

A Proposed Model of Secure Academic Transcript Records with Blockchain Technology in Higher Education

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Abstract: The higher education institution today is a concern to become an institution that gives birth to people who can compete in the current era. Stakeholders at the higher education institution will see how the data produced by graduates can be trusted and no data manipulation takes place at the higher education institution. Based on this problem, this article explains how higher education institutions use blockchain technology that is able to maintain data security and prevent data manipulation, especially in academic transcript files. Academic transcript records become an output from students after completing a semester or level of education at the higher education institution. In general, academic transcript records are used when students complete a study at a higher education institution as a document requirement for access to the company where they work. Thus academic transcript reports become important for companies to find out if this student is competent in a certain area. In this case, accurate and valid data is certainly needed and the truth can be trusted. This qualitative research contributes to the higher education institution through a proposed blockchain technology model, especially in academic transcript records, so that the results of the proposed model ensure that data manipulation does not occur in data in academic transcript records. The results of this model will be used as design material for application design, so that the blockchain platform can be used in higher education institutions, especially when publishing valid academic transcript records that can be trusted with the data.

1 INTRODUCTION

Higher education institutions around the world have similar or even similar processes for value chains in higher education, namely accepting future students, providing knowledge to students, giving experiences in higher education, examining feedback on what students learn, asking students to work on the final level thesis then test the thesis until it has passed higher education. This is a common thing, always the value chain of a higher education everywhere. Long ago, before the existence of technology, the value chain was executed manually without the help of technology. So, there are many human errors. Such as, for example, including the wrong student until a lot of cheating takes place in the business process of higher education (Kooli, 2019).

With the development of time, especially in the last decade, higher education in today's world needs smarter technology and safer security options. The

goal is to create secure data security when implementing business processes and value chains that are located at the higher education institution. With technology and security evolving, it is possible for higher education institutions to have a value chain linked to complementary technology in creating secure data storage (Ivanović et al., 2018).

Security technology is indeed a major concern in data, so no data can be manipulated, and real data integrity can be trusted. Developments in digital technology in the education world are also increasing to support business education at every higher education institution. For example, stakeholders who play a role in the higher education institution have access to data in the database and it is of course quite possible that human errors can lead to data changes or intentional or unintended data manipulation. The data in the higher education institution is not small but contains thousands and millions of data. With these conditions the higher education institution should think

of more modern technology to prevent data manipulation (Palma et al., 2019).

Data manipulation and data fraud can occur due to the existence of irresponsible users or due to intentional changes to the data by the user. This will therefore be harmful to some or all stakeholders. Higher education institutions must maintain data integrity that is further enhanced by the existence of technology that continues to evolve and is modern. Everyone's confidence in the higher education institution is therefore maintained and even improves the relationship of trust between stakeholders in the higher education institution (Meyliana et al.,).

In this era, blockchain is one of the data integrity solutions and data manipulation solutions. Blockchain is a technology used as a concept in distributed ledgers, where it can be validated by consensus and the presence of cryptographic algorithms. The concept that Satoshi Nakamoto built in 2008 was the use of Bitcoin (Nakamoto et al., 2008), and its development continued until the smart contract Nick Szabo discovered at the time when implementing blockchain technology in the industry (Singh and Singh, 2016)(Ahram et al., 2017).

Higher education institutions make it possible to use blockchain technology as a reliable technology to ensure data integrity and to prevent data manipulation in the business process and the value chain of higher education students' learning processes. With the development of the learning process continuing to grow, this is imperative to ensure stakeholder satisfaction and to provide smooth workflow data from the moment potential students enroll at the higher education institution until the student is declared to be graduated from the higher education institution. (Meyliana et al.,).

The qualitative research is focused on proposed models in the learning process of students with the use of blockchain technology in higher education to publish academic transcript records with valid and safe publications. With this model it may be easier to develop blockchain technology because of the existence of this model to guarantee data in academic transcript files in accordance with the original reality and data integrity. The discussion about this model is that the value chain can be used in higher education, especially in the learning process of a person named as a student, until the student has passed the higher education.

