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PRIVACY PRESERVING DIGITAL CREATION BY USING BLOCKCHAIN

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ABSTRACT

Non-fungible tokens (NFTs) represent unique digital assets verified through blockchain technology, enabling ownership of both virtual and physical items. Despite the rapid growth in the creation and trading of NFTs, comprehensive research on their market dynamics remains limited. This study examines the transaction network among NFT buyers and sellers, focusing on the structural characteristics of NFT trade interactions. Our analysis reveals that a small number of participants account for most NFT transactions, while most addresses engage in only a few trades. We explore the structural properties of the NFT trades network, including centrality measures, clustering coefficients, and assortativity, and track their evolution over time. Additionally, we construct a graph of NFT relationships, identifying four major communities and highlighting leading projects within each. Our findings also indicate patterns in co-purchases, revealing which NFT projects are frequently bought together. This research contributes to a deeper understanding of the NFT market's structural dynamics and participant behaviour.

Keywords: Non-fungible tokens; NFTs; Blockchain technology; Systematic review.

1.INTRODUCTION

NFT, abbreviated for “non-fungible tokens”, are digital assets that are representative of physical or digital creative work or intellectual property including music, digital art, games, gifs, video clips and more. “Nonfungible” in NFT means that each token is not exchangeable with another token, making each token a unique entity that represents a single specific object. These tokens consist of digital information in the form of media (music, video, image) the value of which can be calculated

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in terms of cryptocurrencies. The NFTs are part of the Ethereum blockchain in particular but differ from Ethereum coins which are fungible, that is, exchangeable with similar types of assets.

Rapid technological advancements and its growth are accompanied by increased security risks including those of authenticity. The uniqueness and nonfungibility of NFTs minimizes, if not completely eradicates, the problem of authenticity and counterfeits to a large extent by means of a digital signature of the owner incorporated in each token such that an asset is easily traceable to its owner. Furthermore, it also addresses the problem of the customers being deceived into buying counterfeit items e.g., tickets or artwork. Buyers can easily trace the items on sale to owners, thereby ensuring a legitimate purchase. Moreover, the introduction of NFTs is opening new avenues for artistic businesses that previously found it challenging to establish online markets in an era of internet-based businesses due to the lack of exclusive ownership [1].

NFTs began gaining attraction of the masses with CryptoPunks in October 2017 but became more popular since the largest art sale in the history, made by Mike Winkelmann, a digital artist who sold his work for nearly USD 70 million. The sale directed a lot of attention towards NFTs, the growth of which has been on an upward trend since it has been getting a generous amount of attention from artists and art enthusiasts. Previously, NFTs were only known in a limited sphere of the blockchain community but currently have a market of their own, making up to USD 1.2 billion in sales as of July 20211 .

In this paper we will give a description about our project name Artcart which will be the powerful NFT art marketplace for digital art and other digital assets. It is designed to help creators display and sell their items while allowing buyers to resell them using cryptocurrency transactions.

- We discuss the notable increase in deployment of NFTs since its inception
- We present the significant challenges posed by the NFT application in the current technological and legal atmosphere
- We explore the diverse applications of NFTs in various domains

The research paper is organized as follows: section 2 comprises an introductory overview of NFTs that entails the discussion of technologies that have been used to create NFTs as well as its history and current market state. Then, section 3 provides a brief look into the numerous use cases of NFTs in various domains. Section 4 presents the challenges pertinent to the implementation of NFTs. Lastly, the conclusion in section 5 summarizes the findings of the research and presents its future direction.

1.1. NON-FUNGIBLE TOKENS (NFT) - A PRIMER

This section gives a brief overview about the technologies being used around the concept of NFTs and the growth of NFT marketplaces.

A. Blockchain

A blockchain is essentially a distributed digital ledger of transactions [2] that encompasses the whole network of computers. It is dispersed, which means it does not require a central authority to

function. Bitcoin was the first cryptocurrency to leverage blockchain technology; it was conceived in 2008 and deployed in 2009 [3]. Since then, this distributed ledger concept has attracted other initiatives from various industries; nonetheless, the financial industry is recognized as the key user. The reason seems to be that identifying the correct current owner of an asset is often not possible [4]. To verify and authenticate ownership, blockchain works in the following way: it is made up of data packages called “blocks”, which are cryptographically interconnected to one another, and by adding each additional block, it creates a chain, which is a complete digital ledger. Distributed Ledger Technology (DLT) is a decentralized database that is administered by various people. Blockchain is a sort of distributed ledger technology [5] in which transactions are stored using an irreversible cryptographic signature known as a hash, and blocks can be authenticated by the network using cryptographic means. This concept ensures the blockchain's integrity all the way to the first block. As the hash values are unique, fraud can be detected because modifications to a block in the chain changes the hash value immediately. Because of the decentralized structure of blockchain, all transactions can be transparently viewed. The technology, on the other hand, is suitable for a wider range of applications and is being researched in a number of fields, including finance, public and social services, security and privacy, smart contracts, and IoT [3].

