

A Study of Applications of BlockChain in Higher Education System - Smart Education System

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Abstract: *Higher education in any country plays a vital role in economic growth of the country. Today's education system has many challenges and issues, such as, there is a huge gap in employer expectations between student knowledge and skill, mushrooming of large no of low quality Institutes, lack of project based learning, decreasing in teaching quality, lack of skill based training for students and teachers, lack of employability skills, failed to introduce of modern technologies and tools in teaching learning process, shortage of training resources and fund, lack of proper mechanism for verification of fake degree certificates and evaluating student credentials for the employers. Also as education becomes more diversified, democratized, decentralized, we still need to maintain reputation of the education system, trust in certification, and proof of learning. Due to these reasons the employability of graduates has tremendously decreased in the recent years. To provide better solution, we can use the blockchain technology in education. The proposed blockchain applications in education system provide a trusted, transparent, distributed, tamper proof, ledger based infrastructure to securely store, share and verify learning achievements, providing standard mechanism for evaluating the credentials earned by the students during the course of study by issuing a digital certificates.*

Keywords: Higher Education, Blockchain, Tamper Proof, Digital Certificates

1. Introduction

Blockchain is a digitalized, decentralized and distributed shared ledger technology that provides a way for information to be recorded and shared by stake holders, with high level of trust and transparency. When new information is recorded onto the blockchain by a participating member of the blockchain network, the data is first embedded in a block, verified and sealed.

The new block is then immediately distributed onto all of the other nodes in the network. After being validated by each node, it will be added to the previous block to form a chain. This can ensure that every member of the blockchain network maintains the most up-to-date records in a network of nodes with no single point of failure. Each node in the blockchain has the same copy of the blockchain.

To update the shared copy a consensus between everyone must be established, data stored on a blockchain is more accurate, consistent and transparent. Because if you try make changes in a single transaction record would require the alteration of all subsequent records and the collusion of the entire network.

The blockchain technology uses smart contracts technique to establish consensus between nodes in the network. There are several consensus algorithms are in blockchain such as Proof-of-Work, Proof-of-Stake, Proof-of-Authority etc. "Smart contracts"- a series of instructions written using a programming language which automatically moves digital assets according to a codified set of rules.

Implementation of blockchain powered smart contracts could allow individuals to build their own applications based on a contract that is automatically enforced between two or more parties, in a decentralized and immutable fashion without the help of intermediaries trusted person.

Today's higher education system is very rigid with limited flexibility and follows curriculum based, exam –oriented, score based formal education system. It does not provide platform for the learner to empower with quality education that they deserve and expected for today's market trend and the Its tightly defined learning methods provide students and teachers with less opportunity to explore their creativity ,new skills and to learn the emerging technologies .

The exam-oriented and score-based approach to evaluate the capability of students does not help the students to identify diverse, creative and innovative talents with them. So he higher education system need to be changed to, motivate , empower the students to learn new current modern technologies and better evaluation method need to be found to assess the skill , knowledge and their credentials earned during the course of study.

But at present there only few solutions allowing users to record their lifetime learning and achievements of students. But it require trusted their party for the verification of experience and credentials claimed in the formal education system.

Most higher education institutions keep students completed course records and credentials in proprietary formats in their centralized server with their own authorization. Since each organization controls its own data, it can be altered or deleted, can be corrupted, unauthorized access and can be destroyed in natural disasters such as flood and earth quake.

The biggest challenges in higher education is the employers and higher educational institutions have highest difficult to ascertain the authenticity of the school and college certificates and efficient a methodology to assess the credentials of the students with the help of third party verification agencies. The educational institutions wish to

have decentralized storage platform will act as a node with full control on the data they own.

Blockchain's distributed ledger technology is ideal as a new infrastructure to secure, share and verify learning achievements in meeting all of these challenges in higher education. The immutability of its distributed ledger technology provides enhanced privacy, security and transparency through public key encryption to make it possible to digitize, store and manage learners' degree and academic certificates and learners credentials such as learners' research experience, skills, online learning experience etc. This will help the employers to verify the authenticity, evaluating the students credential and skill without the help of trusted third party.

2. The Applications of Blockchain in Higher Education

As a blockchain network is distributed tamper proof shared ledger technology, it can be built using multiple nodes, and various stakeholders can provide and participate in these nodes to enhance data reliability. All records can be accessed and verified via other stakeholders- such as other institutions, employers, etc. This eliminates the help of the trusted third party. Also it provides a platform not only can facilitate cross-border learning mobility, formal recognition of non-formal and informal learning through certification and provides a complete picture of an individual's education and experience. Moreover, the system can help to verify the issuer of the credential, as well as the quality of the institution itself.

