IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 13, April 2026
Impact Factor: 8.2

# Integrating Non-Fungible Tokens (NFTs) for Verifiable Asset Ownership in Souls-like Games

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**Abstract:** *This project of ours tries to seamlessly combine traditional Souls-like gameplay with more modern concepts of integrating with NFT, in hopes of creating a unique and proprietary gaming experience. Through linking in-game items to NFTs, an opportunity is created to provide players with verifiable ownership and the ability to trade or showcase their digital assets. Using blockchain promotes transparency, integrity and protection against item duplication or loss. Overall, this project demonstrates how current technologies can improve both player satisfaction and innovation in games, ultimately paving the way for increased immersive and value-centric game design in the future*

**Keywords:** *NFT*

## I. INTRODUCTION

A significant problem in the current gaming environment is the absence of true digital asset ownership, as centralized models provide players with only a license to access their games or in-game items. This method results in players' digital identity and assets being vulnerable to server shutdowns, fraud and unilateral developer decisions that might diminish or eradicate them entirely.

The proposed solution is to integrate blockchain technology and Non-Fungible Tokens (NFTs) into the gaming environment to enable true digital asset ownership for players. This model fundamentally shifts away from the traditional centralized licensing system where developers and digital stores retain ultimate control.

The NFT-based model is economically viable and beneficial to both players and developers. It promotes thriving player-led economies and encourages deeper engagement, which can create new revenue streams. For players, along with the transformation of digital assets into potential investments, they would also benefit from increased innovation and interest from developers in game design and in-game economic systems to allow seamless blockchain integration.

This project aims to blend the challenge and strategy of a Souls-like game with blockchain technology. Players traverse the game world, engage in battle with enemies and gain loot to find random items. Each item is linked to a unique digital badge that is minted as an NFT on the blockchain, giving players true ownership of the in-game rewards they have gained as a direct result of their own effort. This system adds a new layer of value and engagement, turning each discovery and achievement into a meaningful and tangible endeavour not limited to the bounds of the game itself. By integrating NFTs, the game introduces a permanent record of achievements and items that players can collect, display or trade. The project demonstrates how traditional gaming mechanics can enhanced through decentralized technology to create distinct interactive experiences.

### HISTORY

The quest to prove true ownership of a unique digital item began with early experiments like 'Coloured Coins' (circa 2012-2013), which explored *marking*parts of a bitcoin to make them trackable [1]. This concept was fully realized in 2014 when artist Kevin McCoy created 'Quantum', the very first recognized NFT, to verifiable claim ownership of his digital art [2]. The industry's *big bang*moment, however, came in 2017 with the game 'CryptoKitties'. Its viral popularity led to the creation of the ERC-721 standard, a universal rulebook that allowed anyone to build, manage and verify their own, distinct digital items [3]. This ecosystem has since rapidly matured from NFT 1.0 - static digital

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trophies – to NFT 2.0, which features dynamic, 'living' tokens whose properties can change [4]. This significant evolution from static certificates to interactive assets is what makes NFTs possible for complex games, enabling players to verifiably own a 'battle-scarred sword' that tracks its entire history and upgrades.

## II. LITERATURE REVIEW

### Early Work

The foundational literature on use of blockchain technology in gaming, emerging around 2019, established a core context that persists even today. Early researchers like Attaran & Gunasekaran [14] identified the potential for new economic models and revenue streams to be built on verifiable asset ownership and emerging technology, transforming gaming into a potential economic endeavour in current technology. However, technical surveys from the same period by Min, et al. [13] noted significant developmental hurdles, including an'absence of suitable development tools' and the difficulty and complexity of storing large in-game assets onchain. This technical immaturity was coupled with major market roadblocks, chiefly 'market volatility' and a 'negative public perception' of NFTs, which discouraged adoption of the technology in major studios [14]. This 'chicken-and-egg' problem has defined the field, with subsequent studies from 2020 to 2024 by Kapsis, et al. [12] and Rishiwal, et al. [5] consistently identifying issues with scalability, high gas costs, and slow transaction speeds as major technical hurdles that need to be overcome for a successful implementation and integration of blockchain in gaming.

The core promise of blockchain in gaming is to revolutionize the approach of asset ownership by offering verifiable assets and fraud control, as highlighted in recent surveys by Rishiwal, et al. [5] and Chen & Wang [6]. This technical promise, however, is directly challenged by the legal reality. A2021 analysis by Fairfield [11] found that the legal status of ownership pertaining to NFTsis yet to be defined properly, still remaining ambiguous and may not grant all the rights a player expects.This feels like a hollow victory for the player: while the blockchain can verifiably prove they hold a token, the publisher retains centralized control over the asset's actual utility and value, rendering the 'ownership' meaningless if the game servers are shut down or the item's stats are changed.

