

NFT Marketplace Based on Ethereum Blockchain

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Abstract: Non-fungible tokens (NFTs) are transferrable rights to digital assets, such as images, videos, or music. The phenomenon and its markets have grown significantly since early 2021. The number of NFT marketplaces has been rising continuously since a couple of years. Majority of them employ centralized systems for storage of digital assets (files). This is contradictory to the notion of decentralized systems. In this project we propose a secure platform for trading digital assets in the form of Non-Fungible tokens. It will enable the users to create new digital assets and trade them in exchange of Ethereum-based cryptocurrency. Along with this, we aim to explore technical feasibility of a decentralized file system (using IPFS protocol) for storing the digital assets in a more secured way. In this way, we attempt to address the issue of file storage. Also, this project is an attempt to advocate the use of block chain technology.

Keywords: NFT, Blockchain, Ethereum, IPFS, Decentralized Networks

I. INTRODUCTION

Technology advancement and digitization were not always regarded as partners in the evolution of the arts industry. This viewpoint and mindset are about to shift. With their involvement in various Non-Fungible Token projects, content creators, artists, and personalities from a variety of industries have dominated the headlines. This turning away from traditional business models has been accomplished by recognizing the powerful tools and innovative features provided by blockchain technology. The usability of such technology has been directly proportional to the curve of discovery of novel business concepts involving tokens and tokenization processes.

II. LITERATURE SURVEY

#	Paper Details				
	Paper Name	Author	Year of Publication	Publication	Seed Idea
1	On Blockchain Technology: Overview of Bitcoin and Future Insights [1]	Hellani, et.al	2019	IEEE	Understanding blockchain tech, how web3 works, competency of blockchain applications.
2	Decentralized Applications: The Blockchain-Empowered Software System [2]	Wei Cai, et.al	2018	IEEE	Understanding Ethereum Blockchain, smart contracts, various Ethereum tokens and exploring dApps.
3	Building A Decentralized Application on the Ethereum Blockchain [3]	R. Taş and Ö. Ö. Tanrıöver	2019	IEEE	Understanding the tech stack and overall process involved to build dApps,
4	Non-Fungible Token (NFT): Overview, Evaluation, Opportunities and Challenges [4]	Qin Wang, et.al	2021	arXiv	Understanding concept behind NFTs, their recent spike in trends, what makes them special, and exploring concept of digital ownership

Table 1: Literature Survey

III. BACKGROUND AND BASICS

A Non-Fungible Token is essentially a digital certificate of authenticity that cannot be copied. NFTs are used to represent ownership of unique items and are stored on a blockchain or distributed ledger. Because of the secure properties of blockchain technology, the record of ownership is always available, immutable, and guarantees that only one owner can exist at any given time.

NFTs, which are based on the blockchain programmable infrastructure, can represent anything that is both physical and digital in a digital realm. It is critical to recognise that the metadata stored within the Token's smart contract ensures uniqueness and, together with the transparency of the transaction history provided by the underlying technology, allows the NFT to be verifiable by any network participant, reducing the risk of counterfeiting to zero.

IV. IMPLEMENTATION DETAILS OF MODULE

4.1 System Use-Case Overview

This Use-Case diagram represents the functional requirements of the system. It covers following functional requirements:

- Browse Marketplace
- View Item
- Buy NFT Asset
- Place Bid in Auction
- Sell NFT Asset
- Start Auction
- Mint NFT

