

EMPOWERING SCHOLARS: HARNESSING DECENTRALIZED CONTROL IN ACADEMIC PUBLISHING

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Abstract- The prevailing challenges in contemporary research paper publication, including centralization, limited access, prolonged distribution, high publication costs, lack of transparency, slow publication timelines, limited visibility for lesser-known researchers, copyright and ownership issues, inefficient peer review processes, and language barriers, prompt a transformative solution. This research proposes a modern system leveraging blockchain and smart contracts to revolutionize the traditional publication model. Employing Ethereum smart contracts, the proposed system expedites publication, mitigates bias in evaluations, and reduces costs. Innovative features enhance study quality, while the decentralized model ensures traceability and global accessibility for scientific papers with a nominal fee. The proposed system integrates tokenization to establish explicit author ownership and decentralized control, fostering efficient peer review through a token-based incentive structure. This inventive strategy aims to redefine research paper publication, promoting transparency, accessibility, and efficiency. The transformative system has the potential to reshape scholarly communication, unlocking new possibilities for the global propagation of research knowledge.

Key Words: Block Chain, Ethereum, smart contracts, tokenization, peer review, decentralize storage, transparency, accessibility.

I. INTRODUCTION

Scientific research is the cornerstone of knowledge advancement, driving innovation and progress across various disciplines. Central to the dissemination of research findings is the scientific publication system, where in scholars share their discoveries with the wider academic community through journals, conference proceedings, and other scholarly publications. These publications play a pivotal role in facilitating knowledge exchange, enabling researchers to build upon existing findings and contribute to the collective understanding of their respective fields. However, the current scientific publication system is fraught with challenges that hinder its effectiveness and integrity. One of the primary issues plaguing the system is the lack of transparency and efficiency in the publication process. Moreover, the conventional peer review process, is essential for ensuring the quality and credibility of published research, is susceptible to bias and inconsistencies.

The above discussed all problem leads to decrease the quality of scientific articles, slow the publication process and cause the publications not to be published in the right place in the

current publication system. Even sometimes, research reports that are not good enough can pass the tests, be accepted and, thus, become valid publications. In another situation, incorrect or nonexpert reviewers may be appointed for publication evaluation, which causes the article not to be evaluated correctly. Therefore, the evaluation process of publications takes a very long time. To address all these problems, blockchain-based systems have begun to be developed. In this research we are proposing a blockchain-based model which by using the decentralized Ethereum smart contracts to contribute solution to all addressed problems.

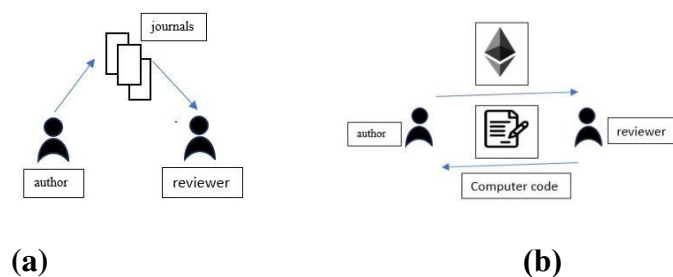


Fig. 1. (a) Traditional publication system

(b) Ethereum smart contracts-based publication system

To address these pressing issues and usher in a new era of transparency and efficiency in scientific publishing, blockchain-based solutions have emerged as promising alternatives. Blockchain technology, best known for its role in powering cryptocurrencies like Bitcoin, offers a decentralized and immutable platform for securely recording transactions and managing data. By leveraging blockchain and smart contract technology, researchers can revolutionize the publication process, ensuring transparency, integrity, and accessibility throughout the lifecycle of a research paper. Our model introduces a decentralized approach to manuscript management, wherein authors upload their work to the InterPlanetary File System (IPFS), generating a unique identifier for each submission. This decentralized storage solution ensures data integrity and accessibility while reducing reliance on centralized servers. Upon submission, manuscripts are seamlessly routed to chief editors who oversee the peer review process. Using smart contracts, reviewers are assigned based on their expertise and availability, mitigating issues with out-of-field reviewers and biased evaluations. Reviewer feedback is recorded transparently on the blockchain, providing an immutable record of the evaluation process.

