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Implementation of a Web-Based Student Candidate Selection System Using the Simple Additive Weighting Algorithm

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ABSTRACT

The rapid development of information technology in the era of globalization encourages various sectors to adopt digital solutions, including education. One critical aspect that requires technological optimization is the selection process for new student candidates. Traditional manual selection methods are time-consuming, prone to human error, and often lack transparency and objectivity. To address these challenges, this research develops a web-based selection system for prospective students at XYZ Junior High School using the Simple Additive Weighting (SAW) algorithm. The novelty of this system lies in its ability to combine multiple criteria—Distance, Age, Report Card Score, and Achievement—into a single, quantifiable ranking that is processed automatically. Using sample data of four student candidates (Anton, Rendi, Siska, and Daniel), the system successfully calculated preference values and produced objective rankings, with the highest preference value being 97.78 for Siska, followed by Anton (75.33), Rendi (73.13), and Daniel (68.00). These quantitative results demonstrate the system's accuracy and reliability in multi-criteria decision-making. The development process includes needs analysis, system and interface design, program implementation, and comprehensive evaluation, which incorporates both system testing to validate calculation accuracy and user testing to assess usability and satisfaction. The results confirm that the system significantly accelerates the selection process, improves calculation accuracy, and ensures fairness and transparency in decision-making. Furthermore, this system can serve as a reference model for other schools seeking to implement similar technology to enhance efficiency and quality in the administration of new student admissions.

I. Introduction

In the era of globalization driven by the rapid advancement of information technology, the need to adopt technology across various sectors has become increasingly urgent, including in the field of education. Information technology not only supports the learning process but also plays a crucial role in optimizing various administrative aspects within educational institutions. One critical aspect of school administration is the selection process for new student admissions. Manual selection processes often encounter several challenges, such as time-consuming procedures, potential human errors, and a lack of transparency in assessment. Therefore, the implementation of technology-based systems to automate the student selection process is a highly relevant and necessary solution.

Several previous studies in Indonesia have developed student selection systems using the Simple Additive Weighting (SAW) method to improve the efficiency and transparency of decision-making.[1] implemented SAW for new student admission selection at SMPIT Cordova Samarinda and showed improved accuracy and fairness. [2] designed a SAW-based Decision Support System (DSS) for SMA Negeri 5 Kupang.[3] Applied the same approach at SMK SMTI Bandarlampung.[4][5] demonstrated that SAW-based systems could significantly reduce human error and accelerate the admission process.

However, despite the success of these studies, many still use local or desktop-based applications and lack comprehensive evaluation of system performance and usability. Moreover, methods such as Analytic Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and Weighted Product (WP) are often considered less intuitive and involve more complex calculations, which can be difficult to apply effectively in school environments requiring quick and easily interpretable results. This limitation creates a research gap in developing a decision support system that is both simple and effective.

SMP XYZ, as a progressive educational institution, is committed to continuous innovation and improving the quality of its educational services. In line with this goal, the school recognizes the importance of adopting a more modern, efficient, and transparent student selection system. One method that can be implemented is the Simple Additive Weighting (SAW) algorithm through a web-based application.

The SAW algorithm is a widely used multi-criteria decision-making method due to its simplicity, computational efficiency, and ability to produce transparent and easily verifiable results. Compared to methods such as AHP and TOPSIS, SAW offers easier implementation, faster processing time, and clear normalization and ranking steps, making it highly suitable for educational decision-making contexts. A selection system based on SAW is therefore expected to process student data more quickly and accurately than manual methods, increase transparency in the selection process, and help the school identify the most qualified candidates based on predefined criteria.

II. The Proposed Method/Algorithm

The research method used in the development of the student selection system at SMP XYZ follows several main stages, namely: data collection, analysis, criteria determination, implementation of the SAW method, and drawing results and conclusions[6]. These stages are organized systematically to ensure that the developed system can address the student selection issues that have so far been conducted manually. The diagram below illustrates the flowchart of the research stages.

