IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 16, May 2023

Block-Chain Framework for Educational Domain and its Benefits

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Abstract: *Blockchain technology has gained significant attention in recent years due to its potential to revolutionize various industries. In the educational domain, a blockchain-based framework has emerged as a promising solution with several benefits. This paper explores the concept of a blockchain-based framework for the educational domain and highlights its benefits. The framework focuses on areas such as credential verification, academic records and transcripts, anti-fraud measures, micro-credentialing, secure assessments, and efficient data sharing. By leveraging blockchain technology, educational institutions can enhance transparency, security, and efficiency in these areas. Credential verification becomes more reliable and tamper-proof as digital credentials are stored on the blockchain. Academic records and transcripts can be securely shared between institutions, simplifying the transfer process and reducing administrative burdens. Blockchain's immutability and cryptographic security features help combat issues like fake degrees or certificates, ensuring the authenticity of educational qualifications.*

The framework also enables the issuance and management of micro-credentials, reflecting specific skills or knowledge. By recording these credentials on the blockchain, individuals can have a comprehensive and verifiable record of their lifelong learning achievements. In the assessment process, blockchain technology enhances security and integrity by preventing data manipulation or cheating. The framework provides a decentralized and transparent platform for storing question banks, exam results, and assessments. Furthermore, blockchain-based frameworks facilitate secure and efficient sharing of educational resources, research findings, and collaborations. Smart contracts automate processes such as copyright permissions, royalty distributions, and collaborative project agreements, ensuring transparency and fairness. While the benefits of a blockchain-based framework in education are promising, challenges regarding technical implementation, scalability, cost-effectiveness, and privacy must be addressed. Further research and development are needed to explore these aspects and enable widespread adoption of blockchain solutions in the educational domain.

Keywords: Block chain technology, Education, Applications, smart contacts, Blockchain Framework

I. INTRODUCTION

Blockchain technology, which was introduced in 2008, initially gained popularity through its application in registering Bitcoin cryptocurrency transactions on a ledger. The primary objective of blockchain was to enable direct transactions between users without the need for a third-party intermediary. As Bitcoin grew in popularity, researchers and practitioners began realizing the vast potential of blockchain beyond cryptocurrencies. Its unique features, such as immutability, transparency, and trustworthiness, proved to be valuable in various fields. Consequently, an increasing number of blockchain-based applications have been developed across different industries.

This paper aims to explore the implementation of blockchain in various fields and its potential applications in education. It focuses on three main themes:

Blockchain-based educational technologies: This theme explores how blockchain can enhance educational systems and technologies. It investigates the opportunities that blockchain technology could bring to education, such as secure credentialing, decentralized learning platforms, and transparent educational records.

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Opportunities in education: The paper delves into the specific opportunities that arise from integrating blockchain technology in the field of education. It examines how blockchain can facilitate efficient record-keeping, streamline administrative processes, improve data security, and foster trust between educational institutions, employers, and learners.Complexities of implementing blockchain in education: This theme addresses the challenges and complexities associated with implementing blockchain technology in educational settings. It discusses factors like scalability, interoperability, privacy concerns, regulatory considerations, and the need for collaboration among stakeholders for successful blockchain integration.

The paper also highlights document authentication as a critical topic in the context of blockchain implementation. Document authentication often involves laborious and time-consuming procedures. Blockchain technology can simplify this process by providing a secure and transparent means of verifying various types of documents, including banking notes, government documents, transaction records, and educational certificates.

II. BLOCKCHAIN TECHNOLGY

A blockchain is a clever innovation that is persistently developing and being applied in different domains. Its initiation is from therenowned digital currency, it was utilized exclusively for monetary exchanges, however presently it is being utilized or being proposed in each area that needs changeless and secure record-keeping or record. A Blockchain is a chain of blocks which contain data. The information which is put away inside a block relies upon the kind of blockchain.

