



Credential Verification on Blockchain: A Conceptual Framework of Internet of Education (IoE) for Tertiary Education

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Abstract

Students spend years in higher academic institutions intending to obtain higher qualifications for a better quality of life. Although the focus is to be awarded the academic scroll, however along the journey in university, the student might engage with not only academic affairs but also with other activities that contribute to elevating the level of their soft skills. This includes the credentials that they receive from volunteerism, clubs, sports, and short courses. However, these credentials are mostly in physical form and scattered. Furthermore, there is also an issue of credential fraud which involves a syndicate that produces fake degrees and certifications. Hence, a comprehensive verification system to ensure the authenticity of the credentials is vital. At present, most of the credential verification procedure in universities is conducted manually, which causes a time-consuming and tedious process. Therefore, a verification system underlying the decentralized blockchain technology could be an alternative. Internet of Education (IoE) is a framework that is designed for credential verification in academic institutions. Thus, in this paper, we intend to adopt the conceptual IoE framework for the credential verification process and redesign it specifically for tertiary education.

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1 Introduction

A sustainable economy is resilient and provides a good quality of life for everybody. One of the elements of having a sustainable economic life is by ensuring that they have a source of income, either from their own business or being employed by another organization. Employability has a vital role in a person's life. Students spend years of struggle in their university days to obtain a degree award. All those hard workers are worthy if they can be employed with a good job. The critical role of employment is in improving the lives of communities, addressing poverty, ensuring wellness, and creating new opportunities. Being employed boosts self-esteem by giving one a day-to-day purpose and being engaged improves the mental and physical health of a person as it does not just reward a person financially but also contributes to his or her happiness and helps build confidence (Ahmad and Begum, 2020). On the other side, the industries are also working on hiring graduates with desired skills and qualifications.

However, there one of the crucial issues on employability is related to credentials fraud. According to HireRight (2017), 85% of organizations surveyed uncovered a lie or misrepresentation on a candidate's resume or job application during the screening process by providing fake credentials. Across the Asia Pacific region, background screening conducted by employing organizations found that in 2018 an average of 15.1% of job applicants provided information that deviated from their education, employment, and professional license (HireRight, 2019). This could be classified as resume fraud, which can be defined as an intentional misrepresentation of information on a resume to present oneself more favorably than is accurate (Henle et al, 2019). This happened due to a problem with the procedure of credential verification. In university, most of the credential verification process is conducted manually and it is time-consuming.

The application of current technology advancement could be an alternative to overcome the fraud credential issue. Blockchain is a disruptive technology that promotes a peer-to-peer system that permanently records transactions in its distributed public ledger (Khairuddin and Sas, 2019). Research on blockchain for credential verification has started to emerge (Hasan, 2019; Khandelwal et al, 2020; Nguyen et al., 2020; Saleh et al., 2020). However, there is limited research on blockchain technology that explores integrating all the university credential and verification systems into a single platform. Though, the LEF (2020) has developed a framework of the Internet of Education to create a single comprehensive learner wallet, which consists of all verified credentials. Hence in this paper, we aim to report the adoption of the IoE framework in the university ecosystem, specifically for credential verification.

2 Literature Review

2.1 Academic Credential Verification in Tertiary Education

The education sector holds an important role in uplifting individuals' social and economic status. It is also valuable to fulfil the expertise needs of the industries for both local and international. Hence, for an individual to pursue education to the tertiary level and obtain valid

academic credentials is crucial. Academic credentials include but are not restricted to diplomas, degrees, and certificates which act as proof of the completion of training or education undertaken by the student (Bapat, 2019). Students spend years of struggle in their university days to obtain a degree award. All those hard workers are worthy if they can be employed with a good job. The critical role of employment is in improving the lives of communities, addressing poverty, ensuring wellness, and creating new opportunities. Being employed boosts self-esteem by giving one a day-to-day purpose and being engaged improves the mental and physical health of a person as it does not just reward a person financially but also contributes to his or her happiness and helps build confidence (Ahmad and Begum, 2019).

To apply for jobs or to further studies at a higher level, academic transcripts are one of the essential documents. In most universities, these credentials are given in the form of hard copies to students. For the verification of the credentials, the organization must manually examine all the data which makes the system very time-consuming. (Shukla et al, 2020). It is an inefficient and labour-intensive verification process for prospective employers and certificate issuers, especially when it involves multiple institutions. The verification processes are vital to prevent credential fraud. There is always a possibility that some may produce fake academic credentials which may also go unnoticed (Shukla et al, 2020)

2.2 Credential Frauds

Credential fraud or fake degree is defined as counterfeit degrees bearing the names and signs of real and fully accredited universities and/or degrees from bogus universities, sold outright and that can require some academic work, but significantly less than comparable, legitimate accredited programs (Grolleau, Lakhal and Mzoughi, 2019). The cases of credential fraud have been noticeable ever since the 14th century (Ezell, 2015) and it was reported back in the 18th century that massive cases of degrees being sold by universities in European countries (Zaretskiy, 2016). Today, the phenomenon is even worsening in the current century. This happened due to the growing global competition in job markets which led to a situation where employers are depending on proof of degree qualification to mark an individual competency (Creola, 2005).