Fig1. Metode Simple Additive Weighting (SAW)

Figure 1 shows the data collection stage, which begins with observing the ongoing student selection process at SMP XYZ. In addition, interviews were conducted with school officials and a questionnaire was distributed to prospective students and parents to gather information regarding preferences and selection criteria deemed important. The author also reviewed registration documents such as paper forms and Excel data used by the school's administrative staff. The aim of this stage is to gain a comprehensive understanding of the selection process that has been implemented and to identify shortcomings in that process.

After the data is collected, an analysis stage is carried out, where the writer analyzes all the previously collected data, from observations, interviews, and questionnaires. The results of this analysis are used as the basis for the next stage, which is determining the criteria. At this stage, a number of relevant criteria are established to assess prospective students, such as academic scores, selection test results, distance from home, and non-academic achievements. Each criterion is assigned a weight according to its level of importance. The determination of this weight is based on the results of observations and input from the school[7].

The next step is the implementation of the Simple Additive Weighting (SAW) method. The SAW method is used as a decision support algorithm to conduct objective selection of prospective students. In this method, each alternative (prospective student) is evaluated based on predetermined criteria, followed by normalization and final score calculation by multiplying the normalized values by the

weights of each criterion. The results of this calculation are used to provide recommendations for selecting students who best meet the established criteria[8].

The system development process uses the Agile method approach, which is divided into five main stages. The first stage is planning, which involves initial planning that includes meetings to set sprint goals, create a backlog, and identify key tasks. At this stage, a system requirements analysis is also conducted based on the results of data collection. The next stage is design, where the system architecture is designed including data flow diagrams, database structure, user interfaces, and the logic of the SAW method. After the design is completed, the system begins to be developed in the development stage. After development is completed, testing is performed to ensure that all system functionalities work well and accurately. Finally, the system is evaluated in the review stage involving users to obtain feedback that will be used as a basis for system improvement[9].

In the final stage, which is the results and conclusions, it was found that the use of the SAW method in the student selection system provides more objective and efficient results compared to the previously implemented manual selection process. This system facilitates the school's assessment and decision-making in a transparent and structured manner, thereby improving the quality of the selection process at SMP XYZ[10].

III. Method

This study uses the Simple Additive Weighting (SAW) method to develop a Decision Support System (DSS) that assists in complex decision-making, specifically in selecting new student candidates (PPDB). The DSS is designed to provide optimal alternative solutions based on specific criteria. The SAW method was chosen for its simplicity, ease of implementation, and lower time and cost requirements compared to other multi-criteria decision-making methods such as AHP or TOPSIS. According to the journal *"Evaluation of the Strategic Objectives of Sustainable Development Using Fuzzy AHP and SAW Methods"*, the SAW method is effective in handling problems with many complex criteria because it can easily manage different weighted criteria without requiring complicated adjustments.

The core concept of SAW is to calculate the weighted sum of the performance ratings of each alternative across all attributes. This requires a decision matrix (X), which is then normalized so that all alternative values are on a comparable scale. Normalization is performed according to the type of attribute: for *benefit* attributes, the normalized value is *rij=xij/max*; for *cost* attributes, rij=min(xij)/xij. The preference value Vi is obtained by summing the products of normalized values and their corresponding criteria weights. The alternative with the highest preference value is considered the best.

SAW Implementation Steps

1. Determine the Criteria: Define the criteria to be used as the basis for decision-making.
2. Determine Alternative Suitability Ratings: Assess each alternative against each criterion.
3. Create and Normalize the Decision Matrix: Build the decision matrix and normalize the values according to the attribute type.
4. Calculate Preference Values and Final Ranking: Multiply the normalized matrix by the weight vector and determine the best alternative.

