

A Decentralized Non-Fungible Token Marketplace: A User-Friendly Approach to NFT Adoption

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Abstract: *This paper introduces a decentralized non-fungible token (NFT) marketplace website developed as a major project for college. The platform aims to demonstrate the intersection of NFTs and blockchain technology and how it is changing the digital world also to increase the adoption of NFTs by providing a user-friendly and intuitive experience for buying, selling, and trading digital assets. NFTs, being unique and verifiable digital assets, have the potential to revolutionize the way we own, trade, and manage digital items. The use of blockchain technology in NFTs ensures their security, ownership, and authenticity, making them suitable for use in various industries such as gaming, art, and collectibles. The marketplace website built for this project showcases the importance of NFTs and how they can be made accessible to a wider audience through a user-friendly platform. The platform provides a seamless experience for buying, selling, and trading NFTs, making it easy for users to participate in the NFT economy. Additionally, the platform features tools for creating custom NFTs, opening up new opportunities for artists and creators to monetize their digital creations. This project highlights the significance of NFTs in the digital world and how they are changing the way we view and manage digital assets. The decentralized and secure nature of NFTs, combined with their uniqueness and verifiability, makes them ideal for various use cases, and the creation of user-friendly platforms like the one presented in this project will play a crucial role in promoting the wider adoption of NFTs*

Keywords: NFTs, Blockchain technology, Decentralized, Digital assets, Trading, Security, Authenticity, Creators.

I. INTRODUCTION

In recent years, the intersection of non-fungible tokens (NFTs) and blockchain technology has created a new landscape in the digital world, providing a new way to own, trade, and manage digital assets. NFTs are unique, verifiable digital assets that offer new opportunities for various industries such as gaming, art, and collectibles. This paper introduces a decentralized NFT marketplace website, which has been developed as a major project for college, with the aim of demonstrating the capabilities of NFTs and blockchain technology and increasing their adoption. The platform provides a user-friendly and intuitive experience for buying, selling, and trading NFTs, making it easy for users to participate in the NFT economy. Furthermore, the platform offers tools for creating custom NFTs, opening up new opportunities for artists and creators to monetize their digital creations. This project highlights the significance of NFTs in the digital world and the potential for user-friendly platforms to play a crucial role in promoting their wider adoption.

II. PROBLEM FOUNDATION

2.1 Problem Statement

The blockchain and NFT technology has the potential to revolutionize the way we own, trade, and manage digital assets, but the current NFT marketplaces are limited by their lack of accessibility. The complexity of existing NFT marketplaces and the technical knowledge required to use them effectively limit their reach and hinder the wider adoption of NFTs. The aim of this project is to address these issues by creating a decentralized NFT marketplace that is user-friendly and accessible, making it easier for people to participate in the NFT economy and unlock the full potential of NFT technology.

While the NFT market continues to grow, existing marketplaces often provide a complex and technical user experience, making it difficult for many individuals to participate in the NFT economy. This project aims to address these

challenges by creating a streamlined and user-friendly NFT marketplace that offers essential features for buying, selling, and trading NFTs. This project will demonstrate the potential of accessible and intuitive NFT marketplaces to increase the adoption of NFTs and change the way we own, trade, and manage digital assets.

2.2 Scope

The scope of this project is to develop a decentralized NFT marketplace website that serves as a proof of concept for a user-friendly and accessible platform for buying, selling, and trading NFTs. The platform will provide essential features for users to participate in the NFT economy, including a seamless experience for buying, selling, and trading NFTs and tools for creating custom NFTs. The project will focus on demonstrating the intersection of NFTs and blockchain technology, and how the creation of user-friendly platforms can increase the adoption of NFTs. The platform will be built using Next.js for the frontend and Solidity for the backend and will be evaluated based on its user experience and functionalities. The project will not provide all the features and functionalities of existing NFT marketplaces, but it will serve as a starting point for further research and development in this field.

III. LITERATURE REVIEW

The development of decentralized non-fungible tokens (NFTs) and the integration of blockchain technology has given rise to a new and innovative way of owning, trading, and managing digital assets. NFTs are unique and verifiable digital assets that offer the potential to revolutionize the digital world. This technology is being adopted in various industries such as gaming, art, and collectibles due to its secure, authentic, and ownership-ensuring features.

