ISSN 2580-2887 (print)
ISSN 2580-2895 (online)

Jurnal Sistem dan Manajemen Industri

Universitas Serang Raya

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Jurnal Sistem dan Manajemen Industri

ISSN (Print) 2580-2887 ISSN (Online) 2580-2895

Website-based final project management system design at Trisakti university industrial engineering

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ARTICLE INFORMATION

Article history:

Received: July 22, 2022
Revised: November 17, 2022
Accepted: November 24, 2022

Keywords:

System information management
Final project system management
Website-based system
Object oriented modelling

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A B S T R A C T

Preparing the final project is one of the requirements for graduation from a college student. The right Final Project management system will affect the quality of education. Industrial Engineering Trisakti University is one of the leading universities in Indonesia that continues to develop its education system. Managing the final project at Trisakti University Industrial Engineering is still manual and has not been integrated. As a result, the risk of errors in entering and saving Final Project data is still high. Therefore, this research was conducted to design a final project management system at Trisakti University Industrial Engineering. It begins with analyzing the existing management system. It is described with swim lane diagrams and PIECES to determine the process flow in the system and the actors who play a role in the system. After analyzing the system, proceed with designing information systems with Object-Oriented Modeling and evaluate it with black box testing and ERRC. This research results in website-based final project management at Trisakti University Industrial Engineering.

1. INTRODUCTION

Education is a necessary sector of a country because the quality of education will affect the future of a country [1]. Pandemic in Indonesia since 2020 has been one of the drivers of accelerating the development of information technology, including in the education sector. All educational activities must be online. The lecture process, which used to be held on campus, has now become online from home. Not only that, but the restrictions on people's movement imposed by the government at the beginning of the pandemic also caused management and administration activities to be flexible so that distance was no longer a barrier to all activities in the education sector.

Designing an information system to support academic activities at a university is one solution to accelerate development in the world of education [2]. Academics is one form of the service industry that, if managed using an information management system, can optimize performance systems [3]. The management system in the world of education is divided into various processes, one of which is the final project management system. The process of completing the final project is one of the important requirements for prospective undergraduates at the level

of higher education. This process is the final process in undergraduate-level lectures to declare whether a student is worthy or not getting a bachelor's degree [4].

In previous studies, many systems were developed using a website-based system, such as the health system, public services and academic systems [5], [6]. Nowadays, Trisakti University uses a website-based for its academic system, but the final task management process is still done manually.

The Department of Industrial Engineering, Trisakti University, is one of the universities in Indonesia accredited nationally and internationally and has an active role in improving the quality of education in Indonesia. However, currently, this department has problems with the management process of the Final Project. The process is still manual and not integrated. The data collection, assessment, and data storage for Final Project students are still manually done by using google forms and google drives that are filled out by lecturers and Final Project administrators so that the data did not integrate. It can be a high risk of data entry errors and loss of Final Project data. Therefore, we conducted this research to design a website-based Final Project management system.

This research uses an object-oriented system development approach and focuses on the final project management design at Trisakti University. Much previous research is related to it. The development of information management systems with UML, especially College student management, has been conducted by looking at the feasibility, requirements, functional and performance analysis [7]. The development of an information system for school payments has been done, and the black box evaluation method serves as a software assessment [8]. The UML method is also used to analyze and design colleges' and universities' scientific research management systems [9].

Developing a system can be explained into several phases: Analysis, design, implementation, and maintenance. The system analysis stage is the stage of studying all the processes that occur in the running system. The purpose of this process is to describe the system that is running so that later it can be known the system requirements for development at the system design stage [10]. We analyzed the final project management information system using Swimlane and PIECES (Performance, Information, Economy, Control, Efficiency, and Service) diagrams (source). Swimlane diagrams are considered a tool that can validate business rules and procedures according to stakeholders effectively and efficiently [11]. PIECES analyses system deficiencies from 6 aspects: Performance, Information, Economy, Control, Efficiency, and Service. Analysis of deficiencies in the system with PIECES became the object of system improvements [12].

After the system analysis, the following process is the design of the final project management system. It begins with making information system diagrams in context diagrams, case diagrams, and sequence diagrams. A context diagram uses to identify the system's actors and the information exchange that occurs in the system [13]. Use case diagram represents actors' interaction and role in the system [14]. At the same time, the sequence diagram is used to describe the architecture of the programming code [15]. The next step is making activity diagrams and database design. Activity diagrams help describe behaviour or interactions between multiple use cases [16]. The data management program stands alone in a commercial program package to read, fill in, delete, and report data in the database [17]. Database design is to determine data requirements for the system and its parameters [18], [19]. Then the web design process, the website is designed as a framework using Codeigniter, designed the user interface for users, and the user experience for the user experience in using the website.

2. RESEARCH METHODS

The research process begins with collecting data on the management of the Final Project. The data used comes from primary data and secondary data. They collected primary data by interviewing the Final Project coordinator. At the same time, they used secondary data in the form of trial participant data, the Final Project registration form, the Final Project assessment form, the Final Project assessment recapitulation form, and the actual Final Project process flowchart.

The data that has been collected is used as material to analyze the actual system requirements and design a final project management system. Analyzing the system is essential in the system management design process. The system analysis process will produce detailed system requirements to drive more effectively and efficiently [20]. That process uses Swimlane and PIECES (Performance, Information, Economy, Control,

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Efficiency, and Service). Furthermore, the system design analyzes user needs through object-oriented diagrams in context diagrams, use-case diagrams, sequence diagrams, and activity diagrams. After successfully analyzing the system requirements, the next step is to design the database.

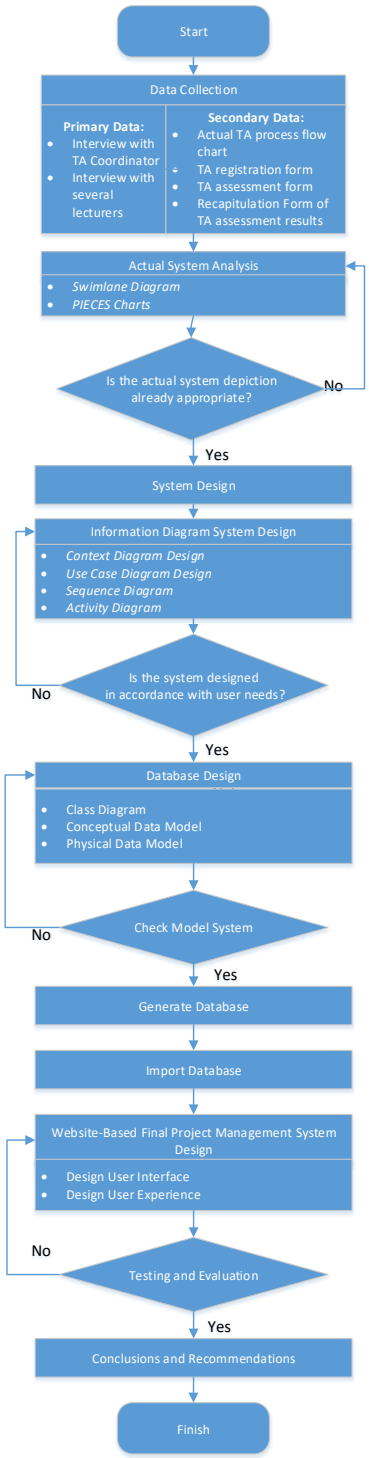

Fig. 1. Research methodology flowchart

The stages in designing the database are to create class diagrams, conceptual data models, and physical data models. After designing the database, the following process is to generate the database and import the database. The programming language used is PHP, MySQL is the database while building PHP applications using Codeigniter. The next step is to build a website-based final project management system with three stages: designing the system, user interface, and user experiences. After the website has been created, the validation steps used black box testing. The final step is to conclude and provide recommendations for the system (Fig. 1).

3. RESULTS AND DISCUSSION

3.1. Actual System Analysis

Utilizing information technology through current information systems can improve the quality and speed of information produced, increase integration in information and operations among local and global organizational stake-holders, and reduce various potential risks [21]. The final project Management System in the Department of Industrial Engineering at Trisakti University, is currently still done manually and has not been integrated. Filling in the final project documents is still done manually on paper or using google forms. The data storage is still using Google Drive. The manual and not integrated data results in problems that are difficult to find or lose. That problem is necessary to develop a final project management system by utilizing website-based information technology that lecturers and students can access.

The Final Project Management System in the industrial engineering department of Trisakti University starts from the *Prayudisium* registration stage carried out by students as prospective Final Project defence participants. At this stage, students will fill out a form provided by the faculty and distributed by the department. After being filled in, the Department's Final Project admin sends the form to be checked by the faculty admin. After checking by the faculty, the data is returned to the department admin. Students who pass the faculty check stage will proceed to the *Prayudisium* stage.

At the *Prayudisium* stage, the participant's file will be re-checked for completeness by the department, and if the file does not meet the requirements, the file will be returned to the student and asked to complete the unmet requirements. Students whose documents are

complete will advance to the *prayudisium* stage.