B. Ethereum

Ethereum is a community-run technology software platform that enables hundreds of decentralized apps to be built and deployed. Ethereum is based on blockchain technology. It is a blockchain with a built-in Turing-complete programming language. It has an abstract layer that allows anyone to define their own ownership, transaction formats, and state transition methods. This is accomplished through the use of smart contracts, which are a collection of cryptographic rules that are only performed if specific terms are satisfied [6]. In addition, such a platform serves as the foundation for a virtual currency known as Ether, which is a cryptocurrency asset used in the Ethereum blockchain. Ether is, in some ways, the gasoline for running Ethereum's distributed applications. It is possible to send money to other accounts or to machines that are doing a certain task using this currency. Ether may therefore be used to operate decentralized applications, create smart contracts, generate tokens, and make ordinary peer-to- peer payments. As a result, Ethereum is also known as “programmable currency” [7]. Ethereum consists of EOA and Contract. The EOA is controlled by a private key while Contract accounts are controlled through contract code. An account consists of four things: nonce, ether balance, contract code hash, and storage root [8].

C. NFT Marketplace (Buying and selling NFTs)

Minting NFT is a process through which digital art becomes a part of the Ethereum Blockchain [9]. NFTs are tokens that are “minted” after they have been created, similar to how metal coins are minted and incorporated into circulation. The digital art is symbolized as an NFT, allowing it to be bought and sold on the market, as well as digitally tracked throughout the whole process [9][10].

The NFT market observed a sudden uprising in the second half of 2020 with an NFT art selling for USD 69 million. Furthermore, the total volume of NFT sales in 2020 was USD 2.5 billion while the total sales volume of NFTs in the first six months of 2021 surpassed USD 10.7 billion. This indicates a significant change in the growth of NFTs over a short period of time [11]. The 24-hour

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normal trading volume of the NFT market is USD 4 billion, while the 24-hour normal trading volume of the entire cryptographic money market is USD 341 billion [12] .

Various online marketplaces can provide a platform for buying and selling NFTs but some of them are more sought- after than others as shown in Table I. However, not all marketplaces sell the same collectibles or works of art. As a result, the type of collectible is solely determined by the type of market. The majority of these marketplaces sell a diverse range of NFTs, but each platform operates differently2 .

TABLE I. TOP NFT MARKETPLACES

MARKET	TRADES	VOLUMES
Open sea	46,067	$73.45m
AxieInfinity	40,429	$19.44m
CryptoPunks	12	$2.45m
Automic Market	7103	$1.03m
PancakeSwap	1342	$783.74k

Market Traders Volumes OpenSea 46,067 $ 73.45m Axie Infinity 40,429 $ 19.44m CryptoPunks 12 $ 2.45m AtomicMarket 7103 $ 1.03m PancakeSwap 1342 $ 783.74k

2021 has seen a significant increase in interest in NFTs, with NFT marketplaces like Nifty Gateway and OpenSea recording the highest trading volumes in the first quarter of 2021. The most expensive NFTs are listed in Table II.

TABLE II.MOST EXPENSIVE NFTS NFTs

NFTs	VALUE
Everydays: the First 5000 Days	$69.3m
CryptoPunks #7523	$11.75m
CryptoPunks #3100	$7.67m
CryptoPunks #7804	$7.6m
Beeples Crossroad	$6.6m

Value Everydays: the First 5000 Days $69.3m CryptoPunk #7523 $11.75m CryptoPunk #3100 $7.67m CryptoPunk #7804 $7.6m Beeple’s Crossroad $6.6m International Journal of Research

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2.NFT APPLICATIONS

This section discusses the various applications of NFTs and how they are reshaping the future of digital assets. A summarized version of NFT application is given in Table III.

A. Digital Art

Digital art is the creative content that exists on the virtual or digital medium and consists of music, films, paintings, images and more. Like its counterpart i.e. physical art, it can be sold by artists and bought by art collectors and enthusiasts. However, it is also susceptible to being counterfeit or stolen. The use of NFTs in this regard attaches a unique hash with each piece of art that allows it to be differentiated. Artists or authors of original works can include their signature in the digital tokens, thereby reinforcing the authenticity of produced content. Although it is possible to make copies of the digital art, NFTs ensure that each copy belongs exclusively to the buyer such that it is not interchangeable with another copy [13], adding to the attraction of art for hobbyist art collectors and speculators.