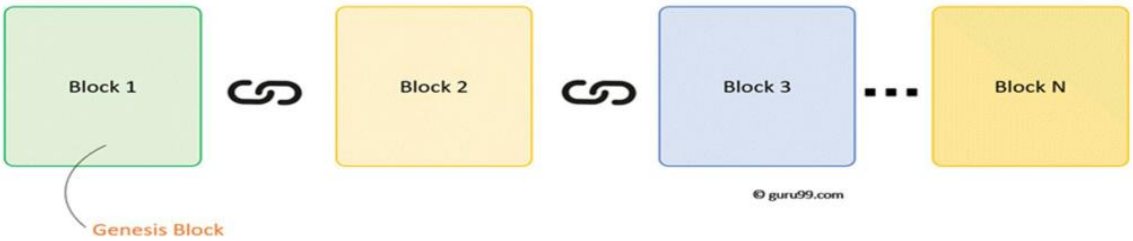

Figure-1: BLOCKCHAIN

III. BLOCKCHAIN FRAMEWORK

A blockchain framework refers to a software architecture or platform that provides the necessary tools, libraries, and protocols to build and deploy blockchain-based applications. These frameworks offer a foundation for developers to create and customize blockchain networks according to their specific requirements. Here are some popular blockchain frameworks:

- Ethereum: Ethereum is a blockchain framework that supports the development of decentralized applications (DApps) and smart contracts. It provides a Turing-complete programming language called Solidity and offers a robust development environment with tools like Truffle and Remix.
- Hyperledger Fabric: Hyperledger Fabric is an open-source blockchain framework hosted by the Linux Foundation. It is designed for enterprise use cases and offers a modular architecture, permissioned network model, and support for private and confidential transactions. Fabric provides a rich set of APIs and SDKs for application development.
- Corda: Corda is a blockchain framework developed by R3 specifically for financial and enterprise applications. It focuses on privacy, security, and interoperability, and uses a "shared ledger" model to enable direct transactions between parties. Corda supports smart contracts written in various programming languages.
- Quorum: Quorum is an open-source blockchain framework developed by J.P. Morgan. It is based on the Ethereum codebase and is designed for private and consortium networks. Quorum offers features like privacy enhancements, faster transaction processing, and support for permissioned voting.
- Stellar: Stellar is a blockchain framework designed for facilitating fast and low-cost cross-border transactions and decentralized exchanges. It supports the issuance and transfer of digital assets, making it suitable for financial applications.

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- EOSIO: EOSIO is a blockchain framework that provides high throughput and scalability for decentralized applications. It features a delegated proof-of-stake (DPoS) consensus algorithm and supports smart contract development using the C++ programming language.
- Tendermint: Tendermint is a Byzantine fault-tolerant consensus engine that can be used as a blockchain framework. It provides a high-performance, secure, and modular architecture for building custom blockchain applications.

IV. TYPES OF BLOCKCHAIN

1. Public Blockchains: Public blockchains are open and permissionless networks where anyone can participate, validate transactions, and contribute to the consensus mechanism. Examples include Bitcoin and Ethereum. Public blockchains offer high decentralization and security but may have scalability limitations.
2. Private Blockchains: Private blockchains are restricted networks where participation and access are controlled by a centralized authority or a consortium of trusted entities. These blockchains are often used by organizations for internal purposes, such as supply chain management or record-keeping. Private blockchains provide more control, privacy, and scalability compared to public blockchains.
3. Consortium Blockchains: Consortium blockchains are a hybrid between public and private blockchains. They are governed by a consortium or a group of organizations with shared interests. Consortium blockchains offer a higher level of decentralization compared to private blockchains but have restricted participation limited to consortium members.
4. Permissioned Blockchains: Permissioned blockchains require participants to obtain permission or specific credentials to join the network and perform certain actions, such as validating transactions or accessing data. These blockchains are often used in enterprise settings, providing controlled access, higher efficiency, and privacy.
5. Hybrid Blockchains: Hybrid blockchains combine elements of both public and private blockchains. They allow for both public participation and private governance, providing flexibility and scalability for various use cases. Hybrid blockchains can enable selective transparency and data privacy based on specific requirements.
6. Sidechains: Sidechains are separate chains that run parallel to the main blockchain, connected to it through two-way pegs. They enable the development of additional features or experimentation without affecting the main blockchain's performance or security. Sidechains can facilitate scalability and introduce new functionalities to the blockchain ecosystem.
7. Federated Blockchains: Federated blockchains are governed by a group of pre-selected entities or nodes that collectively make decisions regarding block validation and consensus. This type of blockchain offers a balance between decentralization and scalability, with a smaller number of trusted validators.

