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Development of a Web-based SIMLP2M UNM Application

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Abstract. This research was conducted to develop a web-based information system application related to research and community service within the scope of UNM . In developing this application, the ISO 9126 model is used to test the reliability ofthe application . This application is developed and validated by experts and users . From the results of this development, it was obtained that the SIM LP2M UNM application received a Good (B) rating by experts with a percentage of 84.9 % , and also got a Good rating (B) by respondents with a percentage of 79.5 %.

Keywords: Information systems; web; research; devotion.

INTRODUCTION

Research and community service are important things to do in order to develop and apply knowledge that can benefit human life [1] . Within the scope of the Makassar State University (UNM) , research and community service activities are managed by an institution called the Institute for Research and Community Service (LP2M). LP2M UNM is tasked with managing the process of submitting research and service proposals proposed by research lecturers, the process of uproval reviewers, reporting of research results, and so on. However , all these processes are still being carried out manually (non-digitally), so the implementation takes quite a long time.

On the other hand, the development of technology in the era of the industrial revolution 4.0 is currently very fast, one of which is information system technology . The use of information system technology has been widely applied both at the corporate, institutional and university level. Information systems can be used for management and monitoring of activities, such as research and community service activities and others. The use of this technology can provide advantages in terms of time efficiency, cost, storage and more effective data provider , and several other benefits [2] .

From the above description, it takes a man stem web-based information that can be used by LP2M UNM manage research activities and community service.

Information Systems

Information systems can be interpreted as a system in an organization which is a combination of people, facilities, technology, media, procedures and controls aimed at getting important communication lines, processing certain types of routine

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transactions, giving signals to management and others. to internal and external events that are important and provide an information base for decision making [3] . The information system has six components or also called building blocks (*Building Blocks*), such as [4]:

1. Input component
2. Model components
3. Output component or output component
4. Technological components
5. Database components
6. Component control or control components .

The input component is part of the system that acts as a path for data entry into the information system, while the Model component is a combination of procedures, logic, and mathematical models that will manipulate input data and data stored in the database with predefined rules to produce output that is desired. Then the output component is part of the system that displays the information needed by the user. Furthermore, the technology component is a tool box in an information system that is used to receive input, run models, store and access data, generate and send output and help control the overall system. A database component is a collection of data stored on a device that can be manipulated as needed. While the control components are used to regulate the flow and overcome disturbances to the system.

Web Applcation

Web-based application is an application that can be accessed using a web browser via the internet network [5] . The advantages of web-based applications include :

- Does not require high specifications to perform and use web applications.
- Can be run anywhere and anytime without having to install.
- Can be used on various types of operating systems
- Can be accessed through many media such as computers, laptop, and smartphones.

ISO 9126 Model

One assessment of quality of software based on the model of ISO 9126 which was designed by the International Organization for Standardization (ISO) and the International Electro technical Commission (IEC) . *ISO / IEC 9126* aims to overcome some of the biased perceptions of a software development project. This bias includes changing priorities after project commencement, or not having a clear definition of understanding the software development project objectives [6] . ISO 9126 defines the quality factor in the following six quality characteristics [7] :

1. Functionality. This is related to the software's ability to perform functions according to user needs when used under certain conditions.
2. Reliability. Related to the ability of the software to maintain certain performance when used.

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3. Usability. Regarding ease of use by the user.
4. Efficiency. Regarding the ability of the software to provide appropriate performance and relative to the number of resources used when the device is running.
5. Maintainability. Regarding the ease with which the software can be adjusted or changed.
6. Portability. Regarding the ability of the software to run in different environments .

RESEARCH METHODS

The research and development stage of the system can be seen in Figure 1 below.

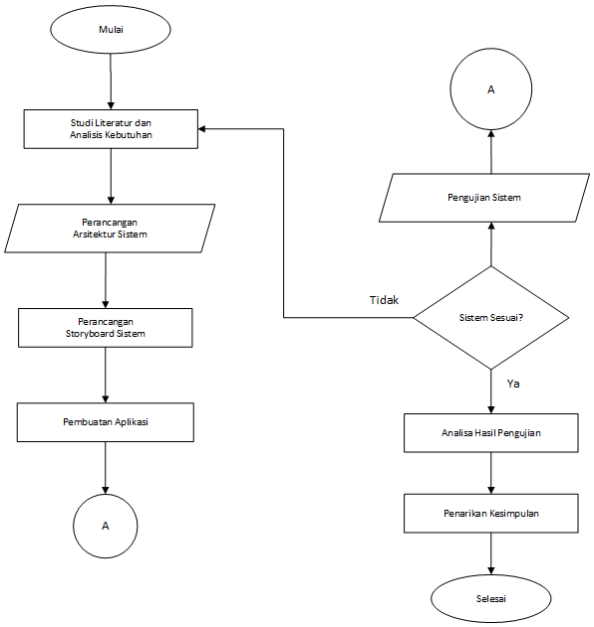

Figure 1. Research Flowchart.