Tokenization of digital art by means of NFTs has enabled the artists to not only gain more profits from the sales of their work but also receive a royalty each time their artwork is transferred to a new owner. The concept of royalty was previously impractical, especially in case of physical art as it was difficult to keep track of its ownership but the incorporation of NFTs has enabled novel avenues for artists to be compensated for their craft [13]. The most notable record is that of Mike Winkelmann, better known as Beeple, who has made a digital art sale worth USD 69 million at Christie's, which is the highest sale made from art, historically.

B. Fashion

Luxury fashion brands are leveraging the properties of unique ownership, permanence and royalty acquisition enabled by the NFTs. Many fashion brands use their online presence to widen their reach but still remain economically inaccessible to the masses which sustains the demand for counterfeit and replicated articles. Businesses are losing large sums of money to counterfeit items of their brands, the effects of which can be prevented with the use of NFTs, if not eradicated completely.

The use of NFTs in fashion is still a relatively new concept but after pandemic, due to closure of physical stores for a year or so, the fashion industry is attempting to broaden their prospects by venturing into fashion tech. Companies have already begun embedding digital NFTs to physical articles to distinguish ownership and retain exclusivity5 .

Jacob & Co., a luxury goods brand, auctioned a digital watch which was sold to the highest bidder for USD 100,000. RTFKT, a virtual fashion brand, sold a jacket for a price of more than USD 125,000. High valuation of fashion-based NFTs indicate the presence of demand for virtual clothing articles. Since the fashion industry relies on the sales of physical goods, it is unlikely that NFTs will completely replace the same but it provides a lucrative opportunity for luxury fashion businesses to utilize it as an extension6 .

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C. Licenses And Certifications

NFTs assigned to individual licenses and certifications can minimize the time and effort that companies have to expend on verifying critical documentation, thereby improving administrative operations. Moreover, the institutes issuing certificates and licenses can eliminate the workload of record- keeping with each document having a unique NFT that can be checked for authenticity7 . The issuance of the licenses and certificates on the blockchain makes them resistant to tampering, which reduces the likelihood of encountering fraudulent documents. An example of this use case of NFT is Zastrin, which is an education-based company that sells online programming courses. The company uses NFTs to purchase course licenses and issue course completion certificates8 .

D. Collectibles

Collectibles are a significant entrant among non-fungible token use cases. In fact, it was one of the very first ways that introduced and further normalized the idea of NFTs to the general public through Cryptokitties. These collectibles were introduced to the market in 2017 and were the reason behind the clogging up of Ethereum network as well [14]. They are one-of-a-kind digital kittens that users can procreate to create unique kittens [15]. Each crypto kitty has unique characteristics, such as fur pattern, eye color, etc. By clicking on a button, users can purchase two different cats, a sire, and a dame, for domestication [16]. The generated kitten has its own individuality as well as a genetic algorithm. The value of crypto kitties is determined by the scarcity of genetic profile. Furthermore, the number of times a sire is used to procreate other kittens is a key variable in predicting the significance of crypto kitties [17].

E. Boosting Gaming Potential

NFTs have gained a significant amount of attention from the gaming community and developers. They can provide ownership data for in-game objects, fuel in-game economic systems, and provide many other perks to facilitate the players [18]. Many standardized games let players buy different items and objects for inventory. However, if the purchased item is an NFT, the player could claim back the money by selling the item once they no longer need it. The player might even generate profit if the value of the said item increased over time [19]. This process is not just beneficial for the gamers but also benefit developers in multiple ways. Every time an NFT is sold in the marketplace, developers earn a royalty as well. This results in a more interdependently beneficial business framework in which both players and developers profit from the International Journal of Research Publication and Reviews, Vol 3, no 11, pp 2646-2653 November 2022 2649 intermediate NFT market [20]. This also indicates that if the developers discontinue support for a game, the items accumulated by the gamers remain as their own property.

F. Domain Names

This is yet another way that NFTs are being used, perhaps in an unnoticeable way. Blockchainbased domain name services such as the Ethereum Name Service (ENS) and unstoppable domains have begun to receive the attention they deserve [21]. Users can change their address from a lengthy, complicated string of numbers to any desirable length resulting in a more welcoming and user-friendly process[22]. Furthermore, unstoppable domains are powered by the

Crypto Name Service (CNS) which is developed on the Ethereum blockchain [22]. The process of creating a domain name generator is simple, but the struggle lies in the demand for these domains. Both ENS and unstoppable domains have been successful in their attempts at decentralized domains thus far.