V. BLOCKCHAIN FEATURES

- Decentralization: Blockchain operates on a decentralized network of nodes, where no single central authority has complete control. Instead, multiple participants (nodes) maintain and validate the blockchain, ensuring transparency and reducing the reliance on a central entity.
- Immutability: Once data is recorded on a blockchain, it becomes extremely difficult to alter or delete. Each block in the chain contains a cryptographic hash that depends on its content and the hash of the previous block, creating a tamper-evident structure. This immutability ensures data integrity and establishes trust within the network.
- Transparency: Blockchain provides transparency by allowing all participants in the network to have access to the same set of data. Each transaction or data entry on the blockchain is visible to all participants, promoting accountability and auditability. However, depending on the type of blockchain, privacy features can be implemented to restrict access to sensitive information.
- Security: Blockchain employs advanced cryptographic techniques to secure data and transactions. Consensus mechanisms, such as Proof of Work (PoW) or Proof of Stake (PoS), ensure that transactions are validated and

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added to the blockchain in a secure manner. Additionally, the decentralized nature of blockchain makes it more resilient to attacks and data manipulation.

- Trust: Through its decentralized and transparent nature, blockchain technology enhances trust among participants. The consensus mechanisms and cryptographic techniques employed by blockchain ensure that transactions and data are verified and validated by multiple participants, reducing the need for trust in intermediaries.
- Efficiency and Speed: Blockchain has the potential to streamline processes and reduce intermediaries, leading to increased efficiency and faster transaction times. Smart contracts, self-executing digital contracts stored on the blockchain, automate agreement terms and facilitate direct peer-to-peer interactions, eliminating the need for intermediaries in certain cases.
- Scalability: Blockchain technology has faced scalability challenges due to the computational and storage requirements of maintaining a distributed ledger. However, ongoing research and the development of layer-two solutions, such as sidechains and off-chain channels, aim to address scalability concerns and increase the throughput of blockchain networks.

C. Blockchain Applications and Use Cases Blockchain has been proposed to be used in different applications and use cases, as shown in Figure

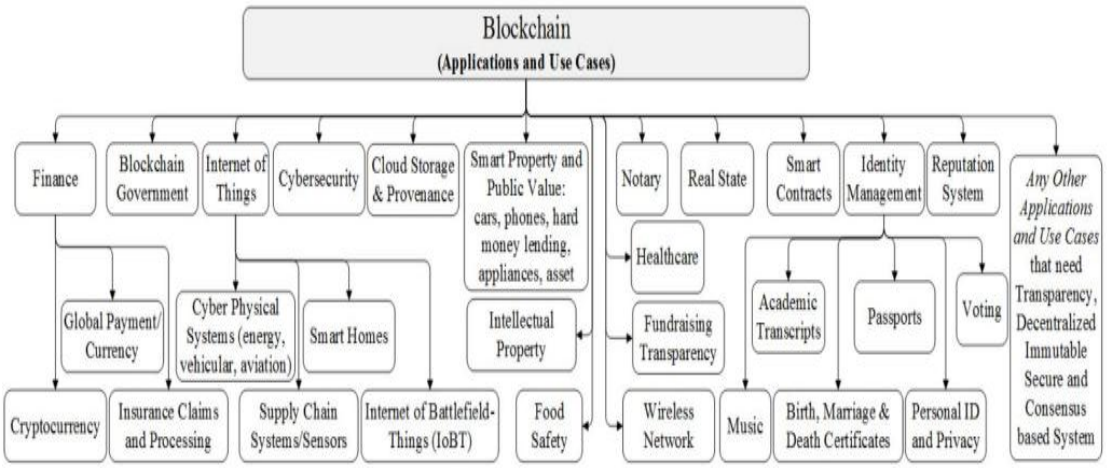

FIG-2 BLOCKCHAIN APPLICATION, USE CASES

Blockchain technology has expanded beyond its initial application in cryptocurrencies, and numerous industries have recognized its potential to revolutionize various processes. Here are some notable applications and use cases of blockchain:

8. Financial Services: Blockchain technology has transformed the financial industry, offering faster and more secure transactions, reducing costs, and improving transparency. It enables efficient cross-border payments, remittances, smart contracts for automated agreements, decentralized lending, and decentralized exchanges.
9. Supply Chain Management: Blockchain provides end-to-end visibility and traceability in supply chains, ensuring transparency and authenticity. It enables tracking and verification of products at each stage, preventing counterfeiting, enhancing product provenance, optimizing inventory management, and facilitating ethical sourcing.
10. Healthcare: Blockchain has the potential to improve healthcare data management, interoperability, and patient privacy. It enables secure sharing of medical records among healthcare providers, ensures data integrity, facilitates clinical trials and research, and enhances drug supply chain management, reducing the risk of counterfeit medications.
11. Identity Management: Blockchain can revolutionize identity management by providing a decentralized and tamper-resistant platform. It allows individuals to control their identities, selectively share personal information, and mitigate risks associated with identity theft and fraud.

