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Development of higher education final judgment management information system using user-centered design method

Didi Supriyadi^{1*}, Khairun Nisa Meia², Ngafidin², Jerry Lasama³, Rafian Ramadhani⁴

^{1,2} Department of Information System, Faculty of Informatics, Telkom Institute of Technology Purwokerto

^{3,4} Department of Informatics, Faculty of Informatics, Telkom Institute of Technology Purwokerto

^{1,2,3,4} D.I. Panjaitan Street, Number 128th, Purwokerto Selatan, Banyumas, Jawa Tengah, Indonesia 53147

*Corresponding email: didisupriyadi@ittelkom-pwt.ac.id

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Abstract — Final Judgment is a consideration process to declare that a student has met the academic and administrative requirements to hold a scholarship academic degree from the college. The Final Judgment management process business in universities involves many processes and stakeholders. Based on the result of observations and interviews, it is known that Final Judgment Management at the Informatics Faculty of ITTP is currently done manually by filling out the registration form and takes a long time for its processing. This study aims to develop Information Systems using User-Centered Design (UCD) methods that can meet the users' needs in implementing and managing Final Judgment processes. The developed system was tested for usability using a user questionnaire with the Nielsen Attribute Usability (NAU) method. The method consists of five criteria: Learnability, Memorability, Efficiency, Errors, and Satisfaction. Usability test results showed: Learnability rate of 3.60, Memorability of 3.35, Efficiency of 3.90, Errors of 3.12, and Satisfaction of 3.63. Therefore, the average usability level of the Final Judgment system is 3.52. The user agrees that the developed Final Judgment information system has met the expected functional needs and is considered more effective and efficient.

Keywords – IS Development, Final Judgment, User-Centered Design, Nielsen Attribute Usability

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I. INTRODUCTION

The development of information technology in Indonesia today is very rapid. This is shown by the increasing number of Internet users in Indonesia until 2017. According to data from a survey conducted by the Indonesian Internet Service Providers Association (APJII) in 2017, the number of Internet users in Indonesia from 132.7 million in 2016 increased to 143.26 million in 2017 (equivalent to 54.68% of the total population in Indonesia)[1]. The globalization of information has also placed Indonesia as part of the world's information society that encourages changes in activities in various fields. The Indonesian Government also supports the development of information technology. One of which is establishing the Law of the Republic of Indonesia Number 11 of 2008 concerning the Information and Electronic Transactions [2].

Information technology is no longer considered a merely supportive thing but has become part of the value of an organization's business strategy. Information technology is regarded the key to saving transactional operating costs for organizations. Information technology as an enabler for service/product innovation for consumers. Information technology is a solution to limited access to information and services for consumers. The condition of the Corona Virus Disease 2019 (COVID-19) pandemic has a negative impact on all social aspects. Also, it raises a challenge for organizations to be able to survive to provide the best services for consumers so that they can compete with other organizations. This occurs not only in specific sectors but also all business sectors, including the Education sector [3].

Informatics Faculty of Telkom Institute of Technology Purwokerto (ITTP) is one of the organizers of Education in Indonesia. ITTP is also inseparable from the challenges and impacts of the COVID-19 Pandemic. Various challenges faced by this institution in the conditions of the COVID-19 Pandemic include strengthening the implementation and education services that must continue to run. The institution has developed various service systems for online-based students in the learning process [4]. Today, Higher Education Institutions are market-oriented. The market influences their sustainability. Therefore, the institutions must be able to meet market needs[5]. To meet the market needs, the institution can provide the best service to customers, including students.

