

Enhancing Game Security Through NFT Integration

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Abstract: Integrating Non-Fungible Tokens (NFTs) into games has become a potential strategy to improve security and player ownership as a result of the gaming industry's explosive expansion and the rising popularity of blockchain technology. NFTs are one-of-a-kind, undivided digital assets that may stand in for individual game elements, characters, or even full game assets. The cryptographic capabilities of NFTs may be used by game creators to overcome a number of security issues present in conventional gaming systems. This study investigates the potential of NFTs to enhance game security. First, it looks at how NFTs are used to tackle fraud and item duplication problems. Players may confirm the uniqueness and originality of things by documenting each one-of-a-kind in-game asset on the blockchain, prohibiting fraudulent trades and counterfeit goods. The research assesses the difficulties and restrictions of using NFTs into games, including scaling issues, gas costs, and environmental effect. To the maximum extent that NFTs can enhance security while preserving a healthy gaming environment, these problems must be resolved.

Keywords: *Non Fungible Token, Smart Contracts, Blockchain*

1. Introduction

The gaming industry has witnessed a surge in number of users in recent years, With increases in number of users the amount of hackings and cheatings have also increased. With gaming industry set to be valued at 470 Billion dollars it has become very important to secure this environment. NFTs provide a decentralized ownership structure that is open and transparent, giving participants complete control over their digital assets. Traditional gaming platforms frequently experience centralization problems, possible data breaches. In-game assets may be traded, sold, or transferred outside of the game environment thanks to NFTs, which give players genuine ownership over them. NFTs can also improve the authentication procedures and player data security. Players may encrypt their accounts with cryptographic keys using blockchain-based identity management systems, lowering the danger of hacking and unwanted access. The additional security measure deters account theft and in-game cheating. Any data which can be stored in blockchain can be called as NFT. It is known as non fungible token, it offers a unique way to own digitalassets which improves security in gaming.

2. Blockchain Gaming

In any games there are some elements which are created by game developers to increase the amount of time a user spends on their platform, this can be anything like skins, weapons, cards etc. Generally gamers purchase these using the in game currency which they earn by playing the game. This is known as in-app purchases[1]. But there is a risk that hackers may hack the central server of the game and gain the access to these things , Which will incur loss to the gaming company. This is where Blockchain gaming will come into picture. With the core nature of blockchain being peer to peer this can solve the issue. If we can maintain the components using NFT's then the unique nature of these will offer more security. Gamers can buy these components using cryptocurrency and the same crypto can also be used an in game currency too which we can also sell the nft's outside the gaming environment which is beneficial to gamers. And also the price of the NFT's will be driven by the gamers rather than the game creators which is beneficial to the gaming community. The purchase of NFT's in game can be written by smart contracts[2], smart contracts are a piece of code written by blockchain developers which will be

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3. Properties Of Nft

Uniqueness: NFTs are unmatched digital objects that stand apart from other tokens thanks to their distinctive character. The NFT's one-of-a-kind status is ensured by its uniqueness being tightly woven into the code and supported by the fact[3] that it is present on a blockchain. **Indivisibility:** NFTs are indivisible entities, in contrast to conventional cryptocurrencies, which are divisible. They are bought, sold, and owned in full, which increases their position as exclusive and comprehensive assets.

Blockchain Authentication: NFTs and blockchain technology are closely related, especially on platforms like Ethereum[4]. An NFT's ownership history, origins, and future transactions are forever recorded in a transparent and immutable ledger because to this relationship

Ownership and Provenance: The permanent record provided by the blockchain makes it possible to follow an NFT's development through time. This unquestionable provenance establishes the validity and ownership of the NFT and dispels any skepticism regarding its authenticity.

Smart Contract Utility: NFTs frequently use smart contracts, which are self-executing contracts with programmed terms[5]. These contracts automate a variety of procedures, including the delivery of royalties to artists each time the NFT is resold.

Global Connectivity: NFT markets function on a global scale, giving artists the opportunity to display and distribute their digital products anywhere in the globe. Because of this connectivity, a thriving ecology where artists and collectors may engage across regional borders is fostered.

Transfer of Ownership: Blockchain transactions are used to transfer NFT ownership[6], making the process safe and verifiable. By eliminating the need for middlemen, this capability simplifies the procedure.

Historical Transparency: The blockchain keeps track of every NFT's lifespan, including its creation, ownership changes, and transactions. By being transparent, an NFT's whole history is accessible to anybody who is interested.

Creative Compensation: In the smart contract of an NFT, royalties provisions may be incorporated by creators[7]. By guaranteeing that they get a portion of the money each time their NFT is sold on the secondary market, this innovation gives artists more leverage.

