BLOCKCHAIN FOR STUDENT INFORMATION SYSTEM: NEED OF TECHNOLOGICAL ADOPTION

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Abstract

Decentralized and well maintained data transaction with new aspect of block reduces centralized administration burden in many aspects with automated security measures. Block chain involves series of tasks and transaction performed in decentralized form with high security, trust and reliability of transaction that creates meaningful information. Evolution of technology and life style demands more reliable and sharable framework for education system. Students' information system creates information at different points of interaction leading in some useful transaction needs super centerlines of administration. Block Chain immutable solution provides more protected, trusted fully functional block of records which benefits to educational organizations or higher management institutes and creates value relationship with its stakeholders. An immutable block chain record with distributed ledgers, proof of Work and encryption crop thought run-through and impacts domain information. This raises a thirst for carrying out the study on mechanism, functions and elements of Blockchain framework for Student Information System.

Keywords: Block Chain, Encryption, distributed ledgers, Proof of Work, Student Information System.

INTRODUCTION

Though numerous digital solutions are available then also system likes student information system to deal with new challenges trying to adopt evolutionary digital solutions for records. The study grabs sufficient framework to provide updates of facts in this field, importance and to carve out a space for research in block chain based student information system. The main objective of this study is to capture major elements and functions of transaction for different stakeholders, designing blockchain framework or mechanism addressing information security in the related research fields. Student Information System is helpful to university/ education institute administrators, experts and executives to analyse and focus processes and performance for domain stakeholders. A prevalent research directed to blockchain design has proved potential information security in decentralized form of ledger. The Researcher would like to study blockchain based system more specifically Student Information system and to explore the mechanism, implementations and some interesting findings of different researchers. This can be considered to design new framework addressing limitation of existing systems and to trace out required gap. Thus preliminary investigation will help with framework design and elements identification.

BLOCK CHAIN

Block chain is a distributed database keeping continuously growing list of records or blocks. It is the technology designed to make it impossible to hack the system or forge the data stored on it, thereby making it secure and immutable

It generates record copy under distributed ledger technology at point of transaction performed. And all copies of distributed ledger are updated and validated simultaneously.

Blockchain store data in form of Blocks digitally chained together as shown in figure No.1.
Figure 1: Blockchain

Fundamentals of Block Chain- 

1. Public Distributed Ledger
   
   A blockchain process initiates with decentralized public distributed ledger to store transactions in network.

   It is database that is shared among different computer users of computer network as per their requirement.

   These transactions can be accessed and verified by associated network users only.

2. Encryption
   
   Cryptographic algorithms (SHA256) are applied to blockchain to ensure security.

   Each user in the blockchain uses key to access blocks.

3. Proof of Work
   
   Proof of Work (PoW) is a method to validate transactions in a blockchain network by solving complex mathematical puzzle called mining.

4. Mining
   
   When miners use their resources as time, money electricity etc. to validate new transactions and record them to public ledger they are given a reward.

   Some major Benefits of Blockchain are Trust, Traceability, Security and Privacy, Immutability, Visibility, Decentralised Structure, Tokenization, Control of Data, Innovation and Reduced Cost as depicted in figure no.2.

   Blockchain is simply a chain of blocks; iterative process confirms integrity of previous block all the way back to the initial block which is called Genesis block (Block 0). Whereas blocks not selected for chain are called as Orphan Block.
Logically it can have several layers as Infrastructure, Networking, Consensus, Data, and Application as represented in table no.1

Table 1: Block chain Logical Layers

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Logical Layer</th>
<th>Components</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Infrastructure</td>
<td>Hardware</td>
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<tr>
<td>2</td>
<td>Networking</td>
<td>Node discovery, information propagation, verification</td>
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<td>3</td>
<td>Consensus</td>
<td>Proof of Work, Proof of Stake</td>
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<td>4</td>
<td>Data</td>
<td>Blocks and transactions.</td>
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<td>5</td>
<td>Application</td>
<td>Smart Contracts/ decentralised applications</td>
</tr>
</tbody>
</table>

STUDENT INFORMATION SYSTEM

Student Information System is the system where student information is stored, handled, retrieved and analysed thoroughly, steadily and analytically.

