



# Blockchain-Backed Digital Collectibles Market: Revolutionizing Ownership and Value

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**Abstract**—Non-fungible tokens (NFTs) are digital assets that provide unique ownership and authenticity of digital media such as art, music, and collectibles. NFT Marketplace is a blockchain-based platform that enables the creation, trading, and collecting of NFTs. The platform leverages blockchain technology to ensure the authenticity and ownership of NFTs, providing a secure and transparent way to transact digital assets. In this major project report, we explore the NFT Marketplace and its underlying blockchain technology. We provide an overview of the platform's features, including the ability to tokenize any digital asset, create customizable smart contracts, and sell NFTs with low fees and instant trades. We also discuss the advantages and disadvantages of the platform, including its ease of use, potential for fraud, and scalability challenges. The Non-Fungible Tokens (NFTs) have revolutionized the digital realm, redefining the concept of ownership and trade of unique digital assets. NFTs represent one-of-a-kind tokens, each verifiably and indelibly linked to a specific digital or physical asset, encompassing diverse forms of content, including video, audio, and images. These unique tokens have paved the way for creators to monetize their digital creations while providing collectors with an innovative means to invest, trade, and showcase their multimedia NFT collections. Central to the NFT ecosystem are NFT marketplaces, digital platforms designed to facilitate the creation, sale, and management of

NFTs in various multimedia formats. These marketplaces have proliferated, providing creators with the means to mint NFTs, buyers with the opportunity to acquire them, and collectors with platforms to curate and trade their diverse NFT portfolios.

**Keywords**—NFTs, NFT Marketplaces, Blockchain, Security, Ownership, Value, Digital Assets, Smart Contracts, ERC721, Opensea, Solana, Cardano, IPFS.

## I. INTRODUCTION

The traditional paradigm of ownership and value is evolving rapidly in the digital age. Non-Fungible Tokens (NFTs) have emerged as a transformative force, redefining how we perceive and transact with digital assets. This paper combines insights from various research works to present a comprehensive analysis of NFTs and their marketplaces, shedding light on their origins, growth, challenges, and potential.

A digital marketplace is an online platform that creates an environment for buyers and sellers to negotiate for products or digital content. In digital marketing, sellers can sell products quickly and buyers can provide instant feedback and review products for improvement. Digital Marketplace does not purchase rights to products or digital content. It only plays an important role as an intermediary between buyers and sellers.

All of the buyer-seller transactions in the current digital marketplace are overseen by the admin or marketplace owner. The majority of the time, the transaction adheres to the centralised network architecture and is not entirely visible. For these reasons, there are frequently still some opportunities for database manipulation. Due to the lack of a validated contract between the buyer and seller, the transaction has only been confirmed by the marketplace owner. After the goods or services are exchanged, it causes privacy and security issues between the customer and the vendor.

An online marketplace built on the Ethereum Blockchain, where every transaction is handled by smart contracts that use NFT, might be the solution to the issue.

The authors of this research have suggested an NFT smart contract framework for the online market. To create NFT-based token smart contracts, an EthereumERC721 token standard is used. Two intelligent contacts are required in our blockchain-based digital marketplace to oversee the exchange of digital goods between buyers and sellers. The first involves the seller producing a market item, while the second involves the marketplace transposing the market things. Additionally, there are minimum listing costs for the products on the market. Moreover, make sure the decentralised network offers the highest level of security.

## II. LITERATURE REVIEW

Blockchain is a decentralize information overseeing framework, where the information are consecutively put away in an encoded chain of blocks and conveyed into a distributed (P2P) organization. The idea of blockchain is generated from electronic Bitcoin system proposed by Satoshi Nakamoto.

A permissioned blockchain with Proof of Authority (PoA) technology that ensures data privacy, data owners' discretion over sharing sensitive information, and efficient distributed management of medical records is the subject of the paper put out by [2]. In order to determine the effectiveness of this consensus process when utilizing Blockchain technology for safe data exchange, the work is predicated on modeling the results of applying PoA.