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12. Voting Systems: Blockchain-based voting systems offer transparent, immutable, and secure voting records, reducing the risk of tampering and enhancing trust in elections. It can enable remote and online voting, streamline the counting process, and increase voter turnout.
13. Intellectual Property Protection: Blockchain can provide a decentralized platform for registering and protecting intellectual property rights. It creates an immutable record of ownership and timestamps for digital assets, ensuring proof of creation and ownership.
14. Energy Sector: Blockchain technology can facilitate peer-to-peer energy trading, enabling direct transactions between energy producers and consumers. It can improve energy grid management, enable renewable energy certificate trading, and enhance transparency in carbon credit markets.
15. Real Estate: Blockchain offers a secure and transparent platform for real estate transactions, reducing fraud and streamlining property transfers. It enables efficient and tamper-proof record-keeping of property titles, rental agreements, and property sales.
16. Education: Blockchain has the potential to revolutionize credentialing and academic records. It can provide secure and verified digital certificates, enabling lifelong learner records, enhancing employability, and simplifying the verification process for employers and educational institutions.
17. Charity and Philanthropy: Blockchain can increase transparency and accountability in charitable organizations by ensuring that funds are tracked and allocated to specific projects. It enables donors to have visibility into the impact of their contributions and promotes trust in the philanthropic sector.

VI. BLOCKCHAIN IN EDUCATION

The Blockchain can assist instructive establishments with reinforcing their capacity to help educators, convey information to mentors and local area individuals, enable new learning frameworks, and extend and give learning open doors to additional student. Figure 1b portrays the general construction of Blockchain and clients in the space of schooling. There are a few purposes and benefits of utilizing
blockchain innovation in the field of schooling:

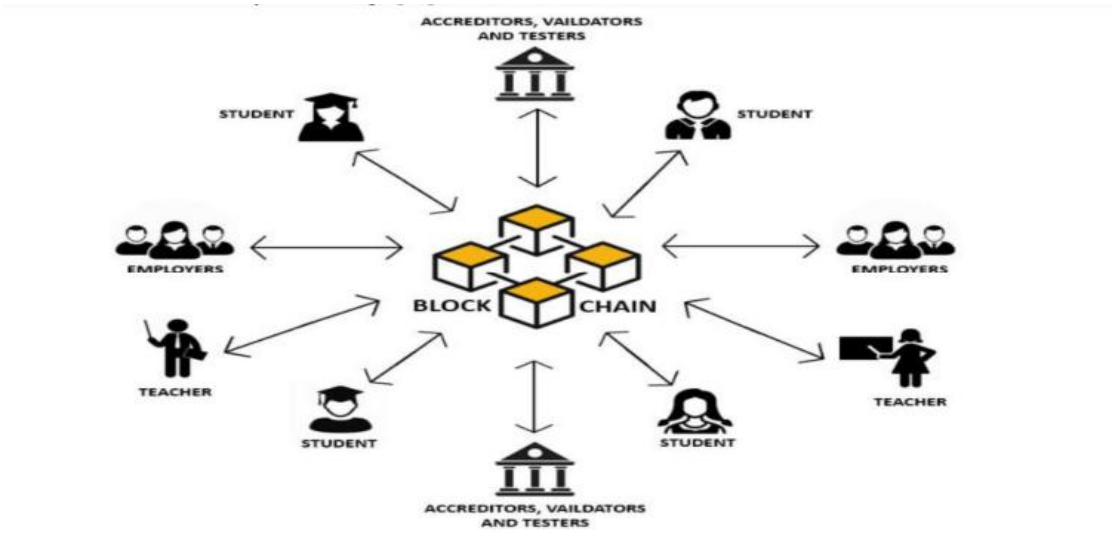

Figure 3 Blockchain in Education

6.1 Online Education

Online schooling, otherwise called distance learning or electronic learning, utilizes information and web innovation to convey data furthermore, work with learning. It's alluded to as an electronic learning strategy. With blockchain innovation, an optimal answer for on the web learning issues, for example, authenticity and assurance, will be advertised. The Blockchain will likewise make non-modifiable learning reports for internet educating without the requirement for outsider oversight, guaranteeing that course credits are satisfactorily perceived.