Digital scarcity amplification: Digital scarcity is introduced by NFTs, which is amplified by their exclusivity and indivisibility. [8]By appealing to how people perceive value, this idea frequently raises the value and cost of these rare digital goods.

3.1 Difference Between Traditional gaming and Blockchain Gaming

Property	Traditional Gaming	Blockchain Gaming
Ownership and Digital Assets	Players own copies of games in conventional gaming, which they keep on their devices or in their online accounts. They normally do not, however, possess ownership of any in-game assets, characters, or goods.	Blockchain technology is used in blockchain gaming to provide real ownership of in-game resources. These assets are represented by non-fungible tokens (NFTs), which players hold and which are kept on a blockchain. Players are now able to purchase, sell, and trade their in-game goods outside of the confines of the game.

Interoperability	Items and advancement are typically restricted to certain games or platforms in conventional games. It is uncommon for assets to be moved across games.	Blockchain games can offer interoperability, allowing players to use their NFTs across different blockchain games and platforms that support the same standard. This can create a more seamless gaming experience across different titles.
Decentralization	Traditional video games are frequently run and managed by centralized game publishers and producers.	Decentralized autonomous organizations (DAOs) and smart contracts can be used in blockchain gaming to share the game's economics, governance, and development among players and other stakeholders.

Transparency and Trust	Players must have faith that the game is run fairly because the creators often have control over the game's mechanics, currency, and backend operations.	The openness and immutability of blockchain technology can boost confidence. The blockchain may be used to verify game mechanics and asset ownership, which lowers the chance of fraud or manipulation.
Monetization and Economies	Sales of games, DLC, and microtransactions are common methods of monetization. The in-game economy is under developer control.	Blockchain gaming may allow players to earn cryptocurrency or tokens. Through governance systems, the community may affect tokenomics and economies.
Community Participation	Traditional games can have vibrant communities, but creators often have the final say.	Many blockchain games involve the community in decision-making processes through DAOs. Players can influence the direction of the game and suggest changes.

Liquidity and Value	Typically, in-game currency and objects are only valuable inside the context of the game.	NFTs may have external value, giving players the opportunity to exchange or sell them for money in the real world.
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totalSupply: The total number of tokens that have been minted in the collection.

mintedPerWallet: A mapping to keep track of how many tokens a wallet has minted.

Constructor: The constructor is executed when the contract is deployed. It initializes the base URI for metadata, mints the reserved

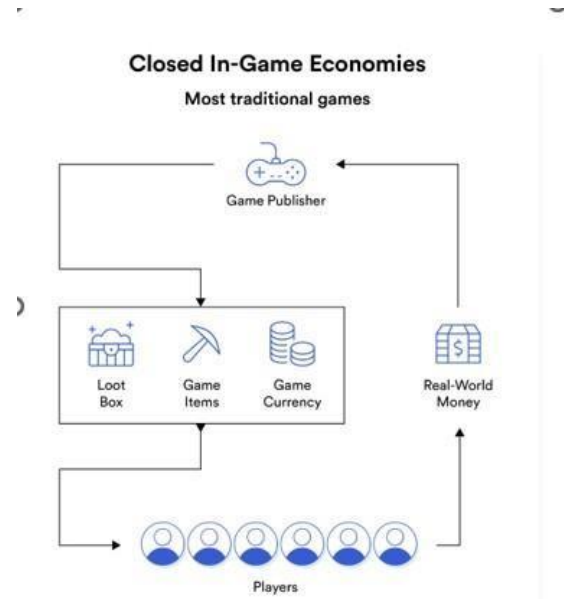


Figure 1: Closed In-Game Economies

4 Algorithm

Contract Inheritance: The contract inherits from two other contracts - ERC721 and Ownable. ERC721 is the standard interface for NFTs, and Ownable provides functionality for ensuring that certain functions can only be executed by the contract owner.

4.1 Constants and Variables:

MAX_TOKENS: The maximum number of tokens that can be minted in the collection (set to 10,000).
 TOKENS_RESERVED: The number of tokens reserved for special purposes (set to 5).

price: The price of each token in Wei (0.1 Ether).
 MAX_MINT_PER_TX: The maximum number of tokens a single wallet can mint in one transaction (set to 10).

isActive: A boolean flag to control whether the sale is active or paused.

