Recording of Student Attendance with Blockchain Technology to Avoid Fake Presence Data in Teaching Learning Process

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A B S T R A C T

University operational activities are a routine part of university operations and supervisory control and monitoring function. The low controlling and monitoring of operational activities can cause irrelevance in the teaching and learning process. A graduate may have a graduation document but has never attended the teaching and learning process. An official institution can issue this graduation document, but it is fake because no teaching-learning activity occurred. It happens because the data is easily being manipulated and changed in the current system. From the problem, this is what drives this research to be carried out. With the characteristics of distributed, secure, and traceable information, Blockchain will solve this problem. Based on a previous study, blockchain technology facilitates university operational activities so that it will solve the current problems. This research uses qualitative research methods. The research process starts with literature studies and forum group discussions conducted on nine universities in Indonesia (public and private universities). This study used the User-Centered Design Technique. This research focuses on the user, so the results possibly are applied. The research results prove that Blockchain technology can record student attendance as part of the graduation process's teaching and learning process. Blockchain's immutable, unchangeable, and distributed characteristics will ensure the student attendance record's validity in the teaching and learning process.

1. Introduction

The problem of graduation documents forgery has risen in various countries. Several previous studies have reported that graduation documents forgery requires a new solution, Blockchain technology uses to be a solution [1], [2]. Other research states that Blockchain technology uses record operation activity in a university to protect information [3], [4]. This research tried to simulate the use of Blockchain technology (multichain) [5] to record student attendance because Blockchain characteristics such as distributed [6], secure, and traceable

information [7], [8]. Blockchain will be a new solution to this problem [9], [10]. To prevent the falsification of graduation documents issued by the Institution (such as fake attendance report). The irregularity was found because several universities issue original graduation documents, but the graduate had never conducted academic activities [11]. The early research stated a similar issue regarding fake attendance [12].

Blockchain technology is expected to provide a solution to this problem. This qualitative research was conducted by involving 9 universities, private and public universities, to obtain input and validation of the simulation result. The technique used in the research is user-centered design (UCD) [13], [14]. By using the

UCD technique, the research results will prioritize the user needs. This study aims to test blockchain technology for student attendance recording. The simulation results found blockchain technology can facilitate record student attendance during the lecture process, which is very important as a control and supervision function over university operations. The limitations of the existing system capabilities such as user easily to update the data. But with Blockchain technology, which can record data and not easily be manipulated and changed, even the data will always be immutable. After obtaining validation from 9 universities, the final result of this study stated that blockchain technology can be used for recording the attendance lists. This systematic writing of this paper starts with an abstract, introduction, literature, method, result and discussion and finally, the conclusion. The research stages can be seen in Figure 1 below.
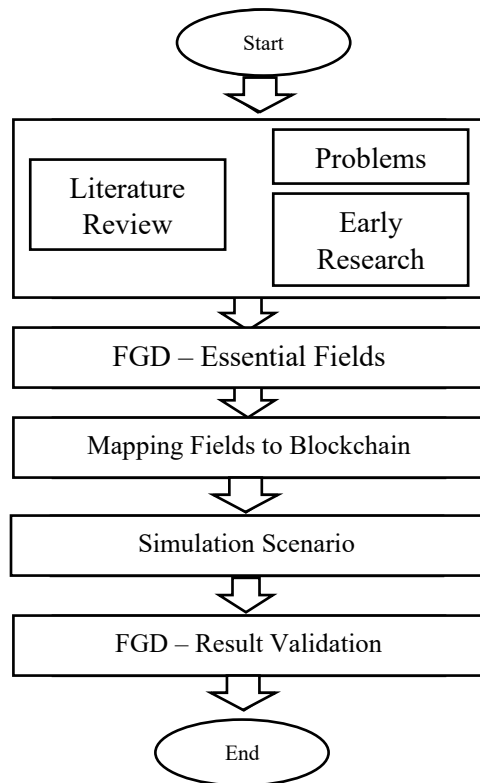

Figure 1: Research Stages

Exhibit at Figure 1, the first research stage began with a literature review. This literature review found graduates who had graduation documents, but graduates were never found to be present in lectures. Another study found that Blockchain can handle this problem. The next step was to conduct FGDs with nine private and public universities to find necessary fields to support attendance records. After determining the fields, mapping is carried out to record student attendance into the blockchain (multichain) application and directly written into the multichain application (Blockchain). After that, a simulation was carried out and validated to 9 universities through FGD.

