INVOTEK
Jurnal Inovasi Vokasional dan Teknologi

Volume 21 Number 1, 2021
ISSN: 1411 – 3411 (p) ISSN: 2549 – 9815 (e)
DOI : 10.24036/invotek.v21i1.833

Blockchain-based diploma information system development

Heru Saputra[1]*, Bebby Ilham Aresta[2], Tri A Sundara[3], Ilfa Stephane[4] and Lakry Maltaf Putra[5]

[1-5]Department of Information Systems, STMIK Indonesia Padang
Jl. Khatib Sulaiman No.1, Padang, Indonesia-25131

* *Corresponding author: h3ru.saputra@gmail.com*

Abstract

A diploma is a document of recognition of learning achievement from a level of education obtained after completing the study period after passing the final exam. The importance of the certificates' existence for working purposes has resulted in the proliferation of making and using fake certificates for various purposes such as applying for jobs, fulfilling the requirements to become members of the legislature, etc. The Diploma Information System using blockchain-based distributed computing can be one way to maintain the diploma's authenticity and validity. This study uses the waterfall method with several applications, *ethereum remix ideas*, ganache, and metamask, aiming to develop blockchain-based diploma information on STMIK Indonesia Padang by utilizing blockchain technology.

Keywords: Diploma information system, certificate falsification, blockchain

1. Introduction

A diploma is a document of recognition of learning achievement and completion of an educational level after passing an exam held by a tertiary institution as stated in the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 81 of 2014 chapter 1[1]. A diploma can also be defined as an essential certificate or document belonging to someone given to him because he has completed his education and has been issued by the competent authority, namely the Department of Education, through the education channel [2]. In reality, a diploma means a graduation certificate in the form of a State document through the learning process in schools ranging from elementary, junior high, high school to tertiary institutions. The existence of a diploma is considered so crucial for society today. Seeing the high demand for diplomas makes it an opportunity for individuals and organizations to produce diplomas instantly, which we are familiar with as fake diplomas.

The use of fake certificates is not a new phenomenon; generally, fake certificates usually fulfill registration or recruitment requirements from a position. The practice of fictitious education by issuing fake diplomas like this has jolted our awareness that they can print a bachelor's degree, master's degree, or doctoral program in just a few months. Of course, there is no free term for it all because to get this degree, and a student must deposit money ranging from tens to hundreds of millions of rupiah [3].

Many cases of diploma falsification occur in Indonesia; as reported by the regional kompas.com online media [4], there is a practice of fake diplomas in the Probolinggo area of East Java. Legislators used the phony diploma in the 2019 election. From these findings, the certificate material is genuine, but the serial number and contents listed on the certificate are fake. Another terrible news was the case of a phony diploma committed by a prominent comedian of four friends. It was sentenced to 17 months in prison by the judges' panel for alleged document forgery to apply as rector at Muhadi Setyabudi University (UMUS) Brebes in 2017 [5].

Therefore, a certificate information system must maintain the diploma's authenticity, validity and not be changed or duplicated. Blockchain-based distributed computing is considered one way to answer this problem because Blockchain is a revolutionary system that connects computer networks in a decentralized and distributed manner [6]. Initially used in the financial sector blockchain, this

Received date 04/09/2020, Revised date 16/01/2021, Accepted date 06 / 02 / 2021

P-ISSN: 1411-3414
E-ISSN: 2549-9815

technology has great potential to be used in many fields [7], so blockchain technology has developed rapidly until now. Almost all areas have applied it. Blockchain has advantages in security, transparency, autonomy, anonymity, and maintain data integrity. Blockchain technology has begun to be widely used in education because it benefits from a decentralized system and strong cryptography. It is hoped that universities will build an archive storage infrastructure [8]. The Blockchain itself has been used in the ethereum system. Ethereum is one of the most suitable due to its overall consistency of use and provision of intelligent contract logic [9]. A smart contract is a program that can ensure that the transactions that occur are by the agreements or regulations that have been mutually agreed upon in a distributed database network [10]. With new technology such as Blockchain, it can authenticate the ownership of a valid certificate in higher education and maintain the certificate's authenticity and validity.