By revolutionizing the scientific publication process through blockchain technology, our proposed model aims to address the inherent challenges of the current system and pave the way for a more transparent, efficient, and inclusive scholarly communication ecosystem. Through empirical validation and real-world implementation, we seek to demonstrate the viability and efficiency of blockchain-based solutions in transforming scientific publishing and advancing knowledge dissemination worldwide.

II. RELATED WORK

To clearly define the problem and to explain the solutions we first present how the current scientific publishing system works in detail. Then, what kind of challenges the current system faces are listed and how blockchain technology can decrease the current deficiencies is presented.

Scientific publishing stands as a cornerstone in disseminating research findings, contributing significantly to the intellectual landscape. The traditional publication system grapples with issues such as high costs, a slow and biased review process, copyright complexities, inadequate rewards for contributors, and a lack of interconnectivity among researchers.

Challenges in Traditional Scientific Publication:

- 1) High Publication Costs:** The traditional scientific publication system is marred by exorbitant costs, limiting accessibility to valuable research. Authors often face financial barriers, hindering the dissemination of knowledge to a wider audience.
- 2) Slow and Biased Review Process:** The peer-review process, a cornerstone of scientific rigor, is fraught with issues of sluggishness and bias. These challenges compromise the timely dissemination of critical scientific findings and may introduce inherent prejudices in the evaluation process.
- 3) Copyright Complexities:** Copyright constraints imposed by publishers impede the free exchange of ideas and hinder the progress of scientific discourse. The control exerted by publishers over intellectual property rights poses challenges to collaboration and knowledge dissemination.
- 4) Lack of Rewards for Contributors:** Contributors to scientific publications often face a lack of tangible rewards, discouraging sustained engagement and commitment.

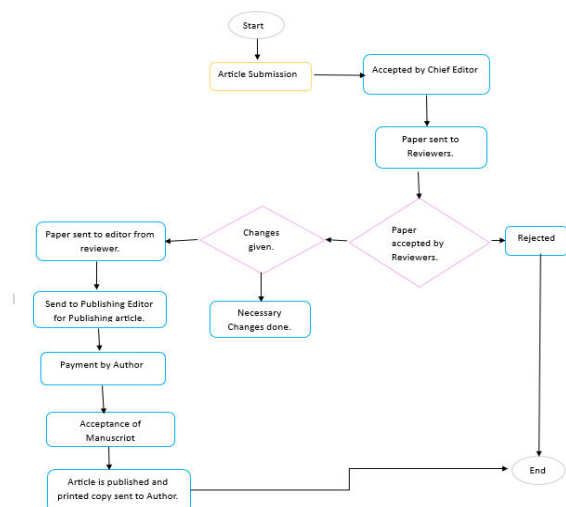


Fig. 2. The proposed traditional publication system

Scientific publishing plays a pivotal role in advancing knowledge, yet the industry is confronted with various challenges that impede the progress and efficiency of the publication process. This paper delves into the issues plaguing the traditional scientific publication system, such as exorbitant publication costs, a protracted and biased review process, copyright complexities, and a lack of incentives for contributors. Moreover, it explores the absence of seamless connectivity among researchers as a hindrance to collaborative efforts. Against this backdrop, the study introduces the innovative concept of blockchain-based publishing systems as potential solutions to these challenges.

Blockchain, a decentralized and distributed ledger, offers transparency and trustworthiness through its proof-of-work model. Smart contracts, operating on platforms like Ethereum, enhance decentralization by automating agreements. This technology has been applied across various sectors, including scientific publishing, where platforms like have begun sharing knowledge. Our paper presents a comprehensive exploration of a blockchain-based scientific publishing system, offering detailed insights not found in existing literature. The proposed platform, detailed in utilizes Ethereum-based smart contracts to automate processes, reducing bias in peer reviews, improving paper quality, and minimizing costs and publication time. Authors submit articles through a web application, and the platform verifies authorship via blockchain, using smart contracts for payment and providing an initial paper version. The system streamlines journal selection, editor, and reviewer assignments, updating requests, and final publication, with plans to further automate the entire process in later versions.

