NFT-Blockchain Technology

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***Abstract*—.In recent years the Non-Fungible Tokens(NFT) have become the hottest transaction with the wide spread of blockchain applications in Web 3.0 space. NFTs are digital assets or currencies that are created on blockchain technology and represent their ownership. They are immutable and irreplaceable. They are made with smart contracts on the Ethereum blockchain network. This report discusses the overview of NFTs in blockchain, then extends the applications and their future directions.**

***Keywords*— Non-Fungible token, Blockchain, Ethereum, assets, smart contracts.**

I. INTRODUCTION

The recent pandemic has huge impact on the world with rapid changes in digital technologies. These get to rise in interest on digital currencies and transactions. The peer-to-peer network and decentralized nature of blockchain have increased interest in cryptocurrency and made it immune by eliminating the centralized system. The recent NFT innovation impacted intellectual properties and it represents unique properties. Due to digital platforms, the ownership of original digital arts of artists and creators has become unaware. The NFTs are aimed to solve this issue by providing the assets with the authenticity of ownership.

II. NON-FUNGIBLE TOKENS

Before getting the concept of NFTs it's important to get to know about the blockchain, Ethereum, and their characteristics.

A. Blockchain

The Blockchain is basically a distributed ledger that powers the decentralized application(D-App) connected with a huge number of nodes (computers, high computational; devices, etc.) It maintains the data of transactions that occurred in the network and is validated by the nodes. These transactions are stored in 'blocks' and they collectively make a chain in the network. With help of cryptographic algorithms and hashing tricks the transactions in the blocks are authenticated and hard to manipulate them. A D-App is different from most traditional applications in which the client-side website that is part of the app that users interact with doesn't talk to the centralized server that connects to the database instead the adapter lies on the blockchain to store that of valued data. It provides an efficient solution for storing any digital currency or digital asset on distributed nodes across the network and those are immutable, instead of the untrusted person controlling the database of the centralized system.

B. Ethereum

Ethereum is the platform where D-Apps were built and deployed on the Ethereum blockchain with programmable money agreements called 'Smart contracts. They represent functionalities and properties of transactions between the unfamiliar parties and decentralized participants. Ethereum has its cryptocurrency known as "Ether (ETH)". It is used for making payments, building D-Apps, and generating tokens. Tokens are not Ethers; they are stored in contracts to manage balance and they have monetary value they won't give privileges or rights in the networks. Using smart contracts, Ethereum-based tokens, exchanges, crowdfunds, or auctions are built. Anyone can have their own ownership, and state transition methods with the abstract layer in Ethereum. Ethereum is known as "programmable currency".

C. Non-Fungible Tokens and Marketplaces

Unlike regular fungible tokens, the NFTs represent the unique value of any digital assets or currencies and they are non-replaceable or non-interchangeable and operated on the digital market named as NFT marketplace. This is used to make unique ownership for particular digital creations. The smart contracts associate each NFT with an ID and link to where the content of the NFT can be found on the web. This content can be an image, music, or video. Storing large files makes the blockchain difficult and expensive, so the NFT are stored on file storage systems like the Interplanetary file storage system. The smart contract keeps track of the address of these NFTs and their owners as shown in Fig.1.

The NFTs were developed with aim of providing ownership for the digital creators and avoiding the copy or duplicating the assets. NFTs existed in token form and are traded through cryptocurrencies on the blockchain, unlike digital currency is fungible and exchangeable. The transactions of NFTs are just a sale of mere ownership of assets not transferring the copyright ownership of it unless the owner explicitly sends it.

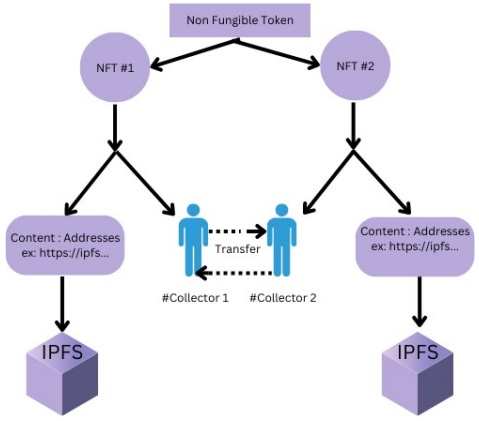

Fig. 1 A pictorial diagram representing the NFT function in a smart contract.

