

Application Method Simple Multi-Attribute Rating The Technique (SMART) At Selection Receiving Scholarship Tahfidz

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Abstract

The Tahfidz Scholarship is a development program for Mahfouz centers in the community, community, educational institutions, and installations. The aim is to form and print Al-Quran memorizers. So far, the system used to determine the selection of scholarship recipients is by selecting one by one the data and values of the applicants. So that it can cause errors in the final selection stage. In addition, if you still use manual methods, there is a concern that the selection of prospective scholarship recipients will not be conducted objectively. So use of a computer-based Decision Support System can be used as a solution to facilitate decision making. The method used in this study is the Simple Multi-Attribute Rating Technique (SMART). The purpose of this study was to facilitate the Tahfiz Center (RTC) Research and Development section in selecting prospective Tahfidz scholarship recipients. From the results of this study, it is hoped that the Simple Multi-Attribute Rating Technique (SMART) method can be implemented in the Scholarship Recipient Selection Decision Support System with the output of data on scholarship recipients who received assistance from the Tahfiz Center (RTC) House.

Keywords: Scholarship, SMART, Decision Support System (SPK)

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1. Introduction

In this modern era, the use of information and communication technology has played a very important role as a tool in completing a job, and in line with the development of information technology that is increasing rapidly affecting an information system to support the needs of an organization, agency or an institution. As in improving the quality and quantity of institutions, in addition to processing information, technology can also be used to help make decisions effectively with a technology called a decision support system. Based on the analysis from Hidayatus journal, the number of criteria given, and the very limited scholarship quota makes it difficult for schools to determine the right priorities for scholarship recipient students. So there needs to be a system that can help the selection process so that scholarship recipients can be right on target. Decision Support System (DSS) is a computer-based system used to solve problems and as a tool in supporting the decision making process [1].

A scholarship recipient is someone who has passed predetermined criteria. Data from scholarship recipients will be selected to determine which person is eligible for the scholarship. This selection process requires accuracy and time because the data will be compared with the scholarship criteria one by one. But apparently, there are some institutions that have not used a computerized system, as happened at the Tahfidz Center House. In storing data, Rumah Tahfidz Center still uses paper and is not well documented. In addition, decision making is still done manually, so it is possible if the decisions are less objective [2].

The decision support system method used in this study is the SMART method. This is because this method is quite effective in simplifying and accelerating the decision-making process by solving the problem into several parts. In addition, the SMART method has advantages, including: 1) the calculation is simpler, 2) flexible in weighting, 3) expanding decision making in processing data/information for decision making, 4) adding and subtracting alternatives will not affect the weighting calculation because each alternative assessment does not depend on each other [3].

With the SMART method, the writer can create a system that facilitates decision making for the recipients of the Tahfidz scholarship at the Tahfidz Center House. With this system, it is hoped that later it will be able to help RTC R&D in deciding the best alternatives to choose those who deserve a scholarship. The criteria that have been determined in this case study are the number of memorization, Tajweed, and fluency. Thus a system is needed that can help make decisions on prospective Tahfidz scholarship recipients accurately, effectively, objectively, and quickly [4].

Based on the results of the analysis of the running system at the Tahfidz Daarul Qur'an House, the problems that arise include: 1) the absence of a computerized scholarship acceptance decision support system to assist in determining the best alternative, 2) it is necessary to improve the data storage system that is not documented with good [6]. Based on the description above, the authors conducted research on the decision-making system in selecting scholarship recipients at the Tahfidz Center House. The purpose of this paper is: 1) to implement a Decision Support System in selecting the scholarship acceptance at the Tahfidz Center House. 2) Creating a system that can facilitate decision making for scholarship acceptance at the Tahfidz Center House. 3) To apply the SMART method to scholarship admissions. While the purpose of this research is to facilitate the Tahfidz Center (RTC) Research and Development section in selecting prospective recipients of the Tahfidz scholarship [7].

In making the decision support system for the acceptance of the tahfidz scholarship, the authors limit the problem to the decision support system for the acceptance of the tahfidz scholarship, which includes processing data for scholarship candidates, criteria data, assessment data, and data on scholarship recipients who have passed. In addition, the authors also limit this problem only by using the Simple Multi-Attribute Rating Technique (SMART) method with the following criteria: number of memorization, recitation, and fluency [8]. In conducting this research, the author refers to previous research related to research discussions, including research conducted by Eva Yulianti and Riska Damayanti entitled Decision Support Systems to Determine Scholarship Acceptance for Students of SMAN 9 Padang Using the AHP (Analytical Hierarchy Process) Method. . This study has criteria, namely: average value, number of parents' income, number of dependents of parents, and number of siblings. This system is designed using the Visual Basic 6.0 programming language with the aim of making it easier to select students for scholarships with predetermined assessment data [9].

