

# IMPLEMENTASI *BLOCKCHAIN* PADA SISTEM PELAYANAN ADMINISTRASI AKADEMIK (STUDI KASUS : SEMINAR FST UIN SUSKA RIAU)

## TUGAS AKHIR

Diajukan Sebagai Salah Satu Syarat  
Untuk Memperoleh Gelar Sarjana Teknik Pada  
Program Studi Teknik Industri

Disusun Oleh:

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UIN SUSKA RIAU

FAKULTAS SAINS DAN TEKNOLOGI

UNIVERSITAS ISLAM NEGERI SULTAN SYARIF KASIM RIAU

PEKANBARU

2023

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**IMPLEMENTASI TEKNOLOGI SISTEM BLOCKCHAIN  
PADA PELAYANAN ADMINITRASI AKADEMIK  
(Studi Kasus : *Website Seminar Fst Uin Suska Riau*)**

**TUGAS AKHIR**

Oleh :

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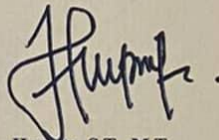
Telah diperiksa, disetujui, dan disahkan Sebagai Laporan Tugas Akhir  
di Pekanbaru, pada tanggal 22 Juni 2023

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PADA PELAYANAN ADMINITRASI AKADEMIK  
(Studi Kasus : *Website Seminar Fst Uin Suska Riau*)

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di Pekanbaru, pada tanggal 22 Juni 2023

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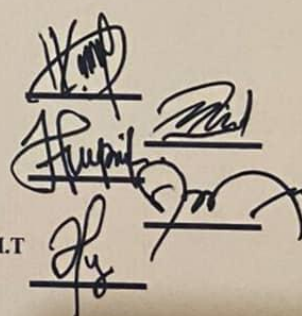
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## LEMBAR PERSEMBAHAN

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

*"Allah tidak membebani seseorang melainkan sesuai dengan kesanggupannya."*

*(Q.S Al-Baqarah ayat: 286)*

*Dengan rahmat Allah yang Maha Pengasih lagi Maha Penyayang*

*Dengan ini ku persembahkan sebuah karya untuk Mama dan Papa tercinta*

*Yang tak henti meendo'a kan, membiayai kuliah dan memberikan semangat kepada ku untuk  
menuntut ilmu*

*Dengan ridho dan do'a mu lah aku bisa menyelesaikan perkuliahan ini*

*Terimakasih Mama dan Papa ats cinta dan kasih mu yang tak terhingga selalu memberi*

*semangat dan motivasi hingga aku bisa mencapai titik ini*

*Aku akan selalu berusaha untuk membuat Papa dan Mama bangga*

*Pekanbaru, 22 Juni 2023*

UIN SUSKA RIAU

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## KATA PENGANTAR



*Assalamu 'alaikum wr.wb*

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3. Ibu Misra Hartati, S.T.,M.T Selaku Ketua Jurusan Teknik Industri Fakultas Sains dan Teknologi Universitas Islam Negeri Sultan Syarif Kasim Riau.
4. Bapak Anwardi, S.T.,M.T Selaku Sekretaris Jurusan Teknik Industri Universitas Islam Negeri Sultan Syarif Kasim Riau.
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Dalam penulisan laporan ini, penulis menyadari bahwa laporan ini jauh dari kesempurnaan, untuk itu penulis mengharap kritik serta saran yang bersifat membangun dari semua pihak untuk kesempurnaan laporan ini dan agar lebih baik di masa yang akan datang.

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## Blockchain Implementation in the Academic Administration Service System

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**Abstract** An academic information system is a website that must be owned by every university to improve academic performance. The Academic Information System (AIS) Seminar is an academic administration service website for students of the Faculty of Science and Technology. This website contains submissions for seminars/conferences, appointments of supervisors/examiners, active scholarships letters, and letters of good conduct. The problem that occurs is when students submit a letter as an administrative file that they want to go to, verification of student submissions is still manual to the admin. It should be a good information system. When the user has filled in the data that has been submitted, the admin immediately gets the data and processes the submission from the user. With Blockchain, technology systems can record digital transactions before they are stored permanently, and existing data can be decentralized so that student submission data is available to the admin. The User-Centered Design method produces solutions based on student and admin needs and runs according to the functions tested with black box testing.

### Introduction

The education sector uses information technology which can be seen in the Academic Information System. The academic information system is used by educational institutions to improve student services, one of which is administrative services submitted by students as files to fulfill existing requirements. Completion of the submitted letter not on time will have an impact on other administrative processing stages.