Tariq et al.(2019) have classified credential fraud in education industries into four different categories. First is document fraud which includes the amendment of the original certificate such as name, signature, and name of degree or fully completely fake document by using incorrect logos or serial numbers (CVC Nigeria, 2018). Secondly is institutional fraud which describes to the state that the staff within an institution has intentionally created illegitimate credentials into the official records of the university or institution. This method is more reliable than document fraud because the credential itself is authentic and can usually withstand cursory scrutiny because it is backed by university records (Henry, 2018). Thirdly is Diploma mills which are schools or universities selling or awarding degrees that require less than the minimum level of the required standard. It has a sophisticated system that includes marketing to ensure its buyers can customize their desired fake

degree. Those mills are the leaders in credential fraud (Barigaba, 2016). Finally, accreditation fraud refers to the case where the accreditation body that certifies a credential as valid may itself be compromised. The most common strategy employed by diploma mills is to establish fake accreditation mills to legitimize the credentials that they sell (Tariq et al., 2019).

To overcome those academic credential frauds, it requires a sophisticated verification system to ensure the validity of the degree. However, in job employment, academic credentials are not the only criteria that will be evaluated for job placement. Other criteria such as involvement of candidates in volunteerism activity, language skills, co-curricular activities, and other soft skills are also vital in decision-making for job employment and those involvements also require verification to avoid fraud.

2.3 Blockchain-Based Verification System

Credential fraud or fake degree is defined as counterfeit degrees bearing the names and signs of real and fully accredited universities and/or degrees from bogus universities, sold outright and that can require some academic work, but significantly less than comparable, legitimate accredited programs (Grolleau, Lakhal and Mzoughi, 2019). The cases of credential fraud have started been noticeable ever since the 14th century (Ezell, 2015) and it was reported back in the 18th century that there were massive cases of degrees being sold by universities in European countries (Zaretskiy, 2016). Today, the phenomenon is even worsening in the current century. This happened due to the growing global competition in job markets which led to a situation where employers are depending on proof of degree qualification to mark an individual competency (Creola, 2005).

While blockchain technology has recently introduced a document verification process that combats document fraud and misuse. Blockchain technology simply can be defined as a distributed database, that chronologically stores a chain of data packed into sealed blocks (Grech and Camilleri, 2017). Blockchain is known as a public ledger with a transparent system. The biggest advantage of Blockchain is decentralization no single person or company is controlling the data entry or its integrity in the ledger, yet the data is verified continuously by every node in the blockchain network. Furthermore, those verified data in the recorded blockchain went through complex verification and rigid protocol to ensure the data was immutable. Once the data has been recorded, it can never be changed or tempered (Khairuddin and Sas, 2019). Information remains in the same state for as long as the network exists. This disruptive technology has started to emerge and evolve in the field of cryptocurrency (Nakamoto, 2008). Nevertheless, Blockchain has been pushed beyond the fintech sector. The uniqueness of the decentralised platform offered by Blockchain has lured plenty of multi-corporations to adopt the technology and applied in various fields such as in medical, real estate, and copyright management applications (Ekblaw et al., 2016; Elsdon et al., 2018; Karamitsos et al., 2018). In the education sector, there is research exploring the technology to verify academic credentials on the blockchain (Hasan, 2019; Khandelwal et al, 2020; Nguyen et al., 2020; Saleh et al., 2020).

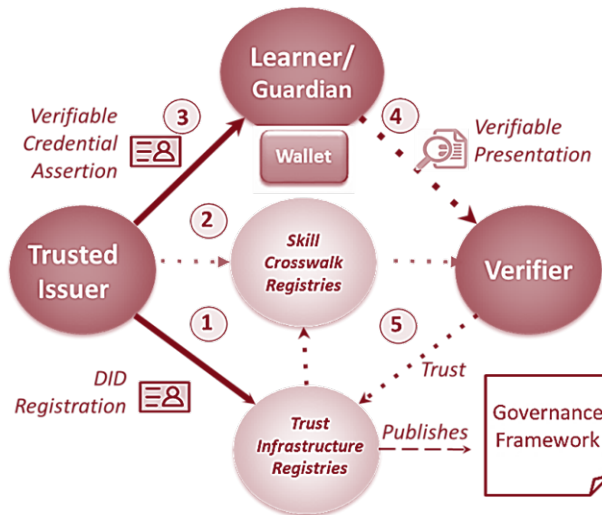


Figure 1: Internet of Education (IoE) Framework (LEF, 2020)

LEF (2020) has proposed a comprehensive framework of a blockchain-based wallet of Internet of Education (IoE) for verifying academic credentials (Figure 1). The framework includes the three main entities of the system which are the credential trusted issuer (institution/ university), learner/ parent (wallet owner), and credential verifier (institution/ university). The wallet holds the verified academic credentials (skill crosswalk registries) of the owner in the blockchain which can be accessed by an employer or other academic institution. The advantages of the IOE wallet are the transparent network between the owner issuer and verifier, permission access to view the documents also the uniquely identifiable digital certificate. Furthermore, the framework is customizable according to the type of academic and soft skills credentials issued by an academic institution including school and university. Hence in this paper, we will discuss adopting the IoE framework at a university level.

