

Adoption of upcoming blockchain revolution in higher education: its potential in validating certificates

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Abstract

The important role of an educational certificate is very influential in playing professionalism in the ecosystem of a company. Because the certificate is very valuable, it is necessary to store the long term storage space available in Tamper-proof ledger. The heavy Focus in the research conducted is to present a revolutionary Blockchain technology for education in response to an effective solution in validating the certificate by implementing a blockchain-owned advantage that is a system of Distributed and cryptography, the presence of blockchain technology will be able to eliminate the existence of false diplomas. The study adopted two methods namely, the method of descriptive analysis and the library study method. Blockchain is expected to contribute success and improve the quality of national education.

Keywords— *Blockchain, Diploma, authenticity, education, Validating certificate.*

1. INTRODUCTION

Blockchain is the latest information technology, which is currently in existence has started to be widely applied in all kinds of daily necessities in various applied fields. This Blockchain technology is developed in order to support the disruption era of information that provides alternative solutions of centralized technological architecture. Blockchain is realized with the concept of decentralized information in data integrity processing [1]. The Data stored in the Blockchain will permanently automatically record. Data that will be communicated peer-to-peer to the internal network and actively collaborating. This is very different to the concept of Internet-based that developed in the previous information technology. Blockchain technology is Rumored as one of the technologies that is capable of replacing centralized information architecture that is currently dominant developed, namely through the implementation of Internet-based technology [2].

Seen from another point of view, higher education as one of the non-business institutions has come to feel challenged to try and adapt the concept of blockchain technology. The implementation of Blockchain technology into the main business of higher education is the learning and education process. In the research done this time will be described what the power of Blockchain technology in supporting the needs of processes in Higher education. But basically, the world of education is still minimal in the application of Blockchain technology still has not been applied much, in addition to this technology is often used for handling financial information, job contracts are also due to the lack of difference of stakeholders in the world of education will benefit the social and potential of Blockchain technology [3]. The certificate of Education issued by educational institutions also has a very important value in supporting the socio-economic national community especially in Indonesia. The certificate is used as the original license which can be used as the consideration and reference of the recipient party in considering competency test feasibility. Blockchain is able to maintain the authenticity of the certificate data to be forged, and in this case it is able to suppress the number of certificate misappropriation data [4].

1.2. BLOCKCHAIN TECHNOLOGY FOUNDATION

Blockchain-owned protocol transaction structure is capable of facilitating not only digital currency transfers only, but other digital assets, such as. Assets that have existed or forms, such as houses, cars, cash and land. While assets can be called as intangible assets such as intellectual property, such as patents, copyrights. Virtually anything that has a value capable of being tracked in the Blockchain network, it can already be ensured to reduce the risk and cut costs over all involved [5]. Other key properties related to Blockchain are security, interoperability and programmability, which is the character of the consensus protocol run, a simple overview can be seen through (Fig. 1: Blockchain consensus protocol).



Fig.1: Blockchain consensus protocol.

The simplest analogy of Blockchain through (Fig. 1) is A record (database) that will continue to be developed. It can also be referred to as a Block that is interconnected and secured through cryptographic principles. Inside each block will load the cryptographic hashes from the previous block, the timestamp, and the transaction record. In this system, all transactions will be interconnected and if there is an attempt to change the data on one block, it must change the data on the other block [6]. Each block protected by this cryptographic is interconnected and creates a network. All the networked computers in a particular and continuous will mathematically verify a copy of the Blockchain with all other copies in one network. This will be similar and able to be applied in the effort to integrate certificate data in the education world, which is sure to suppress the amount of data being diverted. In an effort to improve the excellence of human Resources and the advancement of economic order and living standards are much better already of course and world education is a main gate in entering the intended phase [7].

2. RESEARCH METHOD

The methods adopted in this study will be conducted by explaining the study of libraries related to the characteristics of the Blockchain that has been done before. Especially for Blockchain technology within the scope of non-commercial or higher education fields, dimensions and other viewpoints are required to maximize the coverage area. The results of this fact collection and field studies concluded that the application of Blockchain technology could provide an overview especially in terms of future adoption of the Blockchain Revolution in higher education: its potential in validating certificates [8].