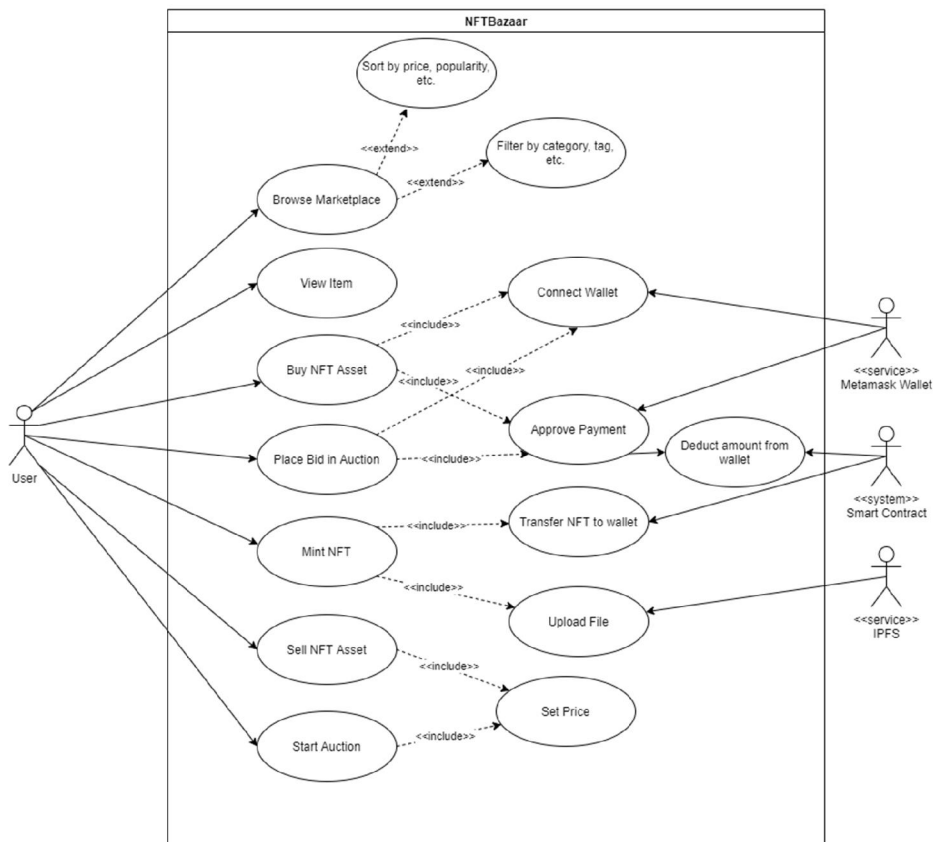


Figure 1: System UML Diagram



4.2 System Backend Overview

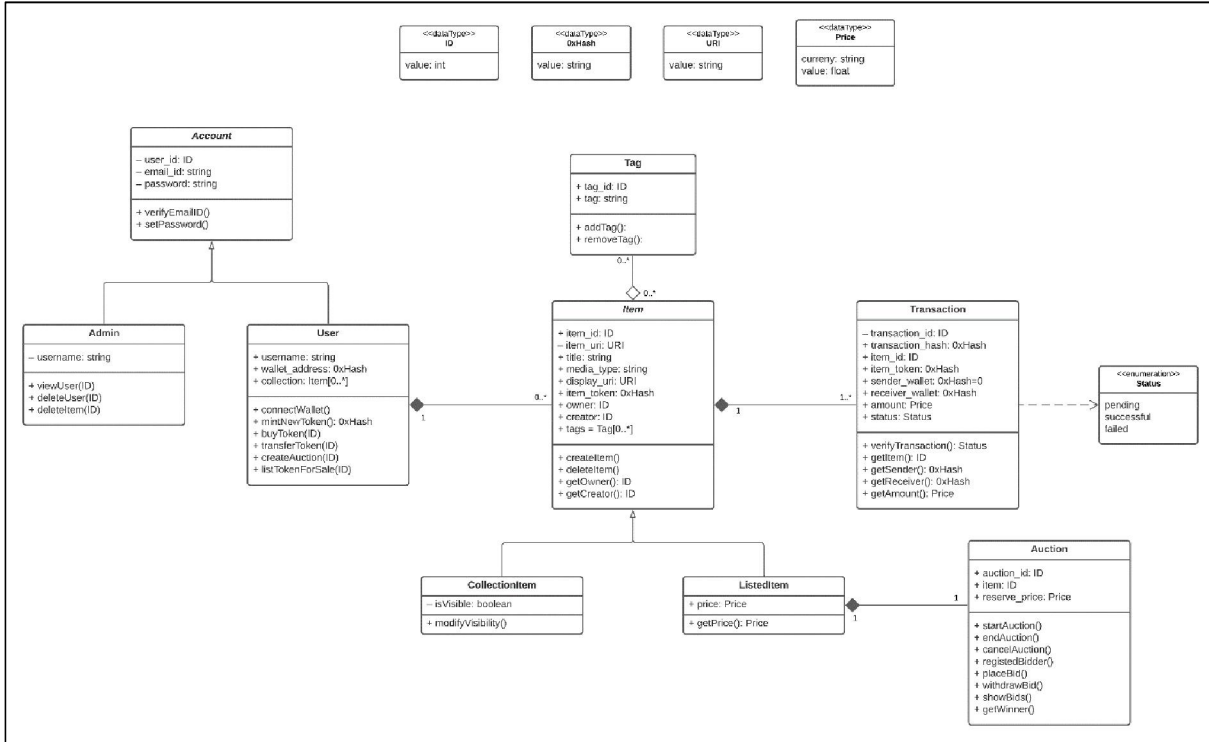


Figure 2: Software Backend Class Diagram

Above Class Diagram represents all the basic classes present in backend. Below are some insights about the classes:

- Admin and User classes inherit from Account abstract class.
- Collection Item and Listed Item classes inherit from Item abstract class.
- There is a composition relationship between User class and Item class.
- There is a composition relationship between Item class and Transaction class.
- There is a composition relationship between Auction class and Listed Item class.
- There is an association relationship between Tag class and Item class.

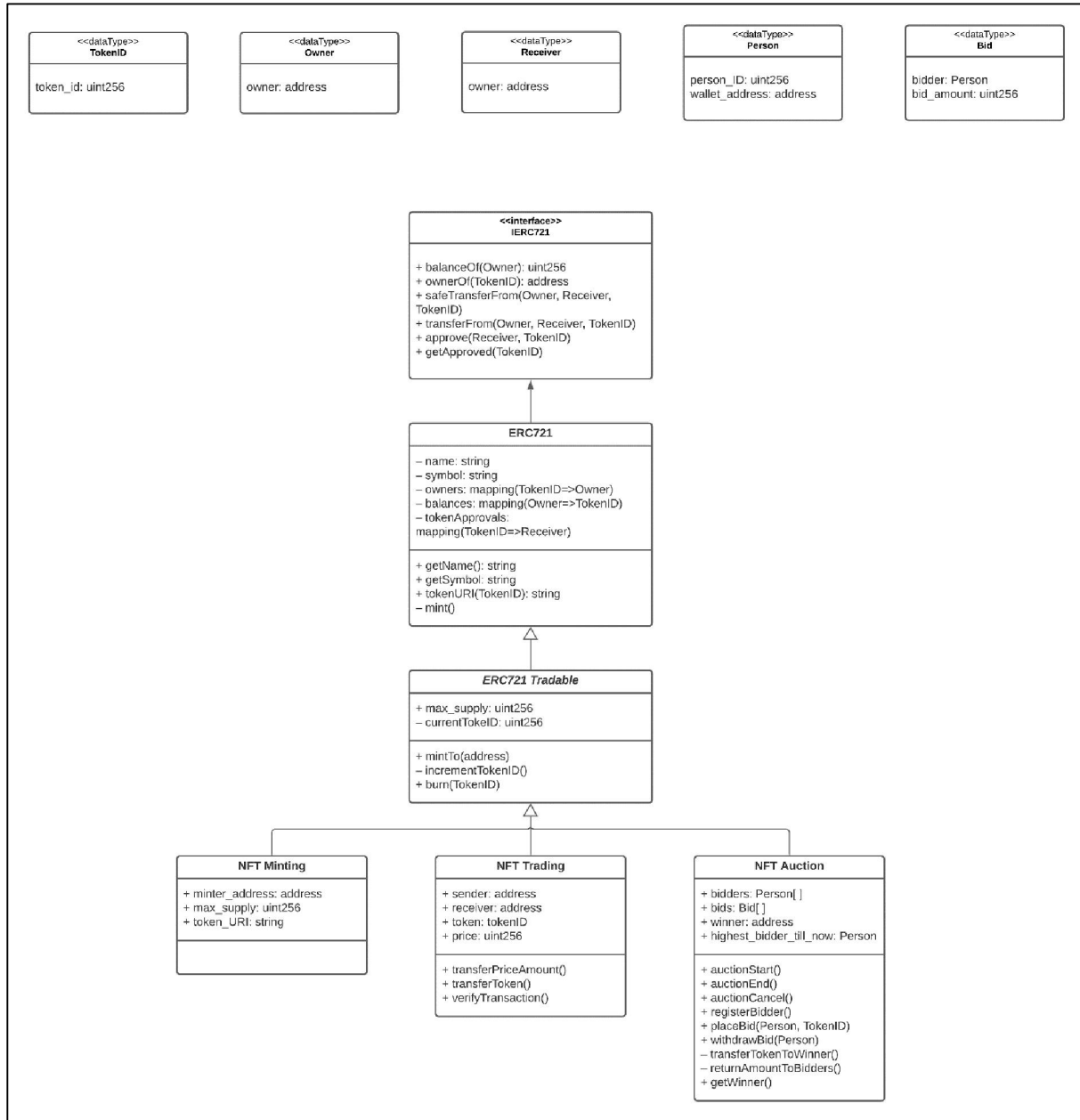


Figure 3: Smart Contract Class Diagram

Above Class Diagram represents the structure of Smart Contracts. Below are some insights about this diagram.

- Interfaces: IERC721
- Abstract Classes: ERC721Tradable
- Concrete Classes: NFT Minting, NFT Trading, NFT Auction

4.3 Architecture Overview

- React Client: This is a webapp built with ReactJS. It is primary interface between the user and the backend. It provides an easy-to-use graphical interface allowing the user to use all features of the software with ease. It communicates with the backend server using REST APIs. It also lets the user to access the wallet using Web3 libraries and JSON-RPC.

- Metamask Wallet: This is a popular wallet that is used to store cryptocurrency. The client-side webapp communicates with this wallet using Web3 protocol. It lets the user approve payments.