2. Method

The stages carried out in this research are the planning stage for developing a diploma-based information system Blockchain. The next stage is to design a system using the Waterfall System Development method [11], which has steps like Figure 1. This step consists of four different backgrounds, including problem identification and data collection, the system design stage for the sign and verification process with Blockchain tools' help, the implementation stage by creating a website, and finally, the system testing stage.

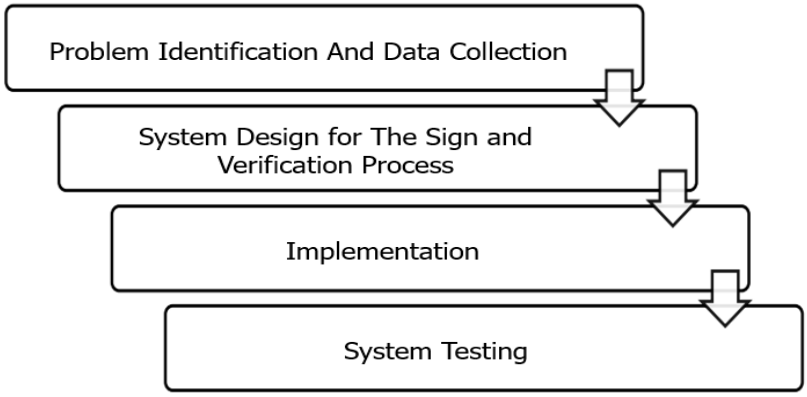

Figure 1. Research Stages

2.1 Stages of problem identification and data collection

At the data collection stage, the author conducted an interview process with BAAK and ICT staff then made observations to observe the certificate issuance process and the existing diploma legalization process.

2.2 System Design

In the system design stage, the author makes an information system design using Unified Modeling Language (UML) for the sign-in process and the certificate innovative contract verification process using blockchain tools.

2.3. Implementation

The writer creates a website in the implementation stage, where the website is connected to the smart contract. The designed website will consist of a diploma data input and output form, which displays the diploma recipient data, including diploma certificate serial number, NIRL (pass registration number), student name and ID number (NPM), place of birth date of the student, identification number family (NIK), educational program, study program, date of graduation, national certificate number, and date of graduation. The data can be saved in a pdf file format and can be uploaded, connected to the InterPlanetary File System (IPFS), and displays a QR Code.

P-ISSN: 1411-3414
E-ISSN: 2549-9815

2.4. System Testing

The system will be tested and used by the BAAK and ICT staff; the author will perform a validation test of the system, which aims to determine whether the system is appropriate or not. If in the test there are still errors in use, then the author is willing to repair the system so that the system can run properly

3. Results and Discussion

The stages are taken in making blockchain-based diplomas using the Solidity programming language, web3 JavaScript and Ethereum remix applications, ganache, and metamask. The blockchain-based diploma information system is implemented into a website-based system that simplifies the certificate verification process. Before certificate verification, the compile and deployment process is first carried out through a smart contract, making a smart contract using the Remix Ethereum IDE, presented in Figure 2 and Figure 3.