The *prayudisium* schedule is made by the Final Project defence coordinator based on the completion of the session readiness form by the supervisor and examiner. The recorder will input the attendance list on the official report form during the Final Project defence. In this Final Project defense process, the examiners and final project supervisors will evaluate and assess the Final Project defense participants. The eligibility of Final Project defense participants to pass will be determined based on the results of discussions conducted by the examiner and the final project supervisor.

The final Project defence assessment results are recorded by the note-taker and reported to the department admin. The content of the assessment of the Final Project defense results includes decisions regarding eligibility to pass, with or without improvement, or not pass. If it is declared that it has passed with improvement, the Final Project defense participant must make repairs to the final project no later than seven working days after the Final Project defense. If this is not done, it will cause the grades not to come out, and they will delay graduation. In addition, if until the next *Prayudisium* period, the student cannot complete the final project revision, then the final assignment session's results are declared void, and the student is obliged to repeat the entire *Prayudisium* process and Final Project trial in the following period. The Final Project management system ends when the admin registers students who have completed the Final Project defense. The final project management process is depicted using a swim lane in Fig. 2.

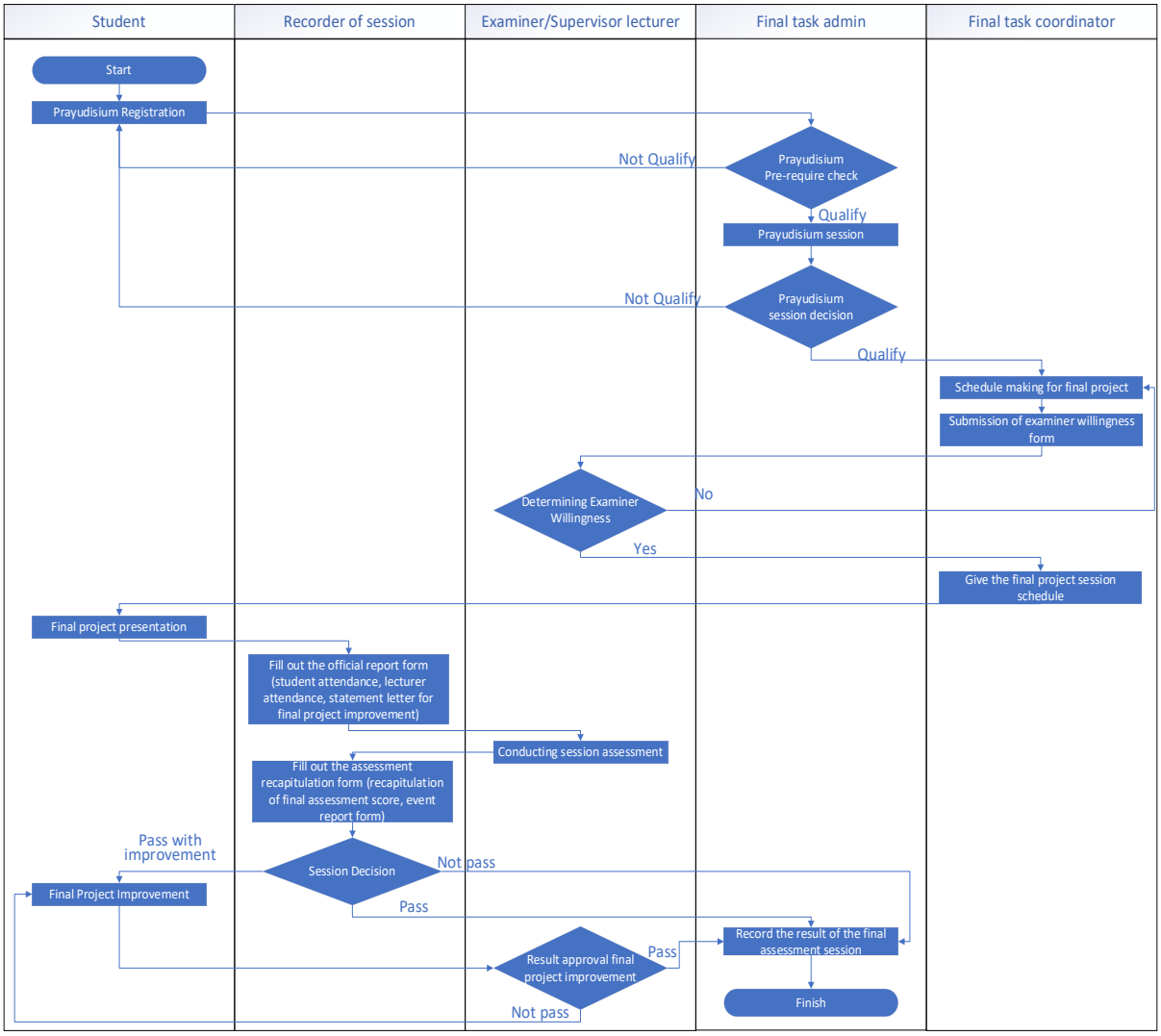

Fig.2. Swimlane final project management process diagram

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Table 1. PIECES diagram for final project management

System Name: Final Project Management			**System Analyst:** Ewaldo Brata
Made by: Ewaldo Brata			**Created date:** 21 November 2021
No	**PIECES Aspect**	**Current System**	**Proposal System**
1	System Performance	The performance of the initial Final Project management system is not optimal because it is still manually and not integrated. It increases the opportunity for data errors and the processing time is longer.	The performance of the proposed Final Project Management System that utilizes a website-based program can integrate data to reduce the chance of errors and faster processing time.
2	Information/Data generated	The presentation of information in the initial system uses a form that did not integrate, so the data or information provided is still incomplete and unsystematic.	Presentation of information using a form integrated into the dashboard with multiple user access according to functional requirements so that the information or data provided will be more systematic.
3	Economic Value/ Benefit	It costs a lot of money to use paper for Final Project administration forms and often leaves unused paper.	Using user interfaces and data storage using a MySQL database can increase the economic value because the costs are cheaper according to their needs.
4	System control/ security	There is the possibility of human error and data loss in entering the data because the system is processed manually.	Using integrated databases and forms will reduce the possibility of human errors and lost documents or files to increase the control value of the previous system.
5	System Efficiency	Using unsystematic and integrated administration forms makes the system inefficient because running the process takes a long time.	Using an integrated Final Project management website, where an integrated system provides all forms, can improve system efficiency by saving time in the Final Project administration process.
6	Service	The actual service process in the Final Project management system is not good enough for stakeholders because they do not use an integrated Final Project administration form. Hence, it requires effort to find a specific form for the process.	Integrating Final Project administration forms in a user interface makes it easier for stakeholders to search for the fit forms.

A swim lane diagram is made to determine the role of stakeholders at each stage in the system [11]. The design of this final project management system is done with object-oriented diagrams so that a PIECES (Performance, Information, Economy, Control, Efficiency, and Service) diagram is made at the analysis stage [22]. The purpose of making a PIECES diagram is to discover the system's shortcomings, which will later be developed in system design [10]. Table 1 is the PISCES diagram of the Final Project management system. The analysis results using PISCES diagrams are input to determine the needs of users or actors in the system. Table 2 is the user admin need for the system.

After making a PIECES diagram, the next step is to analyze user needs. Analysis of user requirements aims to determine the needs of each user directly related to the system. The industrial engineering department's Final Project

management system website has three user levels: admin (Final Task admin and Final task Coordinator), lecturers (recorder of session and examiner), and students. The admin user consists of the Final Project admin stakeholders and the Final Project Coordinator. The admin user acts as a manager and grantor of access to new users and creates a database for trial participants and lecturers who will be involved. The second user is a lecturer consisting of stakeholder supervisors, examiners and note-takers. Lecturer access includes trial assessment for supervisors, assessment of the guidance process, assessment of the trial as examiners, and recapitulation of assessments. The third user is a student as a trial participant who will register for the Final Project trial. Each user has different inputs, roles, rules, processes, and outputs according to their needs. Analysis of user needs for the final project management system in the Industrial Engineering department of Trisakti University is presented in Table 2.

3.2. System Design

System design can be interpreted as drawing, planning, and making ideas to organize several elements in the system so that they become a unified whole and valuable [23]. In designing an Object-Oriented Analysis Diagram (OOAD), it describes a system with a collection of several objects and the behaviour or relationships between them [15]. Unified Modeling Language (UML) is a standard for designing models of OOAD into software [13]. UML forms can be context diagrams, case diagrams, sequence diagrams, and activity diagrams [24].

A context diagram based on object describes the flow of the final project management system process in a diagram. In the context diagram of the final project management system, there are five entities or actors: college students, session coordinators, Final Project defense admins, note-taker, and examiners. The process begins with the registration of the *Prayudisium* by college students, and the last process is the recapitulation of the results of the Final Project defense. Images of actors and process flow in the context diagram of the final project management system design can be seen in Fig. 3.