Research [1] regarding the effect of online service quality on academic information systems uses the Servqual method to measure service quality and a combination with the Kano method to categorize the attributes of how satisfying the product or service is. In research [2] regarding the service quality of academic information systems as student users by distributing questionnaires and then testing with reliability tests, validity, and carrying out multiple linear regressions, it was found that information quality, system quality, and service quality had a positive and significant effect on the satisfaction of using academic information systems. From these two studies, it was found that academic information systems can improve the performance of academic services and increase student satisfaction as users.

This academic information system has many benefits for institutions in improving academic performance. The stored data includes lecturer, study program, and other student submission administrative data [3]. According to the results of observations, the management of data for submitting letters from students to the academic department is less effective and efficient. The problem is that when students submit letters as administrative files they want to go to, verification of student submissions is still manual. It should be a good information system. When the user has filled in the data that has been submitted, the admin immediately gets the data and processes the submission from the user.

In addition, another problem that occurs is that students do not know exactly where the tracking details of the letter have gone. This resulted in filing a letter taking a

long time. With this, sometimes students manipulate the application letter data that has been obtained by previous students to be converted into their own

The academic information system website has two admins: study program admin and faculty admin. Admin is an actor who fills in and processes the data that has been submitted. The data submitted is still stored centrally where all data transaction activities will be stored in only one storage space, namely the faculty admin, so this makes it difficult for the study program admin to verify data because the study program admin does not get the data that has been submitted. This causes students to have to manually confirm to the study program admin if they have filled in the data on the academic information system website page.

A solution to the problem of the academic information system is obtained by applying blockchain technology. Blockchain is a technological system for recording digital transaction data that is validated by the system before being permanently stored in interrelated and decentralized data records [4]. A blockchain-based platform can be built to create and store contracts between students and university sponsors. Create and archive transactions in a secure distributed ledger [5]. Finally, the existing literature has made an important contribution. The development of the proposed guidelines includes a high level of blockchain integration education combined with information seeking can broaden the scope of transition education and increase the credibility and independence of the university [6]. Each user can check the correctness of data at any time. Blockchain capabilities can be applied to increase the efficiency and effectiveness of the system with easy verification of digital data. Data owned is decentralized so that it is transparent for users, which is useful for tracking digital transactions and guaranteed security [7].

Academic blockchain is in a ledger in which there are data blocks that allow data to be stored properly. The use of blockchain can maximize academic information systems in managing academic administration services to make them more effective, efficient and transparent. Research with a private blockchain model supporting academic systems at

universities provides the advantages of much faster computing time, lower costs, and greater scalability. By using blockchain in the education sector, it is expected to experience significant changes in terms of security, transparency and efficiency [8].

In a private blockchain, the identity of the participants must be strictly verified. Usually, participants must register their identity and obtain permission before they can participate in the network. The identity of the actor is taken from the NIM (student identification number) or NIP (employee identification number) owned by each person. This helps ensure integrity and trust within the network.

This research aims to redesign the student academic administration service system so that manual verification does not occur between students and admins and to provide improvement suggestions to the Leaders on the FST seminar website in managing academic administration services to be more effective and efficient with blockchain capabilities. The private blockchain method is integrated with the User Centered Diagram method and Blackbox testing.

## Literature Review

### 1. Academic Information System

Information systems are activities of organized procedures to provide decision-making and control information in an organization. In terms of language, an information system consists of a system that can be interpreted as a collection of people or several people who work together and are structured to fulfill certain goals [9]. The purpose of information systems is to provide information for use in planning, monitoring, evaluating and decision making. Usually describes the interaction between people, algorithmic processes, data and technology [10]

### 2. System Information

Data Flow Diagram (DFD) is a diagram that uses notations to describe the flow of data from the system, the use of which is very helpful in understanding the system in a logical, structured and clear manner. "In general, DFD (Data Flow Diagram) is often used when the functions the function and Flow of the system has complex parts, DFD (Data Flow Diagram) can describe these parts so that they can be more easily understood [12].

Use case diagram is a model that is used to describe the behavior of the system to be built. Use case diagrams define an interaction between actors and the system to be built. Use case diagrams are very useful for knowing functions and who is in the system. Use case diagrams present the interaction between use cases and actors. Where actors can be people, equipment or other systems that interact with the system being built. Use cases describe system functionality or requirements that must be met by the system from the point of view of [13].

Activity diagram is a model that describes the behavior of the objects in the use case diagram by describing the lifetime of the object and the messages sent and received between objects. The Activity diagram describes the relationship between the user and the system.

