JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

BLOCKCHAIN-BASED EDUCATIONAL ASSETS MANAGEMENT PRICING MODEL USING SMART CONTRACT AND TOKENIZATION

Mrs.R.Jayalakshmi[1], K.Kabilesh[2], G.Raghul[3]and V.Venkatesan[4]

[1] Asst. Professor, Rajiv Gandhi College of Engineering and Technology, Puducherry, India

[2,3,4] B. Tech (CSE Students), Rajiv Gandhi College of Engineering and Technology, Puducherry.

ABSTRACT

Decentralized blockchain solutions redefine education asset management by ensuring data integrity and user empowerment. They transform diverse educational data into tamper-resistant digital assets, fostering personalized teaching methods. Represented as NFTs on Ethereum, these assets guarantee uniqueness and traceability, bolstering authenticity. Micropayment pricing enhances accessibility, allowing users to engage with educational assets seamlessly. Smart contracts govern pricing dynamics, enabling perinteraction payments, subscription models, and dynamic pricing based on user engagement. The system prioritizes userfriendliness, interoperability with existing learning management systems, and compliance with regulations, ensuring a smooth transition for educational institutions and users. Integrated digital wallets facilitate funding and streamline transactions, further enhancing user experience. Blockchain's transparent nature ensures reliability and efficient asset management, contributing to a forward-looking educational ecosystem. By combining tokenization with micropayment pricing, this system offers a dynamic and secure environment for educational stakeholders. It aligns with the evolving trends in decentralized and blockchain-driven technologies, paving the way for a more accessible, transparent, and user-centric educational landscape. Overall, the integration of blockchain technology represents a significant step forward in addressing the limitations of traditional centralized models, heralding a new era of innovation in education asset management.

INTRODUCTION

Blockchain, a distributed database, records and verifies transactions among participants, ensuring security and immutability. It digitally secures assets like land and cars. Each block contains multiple transactions, forming a chain across the network. Blockchain, a type of Distributed Ledger Technology (DLT), employs immutable cryptographic signatures called hashes. Despite its potential for future Internet systems, blockchain encounters

technical challenges, notably scalability. The current Bitcoin block size limit restricts transaction rates to about 7 transactions per second, hindering high-frequency trading. Addressing scalability concerns is crucial for blockchain's broader adoption and realization of its transformative potential.

A Blockchain Explorer is a search engine revealing block, transaction, and smart contract details on a blockchain. It enhances transparency, enabling users to easily track activity. Without it, finding specific transactions or wallet addresses would be daunting due to the high transaction volume.Explorers become invaluable tools as users grasp data interpretation. Ethereum's transparent nature extends to its explorers, aiding verification of data on both main and test networks. Market data provided assists investors analysts in evaluating cryptocurrency performance. Ethereum is a decentralized platform with its cryptocurrency, Ether (ETH), and programming language Solidity. Users create, publish, and use decentralized applications (dapps) on Ethereum, paying fees known as "gas" for computational power. It operates as a permissionless, non-hierarchical network of nodes reaching consensus on blocks of transactions. Miners add blocks to the blockchain, receiving Ether rewards. Each Ethereum account holds ETH and can send it to others, with the smallest unit being a Wei. Ether is crucial for transaction fees, incentivizing miners. Smart contracts automate digital asset transfers based on predefined conditions. Initially used in Bitcoin, Ethereum enhanced capabilities with Turing-complete language, enabling more complex contracts. Other platforms include Solana, Polkadot, and Hyperledger Fabric. NFTs gained traction recently, offering unique digital ownership. NFTs, non-fungible tokens, are cryptographic assets on blockchain with distinct properties, not interchangeable like cryptocurrencies. ERC stands for Ethereum Request for Comments, focusing on Ethereum application standards, including tokens. Tokens are transferable units of value, colloquially called cryptocurrencies or coins, categorized as fungible or non-fungible.

