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Implementation of the SAW Method in the Decision Support System for Determining Scholarship Recipients at Ibrahimy University

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ABSTRACT

Education is crucial for the progress of a nation. Every student in an educational institution has the right to receive financial assistance through scholarships. Scholarships are awarded to individuals or organizations as financial aid for their achievements. Ibrahimy University is one of the universities that offers scholarship programs. However, the manual process of determining scholarship recipients at Ibrahimy University could be more effective and efficient. To enhance the selection process, a Decision Support System for Scholarship Recipients can assist the university in selecting deserving candidates. This research utilizes the Simple Additive Weighting (SAW) method as an approach to decision-making. The SAW method allows the evaluation of students based on predefined criteria and preference weights, ensuring objective and measurable assessments. Data is collected through direct observation and interviews with Ibrahim University, specifically with the student welfare section. The gathered data is processed and analyzed to serve as a foundation for system development. The findings of this research indicate that this system can enhance the accuracy, efficiency, and effectiveness of the scholarship recipient determination process.

Keywords:

Scholarship Determination; Decision Support System; Simple Additive Weighting (SAW)

INTRODUCTION

Education is a crucial pillar for national progress. Educational institutions bear the most significant responsibility for disseminating knowledge. Consequently, every student in an academic institution has the right to receive financial assistance through scholarships(Poncie & Wibowo, 2020). Scholarship is defined as financial assistance given to students to be used to continue their education. Scholarship is a form of financial support provided to students to pursue and complete higher education based on specific considerations(Mastur et al., 2023). Scholarships recognize individuals or organizations for their work achievements, typically through monetary support or specific access to educational resources(Muqorobin et al., 2019).

Ibrahimy University is one of the universities that organizes scholarship programs, namely rectorate scholarships in the form of Tahfidz Quran scholarships and lower middle-class economic scholarships. Apart from that, at Ibrahim University, there are also scholarships from the government, namely the Smart Indonesia Card (KIP) for College, scholarships from the Regency Government (PEMKAB), and scholarships from the Ministry of Social Affairs of the Republic of Indonesia in the form of Quran tahfidz scholarships, academic achievement improvement scholarships. And non-academic. To get a scholarship, prospective participants must fulfill the requirements of each scholarship that has been determined. Many requirements serve as a reference when selecting scholarship recipients. It takes a long time because the Head of the Student Welfare Subdivision (Kasubag) individually examines the collected requirements files. The mechanism for awarding scholarships is still done manually; namely, the Head of Subdivision (Kasubag) Student Welfare re-checks the data of students who apply for scholarships on Microsoft Excel, and then the

university leadership determines and decides which students will receive KIP scholarships, as well as determining which students will be proposed as recipients of scholarships from the District Government and the Ministry of Religion of the Republic of Indonesia. Therefore, it is necessary to have a system that supports applying and determining scholarship recipients. Using a decision support system can shorten selection time and improve the quality of scholarship decisions.

A decision support system is a computer-based system that generates various decision alternatives to assist management in addressing multiple problems using data and models(Muchariroh, 2019). The decision support system has many methods, including the SAW method. The SAW method is often referred to as weighted summation. The SAW method calculations are more efficient because the calculation time is shorter(Saputra & Maulani, 2023). Several methods are available for decision support systems, including the Simple Additive Weighting (SAW) method, also known as weighted sum. The SAW method offers more efficient calculations, requiring less time(Alamsyah et al., 2021). This method is particularly suitable for evaluating and selecting alternatives based on specific criteria. Implementing the SAW method in determining scholarship recipients at Ibrahimy University is expected to simplify and expedite the data processing for students eligible for scholarships. Based on previous research conducted by Prakoso Aji Sasmito et al. titled "Decision Support System for Scholarship Recipients by Applying the Simple Additive Weighting (SAW) Method" conducted at Tanjungpura University, a decision support system was produced that has been functionally tested and obtained appropriate results and can run without errors. The decision support system created was to select students eligible for the KIP Kuliah scholarship only(Budi, 2022). The difference between that research and the current research is that only one type of scholarship was selected in the previous research. The system users were only administrators and the rector. In contrast, the current researchers developed a decision support system for several types of scholarships at Ibrahim University, with users being administrators and students.