Activity diagram is a visual form of a workflow that contains activities and actions, which can be in the form of choices or repetition. These activities are described using symbols to describe the activities carried out by actors on the system. It is said that the Activity diagram is the main activity of the user on the system to be made [14].

### 2.3 Blockchain in Education

Blockchain is considered a breakthrough technology with a significant impact across a wide range of industries, enabling the creation of decentralized applications. It is programmed to work on a network and store recordings that can be shared safely without protection mediation by a third party. In blockchain applications, data is stored under encrypted groups Signature to address anonymous abuse issues with common algorithms. These data storage and validation features are key factors in the usage of Blockchain in higher education [15]. Blockchain has six important components which are its characteristics, namely decentralized, transparent, anonymous, basic consensus, immutable, and open source [16].

The blockchain is a decentralized and immutable database composed of a series of "blocks" that contain data, including dates, times, amounts, and/or participants in transactions. When a user initiates a transaction with another user on a peer-to-peer network, a cryptographic identification mechanism is used to uniquely identify the participants. The transaction is then sent to the blockchain network storage pool and awaits verification. The new block is created by reaching a certain number of authorized nodes. this is called consensus building. After consensus, a new "block" is created and each node updates the corresponding copy of the blockchain ledger. To complete the consensus step, a consensus algorithm is used. This process is called mining. Common consensus mechanisms include proof-of-work (PoW) and proof-of-stake (PoS) [17].

Blockchain can be implemented on all platforms, which means it is used from the learning process with e-learning, enrollment, performance, good grades recorded and submitted to cover finances including tuition, library and other educational needs must. Distributed application of blockchain technology allows multiple parties to participate to take notes. This quickly exposed cases in colleges and schools, including forged diplomas or administrative letters, for being irreversible and irreplaceable [18].

A private blockchain, also known as a permissioned blockchain, is a type of blockchain that is restricted to only a specific group of people or organizations who have the permission or authority to participate in the network. In contrast to public blockchains such as Bitcoin, where anyone can participate, private blockchains provide tighter control over access and usage. The following are some common aspects of private blockchain systematics [8] [19] [20] :

1. Only parties with permission or authorization can participate in a private blockchain network. Each participant must be acknowledged and authorized before being able to access or contribute to the network.
2. Private blockchains can use either translated or distributed model contexts, depending on needs and network goals. The context model involves one or

more entities that act as key determinants in transaction validation. The distributed context model, on the other hand, involves multiple participants in the transaction validation process.

In a private blockchain, the identity of the participant must be strictly selected. Usually, participants must register their identity and obtain permission before they can participate in the network. This helps ensure integrity and trust within the network.

Only authorized participants have access to the network and the information contained within it. Each participant may have a different level of access depending on their role and responsibilities within the network.

Private blockchains often offer a higher level of security and privacy than public blockchains. Information that resides within a private blockchain network is usually encrypted and only accessible to the spilling participants.

Private blockchains tend to have more limited scalability compared to public blockchains. Due to a more limited number of participants and nodes, private blockchains may have limitations in terms of transaction capacity and throughput.

The use of blockchain technology in academic information systems in education can provide several significant benefits. Here are some of the main benefits that can be obtained [21] [22] [23] [24]:

Blockchain uses strong cryptography and distributed consensus mechanisms to protect data integrity. By implementing blockchain on academic information systems, student data, academic transcripts, certificates and other information can be stored securely and cannot be manipulated. This helps prevent misuse and falsification of academic data.

Blockchain can facilitate identity verification of students efficiently. The student's identity can be confirmed and verified through the registration process recorded on the blockchain. This helps minimize the risk of false identities and ensures that academic data is linked to the right individual.

Blockchain is a distributed ledger that can be accessed by all authorized parties. This increases transparency within the AIS and allows students, faculty, and administrators to verify and track data in real time. Data reliability is also enhanced as any changes or updates are recorded permanently and cannot be changed.

Blockchain can be used to store student certificates, achievements and qualifications in a decentralized manner. This allows educational institutions, prospective employers and other institutions to easily verify the authenticity and validity of certificates and student academic qualifications.

Blockchain can support efficient credit transfer processes between educational institutions. With the existence of a blockchain-based academic information systems, students' academic track records can be verified quickly and safely by the receiving institution. This can facilitate academic mobility and speed up the credit transfer process.

