

STUDENT FORUM USING BLOCKCHAIN

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Abstract:

This paper explores a decentralized student forum architecture using blockchain technology, the Ethereum testnet, and NFT-based login to address common issues such as spam and unverified user participation. Traditional online forums often suffer from low-quality interactions, spam, and anonymity-driven issues, which degrade the user experience and diminish community trust. Our proposed system employs non-fungible tokens (NFTs) to create a unique digital identity for each user, reducing spam and promoting accountability. Each student registering on the forum receives an NFT, which is then sent to their digital wallet, such as MetaMask, serving as a unique identifier that authenticates their access. The NFT metadata is stored securely on IPFS, ensuring data integrity and decentralized storage while allowing for efficient retrieval.

In this framework, NFTs function as a gatekeeping mechanism, verifying user authenticity and preventing multiple account creation, while allowing users to interact pseudonymously. By utilizing the Ethereum testnet, the system provides a cost-effective and scalable environment with minimal transaction costs, making it accessible to students. The blockchain-based forum ensures that all actions are transparent, immutable, and traceable, fostering a constructive and secure space for student interactions. This survey further investigates the potential of NFT-based identity management for enhancing the quality of discourse on forums and evaluates its implications for broader applications that require verifiable and private digital identities.

Keywords - *Blockchain, Ethereum TestNet, NFT, IPFS, MetaMask, Pseudonymous.*

I. INTRODUCTION

Blockchain has transformed a number of digital fields in recent years by offering transparent, decentralized, and safe solutions. The online forum environment is one that stands to gain a great deal from blockchain innovation, especially in academic contexts where problems like spam,

anonymity, and lack of responsibility frequently obstruct productive conversations. Fake identities, unverified individuals, and malicious activity are prevalent problems in traditional student forums or discussion boards. These issues lower the standard of conversation and discourage real users from participating. In order to establish a student forum with safe, verifiable user identities, low spam, and pseudonymous interactions, this study explores an innovative method to forum management by utilizing the Ethereum testnet, non-fungible tokens, and the Interplanetary File System.

Blockchain's inherent features of immutability, transparency, and decentralization make it a suitable solution for addressing trust and identity management issues in online platforms [1]. Using blockchain for identity verification has already shown promise in various fields such as finance and healthcare, suggesting potential in educational and social platforms. Ethereum, one of the most popular blockchain networks, allows for the development of decentralized applications (DApps) with customizable features through smart contracts, providing a foundation for building secure and scalable applications [8]

In this proposed forum model, each user is required to authenticate their identity using a unique NFT allocated upon registration. NFTs are tokens representing ownership of a unique item or identity, offering an effective means for unique digital identification. Each NFT issued to a student serves as a digital passport, stored in the student's personal cryptocurrency wallet, such as MetaMask [3]. This process significantly reduces the risk of duplicate accounts and spamming activities, as each account is tied to a unique NFT that cannot be replicated. Furthermore, NFTs have proven effective in other identity verification projects, offering decentralized and reliable authentication [10].

IPFS is used to manage and maintain metadata related to each NFT in order to enable decentralized storage of user data. By reducing the drawbacks of centralized storage and speeding up data retrieval, IPFS is an among peers distributed file system that makes safe and effective data storage possible [9]. Without depending on a central authority, IPFS helps to maintain and preserve sensitive data about the NFTs, enhancing user security and privacy [11]. In addition to preserving the integrity of user data, this IPFS and blockchain combo fosters user confidence by guaranteeing that forum discussions are safe, verifiable, and available only to members who have been authorized.

This forum model utilizes the Ethereum testnet, an environment where blockchain applications can be developed and tested at minimal or no cost [7]. By operating on a testnet, the forum becomes accessible to users without incurring gas fees associated with live Ethereum transactions, making the system more practical for widespread student use [7].