One of the reasons for the amplification of the 'negative public perception'can be attributed to the rise and fall of the 'Play-to-earn' (P2E) model. A key 2022 case study of *Axie Infinity* by Si, et al. [9] concluded that many P2E models are 'economically unsustainable'as they are inherently dependent on a constant influx of new players for preventing an economic bubble. This exposed a fundamental design flaw, analyzed in 2023 by Chen & Wang [6], specifically the 'difficulty in balancing player incentives (earnings) with game fun (playing)'. The P2E model's 'finance-first' approach was, in fact, its fatal flaw. A 2021 empirical study by Gao & Li [10] provided the crucial insight: user adoption is not driven by finance, but by 'perceived enjoyment', 'usefulness', and 'trust'. The study issued a clear warning—the game *must be fun first* [10]—which serves as a direct explanation for why the P2E models collapsed. They ignored the primary driver of player retention and, through their 'poor UX' and 'unnecessarily complex wallet management' [8], actively eroded the 'trust' [8] necessary for adoption, as later confirmed by Lu, et al. in 2022.

Finally, the 'metaverse' ideal of interoperability—using an item across multiple games—has also been stalled. A 2023 paper by Lee & Kim [7] investigated this and concluded that while technical barriers like the'absence of common metadata standards' exist, the primary hurdle is competing corporate interests. Publishers, whose business models rely on siloed ecosystems, have simply no financial incentive to allow players to import assets earned in a competitor's game.

### Research Gap

This review reveals a technology that has so far failed because its dominant applications were finance-first models that proved to be unstable and unsustainable precisely because they did not adhere to a simple requirement of games – be fun. The literature is saturated with analyses of P2E, leaving a significant research gap in exploring 'fun-first' integrations. This paper aims to fill that gap by exploring a 'Play-to-Prove' model, where NFTs are not financial instruments but intrinsically valuable, verifiable trophies—a model that aligns perfectly with the prestige-driven, high-difficulty nature of *Souls-like* games.

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TABLE I:

| Year Of Publication | Paper Title | Objective | Findings |
|---|---|---|---|
| 2024 | **"Blockchain-Secure Gaming Environments:A Comprehensive Survey"** *(Rishiwal, V., et al.)* | Provides a holistic review of blockchain applications for in-game security, asset verification, and preventing fraud. | Identifies scalability (transaction speed and cost) and the need for standardized protocols as major hurdles. |
| 2023 | **"Tokenomics in Digital Entertainment: A Framework for In-Game Economies"** *(Chen, L. &Wang,J.)* | Provides a holistic review of blockchain applications for in-game security, asset verification, and preventing fraud. | Highlights the difficulty of balancing player incentives (earning) with game fun (playing) to avoid economic bubbles. |
| 2023 | **"Beyond Collectibles: Interoperability of Non-Fungible Tokens in the Metaverse"** *(Lee, J. & Kim, H.)* | Investigates the technical and practical aspects of making NFTs usable across different games. | Concludes that a lack of common metadata standards and competing corporate interests are the primary barriers to interoperability. |
| 2022 | **"Designing for Trust: User Experience and Adoption of NFT Marketplaces"** *(Lu, Y., et al.)* | Analyzes user interactions with NFT marketplaces and finds that trust is a key factor in adoption. | Finds that complex wallet management and a poor user experience (UX) are significant barriers for non-technical players. |
| 2022 | **"Play-to-Earn: A New Paradigm in Game Economics or a Speculative Bubble?"** *(Si, C., et al.)* | Analyzes the "Play-to-Earn" (P2E) model, using Axie Infinity as a primary case study. | Concludes that many P2E models are economically unsustainable, relying on a constant influx of new players. |
| 2021 | **"The Legal Status of In-Game Assets: A Comparative Analysis of Digital Ownership"** *(Fairfield, J.)* | Compares the legal definitions of "ownership" in traditional gaming (a limited license) vs. blockchain (NFTs). | Determines that the legal status of NFT "ownership" is still ambiguous and may not grant all the rights a player expects. |

## III. LITERATURE SURVEY

### SOULS-LIKE GENRE

The Souls-like genre, an ARPG subgenre popularized by FromSoftware, is defined by its integrated design philosophy. Its core mechanics center on unforgiving, methodical combat that demands pattern memorization, precise timing and a relentless attitude.It is reflective of the nature of how one should approach difficulties and hurdles in real life – persevering and persisting. This is paired with intricate level design and a high-stakes checkpoint system, where death risks the permanent loss of accumulated resources and resets most enemies, forcing players to repeatedly master hostile environments **[21, 22]**and aim towards perfection in their abilities.