2 LITERATURE REVIEW

2.1 Academic Transcript Records

Data that can give everyone information about courses that have been followed and numbers about students are included in academic transcript records. With this data we can also see the extent of the student's performance in each semester, for example if you want to know how much the GPA score or the value of a course the student has taken (Owolabi et al., 2018).

When students study at a higher education institution, parents of students can see the achievement of results through academic transcript reports provided or student parents request student services. In addition to the time during the study period, students after graduation, the company / industry party also sees student performance while the student is in the higher education institution (Itoh et al., 2013).

2.2 Blockchain in Education Sector

Blockchain in the education sector is indeed not discussed much. But given the advantages of the blockchain and also the needs at the university, blockchain is very likely applied. As with other sectors, the education sector also has many validation phases, verifications and transactions must be recorded correctly. If done correctly, stakeholders related to the data can directly access and validate without having to confirm repeatedly. Research conducted by (Turkanović et al., 2018) attempted to build a blockchain platform for recording transactions in higher education based on the concept of the European Credit Transfer and Accumulation System. This technology offers a decentralized system, lecture credit and a process of recording values that stakeholders with data interests see such as companies, institutions and other organizations. All processes that are carried out in the blockchain are stored securely from the student's registration (Turkanović et al., 2018).

Transactions that can take place in a blockchain to tertiary institutions such as financial transactions, learning processes, education, book loans, assessments, certification, etc. can be implemented (Grech and Camilleri, 2017). As also done by Bdiwi, Runz, Faiz and Cherif who tried to connect the process in educational activities in the Ubiquitous Learning environment (Bdiwi et al., 2017).

2.3 Data Security in Blockchain

Data security on the blockchain uses the cryptographic method that is split into two keys, namely Public Key and Private Key. Both keys are used when the transaction takes place. The use of the public key in a block requires consensus between all interested parties (between nodes) so that the proof of work / evidence of interest in the block can produce. This concept ensures that the data has multiple security layers, making it difficult for the intruder (attacker) to modify the data. While the use of the private key aims to secure the identity of the user (Li et al., 2017).

3 RELATED WORK

Figure 1 shows that the process starts after the student is registered as a registered student and has a student ID that is always linked to the student as the student's unique identity in a higher education institution. With the existence of the student ID, the student can register according to faculty attended by the student. Students will register / register in the faculty department every semester. In this condition too, the faculty department will always create and maintain the curriculum every few years to ensure that the curriculum is updated in accordance with the needs of the stakeholders of higher education institutions.

After registration, students give lectures with teachers in the classroom and / or laboratory. During the lecture process, students also have access to learning resources (Learning Management System, course material, libraries, etc.). Students will take the interim and end of the semester exams. The exam results are then corrected by the teacher and the grades are entered in the academic system. Assessment results are used to evaluate and evaluate student performance next semester registration. If there are students who perform less than required, students receive guidance and repeat the course. However, if students fail in each semester, the faculty will recommend trying to relocate or resign. If the evaluation produces good results, the student continues with the next semester and repeats the process until the student is eligible for a thesis course.



Figure 1: Value Chain of Student Learning.

4 RESULT AND DISCUSSION

This research gives the result that there is a proposed model of blockchain that can be used for academic transcript reports from students in higher education. To explain these results, this section is divided into 2 (two) sections, namely the first with regard to activity diagrams with the existence of blockchain technology, the technological basis of the higher education institution. And the second is about the blockchain technology design model at the higher education institution.

4.1 A Proposed Activity Diagram with Blockchain

In Figure 2 is an activity diagram with the blockchain technology platform below. There are 8 users and 1 blockchain platform in the business process. Users who are main users are (1) students in the learning process of the higher education institution. Because with the presence of students, the process can proceed according to the procedures followed by the higher education institution. (2) Student registration and planning unit is the user who makes the class schedule and exam schedule. (3) Teachers and (4) Assistants are users who become facilitators in teaching and teaching students. Teachers and assistants have lesson activities organized by the student registration and planning unit.