In addition, the authors also looked at research conducted by Kelvin Wijaya, et al, entitled Scholarship Recipient Decision Support Systems with Technique For Order Preference Method By Similarity To Ideal Solution (TROPICS) at Sam Ratulangi University, Manado. Where the purpose of this study is to produce a decision support system with an objective and systematic process so that the scholarship recipients are right on target and are the candidates with the best qualifications [4]. Another research related to this writing is research conducted by Sri Eniyati regarding the Design of a Decision Support System for Scholarship Admissions using the SAW (Simple Additive Weighting) Method at SMK Negeri 10 Semarang with the criteria (Total Parents 'Income, Semester, Number of Parents' Dependents) , Number of Siblings, and Value). Where the purpose of this research is to be able to determine who will receive the scholarship based on the weight and criteria that have been determined more easily and efficiently [10].

2. Research Method

2.1 Supporting Theory

A. Understanding Information Systems

"The information system is a system within the organization that brings together the needs of daily transaction processing that supports the managerial functions of the organization's operations with the strategic activities of an organization to be able to provide reports required by certain external parties". "Information system is a system of a man-made system which generally consists of a set of computer-based and manual components designed to collect, store, and manage data and provide output information to users " [11].

B. Basic Concepts of Information Systems"

Suggests that the system implies collections of components that have elements of interrelation with one another." A system has several characteristics, the characteristics referred to are:

1. System Components (Components)

A system consists of a number of interacting components, which work together to form one unit. The system components can be in the form of a subsystem.

2. System Boundary (Boundary)
The scope of the system is an area that limits between other systems and other systems or systems with the external environment.
3. The environment outside the system (Environment)
Any form that is outside the scope or limitations of the system that affects the operation of the system is called the external environment.
4. System Connectors (Interface)
Is a medium that connects the system with other subsystems that allow resources to flow from one subsystem to another by passing through the liaison.
5. System Input (Input)
It is the energy put into the system which can be in the form of maintenance (maintenance input) and signal (signal input).
6. System Output (Output)
The yield of energy is spent and classified into useful output. This output is an input for other subsystems.
7. Processing Systems (Process)
A system can have a process that will convert the input into an output.
8. System Goals (Objective)
The system has predetermined goals and objectives and is deterministic. The system is said to be successful when it hits the goals that have been planned.

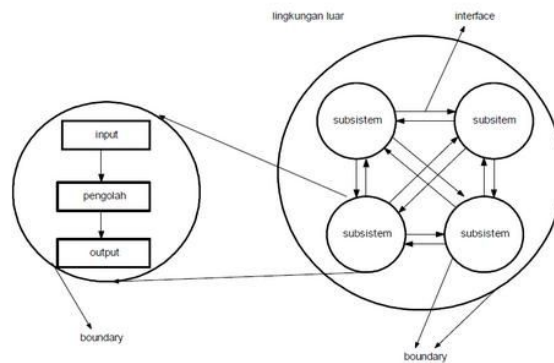


Figure 1. System Characteristics

C. Definition of Decision Support System (DSS)

"Decision Support System (DSS) or Decision Support System (DSS) is a system that has problem-solving abilities and the ability to communicate problems. This system is used to assist decision making in semi-structured and unstructured situations, where no one knows exactly how decisions should have been made." Sprague and Watson define a Decision Support System (DSS) as a system that has five main characteristics, namely:

1. Computer-based system.
2. Used to assist decision-makers.
3. Help solve complex problems that are impossible with manual calculations.
4. Through an interactive simulation.
5. Where the data and analysis model is the main components.

C. Understanding Simple Multi-Attribute Rating Technique (SMART)

"Simple Multi-Attribute Rating Technique (SMART) is a multi-criteria decision-making method developed by Edward in 1997. SMART is a multi-criteria decision-making technique based on the theory that each alternative consists of a number of criteria with values. Each criterion has weights describing how important it is compared to other criteria. This weighting is used to assess each alternative to obtain the best alternative."

- 1) The order of the SMART Method

The order in which the SMART method is used according to Goodwin and Wright is as follows:

- Determines the number of criteria used.
- Determine the weight of each criterion's criteria using intervals of 1-100 for each criterion with the most important priority.
- Calculate the normalization of each criterion by comparing the criterion weight values with the total criterion weights. Using the formula:

$$\text{Normalisasi} = \frac{W_j}{\sum W_j} \dots\dots\dots$$

Where W_j is the weight value of a criterion, meanwhile, $\sum W_j$ is the total weight of all requirements.