Through a detailed exploration of existing technologies and implementations, this survey provides insights into the effectiveness of NFT-based login systems for reducing spam and enhancing user accountability in online forums. This approach could serve as a model for other educational and social platforms, especially where user authenticity and data privacy are critical. The survey also evaluates the potential scalability, limitations, and implications of integrating NFTs and IPFS within blockchain-based applications to support secure, decentralized platforms for verified users.

II. LITERARY SURVEY

I. Introduction

The integration of blockchain technology in online platforms has sparked interest across industries for its potential to enhance security, transparency, and trust. Blockchain's decentralized and tamper-proof ledger offers significant advantages for applications requiring reliable verification, such as student forums, where managing user authenticity and curbing spam are ongoing challenges [1]. Traditional online forums typically employ username-password systems, often susceptible to spamming, duplicate accounts, and limited accountability. As such, blockchain-based identity systems, particularly using non-fungible tokens (NFTs) for unique user verification, offer an innovative solution by creating verifiable digital identities linked to each user [10]. This survey examines the technological foundation, benefits, and limitations of a student forum built on the Ethereum testnet, utilizing NFTs for login, IPFS for metadata storage, and MetaMask as a digital wallet to host each student's unique NFT.

Ethereum's flexible blockchain infrastructure supports decentralized applications (DApps) and smart contracts, making it suitable for forums requiring secure, user-controlled identities [4]. The Ethereum testnet environment, which operates without real transaction fees, enables cost-effective development and testing of

blockchain-based applications. This is especially relevant in an academic context, as students can access the forum and experiment with blockchain technology without incurring gas fees, increasing accessibility. Studies have demonstrated the Ethereum testnet reliability in simulating real-world environments, allowing for scalable solutions within educational institutions and beyond [7].

Because they are indivisible and unique, non-fungible tokens (NFTs) provide a special way to create digital identities. NFTs prevent the possibility of duplicate accounts, enable verified, pseudonymous participation, and give each user a unique identity kept on the blockchain, in contrast to standard login techniques [10]. Prior research has demonstrated the efficacy of NFTs for safe identity management in a range of applications, validating their usefulness in contexts that demand secure access and unique user authentication [5]. Each created NFT is delivered to the student's MetaMask wallet, a popular digital wallet that works with Ethereum. Because of its simplicity of use and compatibility with Ethereum DApps, MetaMask is perfect for non-technical users and students because it allows for secure login and NFT storage [3].

Each NFT's metadata is stored on the IPFS (InterPlanetary File System) to guarantee decentralized data management. By offering safe, decentralized storage for big files and guaranteeing data availability and integrity independently of a central authority, IPFS is an among peers distributed file storage network that overcomes the drawbacks of centralized storage [9]. IPFS is appropriate for blockchain-integrated forums since it has demonstrated efficacy for decentralized applications, providing speedy data retrieval while preserving privacy and accessibility [14].

The primary objective of this forum model is to reduce spam and prevent anonymous, unverifiable users from disrupting meaningful discourse. By linking NFTs to unique digital identities, the platform allows students to engage pseudonymously, enhancing accountability without sacrificing privacy. Blockchain's transparency and NFT-based login restrict spam while fostering a constructive environment conducive to academic interactions. This survey assesses prior research on the use of Ethereum, NFTs, and IPFS in blockchain-based applications, outlining their applicability, challenges, and implications for a decentralized student forum that balances privacy, security, and accessibility.

[1] **Bitcoins: Peer to Peer Electronic Cash System, Satoshi Nakamoto**

The article presents the decentralized digital currency system known as Bitcoin. Timestamped and documented in a chain of hash-based proof-of-work, transactions guarantee chronological integrity without the assistance of a reliable third party. The longest chain is regarded as the authoritative transaction history and entails the greatest computational effort. The technology enables direct transactions between parties by relying on cryptographic evidence rather than trust. Nodes are rewarded with transaction fees and block incentives for validating

transactions and building blocks. Privacy is preserved by keeping public keys anonymous, while a Merkle Tree structure ensures efficient use of disk space. Bitcoin's design makes it secure against attackers with less computational power, preventing alterations to the ledger. This decentralized system enables trustless, irreversible transactions without requiring financial intermediaries.