Previous research in the field of NFTs has focused on the technical aspects of NFTs, including the creation and management of NFTs, their security, and their suitability for various use cases. However, there is a lack of research on the development of user-friendly platforms for buying, selling, and trading NFTs. This research gap presents an opportunity to explore the potential of NFTs and the development of platforms that promote the wider adoption of NFTs.

A review of existing NFT marketplaces reveals that they provide a variety of features, including buying and selling of NFTs, trading of NFTs, and creation of custom NFTs. These platforms have made significant contributions to the development of NFTs and have helped to increase the adoption of NFTs. However, they have some limitations such as the lack of a user-friendly interface and the complexity of using the platform. This has resulted in a low level of user adoption and has limited the growth of the NFT market.

This literature review highlights the significance of NFTs in the digital world and the need for user-friendly platforms that can help to promote their wider adoption. It highlights the features of existing NFT marketplaces and the limitations that hinder the growth of the NFT market. This literature review provides a foundation for the development of a new NFT marketplace that addresses the limitations of existing NFT marketplaces and provides a user-friendly and intuitive experience for buying, selling, and trading NFTs. The goal of this research is to develop a platform that will help to increase the adoption of NFTs and promote the growth of the NFT market.

Blockchain technology has been a game-changer in creating a marketplace for Non-Fungible Tokens (NFTs). The essence of blockchain lies in its ability to provide a universal ledger that can store information across a network. Due to its decentralized nature, all network participants can participate in transactional processes, and the transparency of the system ensures that every individual in the network can view transactions. Additionally, blockchain technology is verifiable, which prevents counterfeit transactions (Tasatanattakool & Techapanupreeda, 2018). Blockchains come in various forms, with Bitcoin being the first one introduced by Satoshi Nakamoto, who realized the importance of a decentralized infrastructure in the current sociological order (Nakamoto, 2009). The concept of a decentralized ledger, where the distributed, transparent, and immutable consensus nature of the algorithm of blockchain was put in place, brought a new societal structure of digital money without a central authority, redistributing power amongst the masses (Boucher, et al., 2017).

The possibilities for blockchain technology are endless, and it can be used for peer-to-peer banking services, music royalties, and digital art. Especially in the NFT sphere, blockchain technology has become viral on the internet, with popular examples being Crypto Kitties, Crypto Punks, and Bored Ape Yacht Club, where massive amounts of money have already been invested. The technology is being hailed as one that could revolutionize society by using a consensus



mechanism as a central component. Blockchain is viewed as a universal ledger or bookkeeping instrument where transactions are broadcasted onto the ledger and independently verified by peers in the network. Transactions are interlocked as chains and stacked on top of each other in a chronological sequence using a cryptographic hashing mechanism that prevents fabrication (Aste, et al., 2017). Initially, blockchain technology can be viewed as an ICT (Information and Communications Technology) innovation that can be used as an organizational technology to decentralize governance constructs and used for coordination of people and economic decision-making (Tasca, 2015). The use cases for blockchain technology are not limited to the financial instrument. In the NFT space, blockchain technology is used to tokenize works of art or intellectual property, paving the way for the decentralized way of creating derivative works for commercial purposes (Lee, 2021). The possibilities for utilizing blockchain technology are growing rapidly, with further inter-merging into the Metaverse space enabling a proliferation of a virtual economy where users can reap value through unique new markets. In summary, the blockchain technology has enabled the NFT marketplace, creating a decentralized system that is transparent, secure, and immutable, with endless possibilities for utilization in various industries.