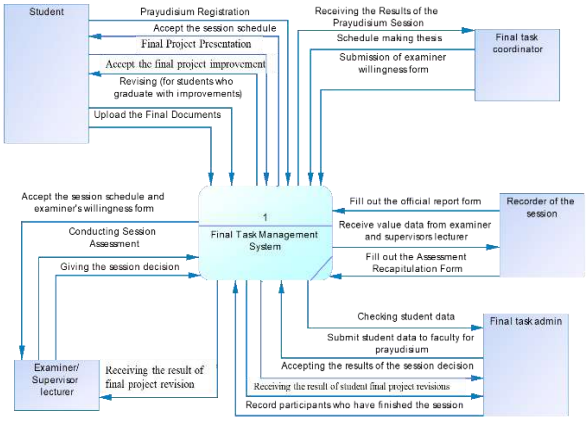

Fig. 3. Context diagram of final project management system

Table 2. User admin needs

Stakeholder	Input (s)	Role	Rule	Process	Output (s)
Admin	1. E-Mail 2. Password	Session Coordinator and Admin	Fill in the required information.	Login Account	Entering a Webpage.
	1. Lecturer Name 2. Email 3. Role User		Fill in the information according to the data	Account Creation	Lecturer accounts that can access
	1. Day/Date 2. Student ID 3. Student Name 4. Topic 5. Laboratory 6. Main Advisor/ Assistant 7. Examiner 8. Writer 9. Room		Fill in the required information according to the existing data.	Sharing the schedule of the participants	Student Data who will present the trial

http://dx.doi.org/10.30656/jsmi.v6i2.5088

Use case diagrams to determine what functions exist in a system and who has the right to use these functions [13]. Fig. 4 represents the Use-case diagram of the Final Project Management System.

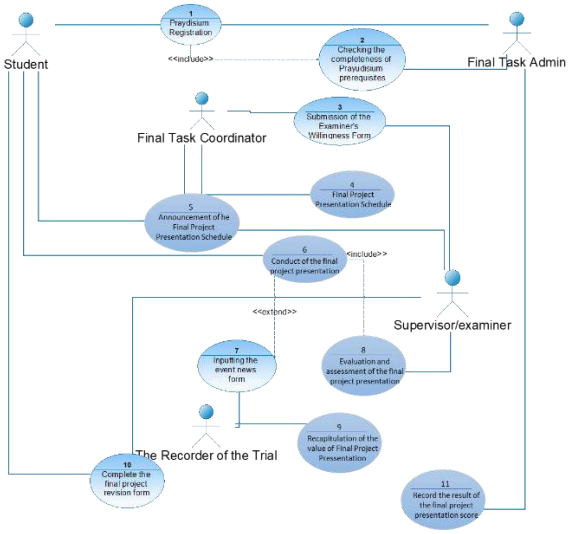

Fig. 4. Use case diagram of the final project management system

Use case diagrams aim to know what functions exist in a system and who has the right to use these functions. Use case diagrams have several components in their design. That is, there is an actor to describe someone who interacts with the system where the actor can only enter data information and receive information from the system but does not control the use case. Furthermore, there is an Association that serves to connect links between elements. Then there is a generalization, which is an element that is independent of other elements. Finally, a dependency is an element that depends on another element. The project management final by case diagram has five actors: Final Project trial participants, trial coordinator, supervisor/examiner lecturer, session admin, and note taker.

Sequence Diagram provides information about the interaction between two objects in two dimensions. Also, it describes a scenario carried out in response to an event that produces a specific output. The Sequence diagram of the final project management system has five actors: the Final Project defense participant, Final Project defense coordinator, Final Project defense admin, examiner/supervisor lecturers, and note-takers. Each actor will be connected using an Association according to the process that occurs for each actor. There are several sequences of processes in the system designed. They are the *prayudisium* registration process, checking the completeness of the *prayudisium* prerequisites, submitting examiners' readiness forms, making Final Project defense schedules, announcing the Final Project defense schedule, conducting the Final Project defense, inputting the official report form, evaluation, assessment of the Final Project defense, recapitulating Final Project defense scores, and data collection of participants who have conducted the Final Project defense. Fig. 5 is a *Prayudisium* Registration Sequence Diagram and Checking the Completeness of *Prayudisium* Prerequisites.

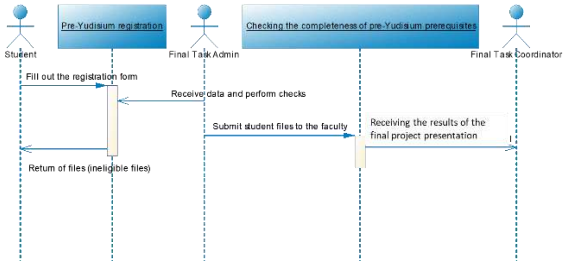

Fig. 5. *Prayudisium* registration sequence diagram and checking the completeness of *prayudisium* prerequisites

An activity diagram shows the activities carried out by each actor from beginning to end. The activity process can also have decisions or choices that actors in a related activity must determine. Activity diagrams include initial state, activity, branching, merging, and final state. Activity diagrams are made based on the sequence of processes in the sequence diagram. Fig. 6 is an activity diagram of the final project management system.

A database is a collection of related data arranged based on a particular structure [25]. Database design facilitates processing data from the existing system into a computerized system or website [18]. The database design in this research was created by making Class diagrams, Conceptual Data Models, and Physical Data Models. Class diagrams show systems in the form of static models, descriptions, attributes, and relationships between classes [26]. In designing the class diagram for the Final Project management information system at Trisakti University Industrial Engineering, there are 12 classes. Attribute Information has the symbol "-," which means that the attribute is private or private, and the symbol "+", which means that the attribute is public or

public. The data types contained in several attributes in the class diagram of the Final Project management system are "int" or integer data types which have a value in the form of numbers, and "VARCHAR", which has a value in the form of a collection of several characters and numbers. The class diagram that has been designed can be seen in Fig. 7.

The design of the Conceptual Data Model (CDM) is obtained from the results of the design on the previously designed class diagram. The primary key must be selected from each class [27]. The primary key is an attribute of an entity that is the most unique or only a specific actor owns. The conceptual data model that has been designed can be seen in Fig. 8.