As seen in the research flow chart above, the flow of the system research and development stages consists of literature study and needs analysis, system architecture design, story board design, application development, system testing, and checking on system test results. If the system has been developed according to the needs, the system has been completed, but if not, it will return to the initial process, namely literature study, then continue to the next stage until the system is successfully created.

In the early stages of design, the first thing to do is design the system architecture. The results of the system architecture design on the *SIM LP2M UNM* application are as follows.

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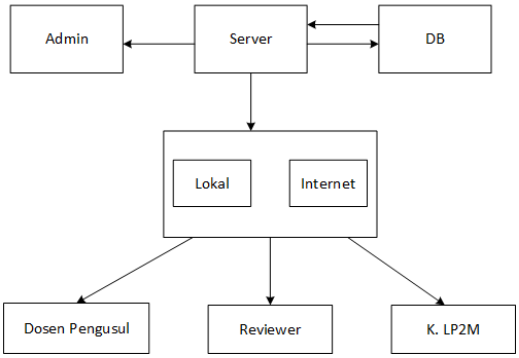

Figure 2. System Architecture

This system is designed with four user levels, namely admin, lecturer proposer, reviewer and head of LP2M. In the system architecture, it can be seen that users are divided into two groups, namely operational and non-operational groups. The operational group is the admin who is in charge of managing the database on the server, while the non-operational group consists of lecturers who propose, reviewers and the head of LP2M who only act as system users.

Specifically, the relationship between users is presented in **Figure 3** below.

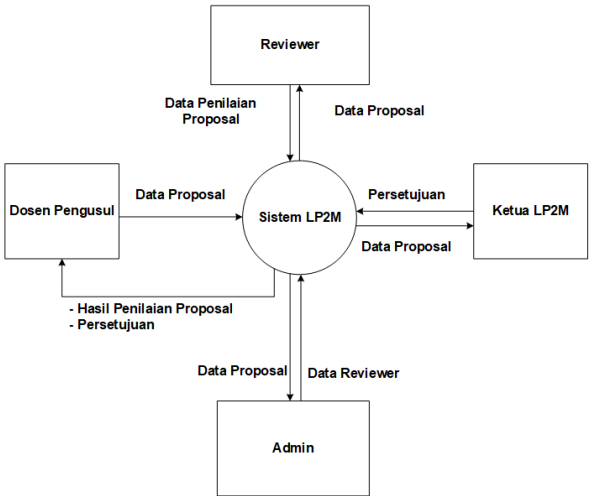

Figure 3. *Unified Modeling Language (UML)* System

In the UML system above, the lecturer who proposes to input the proposal data that wants to be submitted then the system will display the data to the admin, reviewer and chairman of LP2M. Before the data reaches the reviewer, the admin adds the reviewer data which will then be linked to the previously inputted proposal data to be assigned to each reviewer. Furthermore, the reviewer will provide an assessment related to the proposal submitted by the lecturer proposing, and then the results of the assessment will be returned to the proposing lecturer. In addition, the head of the LP2M will determine the proposal to be approved, which will then be returned to the proposing lecturer. UML is a series of block diagrams that are widely used to perform abstraction or depiction of an object-oriented system or software

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[8]. UML consists of several graphic elements which are shown in diagrammatic form. The representation of the graphic elements in the diagram is presented in order to provide various points of view of an application based on the function of each diagram. This collection of various points of view is known as a model [9].

From the UML that has been presented previously, the use case of each user is described as follows.

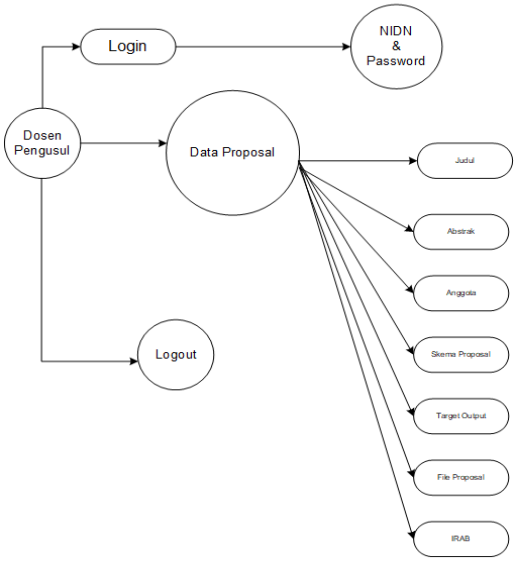

Figure 4. *Use Case* Diagram for Proposing Lecturer

In the proposing lecturer use case, the lecturer can input data (view, create, edit, and delete) on the system. For the proposal submission process, the components that need to be inputted are the title, abstract and keywords, research members or service implementers, the proposed proposal scheme, promised output targets, proposal files, and the proposed RAB. Whereas for the process of reporting research or service results, the components that must be inputted are abstracts and keywords, approved budgets, report files, and the resulting research or service outcomes.

