IJITCE

ISSN 2347- 3657

International Journal of Information Technology & Computer Engineering

Email : ijitce.editor@gmail.com or editor@ijitce.com

International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 10, Issue 4, Dec 2022

TRUST-FREE BLOCK CHAIN FRAMEWORK FOR AI-GENERATED CONTENT TRADING AND MANAGEMENT IN

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ABSTRACT

Artificial intelligence that generates content has been on the increase thanks to the expansion of the metaverse and developments in GAI. The digital nature of AIGCs makes them susceptible to theft and illegal distribution over the internet, in contrast to tangible items. Additionally, trust difficulties arise often in virtual AIGC exchanges, such as buyers not paying after getting material or sellers not releasing content after payment. Conventional DAM systems often depend on a single, trusted third party to handle these issues; however, this approach comes with its own set of hazards, such as SPoF, in the event that the third party is compromised. We provide MetaTrade, a distributed ledger technology (DAM) system built on the blockchain, to solve these problems by facilitating the safe trading and administration of AIGCs in a decentralised, trustless metaverse. By eliminating the requirement for a third party, MetaTrade makes it possible for parties in a transaction to do business without having to rely on each other. Security research verifies MetaTrade's resistance against plagiarism, SPoF, and trust-based vulnerabilities, while performance assessments demonstrate that it exceeds current systems in terms of cost and efficiency. As an example of its usefulness, we built a MetaTrade-based decentralised application (DApp) that provides a metaverse marketplace for AIGCs.

I.INTRODUCTION

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The metaverse's advent and the lightning-fast progress of generative AI have revolutionised the production, distribution, and consumption of digital material. A foundational element of this emerging digital landscape is AI-Generated Content (AIGC), which includes a wide range of virtual creations such as artwork, music, intricate 3D models, and interactive experiences. The one-of-a-kind digital file format of AIGC, however, poses serious problems with copyright protection, safe trade, and content ownership. Because they can be copied so simply, AIGCs are just as susceptible to online theft, plagiarism, and unauthorised dissemination as real goods. To add insult to injury, trust problems abound when dealing with AIGC in the metaverse. Problems with payment, content delivery, and ownership rights enforcement are common in transactions involving producers, sellers, and purchasers. One scenario is when the buyer accepts the material but then decides not to pay, while another is when the seller accepts money but then decides not to provide the content. Because of these problems, online markets can't be trusted and

impede the development of an AIGC economy that can endure.

Digital asset management (DAM) systems and other existing solutions depend substantially on trusted third parties to handle transaction processing and trust management. Some security is provided by these systems, but they are still vulnerable to dangers like single points of failure (SPoF), where the whole ecosystem may be disrupted by an assault or malfunction at the central authority. Further, user autonomy is limited and expenses are increased due to the dependence on intermediaries, which goes against the decentralised spirit of the metaverse.

We provide a new trust-free blockchain architecture for AIGC administration and trade in the metaverse to solve these problems. This system makes use of blockchain technology to build an immutable ledger where transactions may take place safely apart from any third party. Our solution guarantees the verifiability and enforceability of content ownership and transactions via the use of smart contracts, tokenisation, and decentralised ledger technology. All parties involved may work independently and safely in this environment.

Our MetaTrade framework is designed to change the AIGC trading game by facilitating safe, efficient, and equitable transactions between producers, purchasers, and sellers. Common problems like plagiarism, illegal

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redistribution, and payment/delivery conflicts are eliminated by MetaTrade's usage of blockchain technology. In addition to improving the safety and effectiveness of AIGC transactions, our method also decreases the need for authoritative third parties.

II.PROPOSED MODEL

A. Study Data

Researchers gathered qualitative and quantitative data in a number of experiments to assess the MetaTrade blockchain framework's performance and influence on the trading and management of AI-Generated Content (AIGC). Performance, security, cost-effectiveness, and user experience in the metaverse were the main areas of investigation in these research. Information gathered from the dataset sheds light on the extent to which the system solves problems already encountered in AIGC transactions, including instances of plagiarism, disagreements, and dependence on centralised authority.