2.1 LIBRARY STUDY METHOD

The study of the library is a method of research conducted in the activities of searching for references and information from various sources such as scientific journals, books, literature and opinions of experts who have a common topic raised in the research is underway. The purpose of the library study is to know the information of the various research results that have been done before, so it can be proposed in conducting further research activities. In this study there were several literature studies on blockchain technology with other related research [9]. The following 7 (seven) study libraries used in this study include: "The Blockchain Revolution: An Analysis of Regulation and Technology Related to Distributed Ledger Technologies" was a research title that was conducted in 2017 [10]. In this study, it has produced a study that discusses, as well as providing answers to questions that serve as their main study.

Where Blockchain is viewed in terms of academic, technological, industrial, and other viewpoints. Blockchain for education, a research title conducted in the year 2017 which in the study will discuss and introduce the fundamental principles of Blockchain that focuses on its potential in the education sector [11]. "Exploring blockchain technology and its potential applications for education" is also a

similar study in the world of education that discusses the potential that can be excavated from the existence of a revolutionary technology called blockchain capable of being used to solve some educational problems. A research title conducted in 2018 with the title, Cryptocollege : How blockchain can reimagine higher education, it also discusses how blockchain Has a strong potential to provide a new hybrid model for higher education that supports lifelong learning on a global scale.

The Blockchain and Kudos: A Distributed System for Educational Record, Reputation and Reward is a research title conducted in the year 2016 [12]. The study discusses the instantiates and democratic blockchain technologies that carry the name of educational reputations outside of the academic community. That can have a substantial impact on the reputation management for the education system. Similar research has been conducted in the year 2017 with The title "The Application Model and Challenges of Blockchain Technology in Education" This study discusses, Blockchain is able to create an educational platform by developing a certificate system of degrees, building educational resources, creating a system "Self-organization" as well as decentralized education system [13]. As well as research with the title "Application of Blockchain Technology in Online Education" discusses the same thing about how Blockchain is able to solve problems in the educational world like, keep a record of the learning distributed, provide credible digital certificates and protect intellectual property through data encryption [14].

3. RESULT AND DISCUSSION

Blockchain is a technology that attracts many industrial sectors, especially in the education sector. As one of the technological innovations that can provide a participatory impact on global economic growth. Exploratory blockchain is a decentralized ledger record which is the basis of understanding the blockchain is able to bring interest in the education sector, specifically on its potential to receive digital certificates and educational institutions [15].

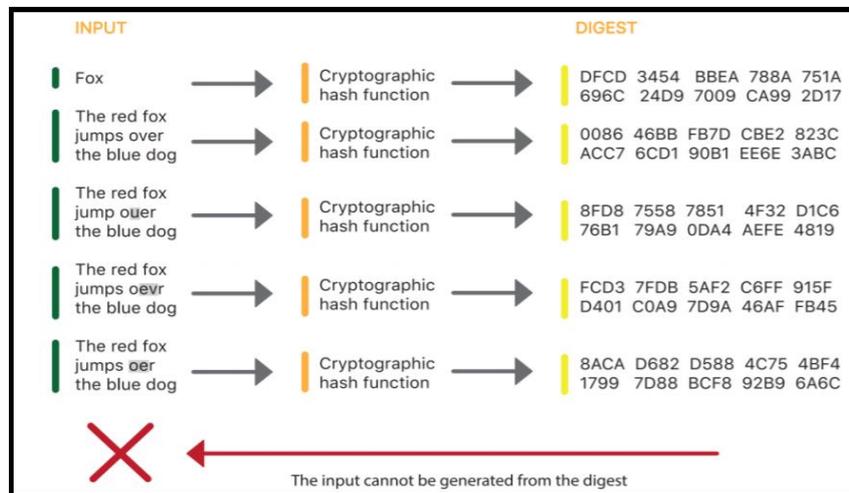


Fig. 2: Cryptographic Hash Function

A hash code is a unique node that can be defined as one of the digital security modes whose functions are similar to digital fingerprints. Hash-Generator is a program that allows a user to be able to perform activities and transactions in uploading text strings by creating a unique ID [16]. Hashing can be used as an antitussive device, because if one of the letters or numbers in the document is changed, it will automatically generate a completely different ID. of course it is very good to be implemented in a digital certificate issued by an educational institution. With the Hash concept, data misappropriation of certificates performed by irresponsible parties is able to be suppressed. Therefore, the education Agency is required to continue to develop technology in this era to be able to disruption technology to not far left behind.