The digital certificate system based on blockchain technology is introduced by the author in [3]. A digital certificate that is both verifiable and anti-counterfeit could be created because to the blockchain's immutable feature.

The study A Survey of Blockchain-Based Telecommunication Services Marketplaces by Roman-Valentyn Tkachuk [4] offers an overview of Telecommunication Services Marketplaces (TSMs) that use blockchain technology as the

primary trust-enabling entity to do away with middlemen. Additionally, give a summary of the scientific and commercial suggestions.

In [6], the authors described how a smart contract on the Ethereum blockchain powers a Decentralized App (DAPP) that allows users to share common objects. Through this agreement, users can join up and rent devices without the need for a Trusted Third Party (TTP), without disclosing any personal information, and without first signing up for the service.

The majority of today's blockchain-based farming frameworks are centered around food tracking and traceability, as noted in Guilain Leduc's study [7]. Research on the creation of online marketplaces to facilitate the exchange of agricultural products between farmers and possibly interested third parties is extremely rare, and performance assessments of the suggested frameworks are also extremely uncommon.

We realize from the aforementioned literary works about blockchain architecture and smart contracts that the system based on blockchain technology is safe, transparent, unchangeable, and dependable for users. Recognize that blockchain technology can be very helpful in resolving issues that arise on a daily basis.

## III. PROPOSED SYSTEM

### 1) System Architecture:

Smart contracts make up a digital marketplace. It is to enable the creation of distinctive digital assets by the user through NFT implementation using the ERC721 token specifications. The marketplace is the other smart contract; it enables users to list goods for sale, assist in the transaction, and transfer value from one side to another. Additionally, a payment mechanism has been included that enables the marketplace owner to charge a listing cost, which is depicted in the suggested design below the corner. The listing fee will be sent to the contract owner when the transaction is completed.

The cost of the digital material must exceed the listing charge. If not, an error message will appear when the data is added. Following final confirmation of all details, we authorise the smart contract and put it in external storage. The transfer information is kept in internal storage. Following that, products that complied were shown in the market catalogue area. The buyer bids on the objects in the corner of the proposed architecture, and after conforming, a new contract is made and the buyer transfers product ownership to the seller. Additionally, new data was added to the storage.

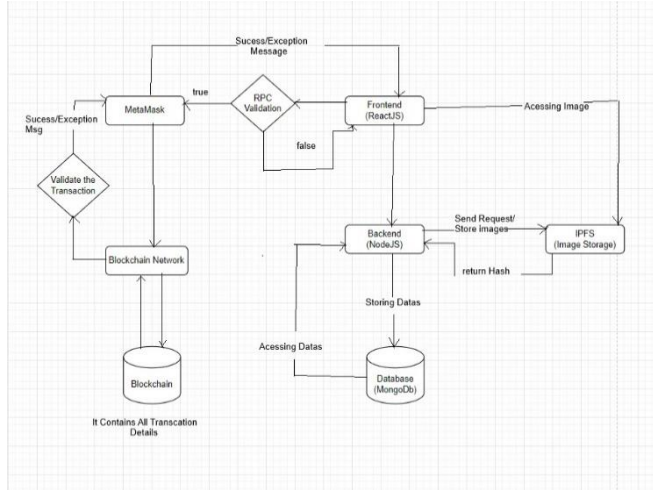
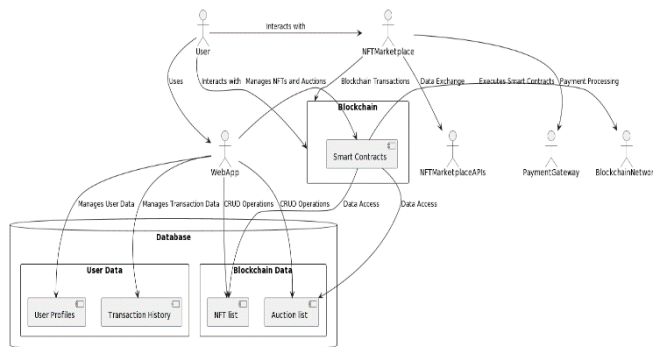