- Nodejs Backend: This server contains all the business logic of NFTBazaar. It communicates with the client through REST APIs, with the distributed file system using IPFS protocol and with the Ethereum Blockchain using the smart contracts. It also has a SQL database.
- Distributed File System: This is a peer-to-peer network of devices which stores files. The files uploaded by the users for tokenization will be stored on this network. The backend can access this network using the IPFS protocol.
- Ethereum Blockchain: It will store the URIs of NFTs. It also stores the smart contract and all the transactions performed by users.
- Smart Contract: It is a piece of code with some business logic that is deployed on the blockchain. It performs all transactions on the blockchain – transfer currency, create NFT, etc.

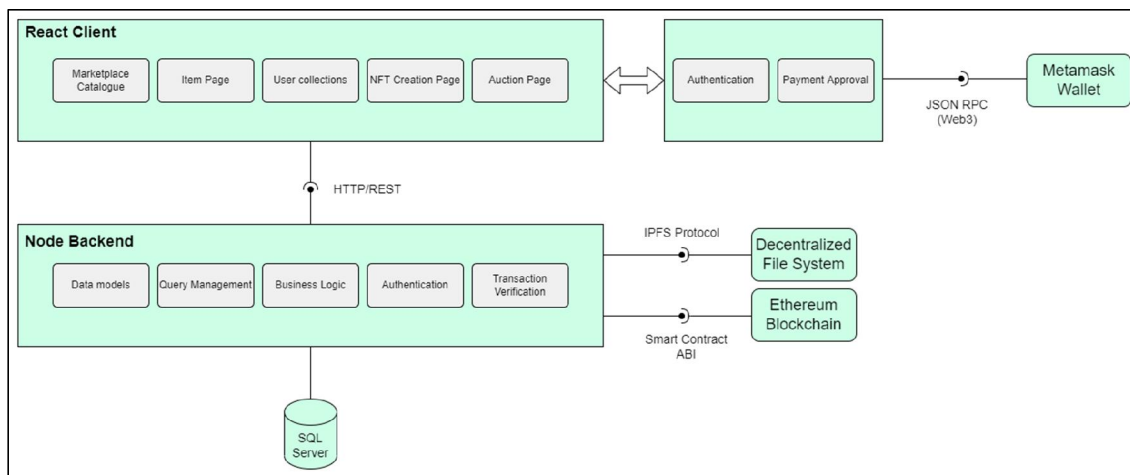


Figure 4: Architectural Diagram

4.4 Data Flow of Preliminary Model

Above Data Flow Diagram represents the flow of data during the procedure of buying NFT assets. Following are some insights about it:

- The User requests to view the Marketplace Catalogue.
- User may filter or sort the results according to their liking.
- The User chooses an item of interest and requests to view it.
- On the Item View page, the user may request to buy the item.
- Payment is approved by the User Wallet.
- Amount gets deducted from the User Wallet and gets added to Seller Wallet.
- The NFT token gets transferred to User Wallet.
- All transactions get added to Transaction Database.