6. Blockchain can be used for the authentication and validation of important documents such as diplomas, transcripts, and academic contracts. Every document entered into the blockchain will have an audit trail that can be verified by authorized parties, increasing trust and reducing the risk of forgery.

7. The use of blockchain within an SIA can increase administrative efficiency by automating certain processes, such as registration, scheduling, and distribution of transcripts. This can reduce administrative costs and improve the student and faculty experience.

By using blockchain technology in academic information systems, educational institutions can improve data integrity, enhance security, and optimize administrative processes, while providing the transparency and reliability needed in education. Educational Institution has massive student's data and they need to keep track of every student. They continuously move from semester to semester and their records also keep on increasing. The student's data is stored in the blockchain network which will increase its block size leads to an increase in the latency of the transaction [21].

## 2.4 User Centered Design (UCD)

User Centered Design (UCD) is a method that involves users in each development process so that users can provide recommendations regarding application interfaces, as well as the final results in application design which are expected to produce solution designs based on user needs [25].

Following are the key concepts of user centered design. The user is at the center of the development process. The nature and purpose of developing this system is based on user experience. Results of user reviews with the system is the basis for application development. By another definition: user centered Design is a useful interface design process for application purposes, user properties, User environment and system design tasks and workflows. Therefore, it can be said that user-centered design is an iterative process from start to evaluation. A system that fully meets the needs of users [26].

The User Centered Design (UCD) method has 4 stages of work, namely [25] :

1. Understand and define user context
2. Determine user and organizational needs
3. The resulting design solution
4. Evaluation of design against user needs

## 2.5 Black Box Testing

Black box testing is testing focused on testing the interface or look and feel included in the application and achieving the functional flow required by the user. Black Box Testing does not verify the source code of the program. Black box testing is performed in the following phases: from creating a test case to test the functionality included in the application to creating a test case to test the flow or workflow adequacy of a program functionality that satisfies the needs and requirements of users. to check for bugs/errors based on the appearance of the app [27].

Black box testing has an important role in software testing, namely to validate the overall function of the system when it is working properly. Black box testing is someone who tests software with the black box method does not need to have programming/structural knowledge in software. Testers who use black box testing do not have access to knowing the source code and system architecture, only through the interface by providing input and checking output without knowing how the input is operated until it becomes an output [8].

### Methods

Data collection was obtained from observations, interviews and data analysis from previous researchers [1]. The types of data used in this research are primary data and secondary data. The primary data includes observations and direct interviews with study program admins, faculty admins and leaders related to the existing system. Meanwhile, secondary data was obtained from the flow of the letter submission process listed in the description of the service system procedures on the website as well as the results of the analysis of previous researchers [1] regarding student satisfaction with the existing administrative system.

The data that has been collected is then processed to get the desired results. Data processing aims to make the system decentralized, so that the learning program admin gets data on the system which makes students not need manual verification. The stages carried out on this blockchain basis include making data flow diagrams, use case diagrams, activity diagrams and continuing to create a user interface using the user centered design method. After creating the user interface, testing is carried out according to function using black box testing

### Result and Discussion

The system development model used is the UCD (user centered design) model which is a design philosophy that places the user as the center of a system development process. There are four processes carried out in UCD, namely:

#### 1. Understand and define user context

Students as users will fill out the registration form for submitting letters on the academic information system website, then the data filled in and submitted will be verified

by the study program admin. After the data is verified, the data will be validated by the faculty admin. If the faculty admin has validated, the leader's signature will be obtained, then the submission letter is complete and entered into the student's account/email.

#### 4.2 Determine user and organizational needs

Students as users need the efficiency and effectiveness of submission letters that are completed quickly and do not require manual verification again. Effectiveness and time efficiency will be realized if the study program admin gets data that has been filled in by students so that the study program admin will acc and then the data is sent to the faculty admin

**Table 1** Requirement Function Table

Function Name	Information
Log in	Student log in using nam Admin log in using nip/nik
Fill out the submission form	Display in filling out personal data and the intended submission letter
Letter Submission List	Display of data obtained by the admin from the student submission letter
Verification/ Validation	Admin acc menu, if the submission data is correct
Leadership Signature	Proof of the validity of the application letter

#### 4.3 The resulting design solution

This stage provides a solution by making a system design using the prototype to be designed. Building a prototype aims to describe the workflow of the application in the stage of describing software design using UML system information (Data Flow Diagram, Use Case Diagram and Activity Diagram). The data flow diagram illustrates the flow of the letter sending process starting from student submissions to the validated study program admin then to the verified faculty admin, finally the letter is received by the leadership and then sent to the student's email (see Fig. 1). Each DFD process is interconnected, and all databases generated in each process are stored on the blockchain. The database is decentralized, so that all entities can find out the data (both data filled in by students, examiners/supervisors and letter archives) in the process of submitting letters.