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Narratively, the genre is distinguished by its rejection of explicit exposition in favor of indirect, environmental storytelling. Lore and plot are conveyed atmospherically, hidden within item descriptions and world design, creating an opaque experience that academics have termed the 'ludic sublime'—a sense of awe and mystery derived from the unknowable **[19]**. This 'ludonarrative harmony', where gameplay mechanics directly communicate themes **[18]**, extends to asynchronous multiplayer features that create a sense of shared struggle and 'procedural surveillance **[20]**. The same follows for the quest design as well where the players are expected to pay attention to environmental clues and items to progress effectively.

The psychological impact of this notorious difficulty is a central area of research. Some studies suggest the genre's demanding loop of failure and eventual mastery can foster psychological resilience in players **[15]**. However, this same difficulty is a primary source of player friction, frequently cited in negative reviews **[16]**. This emotional response is not universal; research indicates that the reception to the genre's challenging design varies significantly across different cultural contexts **[17]**.

## IV. WORKING PRINCIPLE

*Preparation Phase*

The deployed NFT smart contract address on the target blockchain network must be identified. Minting commands are prepared by specifying the recipient wallet address, unique token ID, and metadata storage location. These commands are then translated into smart contract-compatible code format.

*Transaction Construction*

The blockchain is queried for the next transaction sequence number to maintain proper ordering and prevent duplication. Current gas pricing data is retrieved to determine appropriate transaction fees. Computational requirements for the specific minting operation are estimated. Complete transaction packages are assembled containing sequence numbers, gas costs, sender and receiver addresses, and encoded minting commands.

*Player Approval Mechanism*

Transaction packages are converted into standardized format. Unique transaction fingerprints are generated using hashing algorithms. These fingerprints are transmitted to player wallets through established secure connections. The wallet displays transaction details for player approval. Upon approval, mathematical signatures are created using private keys that remain exclusively within the wallet application.

*Blockchain Submission*

Signed transactions are received from wallets. These signed transactions are submitted to blockchain networks for processing. The blockchain returns transaction hash identifiers for tracking. Polling mechanisms are implemented that repeatedly check transaction status until confirmation. Successful minting is verified and newly created NFT details are extracted.

*Blockchain Communication Protocol*

Each blockchain interaction is formatted as a structured request containing the desired operation and necessary parameters. Requests are transmitted over the internet to blockchain node providers. The providers process requests and return either requested information or error messages. For time-dependent operations, continuous status checking is implemented until confirmations are received.

*Security Architecture*

Player private keys never leave wallet applications, maintaining security against unauthorized access. Network-specific identifiers are included in each transaction to prevent replay attacks across different blockchain networks. The mathematical signature system prevents tampering with transaction data after signing.

*Application to NFT Souls-Like Game Design*

This approach provides complete control over blockchain interactions within games. All blockchain functionality can be customized for specific game mechanics, including boss-defeat NFT rewards, tradeable in-game item tokenization, and on-chain player achievement tracking. Dependency on potentially discontinued or modified third-party SDKs is

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avoided. Full transparency is maintained over blockchain integration mechanics, facilitating troubleshooting and performance optimization.

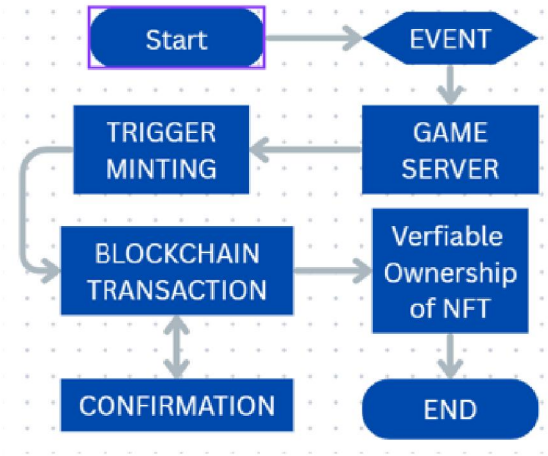


Fig. 1. Flowchart

## V. ARCHITECTURE OVERVIEW

*System Overview and Network Topology*

The implemented architecture makes use of a client-authorized AppChain model, constructed for low latency and regional environments. Instead of relying on a public layer 1 of Main net (as it riddled with problems in high gas fees and long block confirmation times which make it unsuitable for a real-time Action game), the model deploys a Proof-Of-Authority (POA) consensus mechanism.