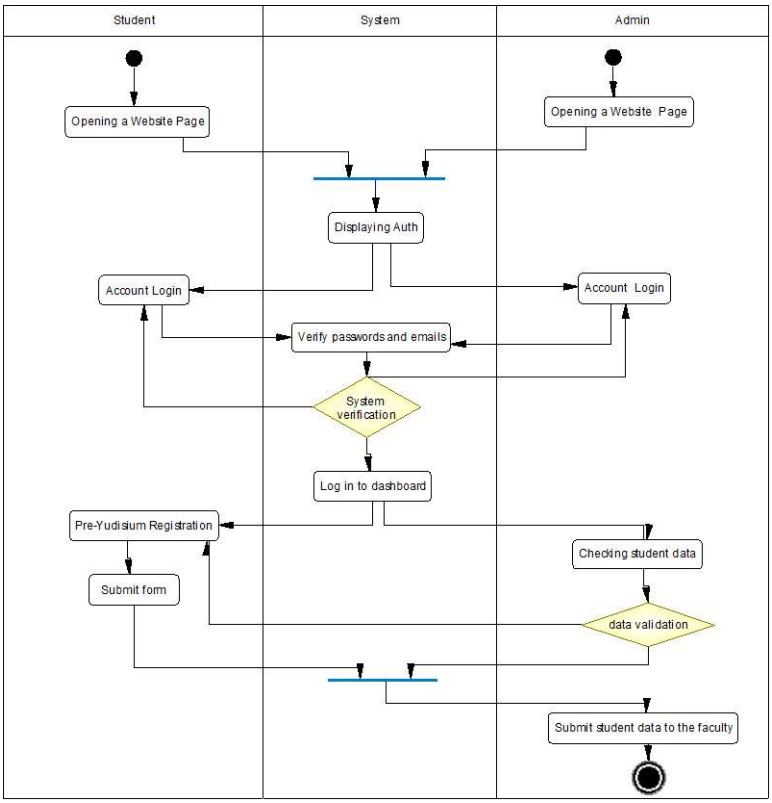

Fig. 6. Activity diagram of *prayudisium* registration

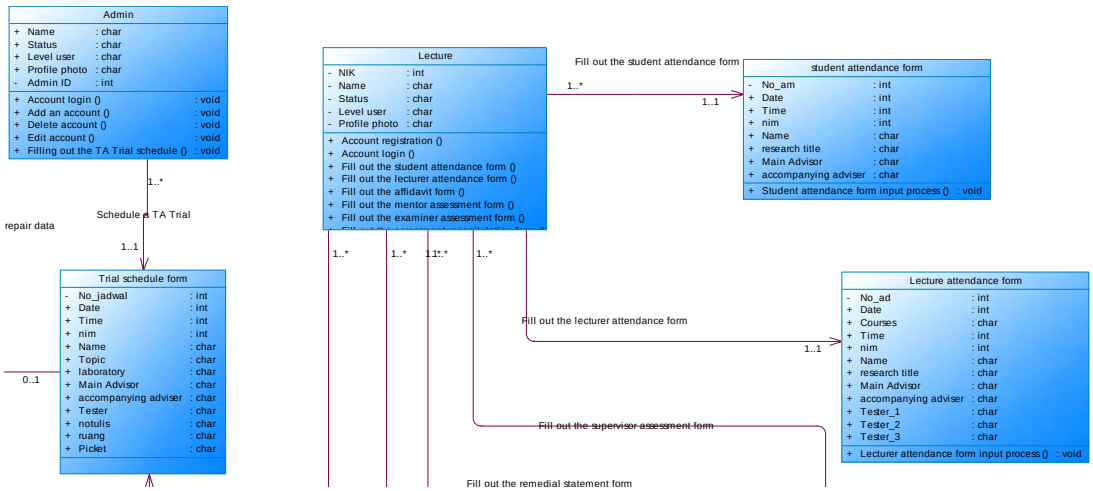

Fig. 7. Class diagram final project management system

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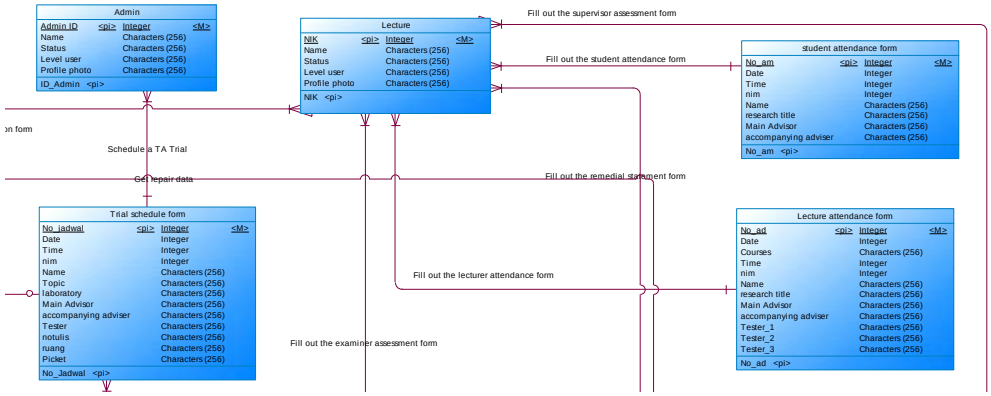

Fig. 8. Conceptual data model

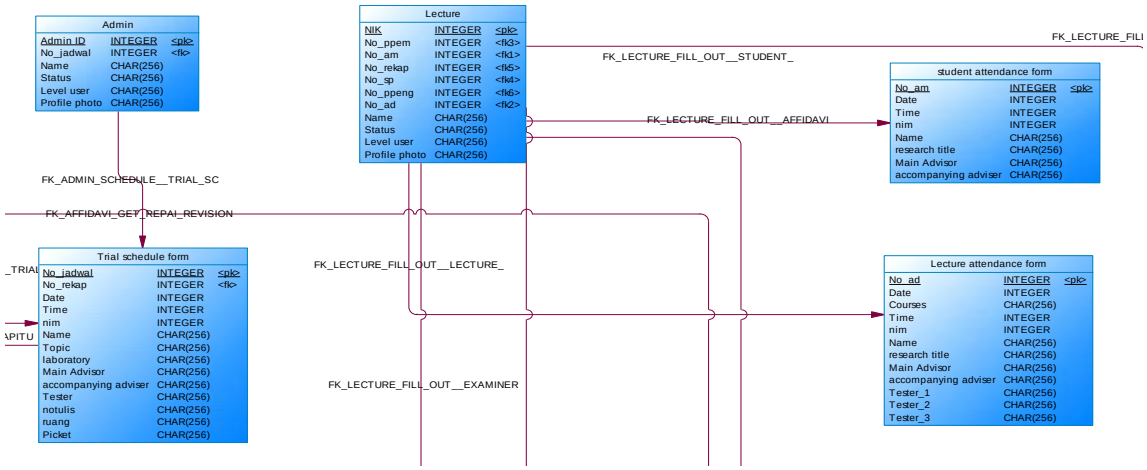

Fig. 9. Physical data model

Physical Data Model (PDM) is a model that tells the relationship of several structured tables, including primary keys and foreign keys. PDM is similar to CDM, except that there are no foreign keys in CDM. A foreign key is a primary key in a table that has a relationship with that table [28]. The primary key becomes an attribute that is exchanged for another entity. The Physical Data Model that has been designed can be seen in Fig. 9.

3.3. Website-based Final Project Management Design

Website-based applications run using the internet and a browser [29]. Web-based applications are now becoming increasingly popular because of the interface that can be adapted to the user's needs and can be a medium of user communication [30]. The data presented initially in Microsoft Access is converted into the MySql system. MySql is a relational database system allowing users to group information easily [27]. The degenerated data is then used to build the website the user interface and user experience.

User Interface (UI) describes how a user interacts with a computer system which consists of all hardware, software, screens, menus, functions, outputs, and features that affect two-way communication between the user and the computer [10]. The user interfaces are the key to usability, including user satisfaction, support for business functions, and system effectiveness [31]. It made the user interface using the Hyper Text Markup Language (HMTL) programming language. An HTML document is a pure text file usually used to create a web page or display on a website [30].

A good UI must be supported by a good User Experience (UX). User Experience is a process where users can interact with the interface in a good and comfortable manner. UX is the link between users and web pages. UX is designed to increase user satisfaction when accessing a display on a website [32]. UX design in the final project management system using PHP applications using

Codeigniter. PHP is a programming language that is commonly used to build UX. One of the advantages of PHP is that it can support the processing of various databases, including MySQL, PostgresSQL, Oracle, Sybase, and ODBC [33].

A good website design must pay attention to several important things: User Interfaces must be easy to learn and use by users, increase user productivity, provide flexibility, simplify user work, and have an attractive design and layout for users [34]. The website design must provide awareness of the psychology of its users so that users feel comfortable and helped in its use. The user psychology in question is also related to the choice of colours and symbols displayed on the website [35].

3.4. Implementation

The final project management system based on the Trisakti Industrial Engineering website that has been designed can be accessed at smt-trisakti.rf.gd/auth. In the Auth section of the Final Project management system website, the website display will show the tagline "Trisakti Final Project Management System"; a form box can be filled by entering an email and password. At the bottom of the form box are two types of buttons: login and register. If the user already has an account, then the user only needs to fill in the email and password obtained and press the login button to enter the dashboard (Fig. 10). Users who do not have an account can press the register button to enter the register and create an account.

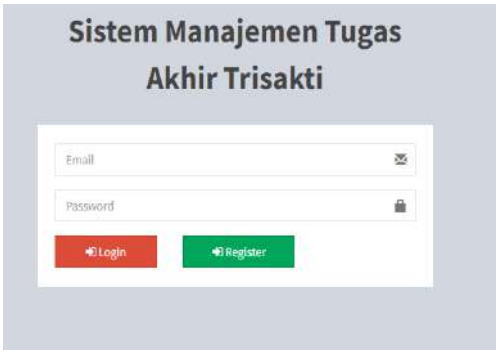

Fig. 10. Display authority login/register

In the user registration section of the Final Project management system website, several personal data must be filled in, namely full name, email, password, user level, status, and profile photo (Fig. 11). After the user fills in the personal data, the following process is carried out by pressing the add button then the account is successfully created. The initial display, as shown in Fig. 12, will be seen if the user has successfully logged in through the Auth login. On the left sidebar of the website, there are several options based on the existing roles: student, lecturer, and admin. Besides that, there is also access management which the admin can only open to grant or manage access to each role. Access rights for each role are adjusted to the database design that has been done previously.

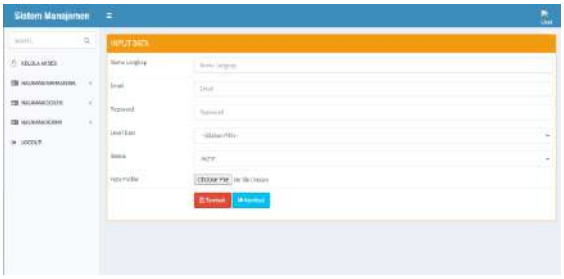

Fig. 11. User registration form display

Fig. 12. Final project management system website main menu

Fig. 13. Admin database submenu display

Each Role has different access rights. The admin role has complete access, especially for database management and access rights management for the admin and student roles. The role database can be seen in Fig. 13. The lecturer can access menus related to the course of the Final Project defense, such as filling out absences, assessing the guidance process, and evaluating the results of the Final Project defense. An example of

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access to the lecturer role when filling out the examiner's assessment form is shown in Fig. 14. Meanwhile, the student role has access rights to register for the Final Project defense, view the trial schedule, and upload Final Project defense materials and revisions. An example of student access rights when registering for a trial is in Fig. 15.