Fig. Architecture Diagram

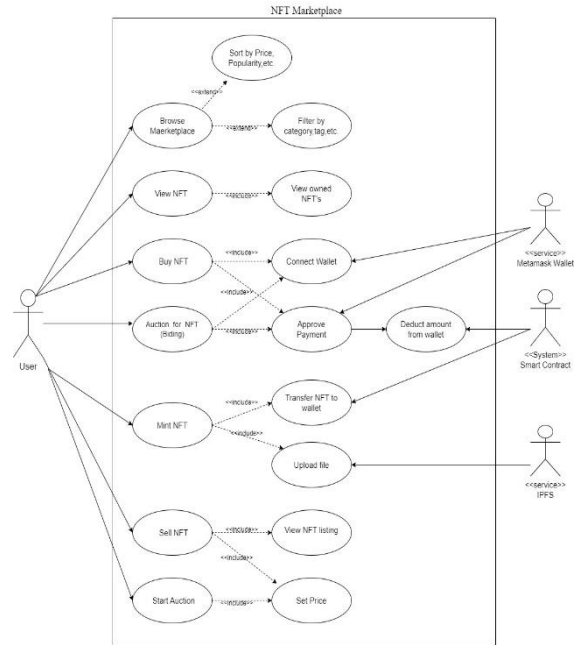
a) Data Flow Diagram:

A data flow diagram is a visual representation that illustrates the flow of information within the system. It highlights the data movement between them by identifying the processes, data sources, and destination. Each of these tasks is represented as a process node, and the direction of data flow is indicated by arrows. This graphical tool helps with the analysis, planning, and optimization of the system's activities for increased efficacy and efficiency by offering a simple, clear perspective.



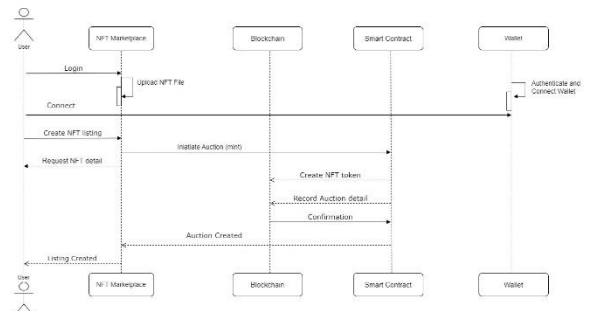
b) Use Case Diagram:

Use case illustrates a unit of functionality provided by the system. The main purpose of the use-case diagram is to help development teams visualize the functional requirements of a system, including the relationship of "actors" to essential processes, as well as the relationships among different use cases. Use-case diagrams generally show groups of use cases, either all use cases for the complete system, or a breakout of a particular group of use cases with related functionality to Show a use case on a use-case diagram.



c) Sequence Diagram:

Sequence diagrams can be used to explore the logic of a complex operation, function, or procedure. They are called Sequence diagrams can be used to explore the logic of a complex operation, function, or procedure of a sequence diagram is that it is time-ordered. Sequence diagrams can be used to explore the logic of a complex operation, function, or procedure Sequence diagrams can be used to explore the logic of a complex operation, function, or procedure



2) Existing System:

The seller generated products in the current system by providing some basic details such as the product name, description, view image, etc. The item will be instantly authorised by the marketplace authority upon creation. Additionally, the outside organisation is in charge of maintaining all data. The schematic representation of the current system architecture is shown in Figure 2. The proprietors of marketplaces may alter the data at will. Conversely, customers choose the goods and put them in their carts. After verifying the payment, the buyer can take possession of the item. Between buyer and seller, no digital contract is being created. The complete current system, is also updated and maintained by the market. Following the product's sale, the customer permanently lost possession of the item.

### 3) Methodology:

When compared to the current system, the suggested architecture offers a few benefits. A decentralised architecture using Ethereum ERC721 for an NFT-based digital marketplace to produce and distribute digital content. The following techniques were employed in the development of our suggested architecture.

#### a) *Blockchain for Ethereum:*

A blockchain is a distributed ledger that is decentralized and unchangeable. It consists of many blocks connected by hashes, and each block records transactions in a way that makes them unchangeable. A predetermined block size saves a certain amount of data into a distributed record.