Final Judgment is the final assessment process of all courses that students have taken and the determination of grades in academic transcripts that decide students' graduation in pursuing studies in a particular study program. The Final Judgment process at the Informatics Faculty begins with students being declared to have passed the Final Project session, registering for the Final Judgment, participating in the Final Judgment ceremony, and obtaining a Certificate of Graduation (SKL) to register for graduation. There are various requirements and conditions of Final Judgment registration at the Informatics Faculty of ITTP, such as Financial-Free Certificate, Laboratory and Library Free, and pass competency certification according to their respective fields of science [6]. Final Judgment management at the Informatics Faculty is still conducted manually by filling out the registration form which the faculty administration will then check. The Final Judgment validation data collection process takes an average time for each student of about 3-5 working days. The obstacles faced in running the process business include students experiencing difficulties or limited time in registering that must be present directly to the campus (lack of flexibility in services), the faculty does not yet have a Final Judgment database whose activities can be in real-time monitored from the level of study programs to faculties. In addition, the increasing number of students who do Final Judgment every year as shown in Figure 1, is felt by most students and other academicians are less fast, precise, effective and efficient, and less safe for the COVID-19 pandemic if the processes are still carried out manually and direct interaction with humans.

Some research related to the development of the Final Judgment or Graduation information system that has been carried out includes research on the Development of a website-based Graduation Management Information System using the Waterfall method [7] and Online Registration and Graduation Information System Testing using Black Box Testing with Equivalence Partitioning and Boundary Value Analysis methods [8]. System development using the waterfall method is considered to have weaknesses: among others, the development phase is carried out sequentially cannot be carried out in parallel and the development period takes more extended [9].

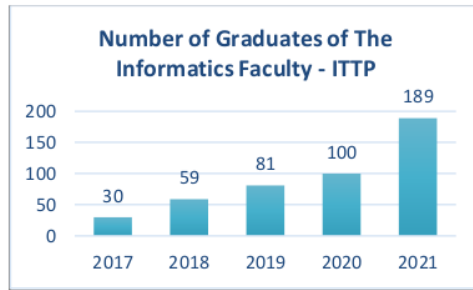


Fig.1. Graduate Data of Informatics Faculty

Based on the background description above, this study was carried out to solve the problem of managing Final Judgment and graduation business processes that have been carried out manually by the academic community of the Informatics Faculty of ITTP by developing a Final Judgment management information system. The development of the Final Judgment information system uses the User-Centered Design (UCD) method. UCD is a repetitive system design approach involving system users [10], [11]. End-user involvement in designing a system is expected to increase the success of system implementation [12], [13].

II. RESEARCH METHOD

The development of the Final Judgment Management information system using the UCD method includes several stages, as described in Figure 2.

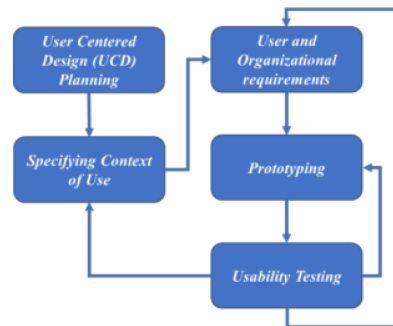


Fig.2. The User-Centered Design Cycle [14]

A. User-Centered Design (UCD) Planning

This stage is important stage to identify problems and create a vision and objectives for system development. This stage involves stakeholders as users of the system to be developed. This stage was carried out to build effective engagement and communication with stakeholders [14]. In addition, the purpose of this planning stage is to reduce the demand for improvement from users after the system is developed, reduce user errors, create more effective quality, and make developed systems easier to be learned.

B. Specifying Context of Use

This stage identifies the environment the system will work. For example, any process business that will be improved performance by utilizing technology or systems to be developed. The user's role in this stage determines the specifications and processes that must be well defined to be set in the system [14]. This stage can be carried out by using questionnaires or interviews with users who analyze the organizational environment, tasks, and users. This stage focuses on achieving the usefulness of the system to be developed.

C. User and Organizational requirements

This stage focuses on the user of the system to be developed. This stage is carried out to identify the needs of users and organizations. This stage includes the quality of human and computer interaction design, the quality of the functional system to be used, and the effectiveness of collaboration and communication between the system and the user [10].