2. Literature Review

This session will describe some of the theories used in this study.

2.1. Multichain

Multichain is a platform created in 2015[5]. Multichain made for cryptocurrency. Multichain is a blockchain with private and permission types. The simulation carried out is limited to a laboratory at the university, but the simulation data are real data from the current system.

2.2. Blockchain for Education

Blockchain technology discovers in 2008 [15], and after a cryptographer in 2014 [16] combines smart content features into Blockchain technology. Many previous studies have stated that blockchain technology can be used to improve the process and activities in education, such as borrowing books or libraries [17], students loan [18], for graduation documents [19], [20], and others in education [1], [21]. From previous research, it can be said that Blockchain is not only for cryptocurrency but also for support operations in education.

2.3. Blockchain Characteristics

Blockchain Technology's characteristics help monitor lecture activities to minimize the occurrence of fake graduation documents, especially those issued by institutions that have the authority to issue documents. The characteristics of Blockchain are [6], [16]:

- Immutable, which means that information that has been recorded on the Blockchain will always be there and never deleted. In this case, attendance records that occur as a result of students coming to attend lectures will continue to be recorded forever and cannot be removed.
- Unchangeable, which means the information that has been recorded on the Blockchain cannot be changed or updated forever. In this case, the attendance that occurs as a result of students coming to attend lectures will continue to be recorded forever and cannot be updated.
- Secure, it means that all data in blockchain technology will be stored safely. In this case, blockchain technology (multichain) uses unidirectional encryption. When the transaction (absence transaction) is recorded, it is encrypted with the hashing method. Besides that, the transactions also follow the Merkle tree method hashing, and it does not only occur in a transaction but the entire transaction.
- Transparent means that all nodes on the registered network can see all activities or activities recorded on the Blockchain (all parties can see the transaction/absence transaction).
- Peer-to-Peer means absence transactions that occur on the Blockchain are done peer-to-peer, meaning there is no intermediary party at the transaction time. In this case, regarding attendance, attendance is directly given by the university to students.
- Distribute factor means that all absence transaction information recorded on the Blockchain will be distributed to all nodes on the same network.

2.4. Previous Research

Previous research searches have been carried out using Publish and Perish applications[22] at Scopus database, with keyword attendance in the title paper, with a range of 2015-2021, and found 1 article discussing student attendance. The problems presented are the same as the problems found, such as manipulating attendance being the problems found[12]—solution found by using IoT. However, manipulation on the database level possibly occurred.

3. Methodology

The methodology used in this research is the qualitative method. Some techniques used are literature studies and focus group discussions. The details of the activity can be seen in Figure 1. The research process initially started with a literature review. In this stage, two things were found, namely existing problems and previous research. The problem found at this stage is focusing on university operations for monitoring lecture activities with a student attendance system. Another finding states that blockchain technology facilitates operational lecture activities and can even be used to prevent fake diplomas.

The next step is determining the essential fields to be written on the Blockchain (multichain). Figure 4 shows the existing attendance report, from which the report can be described which fields will be used. It also shows the students list who attended face-to-face meetings and made class attendance in rooms 521 and 523 on October 23, 2017, with subject codes comp6049 and comp6045.

Mapping fields will be written on the Blockchain (multichain), after mapping the fields, the attendance scenario is created. After the scenario is complete, the simulation is carried out using multichain.

3.1 Simulation Testing

This study using simulation techniques. This simulation technique uses because this technique has similarities to the actual situation or is close to the actual situation. This technique is also very quick and inexpensive to perform and makes it easy to judge whether it is appropriate [23].