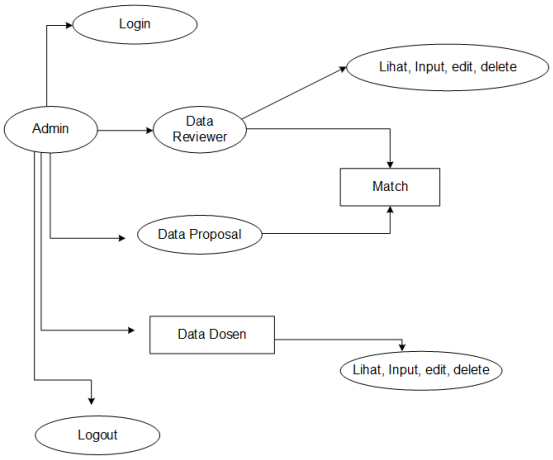

Figure 5. *Use Case* Diagram Admin

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In the admin use case, the admin can monitor proposal data, manage lecturer data, manage reviewer data, and assign reviewers to review submitted proposals. The admin can also export proposal data as well as the results of research and service if needed at any time.

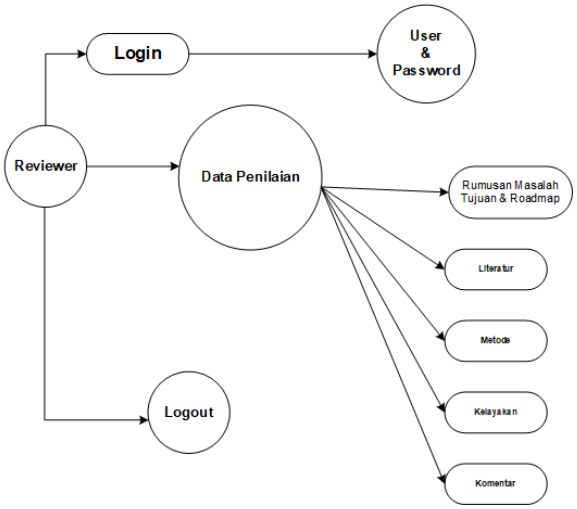

Figure 6. *Use Case* Diagram Reviewer

In the use case reviewer, the reviewer evaluates the proposal submitted. The components of the assessment provided are problem formulation, research or service objectives, road map, literature, methods, feasibility, and comments on the proposed proposal..

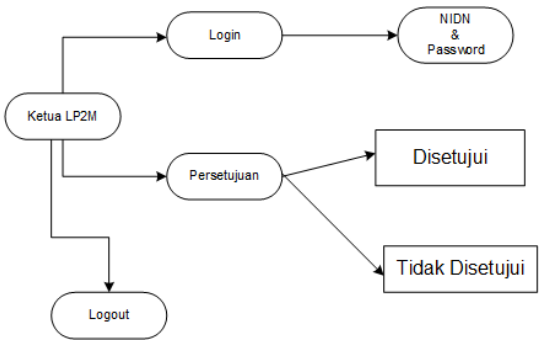

Figure 6.1 *Use Case* Diagram of the Head of LP2M

In the use case of the Head of LP2M, approval is made of the proposals submitted by the lecturer proposing. At this stage, if the proposal is approved, the proposal can be funded, and vice versa. The results of this approval will be displayed on the account of each lecturer proposer so that the proposers know the status of the proposal he submitted.

From the description of the user *use case* above, the design of the user *activity* diagram is as follows.

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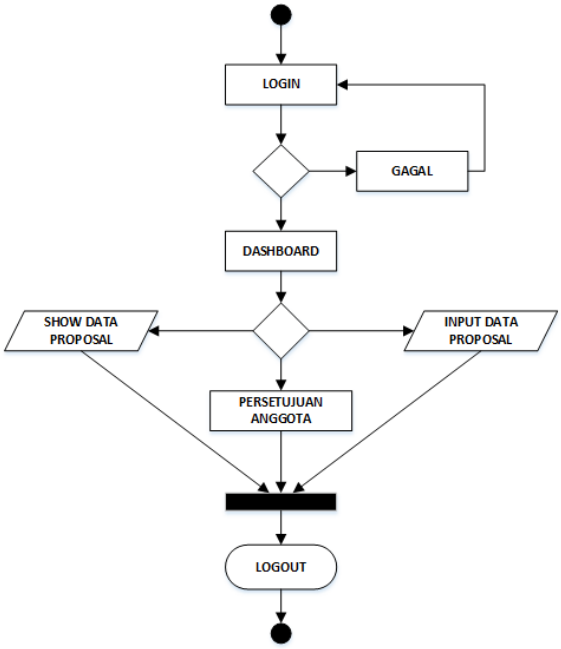

Figure 7. *Activity* Diagram of the Proposing Lecturer

The flow of the proposing lecturer activity diagram starts from the login, then if successful, the system will display a dashboard consisting of a proposal data show, proposal data input form, or member approval. If it fails, it will be directed to relogin. To leave the system, the lecturer who proposes it can log out.