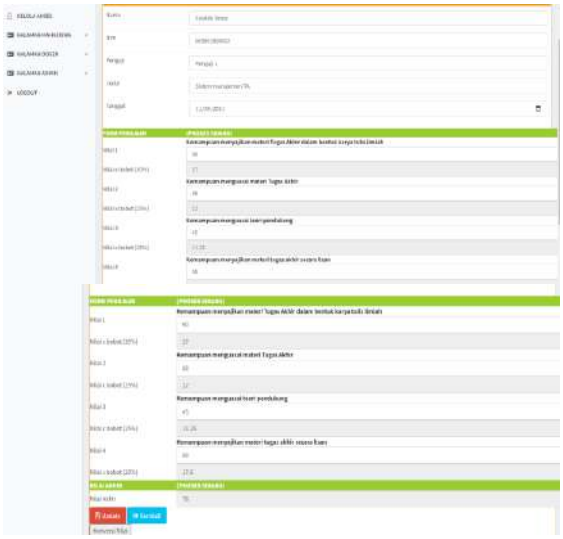

Fig. 14. Display of the button for the edit form of the examiner's assessment

Figure 15. Final project defense registration submenu display

3.5. Testing and Evaluation

System testing in this study uses the black box testing method, namely observing the execution results and checking the software's functionality [34]. The advantage of black box testing compared to white box testing is that it can quickly test the entire software function and find defects [36]. The test was carried out by taking ten respondents consisting of students. They were asked to fill out a questionnaire in a google-form, containing questions about the process scenario on the website. The test results conclude that the system has accepted the website.

Next, the system test analysis uses the Eliminate, Reduce, Raise, and Create (ERRC) table. The ERRC table determines what factors need to be eliminated, reduced, improved, and created in the final project management system of Trisakti University Industrial Engineering [37]. Based on the website designed for the final project management system, some activities can be eliminated, reduced, raised, and created. Activities that can be eliminated are the38 risk of damage or loss of files because the system is designed to be able to save data automatically into a database. The activity that can be reduced is the error in data collection because the data collection is not done manually but is automatically stored in the user interface and uses an automated formula according to the weight given. The next activity that can be reduced is purchasing paper and physical storage. Using a database in the control panel can reduce costs because it is cheaper. Activities that can be improved are the length of time in searching the form and the time it takes to process the input form. Using an integrated user interface means users do not need to search for separate old files because forms and modules have been provided systematically based on existing roles. The activities that can be made are the completed form can be directly downloaded in the form of the output in pdf form, making it easier for users to carry out their operations.

4. CONCLUSION

This research produces a website-based final project management system for the Department of Industrial Engineering at Trisakti University. Creating this website begins with analyzing the system using the swimlane diagram and PIECES methods. The following process is system design with context diagrams, use case diagrams, sequence diagrams, and activity diagrams. After that, database design and website design has done. The final project management website design is then validated using black box testing. The result of black box testing is the acceptance of the website design. The evaluation results using ERRC also show that the existence of a website can help the final project management system run more effectively and efficiently.

For further research, this system can be developed by integrating the final project management system with the academic system. A website-based system will facilitate access anywhere and anytime and reduce maintenance costs.

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by Elfira Febriani Harahap

Submission date: 11-Apr-2023 02:56PM (UTC+0700)
Submission ID: 2061392652
File name: system_design_at_Trisakti_university_industrial_engineering.pdf (1.37M)
Word count: 7593
Character count: 42519

Jurnal Sistem dan Manajemen Industri Vol 6 No 2 December 2022, 121-134

Available online at: http://e-jurnal.lppmunsera.org/index.php/JSMI

Jurnal Sistem dan Manajemen Industri

ISSN (Print) 2580-2887 ISSN (Online) 2580-2895

Website-based final project management system design at Trisakti university industrial engineering

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ARTICLE INFORMATION

Article history:

Received: July 22, 2022
Revised: November 17, 2022
Accepted: November 24, 2022

Keywords:

System information management
Final project system management
Website-based system
Object oriented modelling

A B S T R A C T

Preparing the final project is one of the requirements for graduation from a college student. The right Final Project management system will affect the quality of education. Industrial Engineering Trisakti University is one of the leading universities in Indonesia that continues to develop its education system. Managing the final project at Trisakti University Industrial Engineering is still manual and has not been integrated. As a result, the risk of errors in entering and saving Final Project data is still high. Therefore, this research was conducted to design a final project management system at Trisakti University Industrial Engineering. It begins with analyzing the existing management system. It is described with swim lane diagrams and PIECES to determine the process flow in the system and the actors who play a role in the system. After analyzing the system, proceed with designing information systems with Object-Oriented Modeling and evaluate it with black box testing and ERRC. This research results in website-based final project management at Trisakti University Industrial Engineering.

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1. INTRODUCTION

Education is a necessary sector of a country because the quality of education will affect the future of a country [1]. Pandemic in Indonesia since 2020 has been one of the drivers of accelerating the development of information technology, including in the education sector. All educational activities must be online. The lecture process, which used to be held on campus, has now become online from home. Not only that, but the restrictions on people's movement imposed by the government at the beginning of the pandemic also caused management and administration activities to be flexible so that distance was no longer a barrier to all activities in the education sector.

Designing an information system to support academic activities at a university is one solution to accelerate development in the world of education [2]. Academics is one form of the service industry that, if managed using an information management system, can optimize performance systems [3]. The management system in the world of education is divided into various processes, one of which is the final project management system. The process of completing the final project is one of the important requirements for prospective undergraduates at the level

of higher education. This process is the final process in undergraduate-level lectures to declare whether a student is worthy or not getting a bachelor's degree [4].

In previous studies, many systems were developed using a website-based system, such as the health system, public services and academic systems [5], [6]. Nowadays, Trisakti University uses a website-based for its academic system, but the final task management process is still done manually.

The Department of Industrial Engineering, Trisakti University, is one of the universities in Indonesia accredited nationally and internationally and has an active role in improving the quality of education in Indonesia. However, currently, this department has problems with the management process of the Final Project. The process is still manual and not integrated. The data collection, assessment, and data storage for Final Project students are still manually done by using google forms and google drives that are filled out by lecturers and Final Project administrators so that the data did not integrate. It can be a high risk of data entry errors and loss of Final Project data. Therefore, we conducted this research to design a website-based Final Project management system.

This research uses an object-oriented system development approach and focuses on the final project management design at Trisakti University. Much previous research is related to it. The development of information management systems with UML, especially College student management, has been conducted by looking at the feasibility, requirements, functional and performance analysis [7]. The development of an information system for school payments has been done, and the black box evaluation method serves as a software assessment [8]. The UML method is also used to analyze and design colleges' and universities' scientific research management systems [9].

Developing a system can be explained into several phases: Analysis, design, implementation, and maintenance. The system analysis stage is the stage of studying all the processes that occur in the running system. The purpose of this process is to describe the system that is running so that later it can be known the system requirements for development at the system design stage [10]. We analyzed the final project management information system using Swimlane and PIECES (Performance, Information, Economy, Control, Efficiency, and Service) diagrams (source). Swimlane diagrams are considered a tool that can validate business rules and procedures according to stakeholders effectively and efficiently [11]. PIECES analyses system deficiencies from 6 aspects: Performance, Information, Economy, Control, Efficiency, and Service. Analysis of deficiencies in the system with PIECES became the object of system improvements [12].

After the system analysis, the following process is the design of the final project management system. It begins with making information system diagrams in context diagrams, case diagrams, and sequence diagrams. A context diagram uses to identify the system's actors and the information exchange that occurs in the system [13]. Use case diagram represents actors' interaction and role in the system [14]. At the same time, the sequence diagram is used to describe the architecture of the programming code [15]. The next step is making activity diagrams and database design. Activity diagrams help describe behaviour or interactions between multiple use cases [16]. The data management program stands alone in a commercial program package to read, fill in, delete, and report data in the database [17]. Database design is to determine data requirements for the system and its parameters [18], [19]. Then the web design process, the website is designed as a framework using Codeigniter, designed the user interface for users, and the user experience for the user experience in using the website.

2. RESEARCH METHODS

The research process begins with collecting data on the management of the Final Project. The data used comes from primary data and secondary data. They collected primary data by interviewing the Final Project coordinator. At the same time, they used secondary data in the form of trial participant data, the Final Project registration form, the Final Project assessment form, the Final Project assessment recapitulation form, and the actual Final Project process flowchart.

The data that has been collected is used as material to analyze the actual system requirements and design a final project management system. Analyzing the system is essential in the system management design process. The system analysis process will produce detailed system requirements to drive more effectively and efficiently [20]. That process uses Swimlane and PIECES (Performance, Information, Economy, Control,

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Efficiency, and Service). Furthermore, the system design analyzes user needs through object-oriented diagrams in context diagrams, use-case diagrams, sequence diagrams, and activity diagrams. After successfully analyzing the system requirements, the next step is to design the database.