D. Prototyping

After identifying the problem to the analysis of user needs, the next stage is the design stage of the solution design. According to Rohandi, et al [15], designing solution design is the stage of prototyping as a natural solution to test the key to the user. The method of the solution design used in this study uses an object-oriented programming (OOP) approach using Unified Modelling Language (UML) modeling consisting of a Use Case Diagram, sequence diagram, Entity Relationship Diagram (ER-Diagram), and system interface design. The use of user-centered techniques to UML can increase developers' awareness and understanding of user-centered issues [16].

E. Usability Testing

The system evaluation stage after the completion is developed with the evaluation approach used in usability testing. Usability is a significant component of the UCD method in the system development [17]. Usability is the level of usefulness of a system, product, or service based on the user's perception of effectiveness, efficiency, and satisfaction in specific other contexts [18]. Usability testing is one of the most popular user-centered techniques reported in the survey introduced by Nielsen in 1993 [16]. The study evaluated the system using the Nielsen Usability method. According to Jacob Nielsen, usability refers to the quality attributes of a system interface. Therefore, it is easy to use [19]–[21]. According to Nielsen, there are five variables of usability of a system consisting Learnability, Effectivity and efficiency, memorability, error, and satisfaction.

III. RESULT AND DISCUSSION

A. Results from the UCD Planning stage

This study aims to develop an Information System that can meet the needs of users in carrying out and managing Final Judgment processes at the Informatics Faculty of ITTP. At this stage, direct observation and interviews were conducted with the Head of the Study Program, the academic administration of the faculty as the manager of the Final Judgment process, and students who will complete the graduation Final Judgment. Summary of the interview results to identify problems related to the Final Judgment and the responses submitted by respondents as shown in table 1. These results are used as the basis for developing the Graduation Final Judgment management information system.

B. Results from the Specifying Context of Use stage

Based on the summary of the interview results presented in Table 1, it is known that managing the Graduation Final Judgment of the Informatics Faculty students of ITTP needs to improve their management performance. The improvement starts from the approval of the Student Final Project by the Supervisor and Examiner to the Validation of the Final Project by the Head of the Study Program. These stages are grouped in the pre-Final Judgment cycle. Next is the registration stage of The Final Judgment by students by uploading the requirements documents. They were continued with the management of the Graduation Final Judgment registration by the faculty administration through an examination of the completeness of the requirements documents that have been uploaded by students until the issuance of a Certificate of Graduation by the Dean of the Faculty. The stages are grouped in the Final Judgment package. Both packages are shown in Figure 3.

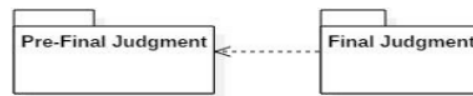


Fig.3. Final Judgment Package

Table 1. Results of Final Judgment Question Interviews

Questions	Answers
How is the registration and management process of the Graduation Final Judgment currently underway?	The registration process and management of the Graduation Final Judgment is carried out by students registering through the google registration form by submitting requirements documents. Furthermore, the Faculty admin checks the completeness of the documents.
Has this process been very helpful in the management process?	The process is quite helpful in the registration process but less effective and efficient for Final Judgment managers. In addition, the Graphical User Interface (GUI)

Questions	Answers
	display still follows the template from google form (less interesting)
What process of managing the graduation Final Judgment needs to be developed based on a web that can run on desktop and mobile devices?	It is necessary to develop a responsive web-based information system on desktop and mobile devices so that it makes it easier for all users. This is because almost all students and lecturers have laptop and smartphone devices.
What functions need to be developed in the information system?	<p>The system must be able to fulfill the registration process of the student's Graduation Final Judgment ranging from uploading the requirements documents to printing a Certificate of Graduation (SKL).</p> <p>7 The system must be able to meet the needs of supervisors and examiners to approve students' Final projects (TA 2).</p> <p>7 The system must be able to meet the needs of the Head of Study Program to validate students' Final Project (TA 2).</p> <p>10 The system must be able to meet the needs of the Dean to approve the issuance of a Certificate of Graduation (SKL).</p>

C. Results from the User and Organizational requirements stage

Based on the summary of the interview results presented in Table 1, it is also known that the needs of users and the faculty as organizations that manage the business processes of the Graduation Final Judgment can be identified. Table 2 identifies the needs of users and organizations for the Graduation Final Judgment management information system developed.

