on the Ethereum

Submission: 21 May 2024; **Acceptance:** 22 July 2024

blockchain. While digital items, such as images, audio, and videos, are the most common assets traded as NFTs (Das et al., 2022), However, ensuring the security of NFTs is a major challenge, particularly focusing on safeguarding users' private keys. This project aims to address these challenges by developing a decentralized application (DApp) named Decentralized NFT Exchange, which offers a safe and user-friendly platform for NFT management.

The work aims to tackle several fundamental questions regarding the secure management and trading of NFTs. The work was to identify how users can connect their cryptocurrency wallets securely, allowing themto interact with NFTs without exposing their private keys. Besides that, how the NFTs are traded securely and transparently on a blockchain-based marketplace was also investigated (Batra et al., 2023).

To address these questions, the team has designed and implemented the decentralized NFT exchange. This platform enables users to securely connect their wallets to the DApp, create NFTs, and manage their NFTs. Smart contracts written in Solidity for secure and transparent asset transfer on the blockchain were used with Ganache and localhost. Additionally, we createdNFTs based on user input, which were then uploaded to decentralized storage on IPFS (Batra et al., 2023).

Copyright infringement often occurs in our country; of course, there are many examples of copyright infringement that we often see. Work made by someone is the property of that person, whether it already has a patent or not. For example, a simple copyright case in music or YouTube videos re-uploaded by other content creators without the permission of the original owner of the work (Rafli, 2022). Therefore, a technology called decentralized NFT exchange was created to address this problem.

Methodology

A decentralized NFT exchange is a platform for trading, creating resources, and selling NFTs.It is designed for trading and creating various types of NFTs. There are various requirementsfor understanding the concept before creating a decentralized NFT exchange such as Cryptocurrency, Statistics, Trading, Minting, Auction, Ownership, and Rights (Gupta et al., 2022).

1 **Cryptocurrency:** Cryptocurrency, also known as crypto, is a digital currency or virtual currency that uses cryptographic encryption to protect transactions. It operates without a central authority and relies on a decentralized system for tracking transactions and creating new units. Cryptocurrencies use peer-to-peer networks, allow payments from anywhere, and transactions are identified as digital entries in an online database, rather than tangible money.

2 **MetaMask:** MetaMask is a software cryptocurrency wallet used to interact with the Ethereum blockchain. It allows users to access their Ethereum wallet through a browser extension or mobile app, which can then be used to interact with decentralized applications

3 **Wallet Connection:** The Wallet Connect feature is crucial in the NFT Marketplace dApp, allowing users to securely connect their cryptocurrency wallets without exposing their private keys. This is achieved through MetaMask, a browser extension that bridges the user's browser and their cryptocurrency wallet. Users can interact with the dApp's features without manually entering their

private keys, reducing the risk of key theft or unauthorized access. React.js and Ether.js, a popular library for Ethereum-based networks, were used to connect the dApp with users' wallets through the MetaMask browser extension. The Ether.js library provided an intuitive API for sending and receiving data from the blockchain, making it easy to integrate the dApp with the Ethereum network.

4 NFT Creation: The decentralized NFT exchange project focuses on creating unique digital assets called Non-Fungible Tokens (NFTs) within a platform. NFTs represent ownership or proof of authenticity for various digital content, such as artwork, music, videos, or virtual collectibles. Creators and artists can upload content, tokenize it, and define attributes like metadata, ownership rights, and royalties. This empowers creators to monetize their creations by selling or auctioning them on the marketplace, while collectors and enthusiasts can discover, browse, and acquire these unique digital assets. The platform fosters a vibrant ecosystem for digital art and unique digital assets.

5 NFT Minting: NFT minting is the process of creating unique digital assets called Non-Fungible Tokens (NFTs) for trade or sale in a decentralized NFT exchange project. NFTs represent ownership or proof of authenticity for various digital content, such as artwork, collectibles, music, videos, and virtual real estate. Through the minting process, creators or users can tokenize their creations, assign unique metadata, and generate one-of-a-kind NFTs that can be bought, sold, or transferred securely on the blockchain. NFT minting empowers creators and collectors to participate in the digital art and collectibles ecosystem, allowing them to showcase, monetize, and trade their unique digital assets seamlessly.

The mint function in the smart contract creates a new Ethereum token with a URI based on the IPFS hash returned by the Pinata API. The contract specifies the token's characteristics, including name, symbol, and total tokens. The NFT is minted and can be viewed in the Marketplace, with the metadata URI on IPFS allowing users to view its name, description, price, and image. The unique token ID ensures NFT transferability between users.