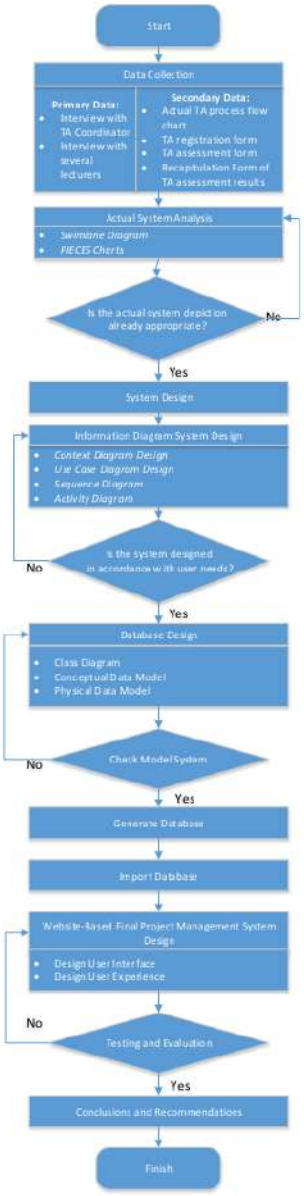

Fig. 1. Research methodology flowchart

The stages in designing the database are to create class diagrams, conceptual data models, and physical data models. After designing the database, the following process is to generate the database and import the database. The programming language used is PHP, MySQL is the database while building PHP applications using Codeigniter. The next step is to build a website-based final project management system with three stages: designing the system, user interface, and user experiences. After the website has been created, the validation steps used black box testing. The final step is to conclude and provide recommendations for the system (Fig. 1).

3. RESULTS AND DISCUSSION

3.1. Actual System Analysis

Utilizing information technology through current information systems can improve the quality and speed of information produced, increase integration in information and operations among local and global organizational stake-holders, and reduce various potential risks [21]. The final project Management System in the Department of Industrial Engineering at Trisakti University, is currently still done manually and has not been integrated. Filling in the final project documents is still done manually on paper or using google forms. The data storage is still using Google Drive. The manual and not integrated data results in problems that are difficult to find or lose. That problem is necessary to develop a final project management system by utilizing website-based information technology that lecturers and students can access.

The Final Project Management System in the industrial engineering department of Trisakti University starts from the *Prayudisium* registration stage carried out by students as prospective Final Project defence participants. At this stage, students will fill out a form provided by the faculty and distributed by the department. After being filled in, the Department's Final Project admin sends the form to be checked by the faculty admin. After checking by the faculty, the data is returned to the department admin. Students who pass the faculty check stage will proceed to the *Prayudisium* stage.

At the *Prayudisium* stage, the participant's file will be re-checked for completeness by the department, and if the file does not meet the requirements, the file will be returned to the student and asked to complete the unmet requirements. Students whose documents are

complete will advance to the *prayudisium* stage.

The *prayudisium* schedule is made by the Final Project defence coordinator based on the completion of the session readiness form by the supervisor and examiner. The recorder will input the attendance list on the official report form during the Final Project defence. In this Final Project defense process, the examiners and final project supervisors will evaluate and assess the Final Project defense participants. The eligibility of Final Project defense participants to pass will be determined based on the results of discussions conducted by the examiner and the final project supervisor.

The final Project defence assessment results are recorded by the note-taker and reported to the department admin. The content of the assessment of the Final Project defense results includes decisions regarding eligibility to pass, with or without improvement, or not pass. If it is declared that it has passed with improvement, the Final Project defense participant must make repairs to the final project no later than seven working days after the Final Project defense. If this is not done, it will cause the grades not to come out, and they will delay graduation. In addition, if until the next *Prayudisium* period, the student cannot complete the final project revision, then the final assignment session's results are declared void, and the student is obliged to repeat the entire *Prayudisium* process and Final Project trial in the following period. The Final Project management system ends when the admin registers students who have completed the Final Project defense. The final project management process is depicted using a swim lane in Fig. 2.

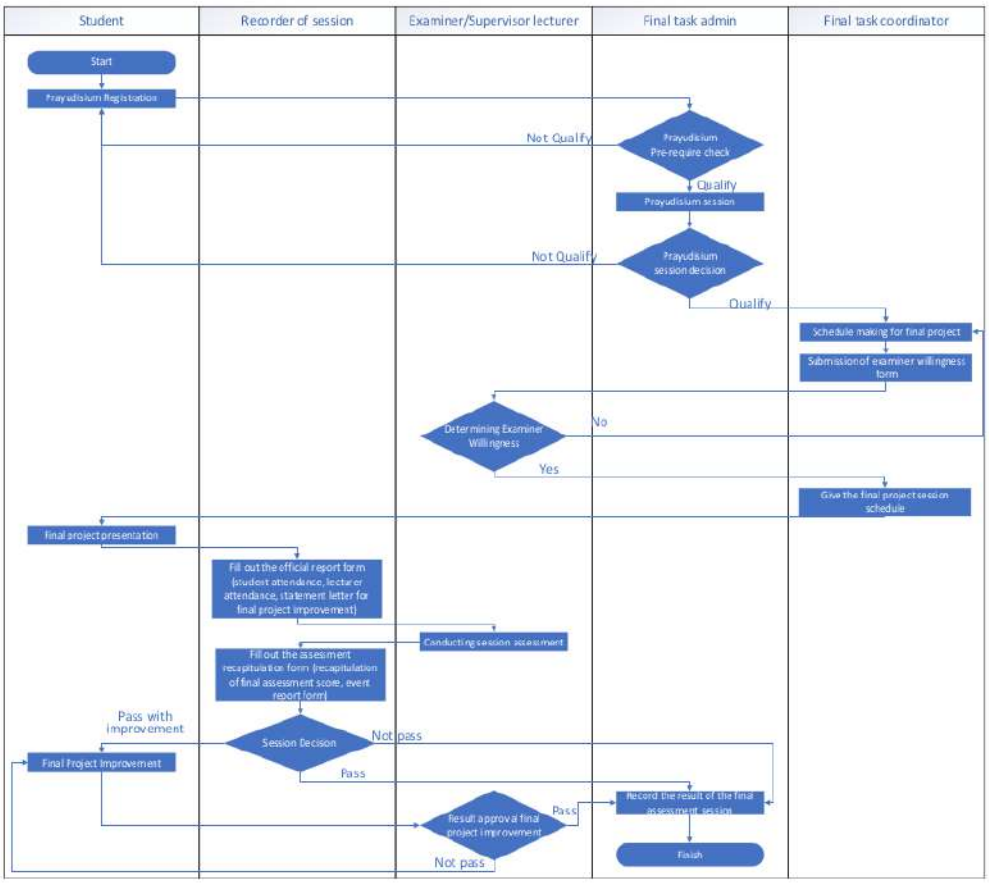

Fig.2. Swimlane final project management process diagram

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Table 1. PIECES diagram for final project management

System Name: Final Project Management		**System Analyst:** Ewaldo Brata	
Made by: Ewaldo Brata		**Created date:** 21 November 2021	
No	**PIECES Aspect**	**Current System**	**Proposal System**
1	System Performance	The performance of the initial Final Project management system is not optimal because it is still manually and not integrated. It increases the opportunity for data errors and the processing time is longer.	The performance of the proposed Final Project Management System that utilizes a website-based program can integrate data to reduce the chance of errors and faster processing time.
2	Information/Data generated	The presentation of information in the initial system uses a form that did not integrate, so the data or information provided is still incomplete and unsystematic.	Presentation of information using a form integrated into the dashboard with multiple user access according to functional requirements so that the information or data provided will be more systematic.
3	Economic Value/ Benefit	It costs a lot of money to use paper for Final Project administration forms and often leaves unused paper.	Using user interfaces and data storage using a MySQL database can increase the economic value because the costs are cheaper according to their needs.
4	System control/ security	There is the possibility of human error and data loss in entering the data because the system is processed manually.	Using integrated databases and forms will reduce the possibility of human errors and lost documents or files to increase the control value of the previous system.
5	System Efficiency	Using unsystematic and integrated administration forms makes the system inefficient because running the process takes a long time.	Using an integrated Final Project management website, where an integrated system provides all forms, can improve system efficiency by saving time in the Final Project administration process.
6	Service	The actual service process in the Final Project management system is not good enough for stakeholders because they do not use an integrated Final Project administration form. Hence, it requires effort to find a specific form for the process.	Integrating Final Project administration forms in a user interface makes it easier for stakeholders to search for the fit forms.

A swim lane diagram is made to determine the role of stakeholders at each stage in the system [11]. The design of this final project management system is line with object-oriented diagrams so that a PIECES (Performance, Information, Economy, Control, Efficiency, and Service) diagram is made at the analysis stage [22]. The purpose of making a PIECES diagram is to discover the system's shortcomings, which will later be developed in system design [10]. Table 1 is the PISCES diagram of the Final Project management system. The analysis results using PISCES diagrams are input to determine the needs of users or actors in the system. Table 2 is the user admin need for the system.