The primary purpose for students entering higher education was to improve their career prospects and as a pathway for career enhancement. So the institutions must offer an advice and guidance to support to empower them in developing their employability for future careers within and beyond their formal course and by learning modern technologies.

Blockchain technologies present enormous opportunities to help higher education providers to improve transparent and quality education system and also reduce costs and eliminate fraud by avoiding manual verification of transcripts and other documents.

The following figure 1. Shows some example applications of blockchain in education

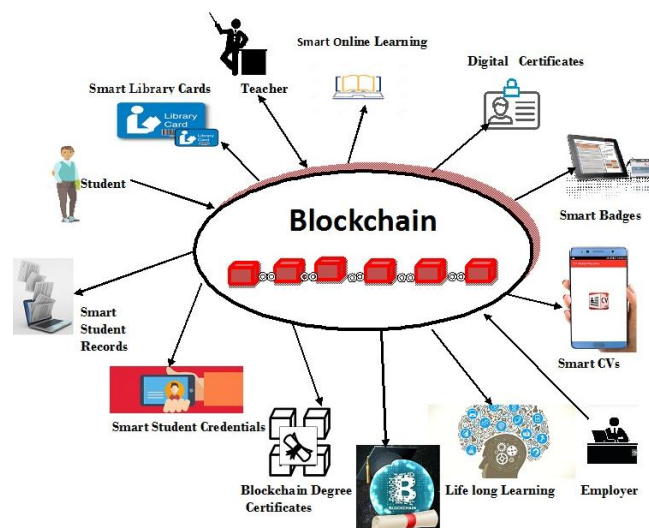


Figure 1: The Potential Applications of Blockchain in Higher Education and the Stake holders

The Potential applications of blockchain in education include,

2.1. Storage of tamper free permanent records

In the education and skill domain applications, they service provider must keep a reliable repository of academic and workmanship records. Due to lack of security, a false, and forgery records can be available in these records. Hence an employer requires a trusted third party education verification service providers help to ensure the authenticity of certificates. Blockchain provides a secure repository for keeping tamper free storage of records, time stamped can be a big help for all stakeholders including students, universities, employers and others to ensure the authenticity and eliminate duplicate records without the help of intermediate third party.

Student Identity verification: Blockchain based secure identity cards can be provided to the students which contain the essential information to uniquely identify the student in the colleges, class room, and library and in the campus.

2.2. Smart Learning Applications

The lifelong learning more important for the employee's constant need to improve their skills, knowledge, higher education systems and job recruitment processes need to be more efficient and immersive to adapt to current demands. The blockchain in the education sector allow students to build up a secure, verifiable digital record of formal qualifications, experience and soft skills gained over their lifetime. A smart contract, in blockchain applications can provide students with the ability to gain greater control over their individual education by providing easy access to content and skill oriented courses can be suggested based on previous successes or failures and attainment.

2.3. Digital Degree Certificates

Degree Certificates play an important role in education and in professional development. The student's individual learning records become essential for people's professional careers. So these records are to be stored in a permanent tamper free storage for long-term available. The Conventional academic degrees received from colleges a have not provide an authenticity and proof of originality. To get an employment, a these certificates requires a third party verification.

The recording of credentials in blockchain can make these educational certificates and documents more credible. For this, a blockchain wallet can be developed which can allocate non_editable digital degree which can be availed by the students via their smart phones or smart cards. Student badges containing learning blocks acquired from multiple platforms these blockchain-enabled digital certificates are secure, verifiable and cannot be tampered without a consensus decision by each member involved in the chain and it supports learning histories. Using this advanced digital certification system, employers can easily verify that a graduate's degree is legitimate. This digital degree also renders complete ownership of the records to the students.

2.4 Student Ownership of Credentials

In traditional education system at the end of the course examination the colleges issue a degree certificates, but to test the knowledge, skills and credentials acquired during the course of study, these certificates, does not provide the learner to demonstrate the same for the purpose of employment or earning a livelihood. And also continuous learning's can be done from multiple sources including conferences, formal classroom sessions, mentorship sessions, on the job and many more. The credential earned through these also should be recorded as additional credentials.

Blockchain technology used to seamlessly record these and stack these up in a repository. Using badges for each learning block which are peer certified and non-editable, instead can be used to keep a record of all valuable credentials earned during a lifetime. This blockchain also renders complete ownership of the credentials to the students. Blockchain technology empowers students to access and control their own educational data on e-portfolios, feedback and accreditation.

2.5 Automatic Transfer of Student Credentials

Students experience difficulties transferring to another higher education institution, while still preserving and proving courses completed at a previous institution. This problem is even more vivid in cases when a student wants to transfer to an institution in another country, where language and disparate processes are likely to pose additional barriers. Moreover, standards for record storage vary, which can make inter institutional record exchange difficult.