Case Study: PPDB

In this PPDB case study, the research uses four criteria:

- Shortest Distance (C1) with a weight of 30
- Oldest Age (C2) with a weight of 25

- High Report Card Score (C3) with a weight of 20
- High Achievement (C4) with a weight of 25

The preference weight vector used is W = {30, 25, 20, 25}. Four student candidates, namely Anton, Rendi, Siska, and Daniel, are used as samples to demonstrate the calculations.

Table 1. Decision Matrix (X)

Candidate	Distance (C1, km)	Age (C2, yrs)	Report Card Score (C3)	Achievement (C4, pts)
Anton	5	15	85	3
Rendi	8	14	90	4
Siska	3	16	80	5
Daniel	6	15	88	2

Notes:

- C1 = Distance → **cost attribute** (the smaller the distance, the better)
- C2, C3, C4 = **benefit attributes** (the larger the value, the better)

Table 2. Normalized Matrix (R)

Candidate	C1 (Distance)	C2 (Age)	C3 (Report Card)	C4 (Achievement)
Anton	0.6	0.9375	0.9444	0.6
Rendi	0.375	0.875	1	0.8
Siska	1	1	0.8889	1
Daniel	0.5	0.9375	0.9778	0.4

The preference value is calculated using the formula:
$Vi=\sum(rij \times wj)V$

Table 3. Preference Value Calculation (Vi)

Candidate	Calculation	Vi
Anton	(0.6*30)+(0.937525)+(0.944420)+(0.625)	75.33
Rendi	(0.37530)+(0.87525)+(120)+(0.825)	73.13
Siska	(130)+(125)+(0.888920)+(125)	97.78
Daniel	(0.530)+(0.937525)+(0.977820)+(0.425)	68.00

Table 4. Final Ranking

Rank	Candidate	Vi
1	Siska	97.78
2	Anton	75.33
3	Rendi	73.13
4	Daniel	68.00

Conclusion: The best student candidate according to the SAW method is **Siska**.

System and User Testing

After DSS implementation, system testing was conducted to validate the SAW calculations, check data input-output processes, and test system performance with large datasets. Subsequently, user testing was carried out to evaluate ease of use, accuracy of ranking results, and user satisfaction with DSS recommendations. The testing results were used to refine the system to ensure it provides accurate, reliable, and user-friendly recommendations.

In conclusion, the SAW method applied in this study is not only effective in multi-criteria decision-making but also thoroughly tested to ensure that the DSS functions optimally and meets the PPDB requirements.

IV. Results and Discussion

The developed Decision Support System (DSS) for PPDB is designed with a user-friendly web interface to facilitate data input, calculation, and display of results. While the interface allows users to enter candidate data, select criteria weights, and view rankings, it is important to note that the evaluation of the system goes beyond its appearance.

The SAW analysis was conducted on four student candidates (Anton, Rendi, Siska, and Daniel) using four criteria: Distance (C1), Age (C2), Report Card Score (C3), and Achievement (C4), with weights of 30, 25, 20, and 25, respectively. After normalizing the decision matrix and calculating preference values, the system successfully generated a ranking of the candidates. The results showed that Siska obtained the highest preference value (Vi = 97.78), followed by Anton (75.33), Rendi (73.13), and Daniel (68.00). This confirms that the system correctly implements the SAW method to determine the optimal candidate based on multiple criteria.

In terms of system evaluation, both system testing and user testing were performed:

1. System Testing: Validated the accuracy of SAW calculations, ensured that inputs and outputs were correctly processed, and checked system stability when handling multiple candidates and large datasets.
2. User Testing: Assessed usability, clarity of ranking results, and overall satisfaction of potential users (school staff). Feedback indicated that the interface is intuitive, and the system provides reliable recommendations consistent with manual calculations.

While the web interface is straightforward and visually clear, the key contribution of this system lies in its ability to perform accurate multi-criteria analysis using SAW and provide actionable decision support for student selection. This section demonstrates that the system is not only functional but also effective in producing validated and meaningful results for the PPDB process.