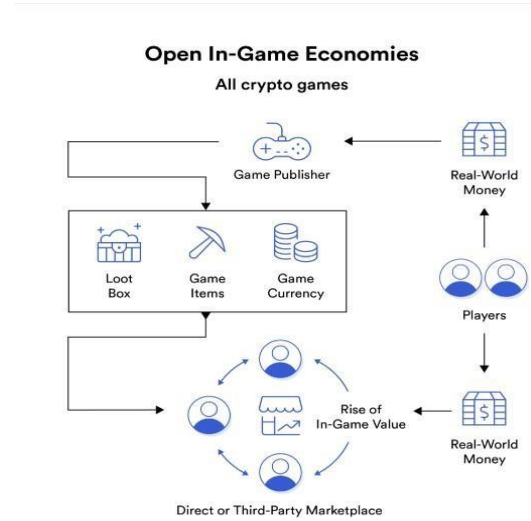


Figure 2: Open In-Game Economies

(TOKENS_RESERVED) to the contract deployer (msg.sender),

4.2 Public Functions:

mint: Allows users to mint a specified number of tokens (_numTokens) by sending the required amount of Ether. Several conditions are checked, such as whether the sale is active, the number of tokens requested is within the allowed limit, and the total supply does not exceed the maximum supply. If all conditions are met, the tokens are minted to the caller's wallet.

4.3 Owner-only Functions:

flipSaleState: Toggles the isActive flag to pause or resume the token sale.

setBaseUri: Allows the contract owner to update the base URI for metadata.

setPrice: Allows the contract owner to update the price of each token.

Withdraw All: Allows the contract owner to withdraw the contract's balance. The contract owner

can send 70% of the balance to one address (0x7ceB3cAf7cA83D837F9d04c59f41a92c1dC71C7d) and 30% to another address (also 0x7ceB3cAf7cA83D837F9d04c59f41a92c1dC71C7d).

tokenURI and _baseURI: These functions are part of the ERC721 standard and are used to generate the metadata URI for each token. The metadata is stored at the specified base URI with the token ID and file extension (".json") appended.

5 Advantages of Using NFT in Games

1. True ownership: NFTs provide players with true ownership of in-game assets. These assets are recorded on the blockchain, ensuring transparency[9] and security. Players can buy, sell, or trade these assets outside of the game ecosystem.
2. Interoperability: NFTs can be used across different games and platforms that support the same standard. This allows players to utilize their assets in multiple games, increasing their value and utility.
3. Player-driven economy: NFT games enable player-driven economies where virtual items and assets have real-world value. Players can earn cryptocurrencies or fiat money by trading rare or valuable NFTs they acquire within the game.
4. Scarcity and uniqueness: NFTs are unique and cannot be replicated[10], making them scarce and valuable. Players are motivated to collect rare and special NFTs, adding an element of excitement and exclusivity to the game.
5. Developer-community collaboration: NFT games often involve the community in the development process. Players can participate in governance decisions, propose changes, and influence the game's evolution.

6 Challenges of Creating NFT'S for Games

1. Scalability and Gas Fees: During times of high network activity, blockchain networks like Ethereum, which are frequently used for NFTs, may experience scalability problems and high gas fees. This may increase the cost and duration of mining, purchasing, and trading NFTs.
2. Fraud and scams: Scammers and fraudsters have been drawn to NFTs due to their relative novelty and popularity. Users must exercise caution when purchasing NFTs, and developers must include safeguards to safeguard their communities from fraud.
3. information Hosting: Keeping information (descriptions, pictures, etc.) for NFTs on decentralized networks like IPFS might present problems with accessibility, expense, and data management.
4. Community Development: The key to long-term success is creating a community around your game and NFTs. Although it can be difficult, building a fan following of

devoted players is crucial for the success of NFT-based games.

5. Regulatory Uncertainty: In some jurisdictions, the regulatory landscape for NFTs and blockchain technology is changing. These legal and regulatory difficulties, which might differ widely by area, must be overcome by developers.

7. Working

Get ready the in-game character information Create a file with all the information on the in-game character. This file can be in any format that is appropriate, such as an image file, audio file, XML file, and others.

2. Switch to the IPFS File System:

To convert the in-game character file into the IPFS file system, use either IPFS Desktop or a web program that supports IPFS. Your file becomes a decentralized, peer-to-peer network file as a result of this procedure.

3. Compose your smart contract:

Use a platform like Remix to create the smart contract for the NFT. Your NFT's rules and characteristics, such as ownership, transferability, and any other metadata, are specified in the smart contract.

4. Store the NFT on the Blockchain:

Set up the smart contract on your preferred blockchain, such as Ethereum or Binance Smart Chain. The ownership and transfer of the NFT will be managed by the smart contract.

