

Unlocking Potential of the Blockchain Technology in Education Sector: A Comprehensive Review

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Abstract:

The educational landscape is changing dramatically from traditional classroom to eLearning and now to blended learning. Educational institutions throughout the world started utilizing online platforms and Learning Management Systems (LMSs) for active engagement of students. As a result of the COVID-19 epidemic, which hastened the adoption of digital learning. Also, the other education systems like Admission System, Examination System, Student Record Management System needs to well-maintained from the efficiency and security perspectives. Blockchain technology has the potential to completely transform the education sector. The current paper portrays systematic and comprehensive review of utilization of Blockchain Technology in Education Sector. The primary objective of this paper is to weighing up potential applications of blockchain in education sector and to identify the key blockchain features that uplifts these applications.

Keywords: Blockchain Technology, Education, Student Record Management, Learning Manage

I. Introduction:

Blockchain Technology relies on a decentralized and distributed ledger architecture. Blockchain models are safer and more reliable than the centralized models which are currently active in the different systems (Badadare et al., 2023). To put it simply, Blockchain technology is a distributed, immutable record of digital events that is transferred point-to-point across various parties (Badadare, Shaikh, et al., 2023). Blockchain has been influenced variety of sectors like Healthcare, Finance, Real Estate etc. Education is one of the potential domains can have different blockchain verticals. Education sector is revolving around numerous stakeholders including students, teachers, Principal, administrative staff, support staff, parents, alumni as well as diverse systems like Admission, Examination, Financial administration, Student Record Management, Learning Management System (LMS) etc. And here, the need of efficient and secured management comes into picture.

II. Related Work:

(Ocheja et al., 2022) reviewed temporal development of blockchain technology in education sector. Their analysis reveals that although blockchain technology has been present for about 13 years, its implementation in education is just now gaining popularity. (Alsaadi & Bamasoud, 2021) Surveyed users' adoption attitude regarding blockchain technology and visualized acceptance statistics. By knowing the benefits of blockchain approximately 86% users manifested acceptance as well as interest for utilization of Blockchain Technology. Authors also explained the role of blockchain technology and its benefits in the education system.

(*The Cyber Threat to Universities*, n.d.) provided brief review of the current cyber security threat to UK universities and academia. Recent public awareness campaigns brought attention to the following facts: Data released by authors revealed important insight on how thieves might undermine academic institutions' infrastructure by stealing important information that could have a negative impact on a nation's economy. Researchers found login pages for 76 colleges spread over 14 countries in 2018 as well as logging pages for 300 phony websites. And reports of over 100,000 professors being pilfered globally occurred between 2013 and 2017, resulting in the loss of over 30

terabytes of academic data and intellectual property. There is a pressing need to find more secure and reliable methods of communication as we shift to using cloud computing and are more frequently interacting online through working groups and online chats.

(Panagiotidis, 2022) illustrates how blockchain technology can be applied to specific academic challenges and focuses on the present and future uses of blockchain in education. Primarily, authors explained blockchain evolutions along with its applications as follows: Blockchain 1.0 was utilized for small-value payments, basic cash transactions, cryptocurrency, and foreign exchange payment systems. Blockchain 2.0 then confronts properties, trading in securities, smart contracts, and other financial topics. Blockchain 3.0 is the next generation of the technology, which focuses on developing applications in fields including e-government, health care, science, culture, and the arts. It uses decentralized storage and decentralized communication. Research on Blockchain 4.0 is now ongoing and aims to provide methodologies and solutions that will enable blockchain technology to meet "Industry 4.0" expectations in business, including supply chain management, asset management, workflow management, and financial management systems. As per their study, most well-known educational applications of Blockchain Technology are:

- Issue, storage, verification and sharing of certificates
- Accreditation of studies or educational institutions by means of Verification of personal achievements
- Ensuring transparency and security of educational management
- Protection of digital rights and digital content by means of Digital signatures, timestamps.
- Learning and educational projects
- Educational and learning platforms
- Reward Systems

(Balpande & Patil, 2021) Stated that, Blockchain was initially used for money transmission, but it is now widely used across a wide range of industries, including banking, healthcare, the Internet of Things (IoT), and numerous other sectors. Blockchain provides numerous opportunities for distributed and decentralized record management in an interoperable manner in higher education organizations. The contributors additionally discussed about various types and features of blockchain technology.

(Min & Ge, 2022) explored the use of blockchain in the course design and evaluation in Chinese universities. They illustrated through qualitative case study investigating the design and evaluation of online course based on blockchain by five teachers of different specialties. Semi-structured interviews and course materials were collected from five teachers for a TPACK framework analysis. The findings of the survey put a light on redesigning online courses with a blockchain framework. By incorporating blockchain technology, course can be well organized, having effective way of content delivery, and increased trust on one another by most of the stakeholders in online education. All the user instructors of this framework agree that establishing systematic multi-party trust is the main benefit of blockchain technology for online course instruction.