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6.2 Student Records

Scholastic records are quite possibly of the most tedious and work escalated process in advanced education. Every section should be physically checked for legitimacy before an approved record of an understudy's grades is accessible. Course satisfied accreditation is another kind of understudy record that is frequently looked for. Each page ought to be marked and stepped for every understudy who demands this record (to guarantee exactness). In the event that material courses and scholarly achievements were put away on a blockchain, an individual could get an precise, verified record with only a couple of taps.

6.3 Diplomas and Certificates

Recognitions and testaments for student could be given and put away on a blockchain, similar as grades. Bosses will then, at that point, need to be given a reference to a computerized declaration as opposed to requiring the organization that gave the certificate to confirm a paper duplicate. It is additionally in progress. Since the greater part of the accessible enlightening certification organizations can't ensure the privacy and unwavering quality of understudy information. In spite of the fact that utilizing Blockchain to address certainty issues could be a suitable arrangement, Blockchain has downsides that cutoff its finished reception. Little throughput and access time are found in Blockchain. It prevents clients from utilizing counterfeit degrees or endorsements to potential managers or foundations for advanced education.

6.4 Badges

Beside degrees, a standard resume gives an abundance of extra subtleties that businesses can view as supportive. We're discussing characteristics like unknown dialect capability, designing ability, or special gifts that aren't intrinsically pertinent to one's occupation. Nonetheless, these capacities are hard to demonstrate. Nonetheless, an individual might employ an outsider expert to approve their skill and issue a certification or identification. Assuming these are put away on a blockchain, they can be utilized to show that an individual has the essential abilities. Open Identification Visa, for instance, is the most important phase toward this path.

6.5 Student Examination and Evaluation

Student will then step through the examination remotely utilizing PCs or cell phones, with the Blockchain playing out the assessment. Instructors would have additional opportunity to commit to other academic or social pursuits on the off chance that they didn't need to grade tests. Instructors can utilizesavvy contract and Blockchain with characterizing the right responses and scoring standards for assessment. Understudy's will then, at that point, show up for the assessment on their PC or gadgets. Student' scholarly achievement and scholastic accomplishments in schooling, readiness, competitions, work, and different occasions beyond school can be estimated utilizing blockchain advancements to survey their capacity, which benefits the two student and organizations hoping to enlist them. A blockchain-based understudy specialized expertise evaluation framework that can test understudy capacity estimation strategies utilizing a grouping calculation. The structure can likewise consider the improvement of an understudyability appraisal environment.

6.6 Examples and Courses

Numerous blockchains additionally support smart contracts. It guarantees that illustrations and courses can be coded into the Blockchain and run precipitously when those rules are experienced. An educator might allocate student tasks. The brilliant agreements on the Blockchain could check the execution of every mission consequently. Educators could be paid in crypto tokens for completing all tasks, and student can get credits. This strategy might be utilized to format entire classes too.

6.7 Identity

With the proliferation of learning applications and administrations, personality the board is becoming essential in schooling. Stages like uPort assist clients with hefting their personality around with them, transferred to the organization, and effectively open. Character the board is very significant in schooling. It empowers schools to:

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1) Work with viable admittance to various frameworks like charging, flask use, looking at books from the library, and so forth.
2) Fulfill expanded state and government administrative prerequisites.
3) Offer the most recent IT frameworks to staff and student.
4) Keep instructive accreditations secure.
Rather than putting away the understudy character record, the blockchain stores data about that archive. Utilizing blockchain, studentcan distinguish themselves online while keeping up with command over the capacity and the board of their own information.

6.8 Attendance and Assignment Completion Tracking

Blockchain gets understudy information and further develops the data recovering cycle for student' participation, task consummation following, and so on. As blockchain networks save all the data about student and their accomplishments, it is feasible to follow their progress in learning and different exercises. Over the long haul, this will direct instructive organizations to roll out vital improvements in the instructive cycle.

6.9 Infrastructure Security

Right now, instructive organizations are confronted with the test to shield their organizations from programmers. As currently referenced, blockchain innovation offers a solid organization and it is difficult to counterfeit the data put away in the blockchain. Organizations likeXage are utilizing blockchain's sealed record that safeguards each component, including new and inheritance frameworks, and gets each association, empowering dynamic information security.

6.10 Efficient Data Storage

Instructive foundations nowadays store more information than any other time in recent memory. The distributed ledger technology(DLT) distributed storage offers more secure and possibly less expensive choices for putting away and recovering information. For instance, Document coin is a prominent crypto project that rewards the facilitating of documents. It interfaces the world with another capacity model, making hyper-nearby and productive capacity.