METHOD

Data Collection Methods

The data collection methods used to obtain information in this research are as follows :

a. Observation
   Observation is conducted by directly observing the relevant part, reviewing the system flow in the data collection process, and observing the selection of scholarship recipients at Ibrahim University.
b. Interview
   This method involves the author asking questions to relevant parties to gather information about how the selection process of scholarship recipients at Ibrahimy University is conducted
c. Literature Review
   The author collects the required data by searching and extracting information related to the researched issues from books and the internet.

System Development Method

This system was developed using the waterfall method, which is well-known in software engineering(Amiruddin et al., 2022). The waterfall model method is shown in Figure 1 below.

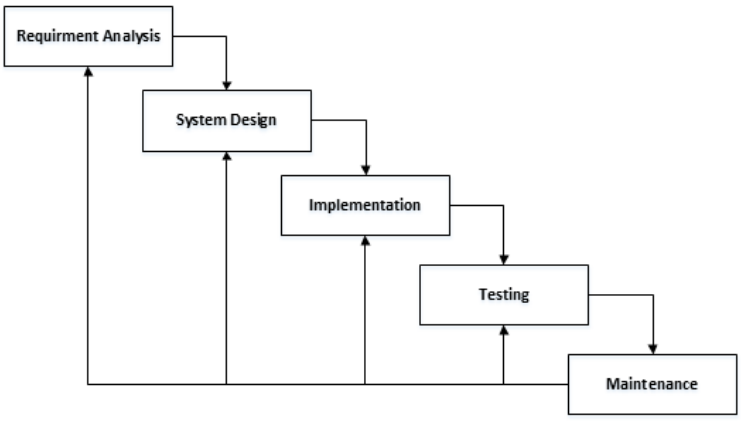

Figure 1. Waterfall Method

The stages in the waterfall method include :

a. System Analysis
   System analysis involves breaking down system requirements into components to determine, evaluate, and propose solutions for problems, opportunities, obstacles, and expected needs.
b. System Design
   System design utilizes the data collected through data analysis to determine the application development workflow. This includes designing the system database using a Context Diagram, Data Flow Diagram, and Entity Relationship Database (ERD).
c. Implementation
   The software design is transformed into a complete program or program unit during implementation.
d. Testing
   After implementation, testing is conducted to identify errors in the system for correction.
e. Maintenance
   The maintenance stage is carried out after the application is deployed and used by users, especially if the system encounters problems that are not detected during testing.

Simple Additive Weighting (SAW) Method

The Simple Additive Weighting (SAW) method is often called weighted calculation. The basic concept of the SAW method is to find the weighted sum of ratings for each alternative for all criteria in the decision-making process. The SAW method involves the normalization process of each decision matrix (X) to a scale that can be compared with all existing alternatives. In the SAW method, there are two main attributes: benefit criteria and cost criteria. The SAW method can provide more accurate and precise assessments because it is based on the criteria values of the predetermined preference weights(Rahmansyah & Lusinia, 2021). The steps in solving the SAW method are as follows :

1. Determining the criteria used, specifically Ci
2. Evaluating the suitability rating of each alternative for each criterion.
3. Construct a decision matrix using criteria Ci and then normalize the matrix using an equation adjusted to the attributes to obtain the normalized matrix R. The equation for normalization is :
   If the attribute provides a benefit, then :

$$r_{ij} = \frac{X_{ij}}{Max\ X_{ij}} \quad (1)$$

Explanation :

r_{ij} = Normalized performance rating
X_{ij} = Attribute value for each criteria
Max X_{ij} = The highest value for each criterion

If the attribute provides a cost, then :

$$r_{ij} = \frac{Min\ X_{ij}}{X_{ij}} \quad (2)$$

Explanation :

r_{ij} = Normalized performance rating
Min X_{ij} = The lowest value for each criterion
X_{ij} = Attribute value for each criteria

4. The final result is obtained through the ranking process. This process involves summing and multiplying the normalized matrix R with the weight vector to determine the highest value, which represents the best alternative (Ai) as the solution. The preference value equation for each alternative (V) is as follows :

$$V_i = \sum_{j=1}^{n} W_j r_{ij} \quad (3)$$

Explanation :

V_i = final value of the alternative
W_j = predetermined weight
R_{ij} = normalization matrix.

RESULTS AND DISCUSSION

System Modeling

The Context Diagram is the highest-level Data Flow Diagram and the least detailed diagram of an information system. It illustrates the movement of data into and out of the system and the entities(Homaidi, 2014). The Context Diagram for the decision support system used to determine scholarship recipients includes administrators and students. Figure 2 below presents an overview of the process flow in the decision support system for determining scholarship recipients using the SAW method at Ibrahim University.