(Chen et al., 2018) Explained most useful and fruitful application of blockchain Technology which is reducing degree fraud. There have been several instances of degree fraud in the past. Now, it can be prevented, by using blockchain technology to award and regulate student degrees. Miners from around the world verify, examine, and maintain the data that is stored in

the blockchain and matches users' IDs. A distributed ledger on the blockchain is reliable and immutable. This guarantees both authority and trustworthiness and will greatly minimize degree fraud.

III. Key Features of Blockchain Technology identified from the Education Sector perspective

By the comprehensive review of Blockchain Technology applications in education sector, some of the key features of Blockchain are surfaced and are as below:

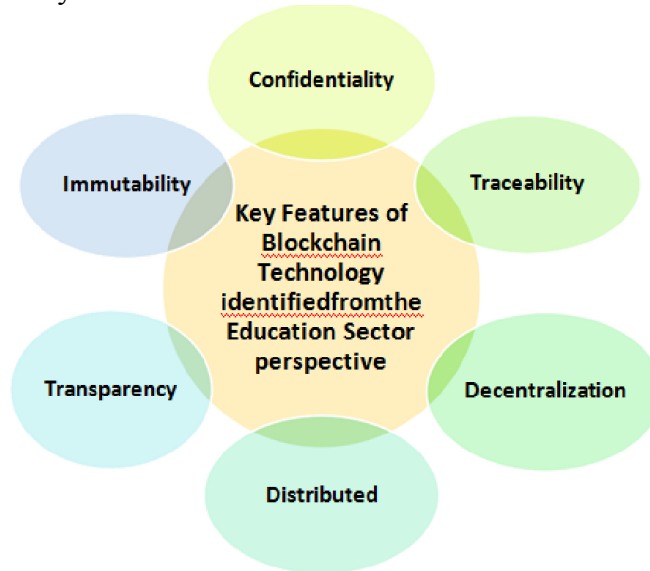


Figure 1: Key Features of Blockchain Technology from Education Sector Perspective

Distributed: This feature ensures No SPOF (Single Point Of Failure). It means if any of the node in education network is inactive due to some reason, data can be fetched from another node. This process leads to establish reliability of the system.

Decentralization: Decentralization prevents concept of central authority from the system, which tends to improve trust level among all the users.

Immutability: Immutability guarantees “No Data Breach”. As the educational information is having paramount importance; maintaining originality of the data is vital.

Transparency: Decentralization feature of the blockchain technology confirms transparency. Preserving transparency across all the educational processes is value addition to any education system

Data confidentiality: Role based access in the blockchain framework establishes abstraction and in consequence ensures data confidentiality.

Traceability: According to traceability feature, blockchain provides full-fledged chain of records with timestamp. In the future, blockchain will offer a reliable educational history if it becomes necessary to track down an individual's educational achievements.

IV. Proposed Blockchain model for Student Record Management System

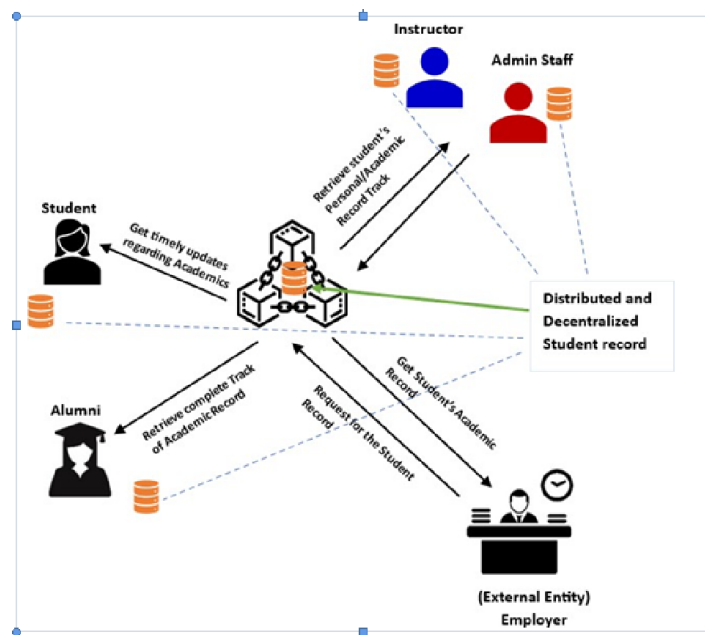


Figure 2: Blockchain model for Student Record Management

V. Conclusion:

Blockchain technology appears to have a lot of potential for use in the field of education, as shown by the systems and applications that have been reviewed. Blockchain technology has a wide range of creative applications in education that go beyond managing certificates and evaluating accomplishments. Blockchain technology has substantial potential for broadening the application prospects for formative evaluation, designing and implementing learning activities, and monitoring the entire learning process for both educators and students alike.

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