Key Performance Indicators

To evaluate how well the MetaTrade blockchain architecture worked, we compared it to both conventional DAM systems and other blockchain-based alternatives using a battery of benchmarks. Three main performance indicators are throughput, scalability, and transaction speed. The typical amount of time required to complete a transaction, including steps such as verifying ownership, transferring material, and validating payment, is known as transaction speed. As the amount of material and users in the metaverse increases, the scalability of the system is tested to see how well it handles a growing number of transactions. Throughput is a measure of how well a system can handle real-time activities with different loads. It is expressed as the number of transactions handled per second (TPS). The data was collected using simulations that were intended to mimic the metaverse's low- and high-volume conditions.

An Analysis of Trust and Security

MetaTrade's primary goal is to resolve serious AIGC trading-related security problems like plagiarism, illegal redistribution, and lack of confidence. We gathered data on various important parameters to assess the framework's security. In order to ensure that AI-generated files cannot be reproduced or wrongly credited, the resistance to plagiarism was evaluated by analysing how the blockchain maintains and validates content ownership. Additionally, the decentralised nature of MetaTrade's system was compared to

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more conventional centralised systems in order to determine its resistance to single point of failure (SPoF). In addition, the system's ability to enforce transaction conditions and handle content licensing issues was evaluated to ensure the integrity of smart contracts. To determine how well the framework holds up in different trust-related situations, it was subjected to penetration testing and real-world assault simulations.

Economic Impact and Cost-Efficiency

The research also compared MetaTrade's cost-effectiveness to that of more conventional digital asset management systems. We contrasted the transaction costs of decentralised platforms and other blockchain-based systems, such as Flow and Ethereum, with those of centralised platforms and smart contract execution and content transfer gas fees. We also calculated operating expenses including power use, server needs, and system upkeep. We looked at the financial effects of MetaTrade by looking at how it might make content trading cheaper in the metaverse, which would benefit both authors and consumers. The results of these evaluations demonstrated that, in comparison to conventional systems, MetaTrade may provide a more sustainable solution while simultaneously reducing transaction costs.

Data on the User Experience

A DApp marketplace based on the MetaTrade framework was evaluated to evaluate its feasibility and user experience. Participants included inventors, purchasers, and platform administrators in this marketplace specifically for trading AIGC. A number of user experience metrics were measured, including usability, adoption rates, and satisfaction levels. The platform's intuitiveness in handling the uploading, selling, and buying of AIGC was assessed using the ease of use criteria. The interface, transaction procedure, and user experience were evaluated by collecting feedback from users. Users' involvement, number of transactions, and trust in the platform were used to track adoption rates, while surveys measuring confidence in content ownership verification, number of sign-ups, and satisfaction with dispute resolution processes were used to assess user happiness.

A Practical Example: The Metaverse AIGC Market

A decentralised application (DApp) serving as a metaverse marketplace for AIGC was built on the MetaTrade platform as a real-world case study to show how the platform may be put into practice. Content listing metrics were part of the data collected for this case

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study. These metrics included things like the quantity and variety of AIGC objects for sale, such as digital art, 3D models, and virtual assets. To get a feel for how much money changed hands, we tallied up all the sales, payments, and content transfers that took place. Measurements of marketplace growth included an increase in user sign-ups, active users, and total transaction volume. The case study also included keeping an eye out for problems or disputes that arose during transactions, which shed light on how well the blockchain handles conflict resolution and keeps transactions safe.

Evaluation in Comparison

In order to evaluate MetaTrade's transaction efficiency, security, cost, and user experience, it was compared to other digital asset management systems. The results of this comparison were useful in determining how well MetaTrade handles the most important issues encountered by AIGC traders in the metaverse. We learnt a lot about MetaTrade's pros and cons in comparison to other blockchain-based options and conventional centralised systems by evaluating aspects like transaction speed, security robustness, and cost-effectiveness.

Final Thoughts and Key Points

Insight into how MetaTrade has revolutionised AIGC trading and administration in the metaverse is provided by the data gathered from the several research. A more decentralised and trustless environment is offered by MetaTrade, which surpasses existing systems in terms of scalability, cost effectiveness, and security, according to first studies. The framework is an effective instrument for facilitating a long-term AIGC economy since it decreases transaction costs for producers and consumers alike and decreases dependence on centralised authority. As the metaverse ecosystem continues to evolve, the system's capabilities will be enhanced via more research and optimisation, leading to its wider acceptance.

