INTI JOURNAL | Vol.2024:18
eISSN:2600-7320

A Study on Non-Fungible Tokens Marketplace for Secure Management

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ABSTRACT

The secure management and sale of digital assets has become a critical problem in an increasingly digitized environment. This project intends to address this issue by creating decentralized applications (dApps) that use blockchain technology to provide secure and efficient digital asset management, with a focus on NFTs. The NFT marketplace includes secure wallet connections, NFT image creation, minting, the marketplace, and profile management. Solidity-based smart contracts are utilized to create the NFT Marketplace back end, and IPFS is used for storage. The NFT Marketplace's front-end development uses React JSX and the web3js framework, allowing developers to connect to the Ethereum network. NFT Marketplace may assist creators in selling their art through a smart contract system, in which the artwork's ownership transfers to the new owner upon submission of a digital certificate.

Keywords:

Blockchain, Digital Assets, Non-Fungible Tokens, decentralized applications, Smart contract.

Introduction

Blockchain technology has completely transformed the management and trading of digital assets, with non-fungible tokens (NFTs) emerging as a particularly exciting application. The protection of NFTs' security, particularly regarding users' private keys, is still a difficult task. The project aims to address these issues by creating decentralized applications (dApps) called NFT Marketplace, which provides a secure and convenient platform for NFT management. The project's primary goal is to address fundamental questions about the safe administration and exchange of NFTs (Chohan, U. W. ,2024; Rani, P.et al, 2023).

Submission: 4 May 2024; **Acceptance:** 29 July 2024

The users can safely link their crypto wallets to the dApp without disclosing their private keys. The distinct NFTs are produced by deep learning models and kept in decentralized storage. Users can securely and openly trade NFTs in a blockchain-based market, where they can manage and view their NFT collections in a simple and intuitive manner. The platform enables users to maintain their NFT collections, produce unique NFTs using deep learning models, and securely link their wallets to the dApps (Aksoy, P. C., 2023; Bala, R., 2024).

We have used Solidity-written smart contracts for secure and transparent asset transactions on the blockchain using the Ganache Localhost test (Aksoy, P. C., 2023). Additionally, the Infura API has created unique NFT photos based on user input and uploaded them to IPFS storage. A non-fungible token (NFT) marketplace is an ownership record stored on the Ethereum blockchain. While digital items, such as images, gifs, and videos, are the most common assets traded as NFTs,

Methodology

An NFT marketplace is a platform for buying, selling, and trading NFTs. It is meant for trading and the creation of different kinds of NFTs. Before building a NFT marketplace, we must understand the concept of cryptocurrency, statistics, trading, minting, auctioning, ownership, and rights (Kaur Nagpal, G., 2023; Colicev, A., 2023).

a. Minting:

The process of creating new non-fungible tokens (NFTs) on a blockchain is referred to as minting. When a creator mints an NFT, they provide important information about the token, such as its name, title, description, and price. In most cases, the minting procedure involves dealing with a smart contract that complies with the relevant NFT standard, such as ERC-721 on the Ethereum blockchain. The smart contract validates the submitted information and assigns the newly generated NFT a unique identification (Abualhamayl, A. J.,et al, 2023).

b. MetaMask:

It acts as an administrative center for all of the transactions. The MetaMask wallet will be used for Ethereum transactions. MetaMask is a popular browser plugin wallet that acts as a portal to the Ethereum network.

c. Wallet Connect:

The NFT Marketplace dApps depends strongly on the Wallet Connect feature, which allows users to securely connect their wallets without exposing their private keys. MetaMask, a browser extension, facilitates this process by connecting the user's browser to their cryptocurrency wallet. Users can interact with the functionalities of the dApps without having to manually enter their private keys, lowering the danger of key theft or unauthorized access. We utilized React.js and Ether.js, a popular library for Ethereum-based networks, to connect the dApps with users' wallets via the MetaMask Browser extension (Kaur Nagpal, G., 2023). The Ether.js library offers a user-friendly API for data transmission and reception from the blockchain, facilitating the seamless integration of the dApp with the Ethereum network.

d. NFT Generation:

The NFT Marketplace project aims to generate one-of-a-kind digital assets known as nonfungible tokens (NFTs) within a platform. NFTs serve as proof of ownership or authenticity for numerous types of digital property, such as artwork, music, and gifs. Content creators and artists can submit their work, transform it, and establish encryption techniques to safeguard transactions and regulate the generation of new units. Cryptocurrencies, as opposed to traditional fiat currencies issued by central banks, run on decentralized networks based on blockchain technology.

e. Gas:

The term "gas" refers to the unit of measurement for the computational work necessary to perform transactions and smart contracts on the Ethereum blockchain. Gas is priced in ether (ETH), Ethereum's native coin. A user must pay a particular quantity of gas when initiating a transaction or executing a smart contract on the Ethereum network. This gas payment is necessary to encourage miners to validate and include the transaction or contract execution in a block (Elsden, C., et al., 2024).

f. Auction:

An auction is a way of selling NFT or assets through a bidding process in which potential purchasers compete by submitting successive bids to receive the object being auctioned. Auctions provide a mechanism for selling and purchasing unique digital assets in the context of non-fungible tokens (NFTs).

