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A Review on Secure Blockchain Integrated System for Technology Oriented Education Structure: Advantages and Issues

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Abstract

In the technology oriented society every arena is looking for Blockchain technology due its revolution and scope of study. Blockchain technology is a digital register of transactions that is replicated and scattered across the entire network. This technology is also applied on education sector due to its immutable characteristics. Adopting Blockchain in education is necessary to store the student record and digitized the transaction with respect to evaluation, credits and certificates taking care of privacy. The main purpose of this paper is to discuss about the issues related to education sector and to overlook with Blockchain based existing application. The paper adopted a systematic approach to find the relevant implementation for education using Blockchain technology. The result of this study makes available of few advantages and issues related to Blockchain adoption. Finally the paper describes the future research scope in online entrance examination for the transparency issue.

1. Introduction

Blockchain is a record storing technology which is considered as a type of database which is designed with unique features like decentralization, trustworthiness, and security (Bdiwi et al.). In Blockchain the data is stored on different nodes of a computer network in a digital format. The difference between Blockchain and database is how the structure of data in managed. Blockchain collects all the data in blocks, once the block is full it closes and add a new block and links with the pervious block which is already filled forming a chain. Blockchain makes impossible to hack the system or forge the data stored on it, thereby making it secure and immutable. It is a type of distributed ledger technology (DLT), a digital system for recording transactions and related data in multiple places at the same time. The significant features of Blockchain can provide a better assistance in the education field to both institutions and students to maintain and authenticate the records and also helps in accessing it. The Blockchain technology plays an important role in administration for managing the finance and accounts related matter. The major advantage of introducing Blockchain in education is data storage management system, data security, system trust, global ubiquitous database, formative evaluation and also fee payment using smart contract. Many institutions have introduced machine learning technology based on Blockchain and record on each student is maintained with respect to credential, learning behaviour and activities preformed in

class.

2. Issues related to education

Xu et al (Xu et al., "ECBC: A High Performance Educational Certificate Blockchain with Efficient Query")mentioned that the first issue related to education is to hold a large set of records manually which requires lot of human resources and manipulation attack. (Xu)The educational system in many countries involves human in creation of physical record where the exams are paper based. Hence the records can be manipulated by a third party. The manual system makes lot of human resource and the record verification difficult. The problem is faced when the central documentation is not maintained. Hoy (Hoy) refers to any record stored through online. (Hoy)The issues are related to online storage. The grading system for the academic is stored through an external agencies which can lead to fake document. The third party can produce a fake academic record. This can lead to the changes in the data either intentionally, accidentally or other illegal means by third party. The digital data can be lost if the institution compromises with such activity. Record exchanging is very refined and inefficient process. In some cases, it becomes impossible.

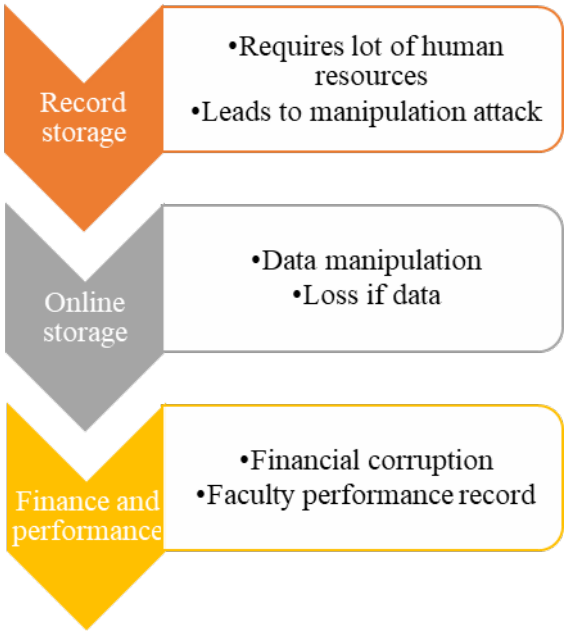

FIGURE 1. Issues related in Education

Chen et al (Chen et al.)address some issues, related to finance and faculty performance in the educational field. (Chen)The institutions undergo with many financial transactions every month with students, employees, vendors, suppliers and government agencies. Also, Institutions may face corruption by some authorities due to unstructured monitoring though auditing is integrated. A decentralized auditing can be integrated to avoid the corruption into financial matters. The institutions do not define a proper structure for apprising and monitoring the faculty performance. The unstructured process might discourage the faculty's sincerity and performance. The faculty need be motivated with some rewards and the record to be stored about individual member