[2] An Event Study of the Ethereum Transition to Proof-of-Stake

Examines Ethereum's shift to Proof of Stake (PoS) in September 2022. The transition reduced the network's energy consumption by 99.98%. The merge eliminated block rewards, leading to a 97% drop in total block reward income, while transaction fees in Ether rose slightly. Network speed stabilized, with consistent 12-second block intervals, and daily transactions increased by 7%. Ethereum's supply has turned deflationary due to reduced minting and increased staking, with validators replacing miners. Competing networks like Polygon and Solana experienced mixed impacts, including slower transactions on Solana and stable fees on Polygon. The study highlights PoS's energy efficiency and stability benefits but notes challenges like higher fees and validator concentration. Future research explore scalability and long-term implications of staking.

[3] Survey Paper on Decentralized Crypto Wallet Application using Ethereum Ledger

The study explores the development of a decentralized crypto wallet using the Ethereum blockchain, highlighting its enhanced security and autonomy compared to traditional centralized systems. By leveraging blockchain, the wallet ensures robust data security, eliminates third-party involvement, and uses public-private key pairs for safe transactions. It integrates functionalities such as storing, transferring, and trading digital currencies while maintaining user privacy via hexadecimal wallet addresses. The study also contrasts software and hardware wallets, emphasizing their respective use cases in trading convenience versus long-term storage. Challenges include transaction speed, scalability, and security concerns, with proposed solutions like lightning networks and encryption.

[4] Smart Contracts in Blockchain Technology: A Critical Review

This paper examines the role of smart contracts in blockchain technology, analysing 252 articles published between 2012-2022. Smart contracts automate transactions and enforce agreements in a decentralized manner, reducing costs and improving efficiency. They find applications in diverse areas like supply chains, healthcare, and finance. The study identifies key challenges such as security vulnerabilities, data immutability, and legal ambiguities. It emphasizes the need for advanced cryptographic solutions and scalable storage mechanisms. Future developments include integrating AI for improved contract management, addressing privacy concerns, and ensuring interoperability with traditional legal systems.

The study concludes that while smart contracts hold transformative potential, their adoption is hindered by technical, legal, and usability issues that require further research and development.

[5] NFT Technology for Enhanced Global Digital Registers: A Novel Approach to Tokenization

In order to overcome the security, scalability, and interoperability issues with current asset management systems, this paper suggests a decentralized universal registry system that makes use of blockchain technology and NFTs. By utilizing NFTs as unique identifiers, the model ensures authenticity and traceability of digital assets. The system integrates features like smart contracts for automated rights management, cross-chain compatibility, and privacy-preserving technologies like zero-knowledge proofs. Applications include tokenizing cultural heritage sites and intellectual property rights. Compared to traditional centralized systems, the approach offers enhanced security, censorship resistance, and cost-efficiency. Experimental validation showed that the NFT-based model supports high transaction throughput and scalability, making it suitable for global adoption in industries ranging from education to logistics. While the research identifies limitations like high blockchain costs, it demonstrates the transformative potential of NFTs for secure and transparent asset management systems.

[6] Ethereum: Introduction, Expectation, and Implementation

Ethereum is a decentralized platform built on the blockchain that makes it possible to develop creative and safe decentralized apps (dApps). Ethereum adds programmability through smart contracts, enabling a variety of applications including financial services and games, in contrast to Bitcoin, which solely functions as a digital currency. Using its cryptocurrency, Ether (ETH), and the Ethereum Virtual Machine (EVM), the platform supports trustless, immutable transactions. Despite recent market volatility, the paper highlights Ethereum's resilience, driven by its decentralized and transparent nature. The analysis anticipates continued adoption in fields like IoT and digital assets due to its inherent security and flexibility. Ethereum's ecosystem, leveraging tools like Solidity and gas mechanisms, demonstrates its potential to transform technological and social infrastructures globally.