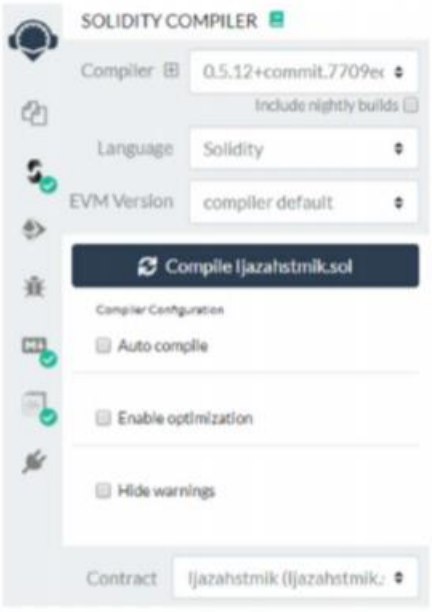

Figure 2. Compile Smart Contract

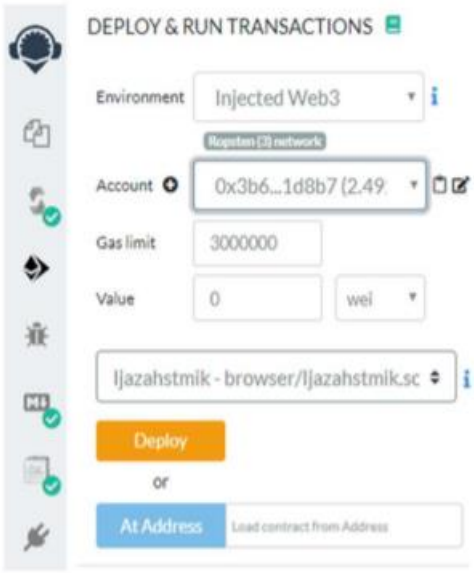

Figure 3. Deploy Smart Contract

Figures 2 and 3 will be processed through the metamask tools. The intelligent contract confirmation process will be carried out, and the certificate data submission process is presented in Figure 4.

P-ISSN: 1411-3414
E-ISSN: 2549-9815

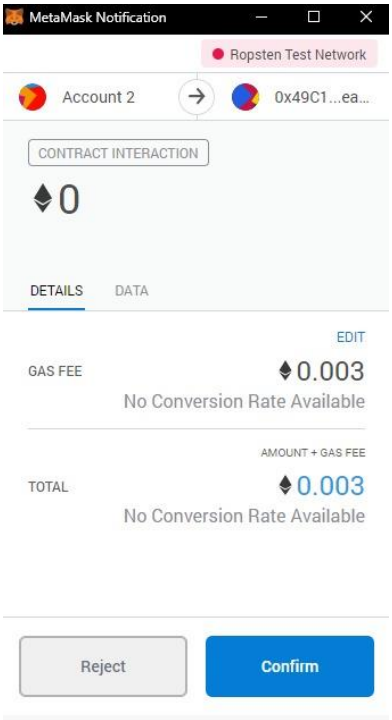

Figure 4. Confirm Smart Contract

After confirming the intelligent contract in Figure 4, the submitted certificate transaction data will be stored on the Blockchain or ledger distributed in the intelligent contract transaction presented in Figure 5 and Figure 6.