G. Virtual World

For the virtual online world, blockchain presents an excellent decentralized environment [23]. In the real world, financial organizations have a variety of methods for evaluating assets. In order to get an appropriate assessment, it is generally required to hire an outside auditor or a rating agency, which is a costly procedure. As a result, many assets remain undervalued even outside market bounds, causing asset owners to lose trust [24]. However, in the virtual world, all types of digital activities are based on blockchain.

3.LITERATURE REVIEW

- **Planning the Review**

This study synthesis aimed to assess the present status of NFT. This investigation was conducted with the greatest seriousness by thoroughly reviewing all current relevant literature. Utilizing organized RQs, databases, and techniques for locating and evaluating material is integral to the review approach. Certain elements of the specified reporting items for systematic reviews were selected to give a clear, quantitative, and thorough assessment of NFT. The entire plan comprises the following important steps:

I. Analysing the state of the field at the moment.
II. Understanding the evolution trends of the study.
III. Determining the field's difficulties and potential future paths. IV. A summary of the investigation's results.

- **Research Strategy**

A holistic review of the literature necessitates an inclusive perspective. Before the search, a sufficient number of databases were chosen to enhance the likelihood of locating highly relevant articles. Throughout the study, Scopus sources are examined.

- **Search Criteria**

To ensure that the information presented here is comprehensive, relevant databases were exhaustively examined. However, not all great works of literature have been included in the search criteria for a variety of reasons. To achieve this goal, a complete literature search was performed. Approximately 127 Scopus results have been examined, published before November 2022. Thirty-four were deemed significant (Figure 1).

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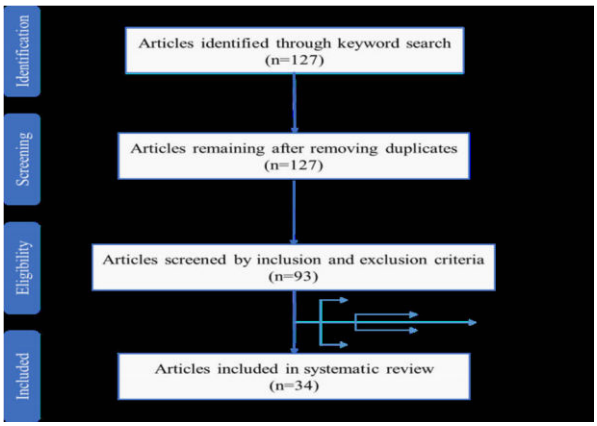

Figure 1. Diagram depicting the selection of studies for a systematic review

Study domain and research topics affected the development of the search string. By searching ―NFT‖ AND ―Non-fungible token‖ pertinent information was identified and collected.

(I) Inclusion criteria (IC)

Research published at any point between 2012 and 2022.

The keywords include ―Blockchain‖, ―Block-chain‖, ―Non-fungible Token‖, and ―NFT‖.

The research scope is restricted to the journal.

(II) Exclusion criteria (EC)

The elimination of articles in the press.

Articles that are not in English.

Exclusion of reviews, conferences, book chapters, dissertations, monographs, and works based on interviews.

4. EXISTING METHODOLOGY:

Centralized Marketplaces Many traditional digital asset marketplaces operate in a centralized manner, where a central authority or platform manages all transactions, user data, and fees. Examples include platforms for digital art and collectibles like OpenSea (decentralized), Rarible (decentralized), or even more centralized digital asset markets.

Centralized Control : These platforms have a single entity controlling all operations, creating issues around censorship, security, and transparency.

Transaction Fees : Higher transaction fees, typically imposed by the platform, which impacts the profitability for creators and buyers.

Limited User Control : Users often have to trust the platform with their data and digital assets, reducing the level of control they have over their content.or specific API calls for web services. The response from the database or API is then processed and presented to the user in natural language.

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Existing NFT Marketplaces : Decentralized NFT marketplaces such as OpenSea, Rarible, and Foundation have adopted blockchain technology to create and trade NFTs. These platforms leverage the Ethereum blockchain for transparency and immutability**,** with smart contracts ensuring secure and verifiable ownership transfers.