Table 1. Identify User and Organizational Needs

Users' Need	Organizations' Need
Approval of supervisors and final project examiners can be done through a developed system.	The process of validating the student's Final Project by the Head of the Study Program can be done through a developed system.
Registration of Graduation Final Judgment which includes filling in the student's identity to upload the requirements documents can be done through the system developed.	Final Judgment registration can only be done after the Supervisor and Examiner have approved and the Head of the Study Program has validated the student's Final Project.
The developed system has a Graphical User Interface (GUI) that is more attractive and easier to use on desktop and mobile devices.	Students can only print a Certificate of Graduation if all stages have been completed

D. Results of the Prototyping stage

This stage is the design of the solution design developed. Solution system design is produced using the use case diagram, sequence diagram, Entity Relationship Diagram (ER-Diagram), and system interface design approach. Use case diagrams to describe the functional needs of the system and the relationship between the user and the system. The results of the design of the use case diagram of the graduation Final Judgment system are shown in Figures 4 and 5. Figures 4 and 5 represent the relationship between actors (students, supervisors, examiners, and the Head of the Study Program) and the Final Judgment information system at the pre-Final Judgment stage and the Final Judgment stage. Each user must first log in to be able to use the Final Judgment information system. Users who do not have an account on the system can create it through the system directly or can also be made by the faculty admin. The Pre-Final Judgment Stage serves to carry out the approval stage of the student's Final Project by the supervisor, examiner, and validation by the head of the study program. In this Pre-Final Judgment Stage, students are asked to upload a Final Project report which will then be checked and approved by the Examiner and supervisor.

Furthermore, on the dashboard system of Examiner and Supervisors will appear notification of the number of student's Final Project approval requests. The Final Judgment stage allows students to register for the Graduation Ceremony by uploading the requirements documents to print the Certificate of Graduation (SKL). Students can proceed to the Final Judgment Registration stage if they have completed the pre-Final Judgment stage. At the Final Judgment stage, the Dean will validate the registration of the Final Judgment and sign the SKL. Students can only print the SKL if the Dean has validated their Final Judgment registration.

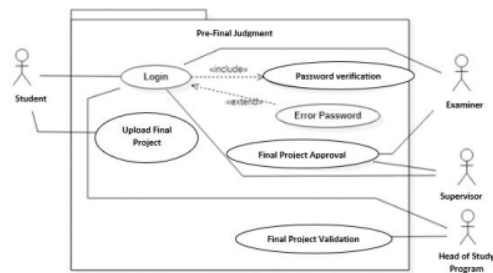


Fig 4. Use Case Pre-Final Judgment Diagram

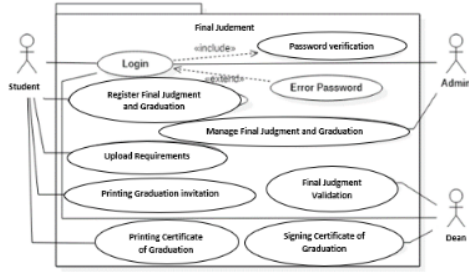


Fig.5. Use Case Final Judgment Diagram

Sequence diagrams represent and describe interactions between objects in a system in more detail. The results of the design of the Graduation Final Judgment system's sequence diagram are shown in Figures 6 and 7. Figures 6 and 7 represent the interaction of students as users with objects in the Final Judgment system starting from the pre-Final Judgment stage to the Final Judgment stage.