After making a PIECES diagram, the next step is to analyze user needs. Analysis of user requirements aims to determine the needs of each user directly related to the system. The industrial engineering department's Final Project

management system website has three user levels: admin (Final Task admin and Final task Coordinator), lecturers (recorder of session and examiner), and students. The admin user consists of the Final Project admin stakeholders and the Final Project Coordinator. The admin user acts as a manager and grantor of access to new users and creates a database for trial participants and lecturers who will be involved. The second user is a lecturer consisting of stakeholder supervisors, examiners and note-takers. Lecturer access includes trial assessment for supervisors, assessment of the guidance process, assessment of the trial as examiners, and recapitulation of assessments. The third user is a student as a trial participant who will register for the Final Project trial. Each user has different inputs, roles, rules, processes, and outputs according to their needs. Analysis of user needs for the final project management system in the Industrial Engineering department of Trisakti University is presented in Table 2.

3.2. System Design

System design can be interpreted as drawing, planning, and making ideas to organize several elements in the system so that they become a unified whole and valuable [23]. In designing an Object-Oriented Analysis Diagram (OOAD), it describes a system with a collection of several objects and the behaviour or relationships between them [15]. Unified Modeling Language (UML) is a standard for designing models of OOAD into software [13]. UML forms can be context diagrams, case diagrams, sequence diagrams, and activity diagrams [24].

A context diagram based on object describes the flow of the final project management system process in a diagram. In the context diagram of the final project management system, there are five entities or actors: college students, session coordinators, Final Project defense admins, note-taker, and examiners. The process begins with the registration of the *Prayudisium* by college students, and the last process is the recapitulation of the results of the Final Project defense. Images of actors and process flow in the context diagram of the final project management system design can be seen in Fig. 3.

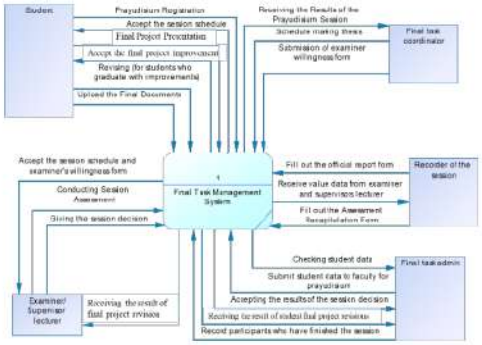

Fig. 3. Context diagram of final project management system

Table 2. User admin needs

Stakeholder	Input (s)	Role	Rule	Process	Output (s)
Admin	1. E-Mail 2. Password	Session Coordinator and Admin	Fill in the required information.	Login Account	Entering a Webpage.
	1. Lecturer Name 2. Email 3. Role User		Fill in the information according to the data	Account Creation	Lecturer accounts that can access
	1. Day/Date 2. Student ID 3. Student Name 4. Topic 5. Laboratory 6. Main Advisor/ Assistant 7. Examiner 8. Writer 9. Room		Fill in the required information according to the existing data.	Sharing the schedule of the participants	Student Data who will present the trial

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Use case diagrams to determine what functions exist in a system and who has the right to use these functions [13]. Fig. 4 represents the Use-case diagram of the Final Project Management System.

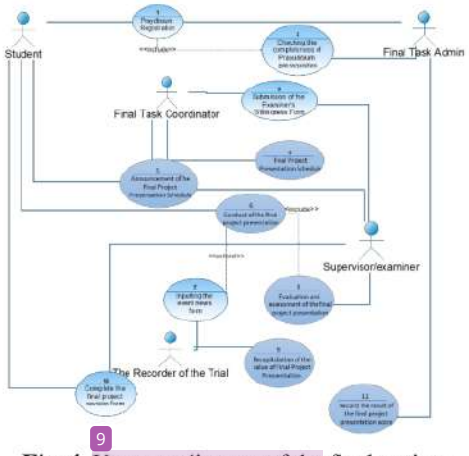

Fig. 4. Use case diagram of the final project management system

Use case diagrams aim to know what functions exist in a system and who has the right to use these functions. Use case diagrams have several components in their design. That is, there is an actor to describe someone who interacts with the system where the actor can only enter data information and receive information from the system but does not control the use case. Furthermore, there is an Association that serves to connect links between elements. Then there is a generalization, which is an element that is independent of other elements. Finally, a dependency is an element that depends on another element. The project management final by case diagram has five actors: Final Project trial participants, trial coordinator, supervisor/examiner lecturer, session admin, and note taker.

Sequence Diagram provides information about the interaction between two objects in two dimensions. Also, it describes a scenario carried out in response to an event that produces a specific output. The Sequence diagram of the final project management system has five actors: the Final Project defense participant, Final Project defense coordinator, Final Project defense admin, examiner/supervisor lecturers, and note-takers. Each actor will be connected using an Association according to the process that occurs for each actor. There are several sequences of processes in the system designed. They are the *prayudisium* registration process, checking the completeness of the *prayudisium* prerequisites, submitting examiners' readiness forms, making Final Project defense schedules, announcing the Final Project defense schedule, conducting the Final Project defense, inputting the official report form, evaluation, assessment of the Final Project defense, recapitulating Final Project defense scores, and data collection of participants who have conducted the Final Project defense. Fig. 5 is a *Prayudisium* Registration Sequence Diagram and Checking the Completeness of *Prayudisium* Prerequisites.

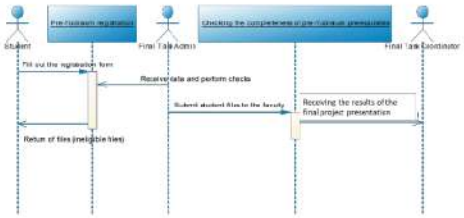

Fig. 5. *Prayudisium* registration sequence diagram and checking the completeness of *prayudisium* prerequisites

An activity diagram shows the activities carried out by each actor from beginning to end. The activity process can also have decisions or choices that actors in a related activity must determine. Activity diagrams include initial state, activity, branching, merging, and final state. Activity diagrams are made based on the sequence of processes in the sequence diagram. Fig. 6 is an activity diagram of the final project management system.

A database is a collection of related data arranged based on a particular structure [25]. Database design facilitates processing data from the existing system into a computerized system or website [18]. The database design in this research was created by making Class diagrams, Conceptual Data Models, and Physical Data Models. Class diagrams show systems in the form of static models, descriptions, attributes, and relationships between classes [26]. In designing the class diagram for the Final Project management information system at Trisakti University Industrial Engineering, there are 12 classes. Attribute Information has the symbol "-," which means that the attribute is private or private, and the symbol "+", which means that the attribute is public or

public. The data types contained in several attributes in the class diagram of the Final Project management system are "int" or integer data types which have a value in the form of numbers, and "VARCHAR", which has a value in the form of a collection of several characters and numbers. The class diagram that has been designed can be seen in Fig. 7.

The design of the Conceptual Data Model (CDM) is obtained from the results of the design on the previously designed class diagram. The primary key must be selected from each class [27]. The primary key is an attribute of an entity that is the most unique or only a specific actor owns. The conceptual data model that has been designed can be seen in Fig. 8.