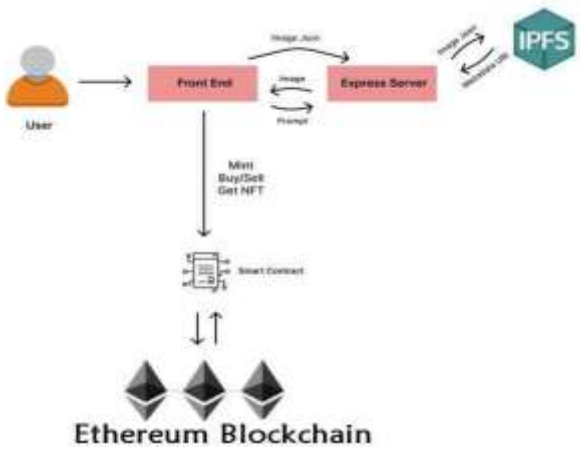

Figure 1. Application Workflow

6 Gas: Ethereum's native money, Ether (ETH), is required for user engagement, known as gas. These fees compensate Ethereum miners for the time and energy required to verify transactions and add security by making it prohibitively expensive for spammers to participate. They also make it prohibitively expensive for bad users to spam the network.

Related Work

Blockchains, first introduced by Satoshi Nakamoto as Bitcoin, are a decentralized payment system with no central actors. The idea of a decentralized ledger, with a distributed, transparent, and immutable consensus algorithm, introduced a new societal structure of digital money without a central authority, redistributing power among the masses (Tasatanattakool et al., 2018).

This stealth innovation was proclaimed as a stealth innovation in 2009. NFTs are unique digital tokens with a single identity, making them scarce and providing a perfect marketplace for digital creators and consumers. They are an identity on the digital ledger, proving proprietorship. The value of NFTs comes from their nonfungibility aspect, as they are unique and once minted on the public digital ledger. Each time a token is transferred, its ownership changes. The original owner retains the rights as the creator of the NFT, and each person trading or owning it is the respective owner who gets incentivized each time a transfer of ownership occurs (Nadini et al., 2021).

An airline ticket allows users to use services, while NFTs use the same concept but digitally. On the blockchain, a certificate of authenticity is created after minted NFTs, indicating that no similar token exists, making them unique and scarce (Voshmigr et al.,2020).

The Internet's NFT mania is challenging to determine its real value, as digital art projects like CryptoKitties and CryptoPunks continue to evolve. The authenticity of these digital assets is a certificate given to the owner, making it difficult to determine their true worth (Usman, et al.,2021).

NFT creators hold copyright to their digital assets, and buying NFTs does not grant unrestricted access to the asset. The owner must confirm their private key and use a legitimate digital signature to transfer NFTs. Proving ownership of NFT-based intellectual property rights implies possession of the creator's original hex hash value. NFT marketplaces must acknowledge their rarity for monopolistic tendencies to function (Khan et al.,2021).

NFTs' value stems from their rarity, expected future value, and provenance. Provenance is the certificate of ownership, history of ownership, and the transfer of ownership hands. NFTs, blockchain-based tokens representing ownership over content, create value for many. Blockchain has immense potential, and NFTs, being a small piece of it, could potentially refurbish societal shifts (Murray et al.,2021).

NFTs are expected to bridge the real and digital worlds, connecting physical and digital entities, facilitating value exchanges. The emerging parallel worlds are an interesting phenomenon to look at since linking real and digital worlds would reform the ways of perceived mass value. Digital ownership transfers hold significant value in the real world, but their corresponding structures change and are complex to determine in the digital world (Wang et al., 2022).

Results and Discussion

The Decentralized NFT Exchange project aimed to create a decentralized platform for minting, and trading NFTs. It involved a user-friendly web application with smart contract integration for secure transactions and ownership of digital assets.

The Decentralized NFT Exchange project has reached its final result, marking a significant milestone in digital art and collectibles. A robust and user-friendly platform connects artists, collectors, and enthusiasts, showcasing diverse, authenticated digital assets as non-fungible tokens (NFTs). This revolutionary technology ensures the authenticity, ownership, and scarcity of each item, providing an innovative solution to the challenges faced by the art industry in the digital age.