5. Get the IPFS Link:

Visit the online tool or IPFS Desktop program you used to convert your file. Copy the specific IPFS link that is linked to the information about your in-game character.

6. Add the IPFS connection:

To your smart contract code to connect the IPFS content to the contract. As a reference to the real content kept on the IPFS network, this link is provided. This reference will be used by the smart contract to connect the digital asset to its ownership and properties.

7. Mint the NFT:

Execute the code to mint the NFT after integrating the IPFS connection into your smart contract. Through this procedure, a special token built on the blockchain that denotes ownership of the in-game character or digital asset is effectively created.

8. Ownership and Transfer:

Users may now purchase, sell, or transfer ownership of the NFT, with the rules outlined in your smart contract controlling all aspects of this. Thanks to the IPFS connection, each NFT is a distinct digital asset with a distinct identity.

minor but harmful roadblocks to producing a seamless user experience.

Scalability: Historically speaking, gamers have had a worse gaming experience with blockchain games compared to regular games since the underlying blockchain technology is still in its infancy. Players typically need to create a third-party wallet and load it with enough network tokens to pay transaction [16] fees before they can begin playing. Players must sign each transaction required by every in-game procedure that requires a transaction, which is a major barrier that undermines gaming immersion and adds modest but damaging hurdles to creating a smooth user experience.

Connectivity and Disconnected Ecosystems: The layer-1 and layer-2 ecosystems that make up the blockchain ecosystem are widely dispersed and unconnected. There is still a difference between an Ethereum game and a Solana game even if blockchains provide as a common and shared backbone for all the games created on top of them. There are few alternatives to bridge messages from one blockchain to another, and players must utilize multiple wallets. Having to create Steam, Epic, and Riot accounts in order to play games from these publishers is a prime illustration of how this issue is analogous to the fragmentation in conventional gaming ecosystems [17]. But the issue's origins are different. There is an incentive to design closed systems in conventional games. Games on the blockchain are inherently more open.

17.

18. playing. Some blockchain games need participants to initiate the start and finish of a game before paying transaction fees in order to collect their prizes. These menial duties interfere with games immersion and provide poor player experiences. This lack of automation is a serious obstacle for designers who want to use smart contracts to power main gameplay or even auxiliary features. This issue is resolved by Chainlink Automation, which enables game designers to autonomously carry out transactions that change the state of the game on behalf of players.

18.1 Working of IPFS

IPFS

IPFS, which stands for InterPlanetary File System, is a peer-to-peer (P2P) distributed file system designed to create a more efficient and decentralized way of storing and sharing data on the internet. [20] It aims to overcome some of the limitations and inefficiencies of the traditional client-server model.

Here's how IPFS works:

1. **Content-Addressable Data:** In traditional systems, you access data using a location-based approach (URLs). In

10. Solutions to the Limitations

11. Improving Scalability:

12. A high-throughput Web3 game is now possible because to improvements in blockchain scalability and the introduction of layer-2 environments. As a result, gamers will no longer have to contend with persistent network congestion and excessive network costs, [18] both of which have a negative influence on the playing experience.

13. Cross-Chain Interoperability:

14. An open-source framework called the Cross-Chain Interoperability Protocol (CCIP) is currently in development to allow layer-2 environments and blockchains to connect with one another. This is the last component needed to enable a common setting for blockchain games. Regardless of the blockchain in use, digital assets can be seamlessly moved between them. [19] player identity and logins can be universal, and cross-chain smart contracts let game publishers take advantage of each blockchain's unique advantages (such as scalability, data storage, security, decentralization, etc.).

15. Automation:

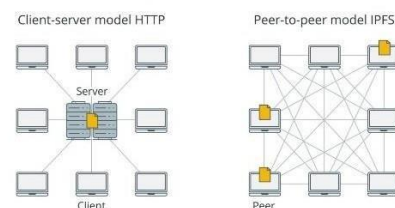
16. Automation of smart contracts is required to enhance the crypto gaming experience. Without it, users are need to exit the game, manually sign a transaction, and shell out money in order to resume

IPFS, data is addressed based on its content, not its location. Each piece of data is assigned a unique cryptographic hash, which serves as its address. This means that identical content will always have the same address, making it easier to verify and retrieve data.

2. **Distributed Network:** IPFS uses a peer-to-peer network where each participating node (computer) stores and serves data. When you add a file to IPFS, the content is divided into small chunks, and each chunk is given a unique hash. Nodes then store these chunks locally, and their addresses are used to retrieve the content later.

Data Sharing: When you request data from IPFS, your request is broadcast across the network. Nodes that have the requested data respond and provide the data. If multiple nodes have the same data, the system chooses the most efficient source to the requester. This helps to reduce redundant data transfer and improve overall network efficiency.