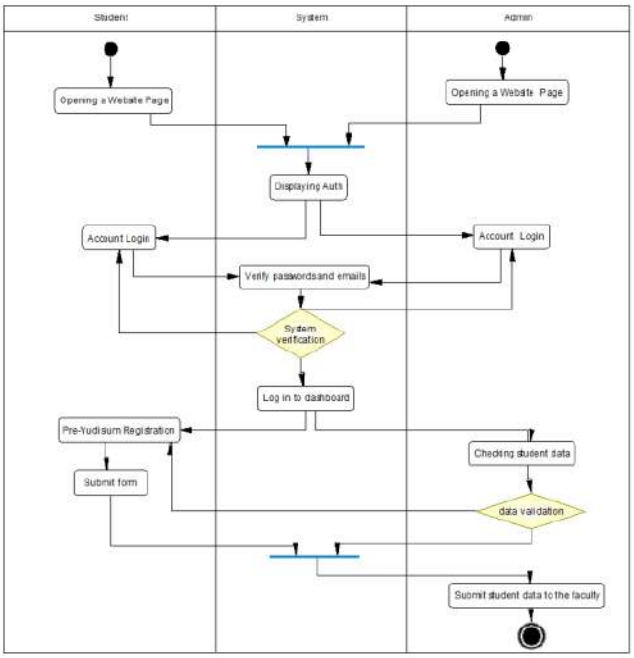

Fig. 6. Activity diagram of *prayudisium* registration

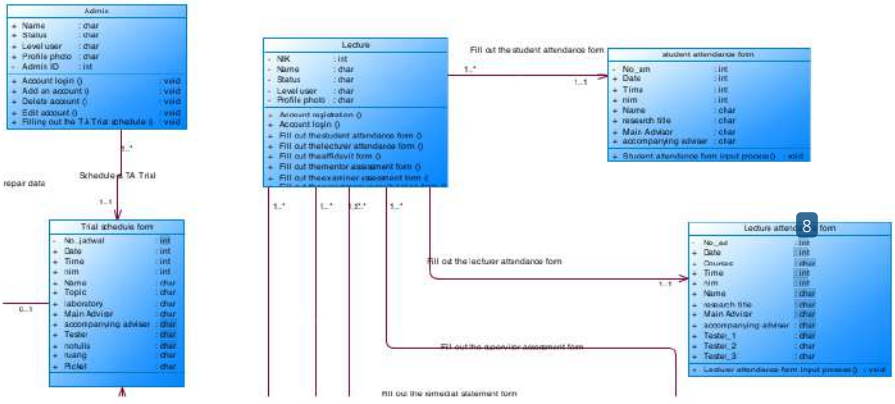

Fig. 7. Class diagram final project management system

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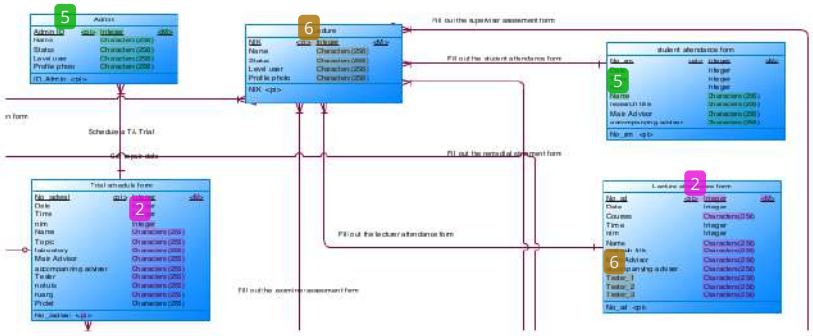

Fig. 8. Conceptual data model

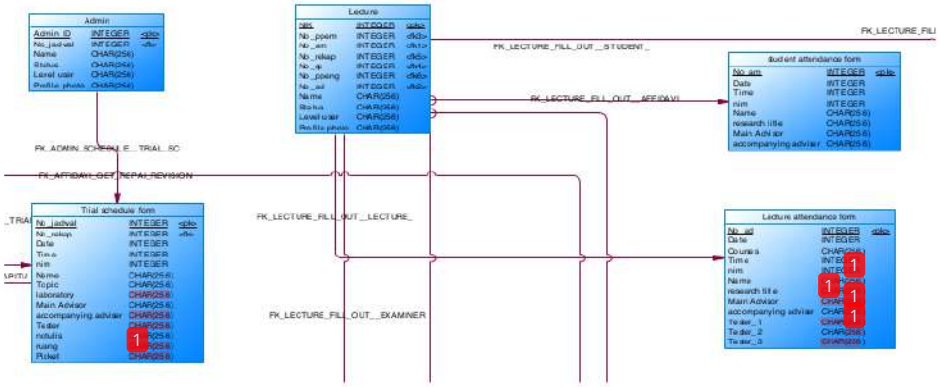

Fig. 9. Physical data model

Physical Data Model (PDM) is a model that tells the relationship of several structured tables, including primary keys and foreign keys. PDM is similar to CDM, except that there are no foreign keys in CDM. A foreign key is a primary key in a table that has a relationship with that table [28]. The primary key becomes an attribute that is exchanged for another entity. The Physical Data Model that has been designed can be seen in Fig. 9.

3.3. Website-based Final Project Management Design

Website-based applications run using the internet and a browser [29]. Web-based applications are now becoming increasingly popular because of the interface that can be adapted to the user's needs and can be a medium of user communication [30]. The data presented initially in Microsoft Access is converted into the MySql system. MySql is a relational database system allowing users to group information easily [27]. The degenerated data is then used to build the website the user interface and user experience.

User Interface (UI) describes how a user interacts with a computer system which consists of all hardware, software, screens, menus, functions, outputs, and features that affect two-way communication between the user and the computer [10]. The user interfaces are the key to usability, including user satisfaction, support for business functions, and system effectiveness [31]. It made the user interface using the Hyper Text Markup Language (HMTL) programming language. An HTML document is a pure text file usually used to create a web page or display on a website [30].

A good UI must be supported by a good User Experience (UX). User Experience is a process where users can interact with the interface in a good and comfortable manner. UX is the link between users and web pages. UX is designed to increase user satisfaction when accessing a display on a website [32]. UX design in the final project management system using PHP applications using

Codeigniter. PHP is a programming language that is commonly used to build UX. One of the advantages of PHP is that it can support the processing of various databases, including MySQL, PostgresSQL, Oracle, Sybase, and ODBC [33].

A good website design must pay attention to several important things: User Interfaces must be easy to learn and use by users, increase user productivity, provide flexibility, simplify user work, and have an attractive design and layout for users [34]. The website design must provide awareness of the psychology of its users so that users feel comfortable and helped in its use. The user psychology in question is also related to the choice of colours and symbols displayed on the website [35].

3.4. Implementation

The final project management system based on the Trisakti Industrial Engineering website that has been designed can be accessed at smt-trisakti.rf.gd/auth. In the Auth section of the Final Project management system website, the website display will show the tagline "Trisakti Final Project Management System"; a form box can be filled by entering an email and password. At the bottom of the form box are two types of buttons: login and register. If the user already has an account, then the user only needs to fill in the email and password obtained and press the login button to enter the dashboard (Fig. 10). Users who do not have an account can press the register button to enter the register and create an account.

Fig. 10. Display authority login/register

In the user registration section of the Final Project management system website, several personal data must be filled in, namely full name, email, password, user level, status, and profile photo (Fig. 11). After the user fills in the personal data, the following process is carried out by pressing the add button then the account is successfully created. The initial display, as shown in Fig. 12, will be seen if the user has successfully logged in through the Auth login. On the left sidebar of the website, there are several options based on the existing roles: student, lecturer, and admin. Besides that, there is also access management which the admin can only open to grant or manage access to each role. Access rights for each role are adjusted to the database design that has been done previously.

Fig. 11. User registration form display

Fig. 12. Final project management system website main menu

Fig. 13. Admin database submenu display

Each Role has different access rights. The admin role has complete access, especially for database management and access rights management for the admin and student roles. The role database can be seen in Fig. 13. The lecturer can access menus related to the course of the Final Project defense, such as filling out absences, assessing the guidance process, and evaluating the results of the Final Project defense. An example of

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access to the lecturer role when filling out the examiner's assessment form is shown in Fig. 14. Meanwhile, the student role has access rights to register for the Final Project defense, view the trial schedule, and upload Final Project defense materials and revisions. An example of student access rights when registering for a trial is in Fig. 15.

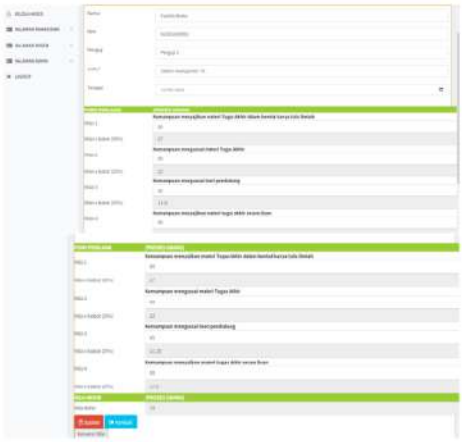

Fig. 14. Display of the button for the edit form of the examiner's assessment

Figure 15. Final project defense registration submenu display

3.5. Testing and Evaluation

System testing in this study uses the black box testing method, namely observing the execution results and checking the software's functionality [34]. The advantage of black box testing compared to white box testing is that it can quickly test the entire software function and find defects [36]. The test was carried out by taking ten respondents consisting of students. They were asked to fill out a questionnaire in a google-form, containing questions about the process scenario on the website. The test results conclude that the system has accepted the website.

Next, the system test analysis uses the Eliminate, Reduce, Raise, and Create (ERRC) table. The ERRC table determines what factors need to be eliminated, reduced, improved, and created in the final project management system of Trisakti University Industrial Engineering [37]. Based on the website designed for the final project management system, some activities can be eliminated, reduced, raised, and created. Activities that can be eliminated are the38 risk of damage or loss of files because the system is designed to be able to save data automatically into a database. The activity that can be reduced is the error in data collection because the data collection is not done manually but is automatically stored in the user interface and uses an automated formula according to the weight given. The next activity that can be reduced is purchasing paper and physical storage. Using a database in the control panel can reduce costs because it is cheaper. Activities that can be improved are the length of time in searching the form and the time it takes to process the input form. Using an integrated user interface means users do not need to search for separate old files because forms and modules have been provided systematically based on existing roles. The activities that can be made are the completed form can be directly downloaded in the form of the output in pdf form, making it easier for users to carry out their operations.

4. CONCLUSION

This research produces a website-based final project management system for the Department of Industrial Engineering at Trisakti University. Creating this website begins with analyzing the system using the swimlane diagram and PIECES methods. The following process is system design with context diagrams, use case diagrams, sequence diagrams, and activity diagrams. After that, database design and website design has done. The final project management website design is then validated using black box testing. The result of black box testing is the acceptance of the website design. The evaluation results using ERRC also show that the existence of a website can help the final project management system run more effectively and efficiently.

For further research, this system can be developed by integrating the final project management system with the academic system. A website-based system will facilitate access anywhere and anytime and reduce maintenance costs.

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