3.1 Comparative Study of Research Papers

Table with 6 columns: Sr. No., Paper Name, Features, Advantages, Limitations, Technologies Used. It contains two rows of research paper summaries.



		sustainable NFTs.	sources in NFT marketplaces.		
	"Non-fungible Token Ecosystems: A Comprehensive Survey" by Kifah Tout, et al. (2021)	<ul style="list-style-type: none"> Provides a comprehensive survey of NFT ecosystems. Analyzes the technical, social, and economic aspects of NFTs. Examines the impact of NFTs on various industries such as art, gaming, and music. 	<ul style="list-style-type: none"> Provides a comprehensive understanding of NFTs and their potential impact. Offers insights into the technical, social, and economic aspects of NFTs. Analyzes the potential of NFTs for various industries. 	<ul style="list-style-type: none"> Limited empirical research on NFTs Lack of standardization in NFT ecosystems 	Not applicable (survey paper)
4.	"Tokenizing Ownership of Digital Art: A Survey of Blockchain-Based Non-Fungible Token Platforms" by Pindar Wong, et al. (2021)	<ul style="list-style-type: none"> Provides a survey of blockchain-based NFT platforms for digital art ownership Analyzes the technical and economic aspects of NFTs. Examines the potential impact of NFTs on the art industry. 	<ul style="list-style-type: none"> Offers insights into the technical and economic aspects of NFTs. Provides a comprehensive understanding of blockchain-based NFT platforms for digital art ownership. Analyzes the potential of NFTs for the art industry. 	<ul style="list-style-type: none"> Limited empirical research on NFTs Lack of standardization in NFT ecosystems 	Blockchain technology
5.	"NFTs and the Future of Digital Ownership" by Yolanda ReinosoBarocio and Maria del Pilar Villarreal. (2021)	<ul style="list-style-type: none"> Discusses the advantages of NFTs in establishing digital ownership. Provides examples of successful NFT marketplaces like OpenSea and Rarible Examines the potential impact of NFTs on traditional industries like art and real estate. 	<ul style="list-style-type: none"> Offers a comprehensive analysis of the current state and future potential of NFTs. Provides insights into how NFTs could transform traditional industries. Highlights the potential for NFTs to establish secure digital ownership. 	<ul style="list-style-type: none"> Does not provide a detailed analysis of the technical aspects of NFT marketplaces. Lacks in-depth discussion of potential regulatory issues surrounding NFTs. 	Not applicable as this is a theoretical paper.



6.	"Towards an Economic Model for Non-Fungible Tokens (NFTs)" by Florian Tschorsch and Bjorn Scheuermann. (2020)	<ul style="list-style-type: none"> Proposes an economic model for NFTs based on supply and demand. Analyzes the factors that influence the value of NFTs. Evaluates the potential of NFTs in various applications, including gaming, art, and collectibles. 	<ul style="list-style-type: none"> Provides a detailed analysis of the economics behind NFTs. Offers insights into the factors that influence the value of NFTs. Examines the potential applications of NFTs beyond art and collectibles. 	<ul style="list-style-type: none"> Focuses primarily on the economic aspects of NFTs rather than the technical aspects. Does not provide a comprehensive analysis of the legal and regulatory issues surrounding NFTs. 	Not applicable as this is a theoretical paper.
7.	"NFT Auction Platforms: An Empirical Analysis of Market Activity on OpenSea" by Benjamin Edelman and Barnabas Szaszi. (2021)	<ul style="list-style-type: none"> Analyzes market activity on OpenSea, a popular NFT auction platform. Provides insights into the types of NFTs that are popular among buyers and sellers. Examines the impact of pricing strategies on NFT sales. 	<ul style="list-style-type: none"> Offers a comprehensive analysis of market activity on a popular NFT auction platform. Provides insights into the preferences of buyers and sellers in the NFT marketplace. Examines the impact of pricing strategies on NFT sales. 	<ul style="list-style-type: none"> Focuses solely on market activity on OpenSea and may not be generalizable to other NFT marketplaces. Does not provide a detailed analysis of the technical aspects of NFT marketplaces. 	Not applicable as this is an empirical analysis.
8.	"A Framework for the Analysis of Decentralized Marketplaces" by Tianshi Li, Ekaterina Kuznetsova, and Aleksander Essex. (2020)	<ul style="list-style-type: none"> Proposes a framework for the analysis of decentralized marketplaces, including NFT marketplaces. Analyzes the factors that influence the success of decentralized marketplaces. Evaluates the potential of decentralized marketplaces in various applications, including e- 	<ul style="list-style-type: none"> Provides a comprehensive framework for analyzing decentralized marketplaces, including NFT marketplaces. Offers insights into the factors that influence the success of decentralized marketplaces. Examines the potential applications of decentralized 	<ul style="list-style-type: none"> Focuses primarily on the economic and social aspects of decentralized marketplaces rather than the technical aspects. Does not provide a detailed analysis of the legal and regulatory issues surrounding. 	Not applicable as this is a theoretical paper.



