APPLICATIONS OF BLOCKCHAIN TECHNOLOGY IN EDUCATION

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***Abstract*: Blockchain technology is the emerging technology which is developing with the advancements in Information and Communication Technology and becoming disruptive technology for existing technologies in various operational areas. This is because of its unique property of decentralization, internal security mechanism, reliability and data integrity. This paper is a review of research related to application of Blockchain technology in education field. It focuses mainly on educational applications that have been developed with Blockchain technology, advantages that can be achieved through Blockchain technology in education, and challenges and security issues of adopting Blockchain technology in education. In this review it is observed that there various functions in education the use of Blockchain technology is in its primary stage and potential to increase the use and can be enhanced in the near future.**

***Index Terms:* Blockchain technology, security issues, distributed ledger, educational institutions.**

I. Introduction:

In recent years, the Blockchain technology has been growing tremendously along with the advancements in Information and Communication Technology. With the increasing utilization of the Internet access in the modern digital life, ensuring security and privacy, especially, for the financial and e-commerce applications have become critical. The enormous growth of cryptocurrencies leverages the rapid development of Blockchain technology. Blockchains are immutable and distributed digital ledger systems without a central authority, storing the cryptographically signed transactions in the form of blocks [1].

In the Blockchain network, the ledgers are public to the community of users in essence; each block has the cryptographically linked connection with its previous block after validation. The block chains are constantly growing, according to the transactions and, thereby, being appended the new blocks. Each block contains a hash value regarding the content of the previous block in the Blockchain network. The Blockchain technology has successfully enabled e-commerce systems such as Ethereum, Bitcoin, Litecoin, and Ripple etc.

The Blockchain technology has been broadly used for a variety of applications. Three different types of Blockchains are available based on the availability of the data, managed data, and actions, including public-permissionless Blockchain, the public-permissioned Blockchain, and private blockchain. Blockchain technology has widely used in different emerging fields such as the Internet of Things (IoT), education, finance and auditing etc [6].

According to [11], the global market investments in terms of estimated capital market spending in blockchain technology during last five year are given by the following chart.

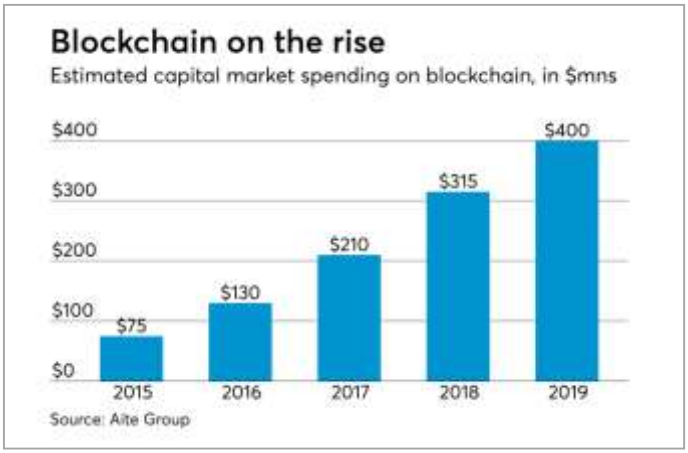

Figure 1- Estimated capital market spending on Blockchain technology [11].

The Blockchain is an encrypted, distributed database that records data, or in other words it is a digital ledger of any transactions, contracts - that needs to be independently recorded. One of the key features of Blockchain is that this digital ledger is accessible across several hundreds and thousands of computers and is not bound to be kept in a single place.

Blockchain chain has already started disrupting the financial services sector, and it is this technology which underpins the digital currency- Bitcoin transaction. With *Blockchain technology* in financial sector, the participants can interact directly and can make transactions across the internet without the interference of a third party. Such transactions through Blockchain will not share any personal information regarding the participants and it creates a transaction record by encrypting the identifying information. The

most exciting feature of Blockchain is that it greatly reduces the possibilities of a data breach. In contrast with the traditional processes, in Blockchain there are multiple shared copies of the same data base which makes it challenging to wage a data breach attack or cyber-attack . With all the fraud resistant features, the block chain technology holds the potential to revolutionize various business sectors and make processes smarter, secure, transparent, and more efficient compared to the traditional business processes. India also started initiatives for adopting new technologies such as Blockchain technology and artificial intelligence (AI) technologies by signing a Statement of Intent (SOI) in the fields of artificial intelligence and Blockchain technology as per the Niti Ayog report 2019 [13].