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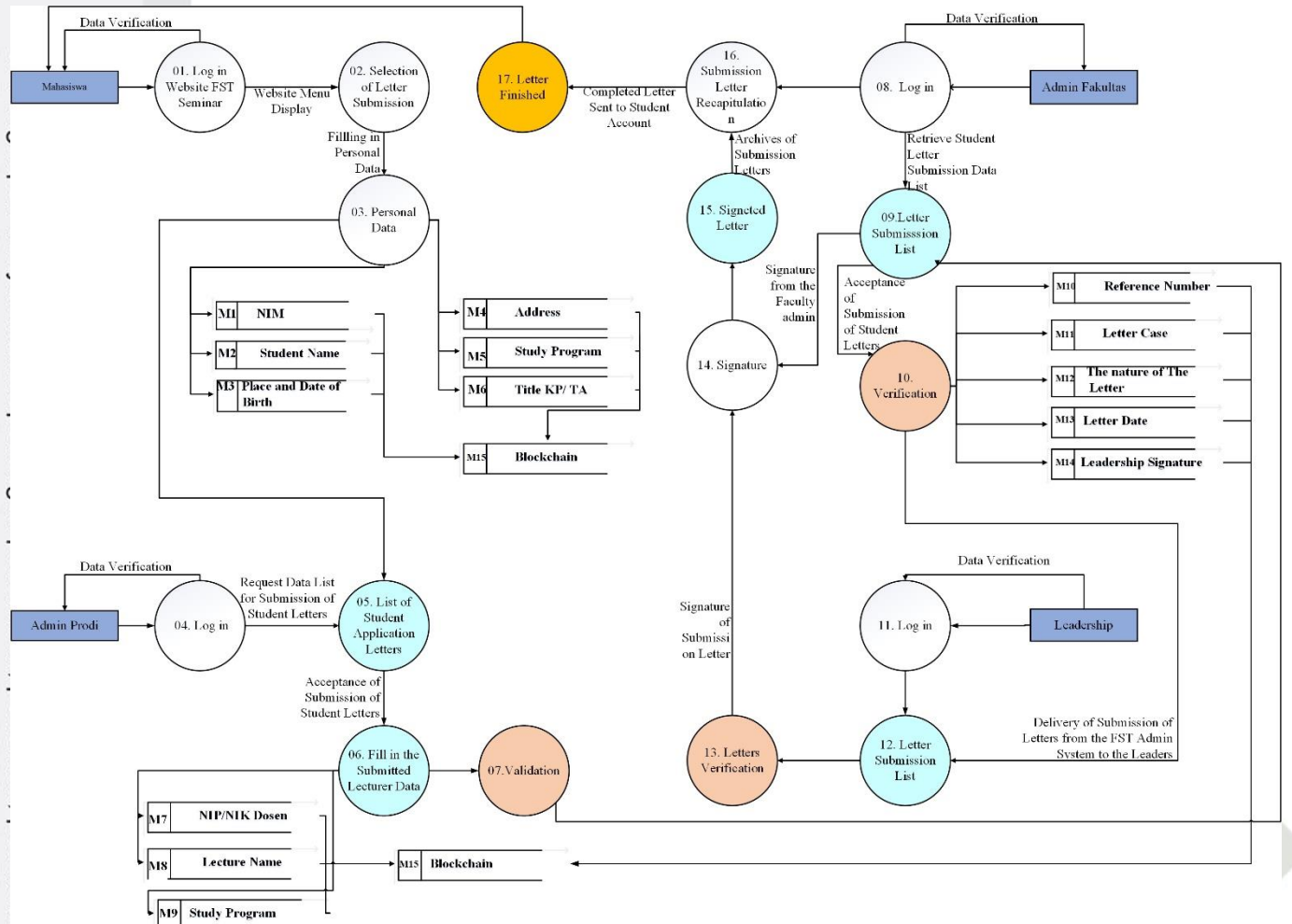


Fig.1 Data Flow Diagram

The use case diagram of the letter submission process has 4 actors representing user activity from each system, namely students, study program admins, faculty admins and leaders. Use case diagrams describe the relationship between the system and actors. Use cases can be interpreted as an overview of the system model (user interface) that will be executed by each actor in the application. Use case diagrams can be seen in Fig. 2.