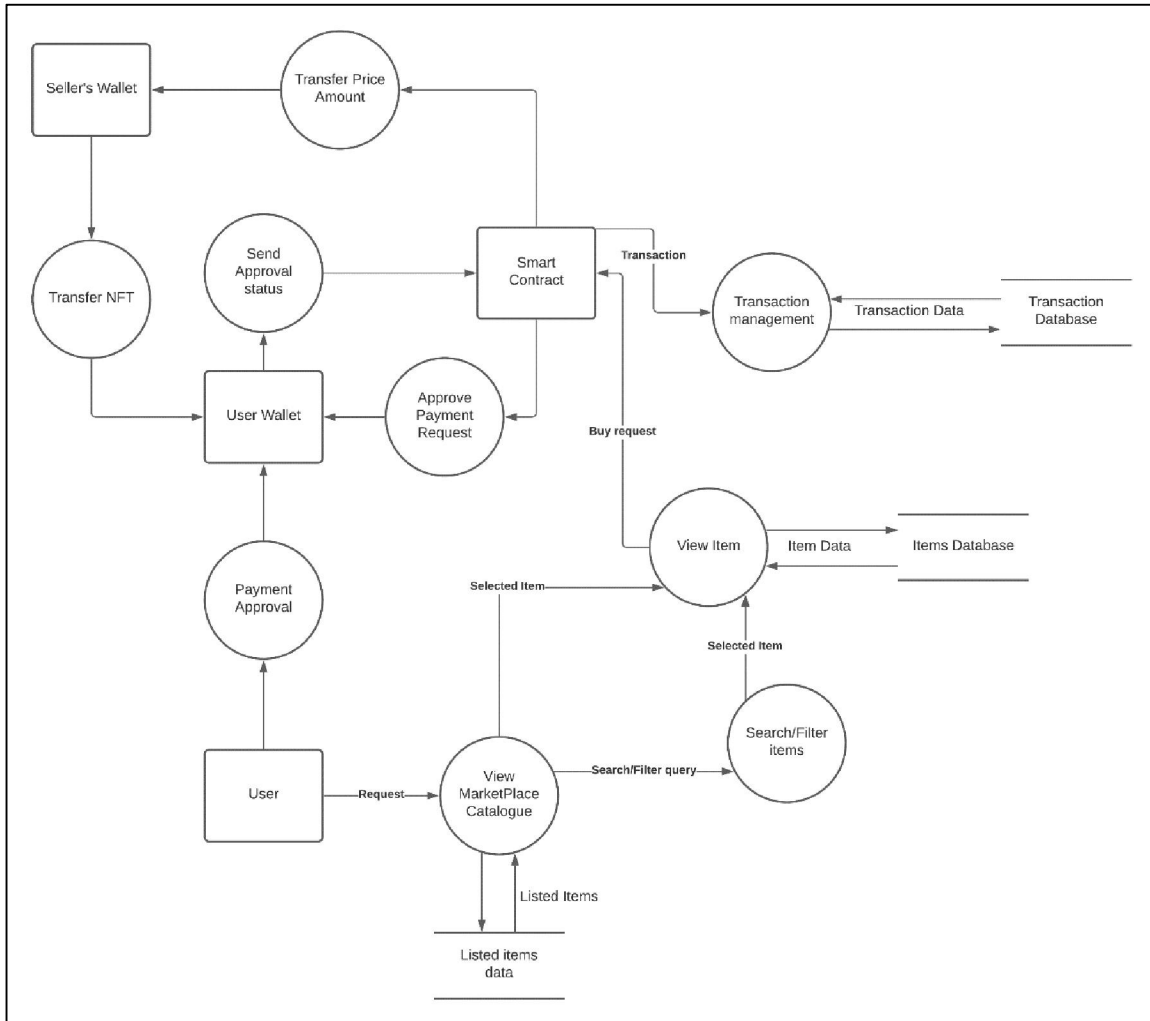


Figure 5: Data Flow Diagram

4.5 Business Rules

- **Conduct Code:** Most NFTs, given the predominance of user-generated content and transactions in NFT marketplaces, include an extra layer of legal restrictions in the form of codes of conduct to govern interactions on the platform.
- **Smart Contracts:** The unique digital creation must be independently identifiable, with ownership transferable within the smart contract. Creators should design-in the economics of trading: How much for a primary sale, how much for secondary sales, royalties, transaction costs and other features of the aftermarket to enable trading, with funds flowing to the appropriate parties by design.
- **Platform Terms of Service:** NFT marketplaces must have essential documents such as Terms of Service, which govern the relationship between the NFT marketplace operator and customers, and between the buyers and sellers of the NFTs featured on the platform. A well-thought-out terms of service agreement can help protect the organization from various legal issues and generally have provisions limiting the company’s overall liability.
- **Terms of Sale:** Sellers or creators listing their NFTs on an NFT marketplace may wish to impose additional terms of sale on purchasers of their NFT, especially if the platform’s terms of service do not sufficiently address risks to the seller or creator.
- **Intellectual Property Protection:** It is vital to verify each participant’s intellectual property rights through each step of every NFT transaction. Be sure to allocate intellectual property rights between the creators/artists,

purchasers/collectors, and other parties involved. The ownership of the original work is copyright ownership, which vests in the creator of the original work. If an NFT is minted and sold, the purchaser will receive a set of intellectual property rights from the creator as part of owning the NFT. The seller of the NFT determines the rights that accompany an NFT.

- **Payments:** If payments are processed on behalf of counter parties, the party touching the money may be a “money transmitter” with its activities governed by applicable Treasury, state and local registration regulations. To avoid the complex process of registration in innumerable jurisdictions, many marketplaces partner with already-registered entities, acting as content creators rather than payment processors.
- **Data Privacy:** Being transparent about the data collection and use is critical. Many jurisdictions require platforms to disclose their data practices in a privacy policy. The fines for privacy violations can be significant.

4.6 Project Process Modelling

Agile project management is an iterative approach to delivering a project throughout its life cycle. Iterative or agile life cycles are composed of several iterations or incremental steps towards the completion of a project. Iterative approaches are frequently used in software development projects to promote velocity and adaptability since the benefit of iteration is that you can adjust as you go along rather than following a linear path. One of the aims of an agile or iterative approach is to release benefits throughout the process rather than only at the end. At the core, agile projects should exhibit central values and behaviours of trust, flexibility, empowerment and collaboration