3 IoE Framework for University Ecosystem

In common, a university holds multiple systems including the student academic system and student activity system. Each system produces a different type of credentials for both the academic and soft skills of students. However, most of the systems are not integrated from one to another. Hence there are multiple administrators for each system. Furthermore, the credentials produced from each system need to be verified manually by various credential issuers from different units in the university. Due to the scattered credentials management in the university, it may cause a problem in the verification of the credentials.

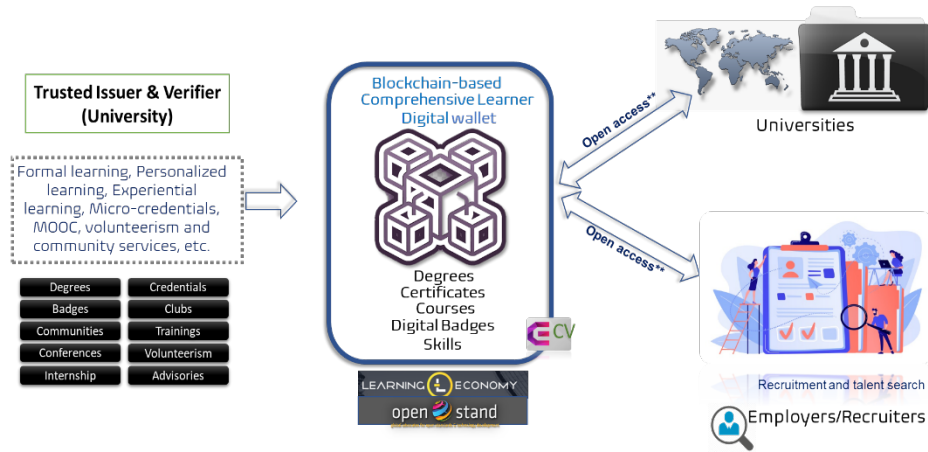


Figure 2: IoE Framework for Tertiary Education

IoE framework promotes an integrated system for managing student's verified credentials. Those credentials are placed in a single wallet that is owned by the student. At the university level, there are multiple credentials have been produced such as from formal learning (degree scrolls and academic transcripts), student activity (clubs and sports) also from community services and volunteerism. Hence, in adopting the IoE framework, each of the administrators of the system that produces those credentials is responsible for being the issuer and verifier (Figure 2). Once the credential is verified, it will be placed in the student's comprehensive learning blockchain-based wallet.

The comprehensive learner wallet holds the verified credentials of a student. These credentials are converted into a universal skill cross-work registry which acts as a verified resume that can be viewed transparently by the potential employer also any academic institution across the globe. Other than that, the owner of the wallet also has the right to choose only relevant credentials to be accessed. The most essential is all the credentials are authentic and do not require any further verification. Therefore, the issue of credential fraud should not exist in this application.

4 Reflection

The IoE framework is mainly designed to overcome the issue of credential fraud. The uniqueness of the underlying blockchain technology ensures that the IoE wallet holds only verified credentials and it cannot be tempered. These provide a significant advantage to the three different groups: *university*, *student*, and *employer*.

The *university* could gain the benefit of having a single platform for the IoE credential verification system. Any credential produced within the university system could be placed in the IoE wallet. Hence the verification processes could be instantly done. Moreover, the issue with tedious manual verification could also be eliminated due to the digital credential in the wallet has been verified.

Meanwhile, as for the *student* having a personal IoE wallet, it will give an instant verified resume for them. Student can improvise their wallet from time to time by taking extra courses or activities to add more credentials. This in turn will give them an added advantage to have a better curriculum vitae for future job employment.

As for the prospective *employer*, the advantage is they may obtain the desired criteria of an employee with a set of skills and qualifications. By recruiting the staff through the IoE wallet application, the employer may skip the tedious credential verification process. On top of that, they do not doubt the authenticity of the credentials of their employee. Hence, only qualified candidates will be employed.

However, this framework could be further expanded to include the issuer and verifier beyond the university system. For instance, if a student took a special course from a private organisation or joined a program organized by NGO, they should also be able to include and verify the credentials in their wallet. Thus, those organizations could be part of the trusted issuer and verifier in the system. This will give added value for the IoE wallet application to be used throughout an individual career path.

5 Conclusion

This paper introduces a conceptual Internet of Education (IoE) framework for higher academic institutions. This framework is designed based on the combination of the IoE and the practical basis of the university ecosystem in issuing credentials, verifying as well as utilizing the credential. In turn, this framework could be beneficial for not only the student's career path but also for expediting the credential verification process in the university and mitigating the issue of fake credentials faced by the employer.

6 Availability of Data and Material

All used or generated information is included in this article.

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