A. Implementasi User Interface

1. Application Login

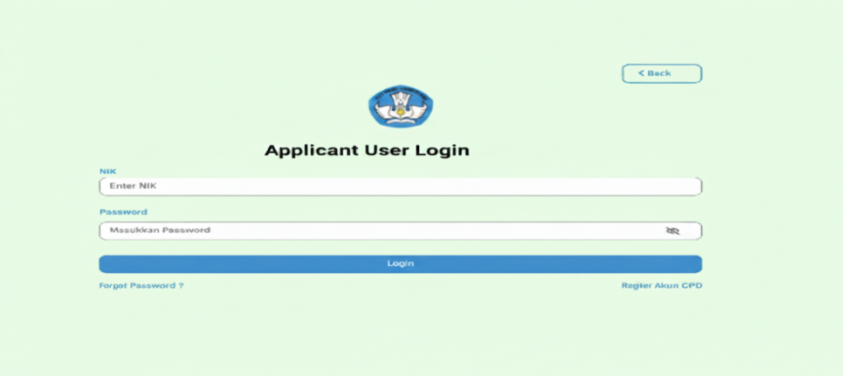

Fig 2. Application Login

Figur 2 explains about the page used by all types of users, namely prospective student users, school operator users, and school principal (headmaster) users. For prospective student users, when logging in, they must select the card option for the user type "Prospective Student", while for school operators and also school principals, they select the card option for the user type "School Operator". Next, prospective students log in using their NIK and password, while school operators and principals log in using their email and password. After that, click the "Login" button to proceed to the dashboard of each user.