II. Research Objectives:

1. To understand Blockchain technology and it's working.
2. To know the various probable applications of Blockchain technology in education.
3. To identify the benefits that could Blockchain technology bring to education.

III. Blockchain Technology-

Blockchain technology enables the creation of a decentralized environment, where the cryptographically validated transactions and data are not under the control of any third party organization. Any transaction ever completed is recorded in an immutable ledger in a verifiable, secure, transparent and permanent way, with a timestamp and other details.

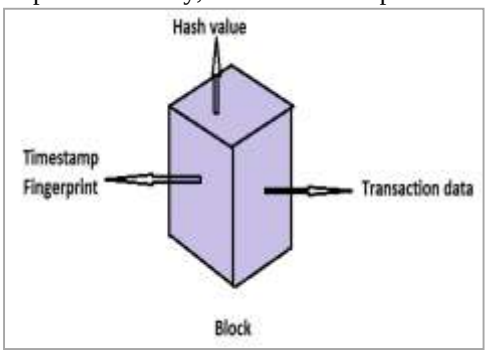

Figure 1- Components of 'Block'

The Blockchain term, originally block chain, was first coined in 2009, by (the still unknown) Satoshi Nakamoto, in the original source code for the virtual currency Bitcoin: "Nodes collect new transactions into a block, hash them into a hash tree"; "when they solve the proof-of-work, they broadcast the block to everyone and the block is added to the block chain" (Nakamoto, 2009).

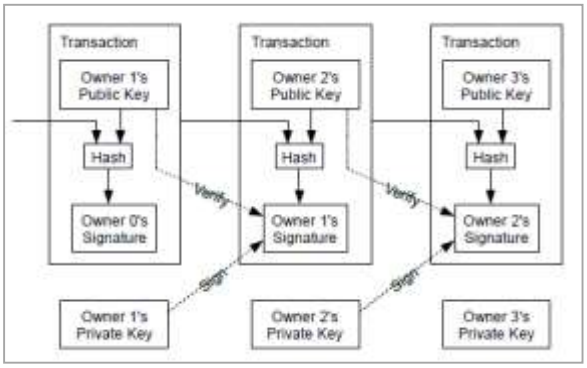

Figure 2 - Concept of Blockchain

The interrelated terms Blockchain, Cryptocurrencies (currency that only exists digitally, using a decentralized system to record transactions) and Initial Coin Offering – ICO (the first sale of a cryptocurrencies to the public, conducted raising funds to support a start-up) were added to the Merriam Webster Dictionary in March 2018.

Advantages of Blockchain Technology in general:

1. Improves the effectiveness with reduction in transaction time.
2. Reduces overheads and intermediary costs as it is direct transactions.
3. Highly secure due to use of cryptographic and decentralized Blockchain protocols.
4. Minimized the chances of cybercrimes, frauds and tampering of records.
5. Highly transparent processes with a proper record creation and tracking.

IV. Blockchain Technology in Educational Institution:

Some of the applications of Blockchain technology in educational institution:

In Blockchain student's records and certificates will be immutable and can be validated and evaluated by anyone who has access to the Blockchain. As the data in Blockchain technology are stored in a shared distributed ledger, once the records or certificates are stored in the Blockchain, it can be verified even after closer of that educational institution. Alternative to paper document : Use of digital records, transcripts, degrees marksheets, diploma marksheets, certificates and any other documentation, paper documents will be replace by Blockchain. We don't have to worry about lose or keeping records. Employers, institutions, students and any other interested party could request access to see particular records and because they are immutable they have higher credibility. True-copy certification is not required as everything will be validated and consolidated in Blockchain format.

Credentials: all our immutable certificates and credentials will be stored in Blockchain and can be retrieved from our digital wallets at any time. If an employer needs to verify that we actually have specific accreditation they could easily check the Blockchain and confirm that we have the skills which are claimed.

Accessibility of records: educator, students and any individual can see and have access to credentials and records from a digital wallet, which basically is an application in our smart phones.

Payment of Course: some institutions are starting to accept cryptocurrencies as a form to pay the course fees. If you have some money in your wallet or if you are into mining cryptocurrencies, why not use that digital money to pay for your fees.

Scrutiny and validation of information: in 2018, MIT together with the blockchain startup Learning Machine used Bitcoin blockchain to issue more than 100 digital diplomas of its graduates. There won't be illegal or fake diplomas or certificates. If you earn your degree, you will get that data in an unchangeable blockchain that you can share with future employers in your resume or LinkedIn account.

