Improve Credibility of Students' Educational Information Using School-Operated-Educational-Blockchain

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***Abstract*: This paper aims to provide a further understanding of the blockchain technology in providing immutable and transparent records for students' educational background. Two main applications in education, called Indorse and Blockcerts were presented and we developed a new application School-Operated-Educational-Blockchain in order to provide more accurate and various information for students' in-school performance and store them securely and transparently on the blockchain.**

Keywords—blockchain, education, School-Operated Blockchain for Education, Indorse, Blockcerts, Comparison

I. INTRODUCTION

Along with the blooming of Bitcoin and other cryptocurrencies, an increasing number of people are paying more attention to the supported technology behind them, which is called blockchain. According to Linux Foundation, blockchain is a set of linked ledgers, which is called blocks, in which each block contains extract, which is called hash, of the previous block, to enable information security and transparency among a distributed peer-to-peer group [1]. Therefore, Blockchain offers a new way for storing information, which is more reliable compared to the centralized database storage, as records to be uploaded on the chain needs to be approved by a majority of the network. Additionally, it takes more efforts to change records on the chain, as each ledger contains a hash of the previous block (Figure 1). For example, in this figure, changes in the No. 42 ledger requires changes in the No.43 and No.44 block, which is harder compared with changes in a centralized database. Based on these characteristics that convince most of the group for information uploading and each block contains a hash of the previous block. Blockchain could increase the credibility of information uploaded on the chain for improving immutability and transparency

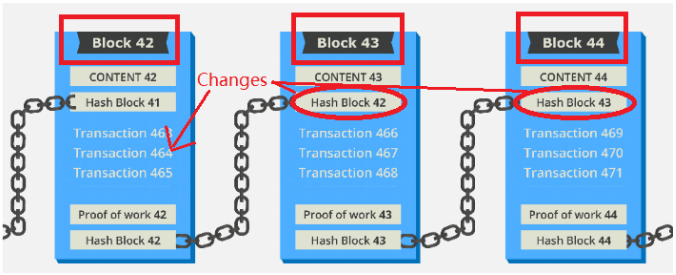

Figure 1: Blockchain's data structure

The scope of this paper is to investigate blockchain's characteristics in improving the credibility of the students' educational background through improving the immutability of students' information and enable the access to students' academic background transparent for the employers or admission offices. In this paper, firstly a brief introduction for of blockchain would be presented. Then, two applications of the blockchain, called Indorse and Blockcerts, which are the most two relevant cases to the research question would be presented in the literature review. Furthermore, in methodology, a new system, called distributed blockchain for education, helping improve the transparency of students' educational information would be presented, together with the comparison with Indorse and Blockcerts would be stated.

Additionally, the main impacts of this application in terms of security and transparency would be specified in the impact section. Finally, counter argument and corresponding rebuttal would be presented which leads to a final conclusion

II. LITERATURE REVIEW

A Indorse

Indorse is decentralized network based on Ethereum platform, based on the POS consensus platform, issued by the indorse token, and the procedures of this application are as follows [2]. (Alice is the user and Bob is the selected user)

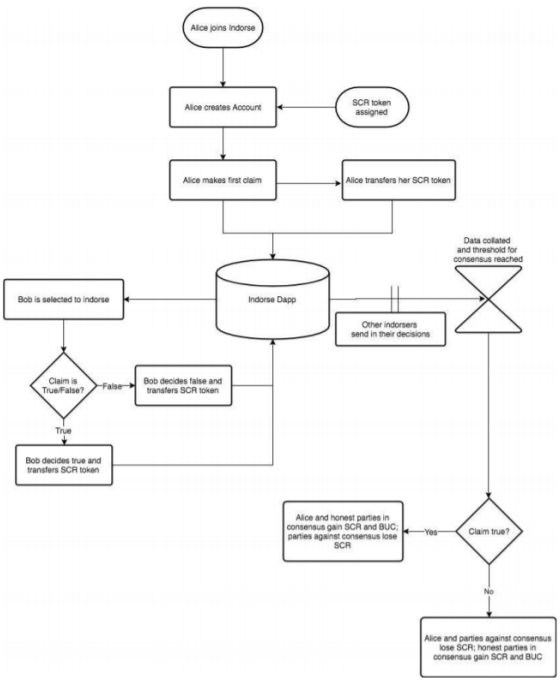

Figure 2: Indorse's working flow

1. Alice creates an account and gets SCR tokens, which is used to guarantee the quality of the claim.
2. Alice makes her first claim to the platform
3. Selected indorsers send their decisions which is pass or failure
4. The indorse platform collects the data and checks whether the threshold is met for consensus.
5. The indorsers who give the same decisions are rewarded with SCR, otherwise, lose SCR (incentive mechanism).
6. If the claim is passed, Alice gets the SCR and claim is passed to Indorse Blockchain.