Fig. 6. Students' Pre-Final Judgment Sequence Diagram

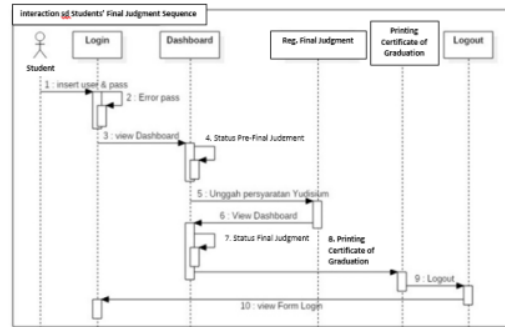
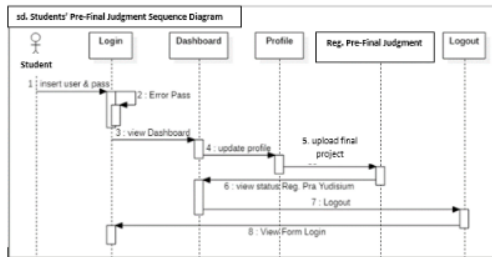


Fig.7. Students' Final Judgment Sequence Diagram

ER Diagram is used to determine the relationship of entities in a system's database. ER design results of the graduation Final Judgment system diagram are shown in Figure 8.



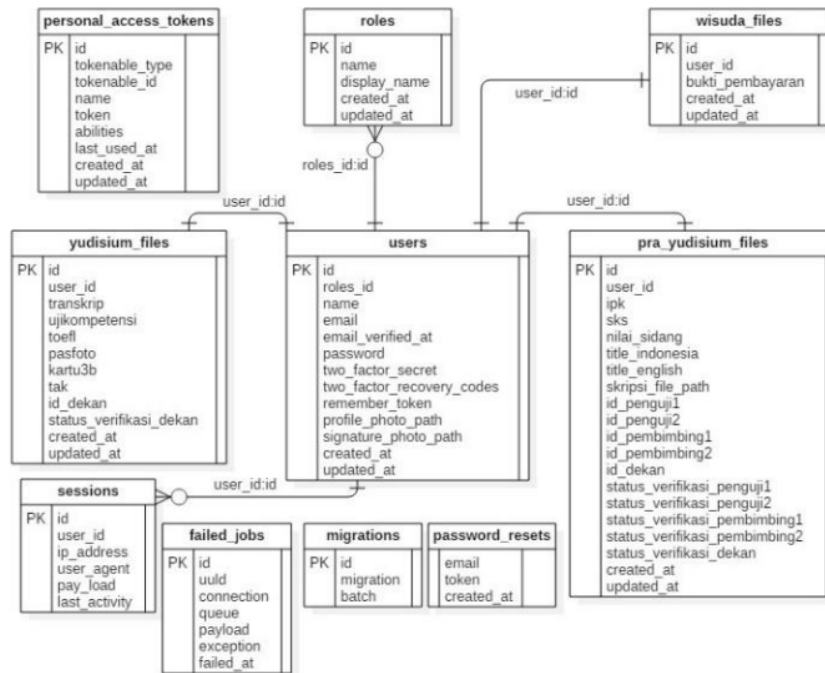


Fig.8. ER – Final Judgment Diagram

The next stage is creating a system interface. System interface creation uses the Laravel framework of the PHP programming language for the backend, and the bootstrap CSS framework to create views and dashboards. At this stage, student users, lecturers, and the Head of the Study Program are designing the GUI (layout, images, text types, and colors). Therefore, the system developed is appropriate for the functional and user needs. Figure 9 shows the login page for the system users. To log in to the system, users must enter a username with an email address and password. System users consist of students, supervisors, examiners, the Head of the Study Program, faculty admins, and the Dean. If the login process is successful, subsequently, the user will be redirected to the dashboard page of each user as shown in Figures 10 - 13. However, if it fails, the user will be redirected back to the login page. Figure 10 shows that the student menu dashboard has 2 (two) sub-menus, namely the Pre-Final Judgment sub-menu and the Final Judgment sub-menu. This page displays the developmental status of each of these stages. If all

the stages have been completed and validated by the Dean, the "Print SKL" menu will be active later.

Masuk untuk melanjutkan.

Email

Password

MASUK

Ingat saya Lupa password?