- Provide the criteria parameter values for each measure for each alternative.
- Determine the utility value by converting the criterion value for each criterion into the common data criterion value. The utility value is obtained using the equation:

$$u_i (ai) = \frac{C_{out} - C_{min}}{C_{max} - C_{min}} \dots\dots\dots (2)$$

Where $u_i ai$ is the utility value of the 1st criterion, for the I the criterion, C_{max} is the maximum criterion value, C_{min} is the minimum criterion value, and $C_{out} i$ is I the criterion value.

- Determine the final value of each criterion by transferring the value obtained from the normalized value of the standard data criteria with the normalized amount of the criteria weight. Then add up the values of these multiplications.

$$u (ai) = \sum_{j=1}^m w_j u_i (ai) \dots\dots\dots (3)$$

Where $u ai$ is the total alternative value, w_j is the result of the normalized criterion weight, and $u_i (ai)$ is the result of determining the utility value.

D. Understanding Tahfidz Qur'an

The word tahfidz is a masdar form of haffaza, the origin of the word hafiz-yahfazu which means "to memorize." According to Quraish Syihab, Hafiz is derived from three letters which have the meaning of maintaining and supervising. From this meaning, the word memorize is born because of those who memorize properly maintain their memory. Also, the meaning of "not careless," because this attitude leads to nurture, and "guarding" because guarding is part of maintenance and supervision. The word hafiz implies the emphasis and repetition of the preserver, as well as its perfection. It also means watching. Allah SWT. Gave the task to the angels Raqib and 'Atid to record humans' good and bad deeds and the future. Allah will convey His judgment to humans.⁷ While the word al-Qur'an is the Kalamullah that was sent down to the Prophet Muhammad. Through the angel, Gabriel as. which is offered verbally, is narrated to us must Worried.

According to Farid Wadji, tahfiz al-Qur'an can be defined as the process of memorizing the al-Qur'an in memory so that it can be recited/pronounced by heart correctly in certain ways continuously. The person who memorizes it is called al-hafiz, and the plural form is al-huffaz. ⁹ This definition contains two main points, namely: first, a person who memorizes and then is able to recite it correctly according to the law of recitation must conform to the Mushaf of the Qur'an. Second, a memorizer always keeps his memorization continuously from forgetting, because memorizing the Koran is very fast disappearing. Referred to as hafidz al-Qur'an, because it does not protect it continuously. Likewise, if he memorized several juz or several verses of the Qur'an, it was not included in the hafidz al-Qur'an [13].

E. Understanding Scholarships

According to Dedi Achmad Sidik, scholarships can be said to be financing that does not come from self or parents' funding, but is given by the government, private companies, embassies, universities, as well as educational or research institutions, or also from the office where an employee's performance can be. Given the opportunity to increase the capacity of human resources through education. This fee is given to those who are entitled to receive the scholarship, mainly based on the classification, quality, and competence of the scholarship recipients [14].

3. Results and Analysis

The research methods used in this study are as follows:

3.1 Data collection technique

1. Observation
Observations made by the author is to look at the scholarship acceptance decision support system that is currently running at the Tahfidz Center House, so that the author can immediately obtain dat
2. Interview
The data was collected by conducting a question and answer session with Ustadz Halimi as the R&D Manager.
3. Literature review
This method uses books, journals, and reports related to the titles appointed as references.

3.2 System Development Model

The system development method used in this paper is the waterfall development model, a software development method that allows the system to be made in a structured and systematic manner (sequentially) according to the existing development cycle. The stages are as follows:

1. System / Software Requirements Analysis
At this stage, it can be done by analyzing system requirements by conducting interviews or others to obtain the required data.
2. Design
Design is a description of the proposal where the process focuses on making the software program's design. In this study, the author's system design is UML diagrams (use case diagrams, activity diagrams, sequence diagrams, class diagrams, deployment diagrams, component diagrams).
3. Code Generation
In this stage, the writer makes a program using the PHP programming language, and the database used is MySQL.
4. Testing Is a test of a program that has been created. Tests carried out on the manufacture of this system use Black Box Testing.
5. Support
At this stage, the author needs to prepare support related to things that may be needed for system changes.

4. Results and Discussion

4.1 Tahfidz Scholarship Admission Procedure Current System

The selection procedure for receiving the tahfidz scholarship is that the Inter-Nation STMIK helps to obtain and provide data on the prospective recipients of the tahfidz scholarship to the RTC R&D department. After that, the RTC R & D department assesses based on criteria, such as the criteria for the number of memorization, fluency, and recitation. After the RTC RTC has finished assessing the prospective Tahfidz scholarship recipients. After completing the tests and assessments of the tahfidz scholarship candidates by the RTC, the assessment data is given to the leadership of the RTC.