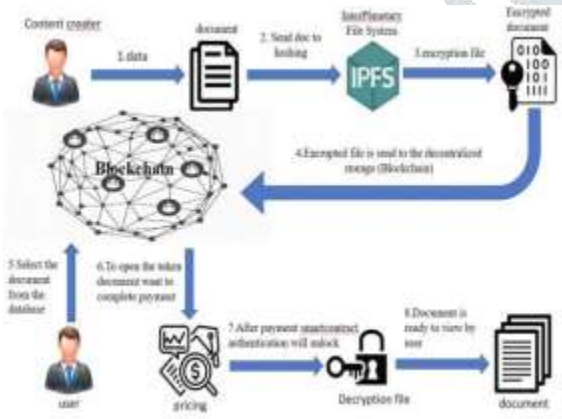
In this paper, we propose The system utilizes blockchain to manage educational assets, such as course materials, as non-fungible tokens (NFTs) on Ethereum. Micropayment pricing allows seamless access via smart contracts, enabling per-interaction payments and dynamic pricing. It prioritizes user-friendliness, interoperability, and compliance, integrating digital wallets for funding. Usage data informs content optimization, while security measures protect payment info. Blockchain ensures reliability, immutability, and efficient asset management. This forward-looking solution combines tokenization and micropayments for institutions, students, and educators, fostering a dynamic and secure educational ecosystem aligned with decentralized trends. A Smart Contract is a computer program automating digital asset transfers based on predefined conditions, akin to traditional contracts but enforced by code. Initially used in Bitcoin, they gained prominence with Ethereum's Turing-complete language, enabling custom contracts. Ethereum, Solana, and others offer platforms for smart contracts, revolutionizing transactional autonomy.

Implementation

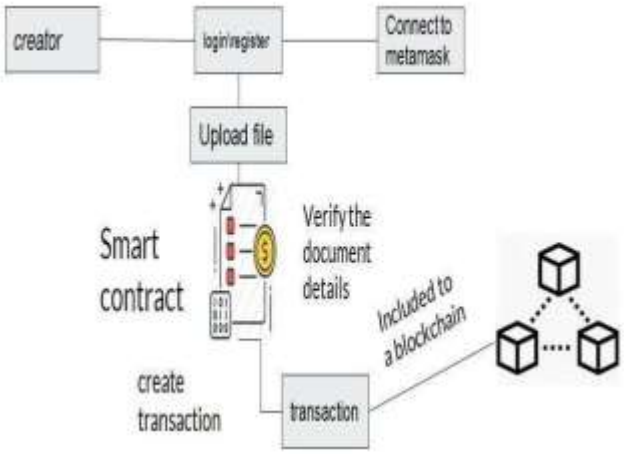
Proposed System: The system leverages blockchain technology to provide a secure, transparent, and decentralized platform for managing educational assets, including course materials, certificates, and academic records. Educational assets are represented as non-fungible tokens (NFTs) on the Ethereum blockchain, ensuring uniqueness, traceability, and immutability. The introduction of micropayment pricing enhances the system's functionality, allowing users to access and interact with tokenized educational assets through seamless microtransactions. Smart contracts govern the pricing logic, enabling per-interaction payments, subscription models, and dynamic pricing based on user engagement.

The system's design emphasizes user-friendliness, interoperability with existing learning management systems, and compliance with relevant regulations. Digital wallets integrated with payment features facilitate user funding and streamline micro transactions. The tokenized assets usage is tracked, providing valuable insights into user behavior for content optimization and personalized pricing. Security measures, including encryption and secure channels, safeguard user payment information, ensuring a trustworthy micropayment experience. The abstracted and transparent nature of the blockchain contributes to the system's reliability, immutability, and efficient management of educational assets. It offers a forward- looking solution for educational institutions, students, and educators by combining tokenization with micropayment pricing. The integrated features contribute to a dynamic, secure, and user-centric educational ecosystem, aligning with the evolving trends in decentralized and blockchain-driven educational technologies.