III. METHODOLOGY

A. System Design and Architecture

The system design and architecture for the decentralized transparency model in scientific publishing will be composed of several key components working together to facilitate document

submission, review, and publication. The architecture will leverage IPFS for decentralized document storage and Ethereum blockchain for transparent transaction management. Below is an overview of the system design and architecture:

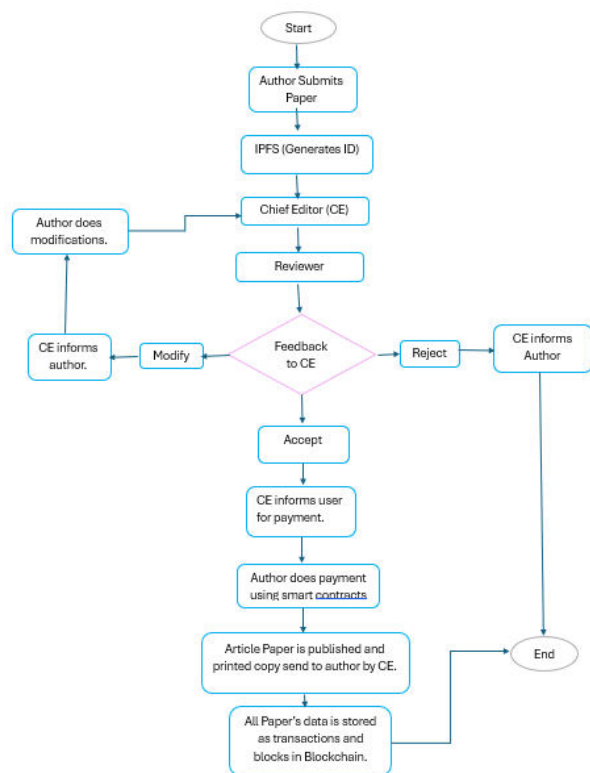


Fig. 3. The proposed blockchain-based publishing system.

B. System Workflow

Authors submit their research papers through the author interface, which generates unique IPFS hashes for storage. Chief editors assign reviewers who access papers via the reviewer interface to provide feedback. Publication decisions are made based on this feedback, and authors proceed with payment via Ethereum smart contracts. Upon payment confirmation, ownership transfers to the publishing organization, while authors retain credit. Papers are publicly accessible on the IPFS network, ensuring transparent and secure data flow throughout the process.

C. Security and Transparency

IPFS ensures decentralized and censorship-resistant document storage. Ethereum blockchain provides transparency and immutability for transactions and ownership transfer. Smart contracts automate payment processing and ensure trustless interactions between parties.

D. Scalability and Performance

The system architecture is designed to be scalable, leveraging the distributed nature of IPFS and Ethereum. Performance optimizations will be implemented to ensure fast document retrieval and transaction processing.

IV. IMPLEMENTATION

In the above figure 3 our proposed model comprises of three main components: front-end, back-end, and smart contracts work together to streamline the publication process while reducing costs and increasing the availability of scholarly content.

A. Front-End Development

1) Decentralized Application (DApp) Development:

We developed a decentralized application (DApp) for engaging with the Ethereum blockchain. Using the Solidity programming language created smart contracts, with HTML, CSS, we created a user interface and web3.js is used to connect smart contracts with user interface. Additionally, we incorporated DApp browsers utilizing the MetaMask extension, allowing users to submit their manuscripts directly to the smart contract.

2) Registration and Login Modules:

In our framework, users register using their unique MetaMask account IDs, eliminating the need for additional user IDs. Following registration, users provide relevant information such as name, role like author, register. Once registered, users can sign in directly to the system using their MetaMask account credentials.

3) Paper Submission and Status Modules:

Authors navigate to the paper submission module to upload their manuscripts and submit them to the system. The manuscript is stored on the IPFS network, and an ID is generated for reference. Authors can track the status of their submitted articles using the article status module.