6.11 Rearrangements of Records

The executives Blockchain innovation in K-12 takes out paper-based processes and improves on record management. It is more than reasonable forrecords like student' declarations, certifications, and records. As well as scrambling records, blockchain offers a method forrecording and following the expansiveness of an understudy's growth opportunities.

6.12 Next-Generation Library Platform

Blockchain is viewed as an establishment in the cutting edge library stage. It offers a substantially more effective and simpler approach to collect, monitor, and store data. That is a gigantic benefit which could be utilized to further develop library and data administrations in schools. For instance, San Jose State College School has gotten a significant award to deal with the capability of blockchain innovation for information profession

VII. CONCLUSION AND FUTURE WORK

The utilization of blockchain innovation to the schooling field is in its outset. Subsequently, an investigation of the cutting edge blockchain research in the field of schooling was directed. It yields a few discoveries. In the first place, it demonstrated that blockchain innovation is generally used to: issue and check scholastic declarations, share student' skills and mastering accomplishments, and assess their proficient capacity. Nonetheless, a large number of different applications are arising quickly.
Second, it shows that blockchain could carry critical advantages to instruction including giving a protected stage to share student' information, bringing down cost, and upgrading trust and straightforwardness. Third, it shows that the utilization of blockchain innovation isn't without challenges. Supervisors and policymakers ought to consider difficulties connected with security, protection, cost, adaptability, and accessibility prior to embracing the innovation. In conclusion, it shows that the instructive regions in which blockchain innovation was applied are as yet restricted. In

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this manner, the potential for blockchain is as yet unexploited. Blockchain is a quickly spreading innovation, and it will be a point of support for the overwhelming majority applications in the following couple of years. An idea forfuture work is to proceed with this work by leading more meetings to recognize a few extra qualities for the currentapplication areas of Blockchain. Specifically, the field of training exhaustively. Cause Instructive courses that to make sense of blockchain innovation at a sensible expense so many individuals can join and survey the savvy contracts in additional detail and study the expected dangers inside this area.

REFERENCES

[1]. P. Fraga-Lamas and T. M. Fernandez-Carames, "A Review on Blockchain Technologies for an Advanced and Cyber-Resilient Automotive Industry," IEEE Access, vol. 7, pp. 17578–17598, 2019, doi: 10.1109/ACCESS.2019.2895302.

[2]. S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system," 2008.

[3]. I. T. Imam, Y. Arafat, K. S. Alam, and S. Aki, "DOC-BLOCK: A Blockchain Based Authentication System for Digital Documents," in 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), 2021, pp. 1262–1267.

[4]. A. Alammary, S. Alhazmi, M. Almasri, and S. Gillani, "Blockchain-based applications in education: A systematic review," Appl. Sci., vol. 9, no. 12, p. 2400, 2019.

[5]. M. U. Bokhari, S. Alam, and S. H. Hasan, "A Detailed Analysis of Grain family of Stream Ciphers.," Int. J. Comput. Netw. Inf. Secur., vol. 6, no. 6, 2014.

[6]. M. U. Bokhari and S. Alam, "BSF-128: a new synchronous stream cipher design," in Proceeding of international conference on emerging trends in engineering and technology, 2013, pp. 541–545.

[7]. M. Aamir, R. Qureshi, F. A. Khan, and M. Huzaifa, "Blockchain based academic records verification in smart cities," Wirel. Pers. Commun., pp. 1–10, 2020.

[8]. S. T. Siddiqui, R. Ahmad, M. Shuaib, and S. Alam, "Blockchain Security Threats, Attacks and Countermeasures," in Advances in Intelligent Systems and Computing, 2020, vol. 1097, pp. 51–62, doi: 10.1007/978-981-15-1518-7_5.

[9]. A. Gorkhali, L. Li, and A. Shrestha, "Blockchain: a literature review," J. Manag. Anal., vol. 7, no. 3, pp. 321–343, 2020, doi: 10.1080/23270012.2020.1801529.

[10]. M. A. Khan, M. T. Quasim, F. Algarni, and A. Alharthi, Decentralized Internet of Things: A blockchain perspective, vol. 71. Springer Nature, 2020.

[11]. S. Abdus, A. Shadab, S. Mohammed, and B. Mohammad.Ubaidullah, "Internet of Vehicles (IoV) Requirements, Attacks and Countermeasures," 5 Int. Conf. "Co mputing Sustain. Glob. Dev., no. March, pp. 4037–4040, 2018. [17] A. Raghuvanshi, U. Kumar Singh, M. Shuaib, and S. Alam, "An inves