1) Marketplace: The NFT Marketplace is the platform where the transaction of the NFTs between the buyer and sellers takes place. Digital assets are joined in Ethereum blockchain by the creation of NFTs. The NFTs are minted through smart contracts in minting platforms like Opensea, Mintbase, etc. Before the buyer and seller exchange the token between them the protocols must be followed to create NFT. The owner needs to check the asset documentation and requirements then digitalize it and store it on external storage platforms like IPFS, and other databases as storing on the blockchain require more cost and are difficult. The owner signs and the transaction are sent to the smart contract. On receiving the transaction data, the smart contract builds the NFT. The Ethereum NFTs standards are ERC-20, ERC-721, and ERC-1155. The recent pandemic has increased interest in the digital world. During the Pandemic, there is huge growth in the NFT markets had seen an uprising in total sales volumes.

TABLE I. Top NFT Marketplaces

Market	Avg. price	Traders	Volume
Opensea	$ 344.99	2,417,290	$32.97B
Axie marketplace	$ 170.59	2,173,831	$4.26 B
CryptoPunks	$ 131.82k	7237	$2.97B
Magic Eden	$ 123.3	1,322,041	$1.88B
LookRare	$ 6,37k	110,863	$1.64B

. * Stats of NFT marketplaces till 22 November 2022

Different marketplaces and their trading values are in Table I. The NFT is kept the track of both the assets that are stored on the external databases and the owners of them. When a buyer buys the NFTs on marketplaces the network check, verifies, and validates the transaction. The prices set for the NFTs are transferred from the buyer to and seller's wallet and the transaction is stored on the blockchain network.

D. Applications

NFTs have tremendous applications in different aspects of real life. These embraced the numerous real-world applications of digital assets. The use of this application in these is now the digital content realm. A few important applications are as follows:

1) Digital collectibles and digital arts: It includes a wide variety of the arts, videos, digital real estate, trade cards, stamps, and other intellectual properties. The works are transferred to digital formats and strengthen the unique ownership. Typical instances are Jacob & Co., and Beeple (Mike Winkelmann) sold their work for $125,000 and $64 million on digital platforms.

2) Virtuality: Virtual reality-based digital assets and services are owned by NFT and customized through smart contracts. The inclusion of blockchain mechanism avoids the untrust agencies and enables the smart contracts to govern the NFTs.

3) *Gaming and sports:* NFTs have grabbed the interest of many game developers and their communities. The NFTs provide unique values for the game user's collections and provide ownership for game items. The use of NFTs makes profits for the users even if the game is no longer maintained by the developers. Decentraland is one such virtual game where NFTs represent the virtual land.

E. Challenges and Issues

The growth of NFTs came along with a huge number of challenges and issues associated with it. The power consumed by the Ethereum network is so large. The places in China and Iran face power shortages due to a huge amount of mining. Decrypt and CheckmyNFT platforms have faced the issue of accessing the metadata from external databases like IPFS where the node that store data are disconnected from the network. Maximum NFT trades undergo on Ethereum which only provides the partial hiding of data not complete privacy or strict anonymity. The attackers can imitate the creators and create copies of the assets as NFTs which further raises the problems like copyright, for example, the recent hacker theft of the Nifty gateway NFTs. Another is hackers found flaws in the smart contracts and targeted Defi protocols and theft of $0.6 B.

F. Current solutions and Future Directions

Proof of Stake (PoS) and Proof of Work (PoW) are built to protect the decentralized consensus mechanism to mitigate malicious actions and tamper-proof. The NFTs blockchain provides authenticity and ownership. Zero Knowledge Proof is an emerging technology meant to address future issues. SolarCoin and Bitgreen are alternatives compared Ethereum Blockchain chain considering the environmental impacts of NFTs.

G. Conclusion

NFTs are growing as the unique digitalization of physical and digital assets. Numerous applications and platforms are emerging for the digitalizing of arts, collectibles, etc. With the growth of NFTs technologies, there are several challenges associated with it. The benefits that are provided by the protection can't be ignored. There is a lot of scope for future studies on that challenges and enhancement in various other applications too.

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