*The Authority Node (The Host)* – One node on the local network dons the role of validator and maintains the definitive 'State Machine'. It is tasked with ordering transactions, prevent spending extra and communicating updates regarding states.

*The Light Clients (The Players)* – Machines connecting with the The Host act as Light Clients. They do not attempt to download the entirety of the transaction history and instead, their main work is to query the Authoritative Node for their wallet balances and token metadata.

*Transport Layer* – P2P Communication is handled through means of a proprietary Remote Procedure Call (RPC) protocol over a Local Area Network (LAN), ensuring close to instantaneous replication of state.

*Asset Tokenization (ERC-721 Standard)*

The ERC-721 Non-fungible token standard can be seen in heavy use in the game's loot system for unique digital asset identification. The architecture segregates between the encoded proof of ownership and the heavy 3D rendering data to optimize he network payload.

*On-Chain state (The Ledger)* – When a player opens a loot box or chest, an event is triggered as the Minting Event. As part of such an event, the Authority Node generates a unique encoded identifier (e.g., through a UUID/SHA-256 generation) representing the digital token. This generated token hash is directly mapped to the receiving player's localized wallet address within the ledger in memory.

*Off*-Chain Metdata (The Game Client) – In order to prevent network congestion, the physical attributes of the NFT ( the 3D Mesh, specific hex codes for material colours, the rarity of the weapon, base stats) are stored locally in the game client's memory bank.

*Resolution* – When the ledger confirms a player owns a token, the local client reads the corresponding off-chain metadata URI and compiles the visual Game Object in real-time.

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*Transaction Lifecycle and State Transition*

The core functionality is dependent on an Escrow Smart Contract to tackle P2P trading in a decentralized manner. The state transition flow is as mentioned below :

*Phase A – Asset Listing*

In order to list their in-game digital asset, Player A begins a transaction. Doing so communicates a state mutation request to the Authority Node.

On receiving the state mutation request, the Authority Node verifies Player A's encoded ownership of the Token Hash. As soon as verification is finished, the token's state is modified from Owned to Locked-In-Escrow.

It is then the task of the Authoritative Node to sync this ledger update across the LAN. All connected Light Clients update the UI on the local side to display the asset in the shared Marketplace pool.

Phase B – Settlement and Atomic Swap

As the update is applied in the shared Marketplace pool, an interested Player B may initiate a *Buy* request.

The Smart Contract intercepts this request and as this is a case of direct asset transfer, it executes an Atomic Swap.

The Authoritative Node takes it from here and permanently unlinks the token Hash from Player A's wallet Address and reassigns to Player B's Wallet Address.

The Atomic Swap is followed by a final state sync call, pushed to all Light Clients connected to the LAN. Player A's Client received state invalidation leading to removal of the localized Game Object. On the other hand, Player B receives state validation, reads from the Off-Chain metadata and instantiates the Game Object in their own inventory.

