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## Artcart: NFT Marketplace

*Prof. Himanshi Agrawal<sup>1</sup>, Abhay Bodhe<sup>2</sup>, Ananta Sontakke<sup>3</sup>, Aniket Shahane<sup>4</sup>, Rushi Bihade<sup>5</sup>.*

<sup>1,2,3,4,5</sup>Smt. Kashibai Navle Sinhgad Institutes of Technology, Lonavala.

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### Abstract—

Before the widespread application of blockchain-based technologies, the mechanisms in place for verifying ownership of digital assets and thus, means of securing them remained susceptible to tampering that translated into significant losses. Blockchain is another innovation with solid ramifications for the eventual fate of how we trade data and money as a comprehensively organized society. It is new to the point that there is moderately minimal scholastic work done on it, yet this is evolving rapidly. For this writing survey, we have started by gathering an example of principally peer-inspected sources, and additionally an educational diagram of articles from different channels. Our determination of articles enables us to give an agent perspective of three essential points. In the first place, a portion of the essential current themes being talked about with respect to blockchain innovation. Second, the agent classifications of said points. Third, the potential fate of blockchain improvement alongside its effect on society and innovation.

*Keywords—Blockchain, NFTs, Ethereum, Tokenization, Digital Assets*

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## I. 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 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 non-fungibility 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 2021<sup>1</sup>.

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.

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## II. 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 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 differently<sup>2</sup>.

TABLE I. TOP NFT MARKETPLACES

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	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

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### III. 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 exclusivity<sup>5</sup>.

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 extension<sup>6</sup>.

#### 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 authenticity<sup>7</sup>. The issuance of the licenses and certifications 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 certificates<sup>8</sup>.

#### 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

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. Blockchain-based 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.

### IV. LITERATURE REVIEW

Title	Parameters	Algorithm	Advantages	Limitations
[1] A Comprehensive Study of NFTs	Blockchain, crypto currency, NFTs, event ticketing, creative media	Ethereum contract	NFTs change new use cases for blockchain technology and have the potential to enhance existing blockchain systems by simplifying it.	Multiple researchers have shown that privacy isn't secured because it is feasible to form sense out of onymous knowledge on public blockchains.
[11] non-fungible token (NFT) Markets on the Ethereum Blockchain	NFTs; non-fungible tokens; cryptocurrency; cointegration; Granger causality	Ethereum Blockchain	We got to know that NFTs include other characteristics such as revenue-sharing or voting rights, which can significantly influence the frequency of transactions or the trading volume.	NFTs could be sold "cheaply" and bought back at a high price in order to evade taxes or launder money. While we have consistently described and analysed the NFT market, we cannot say how much of that activity is "real".
[15] Smart Collectibles: Unlocking the Value of Non-Fungible Tokens (NFTs)	Smart collectibles	Solidity	With Smart Collectibles, artists and organizations can enable access to value in a way that is traceable and highly secure and even stack access to multiple forms of value onto the primary non-fungible tokens themselves.	we need to see improvements in three areas: Innovation Participation Interoperability
[9] The non-fungible token (NFT) market and its relationship with Bitcoin and Ethereum	prior studies on the financial aspects of NFT markets.	Ethereum Blockchain	Bitcoin price shock triggers an increase in NFT sales. Also, Ether price shocks reduce the number of active NFT wallets. The results suggest that (larger) cryptocurrency markets affect the growth and development of the (smaller) NFT market, but there is no reverse effect.	NFT market still seems to depend on the cryptocurrency market, specifically BTC, it may well mature over time