2. Register Page

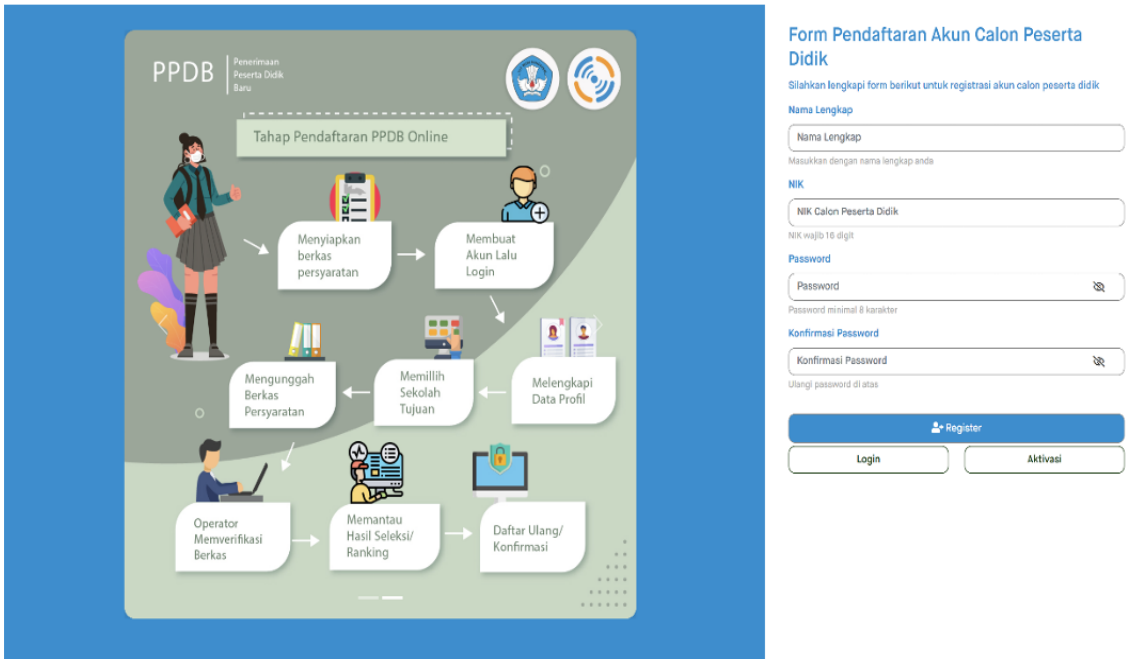

Fig 3. Register Page

Figure 3. This explains about this page to be used by prospective students to register for the creation of a login account. To register the account, prospective students must enter their full name using all capital letters, then their national identity number with 16 digits. After that, they need to input the password, and lastly is the password confirmation which must match the previously entered password for validation to avoid any typing errors in entering the password. For the password, a minimum of 8 characters must be entered freely, so if it is less than 8 characters, the system will reject it and will not allow proceeding with the registration. The password must also be saved by the prospective students to log in later if they have successfully registered. If everything has been entered correctly, the prospective students should then click on the Register button below the password confirmation input.

3. PPDB Opening Page

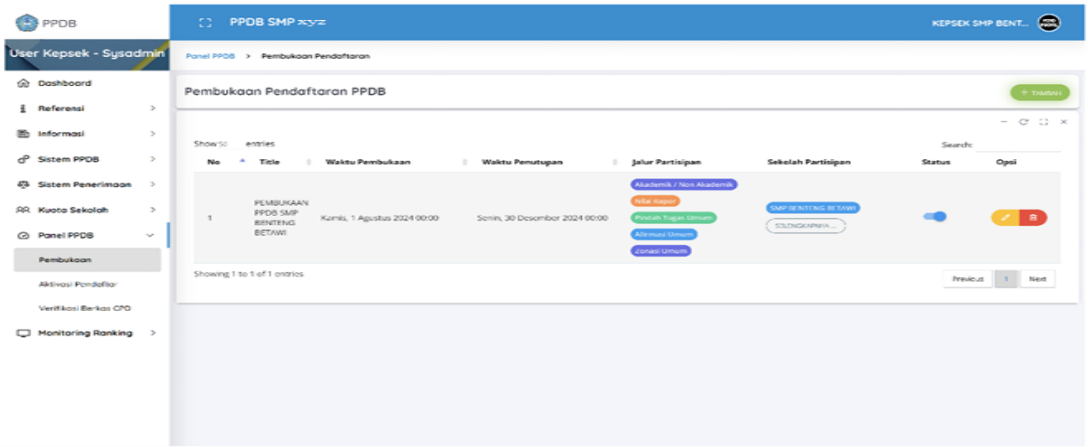

Fig 4. PPDB Opening Page

Figure 4 illustrates the opening page, which is used by schools—represented by the principal—to manage the PPDB registration schedule. On this page, the school can enter the registration tracks to be opened, set the opening and closing times for each track, and add additional notes or information

that need to be conveyed to prospective students. Each registration track can also be set to active or inactive if it is not available. Once all the data has been entered correctly, the principal can save the data, and if successful, the information will be displayed in the registration opening table.