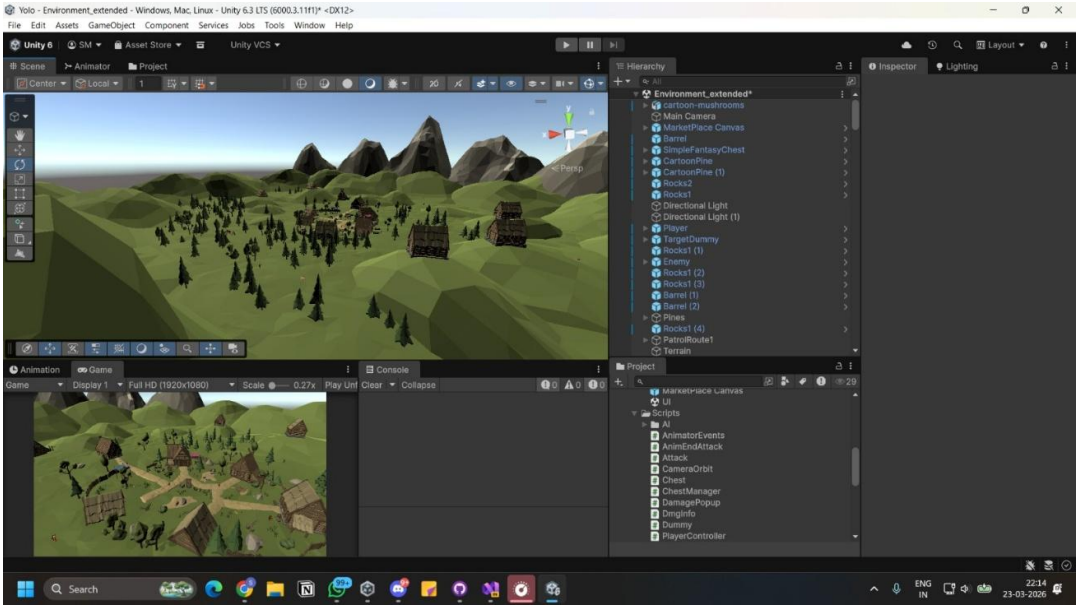

Fig. 2. Rudimentary Terrain built taking inspiration from Souls-like settings

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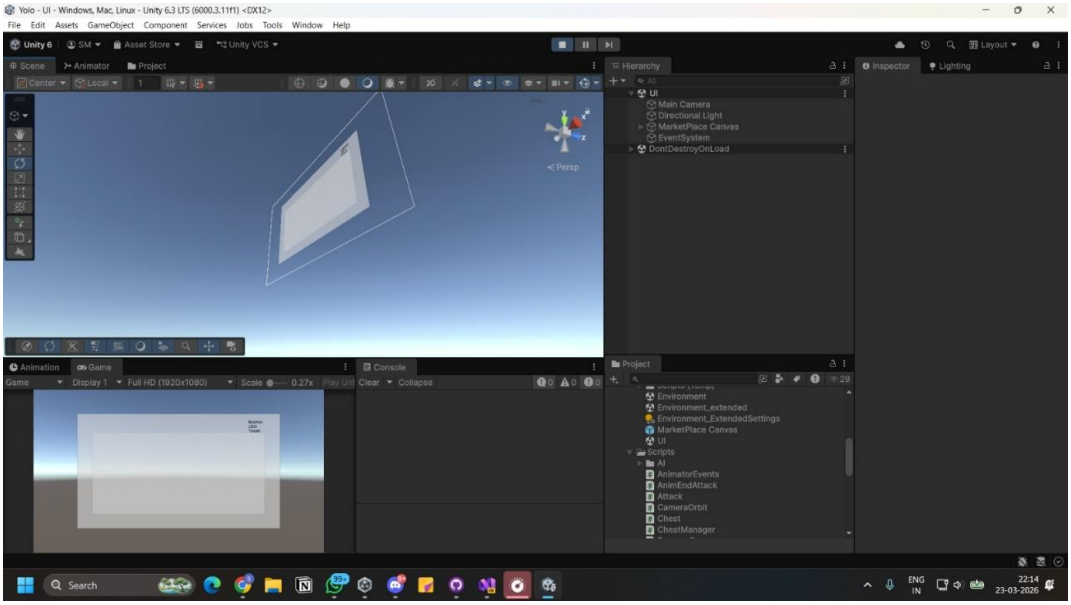

Fig. 3. Showcasing a basic menu for NFT-based transactions

## VI. CONCLUSION

The core promise of 'Verifiable Asset Ownership' of integration of blockchain in gaming has constantly been undermined by the means of application. The dominant 'Play-to-Earn' (P2E) model, which defined the technology's public image, proved to be 'economically unsustainable'. By prioritizing 'earning' over 'playing', this 'finance-first' approach created speculative bubbles that fatally ignored and damaged the primary driver of adoption: 'perceived enjoyment', or the simple fact that a game *must be fun first*. This failure, combined with persistent technical obstacles like scalability, a sub-par user experience and the ambiguous legal status of digital ownership has fueled the negative public perception that continues to stall mainstream adoption.

This history reveals a critical research gap: past analyses have saturated the field with studies of failed 'finance-first' economies, leaving 'fun-first' integrations almost entirely unexplored. This paper fills that gap by proposing a 'Play-to-Prove' model tailored specifically for the *Souls-like* genre, a genre of gaming defined by high difficulty challenges and intrinsic, skill-based rewards. In this setup, NFTs are not speculative financial instruments but *verifiable trophies of achievement,* a permanent record of a player's skill and achievements. By aligning technology with a game's existing mastery and perseverance, this model offers a sustainable path to overcoming the trust and negative perception barriers, ultimately providing a meaningful and valuable use case for verifiable asset ownership in gaming.

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