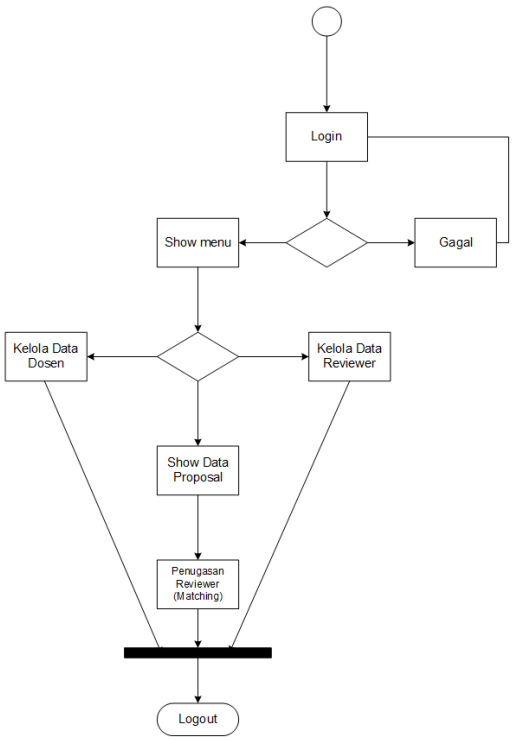

Figure 8. *Admin Activity Diagram*

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It can be seen from the admin activity diagram flow, before the admin manages the data on the system, the admin must first log in to be able to enter the system. After successfully logging in, the system will display a menu that can be used by the admin to manage lecturer data, proposal data, reviewer data, and assignments to reviewers to conduct assessments. Admin can log out when they want to log out the system.

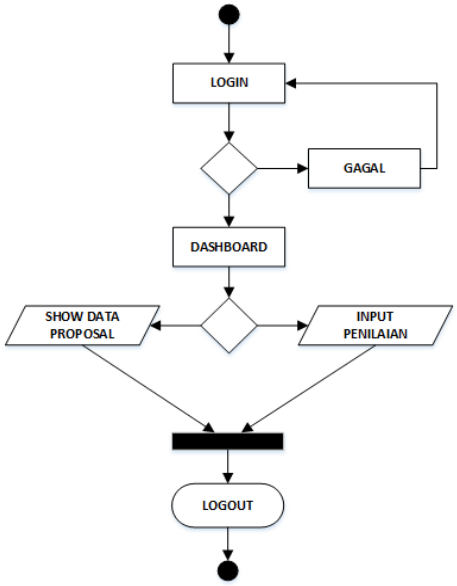

Figure 9. *Activity* Diagram Reviewer

The reviewer activity diagram flow also starts with logging in, then the system will display a dashboard consisting of a proposal data show and a proposal data input form if the login is successful. If it fails, it will be directed to relogin, and when it wants to exit the system, the reviewer can log out.

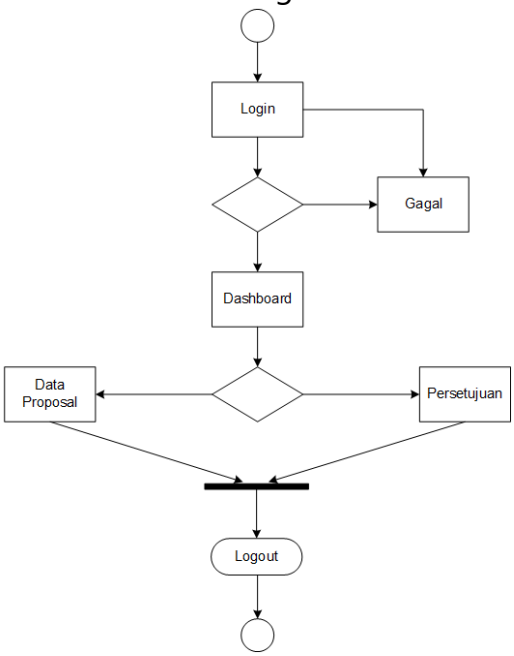

Figure 10. *Activity* Diagram of the Head of LP2M

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In the Head of LP2M activity diagram flow, when the login is successful, the system will display a dashboard consisting of show proposal data along with access to approve proposals. If it fails, it will be directed to relogin. Then, if you want to end your login, the Head of LP2M can log out.

After designing the system architecture, the next step is designing the system storyboard. The results of the story board design of this system are as follows.

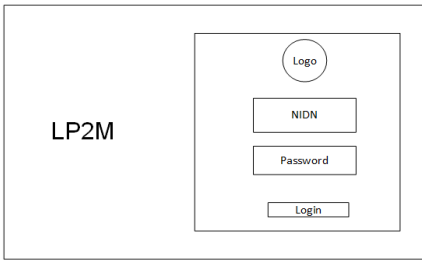

Figure 11. *Initial System Interface Form*

Figure 11 is a storyboard for the initial display of the SIM LP2N UNM application which displays the login form along with the logo of the application.