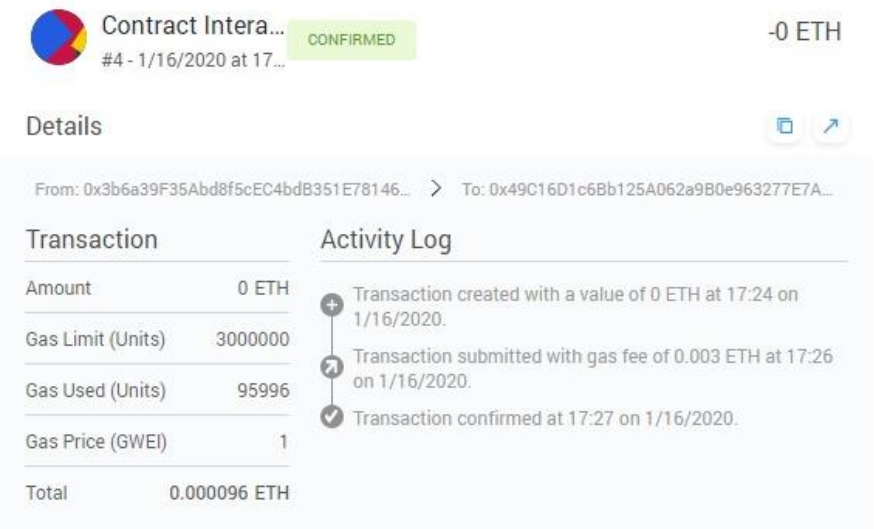

Figure 5. Transaction Details on Metamask

P-ISSN: 1411-3414
E-ISSN: 2549-9815

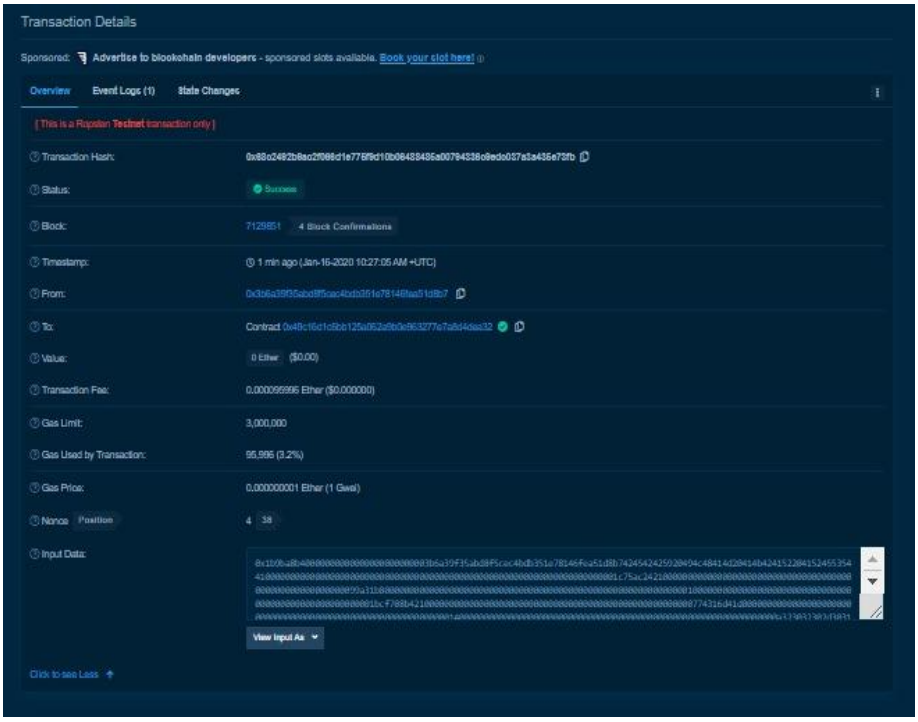

Figure 6. Ropsten Testnet Transaction

After finishing all steps, the next step is to open a blockchain-based diploma publishing website to input all student diploma data before pressing the submit button; the inputted data will be displayed first, as shown in Figure 7.

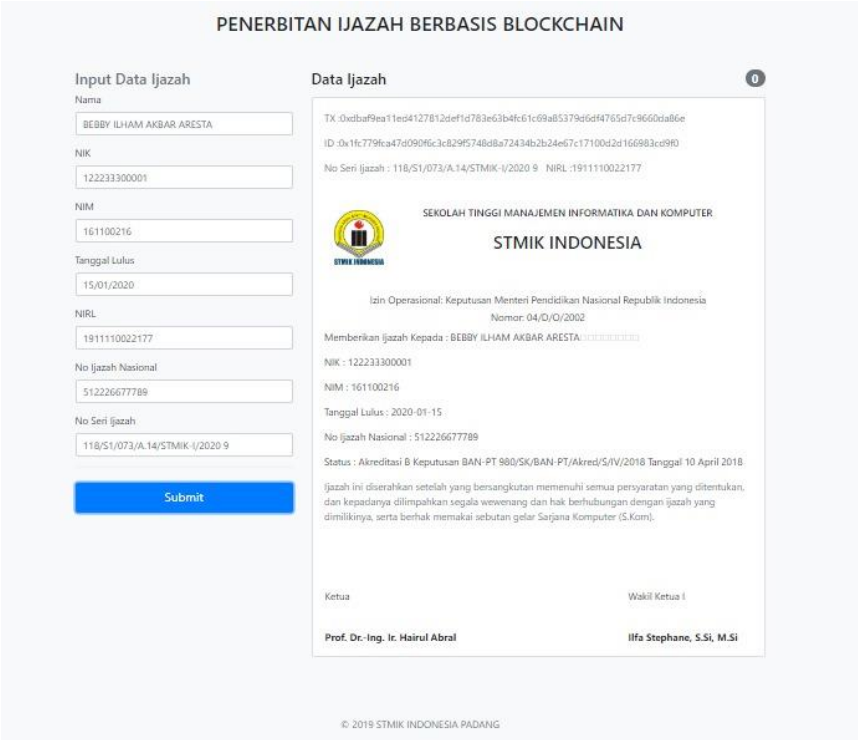

Figure 7. Website page

If there are no more data input errors, the submit button can be clicked, as shown in Figure 7. Then the system output process will be in the form of a data report that has been through the certificate innovative contract confirmation process, which has been stored on the Blockchain, which consists of

P-ISSN: 1411-3414
E-ISSN: 2549-9815

the previously inputted data. The diploma data has a button that holds the diploma data in the file format pdf, as shown in Figure 8.