Key Features of Current Marketplaces:

Minting of NFTs: Users can upload digital assets and mint them as NFTs using smart contracts on platforms like OpenSea. **Buying and Selling**: NFTs are bought and sold via cryptocurrency, with blockchain records maintaining ownership history.
Royalties: Some marketplaces allow creators to earn royalties from secondary sales of their NFTs.
Wallet Integration: Platforms integrate with crypto wallets (e.g., MetaMask) to enable users to securely perform transactions.

Limitations of Existing Methodology While the existing platforms provide valuable services, they have several limitations:
High Gas Fees: Ethereum-based NFT marketplaces often suffer from high gas fees during transactions, making it costly for users to mint or trade NFTs.
Scalability Issues: Existing platforms on
Ethereum struggle with network congestion, leading to slow transaction times and high fees.
centralized elements, such as user account management and platform fees.
Lack of Cross-Chain Interoperability: Most platforms are limited to a single blockchain (typically Ethereum), meaning NFTs minted on one platform may not be easily transferred to others.
Limited Royalties Control: While some marketplaces allow for royalties, creators have little control over the percentage or distribution beyond initial sales.

5. PROPOSE METHODOLOGY :

Decentralized Platform
The proposed NFT marketplace will be entirely decentralized, leveraging blockchain technology to eliminate central control and ensure transparency, security, and user autonomy. All transactions, ownership transfers, and royalties will be managed through smart contracts, ensuring that creators and buyers interact in a trustless, permissionless environment.

Blockchain and Smart Contract Development
Blockchain Network: The marketplace will be built on the Ethereum network (or any suitable blockchain), utilizing its established smart contract ecosystem. This choice provides security, robustness, and extensive community support.
Smart Contracts: Using Solidity to write secure and efficient smart contracts for minting, transferring, and managing NFTs. NFT Minting: Smart contracts will follow the ERC-721 or ERC-1155 standards to create non-fungible tokens with unique metadata.
Ownership Transfer: Contracts will ensure secure and verifiable ownership transfer on every sale or trade, recorded immutably on the blockchain.

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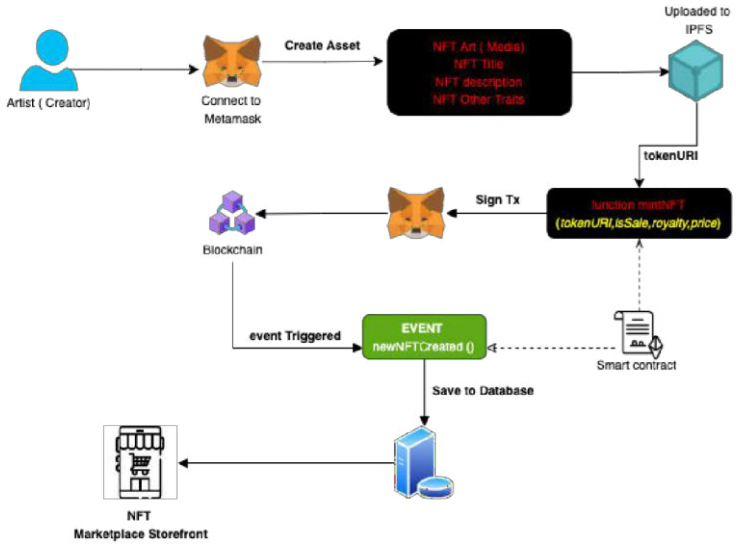
7. ARCHITECTURE

The NFT marketplace architecture is like software architecture. In this, the blueprint of the software system processes and necessary tasks to be executed is played.

In these Architecture let us see how to Create a Digital Asset / NFT Artwork on a Marketplace means minting your digital token. Where a user must upload the Information about the NFT (Artwork) and mint a new token.

Now, these Include three steps, that are:

- Connecting your DApp with a Web3 Wallet: Minting an NFT on a blockchain, requires you to first connect your Dapp with a web3 wallet like Meta mask.
- Uploading Metadata to IPFS: You need to upload your NFT's Metadata to IPFS (Interplanetary File System), metadata includes the NFT's Assets (Image, video, Gif), title, description, and Properties. Since we are building a nonfungible token, we need to make sure this metadata stays forever and is decentralized. Thus, storing it in IPFS is the best option. If you upload these files in a centralized database, it is risky for the security of your file. After you upload your NFT's Metadata to IPFS, you will get a metadata ID (IPFS key)
- Mint your NFT, Take the metadata ID from the IPFS, use it as token URI, and sign the transaction, to mint an NFT.