After the assessment data is received, the direction of the RTC will compare the scores from the test results of other prospective participants in order to determine who is eligible to receive the Tahfidz scholarship. After obtaining a candidate who will receive a tahfidz scholarship, the leadership of the RTC will provide the data to the Inter-Nation STMIK. After the data is received, STMIK provides alan to provide information and contact those who have graduated as tahfidz scholarship recipients.

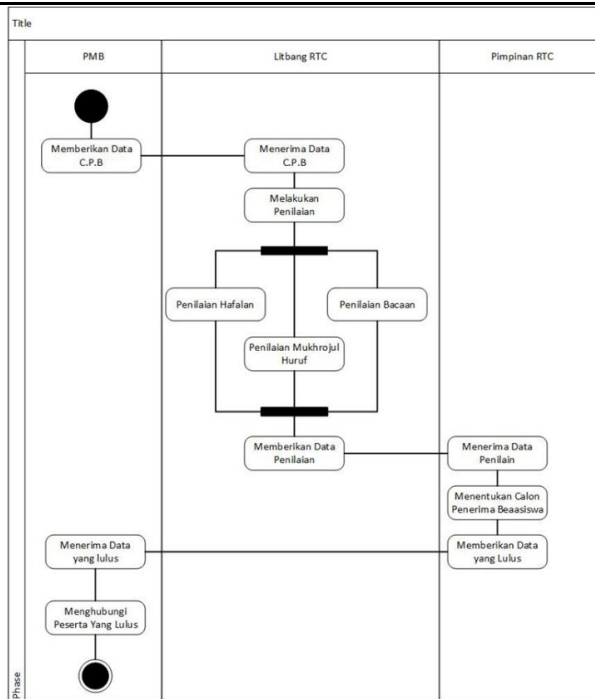


Figure 2. Activity Diagram of Tahfidz Scholarship Admission Procedure Running System

4.2. Application of the SMART Method to the Tahfidz Scholarship Admission Information System

A. SMART Method Completion Steps

- a) Determine the number of criteria used In the SMART method, and there are criteria needed to determine who will be selected as beneficiaries. The criteria are as follows:
 - Memorization
 - Tajweed
 - Smoothness
- b) Determine the weight of the criteria for each criterion using intervals of 1-100 for each criterion with the most important priority.

Table 1. Pembobotan Kriteria

No.	Name Criteria	Weight (Wj)
1	Memorization	40
2	Tajweed	30
3	Smoothness	30
Total		100

- c) Calculate the normalization of each criterion by comparing the criterion weight values with the total criterion weights.
- d) Provide the criteria parameter values for each criterion for each alternative.

Table 2. Rote Assessment

No.	Assessment	Score
1	4 Juz	4
2	2-3 Juz	3
3	1 Juz	2
4	< 1 Juz	1

Table 3. Tajwid Assessment

No.	Assessment	Score
1	Mumtaz	4
2	Jayid Jiddan	3
3	Jayid	2
4	Kurang	1

Table 4. Tajwid Assessment

No.	Assessment	Score
1	Very good	4
2	Good	3
3	Enough	2
4	Less	1

- e) Determine the utility value
In determining the acceptance of a scholarship, what is called an alternative is all existing applicants.
- f) Determine the final value of each criterion by transferring the value obtained from the normalized standard data criterion value with the criterion weight normalization value.

B. Analysis Using the SMART Method

The analysis is done by calculating the normalization of each criterion by comparing the weighted value of the criteria with the total weight of the criteria. The formula used is equation (1).

Table 5. Normalization Result

No.	Name Criteria	Weight (Wj)	Normalization
1	Memorization	40	$40/100 = 0.4$
2	Tajweed	30	$30/100 = 0.3$
3	Smoothness	30	$30/100 = 0.3$
	Total	100	

In determining the acceptance of scholarships, the so-called alternatives are all existing applicants. The calculation sample data in this study are contained in the calculation sample data.