Figure 8. Student Diploma Data

To get a QR Code for each certificate, the diploma file that has been processed, as shown in Figure 8, must be downloaded first, then upload again as shown in Figure 9.

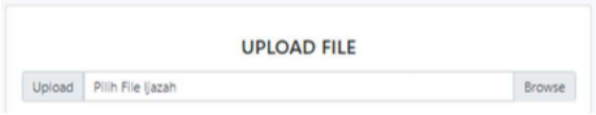

Figure 9. File Upload

After uploading the diploma file is successful, the IPFS data in the form of hash is displayed in a QR Code form, and the print button is used to print IPFS data, which will be presented in Figure 10.

Figure 10. IPFS Address Data

P-ISSN: 1411-3414
E-ISSN: 2549-9815

After the data has been successfully entered, all of the final steps are checking the certificate is valid or invalid. It can be done by checking on the ethereum blockchain explorer page using the certificate transaction in the search field or using the QR Code presented in Figures 11 and 12.

Figure 11. The search column for etherscan.io

Figure 12. QR Code

4. Conclusion

The blockchain-based certificate information system implements the diploma design into a website that uses a smart contract as a compile and deploys process that connects the website to the Blockchain. Through the metamask tools, confirmation of the processes that occur in the smart contract is carried out. Furthermore, each student's diploma data is submitted, stored in a ledger on an innovative contract transaction as primary data when diploma identification is made by using the *etherscan.io* search column, and the diploma QR Code has been designed.

References

[1] "PERATURAN MENTERI PENDIDIKAN DAN KEBUDAYAAN REPUBLIK INDONESIA," pp. 1–12, 2014.

[2] H. Firmansyah, I. Y. Dewi, U. G. Mada, and I. Y. Dewi, "PALSU OLEH ANGGOTA DPRD DALAM PEMILIHAN UMUM LEGISLATIF (CONTOH KASUS PUTUSAN NOMOR : 196 K / PID . SUS / 2016)," vol. 17, no. 1, 2019.

[3] A. M. Masykur, "Ijasah Palsu dan Pendidikan Kita," *Ijazah Palsu dan Pendidik.*, 2009, [Online]. Available: http://eprints.undip.ac.id/1006/1/Ijazah_Palsu_dan_Pendidikan_Kita.pdf.

[4] A. Faisol and Gabrillin, "Soal Tersangka Baru Kasus Ijazah Palsu, Polisi Tunggu Persidangan Anggota DPRD," *https://regional.kompas.com/*, 2020. https://regional.kompas.com/read/2020/01/15/10443081/soal-tersangka-baru-kasus-ijazah-palsu-polisi-tunggu-persidangan-anggota (accessed Mar. 14, 2020).

[5] Gilang Ramadhan, "Kasus Ijazah Palsu, Pelawak Nurul Qomar Divonis 17 Bulan Penjara," *https://tirto.id/*, 2019. https://tirto.id/kasus-ijazah-palsu-pelawak-nurul-qomar-divonis-17-bulan-penjara-eluP (accessed Mar. 14, 2020).

[6] N. I. Fauzan, "Abstrak," vol. 4, pp. 1–15, 2018.

[7] Y. S. Permana, A. I. Hadiana, and E. K. Putra, "Pemanfaatan Blockchain pada Pembangunan Sistem Informasi Pembiayaan Usaha Mikro Kecil Menengah," pp. 12–17.

P-ISSN: 1411-3414
E-ISSN: 2549-9815

[8] A. Winarno, “DESAIN e-TRANSKRIP DENGAN TEKNOLOGI BLOCKCHAIN,” *Semin. Nas. Pakar*, pp. 1–6, 2019.

[9] T. Enades, H. Setia, A. Susanto, H. Gedung, J. Imam, and B. No, "Smart Contract Blockchain pada E-Voting," *Inform. UPGRIS*, vol. 5, no. 2, pp. 3–6, 2019.

[10] H. Yulianton, U. S. Semarang, S. Mulyani, and U. S. Semarang, “Implementasi sederhana blockchain,” no. December, pp. 0–4, 2018.

[11] F. Nuraeni, Y. H. Agustin, and I. M. Muharam, “Implementasi Tanda Tangan Digital Menggunakan RSA dan SHA-512 Pada Proses Legalisasi Ijazah,” pp. 8–9, 2018.