3.2 Simulation Stages

The first step in this research is to look at the attendance reports generated from the running system by taking several samples and then analyzing the current system's attendance report. Map the running system's fields based on the log report to the Blockchain (multichain) fields that will be used. Enter data into the Blockchain (multichain) based on the information in the current attendance log report. The final step is to show the Blockchain results (multichain) to the expert as part of the result validation.
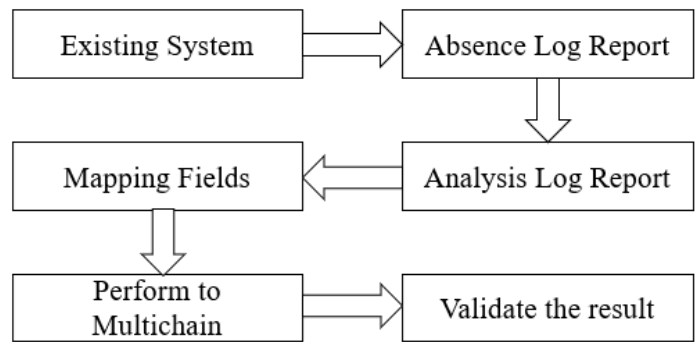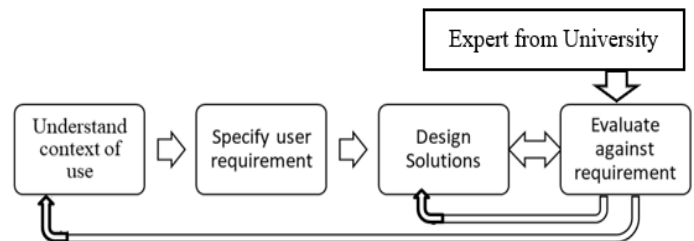

Figure 2: Simulation Stages

Figure 3: User-Centered Design

StudentID	STRM	Crse_id	Crse_code	Class_section	Start_dt	TappingTimeClass	Ispresent	N_Delivery_mode	Facility_ID
2101675432	1710	10545	COMP6049	LC01	10/23/2017	3:24:24 PM	Y	F2F	ANG523
2101675445	1710	10545	COMP6049	LC01	10/23/2017	3:28:36 PM	Y	F2F	ANG523
2101679456	1710	10545	COMP6049	LC01	10/23/2017	3:03:09 PM	Y	F2F	ANG523
2101684765	1710	10545	COMP6049	LC01	10/23/2017	3:18:05 PM	Y	F2F	ANG523
2101719592	1710	10545	COMP6049	LC01	10/23/2017	3:19:27 PM	Y	F2F	ANG523
2101719623	1710	10545	COMP6049	LC01	10/23/2017	3:18:49 PM	Y	F2F	ANG523
2101720354	1710	10545	COMP6049	LC01	10/23/2017	3:20:45 PM	Y	F2F	ANG523
2101724043	1710	10545	COMP6049	LC01	10/23/2017	3:21:55 PM	Y	F2F	ANG523
2101726944	1710	10545	COMP6049	LC01	10/23/2017	2:53:32 PM	Y	F2F	ANG523
2101727285	1710	10545	COMP6049	LC01	10/23/2017	3:03:21 PM	Y	F2F	ANG523
2001625995	1710	10548	COMP6065	LC01	12/22/2017	1:20:00 PM	Y	F2F	ANG521
2001626032	1710	10548	COMP6065	LC01	12/22/2017	1:20:00 PM	Y	F2F	ANG521
2001626000	1710	10548	COMP6065	LC01	12/22/2017	1:20:00 PM	Y	F2F	ANG521
2001625963	1710	10548	COMP6065	LC01	12/22/2017	1:20:00 PM	Y	F2F	ANG521

Figure 4: Student Absence Log from Recent System

3.3 User-Centered Design (UCD)

This qualitative research study uses the User-Centered Design (UCD) approach. This technique is chosen to ensure the simulation results are more focused on the user (user) and industry [7]. The UCD technique creates simulation scenarios where user interaction occurs by communicating with experts in operational fields. For details, see figure 3.