[Buat akun](#)

Fig.9. Login Page View

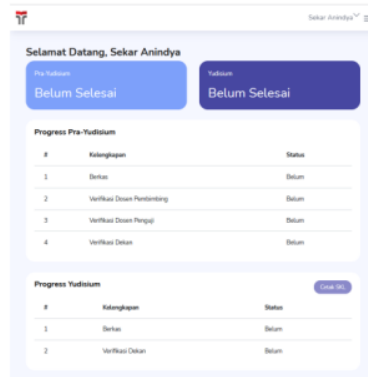


Fig.10. Student Dashboard View

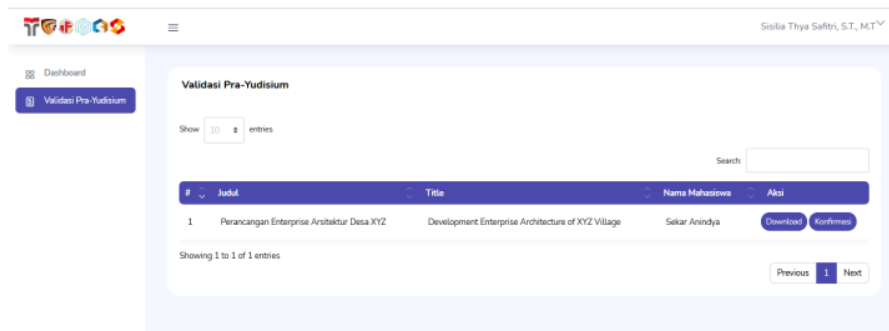


Fig.11. Final Project Supervisor Dashboard View

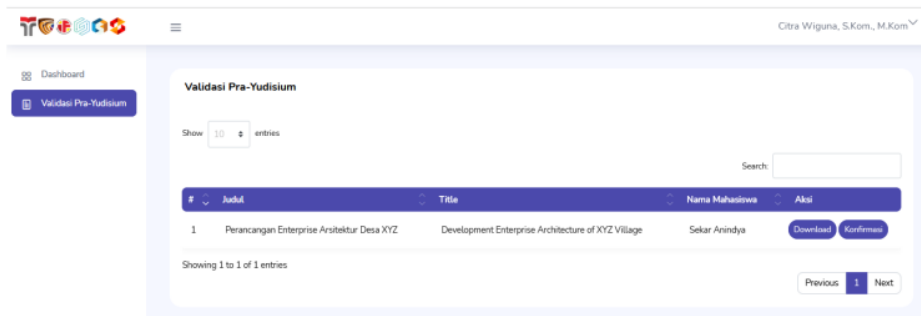


Fig.12. Final Project Examiner Dashboard View



Fig.13. Dean Dashboard View

Generally, the dashboard menu displays for Supervisors (Figure 11), Examiner (Figure 12), and the Head of the Study Program are the same. It consists of a dashboard menu and a pre-Final Judgment menu. The dashboard menu display will display information on the Final Project title list and the name of students who

have registered pre-Final Judgment by uploading the Final Project Report document that supervisor and the examiner must approve. While the dashboard page for the Dean is attached to the dashboard menu itself, which displays information on the number of Pre-Final Judgment and Final Judgment Validation Applications

as shown in Figure 13, the Pre-Final Judgment Validation menu to validate pre-Final Judgment applications and the Final Judgment Validation menu to validate Final Judgment applications.

Pre-Final Judgment and Final Judgment Registration conducted by students is the main process business that must be able to run in the developed Final Judgment system. Then the interface for both functions can be shown in Figures 14 and 15. Figure 14 shows the interface for the student's pre-Final Judgment registration function. The interface is used to upload student Final Project Report documents approved by supervisors and examiners. Figure 15 shows the interface for the Final Judgment registration function after the pre-Final Judgment stage has been approved and validated. The interface is used to upload documents for the registration of the Graduation Final Judgment including certificates of competence, complimentary letter of Library and Laboratory to Transcript of Student Activities (TAK). If the Dean has validated all the registration stages, students can print SKL, as shown in Figure 16.