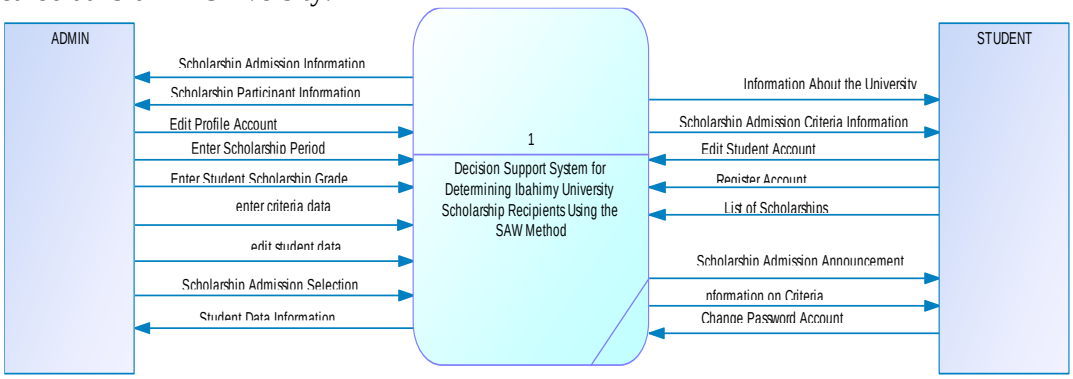

Figure 2. Context Diagram

A Data Flow Diagram (DFD) is a visual model that depicts the flow of data or information within a system(Homaidi, 2014). Its purpose is to demonstrate the overall scope and limitations of the system(Ferdinan et al., 2023). DFDs are also extensively employed in the structured requirements analysis stages(Bani et al., 2023).

a. Level 1 Data Flow Diagram

The Level 1 Data Flow Diagram in the decision support system for determining scholarship recipients explains the details of the flow depicted in the context diagram, including the process of selecting scholarship recipients. Please refer to Figure 3 below for the level 1 data flow diagram.

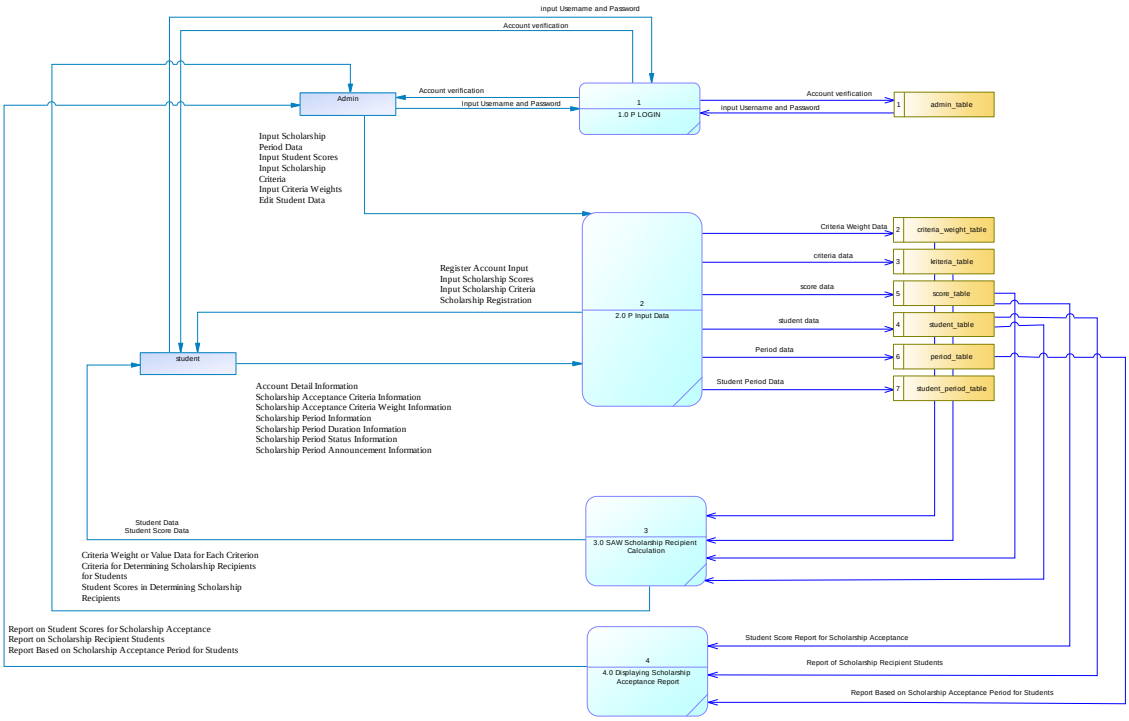

Figure 3. Level 1 Data Flow Diagram

b. Entity Relationship Diagram (ERD)