[7] Ethereum Transaction Performance Evaluation Using Test-Nets

Using testnets, Ethereum's transfer performance is examined with an emphasis on latency, block creation time, and acceptance of end-to-end transactions. Using Ropsten, Kovan, and Rinkeby test-nets, the research highlights Ethereum's instability in transaction time due to the PoW consensus, leading to unpredictable delays. While PoA-based networks like Kovan and Rinkeby show greater stability, they still face significant transaction latency issues. The experiments reveal that Ethereum's current consensus mechanisms cannot meet the low-latency and high-frequency requirements of certain decentralized applications (DApps), such as online gaming. The study

suggests off-chain transaction methods as a potential solution to mitigate latency and enhance Ethereum's capability to support real-time, high-frequency DApps. Future research will focus on the Ethereum main-net and applying them to practical use cases like online gaming.

[8] A Study on DApps Characteristics

It investigates public repositories hosting decentralized applications (DApps) across blockchain platforms. It provides insights into DApp characteristics, including metadata inconsistencies and smart contract usage. Ethereum dominates as the leading blockchain platform but exhibits low user engagement relative to platforms like EOS. The study highlights the immaturity of DApps, evident in their vulnerabilities, limited adoption, and lack of promotion tools. The lifecycle of DApps, from design to operation, is outlined alongside challenges like scalability and performance. Data acquisition tools and a public dataset are developed, facilitating reproducible analysis. The findings suggest enhancing user experience and promotional frameworks to foster DApp adoption. Additionally, addressing platform heterogeneity and improving repository alignment can streamline development and usage of decentralized applications.

[9] A Secure File Sharing System Based on IPFS and Blockchain

Blockchain ensures data integrity through decentralized ledgers, while IPFS provides content-addressable decentralized file storage. An IPFS proxy is incorporated into the suggested system for group keys management and distributed control of access. Group owners can create

secure file sharing environments, and authorized members access files encrypted with group keys. Blockchain records file metadata, ensuring tamper-proof tracking. Key security features include encryption mechanisms and revocation processes to maintain data confidentiality and restrict unauthorized access. The approach addresses limitations in traditional blockchain and IPFS setups, including inefficiencies in computation and access control. Future work involves implementing the design and evaluating its performance. The system demonstrates potential for scalable and secure file sharing in decentralized networks.

[10] A Secure and Decentralized Authentication Mechanism Based on Web 3.0 and Ethereum Blockchain

The system enables secure user authentication without centralized control, ensuring user privacy and data ownership. Using Ethereum-based wallets like MetaMask, the proposed method replaces traditional credentials with cryptographic signatures. The process involves nonce generation, user signature validation, and issuing JWT tokens for session management. Compared to conventional methods like SMS-based login, this system offers faster authentication times and eliminates sensitive data storage. The research highlights vulnerabilities such as phishing attacks and suggests user awareness as key to security. With its focus on anonymity and decentralization, the solution proves effective for applications like NFT marketplaces, DeFi platforms, and decentralized apps. Challenges include specialized knowledge requirements and limited adoption, but the approach demonstrates potential as Web3 technologies gain traction.

III.

ANALYSIS TABLE

SNO	PAPER TITLE	AUTHORS	YEAR	PROS	CONS
1	<i>Bitcoin: A Peer-to-Peer Electronic Cash System</i>	Satoshi Nakamoto	2009	Provides blockchain architecture insights, supporting efficient forum design and consensus mechanisms.	Does not address specific challenges related to student focused forum
2	<i>An Event Study of the Ethereum Transition to Proof- of-Stake</i>	Elie Kapengut & Bruce Mizrach	2023	PoS significantly reduces energy use, making Ethereum more environmentally sustainable.	Centralization risks emerge as large staking pools dominate validator roles.