4) Reviewer Assignment and Review Submission Modules:

A manager, or editor, assigns submitted articles to corresponding reviewers. After filling in relevant fields, the manager selects an article and assigns reviewers, who then evaluate the manuscript and provide feedback. Reviewers have the option to submit their comments as files, facilitating a comprehensive review process.

5) Payment Module:

Based on the feedback given by reviewer the manager or editor ask author to pay publication fees using the Scientific Journal Platform (SJP) token, connecting their MetaMask account for secure transactions otherwise share a message to author paper is not accepted.

By customizing our front-end development to align with the specific requirements of our decentralized transparency model, we create an engaging and user-centric interface that enhances the overall usability and accessibility of the publication platform.

B. Back-End Development

In our decentralized transparency model, the back-end infrastructure plays a crucial role in managing data and facilitating communication between different system components. Here's how we tailored our back-end development to align with the objectives of our project:

1) Database Management:

In our decentralized transparency model, we adopt a novel approach to database management utilizing the Inter Planetary File System (IPFS). IPFS serves as a distributed database, offering a decentralized and censorship-resistant solution for storing related documents and information. Instead of relying on a traditional centralized SQL database, IPFS provides a decentralized repository for manuscript details, user information, and other relevant data.

2) API Integration:

The front-end interacts with the database via REST API JSON protocols. By implementing RESTful APIs, we establish a standardized communication interface, allowing smooth data exchange between the user interface and the back-end database. This ensures flexibility, scalability, and compatibility across different platforms and devices.

3) Testing Environment:

For local testing purposes, we utilize an open-source platform known as Ganache. This platform enables us to simulate the Ethereum blockchain environment locally, facilitating the testing of smart contracts without incurring any costs. Through Ganache, we verify the functionality and integrity of our smart contracts, ensuring they operate as intended before deployment to the live network.

By customizing our back-end development to suit the specific requirements of our decentralized transparency model, we establish a robust and reliable infrastructure capable of supporting efficient and transparent publication processes.

C. Smart Contracts Integration

We've integrated smart contracts into our Asp.Net-based DApp, enabling users to submit manuscripts through MetaMask-compatible browsers. Adhering to ERC-20 standards, we've implemented transfer functions for SJP token transactions. These smart contracts verify balances and manage transaction approvals, ensuring secure and efficient interactions on the Ethereum blockchain. Through this integration, users can securely initiate transactions, such as manuscript

submissions and payments, while maintaining transparency and integrity within the decentralized platform.

V. RESULTS AND ANALYSIS

The integration of blockchain-based smart contracts in our research revolutionized the scientific publication process, leading to enhanced transparency, efficiency, and quality. Authors experienced streamlined manuscript submission, faster peer review cycles, and improved access to reputable journals, marking a significant advancement in scholarly communication.

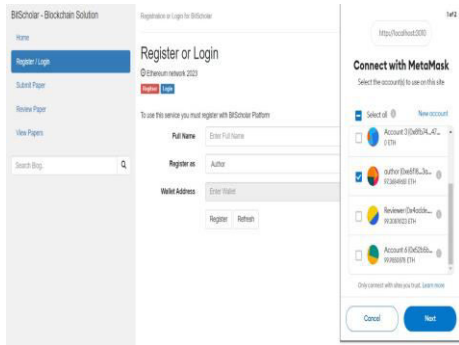


Fig 4. Connecting with MetaMask

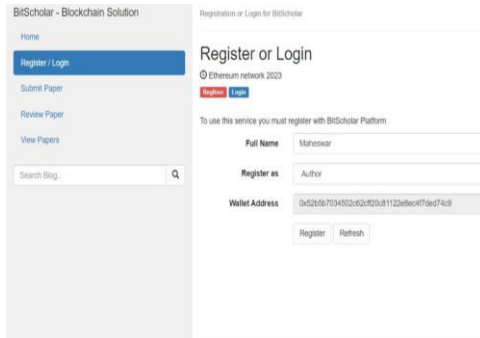


Fig 4.1. Registration and Login page

The screenshot shows the 'Submit a New Paper' form in the BitScholar system. The form includes fields for 'Title of the Paper' (filled with 'Bitscholar'), 'Enter Keywords (with space)' (filled with 'blockchain'), and 'Enter your research paper id' (filled with a long alphanumeric string). There are also fields for 'Author Name' (filled with 'Maheswar') and 'Registered as' (filled with 'Author'). A 'Submit Paper' button is visible at the bottom of the form.