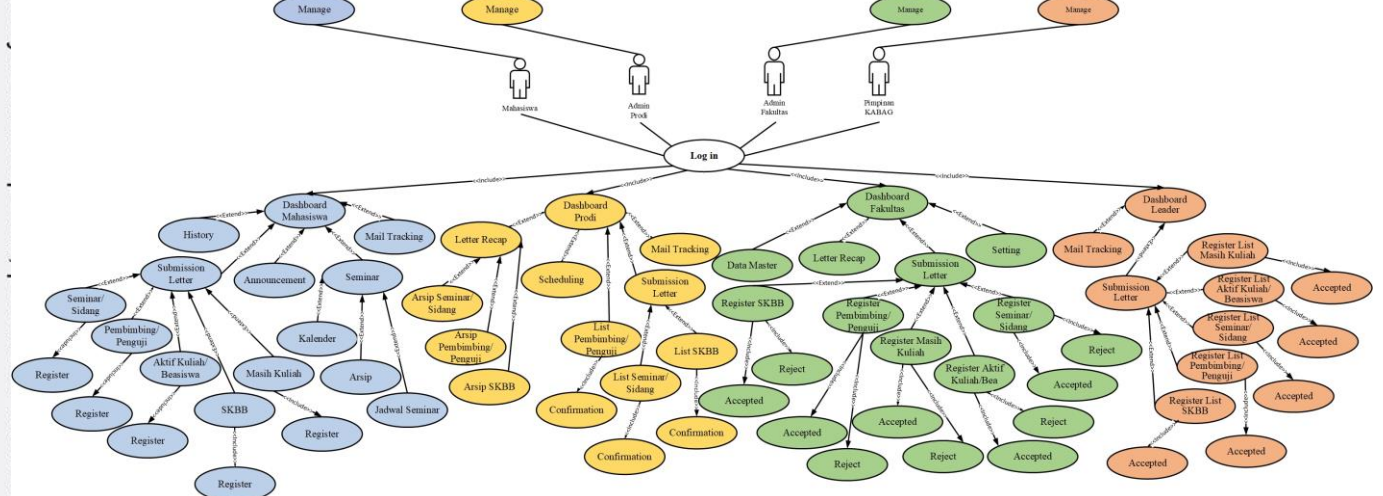


Fig. 2 Use Case Diagram

The activity diagram in the administrative process of submitting letters describes the interaction between the user and the system. This activity can be seen in Fig. 3.

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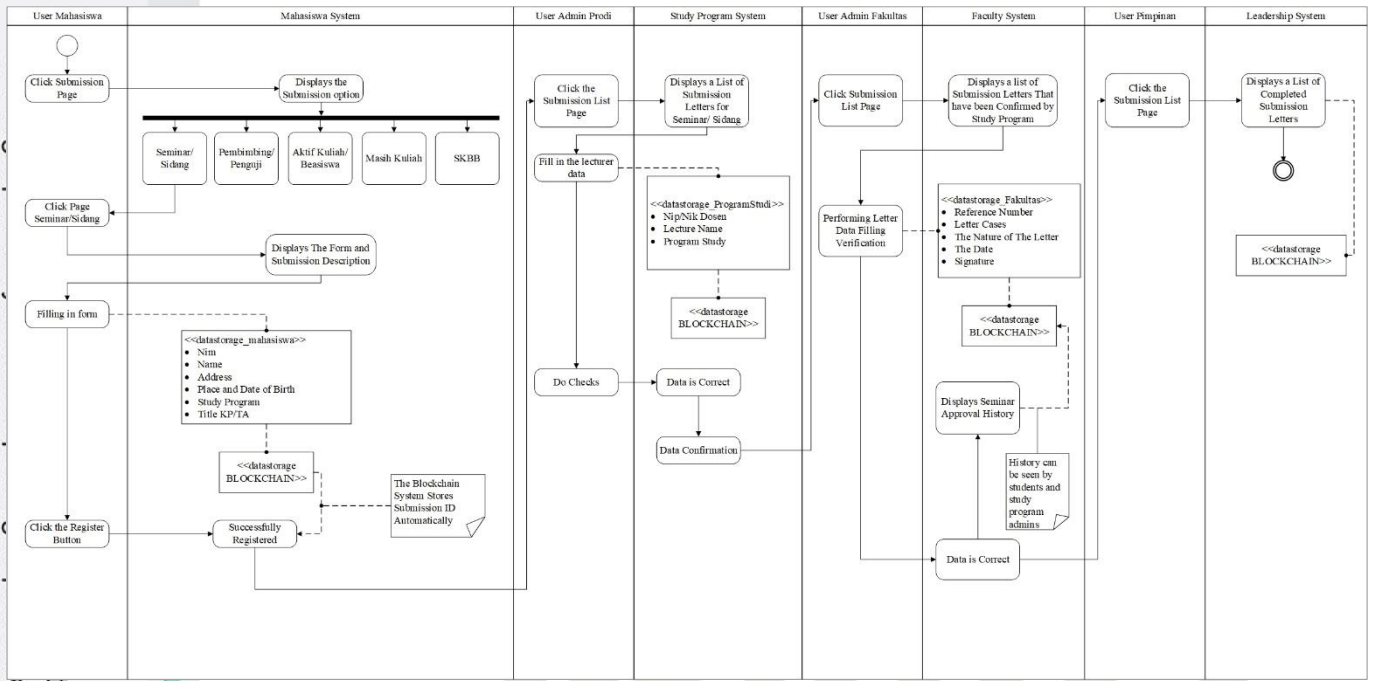