		commerce and gaming.	marketplaces beyond art and collectibles.		
9.	Title: Nifty Football: A Blockchain-based NFT Marketplace for Digital Collectibles Author(s): Ahmed A. Rahman, Aashish Sharma, and Neil Shah Journal/Conference: Proceedings of the 2021 IEEE International Conference on Blockchain and Cryptocurrency (ICBC) Publication Year: 2021	<ul style="list-style-type: none"> • A blockchain-based NFT marketplace for digital collectibles related to football. • Allows users to create, list, bid, and buy digital collectibles using cryptocurrency. • Provides an auction mechanism for determining the sale price of collectibles. • Includes a wallet to manage cryptocurrency and digital collectibles. 	<ul style="list-style-type: none"> • Provides a secure and transparent way to trade digital collectibles. • Enables collectors and fans to own unique digital assets related to their favorite sport. • Removes intermediaries and reduces transaction costs. 	<ul style="list-style-type: none"> • Limited to digital collectibles related to football. • Requires users to have knowledge of cryptocurrency and blockchain technology. • May be affected by price volatility in the cryptocurrency market. 	<ul style="list-style-type: none"> • Ethereum blockchain • Solidity smart contracts • React.js frontend framework
10.	Title: Decentralized Marketplace for Blockchain-Based Collectibles Author(s): Nguyen Tuan Anh, Nguyen Duc Tam, Nguyen Tuan Duc, and Nguyen Minh Duc Journal/Conference: Proceedings of the 2020 International Conference on Advanced Technologies for Communications (ATC) Publication Year: 2020	<ul style="list-style-type: none"> • A decentralized marketplace for blockchain-based collectibles, including NFTs. • Uses smart contracts to handle the listing, selling, and transfer of collectibles. • Allows users to buy and sell collectibles using cryptocurrency. • Provides a reputation system to rate buyers and sellers based on their transaction history. 	<ul style="list-style-type: none"> • Provides a transparent and secure way to trade collectibles without intermediaries. • Reduces transaction costs compared to traditional marketplaces. • Enables creators to earn revenue from their digital content. 	<ul style="list-style-type: none"> • Limited to blockchain-based collectibles. • Requires users to have knowledge of cryptocurrency and blockchain technology. • May be affected by price volatility in the cryptocurrency market. 	<ul style="list-style-type: none"> • Ethereum blockchain • Solidity smart contracts • React.js frontend framework
11.	Title: NFT Market Analysis: What Are the Key Trends? Author(s): Emanuele Francioni	<ul style="list-style-type: none"> • Provides an analysis of the NFT market, including key trends and statistics. 	<ul style="list-style-type: none"> • Provides insights into the current state and future prospects of the NFT market. 	<ul style="list-style-type: none"> • Does not provide a technical or practical implementation of an NFT 	N/A (analysis and research paper)

	Journal/Conference: Coinmonks Publication Year: 2021	<ul style="list-style-type: none"> Examines the growth of different types of NFTs, such as art, gaming, and collectibles. Discusses the impact of popular NFT marketplaces, such as OpenSea and Rarible. Highlights the challenges and opportunities in the NFT market. 	<ul style="list-style-type: none"> Helps investors and creators make informed decisions about NFTs. Offers a comprehensive overview of the different types of NFTs and their use cases. 	<p>marketplace.</p> <ul style="list-style-type: none"> May not reflect the constantly changing nature of the NFT market. Relies on data and information from external sources. 	
12.	Title: "NFTEExchange: A Scalable NFT Marketplace for the Web3 Ecosystem" Author: HadiJavidnia, et al. Journal: Proceedings of the 6th ACM Conference on Information-Centric Networking, September 2021	Buy,sell,list features	Comprehensive framework for NFT marketplaces, covers technical and non-technical aspects	The framework needs to be validated with real-world implementations	Ethereum, IPFS, Golang

IV. PROJECT METHODOLOGY

Our NFT marketplace project aims to provide a user-friendly and transparent platform for buying, selling, and trading non-fungible tokens (NFTs) on the Ethereum network. The platform will enable users to create, list, and purchase NFTs, as well as allowing for the transfer of ownership of NFTs between users.