Inspiration and motivation for students: a form of reward to students could be with tokens. The better they perform in a course, the more tokens they could get. These digital tokens can be implemented with the blockchain technology. In some cases, students could use the tokens earned to pay for more courses, the tuition fees or to move those tokens to their digital wallets and convert them into a cryptocurrencies. Students can earn while they learn by knowing they will be able to earn money for better performance will definitely motivate students.

Recruitments and Connection between students and employers: with the use of these digital tokens that will be part of a blockchain, students with more tokens could be in a leader board or look more appealing for future employers who will be searching for the more competent candidates. One way to measure how skilled candidates are will be by verifying how many tokens students achieved during their courses.

Rewarding high quality content: similarly to the token system to reward students, we could use this model to reward educators, instructional designers and content creators. The better the content and the course, the more tokens students will assign. These tokens will again be converted into cryptocurrencies that educators can cash out or maintain in their digital wallets.

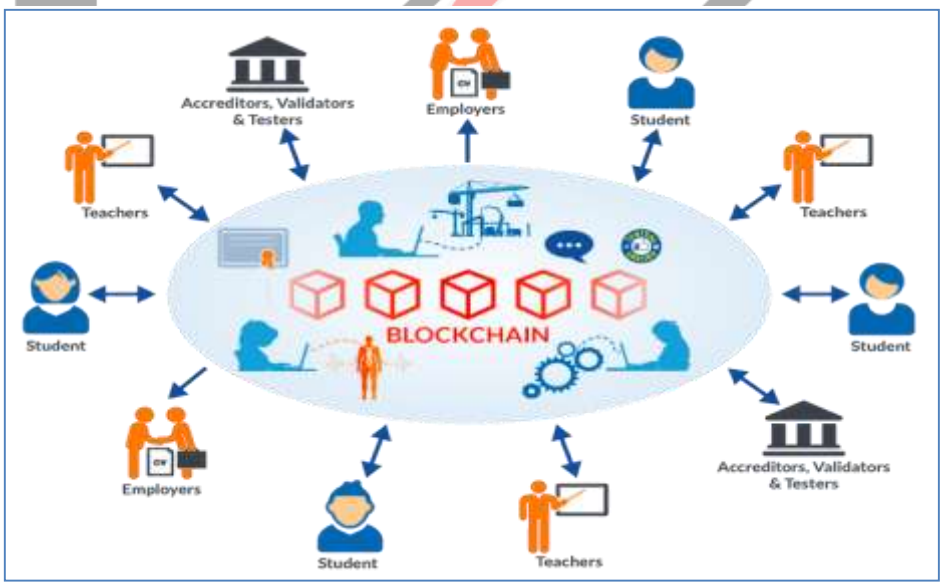

Figure 3- Blockchain application in education [7].

Benefits of Blockchain Technology uses in education:

1. Blockchain Technology replaces the use of papers for keeping records, printing and issuing of various documents such as degree, diploma certificates, transcripts and other paper documents. The documents not required to be maintained and keep in safe place as the Blockchain technology provides verifiable access to all those who needed to check the verification and authenticity of originality of documents.

2. Blockchain technology will improve the scholarship system for students and teachers and provide transparent mechanism for funded projects and grants using cryptocurrencies in educational institutions.
3. Highly secure due to use of cryptographic and decentralized Blockchain protocols and therefore it minimized the chances of cybercrimes, frauds and tampering of records which are having high educational importance.
4. Improves the efficiency and effectiveness of educational activities with reduction in time of verifying the documents and paying course fees, getting scholarships, fellowships, grants etc.

Security issues related to Blockchain Technology in educational institutions:

1. Blockchains uses excessive energy.
2. Mining does not provide network security.
3. Scalability issues increases over the increase in number transactions.
4. Initial implementation cost will be higher for educational institutions.

V. Conclusion:

Blockchain technology has already impacting on the financial sector with cryptocurrencies; also it has potential to impact on several other sectors where ever there is some transaction between two or more parties keeping records with security. This paper is the systematic efforts to present the review of applications of Blockchain technology in education though the Blockchain applications. Blockchain technology has the potential to accelerate the end of a paper-based system for certificates and removes the need for educational organizations to validate credentials. Adoption of Blockchain technology for various functions by educational institutions enables to bring change in verification of academic records, authenticity, validity of certificates and grades of degree courses of educational institutions like colleges and universities. Educational Institutions can automate, standardize and secured many of their functions through a decentralized autonomous network with the use of Blockchain technology in near future.

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