Implementation of Blockchain Technology in Education Sector: A Review

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ABSTRACT: *In today's society, the problem of false academic qualificatios and tampering of student's certificates are increasingly prominent, and the social recognition of data such as student's scores is declining day by day. At the same time, certificates missing become a major problem and a lengthy procedure is used to collect the duplicate certificate. Blockchain is one of the leading technologies, which are used to store the data in secured and linked to each other using cryptographic principle. The main objective of this paper is to use the blockchain method to secure the certificates which is essential for all of us in academic sector.*

Key Words: *Cryptography, Digital Certificates, Consensus, Distributed.*

1. Introduction

> *"Blockchain is a technology that clearly has applications in the world of learning at the individual, institutional, group, national and international levels. It is relevant in all sorts of contexts: schools, colleges, universities, MOOCs, CPD, corporate, apprenticeships, and knowledge bases. Rather than the old hierarchical structures, the technology becomes the focus, with trust migrating towards the technology, not the institutions. It really is a disintermediation technology" - Donald Clark*

A blockchain is a collection of immutable record of data. It is managed by cluster of computers. These blocks of data are secured and linked to each other using cryptographic principles. A block is a collection of data in the blockchain. The data is added in chronological order to the block by connecting it with other blocks. The first block is called Genesis Block in the Blockchain[1].

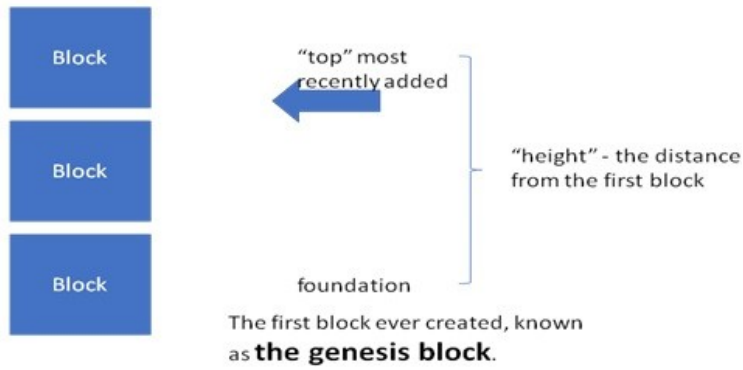

Fig 1: Structure of Blockchain

A ledger in the blockchain is called the *distributed ledger.* It is spread across the network among all peers in the network. Each peer holds a copy of the ledger.

1.1 Characteristic of Blockchain

- **Peer-To-Peer**: All participants communicate with each other directly without any central authority to control it. Thus data exchange can be done directly with third-party.
- **Distributed**: The ledger is spread across the whole network which is used to control the crime.
- **Cryptographically Secured:** It is used to make the ledger tamper-free.

- **Add-Only:** Data is added in the blockchain with time-sequential order, which implies that it is almost impossible to change that data[2].
- **Consensus**: The blockchain can update the ledger via consensus. The update made to the blockchain is validated against the criteria defined by the blockchain protocol. Then it is added to the blockchain only after a consensus has been reached among all participating peers/nodes on the network[4].

1.2 Benefits of Blockchain

The benefits of Blockchain which lead to its development in the technological field are[3]

- It is not owned by a single entity, hence it is decentralized.
- The data is cryptographically stored inside.
- The blockchain is immutable, so no one can tamper with the data that is inside the blockchain.
- The blockchain is transparent so one can track the data if they want.

1.3 Applications of Blockchain

Some of the applications in the future may lead the blockchain in the virtual educational field:

- **Diplomas and certificates:** The academic record of the students such as notes, diplomas and titles must be protected. If this information is stored in Blockchain, then it is out of danger in case the institution loses these files. The delivery of certifications through the blockchain can also be done.
- **Security in the archives:** In virtual education, the documents or files prepared by students and institutions will be safe with this technology. This also helps to avoid theft in both cases and forgery of digital signatures.
- **Reliable transactions:** With the blockchain, it is easy to manage economic transactions with online institutions and to verify the credibility of online institutions, avoiding "falling into the trap" of these fraudulent networks.
- **Accreditation of credentials:** It focuses on interpersonal skills to obtain them through "peer to peer" processes. Credentials are given to the students, with whom the projects are carried out, certifying some skill developed during the group learning.

2. Working of Blockchain

A blockchain carries **no transaction cost**. The blockchain is a simple way of passing information from A to B in a fully automated and safe manner. A block is created to initiate the transaction. This block is verified by millions of computers which are distributed around the net. The verified block is added to the chain by creating a unique record[4].

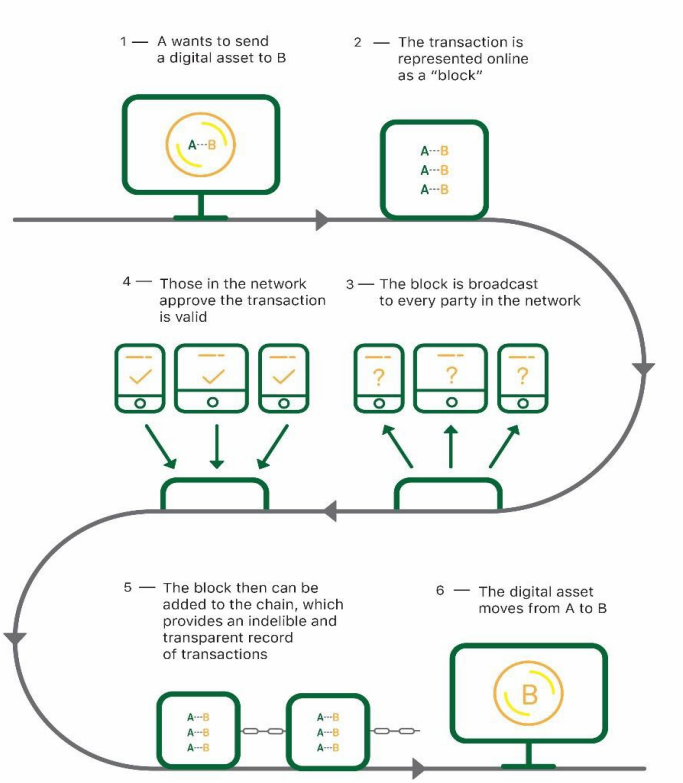

Fig 2 : Working of Blockchain(Source : Adapted from Ryan(2017)