The Entity Relationship Diagram (ERD) illustrates the relationships between entities. Each entity consists of one or more attributes that represent the conditions of the natural world we are examining(Homaidi, 2014).

1) Conseptual Data Model (CDM)

The conceptual data model (CDM) represents data objects that still need to be defined in a database. It illustrates the overall logical structure of a database. The CDM for the decision support system, which determines scholarship recipients, is shown in Figure 4 below :

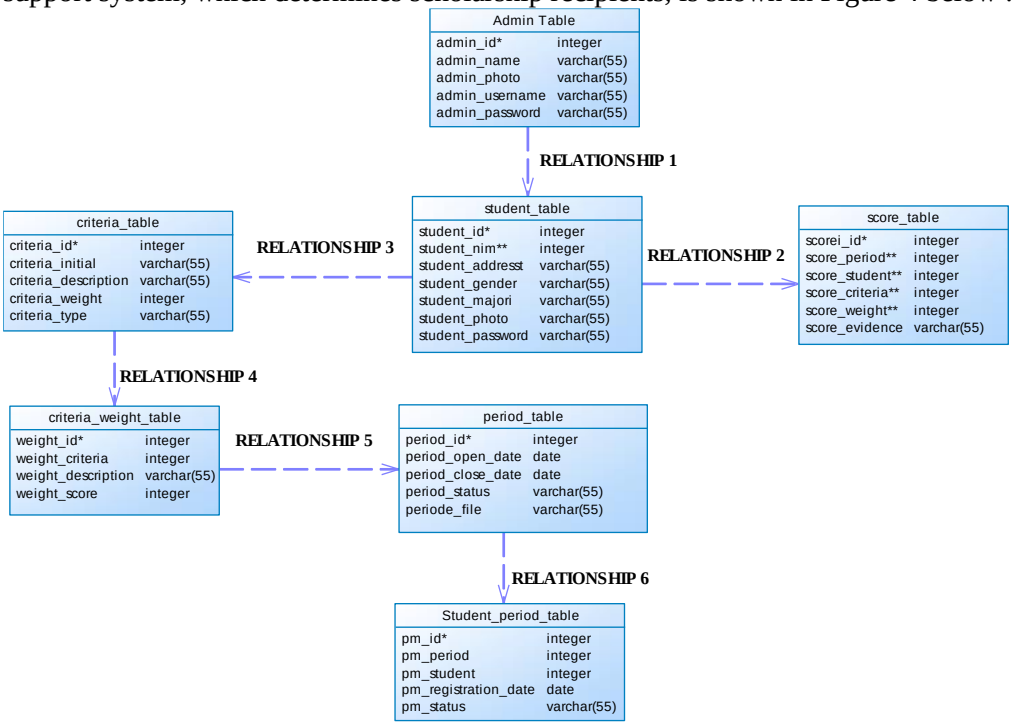

Figure 4. Conseptual Data Model

2) Physical Data Model (PDM)

The Physical Data Model (PDM) illustrates the relationships between entities used as storage locations. The PDM in this system is shown in Figure 5 below :