Fig. 3 Activity Diagram Student, Admin and Leadership

4. Evaluation of design against user needs

The evaluation stage is the final stage in making an application. In order to find out whether the objective function of the user and the organization has been achieved, an assessment is carried out using black box testing.

The user interface on the academic information system website is as follows :

Login for user Students using NIM (student id number) and login using NIP/NIK (employee id number) for Study Program Admin, Faculty Admin and Leadership.

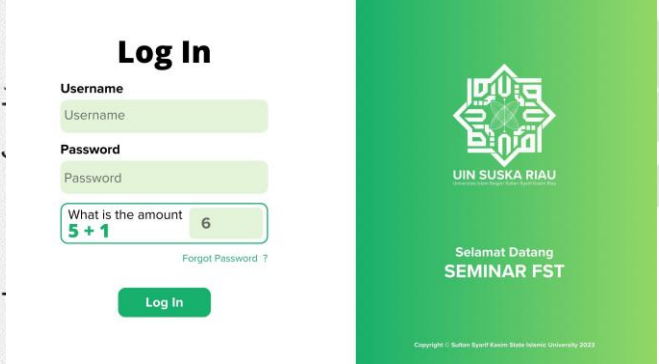


Fig. 4 Login View

If you are already logged in it will enter the dashboard view.

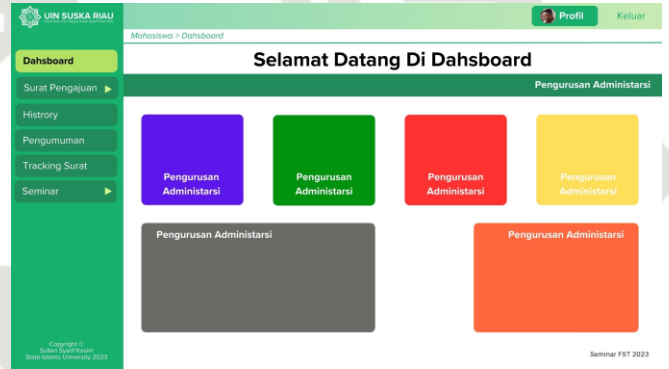


Fig. 5 Student Dashboard View

c. Students choose the intended application letter. Then it will appear to fill out the form. This is the display form of one of the selected submission letters.



Fig. 6 View of Student Submission Letter

d. Registration of student submission letters will be entered into the submission list in the study program admin

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No	ID	Nama	NIM	Jurusan	Pengajuan	Detail Pengajuan	Keterangan
1	PP1057	Anggi Lis...	11950211623	Teknik Industri	Pembimbing	Buka File	Cetak Surat
3	PP4325	Fahreza...	11850211609	Teknik Industri	Penguji	Buka File	Cetak Surat
2	PP9865	Rian Prat...	11950213145	Teknik Industri	Penguji	Buka File	Cetak Surat
4	PP4667	Muhamad...	11950215446	Teknik Industri	Pembimbing	Buka File	Cetak Surat
5	PP0987	Miba An...	11850211879	Teknik Industri	Pembimbing	Buka File	Cetak Surat
6	PP1239	Aditya Ma...	11950211007	Teknik Industri	Penguji	Buka File	Cetak Surat
7	PP6654	Nindi Put...	11950211645	Teknik Industri	Penguji	Buka File	Cetak Surat
8	PP9180	Jawaharu...	11750211600	Teknik Industri	Penguji	Buka File	Cetak Surat