3. Blockchain based application in Education

Ali et al (Alammary et al.)discussed a wide range of application enabled with Blockchain for the purpose of education. (Alammary)The application focuses on different category like learning outcomes, student evaluation, managing certificates, fee and credits transfer, e-learning enhancement, review of examination, collaborative learning and lifelong learning. Nespor J (Nespor) illustrated a Blockchain certification platform relating to certificate management which can handle all academic authorization, student's certificate, student records and achievement records. (Nespor) In the field of education Blockchain based applications benefitted by high level of security and privacy are used to issue digitized certificates. Every student individual will get the access for the data record. Farah et al (Farah et al.) created an application for the evaluation of the student performance and focused on learning outcome management. (Farah) The objectives of learning was enhanced to achieve the competencies at the educational sector. The application measures and evaluates the student performance on two categories such as quantitative and qualitative. The app also helps to track the performance on student activities on learning. Bdiwi et al (Bdiwi et al.) acquaint with an application create an environment for collaborative learning which is one of the significance of Blockchain to provide secured learning environment. (Bdiwi) U-learning (Ubiquitous learning) is one such application with Blockchain technology for students to provide a learning environment. Students can get benefitted by collaborative learning from U-learning system at any part of the world with a secured platform. The U-learning interactive pro-

gram provides an effective communication between students and teachers. A decentralized network is provided by Blockchain with high security to build a collaborative environment for both students and teachers. Many other applications played an important role in education using Blockchain technology. Zhong et al (Zhong et al.)adopted Blockchain an e-learning application was used to solve the issues related to student interaction and to engage them in learning environment. (Zhong) Another application relating to examination made a development in the field of education. The app implementation mainly focused on the agreement oriented Blockchain technology with the external examiner for the quality of assurance. Another category of application is related to fee transfer. The Blockchain technology helped in credit or fee transfer without using any intermediate party providing high secured system.

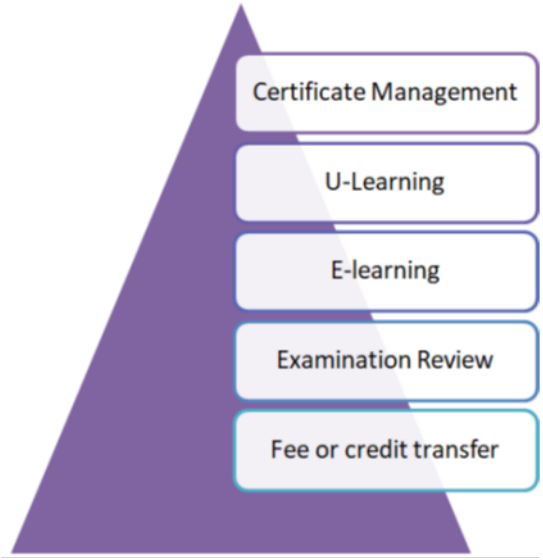

FIGURE 2. Blockchain based application in education

4. Blockchain based Implementations in different categories of Education

Muhamed et al (Turkanovic et al.)initially put forward a decentralized platform using Blockchain for higher education and entitled as EduCTX. (Turkanović)The platform developed on distributed network system using peer2peer concept. The system consisted of unique features like sharing resources and storage capacity all over the world, hence the system is secure, flexible and robust. This system is mainly designed for credit transfer in higher education. The grades and credits are transferred from physical body to Blockchain based technology with no third party intrusion in the transaction of data. A new HEI (hereinafter) tries to connect with Blockchain based system and create a wallet and address consisting of a key. The address must contact a member of HEI to receive a token and transaction is processed. Therefore all the user are encouraged and invited to join the EduCTX for a secured grades and credit transactions. Bin wu et al (Wu and Y. Li)designed an evaluation system for digital education. Online examination mode faces certain issues like transparency and dishonesty. (Wu) The evaluation process completely depends on the faculty. The faculty is the front runner of the examination mode and the management of the examination mode. The student uploads the answer data, the evaluation process provides the score. Most of the faculty uses this process to check the student ability and knowledge. The student and faculty interact through a web application. The data gets stored in the database from both the users. The Blockchain is implemented in both the end user with few modules: evaluation and operational. The Blockchain user interacts with server through HTTP request, data gets uploaded from server and request the data from Blockchain system after the evaluation.

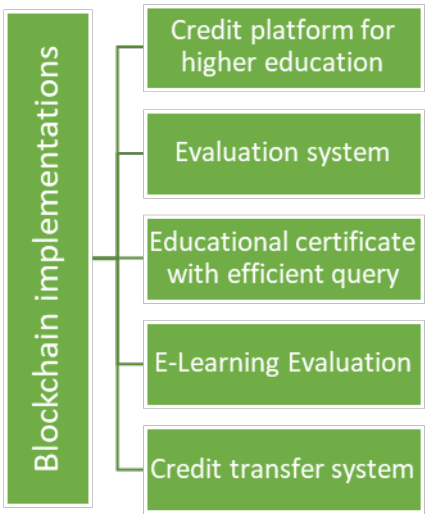

FIGURE 3. Blockchain based implementation in Education

Yuqin Xu (Xu et al., "ECBC: A High Performance Educational Certificate Blockchain with Efficient Query")suggested a Blockchain structure to provide the qualified certificate from the educational institution with low latency, high speed

request and quick output. (Yuqin Xu) The system works with request key chain known as MPT-CHAIN. The request is designed with trust, data security, management and service supporting efficient request, verification of the data block and particular format for transaction with protection for personal secrecy. This Blockchain based system is applied particularly for education certificate in the digitized institution for enhanced service for the students.