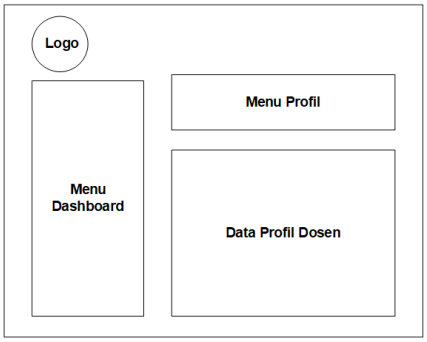

Figure 12. *Proposing Lecturer Interface Form*

Figure 12 is the display storyboard after the applicant lecturer user logs in to the SIM LP2M UNM application. This form displays a dashboard menu, profile menu, and editable lecturer profile data. The dashboard menu contains a list of menus related to the proposal and reporting of research and service, while the profile menu contains a list of menus related to research and service records, articles, books, hki, and several other menus.

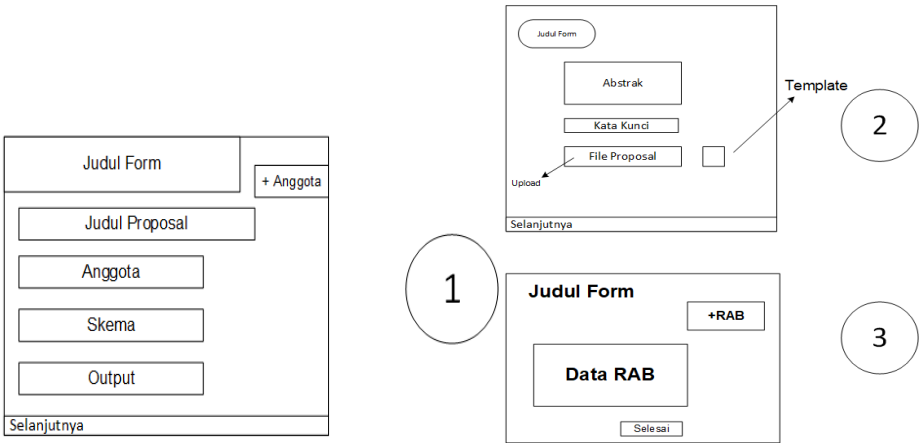

Figure 13. *Proposal Input Form*

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The proposal input form consists of three stages, namely the first stage for inputting titles, members, schemes and research or service outputs, then in the second stage for inputting abstracts, keywords, and uploading proposal files by following predetermined templates, and the third stage is for inputting RAB data.

RESULTS AND DISCUSSION

Research Results

From the research results obtained several views of the system. The first display shows the initial view of the system as follows.

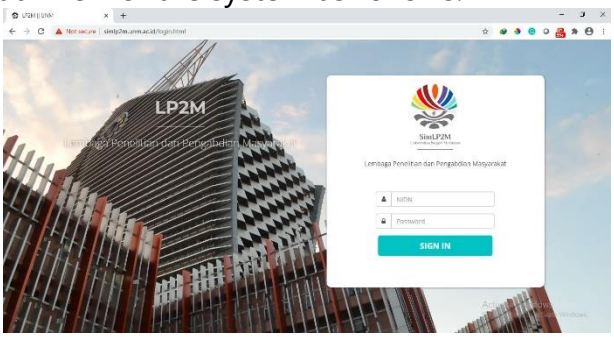

Figure 14. *System Initial View*

Figure 14 is the initial view of the application. In this display there is a login form to enter the system.

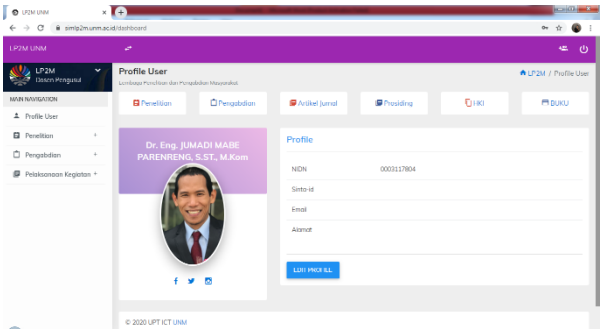

Figure 15. Lecturer Profile Display and Dashboard Menu

Figure 15 is the application display after the proposing lecturer has successfully logged in, which displays the lecturer profile and dashboard menu.

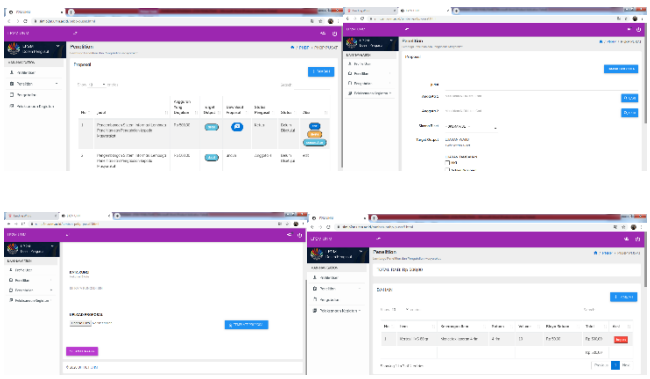

Figure 16 . Display of Proposal Data Entry

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Figure 16 is a display of inputting proposal data consisting of inputting the title, member, schema, output target, abstract, keywords, uploading the proposal file, and filling in the RAB.