Fig. 7 Display of the Letter Submission List on the Study Program Admin

If the study program admin has confirmed, then the letter applicant will enter the faculty admin submission list

No	ID	NIM	Jurusan	Pengajuan	Tanggal Konfirmasi	Detail Pengajuan	Konfirmasi
1	PS1057	11950211623	Teknik Industri	Sidang	07 Mei 2023	Buka File	Terima Tolak
3	PS4325	11850211609	Teknik Industri	Seminar	06 April 2023	Buka File	Diterima
2	PS9865	11950213145	Teknik Industri	Sidang	05 April 2023	Buka File	Terima Tolak
4	PS4667	11950215446	Teknik Industri	Sidang	05 April 2023	Buka File	Diterima
5	PS0987	11850211879	Teknik Industri	Sidang	05 April 2023	Buka File	Ditolak
6	PS1239	11950211007	Teknik Industri	Sidang	05 April 2023	Buka File	Terima Tolak
7	PS6654	11950211645	Teknik Industri	Sidang	27 Maret 2023	Buka File	Diterima
8	PS9180	11750211600	Teknik Industri	Sidang	27 Maret 2023	Buka File	Diterima

Fig. 8 Display of Letter Submission List on Faculty Admin

The names of students who have been accepted by the faculty admin will enter the list of submissions to the leadership.

No	ID	NIM	Jurusan	Pengajuan	Tanggal Konfirmasi	Detail Pengajuan	Konfirmasi
1	PS1057	11950211623	Teknik Industri	Sidang	07 Mei 2023	Buka File	Diterima
3	PS4325	11850211609	Teknik Industri	Seminar	06 April 2023	Buka File	Diterima
2	PS9865	11950213145	Teknik Industri	Sidang	05 April 2023	Buka File	Diterima
4	PS4667	11950215446	Teknik Industri	Sidang	05 April 2023	Buka File	Diterima
5	PS0987	11850211879	Teknik Industri	Sidang	05 April 2023	Buka File	Ditolak
6	PS1239	11950211007	Teknik Industri	Sidang	05 April 2023	Buka File	Diterima
7	PS6654	11950211645	Teknik Industri	Sidang	27 Maret 2023	Buka File	Diterima
8	PS9180	11750211600	Teknik Industri	Sidang	27 Maret 2023	Buka File	Diterima

Fig. 9 Display of the List of Submission Lists to the Leader

1 Discussion by blackbox testing

Of all the system implementation activities discussed, it was found that the system that had been created and implemented was running as expected by testing the system using blackbox testing.

Table 2 Black Box Testing

Process Tested	Test Scenario	Expected results	Test result
Login Student	Nim/Nip/	Login	As

Admin and Leadership	Nik and password must be correct	Successful	expected
Input from the student submission form	data the letter data	Data can be stored in the database	As expected
Prodi admin verification process	The system displays student submission data	The overall data is displayed from the submission of student letters	As expected
Faculty admin validation process	The system receives proof of study program admin verification	The overall data for submitting student letters that the study program admin has verified is displayed	As expected
Leadership Acceptance Process	The system accepts proof of validation in the Faculty admin	The overall data for submitting student letters that have been validated by the faculty admin is displayed	As expected
Tracking Letter Submission	The system tracks the mail from the id number obtained	The id number obtained can trace the mail	As expected



## 5. Conclusion

The development of blockchain technology in the field of education is an interesting discussion to study. The application of blockchain is in a ledger where there are data records that are stored properly and the nature of blockchain is decentralization, so study program admins and faculty can manage student submission data that has been filled in by students. So that students do not need to carry out manual verification again to the study program admin and the submission ID number obtained becomes proof of authenticity for tracking submitted letters. Using blockchain can maximize the effectiveness and efficiency of the use of technology in university academics. By describing the existing problems using the user centered design method, it produces solutions based on the needs of students and admins and runs according to the functions that have been tested with black box testing. Proposals for improvements submitted to the leadership via the FST website will be an important step in optimizing the management of academic administration services.

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## Letter Of Accepted

Dear Ms. Lianny:

Congratulations - your paper #1570917995 "Blockchain Implementation in the Academic Administration Service System" has been accepted for presentation at 2023 International Conference on Green Energy, Computing and Intelligent Technology, which will be held in hybrid mode from the 10th to the 12th of July, 2023.

Your paper has been accepted to be published at IET subject to:

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The reviews are below or can be found at [1570917995](https://doi.org/10.1570917995).

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TPC Chairs

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