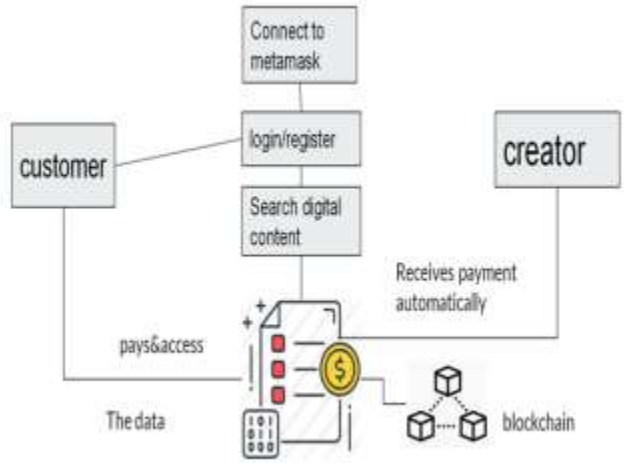
System Architecture



a. Content creator : The content creator is used to register and login process and Connect to the metamask and the content creator upload the assets to the smart contract and tokenization , the smart contract verify the document details and Create transaction and gives the payment details and the document included to a blockchain



b. Content Customer : The content customer used to register and login and Connect to the metamask and the content customer searches for the content they need and they download the smart contract, verify the document details and Create transactions and give the payment details and smart contract to retrieve documents from the blockchain.



c. User Module :The user module allows users to register, log in, and log out. Users benefit from being able to sign on because this associates content they create with their account and allows various permissions to be set for their roles. The user module supports user roles, which can be set up with fine-grained permissions allowing each role to do only what the administrator permits. Each user is assigned one or more roles. By default there are three roles: anonymous (a user who has not logged in) and authenticated (a user who is registered), and administrator (a signed-in user who will be assigned site administrator permissions). Users can use their own name or handle and can fine-tune some personal configuration settings through their individual account page. Registered users need to authenticate by supplying their username and password, or alternately an OpenID login. A visitor accessing your website is assigned a unique ID, the so-called session ID stored in a cookie. For security's sake, the cookie does not contain personal information but acts as a key to retrieving the information stored on your server. d. File Module :File module is used to deal with the files, directories, and symlinks. You can create or get the file details form Blockchain Ledger through the file module. The File module enables you

to upload and attach files to content and to manage these uploads if you have the appropriate permissions. This module is responsible for validating file content and managing uploaded files. It also provides options for displaying file content. As a site administrator, you will be able to control what type of files can be uploaded and their maximum size. The File module provides its functionality by defining a File field type for the field module. e. Wallet Module :The Wallet module contains the payment details of the Content Creator users, which was automatically initiated by the smart contract for every download of the owner's particular content. It also tracks every type of payment. Wallet module is connected to Metamask, from which the user can withdraw the amount outside the Digital Asset Management system.The public ledger stores data such as Ethereum transactions, Ethereum wallet addresses and balances. By using an Ethereum block explorer, you can search through this data and find the relevant information you might need. There are multiple ways in which the Ethereum block explorer is vital during your cryptocurrency adventure. Event and Log index for transaction f. Smart Contract :Smart Contract is the main module that automatically executes all the build-in processes we defined in the implementation and store the details in the blockchain ledger. The Store details can be viewed and tracked by anyone in the system. Once the data is uploaded to the blockchain using a smart contract it verifies the data uniqueness and the ownership and provides the pattern to the user for particular content. If another user tries to upload the same content it gives the copyright issue along with the ownership details. For every content download, Smart Contract initiates the payment and sends the micropayment to the Content Creator.

RESULT AND DISCUSSION

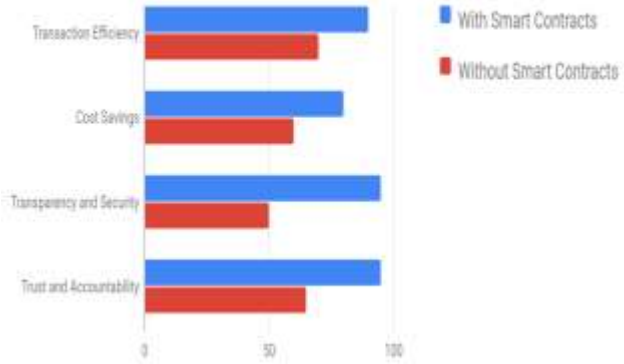
PERFORMANCE ANALYSIS OF SMART CONTRACT :

Transaction Efficiency: With Smart Contracts: Transactions are automated and executed with predefined conditions, leading to faster and more efficient processing. Without Smart Contracts: Transactions rely on manual verification and intermediaries, resulting in slower processing times and higher administrative overhead.