Discussion.

To assess the quality of the SIM LP2M UNM application that has been made, measurements were made by distributing questionnaires to users (22 people) and IT experts (3 people) referring to the ISO 9126 model. The measurement scale used in the questionnaires distributed is a Likert scale. Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of people about social phenomena [10]. The data obtained from the results of the assessment are then converted into categories with the following conditions [11]:

No	Score Range	Category
1	$\bar{X}$ > Mi + 1,8 SBi	Very Good (SB)
2	Mi + 0,6 SBi < $\bar{X}$ ≤ Mi + 1,8 SBi	Good (B)
3	Mi - 0,6 SBi < $\bar{X}$ ≤ Mi + 0,6 SBi	Good Enough (CB)
4	Mi - 1,8 SBi < $\bar{X}$ ≤ Mi - 0,6 SBi	Not Good (KB)
5	$\bar{X}$ ≤ Mi - 1,8 SBi	Very Poor (SKB)

Table 1. Criteria for the Ideal Assessment Category

Keterangan:

1. $\bar{X}$ = Avverage Final Score
2. Mi = Mean Ideal
3. SBi = Ideal Standart Deviation
4. The Formula Mi = (1/2) (Highest ideal score + Lowest ideal score)
5. SBi Formula = (1/6) (Highest ideal score - Lowest ideal score)
6. Highest ideal score = Number of items x Highest score
7. Lowest ideal score = Number of items x Lowest Score

After the calculations are carried out, the results of the data analysis on the quality assessment of the SIM LP2M UNM application are presented as follows.

Overall Respondents' Calculation of the Assessment Score for the *LP2M UNM SIM* application .

1. Number of items = 19
2. Highest score = 4
3. Lowest score = 1
4. The highest ideal score = 19 x 4 = 76
5. The lowest ideal score = 19 x 1 = 19
6. Mi = (1/2) (76+19) = 47,5
7. SBi = (1/6) (76-19) = 9,5

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From the results above, the ideal assessment category criteria table is as follows:

No.	Score Range	Category
1	$\bar{X} > 64{,}6$	Very Good (SB)
2	$53{,}2 < \bar{X} \leq 64{,}6$	Good (B)
3	$41{,}8 < \bar{X} \leq 53{,}2$	Good Enough (CB)
4	$30{,}4 < \bar{X} \leq 41{,}8$	Not Good (KB)
5	$\bar{X} \leq 30{,}4$	Very Poor (SKB)

Tabel 2. Criteria for Ideal Assessment Categories

Furthermore, from the descriptive results of the respondent's data, it was obtained the average final score ($\bar{X}$) of 60,4. So that if it is included in the ideal category criteria table, the SIM LP2M UNM application has a GOOD quality category (B) with a percentage of 79.5% of the highest ideal score.

The calculation of the assessment score for the SIM LP2M UNM Application by the Respondents in each aspects.

1. Ease of Use Aspects

a. Number of items = 5
b. Highest score = 4
c. Lowest score = 1
d. The highest ideal score = 5 x 4 = 20
e. The lowest ideal score = 5 x 1 = 5
f. Mi = (1/2) (20 + 5) = 12.5
g. SBi = (1/6) (20-5) = 2.5

From the results above, the table of criteria for the ideal assessment category is as follows:

No.	Score Range	Category
1	$\bar{X} > 17$	Very Good (SB)
2	$14 < \bar{X} \leq 17$	Good (B)
3	$11 < \bar{X} \leq 14$	Good Enough (CB)
4	$8 < \bar{X} \leq 11$	Not Good (KB)
5	$\bar{X} \leq 8$	Very Poor (SKB)

Tabel 3. Criteria for Ideal Assessment Categories

The descriptive results of the respondents data given an average final score ($\bar{X}$) for the ease of use aspect of 16,4. So that if it is included in the ideal category criteria table, the SIM LP2M UNM application from the aspect of ease of use has a GOOD quality category (B) with a percentage of 81.8% of the highest ideal score.

2. Aspects of System Reliability

a. Number of items = 9
b. Highest score = 4
c. Lowest score = 1

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d. The highest ideal score = 9 x 4 = 36
e. The lowest ideal score = 9 x 1 = 9
f. Mi = (1/2) (36 + 9) = 22.5
g. SBi = (1/6) (36-9) = 4.5

From the results above, the ideal assessment category criteria table is as follows:

No.	Score Range	Category
1	$\bar{X} > 30,6$	Very Good (SB)
2	$25,2 < \bar{X} \leq 30,6$	Good (B)
3	$19,8 < \bar{X} \leq 25,2$	Good Enough (CB)
4	$14,4 < \bar{X} \leq 19,8$	Not Good (KB)
5	$\bar{X} \leq 14,4$	Very Poor (SKB)

Tabel 4. Criteria for Ideal Assesment Categories

The descriptive results of the respondent's data gave an average final score ($\bar{X}$)for the reliability aspect of the system of 28.1. So that if it is included in the ideal category criteria table, the SIM LP2M UNM application from the aspect of system reliability has a GOOD quality category (B) with a percentage of 78% of the highest ideal score.