Table 6. Calculation Sample Data

No	Name	Memorization	Tajweed	Smoothness
1	Yazzidul Yassar	1	1	1
2	Farhan Rifqi.F	4	4	4
3	Ananda Putra Nana	2	3	3
4	Fajar Dwi.S	2	3	3
5	Muh. Irsan Khalis	1	1	2

The utility value is obtained using equation (2)

Table 7. Calculate Utility Value

No	Name	Memorization	Tajweed	Smoothness
1	Yazzidul Yassar	$\frac{(1-1)}{(4-1)}$	$\frac{(1-1)}{(4-1)}$	$\frac{(1-1)}{(4-1)}$
2	Farhan Rifqi.F	$\frac{(4-1)}{(4-1)}$	$\frac{(4-1)}{(4-1)}$	$\frac{(4-1)}{(4-1)}$
3	Ananda Putra Nana	$\frac{(2-1)}{(4-1)}$	$\frac{(3-1)}{(4-1)}$	$\frac{(3-1)}{(4-1)}$
4	Fajar Dwi.S	$\frac{(2-1)}{(4-1)}$	$\frac{(3-1)}{(4-1)}$	$\frac{(3-1)}{(4-1)}$
5	Muh. Irsan Khalis	$\frac{(1-1)}{(4-1)}$	$\frac{(1-1)}{(4-1)}$	$\frac{(2-1)}{(4-1)}$

The results of the utility value calculation can be seen in table 7:

Table 8. Utility Value Results

No	Nama	Hafalan	Tajwid	Kelancaran
1	Yazzidul Yassar	0.00	0.00	0.00
2	Farhan Rifqi.F	1.00	1.00	1.00
3	Ananda Putra Nana	0.33	0.67	0.67
4	Fajar Dwi.S	0.33	0.67	0.67
5	Muh. Irsan Khalis	0.00	0.00	0.33

Determine the final value of each criterion by transferring the value obtained from the normalized value of the standard data criteria with the normalized value of the criteria weight. Then add up the values of these multiplications. See equation (3)

Table 9. Calculates the total value of the alternative

No	Name	Memorization	Tajweed	Smoothness
1	Yazzidul Yassar	0.4×0.0 0	0.3×0.0 0	0.3×0.00
2	Farhan Rifqi.F	0.4×1.0 0	0.3×1.0 0	0.3×1.00
3	Ananda Putra Nana	0.4×0.3 3	0.3×0.6 7	0.3×0.67
4	Fajar Dwi.S	0.4×0.3 3	0.3×0.6 7	0.3×0.67
5	Muh. Irsan Khalis	0.4×0.0 0	0.3×0.0 0	0.3×0.33

The results of the calculation of alternative values can be seen in table 9

Table 10. Results for the total value of the alternatives

No	Name	Memorization	Tajweed	Smoothness	Total
1	Yazzidul Yassar	0.00	0.00	0.00	0.00
2	Farhan Rifqi.F	0.40	0.30	0.30	1.00
3	Ananda Putra Nana	0.13	0.20	0.20	0.53
4	Fajar Dwi.S	0.13	0.20	0.20	0.53
5	Muh. Irsan Khalis	0.00	0.00	0.10	0.10

From the table above, it can be concluded that the viable alternative to receive the scholarship is Farhan Rifqi. F, Ananda Putra Nana, and Fajar Dwi.s.

C. System Analysis Stages

This Decision Support System functions to calculate and select scholarship receipts using criteria as the basic reference for determining scholarship acceptance. Requirement specifications The (System requirement) of the Scholarship Acceptance Selection Decision Support System is the admin page, which

includes the processes: managing scholarship data, managing examiner data, managing criteria, and managing assessments.

a) Use Case User Diagram

Use Case Diagram is a diagram that describes an interaction between one or more actors and the information system to be created. Use Case diagram of the user in Figure 3 illustrates what the user does to access the menu contained in the scholarship acceptance information system.

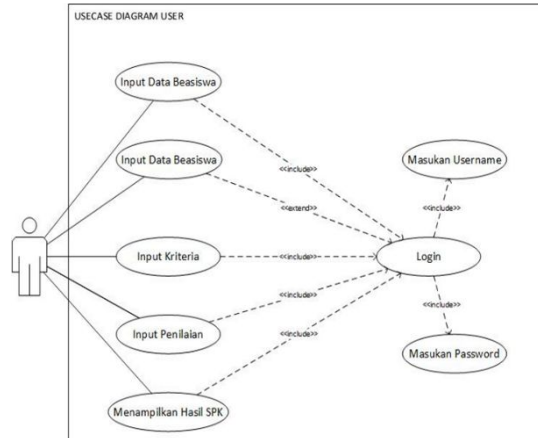


Figure 3. Use Case User Page Diagram

b) Activity Diagram of Decision Support Systems

The SPK Process Activity Diagram illustrates what the user does, in this case the RTC R&D section, to access and manage rote, recitation and fluency assessment data.