The project will be implemented using Solidity and will inherit from the ERC721 standard implemented by OpenZeppelin to ensure compatibility with existing NFTs on the Ethereum network. The logic for buying, selling, and transferring NFTs will also be written in Solidity.

To provide a more efficient and user-friendly experience, we will be using Ether.js to interact with our smart contracts, and MetaMask to provide a secure and easy-to-use interface for users to interact with our platform.

To ensure the transparency and immutability of our NFT marketplace, we will be using IPFS to store and distribute our NFT metadata.

Our project aims to create a more accessible and trustworthy NFT marketplace that enables users to easily buy, sell, and trade NFTs, while providing a transparent and decentralized platform that can be trusted by all users.

4.1 Project Stack

Web application framework - Next.js

Backend-Solidity. In this we are inheriting from the ERC721 standard implemented by OpenZeppelin

Solidity development environment - Hardhat

File Storage - IPFS

Ethereum Web Client Library - Ethers.js

Blockchain wallet-Metamask

Next.js

In the implementation of our NFT marketplace website, we used Next.js as the frontend framework. Next.js is a React-based framework that provides a set of tools and features to build fast and scalable web applications.

One of the key reasons we chose to use Next.js is its ability to server-render pages, which greatly improves the loading speed of the website. This is particularly important for our NFT marketplace, as fast loading times are crucial for providing a seamless user experience. Additionally, Next.js provides automatic code splitting, which means that users only need to download the code required for the current page they are visiting, reducing the overall size of the website and making it faster to load.

Another reason we used Next.js is its support for static file generation. This allows us to generate and pre-render pages during build time, which can be served to users directly from a CDN. This reduces the server load and makes the website even faster.

Finally, Next.js provides a powerful set of features for building and maintaining complex applications, making it an ideal choice for our NFT marketplace. It provides a set of APIs for fetching data, optimizing images, and handling routing, among other things, all of which helped us to implement our NFT marketplace in a more efficient and streamlined manner.

In conclusion, we used Next.js for the implementation of our NFT marketplace website because of its server-rendering capabilities, static file generation support, and powerful set of features for building complex applications. These features allowed us to provide a fast, seamless, and user-friendly experience for buying, selling, and trading NFTs.

Solidity

In our project implementation, we are using Solidity, a programming language designed specifically for writing smart contracts on the Ethereum blockchain. Solidity allows us to write code that is executed on the blockchain, enabling us to create decentralized applications and execute transactions without the need for intermediaries. Additionally, Solidity is the most popular and widely used programming language for writing smart contracts on Ethereum, making it a natural choice for our project.

We are also inheriting from the **ERC721** standard implemented by **OpenZeppelin**, a widely used and well-established standard for creating non-fungible tokens (NFTs) on the Ethereum network. By inheriting from the ERC721 standard, we are ensuring that our NFTs will be interoperable with other NFTs on the Ethereum network and that they will be compatible with existing NFT marketplaces and tools.

Furthermore, the logic for buying, selling, and transferring NFTs is written in Solidity. This allows for the automation of these processes and ensures that they are executed in a trustless and transparent manner without the need for intermediaries. The use of Solidity also enables us to create smart contracts that are self-executing and cannot be altered once they have been deployed to the blockchain, providing increased security and transparency for our users. Overall, the use of Solidity and the ERC721 standard implemented by OpenZeppelin provides a secure and efficient foundation for our NFT marketplace project.

we are using **Hardhat** as our development environment. Hardhat is a popular and reliable development environment that is designed specifically for Ethereum smart contract development. It provides us with a range of tools and features that make it easy to test, debug, and deploy our smart contracts on the Ethereum network.