Design Methodology

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c. NFT Minting:

The process of generating NFTs is known as minting. Non-fungible tokens (NFTs) are distinct digital assets that can independently trade or sell in an NFT marketplace. NFTs serve as proof of ownership or authenticity for a variety of digital content, including artwork, collectibles, music, films, and virtual real estate. The minting process enables creators or users to tokenize their creations, assign unique metadata, and generate unique NFTs for safe purchase, trade, or transfer on the blockchain. NFT minting allows creators and collectors to participate in the digital art and collectibles ecosystem by easily displaying, earning money, and trading their unique digital goods. The smart contract's mint function generates a new Ethereum token with a URI based on the IPFS hash supplied by the Infura API. The contract specifies the token's attributes, such as its name, symbol, and total tokens. Users can view the minted NFT in the Marketplace, accessing its name, description, price, and image through the metadata URI on IPFS. Users can transfer NFT between each other thanks to the unique token ID (Wilkoff, S., et al, 2023). Figure 1 shows the idea of block chain workflow.

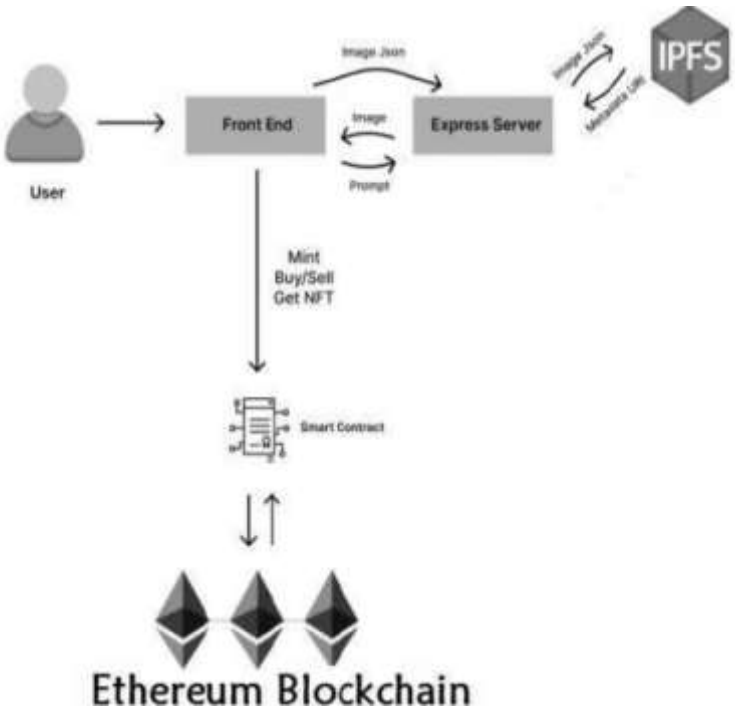

Figure 1. Workflow of Block Chain

Blockchains, which Satoshi Nakamoto first introduced as Bitcoin, are a decentralized payment system with no central agents. The concept of a decentralized ledger, with a distributed, transparent, and immutable consensus mechanism, offered a new digital money societal structure without a central authority, sharing power among the population. Since 2009, this covert innovation was designated as a stealth innovation (Chohan, U. W. ,2024).

NFTs are one-of-a-kind digital tokens with a singular identity, making them scarce and creating an ideal marketplace for digital creators and consumers. They are a digital ledger identity that proves ownership. Because NFTs are unique and recorded on the public digital ledger, their nonfungibility contributes to their value. Every transfer alters the ownership of a token. The initial owner keeps the rights as the originator of the NFT, and each person selling or holding it is the respective owner who is rewarded each time ownership is transferred (Aksoy, P. C., 2023).

An airplane ticket allows users to access services, whereas NFTs operate on the same principle but digitally. The blockchain produces a certificate of authenticity for minted NFTs, demonstrating their uniqueness and scarcity as no similar tokens exist (Elsden, C., et al., 2024). As digital art projects like CryptoKitties and CryptoPunks expand, determining the true worth of the Internet's NFT frenzy becomes more difficult. The owner receives a certificate proving the legitimacy of these digital assets, making it difficult to estimate their genuine worth (Bala, R., 2024).