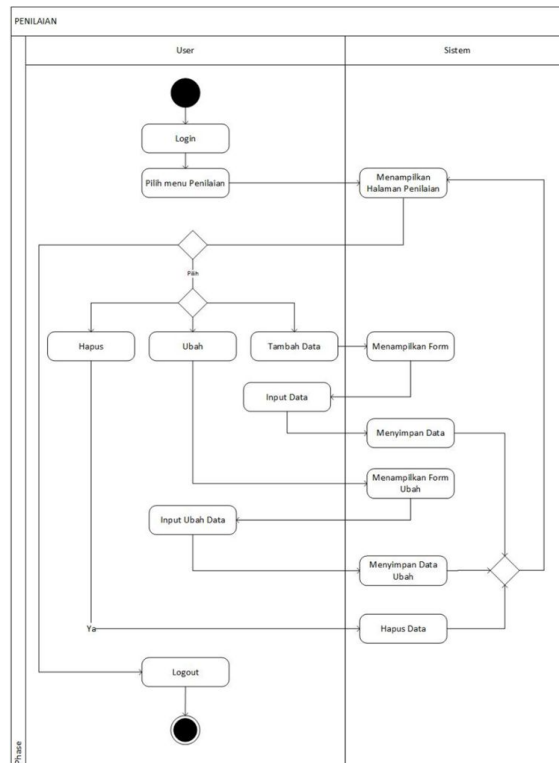


Figure 4. SPK Process Activity Diagram

c) Database

Database is a collection of files that are interrelated and interact, where the relationship is indicated by the key of each existing file. The logical database design in the scholarship acceptance decision support system consists of a scholarship table, a user table, a criteria table, an assessment table, and a table of examiners, as shown in Figure 5.

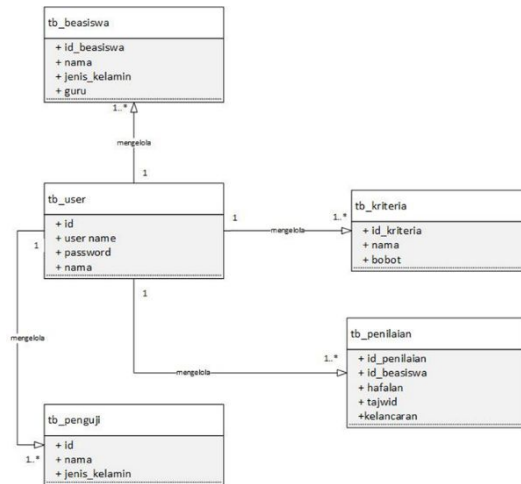


Figure 5. Logical Data Model

d) Software Architecture

In Software Architecture, there are sequence diagrams, components and deployment diagrams, as well user interface design. Sequence diagrams describe the behavior of objects in usecase by describing the life time of objects and messages sent and received between objects [19].

- Sequence Criteria Diagram

The Criteria Sequence Diagram illustrates what the user does, in this case the RTC R&D section to manage the criteria data. Starting from the user logging in to the login form, entering the dashboard page, then selecting the criteria menu and changing the criteria data on the criteria form, where the criteria data are stored in the criteria table [20].

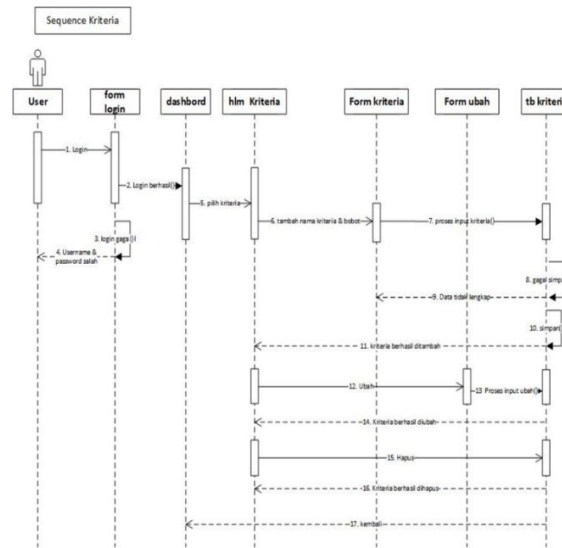


Figure 6. Sequence Diagram Criteria

- Assessment Sequence Diagram

Assessment Sequence Diagrams illustrate what users do to manage assessment data. Starting from the user logging in to the login form, entering the dashboard page, then going to the assessment page and managing the assessment data on the added value form and the change form, where the assessment data will be stored in the assessment table [21].