Cost Savings: With Smart Contracts: Smart contracts eliminate the need for intermediaries, reducing transaction fees and administrative costs. Without Smart Contracts: Intermediaries and manual processes incur additional fees and administrative expenses, leading to higher overall costs.

Transparency and Security: With Smart Contracts: Transactions are recorded on a transparent and immutable blockchain, providing greater transparency and security. Without Smart Contracts: Transaction records may be susceptible to manipulation or fraud, leading to concerns about data integrity and security breaches.

Trust and Accountability: With Smart Contracts: Smart contracts enforce predefined rules and conditions, ensuring trust and accountability in asset management. Without Smart Contracts: Trust and accountability may be compromised by human error or subjective interpretation of rules, leading to disputes and inefficiencies.



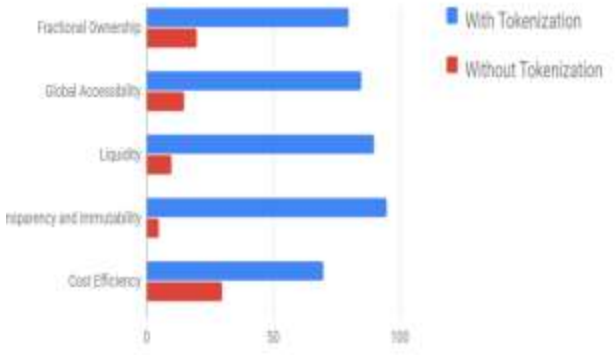
PERFORMANCE ANALYSIS OF TOKENIZATION: Fractional Ownership: With Tokenization: Educational assets can be divided into smaller, tradable units, enabling fractional ownership and making them accessible to a wider range of investors or learners. Without Tokenization: Educational assets are typically sold or accessed as whole units, limiting access to those who can afford to purchase entire assets outright. Global Accessibility: With Tokenization: Tokens representing educational assets can be traded and accessed globally, breaking down geographic barriers and expanding market reach. Without Tokenization: Access to educational assets may be restricted by geographic or institutional barriers, limiting market participation and accessibility for learners worldwide.

Liquidity: With Tokenization: Tokenization enhances the liquidity of educational assets by enabling them to be easily traded on secondary markets, providing investors or learners with flexibility in buying, selling, or transferring ownership stakes.

Without Tokenization: Educational assets may be illiquid and difficult to trade, leading to longer holding periods and reduced flexibility for investors or learners. Transparency and Immutability: With Tokenization: Educational asset transactions recorded on a blockchain are transparent and immutable, providing a tamper-proof record of ownership and transaction history, enhancing trust and accountability. Without Tokenization: Transaction records may be less transparent and subject to manipulation or fraud, leading to concerns about data integrity and security breaches.

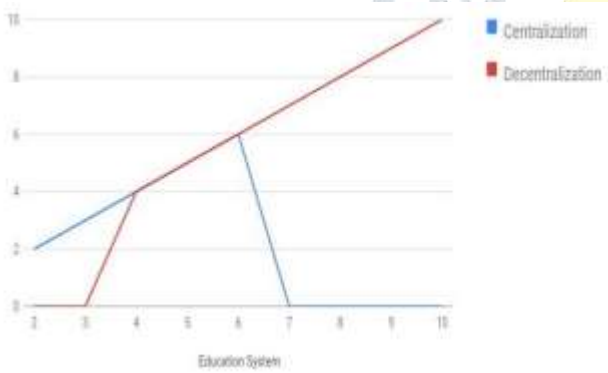
Cost Efficiency: With Tokenization: Tokenization reduces costs associated with traditional intermediaries by automating processes and streamlining transactions, leading to lower transaction fees and administrative expenses.