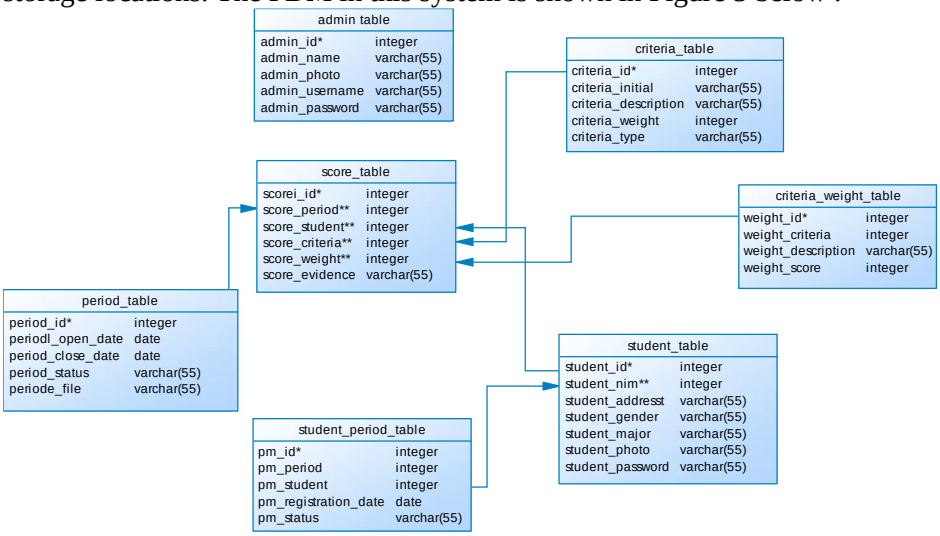

Figure 5. Physical Data Model

System Implementation

1. Main Page

The application's initial interface is a homepage. This homepage provides information about scholarships available at the university and login options for both administrators and students.

Figure 6. Main Page

2. Login Page

The admin login page can be accessed by entering a username and password.

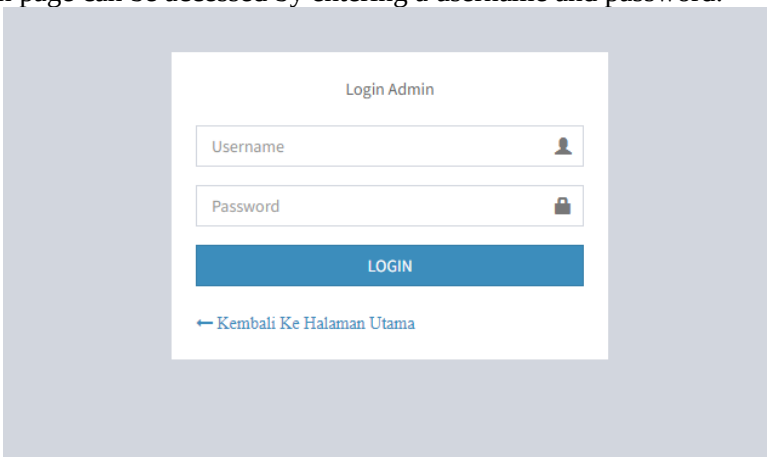

Figure 7. Login Page

3. Admin Dashboard
   The admin dashboard page contains the number of scholarship criteria, the number of students who have applied for scholarships, the number of scholarship registration periods, the admin profile, and scholarship selection.

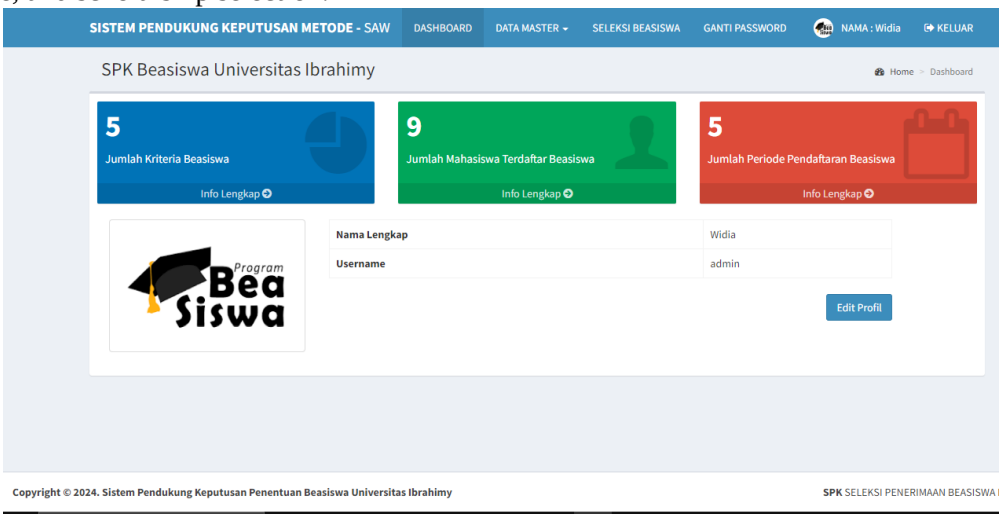

Figure 8. Admin Dashboard

4. Scholarship Period
   This page contains information about the opening and closing times for scholarship registration.