E. Results of the Usability Testing stage

The Usability testing stage aims to obtain information related to the system's usability level developed based on the assessment of system users. The system has been tested on 17 respondents consisting of students, lecturers, the head of the study program, faculty administrative staff, and the Dean with the number of respondents respectively as shown in Figure 17. Usability testing uses questionnaires with the Nielsen Attribute Usability (NAU) model approach.

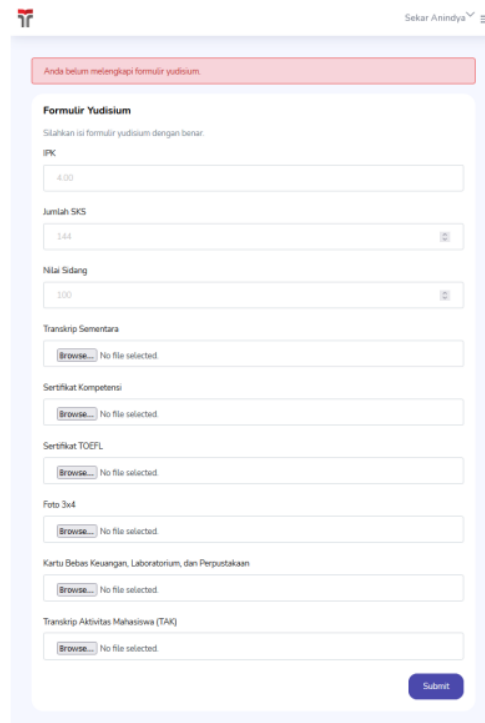


Fig.15. Final Judgment Registration Interface



Fig.16. Certificate of Graduation (SKL) Print Function View

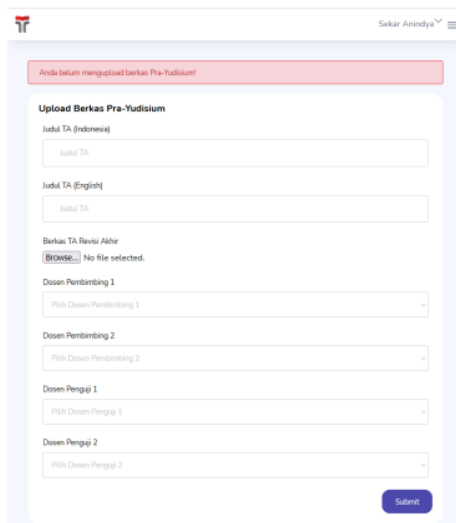


Fig.14. Pre-Final Judgment Registration Interface

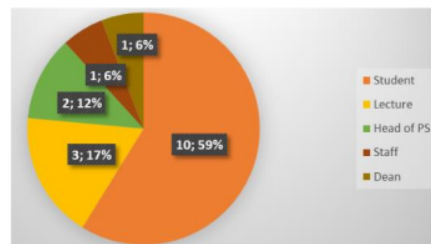


Fig.17. Number of Respondents

The questionnaire model developed by Nielsen consists of 5 (five) criteria usability systems including Learnability, Memorability, Efficiency, Errors, and Satisfaction. Each criterion consists of several indicators measured using 5 Likert scales including Strongly Disagree /SD (1), Disagree/D (2), Neutral/N (3), Agree/A (4), and Strongly Agree/SA (5) as in Table 3.

Table 2. Rate, Interval, and Interpretation of Assessment

Likert	Rate	Interval	Interpretation
1	Strongly Disagree (SD)	<1	Very Dissatisfied
2	Disagree (D)	<2	Dissatisfied
3	Neutral (N)	<3	Neutral
4	Agree (A)	<4	Satisfied
5	Strongly Agree (SA)	>4	Very Satisfied

Table 4 is the result of the calculation of the questionnaire assessment based on the user's perception of the usefulness of the Final Judgment system that has been developed. The questionnaire consists of 18 (eighteen) indicators grouped into 5 usability criteria. Learnability criteria consist of 4 (four) indicators, Memorability criteria consist of 3 (three) indicators, Efficiency criteria consist of 3 (three) indicators, Errors criteria consist of 3 (three) indicators, and Satisfaction criteria consist of 4 (four) indicators. Based on the user perception assessment results, it is known that ER3 is the indicator with the lowest value of 2.88. This result relates to the indicator "I could find the menu I wanted to find". At the same time, EC2 is an indicator with the highest value of 4.18. This result relates to the indicator "I can quickly get the information I am looking for."