Without Tokenization: Educational asset management may incur higher costs due to manual processes and reliance on intermediaries, leading to higher transaction fees and administrative overhead.



COMPARISON OF CENTRALIZATION VS DECENTRALIZATION

In school systems, education is typically centralized, with curriculum development, teaching, and assessment managed by educational institutions or government authorities. A global education system enabled by blockchain can be decentralized, with educational content, credentials, and assessments stored on a distributed ledger accessible to learners worldwide. This decentralization allows for greater autonomy and diversity in educational offerings. Curriculum and Content: School systems often follow standardized curricula developed by educational authorities, with limited flexibility for customization based on individual learning needs or interests. A blockchain-based global education system can offer a wide range of educational content, including courses, tutorials, and learning materials, created and shared by educators and experts from around the world. Learners can access content tailored to their specific interests and learning goals.



CONCLUSION

In our proposed work, we study various models that represent a transformative leap in the realm of education technology. By integrating smart contracts and tokenization, the model introduces a decentralized and transparent system for managing educational assets. Through tokenization, educational credentials such as degrees, certificates, and courses are digitized and represented as tokens on a blockchain, ensuring their authenticity and ownership. Smart contracts govern the lifecycle of these assets, automating processes such as enrollment, certification issuance, and verification. Moreover, the pricing mechanism implemented within the model is dynamic and responsive, taking into account factors such as rarity, demand, issuer reputation, and

market dynamics. This ensures fair and efficient pricing of educational assets within the ecosystem. Additionally, the utilization of utility tokens within the platform facilitates seamless transactions, incentivizes participation Furthermore, the decentralized marketplace provided by the model empowers users to buy, sell, or trade educational tokens, fostering a vibrant ecosystem of learning and knowledge exchange. Overall, this blockchain-based education asset management pricing model holds the potential to revolutionize the education landscape, making quality education more accessible, verifiable, and inclusive for learners worldwide.

REFERENCE:

1. Haya Hasan , Khaled Salah," Proof of Delivery of Digital Assets Using Blockchain and Smart Contracts".
2. Yash Madhwal, Yari Borbon-Galvez, Niloofar Etemadi," Proof of Delivery Smart Contract for Performance Measurements".
3. Olexander Shmatko, Tetyana Borova, Serhii Yevseiev, Oleksandr Milov," Tokenization of educational assets based on blockchain technologies".
4. Nakka Murali Krishna, Dr K Raja Kumar," Assets Tracking System Using Blockchain".
5. Shilpa Agarkar, Ajit Kumar, Jayshri Patil," Non-Fungible Tokens (NFT) – Overview, Analysis, Application and Challenges".
6. Junqing Li, Mo Lan, Ying Tang, Shichao Chen, Fei-Yue Wang," A Blockchain-based Educational Digital Assets Management System".
7. Zibin Zheng, Shaoan Xie, Hongning Dai, Xiangping Chen, and Huaimin Wang," An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends ".
8. Gousia Habib , Sparsh Sharma , Sara Ibrahim , Imtiaz Ahmad , Shaima Qureshi and Malik Ishfaq ," Blockchain Technology: Benefits, Challenges, Applications, and Integration of Blockchain Technology with Cloud Computing".
9. Sidra Anwar, Sadia Anayat, Sheeza Butt ,Saher Butt ,Muhammad Saad ," Generation Analysis of Blockchain Technology: Bitcoin and Ethereum".
10. Julija Golosova , Andrejs Romanovs , "The Advantages and Disadvantages of Blockchain Technology".
11. Ziad Hussein , May A. Salama and Sahar A. El-Rahman,"Evolution of blockchain consensus algorithms: a review on the latest milestones of blockchain consensus algorithms"
12. Haya Hasan , Khaled Salah," Blockchain-based solution for proof of delivery of physical assets".