Student Information System introduces some common functions as

- Enrolment
- Attendance
- Grading
- Scheduling
- Assignment
Blockchain can be initiated for one of these major functions popularly or frequently. Any associated party or stakeholder with specified function as per their transaction requirement will trigger the transaction and hence genesis block of transaction will get created. Further in linked list form next node will be generated with hash function and previous node address.

Blockchain Mechanism

Figure No.3. Block Chain Mechanism
With new transaction request genesis block that s block zero is initiated and using encrypted key it is authenticated. Further Block for transaction is sent to every node of network, when particular node validates the transaction, node receives reward for proof of work and newly created transaction block is added to series of block to create blockchain with all specifications required for Data, Nonce and Hash.

Blockchain Projects

In Blockchain ecosystem different projects are

1) Bitcoin is the first to use blockchain
2) Ethereum-Smart Contract to create certain rules and trust
3) Neo-Chinese Ethereum-python as main language for application
4) Hyperledger Fabric- Enterprise graded modular project

Importance of Blockchain

Blockchain started in 1991 as a way to store and secure digital data. It’s open ledger that several parties can access at once. Blockchain is immutable, secure, transparent and decentralised. Security of data is major issue of importance as due to digital explosion personal data security is questionable? AT the same time, Blockchain can increase security and data integrity with reduction in data redundancy. It can streamline organisation processes.

As depicted in Figure No. 4, Public blockchains are open to all and use proof of stake whereas private blockchains are permissioned blockchain using hyper ledger. Private Blockchains have restrictions and are not open. Hybrid blockchain or consortium is combination of centralised and decentralised features. And fourth type sidechain are parallel to main chain. Sidechain improves efficiency and scalability by allowing movement of digital assets between two different blockchains.

RESEARCH MOTIVATION

With new emerging real world cases blockchain is building trust and exchange value for parties involved in transaction. More companies than initial bitcoin are trying to realise how blockchain can help them and so are investing time, money and resources for blockchain implementation.

Evolution in blockchain technologies give the opportunity to Stakeholders and student information system domain experts to safely record transactions and provide access to transaction blocks, but this task becomes too complex due to challenges like volume, variety, varied users, velocity and scalability of transaction data. University stakeholders need simple, robust, ample and more approximate business solution to gain value from transaction’s data.
The Study aims to explore impact of blockchain on student information system with potential of improved efficiency and transparency for all stakeholders. So by considering the requirement of improvement in framework design for blockchain can be focused for improvement in action on student university data.

RATIONALE AND SIGNIFICANCE OF THE STUDY

• The study will be focusing on designing blockchain framework for Student Information System.

• The study evaluates and identifies the new set of features for Student Information System analysis and pattern recognition.

• This study will be supporting decision making process which helps administrations and experts to identify focus areas for anticipating impact of current happenings.

• This will also be significant to identify and focus potential block chain based process stakeholders.

• As most of the users share their sentiments and experiences online, this kind of unstructured data can be transformed to information which assists decision-making with additional importance.