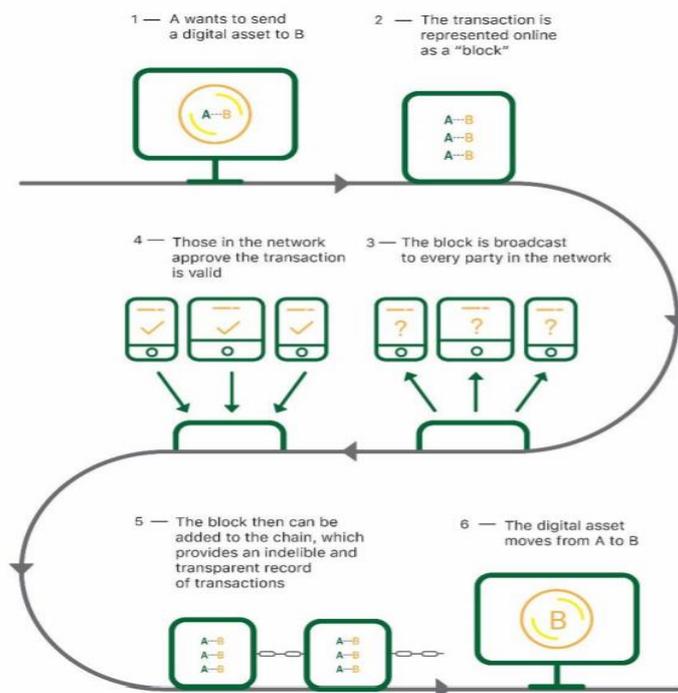


Fig. 3: How blockchain works in certificate issuance management

Blockchain is a data-driven software that is capable of network-oriented and is able to shift risk and is able to be responsible for the process of node code processes against decentralized data storage [17]. Transaction records will be recorded in the blockchain as a transaction asset that is gracefully in the Blockchain protocol function. The concept of blockchain technology is essentially a record of an autonomous ledger that is transparently transparent. Where each transaction will be stored in a blockchain ledger, insert a new entry into the blockchain while receiving a consensus of the network, as well as making transactions to all users scattered across various networks. Blockchain in the system of work order and the process will periodically check that the copies in their ledger will be processed identically to those across the rest of the network. Any device running blockchain software is known as a node and is connected to a network of nodes running such software. When a person can set up a node and transact directly with other nodes on the network, this is known as the public blockchain network [18].

3.1 CERTIFICATE MANAGEMENT

Certification management can revoke, delete and create reference certificates stored in the revolutionary blockchain technology intended for education. Then it is implemented in an accreditation authority, an institution that is linked in contact simultaneously. Each operation is like adding a certificate, requiring that the caller is a registered certification authority and each person will be able to access or retrieve the certificate records provided with the certificate hash. Information consisting of a certificate hash includes, the start date and the expiration date and a status column (On hold) [19].

3.2 CERTIFICATE AS EXTENDED OPEN BADGES

Certificates are an open badge that is expanded by digitizing certificates as a result of changing the data format. In accordance with the certification authorization scheme and application partner requirements it will eventually perform an open standard schema extension with 6 (six) additions. Among them are the date of examination, unique ID, place of publication, applicable inspection rules, data on certification, data about the recipient's certificate and the trusted service address offered to verify the certificate [20].

```
{
  "$schema": "http://json-schema.org/draft-06/schema#",
  "title": "Information on the examination date and place",
  "description": "This extension provides additional information on the examination date and place.",
  "type": "object",
  "definitions": {
    "ISO8601Date": {
      "description": "ISO 8601 date format string. For example, 2016-12-31T23:59:59+00:00 is a valid ISO 8601 timestamp.",
      "type": "string",
      "format": "date-time"
    }
  },
  "properties": {
    "startdate": {"$ref": "#/definitions/ISO8601Date"},
    "enddate": {"$ref": "#/definitions/ISO8601Date"},
    "place": {"type": "string"}
  },
  "required": ["startdate"]
}
```

Fig 5: Schema Extension for Examination

In Figure 5 shows a detailed verification scheme of a property verify address and assertion hash has been set. Which is where this property will allow third parties to be able to implement their own verification service [21].

```
{
  "$schema": "http://json-schema.org/draft-06/schema#",
  "title": "Verify Certificate in BlockchainForEducation",
  "description": "This extension provides the URL to the BlockchainForEducation Verify SmartContract to verify a certificate.",
  "type": "object",
  "definitions": {
    "HashString": {
      "type": "string",
      "description": "Open Badges SHA-256 Hash",
      "pattern": "^sha256\\\[a-fA-F0-9]{64}$"
    }
  },
  "properties": {
    "verifyaddress": {
      "type": "string",
      "format": "uri"
    },
    "assertionhash": {"$ref": "#/definitions/HashString"}
  },
  "required": ["verifyaddress", "assertionhash"]
}
```

Fig 6: Schema for Verification

Blockchain ensures that it can solve problems of fraudulent acts committed by irresponsible parties, in the activity of forged diploma documents. Blockchain has a uniqueness that relates to each other, where it is not owned by another technology, the uniqueness will be depicted in Figure 4 [22].