- List the NFT on Sale:

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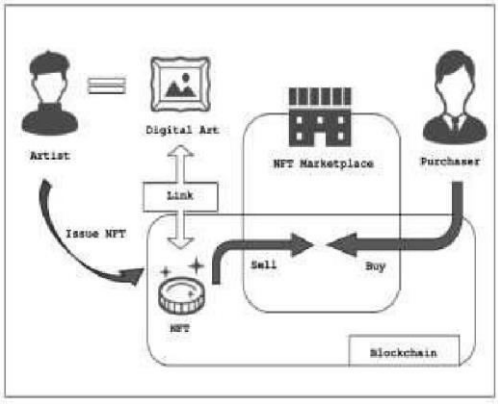
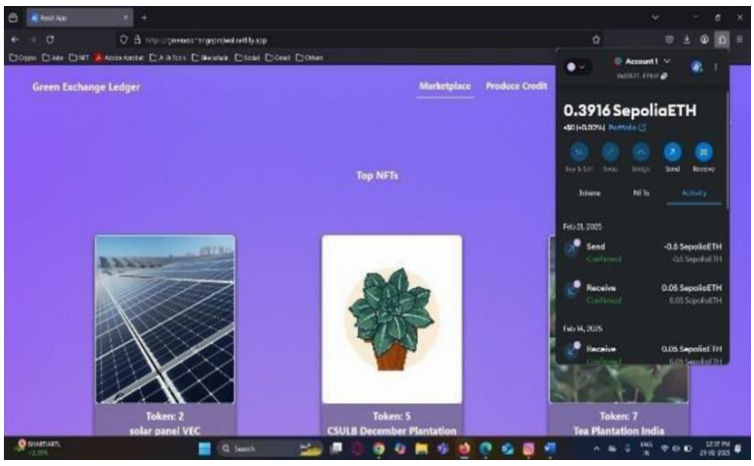
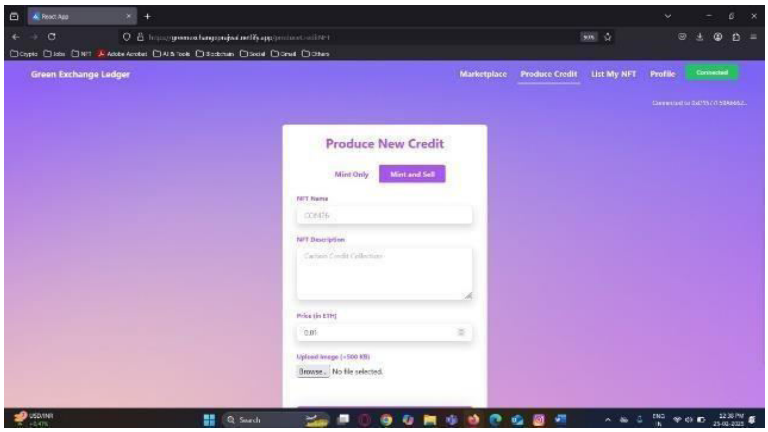