Fig 4.2. Paper submission by author

The screenshot shows the 'Paper Name: Bitscholar' page. It displays the paper's status as 'SUBMITTED', a 'Download Link', and buttons for 'Send to Reviewer' and 'Subject Paper'. The author's name is listed as 'Maheswar' and the account ID is '0x52b5b7034502c62c2ff20c81122E8Ee4f7ded74c9'. The review status is 'NONE'.

Fig 4.3. Paper received by editor.

The screenshot shows the 'Paper Name: Bitscholar' page from the author's perspective. It displays the paper's status as 'LATEST', a 'Download Link', and buttons for 'Send to Reviewer' and 'Subject Paper'. The author's name is listed as 'Maheswar' and the account ID is '0x52b5b7034502c62c2ff20c81122e8ec4f7ded74c9'. The review status is 'None'.

Fig 4.4. Status of paper tracking by author

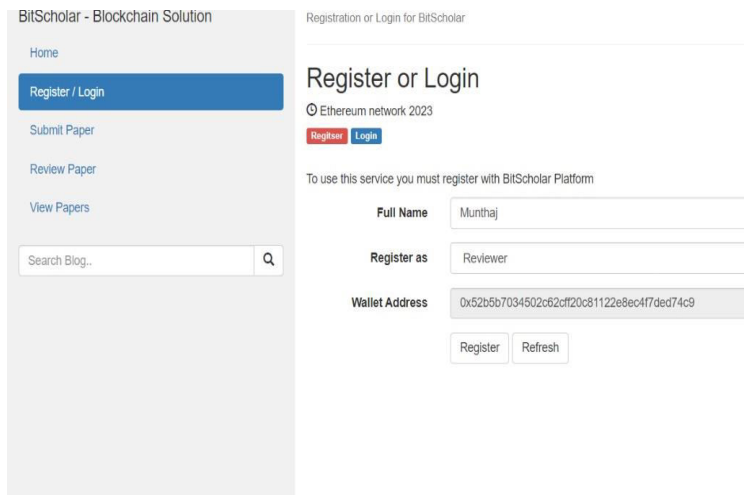


Fig 4.5. Login as Reviewer

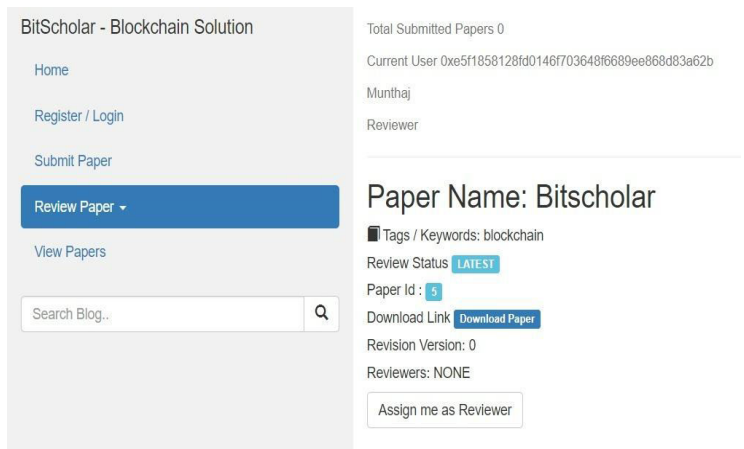


Fig 4.6. Reviewer receives paper from editor.