V. LIMITATIONS AND EXCLUSIONS

As of the time of writing this, cryptocurrency is not a legal tender in many countries [5]. Users need to be aware of all the risks [6] involved while investing in assets. The authors are not responsible at any given time if any anomalies with the finances that might happen if proper attention is not paid.

Users need to load up digital currency onto their existing wallet from 3rd party exchanges like Binance, WazirX, FTX, etcetera. The project is a technical demonstration on how ERC-721 tokens can be traded for digital currency in a modern age web-based application.

VI. SAFETY REQUIREMENTS

The blockchain provides the protection and transferability enabled by distributed ledger technology. Representing anything from tweets to real estate - NFTs are ultimately digital collectibles. NFTs are different from other blockchain-based assets like Bitcoin, Ether, and stable coins that are identical, interchangeable, and ultimately fungible. This is because NFTs represent non-fungible, divisible, and transferable pieces of ownership in distinct assets.

- **Avoiding Duplicity:** To prevent fraudulent users from uploading same file in the marketplace, a database keeps track of all data that goes into the inventory and prompts user an error if duplicity is found.
- **Transaction atomicity:** The atomicity of transaction should be maintained so that the users don't lose their currency or assets in the event of transaction failure.
- **Returning Auction Funds:** Users that participate in auctions need to keep the cryptocurrency staked at said price on hold until the auction ends. Once this ends, the winner of the auction is compensated with the NFT to his/her wallet. And rest of the funds that were put on hold shall be released to where it came from.
- **Data Redundancy:** Databases should use sharding to be redundant to prevent loss of data. Backups of the databases should be done hourly and be kept for one week.

VII. CONCLUSION

Non-Fungible Token (NFT) is a new technology that is gaining traction in the blockchain market. In this report, we look at cutting-edge NFT solutions that could reshape the digital/virtual asset market in the future. We begin by analysing the technical components and then provide design models and properties. Then, we assess the security of current NFTs systems and go over the opportunities and potential applications that use the NFT concept. Finally, we outline current research challenges that must be addressed before reaching mass-market penetration. We hope that this report provides timely analysis and summaries of existing proposed solutions and projects, making it easier for newcomers to stay current.

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