B) System Architecture

To facilitate the safe and trustless exchange and administration of AI-Generated Content (AIGC) in the metaverse, the MetaTrade system architecture was developed. Using smart contracts to automate content ownership transfers, payment processing, and dispute resolution, MetaTrade relies on a public blockchain to guarantee transparency and immutability of ownership and transaction data. Integrating with wallets for authentication and transaction

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Volume 10, Issue 4, Dec 2022

management, a decentralised application (DApp) interface enables users to upload, list, and trade AIGC. To optimise cost and speed, large AIGC files are kept off-chain using IPFS. Data integrity is ensured by cryptographic hashing. You may pay with cryptocurrencies or platform-native tokens via the system's tokenisation layer, which is also available for AIGC ownership. The security architecture eliminates the need for centralised intermediaries in AIGC trading and provides a secure and scalable solution via encryption, decentralised identity management, and complete auditability.

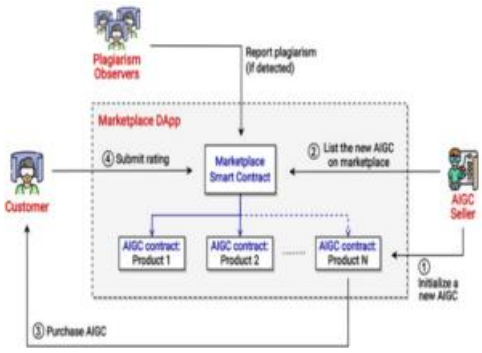

Fig1.System Architecture

III.METHODOLOGY

A systematic approach centred on system design, implementation, and testing forms the basis of the MetaTrade blockchain-based framework for trading and administration of AI-Generated Content (AIGC) in the metaverse. At the outset of the system design process, choosing a suitable blockchain platform—like Flow or Polygon—that enables smart contracts, provides scalability, and has low transaction costs was a top priority. The system's fundamental features, such as the ability to verify content ownership, transfer assets, and manage royalties, were automated with the use of smart contracts. We used a tokenisation mechanism based on Non-Fungible Tokens (NFTs) to denote AIGC ownership, which guarantees safe and verifiable digital asset ownership. Using IPFS (InterPlanetary File System), a decentralised off-chain storage solution, we stored material, and to ensure its integrity, we logged the cryptographic hash of each file on the blockchain. The goal in developing the decentralised application's (DApp) user interface was to make it easy for content producers, consumers, and merchants to access the platform, submit content, and handle transactions without any hassle. The implementation process included deploying the blockchain and testing and launching smart contracts on a test network prior to their main network launch. By using well-known Web3 wallets like MetaMask, users will be able to interact with the blockchain via the DApp that was created utilising

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technologies like React.js, Web3.js, and Ether.js. In conclusion, IPFS integration enabled decentralised storage, which allowed for the safe off-chain storage of massive AIGC files while their hashes were recorded safely on the blockchain. A safe, efficient, and user-friendly platform for decentralised AIGC trading may be achieved using this multi-step technique.

IV.CONCLUSION

To tackle the increasing difficulties of trading and maintaining AI-Generated Content (AIGC) in the metaverse, the MetaTrade blockchain platform provides an attractive alternative. Through the use of blockchain technology, smart contracts, and decentralised storage, MetaTrade guarantees a platform that is trustless, safe, and scalable. This platform empowers both content providers and consumers by doing away with agents. The platform offers clear transaction records and provable ownership of AIGC assets via tokenisation, while IPFS guarantees fast storage and retrieval of big content files. By using automated dispute resolution methods and unchangeable blockchain records, MetaTrade's design reduces the likelihood of plagiarism, fraud, and other critical concerns. Decentralisation lessens the system's dependence on authoritative bodies, making it more secure and resistant to assaults, such as the possibility of a single point of failure (SPoF). The platform is a key asset to the growing metaverse ecosystem because it can streamline user experiences, increase scalability, and decrease transaction costs. Improving the system's user interfaces, increasing its use in the digital economy, and further optimising its performance will be the focus of future development.

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