(5) Academic operation unit is a user who maintains operational learning conditions according to the schedule determined in the Student Registration and Planning Unit section. With these users, users validate the presence of students and exam activities in general. (6) Users of laboratory units are focused on planning assistants for teaching in the laboratory.

In addition, they also ask exam questions regarding laboratory activities. (7) Student Advisory Unit is a user who helps students to maintain the emotional state of students. If a student encounters an obstacle or problem, the student can consult with these users to find a solution to any problems related to education and learning at the higher education institution. In addition, this user wants to evaluate every learning activity performed by students. (8) Faculty department is the user who validates the activities performed by teachers and students. With this validation, every condition made by students can still be followed and become feedback for faculty departments.

Figure 2 shows the process explanation as follows, starting with the student registration and planning unit, which makes a schedule for teaching and learning. After completing the planning, the student

registration and planning unit sends the set schedule to the laboratory unit and faculty for verification. The laboratory unit and faculty department then inform the student registration and planning unit of the approval. The results of the planning are then given to assistants and teachers to perform educational and learning activities.

Until the indicated date, the teacher and assistant teach and practice in the classroom or laboratory. In the meantime, the student registration and planning unit plan the exam. The exam timetable made is given to the faculty department to validate the exam timetable. After validation, the student registration and planning unit will complete the exam schedule. The timetable examination is then communicated to the teacher, assistant and laboratory unit.

At the same time, the faculty department also carried out an assignment for the teacher to make an exam question. So after getting the appointment, the teacher and assistants ask exam questions about theory and practice in the laboratory. When the exam work has been completed by the teacher and the assistant, the Academic Operation Unit performs double exam questions when the time is reached for the exam to take place. When the exam time arrives, the student takes the exam and is set to take the exam by the academic operation unit as in the case of the supervisor and the student's attendance form. The attendance form signed by the student is validated by the Academic Operation Unit and Laboratory Unit.

After the answers to the student's examination have been collected, the answers to the student's examination are given to teachers and assistants to be assessed. After teachers and assistants have assessed and entered the grades in the academic system, this is the important point that the values of the teacher and the assistant are validated by the faculty department and the results of the validation are recorded in the blockchain system. At this stage, therefore, the blockchain registers the value of each student in the student ID created at the start of the student in the higher education institution.

After the faculty department has validated the student research score, the academic operation unit publishes a score for the student to view the student's results. Every semester, the Student Advisory Unit evaluates every student and appeals to students whose grades are not satisfactory. If there is anything to be discussed with the student after the evaluation, the Student Advisory Unit discusses with the student for better performance in the next semester.

At this stage, the results of evaluations performed by the Student Advisory Unit are stored in the blockchain system, so that recording this history is

correct in accordance with conducting interviews or evaluating students. If after an analysis of academic study results in the semester and is lower than the norm, it is advisable to leave the higher education institution. However, if it does not meet the standards, the student can proceed to the next semester.

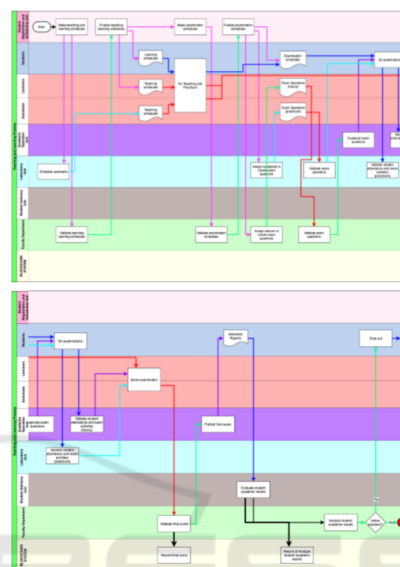


Figure 2: Activity Diagram of Academic Transcript Records

It can therefore be concluded that after the faculty department has validated the final score, the blockchain platform also registers the final score. And finally, when the Student Advisory Unit completes the evaluation of the student's academic study results, the results of the student's analysis are also recorded on the blockchain platform. Thus blockchain technology in learning activities of students of business processes can guarantee data security and produce data integrity that can be maintained.