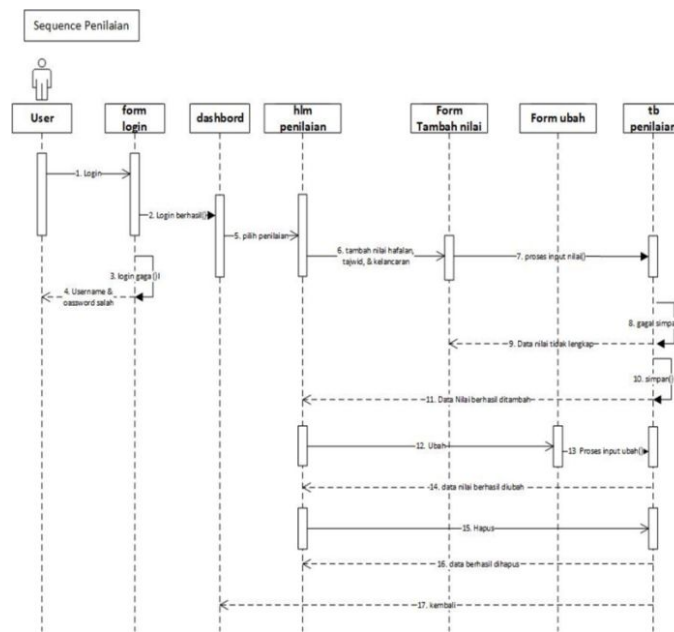


Figure 7. Sequence Diagram of the Assessment

• DSS Process Sequence Diagram

The DSS Process Sequence Diagram illustrates what the user does to perform the utility value calculation process and detail alternative SMART methods. Starting from the dashboard page, then selecting the SPK process button, so you get a data display of the utility assessment results, alternative details, and the final SPK decision result [22].

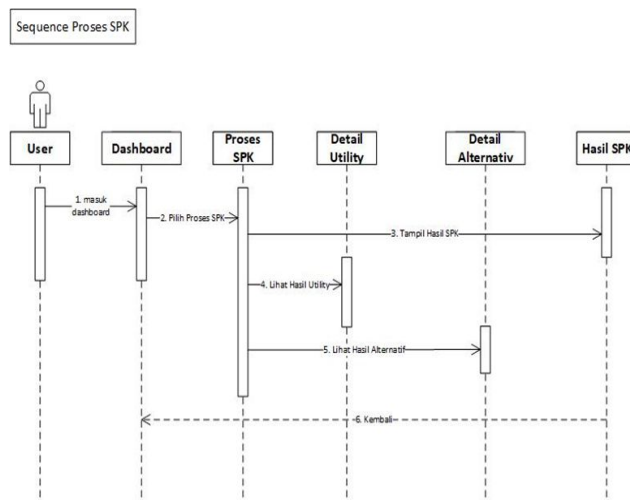


Figure 8. Sequence Diagram of the DSS Process

e) Component Diagram

Component diagrams are made to show the organization and dependence between a collection of components in a system [23]. In this study, the components contained in the SPK SMART Scholarship Acceptance system are the spk_basiswa database made with MySQL and Apache as well as the application supporting software used by the user [24].

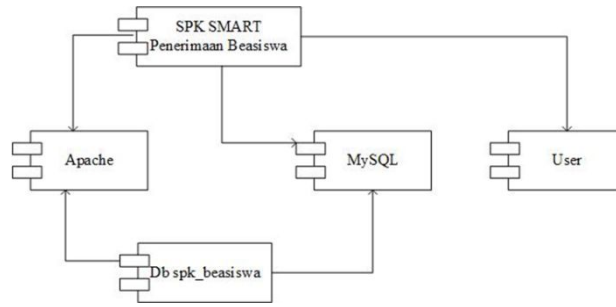


Figure 9. Component Diagram

f) Deployment Diagram

Deployment diagram shows the configuration of components in the application execution process, which consists of a Web server and database server on the SPK SMART Scholarship Acceptance system and the Web browser used by the user [25].

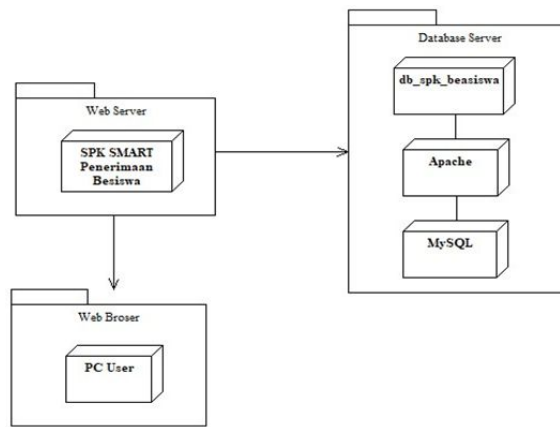


Figure 10. Deployment Diagram

g) User Interface

- **Dashboard Page Views**
This Dashboard page is the starting page when the user successfully logs in.



Figure 11. Dashboard view

- **Criteria Page Views**
This criteria page is a page where users can process data criteria in the form of adding, editing, and deleting criteria data.