LITERATURE REVIEW

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title of Book / Research Article / Thesis / Reports etc.</th>
<th>Author(s)</th>
<th>Publication Details, Year etc.</th>
<th>Key Discussions</th>
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<tbody>
<tr>
<td>1</td>
<td>A blockchain-based models for student information systems</td>
<td>Sura I. Mohammed Ali, Haitham Farouk, Hussien Sharaf, “A blockchain-based models for student information systems”, Egyptian Informatics Journal, Volume 23, Issue 2, 2022, Pages 187-196, ISSN 1110-8665, <a href="https://doi.org/10.1016/j.eij.2021.12.002">https://doi.org/10.1016/j.eij.2021.12.002</a>.</td>
<td></td>
<td>A student information system (SIS) can make use of a decentralized, reliable, and highly trusted ledger that stores vital information. SIS that maintains transactions such as students’ and faculty members’ records, course registration records and student marks. In addition, avoiding the role of a super administrator or a centralized exposed store where data integrity is vulnerable. Using the proposed models pushes towards an electronic community where genuine certificates can be easily issued and published to the interested parties without the need for involving a centralized administration. This paper explained the core building blocks and functionalities of our models within the description. Authors plan to test the proposed models using the smart contracts and the Ethereum network, based on activated the verification, authentication, and transparency of marks.</td>
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<tr>
<td></td>
<td>Title</td>
<td>Authors/Institutions</td>
<td>Journal/Publication Details</td>
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<td>EduCTX is a global higher education credit platform that has been suggested. This platform is built on the European Credit Transfer and Accumulation System idea (ECTS). It is a worldwide trusted, decentralized higher education credit and grading system that may provide a globally united perspective for students and higher education institutions (HEIs), as well as other prospective stakeholders such as businesses, institutions, and organizations.</td>
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<td>4</td>
<td>Study Of Factors Influencing The Use Of Blockchain Technology In Student Information System At Universities</td>
<td>Mrs. Rashmi Prashant Dongre</td>
<td>Thesis, Tilak Maharashtra Vidyapeeth, Pune, Department Of Computer Science, February 2022</td>
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<td>As only TAM and UTAUT model was considered, the future scope may include use of other theories of adoption mentioned in the literature review to cover larger scope of dependent factors. • This study could cover few blockchain applications that could be implemented in university information system. • Future scope may cover more in number with latest available modifications. • Future scope may also include the identification of various cluster based on blockchain adoption stage</td>
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<tr>
<td>5</td>
<td>A Blockchain-Based Information Management System for Academic Institutions: A Case Study of International Students' Workflow</td>
<td>AU - Chen, Weiru AU - Bohloul, Mahdi AU - Ma, Yifang AU - Li, Ling PY - 2021/09/25 SP - Institutions: A Case Study of International Students' Workflow</td>
<td>VL - ahead-of-print DO - 10.1108/IDD-01-2021-0010 JO - Information Discovery and Delivery ER -</td>
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<td>Authors Design/methodology/approach Specifically implemented, a prototype of the blockchain-based information system was developed and tested. Design/methodology/approach Specifically, a prototype of the blockchain-based information system was developed and tested. Findings show that a blockchain-based information management system has the potential to improve data transmission efficiency and protect information privacy.</td>
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<td>6</td>
<td>A Blockchain-based framework for secure Educational Credentials</td>
<td>Shadab Alam1, Huda Abdullah Yousef Ayoub2, Rafan Abdulhaq Ahmed Alshaikh3, Asmaa Hayawi Hussen AL-Hayawi4</td>
<td>This research work would offer a detailed analysis of blockchain Security, Privacy and Trust. It further studies the applications of blockchain technology in the domain of education and involved challenges. Finally, It focuses on three key themes: (1) blockchain-based educational technologies, (2) the opportunities that blockchain technology could bring to education, and (3) the complexities of implementing blockchain technology in education. Document authentication is a critical topic with a variety of challenging and time-consuming procedures to authenticate. A suggestion for future work is to continue this work by conducting more interviews to identify some additional characteristics for the current application areas of Blockchain. In particular, the field of education in detail.</td>
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<td>7</td>
<td>A blockchain-based information management system for academic institutions: a case study of international students’ workflow</td>
<td>Chen, W., Bohloul, S.M., Ma, Y. and Li, L. (2021), Information Discovery and Delivery, Vol. ahead-of-print No. ahead-of-print. <a href="https://doi.org/10.1108/IDD-01-2021-0010">https://doi.org/10.1108/IDD-01-2021-0010</a></td>
<td>Authors implemented block chain based student information system where results shown efficiency in digital student registration. Authors suggested that blockchain-based information management system has the potential to improve data transmission efficiency and protect information privacy.</td>
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<td>8</td>
<td>The Security of Student Information Management System based upon Blockchain</td>
<td>Mingfeng Yang, Jianying Wang (2022), Journal of Electrical and Computer Engineering / 2022 / Article, Special issue- Big Data Analytics in Mobile Information Systems for Advanced Computing.</td>
<td>Authors concluded that the student information management system based on blockchain technology has high security. This experiment is relatively smooth on the whole and is preceded step by step and finally reached effective conclusions. But we believe that this experiment still has room for improvement in terms of experimental methods and efficiency. It is hoped that future experiments can complete the experiment and draw conclusions with more standardized steps in a shorter time and at a faster speed.</td>
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<td>9</td>
<td>Blockchain Goes to School, Digital Solutions, Innovation &amp; Domain consulting</td>
<td>Alok Kumar Jain.</td>
<td>Alok Kumar Jain the education industry is changing before our eyes. No longer solely the province of a centralized learning environment in either the physical or virtual worlds, education now occurs via peer-to-peer interactions, online and from anywhere on the planet. Educational providers, particularly in higher education, are struggling to harness digital technology as a tool for transformation.</td>
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<td>10</td>
<td>A comprehensive literature review on the Blockchain as a technological enabler for innovation</td>
<td>Stefan K. Johansen, , Dept. of Information Systems, Mannheim University, 2018.</td>
<td>Stefan K. Johansen provided comprehensive and detailed documentation of the current technological and literary state of the Blockchain technology within Information Systems research. He outlined in detail what is required for the Blockchain technology to function as a technological enabler for innovation and the required factors for success. It is noted that the Blockchain technology in its current state still has a way to go before the technology will reach a state considered sufficient for mainstream adoption.</td>
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Existing key approaches for improvement to Blockchain System:

1. Identification of major functions and clusters,
2. Improvement in data efficiency and security,
3. Statistical Methods,
4. Adoption Techniques.
RESEARCH GAP

After going through the literature mentioned above much of the work is done.

After Systematic analysis researcher identified GAP as:

- Blockchain needs activated the verification, authentication, and transparency of marks.
- It should include the identification of various cluster based on blockchain adoption stage.
- There is need to improve data transmission efficiency and protect information privacy.
- Document authentication is a critical topic with a variety of challenging and time-consuming procedures to authenticate.
- It has the potential to improve data transmission efficiency and protect information privacy.
- Educational providers, particularly in higher education, are struggling to harness digital technology as a tool for transformation.
- Blockchain technology in its current state still has a way to go before the technology will reach a state considered sufficient for mainstream adoption.

Authors suggested improvement to experiment with improvement in framework for more complex blockchain, types of blockchain and its elements and functions, and data security measures and methods. And further has mentioned to generate more complex sentences with the pattern-based model using aggregation to get better results.

Other than this framework, there could be algorithmic design limitation. There is need for optimized design and implementations for fast accessing of data and authenticate data.

Existing blockchain based student information system has room for improvement and adoption so new evolutionary methods need to be implemented. So exploiting hybrid approaches would improve the results.

Current research aims for studying major elements, function for designing framework for blockchain based student information system and improving these frameworks to overcome limitations they have for student information system...

RESEARCH METHODOLOGY

The researcher has planned to follow Design and Creation research Strategy. The strategy focuses on design of new prototype framework design for blockchain based Student Information System.

This involves transaction initiations for genesis block generation and further creation of series of blocks to record transactions and to provide authentic access to stakeholders.

So the researcher would like to study and experiment by implementing approach as given here to get improved design of Blockchain framework design for Student Information System.

In future work researcher has aimed to explore framework design and will develop Blockchain design prototype will optimise model to get refined solution after considerable iterations.
CONCLUSION

The Researcher performed Conceptual analysis for Blockchain concept and performed Review of Literature to track requirements of study, to track framework and challenges, which formed basis for researcher to enhance subject insights. Proper analysis helped to avoid repetition of research problem and to come up with Novel concept and problem specification, Review of literature tracks research gap and methodological gap which needs continuous improvement and adoption in existing blockchain framework.

Proposed framework gives simplification and improvement in processing logic and speed applied to Student Information System for management institute may be helpful for future research domain. This will also help organisations to design strategic policies.

REFERENCES

3. Dongre Mrs. Rashmi Prashant (2022), "Study Of Factors Influencing The Use Of Blockchain Technology In Student Information System At Universities “, Thesis Tilak Maharashtra Vidyapeeth, Pune, Department Of Computer Science.
14. Simplelearn.com
15. Wikipedia.com