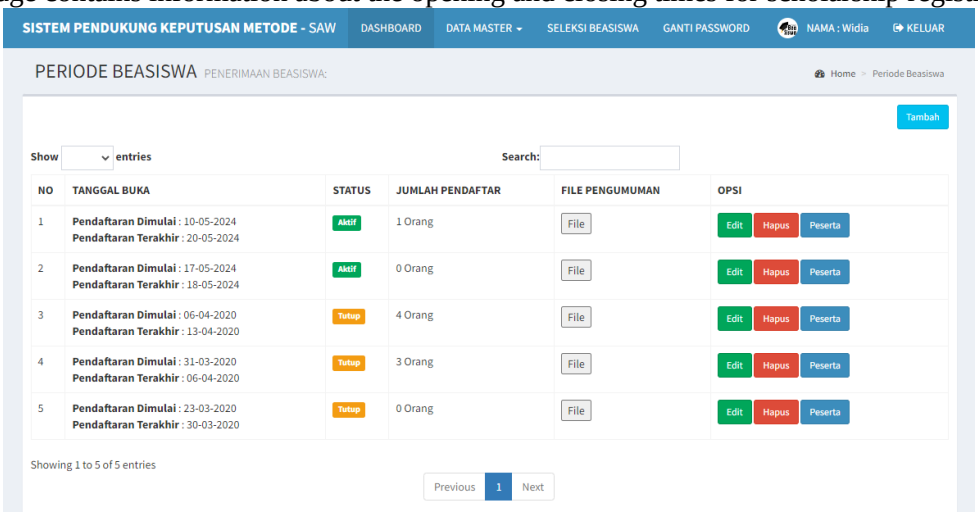

Figure 9. Scholarship Period

5. Criteria Data
   On this page are the criteria used to qualify for scholarships, along with the weighted values of each criterion.

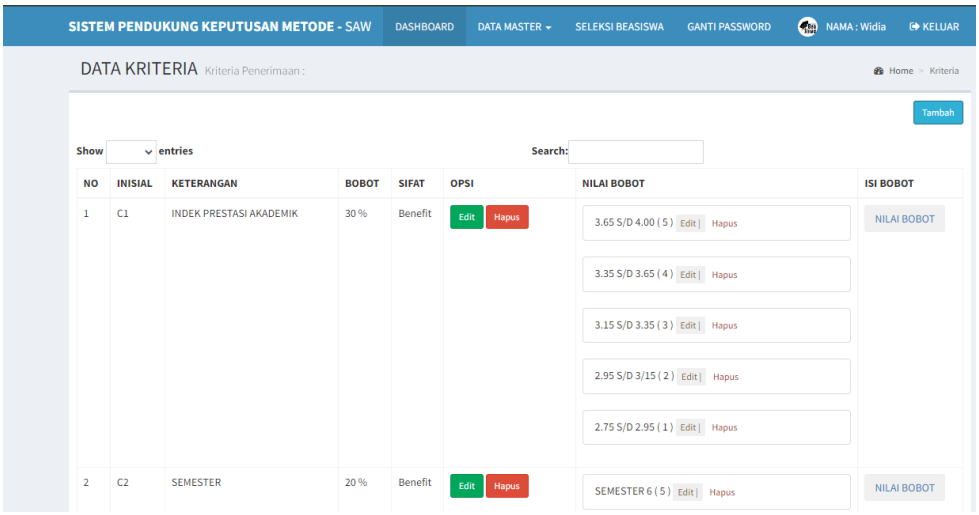

Figure 10. Criteria data

6. Selection Process

This page contains the process of selecting scholarship recipients based on calculation methods using the Simple Additive Weighting (SAW) method. The determination of scholarship recipients can be viewed from the ranking results of the SAW method after determining the quota for those who receive scholarships.

Figure 11. Selection Process

CONCLUSION

Based on the research results, the decision support system for determining scholarship recipients at Ibrahimy University using the SAW method facilitates the Head of the Student Welfare Subdivision compared to the previous application, which used Microsoft Excel. This system is designed to make it easier for the Head of the Student Welfare Subdivision to determine and decide which students are eligible to be proposed for scholarships. Additionally, students can log in themselves to register as scholarship candidates without going through the staff of Ibrahimy University.

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