8.INTERFACE

I. Home Page



II. Create NFT (MINT ONLY):



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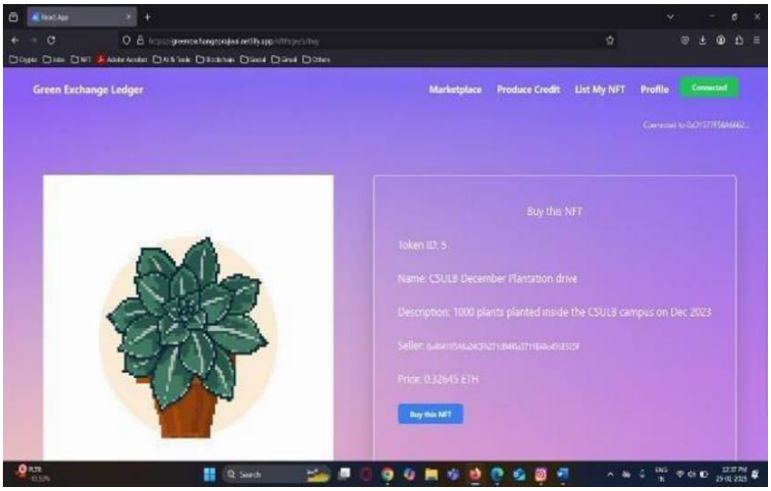
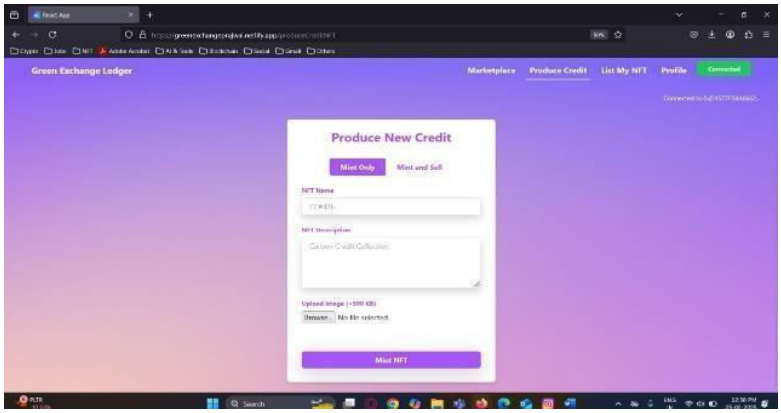
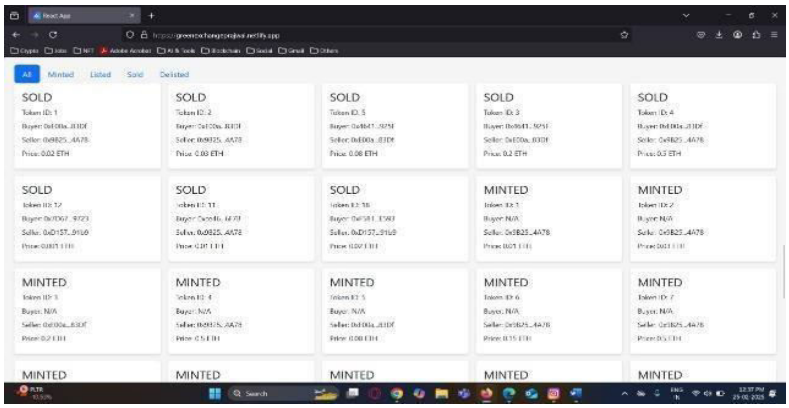
III. Buy NFT :



IV. Mint NFT :



V. NFT Transaction History :



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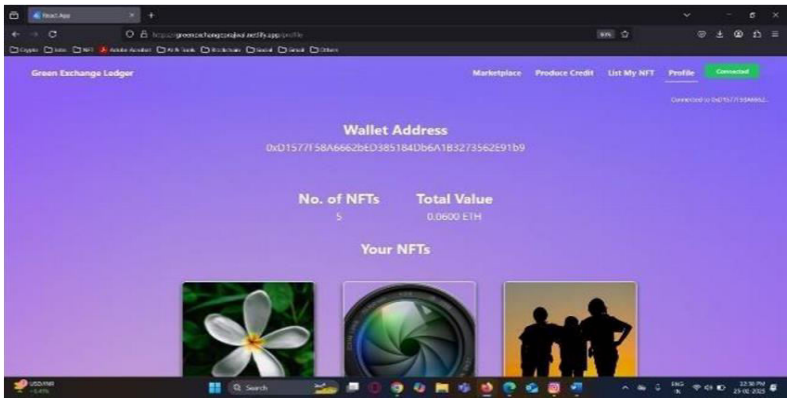
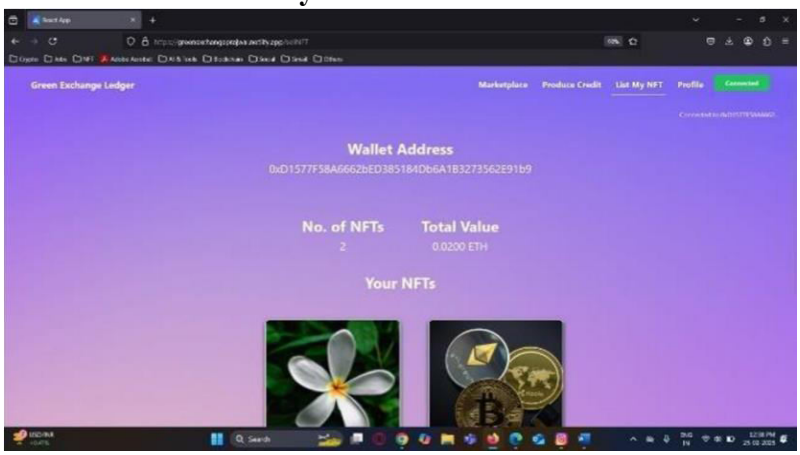
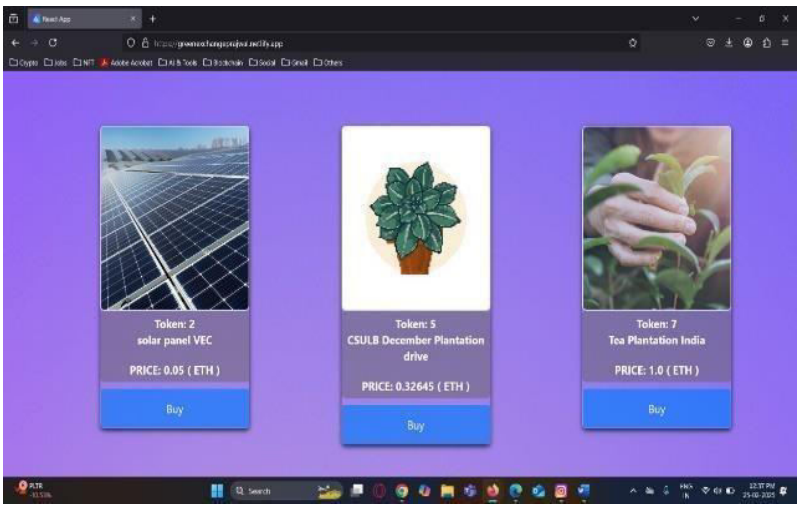
VI. Profile :