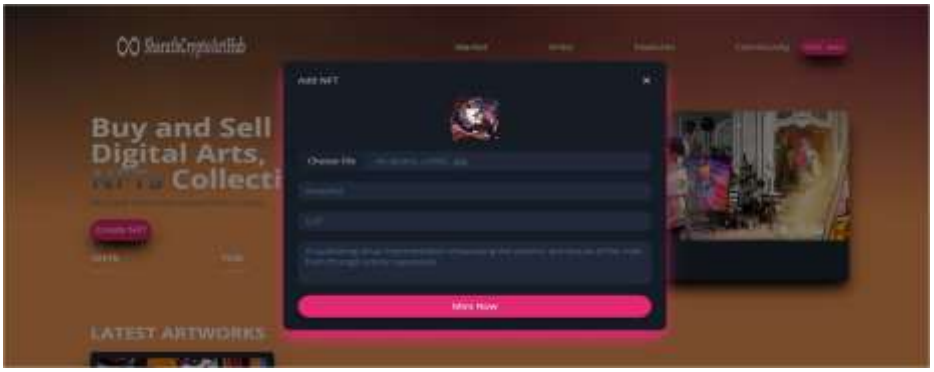

Figure 2. NFT Creation Page

Figure 3. Latest Artwork

Conclusion

The Decentralized NFT Exchange dApp showcases the potential of blockchain technology in creating secure, transparent, and user-friendly platforms for managing and trading digital assets. It addresses fundamental challenges in NFT management, including secure wallet connections, NFT generation, NFT minting, and a marketplace for trading NFTs. The Ethereum network has enabled the creation of personalized and unique NFTs, creating valuable digital assets. The usability study shows that dApp is user-friendly and easy to navigate. Future research may focus on improving scalability, exploring new approaches for NFT generation, and addressing potential security issues in digital asset management and trading. Overall, the NFT Marketplace application represents a significant step forward in decentralized applications for NFT management and trading.

Acknowledgments

The authors would like to express our heartfelt gratitude to Dayananda Sagar Academy of Technology and Management (DSATM) for providing us with the necessary resources and facilities to conduct this research project on "DECENTRALIZED NFT EXCHANGE". The support and encouragement from the institution have been instrumental in the successful completion of this endeavor.

Furthermore, we would like to extend our heartfelt thanks to our family, especially our mothers, for their unwavering love, support, and understanding throughout this journey. Their encouragement and belief in our abilities have been a constant source of motivation, and their financial support has enabled us to pursue this research project with dedication and commitment.

We are deeply grateful to all the individuals and institutions mentioned above for their support and contributions, which have been pivotal in shaping this research paper on "Decentralized NFT Exchange".

References

Alex Murray et al., (2021). Contracting in the Smart Era: The Implications of Blockchain and Decentralized Autonomous Organizations for Contracting and Corporate Governance.

Andrei-Dragos Popescu et al.,(2021). Non-Fungible Tokens (NFT) – Innovation beyondthe craze, ISSN 1737-9334.

Dipanjan Das et al.,(2022). Understanding Security Issues in the NFT Ecosystem, ACMISBN 978-1-4503-9450-5/22/11. https://doi.org/10.1145/3548606.3559342.

Dw Putu Alit Denbagus Rafli et al.,(2022). NFT Become a Copyright Solutions.

Fei Chao et al.,(2018). A framework of blockchain-based secure and privacy-preservingE-government system. https://doi.org/10.1007/s11276-018-1883-0.

Mark Grinblatt and Matti Keloharju et al., Tax-loss Trading and Wash Sales". In: Journalof Financial Economics.

Matthieu Nadini, et al., (2021). Mapping the NFT revolution: market trends, tradenetworks, and visual features. ttps://doi.org/10.1038/s41598-021-00053-8.

Pinyaphat Tasatanattakool et al., (2018). Blockchain: Challenges and applications, DOI: 10.1109/ICOIN.2018.8343163.

Piyush Batra et al., (2023). NFT Marketplace, arXiv:2304.10632vl.

Saffan khan et al.,(2022). DigitalStack: A NFT Marketplace. ISSN: 2320-2882.

Shriyankshi Gupta et al.,(2022). NFT SOCIAL MARKETPLACE. e-ISSN: 2582-5208.

Usman W. Chohan et al., (2021). Non-Fungible Tokens: Blockchains, Scarcity, and Value. https://ssrn.com/abstract=3822743.

Voshmigir et al,.(2020). Token economy.

Weizheng Wang et al., Blockchain-Based Reliable and Efficient Certificateless Signaturefor IIoT Devices - Weizheng Wang.

Yash Mhate et al.,(2022). Challenges of Implementing an NFT Marketplace.