3. Objective of the study

Blockchain is typically used to store records of:

- Asset transactions;
- Smart contracts;
- Digital signatures and certificates.

Thus the researcher wants to explain how the education institutions can use certification method in Blockchain technology for the academic purpose.

4. Certification

Certification is the issue of a statement from one party to another specifying that certain set of facts are true. In India, paper certificates are always used is different format. The certificate is not immune from the risk of forgery. There are few disadvantages in this paper certification:

- Certificate is a manual process which requires significant human resource.
- If a third-party needs to use the certificates, e.g. to verify claims in CV, they need to read and verify each certificate individually and manually, a significantly time-consuming process.
- The certificates can be easily lost due to carelessness. Once lost, a lengthy process is followed to get the duplicate certificate.

The objective of notarising certificates on a blockchain is to transform a digital certificate into an automatically verifiable piece of information that can be consulted by third parties through an immutable proof system, on a public Blockchain. The advantages of digital certificate in Blockchain Technology are:

Fig 3: Advantages of Digital Certificates in Blockchain

4.1 Components of Certification

The elements of the certification are:

1. The claim - the statement that "this set of facts is true". Example: In educational institute, the set of facts are "a learner has acquired a skill", "a teacher has sufficient knowledge to teach", or "a student has completed an assignment".
2. An issuer - a body that has checked and validated the facts, and is certifying that the claim is true
3. Verification of Evidence – The procedure by which the claim is verified and some additional information about the claim is got.
4. A recipient - the person who is addressed by the claim – the learner acquiring skill, the teacher who has enough knowledge to teach or the student who has completed an assignment
5. A certificate - a document that attests the identity of the issuer, the identity of the recipient, the claim and refers to the evidence as necessary.
6. A certificate will include a signature which is a unique symbol, stamp, image or code which can only be affixed by the issuer, thus confirming their identity.

4.2 Processes Involved in Certification

Certification involves three distinct processes:

1. Issuing: The process of recording the claim, issuer, evidence, recipient and signature onto a certificate. The data is recorded in a centralized database of claims.
2. Verification: Third-party verifies the authenticity of the certificate.
   There are three modalities:

a) Verification using security features built into the certificate itself
b) Verification of the certificate with the original issuer
c) Verification by comparison with a centralized database of claims.

3. Sharing: The process by which the recipient of a certificate shares that certificate with a third-party. There are three ways to share certificates:
   a) Directly transferring the certificate to the third-party.
   b) Storing the certificate with a custodian, who is authorized to share only with certain people at the demand.
   c) Publishing the certificate, by putting it in a public registry or store, where everyone may consult it.

4.3 Blockcerts: An open Standard for Blockchain educational certificates

Blockcert is an open standard for creating, issuing, viewing, and verifying blockchain-based certificates. These digital records are registered on a blockchain which is cryptographically signed, tamper-proof, and shareable. The goal is to enable a wave of innovation that gives individuals the capacity to possess and share their own official records. The initial design of Blockcert was developed at the MIT Media Lab and by Learning Machine. The purpose of making Blockcert open source was to avoid trapping of data and to maintain the certificates with easy interoperability when needed for official records.

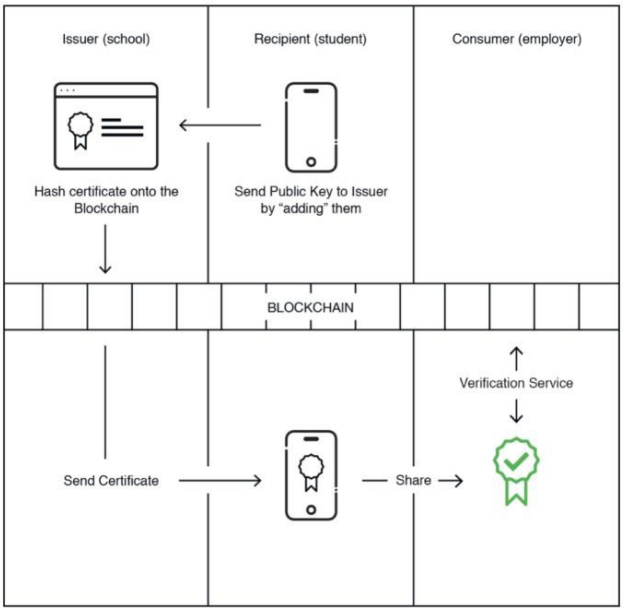

Fig 4 : Issuing and Verification of a certificate on the Blockchain
(Source: Blockcerts (2016))

5. Conclusion

This exploratory study was a review on the blockchain in educational field. Certificates play a major role in academics. Blockcerts method in Blockchain technology is used to store the certificates in proper place, so that they can be accessed easily without any duplication. The difficulties faced by us like forgery in certificates and missing of certificates can be easily avoided. Thus blockchain may bring stakeholders within the educational sector, with a particular focus on its potential for digital accreditation of personal and academic learning.

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