From client-server to peer-to-peer with IPFS



Conclusion

The study discussed in this article highlights the potential of Non-Fungible Tokens (NFTs) as a game-changing method to improve security in the gaming industry. As online gaming grows and draws a large user population, it has become essential to protect player privacy and experience integrity. By incorporating NFTs, the gaming industry may take a multidimensional approach to solving security issues while also opening up fresh potential for users, developers, and the sector as a whole. This research has shed light on how NFTs might work as a potent weapon to combat fraud, hacking, and illegal transactions by examining the major security issues that plague modern gaming environments. Additionally, the examination of real-world case studies has shown how effectively and practically using NFTs may improve security. NFTs provide a workable solution that fits with the changing environment of digital interactions, whether they are used for ownership identification, in-game asset protection, or transparent transaction tracking. It's crucial to recognize that incorporating NFTs into gaming environments is not without its difficulties. Consideration should be given to the possible environmental effects of certain blockchain networks as well as the need to educate users about the complexities of NFTs. In order to allay these worries and promote a sustainable future for NFT-enhanced gaming security, cooperation between game creators, blockchain professionals, and environmentalists will be crucial. This study emphasizes the revolutionary potential of NFTs to improve gaming industry security in its conclusion. The fusion of blockchain technology with gaming reduces security concerns while also opening up new opportunities for creative revenue structures, player interaction techniques, and safe digital ownership paradigms. As the gaming industry develops, accepting NFTs properly may help create a more safe, open, and vibrant gaming environment that will benefit both players and stakeholders.

References:

- [1] A Survey on Consensus Mechanisms for Blockchain Technology: Weiwei Gu, Jianan Li, Zekai Tang
- [2] A Survey on Consortium Blockchain Consensus Mechanisms: Wei Yao, Junyi Ye, Renita Murimi
- [3] Overview of Blockchain Consensus Mechanism: Changqiang Zhang, Cangshuai Wu, Xinyi Wang
- [4] A Survey on Consensus Mechanisms and Mining Strategy Management in Blockchain Networks: Wenbo Wang, Dinh Thai Hoang, Peizhao Hu, Zehui Xiong, Dusit Niyato, Ping Wang, Yonggang Wen
- [5] Study of Blockchains's Consensus Mechanism Based on Credit: Yuhao Wang, Shaobin Cai, Changlong Lin, Zuxi Chen, Tian Wang, Zhenguo Gao, Changli Zhou
- [6] Non-Fungible Tokens (NFT): A Systematic Review: Hamed Taherdoost
- [7] Prospecting non-fungible tokens in the digital economy: Stakeholders and ecosystem, risk and opportunity: Wilson, K.B.; Karg, A.; Ghaderi, H
- [8] Blockchain Meets Marketing: Opportunities, Threats, and Avenues for Future Research: Peres, R.; Schreier, M.; Schweidel, D.A.; Sorescu,
- [9] An End-to-End Blockchain-based Non-Fungible Token Platform for Buying and Selling Digital Arts: Dhruv Ajay Patil, Swarnav Datta, Vineet Nagwekar, Angelin Florence A, Mihir Arunkumar
- [10] Is non-fungible token pricing driven by cryptocurrencies: Dowling, M
- [11] Mapping the NFT revolution: Market trends, trade networks, and visual feature: Nadini, M.; Alessandretti, L.; Di Giacinto, F.; Martino, M
- [12] The History of NFTs & How They Got Started: Wong, B
- [13] IPFS-Blockchain-Based Authenticity of Online Publications: Nishara Nizamuddin, Haya Hasan
- [14] An Innovative IPFS-Based Storage Model for Blockchain: Qiu Hong Zheng; Yi Li; Ping Chen; Xinghua Dong
- [15] A peer-to-peer electronic cash system: S. Nakamoto
- [16] Research Perspectives and Challenges for Bitcoin and Cryptocurrencies: J Bonneau, A Miller, J Clark
- [17] Blockchain for IoT Security and Privacy: The Case Study of a Smart Home: A Dorri, S S Kanhere, R Jurdak
- [18] IPFS - Content Addressed Versioned P2P File System: J. Benet
- [19] "Non-repudiation storage and access control scheme of insurance data based on blockchain in IPFS: J. Sun, X. Yao, S. Wang, and Y. Wu
- [20] "Performance Analysis of Consensus Algorithm in Private Blockchain: Yue Hao, Yi Li, Xinghua Dong, Li Fang and Ping Chen

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- ✓ Present a clear research problem derived from literature
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