Table 3. Results of Assessment

Indicator	SD	D	N	A	SA	AVG	Interpretation
LA1	0	0	6	9	2	3,76	Satisfied
LA2	0	0	3	13	1	3,88	Satisfied
LA3	0	0	7	6	4	3,82	Satisfied
LA4	0	0	12	5	0	3,29	Satisfied
LA5	0	2	9	6	0	3,24	Satisfied
MA1	0	0	8	9	0	3,53	Satisfied
MA2	0	3	10	4	0	3,06	Satisfied
MA3	0	0	9	8	0	3,47	Satisfied
EC1	0	0	5	8	4	3,94	Satisfied
EC2	0	0	0	14	3	4,18	Very Satisfied
EC3	0	0	7	10	0	3,59	Satisfied
ER1	0	0	10	7	0	3,41	Satisfied
ER2	0	2	12	3	0	3,06	Satisfied
ER3	0	2	15	0	0	2,88	Neutral
SA1	0	0	6	11	0	3,65	Satisfied
SA2	0	0	9	8	0	3,47	Satisfied
SA3	0	0	6	10	1	3,71	Satisfied
SA4	0	0	5	12	0	3,71	Satisfied

Based on the results of respondents' assessment of each indicator, it can also be known that the average value of the level of usability and interpretation is shown in Table 5 and Figure 18. Based on Table 5, it is known that the Efficiency dimension is the dimension with the highest average value of 3.90 and the Errors dimension is the dimension with the lowest average value of 3.12. However, the average value of total usability is 3.52. It can be interpreted that the user expresses "Satisfied" with the level of usability of the system developed and has met the expectations and needs of its users.

Table 4. Value of Each Dimension

Dimension	Average	Interpretation
Learnability	3,60	Satisfied
Memorability	3,35	Satisfied

Dimension	Average	Interpretation
Efficiency	3,90	Satisfied
Errors	3,12	Satisfied
Satisfaction	3,63	Satisfied
Total Usability	3,52	Satisfied

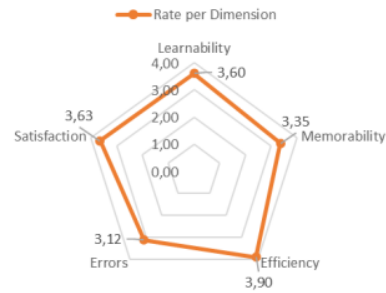


Fig.18. Radar Chart Value of each Dimension

IV. CONCLUSION

Based on the results of implementation and analysis of the development of the Final Judgment system using the User-Centered Design method, it can be concluded that the steps contained in the UCD method are constructive for researchers in developing Final Judgment information systems appropriate to the functional needs of users. It can be proven by testing the system's level of use using the Nielsen Attribute Usability (NAU) method. The testing is carried out on representative users: students, lecturers as supervisors and examiners, the Head of the study program, faculty administrative staff, and the Dean. It was obtained that the average value of each dimension of NAU is Learnability of 3.60, Memorability of 3.35, Efficiency of 3.90, Errors of 3.12, and Satisfaction of 3.63. Therefore, the average value of user satisfaction with the system's usability is 3.52 which is interpreted as the level of satisfaction being "Satisfied". However, 2 (two) of the 5 (five) usability dimensions, have values still below the average value, namely the Memorability dimension and the Errors dimension. If explored further on each indicator, it is known that the indicator of the Memorability dimension, namely MA2 has the lowest value with the interpretation of satisfaction at the "satisfied" level and the indicator of the Errors dimension is ER3 with the performance of satisfaction at the "Neutral" level. Therefore, to increase user satisfaction, the need for socialization of system uses or by providing a "manual book" for users.

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