In this public blockchain, where valuable tokens are involved in this scenario, and the total amount of Indorse cryptocurrency is valuable to 1,090,870 dollars in Nov. 21st, 2018, which means that kind application has been greatly approved by many people in the world [3]. Students lock their Indorse currency in guaranteeing the quality for this claim and Indorse would offer the money back if the skill has been verified through the verification page provided by the student. For viewing, anyone logging on the Indorse website could verify the professional skills, which is much more transparent compared the centralized database storage.

B Blockcerts

Based on the characteristics of blockchain's data structure, MIT's Media Lab has developed a program called "Blockcerts", which helps students to store their educational experiences on the blockchain after the permission from the collegiate institutions in 2016 [4]. According to Learning Machine, Blockcerts not only create a larger and more competitive ecosystem for issuing institutions, but it helps recipients relying on parties who can use their scholastic background in a much reliable status [5]. Blockcerts is an application which could help issue and verify blockchain-based official records. Blockcerts could help remain the availability of credentials, and it contains components for creating, issuing, viewing and verifying certificates across any blockchain.

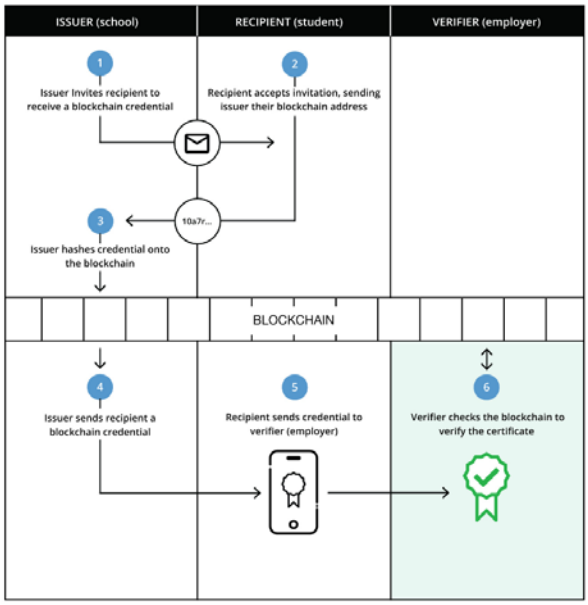

Figure 3: Blockcerts' working flow

1. Issuer invites the recipient to receive a blockchain credential
2. Recipient accepts the invitation, sending issuer their blockchain address
3. Issuer hasher credential onto the blockchain
4. Issuer sends the recipient a blockchain credential
5. Recipient sends credential to the verifier
6. Verifier checks verify the certificate.

III. METHODOLOGY:

In this section, we first present an overview of our design which is called School-Operated-Educational-Blockchain. Secondly, the working flow of the system is provided. Furthermore, the comparison between the proposed application with these two most relevant applications, which is called Indorse and Blockcerts, will be provided.

A. Overview

This application is based on Hyperledger fabric platform and run by the Ubuntu operating system. In this system, three groups of users, which are students, schools, and accessors, are involved. Previously, students create events during various activities. School officers verify the student's behavior and approve the permit to the chain. Accessors view the students' in-school information and can verify again.

B. Working flow

The working flow which is illustrated in Figure 4, is illustrated as follows.

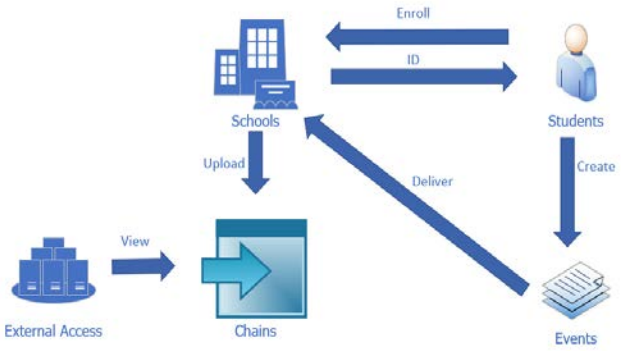

Figure 4: working flow for School-Operated-Educational-Blockchain

1. When the students enroll the school, the universities distribute the unique ID for students.
2. The students study in school and create events, which could reflect their comprehensive abilities.
3. If the students want to upload the events on the blockchain, they should deliver this event to the school, and ask for approval from the school.
4. School verify the students' behavior and determine whether to upload this event on the chain.
5. If the students apply for master degree or working opportunities in companies, they could generate the public key, to the admission office, or employers, which enable them to access their in-school performance.