The blockchain has great potential in the education sector. It can allow students to build up a secure, verifiable digital record of formal qualifications, experience and soft skills

gained over their lifetime. If the students wish to join the higher degree courses or another institution, then blockchain provides automatic credential transferring mechanism which transfers credentials earned by the student in old institution to the new institution. This blockchain based fool proof system records a student's academic history before can help to tackle the issues of bespoke learning. This will ultimately give people the best chance of determining their education path and a successful future career.

2.6. Act as global Assessment Platform for Employers, and Multistep Accreditation process

The accreditation authorities, certification authorities, certifiers and employer need a global platform for verification of certificates and credentials of the student. The Certification authorities must provide identifiable profile information to allow anybody who is verifying a certificate to verify the certification authority as well. Without this profile information, certifications would remain completely anonymous and would consequently not be suited to the purpose of building a well-reputed track record for a student. The Blockchain for Education platform enables tamper-proof, secure and distributed archiving of certificates and there correct and permanent allocation to learners, as well as verification of certificates. This distributed block storage system handles entries by their hashes stored as a Merkle tree. It also provides storing the profile information of certification authorities externally in an immutable way saves storage on the blockchain.

2.7 Smart Payment Transfer Mechanisms

Blockchain in education platform provides an easy method of micropayments without the third party. Blockchain allows zero cost transactions between parties. This could open up micropayments for the use of educational resources, courses, etc.

2.8 Smart Library Cards

The blockchain technology offers a transparent management of resources that libraries can use to deliver such system in a safe and convenient without the need of central authority. With the help of blockchain based smart library card the student authenticity can be easily verified and the libraries are able to verify and identify the current holder of the books at any given time. The blockchain secured library transactions can support digital content like ebooks, scientific publications or any other media. This enables a more precise accounting because instead of having expensive flat-rate contracts with the digital publishers.

2.9. Smart CV's for the Employer's

Currently, in the recruitment process employers receive paper copies of resumes and the student's paper certificates. To prove originality and validity employers can only verify with the issuing organization for the authenticity and validity of the certificate. This process requires time, cost and third party verification agencies. Using the blockchain distributed ledger technique the student certificates, credentials and profile are stored in distributed tamper proof blockchain

network and a QR code for the stored data in the blockchain network is created. The student can create smart CV's containing this QR code which is uniquely identifying profile of the student. It makes the Employers to easily verify the authenticity of educational certificate and assess credentials of the individuals which eliminates cost, third party and requires less time.

2.10. Intellectual property protection for Educational Contents

The research scholars and teachers regularly publish research papers and preserve privacy of their publications as part of their work. In traditional system it is very difficult for the researchers to know the similar studies under way when a scholar begins his research. Blockchain could allow scholars to publish content openly in distributed environment while keeping track of reuse, without putting limitations on the source material. And also has the provision of rewarding to the teachers based on the level of actual use, reuse of their teaching materials and the number of citations to their research papers. Based on metrics the students and institutions make decision on which teaching materials to use. Teachers can publically advertise the publication of their resources and link to them, as well as the other resources they used in creating the material based on use and citation they can awarded payment with help of smart money transfer. This system will be useful for the authors no need to go through research journals with high access fees.

2.11. Online Learning Applications

In the modern education system, the Learning and acquiring knowledge and skill takes place in a variety of contexts including negotiated and online learning with traditional institutions, executive education courses, short time skill oriented courses, blended learning, digital and mobile learning, and digital certification on completion from a reputed institutions across the globe. The blockchain is the distributed ledger technology provides transparent, secure and shared applications that can be accessed by students, employees and employers to verify educational records independent of provider or location.

3. Conclusion

The proposed blockchain technology is a distributed shared immutable ledger storage technology that clearly has applications in the world of higher education system. The blockchain technology could be used in higher education to permanently secure certificates and credentials earned by the students during the courses of study, to verify multi-step accreditation process applications, automatic recognition and transfer of credits, providing tamper free secure storage of digital certificates and also blockchain could be used for the scholars to their tracking intellectual property rights and also providing incentive based rewarding mechanism for use and reuse of that intellectual property values .A blockchain records student credentials in a verifiable, secure and permanent distributed storage databases. Therefore it is very suitable for storing fingerprints of certificates or other

educational credentials. Blockchain reveals forgery of certificates and it supports learning histories and used to provide efficient assess mechanism for recruitment companies to verify, authenticate and assess the student's skills from the certificates issued by the colleges. Blockchain technology can store a complete, trustworthy set of record of educational activities including the processes and results in formal as well as informal learning environments and it foster students' learning motivation. It provides an environment for evaluating teacher's performance evaluation to improve quality education system.

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Author Profile



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