Each block is tagged with a unique hash that addresses the block and includes hashes of previous and subsequent blocks. The initial block is the central component of the chain. A chain of blocks is made up of N blocks linked by their corresponding hashes. Blockchain gives our system immutable, distributed, and decentralized architecture along with transparent transactions and data security. The Ethereum blockchain's objective is to authorize exchanges from declarations, update their status (state), and maintain that state as the default until another exchange is approved. A primary goal is to facilitate interactions between willing parties who may not otherwise have the resources to build mutual trust.

#### b) *Decentralized Network:*

In a decentralized blockchain network, no one has to know or believe in any other individual. The majority of the association's sections have several copies of identical material that are dispersed. A significant number of members of the association will overlook any alteration or corruption of data inside a section. But we have to put our trust in strangers under the current system. The individual is fully in charge of every record that we currently distribute via the online marketplace. Indicates the comparison between centralized and decentralized network where centralized network totally depend on central server and on the

other hand decentralized network operated through Peer-to-peer (P2P) network between nodes.

#### c) *Proof-of-Work (PoW):*

Proof-of-Work, or PoW, is crucial as a hard-to-crack check architecture. It's seen as an update to the current foundation, similar to adding another block to the chain. As a result, consent from network members is needed. A mechanism for agreement called Proof-of-Work (PoW) is used to pursue the decision of whether or not to add another block. The infrastructure is expanded to include only verified exchangers.

It illustrates the work flow between the PoW digital signature blocks. The cryptographic hash used to encrypt the block is called SHA256 (Secure Hash Algorithm 256).

#### d) *Smart Contract:*

Nick Szabo initially presented the concept of a smart contract in 1994 [11]. Smart contracts are digital programs or norms stored on a blockchain that govern automated transactions based on predetermined conditions. Therefore, smart contracts automate the execution of agreements so that everyone can see the outcome immediately and without the need for a delegate or a delay in time. For every service between buyer and seller to be completed under our suggested architecture, two smart contracts are required. When a smart contract is sent, it is first put together and converted into Ethereum bytecode. After that, a space on the Ethereum blockchain is set aside for this Ethereum bytecode.

#### e) *Ethereum Virtual Machine (EVM):*

The part of Ethereum that manages the setup and operation of smart contracts is called the EVM. All things considered, basic worth exchanges that begin with one EOA and proceed to the next do not need to include it; nonetheless, all other items will contain a state update that is recorded by the EVM in Figure 6. On a large scale, the Ethereum blockchain-powered EVM may be seen of as a global decentralised PC with a vast array of executable things, each having

an incredibly robust data storage. Ethereum's hub network layer and hardware are topped by the EVM. Its main goals are to register the status of the organisation and to operate and arrange various types of smart contract code.

f) *Non-Fungible Token (NFT):*

A non-fungible token (NFT) is a unique data unit on a blockchain that may be linked to real and virtual objects to provide unchangeable proof of ownership. To just a few examples, digital images, sounds, records, symbols, and much more can all be linked to the data contained in an NFT. Anything that is flexible is fungible. For example, money is fungible because it can be transferred from one person to another. However, NFT is not fungible as its attributes are unchanging, it is never divisible, and it is never exchangeable.

g) *ERC721:ERC20*, the main token standard modified by the Ethereum Blockchain, maintains what are known as fungible tokens. ERCs are pre-established guidelines with smart contracts made for the Ethereum Blockchain that are used to carry out token operations. One of the major drawbacks of ERC20 is its inability to support non-fungible tokens; this led to the creation of the symbolic standard ERC721.

h) *Transparent Transaction:*

Since all exchanges on the blockchain are identifiable and permanent, transparency is one of the most important components of blockchain exchange. This allows parties to exchange complete certainty without the need for a middleman. The promise of blockchain innovation is increased transparency by making all transactions on the network the subject of publicly available reports; nonetheless, transactions are still referred to as mysterious. Transparent transactions increase the security and trustworthiness of our system compared to the norm.