4. Result and Discussion

This research using the simulation technique begins with data collection from the current system to record student attendance. Figure 4 shows the attendance log of the student's attendance, and the detail is students with the id "2101675432" attend courses with the code "COMP6049" and class code LC01 on October 23, 2017 (10/23/2017) present in class at 3: 24.24 in room ANG523 face to face "F2F".

From the attendance log report, Figure 4 is then simulated into the Blockchain (multichain) application. There is no customization on multichain used.

The lab configuration can be seen in Figure 5, which shows a node with the name chain1 and the multichain version 1.0.9 using the 10011 protocol.

Figure 5: Multichain Node

Figure 6: Multichain Addresses

The address configuration represents a university and student entity. In this case, the entity functions are to send assets that record attendance transactions that occur during the teaching and learning transaction.

The address configuration shows in Figure 6, which describes all entities' addresses for simulating attendance transactions.

After address configuration, the next configuration is asset formation. Assets represent courses, classrooms, and schedules in face-to-face mode (model).

Figure 7 explains the teaching and learning preparation (courses, classrooms, and the schedule) by the lecturer (KD_Lec), lecture schedule shift (15:20-17:00), and student classes.

Figure 8 shows the success of recording the program schedule, which is represented as an asset on the multichain.

Figure 7: Input Dashboard 1 – Comp 6049

Figure 8: Success Result Input

Figure 9 shows a simulation for filling the lecture schedule of COMP6065 course in classroom 521 on December 22, 2017, by KD_Lec (D3730) teachers with a face-to-face model and class LC01 student classes.

Figure 9: Input Dashboard 2 – COMP6065

Figure 10 illustrates the lecture schedule that has been successfully recorded on multichain (Blockchain) as assets. Figure 10 shows the number of students in the class so the assets can be sent to students present, while the attendance date follows the recording date on multichain.

Name	ANG521-COMP6065-2017-12-22
Quantity	40
Units	0.01
Issuer	Univeristy Binus (1SH8oX3Eii3kE2KbYzkUYVVXGQhDV8QzYiHFEx, local)
KDLec	D3730
Time	13:20-15:00
Mode	F2F
Class	LC01

Figure 10: Success Result Input – Class 2

Figure 11 shows attendance transactions for a student 2101684765 - Name 3 with attendance at the COMP6049 course, on ANG campus with classroom 523 on October 23, 2017.

Figure 11: Attendance Activity

Figure 12 shows the transactions record of a student who attended the lecture. This recording proves that multichain (Blockchain) can facilitate to record student attendance activities in the face-to-face learning process that has occurred.

Label	2101684765 - Name 3
Address	1JFBKdvrGWYEzmZ53kyfv4bfD49FotC8wpKL8d
COMP6049-ANG523-2017-10-23	1

Figure 12: Attendance Record in Multichain

The simulation results reported in this paper are not all transactions shown in Figure 5, but the simulation is carried out thoroughly. The simulation involves experts from 9 universities, and all universities agree that the student attendance recording transaction can be done on the Blockchain (Multichain).

This research will complement previous research were using Blockchain (multichain) to become a database in recording student attendance transactions will be more robust because student attendance records cannot be manipulated.

5. **Conclusion, Limitation and Future Research**

This research uses qualitative methods using several techniques, such as FGD with experts and literature reviews. The simulation results are carried out directly by comparing the existing system's attendance logs with multichain results.

This research produces a product that can be used to implement and become solutions in recording student attendance.

Other things that still need to be improved such as multichain configuration using only one node (single node), which should be at least 3 (three) nodes (best practice). Another thing is that there is no wallet created so that students cannot see the simulation's results. It can be used to be developed in future research.

Conflict of Interest

The authors declare no conflict of interest.

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