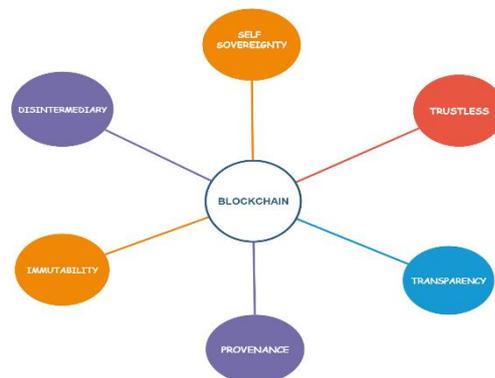


Figure 4. Unique Blockchain-owned

The uniqueness owned by the blockchain is the Self Sovereignty, trustles, transparency, provenance, immutability and the latter is disintermediary. Where the 6 (six) uniqueness owned by the

blockchain will be able to solve the problem, because the blockchain will eliminate third parties, where it will be able to minimize the occurrence of data counterfeiting, because every transaction that occurs between the two parties alone or disintermediary [23]. Further more the principle of the blockchain technology itself is transparent and immutability, it has the sense that every transaction that occurs will be transparent and any data entered and stored on the blockchain will not be changed, can only be added. If we try to change the data already stored on the blockchain, this will result in a hash change of the block, then the data will be invalid because the hash entered is not appropriate. Blockchain applies the principle of trustees which means we do not need to believe in anyone, because all activities have been handed over to the programming algorithm, each transaction will be recorded in the blockchain which will then be encrypted so that Privacy and security level on every transaction is very high. The utilization of blockchain in the field of education will have a significant advantage, if the blockchain is seriously applied then the level of cheating degree will be increasingly reduced, because every transaction occurring on the blockchain will be connected in an independent network. Blockchain will make all transactions recorded efficiently, effectively, safely and transparently in the process of proving the validity of the diploma [24]. Although the current application found in the certificate field is still many issued in the form of paper documents only but the digital certificate management system in the future will be more widely issued. The implementation and implementation of blockchain technology as we have presented and currently review, Blockchain has many major profit strings for digital certification. The first advantage presented by blockchain technology is that there is a verification service that will allow third parties to verify the authenticity of certificates and can be done more easily and practically. Secondly, if there is a decentralized system then the storage will not be changed [25]. And the third is the identity data of the certification authority and the certificate is still stored in the blockchain so that the data will not disappear. So blockchain is a revolutionary technology that can achieve the protection of a certificate and can reduce the occurrence of counterfeiting, especially for digital signatures [26].

4. CONCLUSION

The application of Blockchain technology still has not been applied much, in addition to this technology is still very new, also the initial towing of the field of applied Blockchain is that is related in providing solutions to economic and business problems. In this paper, a discussion related to the application of blockchain technology is widely reviewed in other writings [27]. The application of blockchain in the educational world in this paper refers to the forthcoming blockchain revolution in higher education that will potentiate it in validating the certificate.

Blockchain can be used as an alternative medium for storing digital certificate documents. Certificates can be identified as a piece of paper that is often issued in an exclusive format [28] by vendors to customers, institutions without proper software may not be able to read or verify them. Finally, like paper documents, digital documents can also be forged by sophisticated users in difficult-to-detect ways, and it certainly requires the development of features in the application of Blockchain technology as a distributed storage medium. The utilization of Blockchain technology in the world of education is not different from the implementation in the commercial field or transactions involving funds. Many artifacts and documents in the field of education that can be used as a useful asset that can be used as capital to transact in a safe context and fulfill the needs of all parties involved.

In the research done this time is expected to be used as a reference material for further research. As well as the adoption of blockchain in the education world can be implemented in order to contribute to the seeded and substantial benefits to the world of education.

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