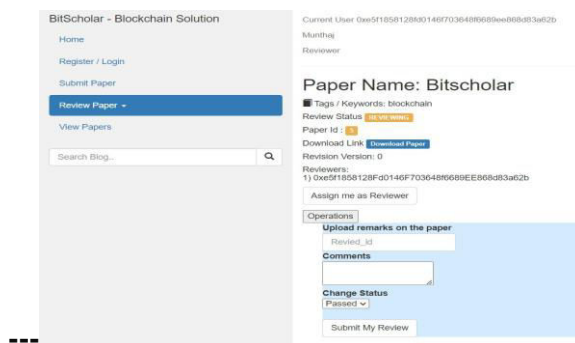


Fig 4.7. Reviewer submitting review about paper

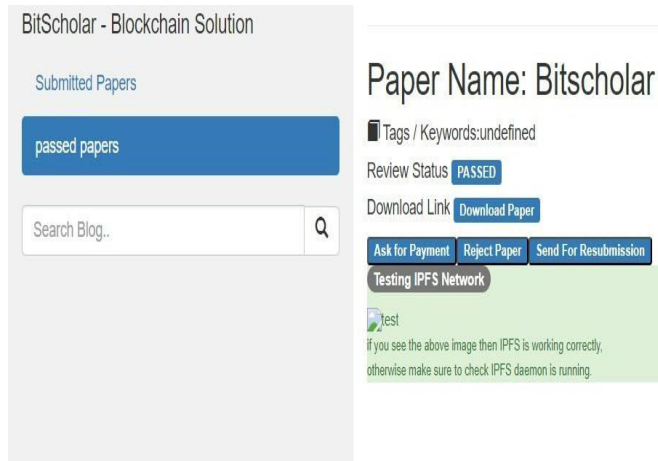


Fig 4.8. Editor make decision according to review status

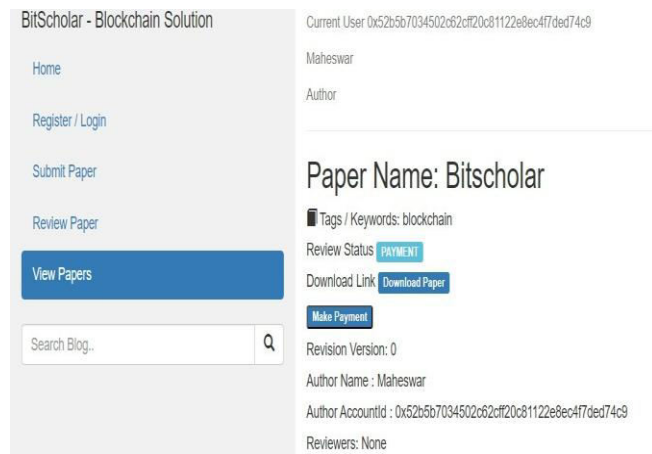


Fig 4.9. Editor asking payment to author for publishing paper.

BitScholar - Blockchain Solution

- Home
- Register / Login
- Submit Paper
- Review Paper
- View Papers

Search Blog..

Total Submitted Papers 1

Current User 0xe5f1858128fd0146f703648f6689ee868d83a62b

Maheswar

Reviewer

Paper Name: Bitscholar

Tags / Keywords: blockchain

Review Status PUBLISHED

Download Link [Download Paper](#)

Revision Version: 0

Author Name : Maheswar

Author AccountId : 0xe5f1858128fd0146f703648f6689ee868d83a62b

Reviewers:

1) 0x4ADde9bCF32ED91120A415BeB7d90DB7B12878C4

Fig 4.10. Paper published by editor.

| EVENT NAME | CONTRACT | TX HASH | LOG INDEX | BLOCK TIME |
|-----------------------|------------|---|-----------|---------------------|
| PaymentMade | Papers | 0-b4168b79f7429f08355e87ca351de975abed541fa3d093d46e311a6d88d30 | 0 | 2024-03-23 23:48:22 |
| assignedReviewerEvent | Papers | 0-26f9f50a183bde4d3d9f2bc33bc6e02b679c7129a71a33303e0191a7f680 | 0 | 2024-03-23 23:32:17 |
| adReviewEvent | Reviewer13 | 0-680f941752b67af805466760596391a6413d918aa6d3389746517232f564 | 0 | 2024-03-23 23:32:17 |
| assignedReviewerEvent | Papers | 0-5536353a44567d9f68177c27f594b633f2d987626a452649f11f639335 | 0 | 2024-03-23 23:29:18 |