NFT creators retain ownership of their digital assets, and purchasing NFTs does not provide unrestricted access to the content. To transfer NFTs, the owner must authenticate their private key and use a valid digital signature. Having possession of the creator's original hex hash value is essential. It is necessary to demonstrate ownership of NFT-based intellectual

property rights. For monopolistic tendencies to function, NFT marketplaces must recognize their rarity (Colicev, A., 2023).

The value of NFTs is influenced by factors such as rarity, predicted future worth, and provenance. The certificate of ownership, the ownership history, and the ownership transfer are all examples of provenance. NFTs, which are blockchain-based tokens that reflect ownership, benefit many people (Wilkoff, S., et al, 2023).

Results and Discussion

In this section, we present the results of the performance and usability study of our project. The performance test involved measuring the time it took to generate NFT images using the Infua API and mint NFTs using smart contract transactions on the Ethereum testnet. Figures 2 and 3 show the data transfer up and down while figure 4 shows the total storage.

Figure 2. Data Transfer Up

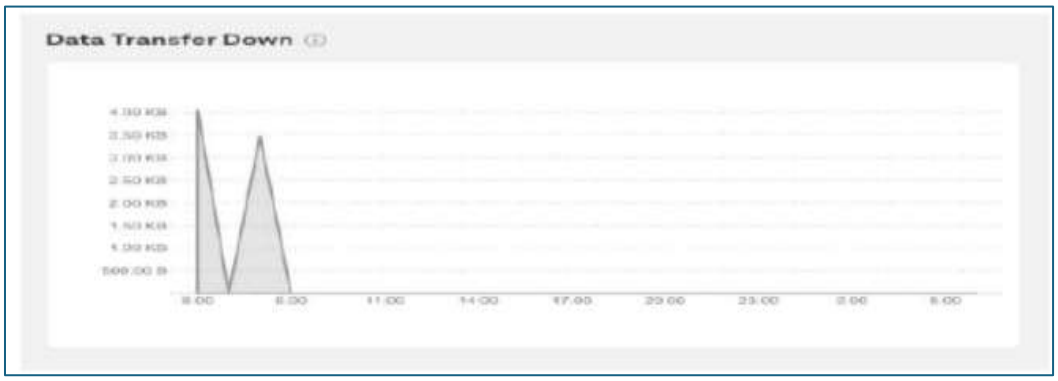

Figure 3. Data Transfer Down

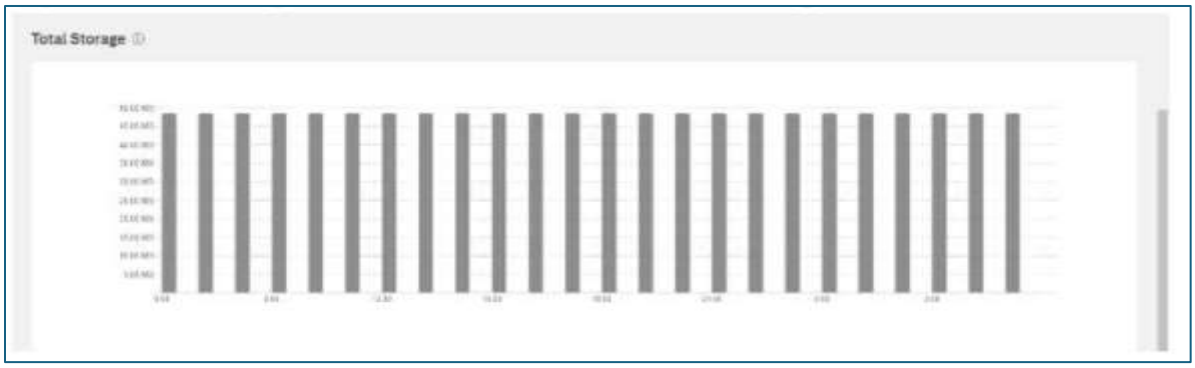

Figure 4. Total Storage

Conclusion

The NFT Marketplace project showcases the potential of blockchain technology in creating safe, open, and user-friendly platforms for managing and trading digital assets. In addition to safe wallet connections, NFT creation, NFT minting, and a market for selling NFTs, it addresses basic issues in NFT administration. The Ethereum network has made it possible to create customised and one-of-a-kind NFTs, resulting in the development of valuable digital assets. The usability study demonstrates how user-friendly and simple the dApps is to use. Future studies might concentrate on scaling up, investigating fresh NFT generation strategies, and addressing potential security concerns in trading and managing digital assets. In terms of decentralized apps for NFT management and trade, the NFT Marketplace application marks a considerable advancement.

Acknowledgement

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 "NON-FUNGIBLE TOKENS MARKETPLACE". The support and encouragement from the institution have been instrumental in the successful completion of this endeavor.

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