VII. List my NFTs :



VIII. Total NFTs :



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9.DISCUSSION

NFTs present improved methods of enforcing authenticity and legitimacy of ownership of assets by linking unique information to a singular account on the blockchain. Consumers of NFTs are leveraging the advantages of NFTs to generate revenue by the sale of their original works with more convenience and security. However, the benefits of NFTs are accompanied by a number of challenges and risks. We discuss some of the ways that can be implemented to address the risks in certain use cases and overcome some of the problems that we have discussed above.

The privacy and security issues are one of the most prominent risk factors of the multiple use cases of NFTs. All transactions take place on the internet where information related to each transaction is vulnerable to unauthorized access and exploitation [33]. Emerging technologies such as zero-knowledge proofs (ZKP), are being developed that can address these issues in the future. ZKP is a cryptographic mechanism that allows you to prove to another party specific attributes without revealing them, such as proving the age of the subject without disclosing the actual age.

Blockchain-based technologies boast of substantial security and privacy, but certain offshoots of the technology are not completely immutable. The increased interest of users in cryptocurrency has led to the introduction of many platforms to facilitate the novel digital currency like web wallets. Although web wallets are based on the blockchain technology, they can be accessed by third parties when online, and some have vulnerabilities to phishing scams, malware, outdated security patches, and DDoS attacks, which cyber hackers can manipulate to their benefit.
Therefore, it is also recommended that collectors and investors holding large amounts of NFTs use more than just a web wallet. Non- browser wallets like Binance or Coinbase with advanced security teams and 2FA, and hardware wallets like Trezor, which guarantees that the private keys never leave the device, are the best options for long-term safekeeping of your crypto and a more widespread use of such wallets can reduce the likelihood of the risk of security and hacking attacks22 .

Furthermore, to decrease the environmental impact of NFTs, developers can be encouraged to move towards more sustainable alternatives including SolarCoin and BitGreen rather than the Ethereum block chain23 .

10.CONCLUSION

NFTs are built on blockchain technology, specifically Ethereum, thereby making it transparent, traceable, and secure. The novel characteristic of unique tokens enabled use cases that had not been demonstrated before such as the exclusive ownership of digital assets. The ownership of each asset is traceable which results in enhanced authenticity. The idea of having complete ownership of an authentic, purchased digital asset e.g., images, gifs, videos, music etc. intrigued art collectors and enthusiasts that led to a sudden growth in its market. NFTs are not only limited to digital assets but can also be applied to physical artistic works, allowing the exchange of physical assets similar to their digital counterparts. Numerous platforms facilitate the buying and selling of NFTs,

comprising media of varied nature. Moreover, its use extended to many other domains namely education where NFTs are applied to licenses and certification, fashion where it is used to distinguish each article, sports where a new means of revenue generation through basketball card NFTs is devised and so on. The increasing widespread use of NFTs, however, comes with many challenges including lack of industry-wide security standards for smart contracts, uncertainty of intellectual property rights, fraud risks by means of artist impersonation, transparency that violates user security and privacy and drastic adverse environmental effects due to large amount of energy consumption. There exist viable solutions for many of these challenges like the use of zero-knowledge proofs (ZKP) for improved privacy, nonbrowser wallets for enhanced protection of the crypto assets and migration of blockchain development to more sustainable platforms such as SolarCoin and BitGreen. These solutions are yet to gain momentum among the wider blockchain community, so the challenges persist and remain yet to be addressed effectively in lieu of the massive potential of the NFTs, the marketplace for which is growing rapidly.

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