3. Appearance and Content Aspects

a. Number of items = 5
b. Highest score = 4
c. Lowest score = 1
d. The highest ideal score = 5 x 4 = 20
e. The lowest ideal score = 5 x 1 = 5
f. Mi = (1/2) (20+5) = 12,5
g. Sbi = (1/6) (20-5) = 2,5

From the results above, the ideal assessment category criteria table is as follows:

No.	Rentang Skor	Kategori
1	$\bar{X} > 17$	Very Good (SB)
2	$14 < \bar{X} \leq 17$	Good (B)
3	$11 < \bar{X} \leq 14$	Good Enough (CB)
4	$8 < \bar{X} \leq 11$	Not Good (KB)
5	$\bar{X} \leq 8$	Very Poor (SKB)

Tabel 5. Criteria for Ideal Assesment Categories

The descriptive results of the respondent's data give an average final score ($\bar{X}$)for the display and content aspects of 16. So that if it is included in the ideal category criteria table, the SIM LP2M UNM application from the appearance and

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content aspects has a GOOD quality category (B) with a percentage of 79.8 % against the highest ideal score.

Calculation of the Assessment Score for the *SIM LP2M UNM* application by the Overall Expert .

1. Number of items = 16
2. Highest score = 4
3. Lowest score = 1
4. The highest ideal score = 16 x 4 = 64
5. The lowest ideal score = 16 x 1 = 16
6. Mi = (1/2) (64+16) = 40
7. SBi = (1/6) (64-16) = 8

From the results above, the ideal assessment category criteria table is as follows:

No.	Rentang Skor	Kategori
1	$\bar{X} > 54{,}4$	Very Good (SB)
2	$44{,}8 < \bar{X} \leq 54{,}4$	Good (B)
3	$35{,}2 < \bar{X} \leq 44{,}8$	Good Enough (CB)
4	$25{,}6 < \bar{X} \leq 35{,}2$	Not Good (KB)
5	$\bar{X} \leq 25{,}6$	Very Poor (SKB)

Tabel 6. Ideal Rating Category Criteria

Furthermore, from the descriptive results of expert data obtained an average final score ($\bar{X}$) of 54.3. So that if it is included in the ideal category criteria table, the SIM LP2M UNM application has a GOOD quality category (B) with a percentage of 84.9% of the highest ideal score.

The calculation of the score for the assessment of the SIM LP2M UNM application by experts in each aspect.

1. Aspects of Functionality

a. Number of items = 4
b. Highest score = 4
c. Lowest score = 1
d. The highest ideal score = 4 x 4 = 16
e. Thelowest ideal score = 4 x 1 = 4
f. Mi = (1/2) (16+4) = 10
g. SBi = (1/6) (16-4) = 2

From the results above, the table of criteria for the ideal assessment category is as follows:

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No.	Score Range	Category
1	$\bar{X} > 13,6$	Very Good (SB)
2	$11,2 < \bar{X} \leq 13,6$	Good (B)
3	$8,8 < \bar{X} \leq 11,2$	Good Enough (CB)
4	$6,4 < \bar{X} \leq 8,8$	Not Good (KB)
5	$\bar{X} \leq 6,4$	Very Poor (SKB)

Tabel 7. Ideal Rating Category Criteria

The descriptive results of the expert data give an average final score ($\bar{X}$)or the functionality aspect of 13. So that if it is included in the ideal category criteria table, the *SIM LP2M UNM* application from the functionality aspect has a GOOD quality category (B) with a percentage of 81.2% of the highest score ideal.

2. Reliability Aspects

a. Number of items = 3
b. Highest score = 4
c. Lowest score = 1
d. The higjest ideal score= 3 x 4 = 12
e. The lowest ideal score = 3 x 1 = 3
f. Mi = (1/2) (12+3) = 7,5
g. SBi = (1/6) (12-3) = 1,5

From the results above, the ideal assessment category criteria table is as follows:

No.	Score Range	Category
1	$\bar{X} > 10,2$	Very Good (SB)
2	$8,4 < \bar{X} \leq 10,2$	Good (B)
3	$6,6 < \bar{X} \leq 8,4$	Good Enough (CB)
4	$4,8 < \bar{X} \leq 6,6$	Not Good (KB)
5	$\bar{X} \leq 4,8$	Very Poor (SKB)

Tabel 8. Ideal Rating Category Criteria

The descriptive results of expert data provide an average final score ($\bar{X}$)or the reliability aspect of 10.3. So if it is included in the ideal category criteria table, the SIM LP2M UNM application from the aspect of reliability has the VERY GOOD quality category (SB) with a percentage of 86.1% of the highest ideal score.