Chuyang li et al (C. Li et al.)proposed a system with the Blockchain technology for e-learning valuation and authorization through certificates. (Li)The problem considered with respect to online education and solved using a Blockchain based network arrangement with the amalgamation of public and private key four schema for the data storage, valuation, credit transfer and digital certificate. The Blockchain based online education and valuation process is compared with the traditional online education system. The Blockchain based system can store the student achievement for lifelong with no falsification. The issue of certificate and their storage is supported with the public network globally using the corresponding Blockchain technology. The Blockchain based application is designed with an optimized structure. The certificate is produced with a verification process by third party authenticity the public key without relying on the institution.

Abhishek Srivastava (Srivastava et al.) designed a Blockchain structure for storing the records of the students and transferring the credits through distributed system. (Srivastava) The structure is accessible and strong by providing correct information in a short time span on an enormous range. The designed Blockchain based structure for institutions provides decentralized atmosphere with the data security and flexibility without altering the student data. The transparency is maintained in the global computing and distributed agreement within the peer nodes. The proposed structure creates a block for each student registration to student identity and their academic related record. Each block consists of a hash linking to other node with student identity. Once the chain is created, it is open for a public network and gets a local copy updated from all peers. The institutions uses digital signature on the concerned document and sends to the next level. The document gets multiple signature from each block for authentication and finally submitted to students. The proposed structure gives easy access for the transfer of credits in a simple and global manner without any restrictions.

5. Advantages of incorporating Blockchain based technology in education

The Blockchain based education enhances numerous benefits for data access control, record management, maintaining transparency, verification of proofs, unique verification and learning environment by taking care of student's confidentiality. The data stored is accountable and transparent to students but the modification is not allowed with respect to certificates or grades. As discussed above, one of the proposed system creates a trusted grading and credit system for higher education in the viewpoints of both institutions and students. The data is transferred to database in a simple and efficient manner. The system provides a transparent interpretation to view the record and the institution employers can get direct access to authenticate the student data.

So, incorporating Blockchain to education provides a simple, unique and ubiquitous system. In the digital education era, the Blockchain based system is used for evaluation process. In an online mode evaluation the data is not transparent and cannot be trusted. A sandbox operation is applied to make the evaluation process simple, efficient and the credits transfer is transparent without altering the data. The benefit of integrating the Blockchain for evaluation process in online education is robust, reliable and ease to use providing the accurate value. Many institutions incorporated digitized infrastructure to provide the certificate but the concerned occurred with respect to trust and data security.

6. Issues relating to Blockchain implementation for education

Blockchain is an evolving technology with unchallengeable features but adopting to education faces certain challenges, few issues are addressed to find the solution in future days. The growing issue is data theft, since using Blockchain in education provides a unified database. This may lead to risk of storage and data theft. Due to transparency of data in Blockchain, the transaction relating credits, grading or certificate is noticeable to every person. Educational institutions need to take some privacy measures to prevent the data theft and restrict the access

FIGURE 4. Advantages of incorporating Blockchain based technology in education

to data. Another challenge would trusting all the parties involved in the Blockchain integration. The student achievement stored using Blockchain technology may be altered by one of the party which may lead educational institutions to introduce some laws for storage. The transparency and third party access may lead to document forgery to start a professional career.

7. Future work in Education using Blockchain

The students' online entrance examination is one of the advantages of technology to the educational institution. However, in the traditional system, the scoring system may not be as transparent as expected. A web test based on Blockchain is proposed to provide a solution for the transparency issue. The proposed solution provides open confirmation of answer provided by students, and the reply data cannot be altered by any party. The future work is combination of online examination in traditional and digital method, the student response is recorded using the Blockchain structure, verified and stored to avoid the falsification. The recorded answered are tracked and data abuse is avoided from unknown using group signature. In order to reduce the load of storing all the sub-chain nodes, a primary chain key is added to the sub-chains.

8. Conclusion

The Blockchain adoption in education is an advance research in primary stage. The purpose of this paper is to extant a detailed information of issues in education sector, some existing application and implementation in education field. The study of the present implementation assisted to categorize the advantages and issues relating to Blockchain integration in education. The study as also helped for the future research guiding to overcome with the existing problem in traditional education system. This is a necessary step to integrate the Blockchain since everyone are looking forward for a technology oriented system.

Authors' Note

The authors Sheela D V and Dr. Chitra Ravi declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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