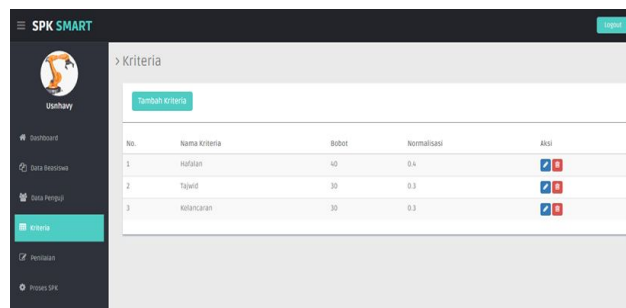


Figure 12. The Criteria Page View

- Rating Page Views

This assessment page is a page where users can process assessment data in the form of adding, editing, and deleting assessment data.

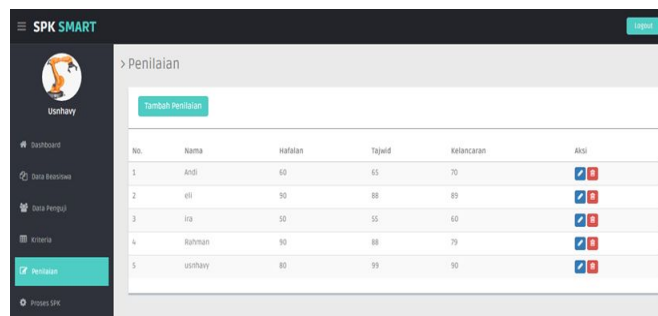


Figure 13. Views of the Assessment Page

- SPK Process Page Display

The SPK Process page is a page where the user can perform the value calculation process using the SMART method automatically, can see the utility assessment data, alternative details, and the final result of the SPK decision.

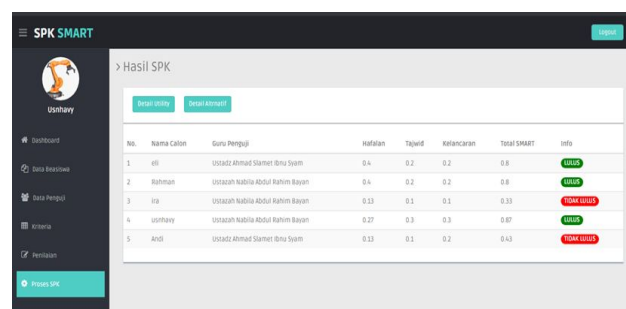


Figure 14. Views of the SPK Process Page

D. Testing (Testing)

In this study the authors tested using black box testing. Black-Box Testing is a software testing technique that focuses on the functional specifications of software..

Table 11. Testing Criteria

Description	Testing Procedure	Input	Expected results	Test result	Conclusion
Testing Criteria	Open the criteria menu Select the Add criteria button Input criteria data Click the save button	Input criteria a Criteria on name & weight (one of the input is empty)	The system will deny save access and display the message "Please fill in this field."	According to expectations	Valid
	Open the criteria menu Select the Add criteria button Input criteria data Click the save button	input criteria a Criteria on name & weight (Everything is filled in correctly)	Success criteria added	According to expectations	Valid
	Select edit to change criteria, or select delete to delete criteria		Modified and deleted	According to expectations	Valid

Table 12. Assessment Testing

Description	Testing Procedure	Input	Expected results	Test result	Conclusion
Assessment Examination	Open the grading menu Select the Add rating button Value input Click the save button	Input the assessment t select the name of the student, memorization, recitation, fluency (one of the input is blank)	The system will deny save access and display the message "Please fill in this field."	According to expectations	Valid

	<ul style="list-style-type: none"> - Open the grading menu - Select the Add rating button - Value input - Click the save button 	<ul style="list-style-type: none"> - Input the assessment, select the name of the student, memorization, recitation, fluency (everything is filled in correctly) 	Value data added successfully	According to expectations	Valid
	<ul style="list-style-type: none"> - Select edit to change the value, or select delete to delete the value 		Value data is changed and deleted	According to expectations	Valid

4. Conclusion

Based on the results of research and discussion of the Scholarship Acceptance Selection Decision Support System at the Tahfiz Center House using the SMART method, it can be concluded that a computerized system for determining scholarship acceptance options is needed. This can facilitate the selection process for prospective scholarship recipients who have registered. In addition, potential recipients can be filtered more transparently. So that the report presented to the leadership of the RTC becomes more valid and objective. Making a web-based decision support system is expected to make it easier for users to use this system. Not fixated on places and devices. So, users can use it anywhere and anytime provided that they are connected to the internet network.

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