C. Comparison between Indorse and Blockcerts

The main comparison between the Indorse application and our School-Operated-Educational-Blockchain is as follows. Firstly, the school operates the blockchain, which is much more credible compared with the Indorse, which is a company in Singapore. Additionally, the school has more information to upload which is related to the students' educational background. Furthermore, the indorse' member is the user on the internet and it is based on the *Ether*eum platform, which is less reliable compared with users in schools, which on the hyperledger platform. Finally, when considering about the events happening within a short period of time, such as then applying for a postgraduate degree, the Indorse servers could not handle all these claims from all over the world, simultaneously. However, the blockchain operated by the schools could serve these claims at the same time as they are decentralized.

The main comparison between the Blockcerts and our School-Operated-Educational-Blockchain is as follows. Firstly, the blockcerts are a centralized platform in helping to improve the transparency for the students' education experiences. However, the information on the blockchain is operated by the centralized platform from Learning machine, which is much less powerful compared all the nodes around schools in the world.

IV. IMPACTS

In this section, the impacts of the blockchain in education would be presented. The main impact of the applications of blockchain in education authentication is that it could help improve the credibility of students' intellectual material through improving immutability and transparency of the students' educational information. Firstly, the immutability means the records on the blockchain is less likely to be changed compared with traditionally centralized database storage. Since changing information on one block on the blockchain requires changing in the following blocks, which takes more efforts and information to be uploaded on the chain need the consensus within the group, which is hard to agree on, compared by the decision from the centralized controlling party. Therefore, the blockchain could help improve the immutability for students' educational material.

The second impact for applications of blockchain in education authentication is to improve the transparency and auditability of academic data. The transparency means it takes fewer procedures for admissions in verifying the students' information, which is called auditability. Furthermore, the information uploaded on the chain requires the agreement of the majority of the group. Therefore, applications for blockchain in education could help improve the transparency for the educational background.

V. COUNTER ARGUMENT AND REBUTTAL

The counter argument is as follows. Even though blockchain could help improve the security, and the transparency, it is only in terms of the process on the blockchain. If the data to be uploaded on the blockchain is unreliable, although it remains trapper-proof on the chain, the results admission obtained from the chain is unreliable.

The corresponding rebuttal is as follows. Even though blockchain itself could only maintain the data integrity on the blockchain, it could not guarantee the quality of information to the uploaded on the chain. However, blockchain is a distributed ledger, combined with assistive technology. In solving this problem, importing access control mechanism and protocols among the group are available. For instance, one of the blockchain platform developed by IBM called Hyperledger introduces the access control mechanism, which means only credible nodes, authenticated by the community are accessible for this platform [6]. Furthermore, another famous platform called Ethereum collects improvement protocols on GitHub, which are efforts to establish disciplinary for maintaining the blockchain applications [7]. In addition, in our design, the schools rather the unknown user on the Internet serves to be the member in our design, therefore, the credibility of the online information is much more reliable compared previous design. Therefore, with the help of the access-control mechanism, group protocols, and member from schools, information to be uploaded on the chain could be convincing.

VI. CONCLUSION

Blockchain technology has brought along transparency and security for the education authentication. Previously, there are many attempts in applying blockchain in education, with Blockcerts and Indorse as examples. However, the credibility of these centralized service provided by these companies is not as credible as educational institutions [8]. Therefore, in our design, which is called School-Operated-Educational-Blockchain, serves to be a much more reliable platform in including schools to be nodes within the decentralized network, and more information related to the students' academic performance and extra-activities would be recorded transparently and securely. Then counter argument with corresponding rebuttals are provided, which means even though blockchain could not completely guarantee the quality of the credibility for these academic materials, blockchain improves the security and transparency for educational information, especially in using the School-Operated-Educational-Blockchain, which could help improve the credibility of the collegiate background.

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