#### IV. FEATURES AND ANALYSIS

a) *Operational Platform:*

We leverage the Solidity platform to design our NFT-based infrastructure and the Open Zeppelin developer tools to create a blockchain-based digital marketplace employing smart contracts. Our marketplace is initially developed through the importation of ERC721 token specifications. Next, we created a function for token generation for newly created items. The market item class, which includes the NFT contract address, unique token id, seller and owner addresses, and the new item price, is what we will use going forward when we design the new create market item method. Next, we need to construct a function called "create a market item for sale" for sellers as well. We now need to provide a feature for the digital products that are currently on sale. The current item ID is an identification variable for this function. We can now create an item as a seller after deploying. Furthermore, as purchasers, we are able to acquire digital things from this marketplace. Every time a new product is created, a listing charge will also be applied to the owner account.

b) *Comprising Existing Contract and Digital Contract:*

In the current market, third parties are always involved in the development of the buyer-seller contract in every aspect. However, with an NFT-based smart contract, outside intervention is prohibited. Contracts are less expensive, quick, transparent, and safe. Any contract can't be changed and will incur significant costs. It is nearly difficult to tamper with any digital contract in the majority of circumstances.

c) *Listing Fee Approval:*

The commission paid to the posting specialist for helping us sell our items is known as the listing fee. The minimum listing fees are applied to the market owner account each time the seller creates a product. Listing fees are never refundable and are only collected once. Listing fees are primarily intended to increase sales, lower market stock risk, and foster market interaction between market owners and sellers.

d) *Security:*

Compared to our current system, the Ethereum Blockchain-based digital marketplace addresses several significant security issues. I've included some of the main security flaws that our suggested fix addresses.

e) *Performance Comparison:*

A comprehensive performance comparison is presented, including transaction speed, time, scalability, and storage costs. This comparison covers the Internet Computer, Ethereum, Cardano, and Solana, highlighting their respective strengths and weaknesses in the context of NFT marketplaces.

f) *Challenges and Solutions:*

Security, transparency, and scalability are major challenges faced by NFTs and their marketplaces. The paper discusses potential solutions and future opportunities within the NFT ecosystem, emphasizing the crucial role of blockchain technology in enhancing security and transparency.

This research underlines the transformative potential of NFTs in reshaping the digital realm's concept of ownership and value. It emphasizes the advantages of NFT marketplaces and the role of blockchain technology in enabling secure and transparent transactions.

The NFT landscape is dynamic, and ongoing research and innovation are essential to keep pace with its rapid evolution. This comprehensive analysis consolidates insights from diverse research studies, serving as a foundation for future investigations in this rapidly changing field.

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## VI. CONCLUSION AND FUTURE WORK

This study compares the performance of a centralized digital marketplace with one based on the Ethereum blockchain. The feature analysis indicates that our suggested system is a distributed, decentralized ledger that addresses a number of significant security concerns. Additionally, the ownership of creative work is created by NFT-based smart contracts. Payment methods based on the collection of digital market listing fees reduce the market share risk for marketplace operators. Compared to the current market, our suggested approach offers an immutable, quick, and non-fungible smart contract between two parties. Our development of a secure and organized NFT-based smart contract architecture was made possible by the ERC721 token standard.

In the future, we hope to create a huge data-handling digital marketplace powered by the Ethereum blockchain and hosted in the cloud, enabling quick smart contracts between two parties. Ultimately, an examination of the benefits that Blockchain-based solutions and structures offer reveals improved data authenticity, security, performance, and verification. The platform for this operation, WEB3.0, is the coming generation of the internet which holds the implicit to change the way we interact and distribute online, by furnishing a more secure and decentralized terrain for druggies, inventors, and businesses in the form of Decentralized operations and Finance which allows for the creation and use of operations that don't calculate on central waiters and interposers, and also enabling the use of a decentralized fiscal system where druggies can directly manage and invest their means without the need of a central authority. The business platform deals with a specific type of art rather than an abundant order of NFTs available on the internet, Therefore attracting a more focused and engaging crowd, leading to further deals of NFTs and more minting by the possessors.

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