[25] Fertile Land: Pricing non-fungible tokens	∴ Digital art, Non-Fungible Tokens, Hedonic Prices, Lasso Regression.	Blockchain	Private LAND can be traded freely, with each change in ownership, and money exchanged, permanently recorded in an Ethereum smart contract	The relatively small number of trades we have available is a clear limitation
[19] Some Very Simple Economics of Web3 and the Metaverse.	Metaverse; Web3; non-fungible tokens (NFTs); blockchain technology; smart contracts; digital entrepreneurship;	dApp	Benefits of the Metaverse include that it expands the living and working space, extends human intelligence to knowledge robots, and enables human “super productivity” via multiple avatars.	There are several challenges that technology entrepreneurs need to overcome, for example, health-related concerns that range from a neglect of self-care to addiction.
[27] ETHEREUM: A SECURE DECENTRALISED GENERALISED TRANSACTION LEDGER.	Blockchain paradigm when coupled with cryptographically secured transactions.	The bytecode that the EVM can natively execute.	Scalability remains an eternal concern. With a generalized state transition function, it becomes difficult to partition and parallelize transactions to apply the divide-and-conquer strategy.	The execution of a transaction is the most complex part of the Ethereum protocol.
[26] Non-Fungible Token (NFT): Overview, Evaluation, Opportunities and Challenges.	Blockchain · NFT · DApp · Smart contract.	token standards related to NFTs, including ERC-20, ERC-721, &ERC-1155.	The concept stems from the last decades and has a great progress with the rapid development of blockchain. Blockchain provides an ideal decentralized environment for the virtual online world.	Tampering refers to the malicious modification of NFT data, which violates integrity. Assume that the blockchain is a robust public transaction ledger and a hash algorithm is preimage resistance and second preimage resistance.
[31] Bitcoin emissions alone could push global warming above 2°C.	Energy and society, Environmental economics, Environmental impact, Sustainability.	The proof-of-work (POW) blockchain technology used by Bitcoin (BTC).	provide three sustainability criteria for signaling when the climate damages may be unsustainable.	As mining efforts have increased over time, we estimate steeply increasing CO <sub>2</sub> e (carbon dioxide equivalent) emissions per coin created.
[32] Policy Assessments for the Carbon Emission Flows and Sustainability of Bitcoin Blockchain Operation in China.	This paper uses the theory of carbon footprint to create a theoretical model for Bitcoin blockchain carbon emission assessment and policy evaluation.	The proof-of-work (POW) blockchain technology used by Bitcoin (BTC). to operate in a relatively stable manner.	Its decentralized transaction characteristics and consensus algorithm provide a novel solution for trust mechanism construction, which is beneficial for	carbon emission intensity of the Bitcoin blockchain still far exceeds the average industrial emission intensity of China under different policy interventions.

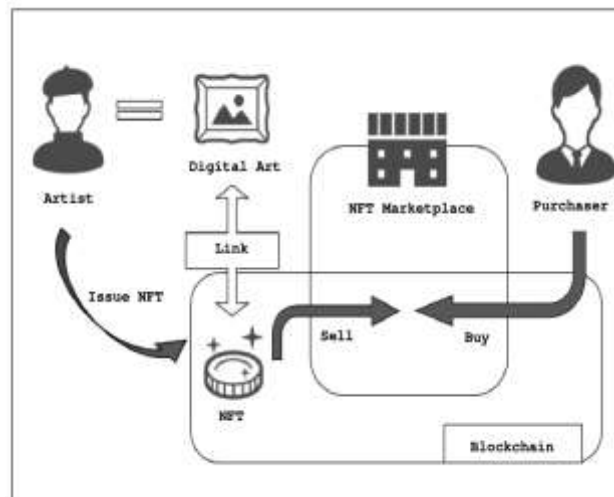
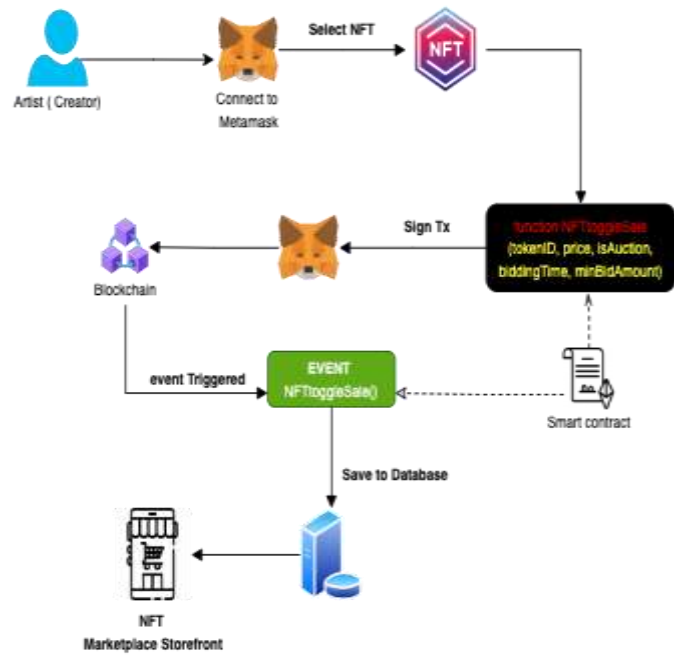
#### IV. ARCHITECTURE

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:



## V. 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 attacks<sup>22</sup>.

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 chain<sup>23</sup>.

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## VI. 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, non-browser 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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