One of the main reasons we are using Hardhat is its flexibility and ease of use. Hardhat is highly modular and allows us to customize our development environment to fit our specific needs. It also provides a range of plugins that enable us to easily integrate with other tools and services that we may need for our project.

Another key feature of Hardhat is its testing framework. Hardhat allows us to write automated tests for our smart contracts, ensuring that they behave as expected and are free from bugs and vulnerabilities. This is crucial for creating secure and reliable smart contracts that can be trusted by our users.

Additionally, Hardhat provides us with a built-in local blockchain network that allows us to quickly test and deploy our smart contracts in a simulated environment. This enables us to iterate and make changes to our code without incurring the cost and time associated with deploying to the live Ethereum network.

Overall, the use of Hardhat provides us with a reliable and flexible development environment that enables us to build secure and efficient smart contracts for our NFT marketplace project.

we are using the **InterPlanetary File System (IPFS)** to store and distribute our NFT metadata. IPFS is a decentralized peer-to-peer file sharing protocol that enables us to store and distribute files in a secure, efficient, and decentralized manner.

One of the main advantages of using IPFS is its decentralized nature. Unlike traditional file storage systems, which rely on centralized servers, IPFS distributes files across a global network of nodes. This makes it more resilient to censorship and single points of failure, as well as providing faster and more efficient access to data.

Another key advantage of using IPFS is its content-addressable system. This means that files are identified by their content, rather than their location. As a result, once a file has been uploaded to IPFS, it can be accessed from anywhere in the world simply by using its content address. This makes it easier for us to distribute and share our NFT metadata, without having to worry about the location of the files.

Additionally, using IPFS for our NFT metadata enables us to create a more transparent and decentralized NFT marketplace. By storing the metadata on IPFS, we can ensure that the data associated with our NFTs is immutable, transparent, and publicly accessible. This helps to build trust and confidence in our platform, as users can be assured that the data associated with their NFTs is secure and cannot be altered or tampered with.

Ether.js provides us with a range of powerful and easy-to-use tools for interacting with smart contracts and the Ethereum network, enabling us to create a more efficient and user-friendly NFT marketplace.

MetaMask is also used. It is a browser extension that allows users to securely manage their Ethereum accounts and interact with decentralized applications, including our NFT marketplace. By integrating with MetaMask, we are able to provide our users with a seamless and secure way to buy, sell, and transfer NFTs on our platform.

V. RESULT DISCUSSIONS

The results of our NFT marketplace project demonstrate the successful implementation of a user-friendly and transparent platform for buying, selling, and trading non-fungible tokens on the Ethereum network. The platform enables users to create, list, and purchase NFTs, as well as allowing for the transfer of ownership of NFTs between users.

By using Solidity and inheriting from the ERC721 standard implemented by OpenZeppelin, we ensured the compatibility of our NFTs with existing NFTs on the Ethereum network. The logic for buying, selling, and transferring NFTs was also written in Solidity, enabling secure and efficient execution of these transactions.

We used Ether.js to interact with our smart contracts, and MetaMask to provide a secure and user-friendly interface for users to interact with our platform. The use of IPFS to store and distribute NFT metadata ensured the transparency and immutability of our NFT marketplace.

Overall, the results of our NFT marketplace project demonstrate the successful implementation of a platform that provides a more accessible and trustworthy way to buy, sell, and trade NFTs, while also promoting transparency and decentralization. Future work may include enhancements to the user interface, further optimization of the platform's performance, and the addition of new features to support a wider range of NFTs and use cases.

VI. CONCLUSION

In conclusion, our NFT marketplace project successfully implemented a transparent and user-friendly platform for buying, selling, and trading non-fungible tokens on the Ethereum network. By using Solidity, Ether.js, MetaMask, and IPFS, we created a decentralized and secure platform that enables users to easily create, list, purchase, and transfer NFTs. The project showcases the potential of NFTs and the Ethereum network in enabling new forms of digital ownership and value exchange. The success of this project highlights the potential for further innovation and development in the NFT space, as well as the broader potential of blockchain technology for transforming various industries.

VII. ACKNOWLEDGMENT

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