Fig 4.11. Transactions information of publications in ganache

VI. CONCLUSION

In summary, our project introduces a groundbreaking decentralized transparency model powered by blockchain technology to address shortcomings in traditional scientific publication systems. Through Ethereum smart contracts and IPFS integration, we streamline the publication process, ensuring cost reduction and increased accessibility. Authors can securely submit manuscripts, while transparent evaluations by editors and reviewers enhance fairness. The utilization of SJP tokens enables seamless transactions and rewards contributors. Emphasizing author ownership and equitable rewards, our system fosters collaborative scholarly communication. With its innovative framework, our project aims to revolutionize scientific publishing, fostering transparency, accessibility, and integrity in disseminating research findings for the advancement of knowledge.

VII. FUTURE SCOPE

The future scope of our project involves advancing blockchain technology for scientific publishing, aiming to enhance transparency, efficiency, and accessibility. Potential avenues include integrating machine learning for automated document evaluation, expanding language and file format support, and fostering collaboration with academic institutions for broader adoption. Continuous research and development will drive innovation to address evolving challenges in scholarly communication, ensuring our platform remains at the forefront of revolutionizing scientific publishing practices for the benefit of the global research community.

VIII. REFERENCES

- [1] Sanka, M. Irfan, I. Huang, and R. C. C. Cheung, "A survey of breakthrough in blockchain technology: Adoptions, applications, challenges and future research," *Comput. Commun.*, vol. 169, pp. 179–201, Mar. 2021.
- [2] M. Javaid, A. Haleem, R. P. Singh, S. Khan, and R. Suman, "Blockchain technology applications for Industry 4.0: A literature-based review," *Blockchain: Res. Appl.*, vol. 2, Aug. 2021, Art. no. 100027.
- [3]. S. Shi, D. He, L. Li, N. Kumar, M. K. Khan, and K.-K.-R. Choo, "Applications of blockchain in ensuring the security and privacy of electronic health record systems: A survey," *Comput. Secur.*, vol. 97, Oct. 2020, Art. no. 101966
- [4] A. Ladia, "Blockchain: A privacy centred standard for corporate compliance," *IT Prof.*, vol. 23, no. 1, pp. 86–91, Jan. 2021.
- [5] M. Westerkamp, F. Victor, and A. Küpper, "Tracing manufacturing processes using blockchain-based token compositions," *Digit. Commun. Netw.*, vol. 6, no. 2, pp. 167–176, May 2020.
- [6] Li, J., Wang, Q., Peng, Y., & Jin, Y. (2019). A Blockchain-Based Framework for Data Sharing with Fine-Grained Access Control in Decentralized Storage Systems. *IEEE Transactions on Services Computing*, 12(4), 635-646.
- [7] Nazir, S., Khan, S. U., & Salah, K. (2021). Blockchain-based Decentralized Framework for Ensuring Data Integrity in Next-Generation Healthcare Systems. *IEEE Access*, 9, 60690-60702.
- [8] Guo, Z., Wang, J., & Wu, L. (2020). A Blockchain-based Secure Data Sharing Scheme in Cloud-assisted Industrial IoT. *IEEE Internet of Things Journal*, 7(6), 5104-5115.
- [9] Pournajaf, L., & Razzazi, F. (2020). Blockchain-Based Secure Data Sharing Scheme in Smart Grid. *IEEE Transactions on Industrial Informatics*, 16(12), 7965-7973.
- [10] Kharitonov, A., & Kharitonov, V. (2022). Blockchain-Based Secure Data Sharing Framework for Smart Cities. *IEEE Access*, 10, 25276-25285.

[11] Liu, Z., Wu, Y., Fan, J., Li, H., & He, R. (2022). Blockchain-Based Smart Contract for Secure Data Sharing in Cloud-Assisted Industrial Internet of Things. *IEEE Transactions on Industrial Informatics*, 18(3), 1973-1983.

[12] Zhang, Y., Wang, Y., Zhang, S., & Zhang, Y. (2022). Blockchain-Based Secure Data Sharing Scheme for Healthcare Internet of Things. *IEEE Internet of Things Journal*, 9(3), 1884-1892.