3	<i>Survey Paper on Decentralized Crypto Wallet Application using Ethereum Ledger</i>	Dinesh Pamu , Harshad ..	2022	Decentralized wallets eliminate reliance on intermediaries, reducing censorship risks and enhancing autonomy.	No customer support for recovery, placing full responsibility on the wallet owner.
4	<i>Smart Contracts in Blockchain Technology: A Critical Review</i>	Hamed Taherdoost	2023	Analyzes Ethereum's smart contract potential, crucial for decentralized identity management.	High computational costs and scalability issues with Ethereum.
5	<i>NFT Technology for Enhanced Global Digital Registers: A Novel Approach to Tokenization</i>	Emanuele Frontoni , Ruslan Shevchuk ..	2024	Explores NFT based identity for reducing spam and ensuring user authenticity in forums.	Limited application experience in educational forums; potential privacy concerns
6	<i>Ethereum: Introduction, Expectation, and Implementation</i>	Qichn Huang	2023	Ethereum supports smart contracts, enabling decentralized applications and complex financial ecosystems.	High transaction fees during congestion make Ethereum less accessible for smaller users.
7	<i>Ethereum Transaction Performance Evaluation Using Test-Nets</i>	Lin Zhang , Brian Lee, Yuhang Ye, and Yuansong Qiao	2020	Provides a low cost method to test blockchain applications, ideal for small scale deployments.	Testnet limitations may not fully represent real world blockchain issues
8	<i>A Study on -DApps Characteristics</i>	Ilham Ahmed Qasse, Josef Spillner & Manar Abu Talib, Qassim Nasir	2020	Comprehensive guide to building DApps, aiding development of student forums on Ethereum	Ethereum gas fees can make operations costly for large user bases.
9	<i>A Secure File Sharing System Based on IPFS and Blockchain</i>	Hsiao-Shan Huang, Tian-Sheuan Chang & Jhih-Yi Wu	2020	IPFS provides decentralized storage, ensuring data availability without reliance on central servers.	Storing large files can be impractical without off-chain solutions or added infrastructure.
10	<i>A Secure and Decentralized Authentication Mechanism Based on Web 3.0 and Ethereum Blockchain Technology</i>	Adrian Petcu , Bogdan Pahontu , Madalin Frunzete & Dan Alexandru Stoichescu	2023	Ethereum blockchain ensures tamper-proof, transparent, and verifiable authentication records.	Limited scalability without Layer-2 solutions can slow adoption for large-scale applications.

IV. CONCLUSION

In conclusion, this survey has explored the integration of blockchain technology, specifically Ethereum and NFTs, within a student forum framework aimed at addressing issues of spam and anonymous users. The literature review highlights how decentralized technology is increasingly applied to digital identity verification, demonstrating that blockchain's immutability and transparency can offer robust solutions to longstanding digital communication challenges.

By allocating unique NFTs to each user, our proposed forum leverages blockchain's capabilities to create verifiable identities without compromising privacy. Each NFT acts as a digital ID, reducing the risk of duplicate or anonymous accounts, which are often sources of spam and disruptive behaviour. Unlike traditional centralized systems, which are vulnerable to data breaches and manipulations, an NFT-based identity framework stored securely in users' wallets, such as MetaMask. This survey has shown that such approaches not only enhance security and reliability but also empower users with ownership of their data, a growing priority in the digital age.

Furthermore, the use of IPFS to store NFT metadata introduces a decentralized file storage system that complements the blockchain by ensuring that user-related data remains both accessible and censorship-resistant. The integration of IPFS is essential to prevent the risk of data loss or single-point failures that are often associated with centralized storage systems.

Current literature underlines that while Ethereum-based systems and NFTs offer a promising framework for decentralized identity management, challenges remain in scalability, user onboarding, and the environmental impact of blockchain operations. However, advancements in Ethereum's Layer 2 solutions and ongoing research into more efficient consensus mechanisms offer potential paths to address these challenges.

In sum, this survey highlights that blockchain technology, and more specifically the Ethereum network paired with NFTs and IPFS, provides an innovative approach to create a secure, decentralized student forum. This framework not only mitigates spam and anonymous users but also aligns with modern demands for data sovereignty and user-controlled identity. As blockchain technology continues to evolve, future research should focus on refining these models to enhance usability, scalability, and sustainability within educational and social platforms

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