Because the nature of the Blockchain is to validate data, to provide accurate, integrated and irreversible information, the stored data cannot be changed. Because blockchain technology has formulas that can be used to ensure that the learning process can always be executed in accordance with the available time, the blockchain cannot repeat the last time. This makes data security safer. Blockchain also works according to the time series that cannot be returned, so that posted data cannot be deleted or changed again. If you want to change it again, you will see an update date for the data. This keeps the data valid.

4.2 A Proposed Model of Blockchain for Release an Academic Transcript Records

In the following section you will find a description of the model of blockchain in Release a Diploma Certification. The model that will be discussed is the model related to Section A of the Activity Diagram with Blockchain Platform and focuses in this section on the blockchain platform model. In this case, the process is related to the input and output of each process in the blockchain platform.

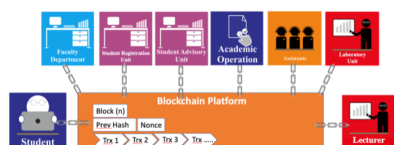


Figure 3: A Proposed Model of Blockchain Platform for Issued a Secure Academic Transcript Records

Through section A described, in Figure 3, entities are involved in the Blockchain platform, namely:

- Faculty department, the actions performed on this entity are validation of the learning schedule, validate the exam schedule, assign the teacher to create exam questions, validate the final score and analyze the academic study results. The most important action to introduce the blockchain system is to validate the final score.
- Student registration and planning unit, the actions that are carried out on this entity are: creating, teaching and learning timetable, completing the teaching timetable, making the examination timetable and completing the examination timetable. No actions are taken in this entity to include in the blockchain system, but the actions performed on this entity affect the validity of the data.
- Student Advisory Unit, the action being taken to evaluate these academic results of students. Only 1 action is performed, but this action is stored in the blockchain system because the results of the analysis of the evaluation are stored as valid data.
- Academic operation unit, the action that this entity takes is to ensure that the exam process of students runs smoothly by asking duplicate exam questions, validating the presence of students and exam activities and publishing the final score on the learning system. The action taken is indeed not included in the blockchain system, but the actions carried out on this entity have an impact to ensure that all research processes run smoothly.

- Students, teachers, laboratory units and assistants are entities that become the driving role so that this process follows the procedure, precisely in the teaching and learning process of the higher education institution. Students listen to lectures and teachers offer knowledge to students, including giving grades to students. The role for teachers is also the same for assistants. Laboratory unit is a unit that plays an important role if, during learning, there is a practice that students must experience in the laboratory. This 4 (four) entity has no direct access to the blockchain system, but this entity is very influential in the education and learning process at higher education institutions and so the actions taken have an impact on data storage, especially for academic transcript files.

5 CONCLUSIONS

From this study it can be concluded that with the blockchain technology that can prevent data from being changed after the data has been entered into the blockchain system, the data becomes valid and more convincing to prevent changes in a higher education institution.

Academic transcript records become an important requirement for all stakeholders in every higher education institution. It is necessary to use technology that cannot change data entered by parties from the higher education institution. With the blockchain it can ensure that the data is safe and reliable to prevent data manipulation.

For example, the higher education institution can offer certainty that the data recorded in the blockchain system are valid data in accordance with the original. A proposed model implemented in this document aims to contribute today to the world of education that the quality of academic transcript files is really needed by stakeholders of higher education institutions and this is a very important need for data security to prevent data manipulation. to prevent .

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