3. Usability Aspects

a. Number of items = 4
b. Highest score = 4
c. Lowest score = 1
d. The highest ideal score = 4 x 4 = 16
e. The lowest ideal score = 4 x 1 = 4
f. Mi = (1/2) (16 + 4) = 10
g. SBi = (1/6) (16-4) = 2

From the results above, the ideal assessment category criteria table is as follows:

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No.	Score Range	Category
1	$\bar{X} > 13,6$	Very Good (SB)
2	$11,2 < \bar{X} \leq 13,6$	Good (B)
3	$8,8 < \bar{X} \leq 11,2$	Good Enough (CB)
4	$6,4 < \bar{X} \leq 8,8$	Not Good (KB)
5	$\bar{X} \leq 6,4$	Very Poor (SKB)

Table 9 . Ideal Rating Category Criteria

Descriptive results of expert data provide an average final score ($\bar{X}$) for the usability aspect of 13.7. So that if it is included in the ideal category criteria table, the *SIM LP2M UNM* application from the usability aspect has a VERY GOOD quality category (SB) with a percentage of 85.4% of the highest ideal score.

4. Effeciency Aspects

a. Number of items = 2
b. Highest Score = 4
c. Lowest Score = 1
d. The highest ideal score = 2 x 4 = 8
e. The lowest ideal score = 2 x 1 = 2
f. Mi = (1/2) (8+2) = 5
g. SBi = (1/6) (8-2) = 1

From the results above, the ideal assessment category criteria table is as follows:

No.	Score Range	Category
1	$\bar{X} > 6,8$	Very Good (SB)
2	$5,6 < \bar{X} \leq 6,8$	Good (B)
3	$4,4 < \bar{X} \leq 5,6$	Good Enough (CB)
4	$3,2 < \bar{X} \leq 4,4$	Not Good (KB)
5	$\bar{X} \leq 3,2$	Very Poor (SKB)

Tabel 10. Ideal Rating Category Criteria

The descriptive results of expert data give an average final score ($\bar{X}$) for the efficiency aspect of 7. So that if it is included in the ideal category criteria table, the *SIM LP2M UNM* application from the efficiency aspect has a VERY GOOD quality category (SB) with a percentage of 87.5% of the score. highest ideal.

5. Maintain ability Aspects

a. Number of items = 2
b. Highest score = 4
c. Lowest score = 1
d. The highest ideal score = 2 x 4 = 8
e. The lowest ideal score = 2 x 1 = 2
f. Mi = (1/2) (8+2) = 5
g. SBi = (1/6) (8-2) = 1

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From the results above, the ideal assessment category criteria table is as follows:

No.	Score Range	Category
1	$\bar{X} > 6{,}8$	Very Good (SB)
2	$5{,}6 < \bar{X} \leq 6{,}8$	Good (B)
3	$4{,}4 < \bar{X} \leq 5{,}6$	Good Enough (CB)
4	$3{,}2 < \bar{X} \leq 4{,}4$	Not Good (KB)
5	$\bar{X} \leq 3{,}2$	Very Poor (SKB)

Tabel 11. Ideal Rating Category Criteria

Descriptive results of expert data provide an average final score ($\bar{X}$) for the maintainbility aspect of 6.7. So if it is included in the ideal category criteria table, the *SIM LP2M UNM* application from the maintain ability aspect has a GOOD quality category (B) with a percentage of 983.3% of the highest ideal score.

6. Portability Aspects

a. Number of items = 1
b. Highest score = 4
c. Lowest score = 1
d. The highest ideal score = 1 x 4 = 4
e. The lowest ideal score = 1 x 1 = 1
f. Mi = (1/2) (4+1) = 2,5
g. SBi = (1/6) (4-1) = 0,5

From the results above, the ideal assessment category criteria table is as follows:

No.	Score Range	Category
1	$\bar{X} > 3{,}4$	Very Good (SB)
2	$2{,}8 < \bar{X} \leq 3{,}4$	Good (B)
3	$2{,}2 < \bar{X} \leq 2{,}8$	Very Good (CB)
4	$1{,}6 < \bar{X} \leq 2{,}2$	Not Good (KB)
5	$\bar{X} \leq 1{,}6$	Very Poor (SKB)

Tabel 12. Ideal Rating Category Criteria

The descriptive results of expert data provide an average final score ($\bar{X}$)for the portability aspect of 3.7. So if it is included in the ideal category criteria table, the SIM LP2M UNM application from the portability aspect has the VERY GOOD quality category (SB) with a percentage of 91.7% of the highest ideal score.

CONCLUSIONS

In this research, the *SIM LP2M UNM* application has been successfully developed and has gone through the testing phase by experts and respondents. The category of GOOD (B) was given by experts with a percentage of 84.9%, and the category of GOOD (B) was given by respondents with a percentage of 79.5%. Thus, this application can be used or widely applied within the scope of UNM. As for what

can be developed for further research is to develop this application for the mobile version.

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