4. Track Quota Page

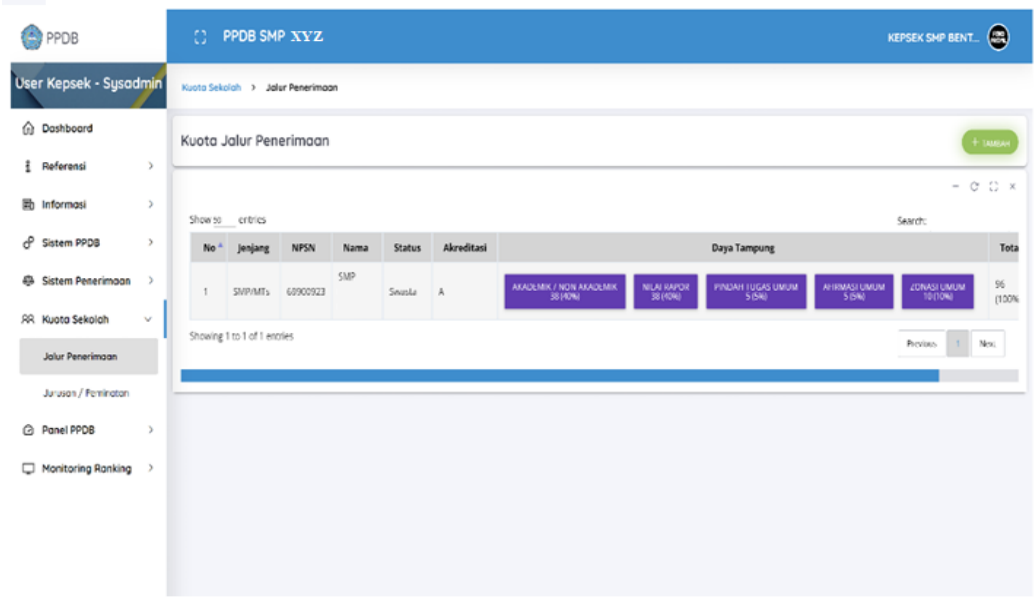

Fig 5. Track Quota Page

Figure 5 illustrates the page used by SMP XYZ to determine the quota for each admission track, such as zoning, affirmation, transfer, academic score, and achievement tracks, based on the school's capacity. The principal, who is responsible for inputting the data, will enter the total capacity available at the school. Then, this capacity will be allocated to each admission track in the form of percentages. The percentages entered by the operator must comply with the regulations outlined in the technical guidelines for PPDB at SMP XYZ

5. PPDB Registration Page

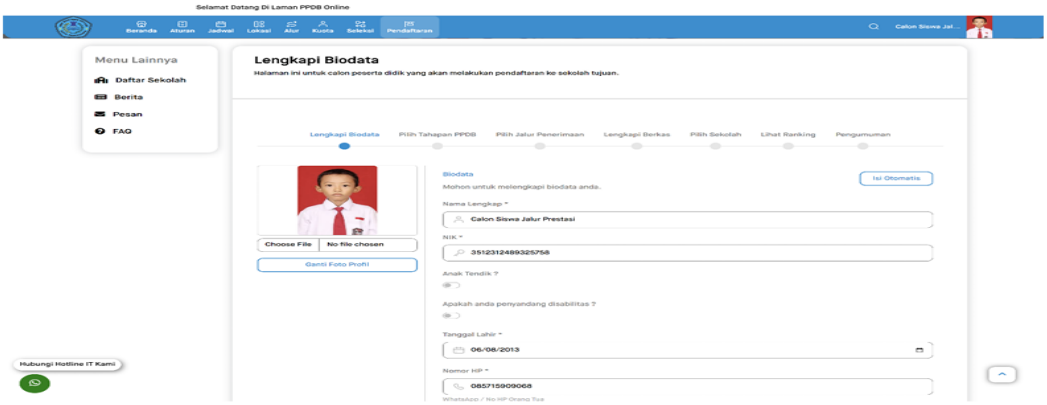

Fig 6. PPDB Registration Page

Figure 6 illustrates the page designed to be used by prospective students to register at SMP XYZ. On this page, several tabs are displayed to guide the registration process, including: Complete Biodata,

Select PPDB Phase, Select Admission Track, Upload Documents, Choose School, View Ranking, and Announcement. In the Complete Biodata tab, prospective students are required to fill out their personal information. In the Select PPDB Phase tab, students must choose the PPDB phase at SMP XYZ that is still open according to the schedule. In the Select Admission Track tab, students choose the admission track that best fits their strategy to be accepted within the available quota. In the Upload Documents tab, students must upload the required documents according to the selected admission track. The Choose School tab is used to select the target school at SMP XYZ. The View Ranking tab allows students to check their ranking position after their documents have been approved by the school operator. To determine how a student attains a specific rank, several assessment standards are applied. Each student's rank is calculated based on total weighted scores derived from predefined standards such as academic performance, achievement, domicile distance, or family background criteria, depending on the admission track chosen. Details regarding these standards, their respective scores, and the calculation method are further explained in the "Method" section.

6. Document Verification Page

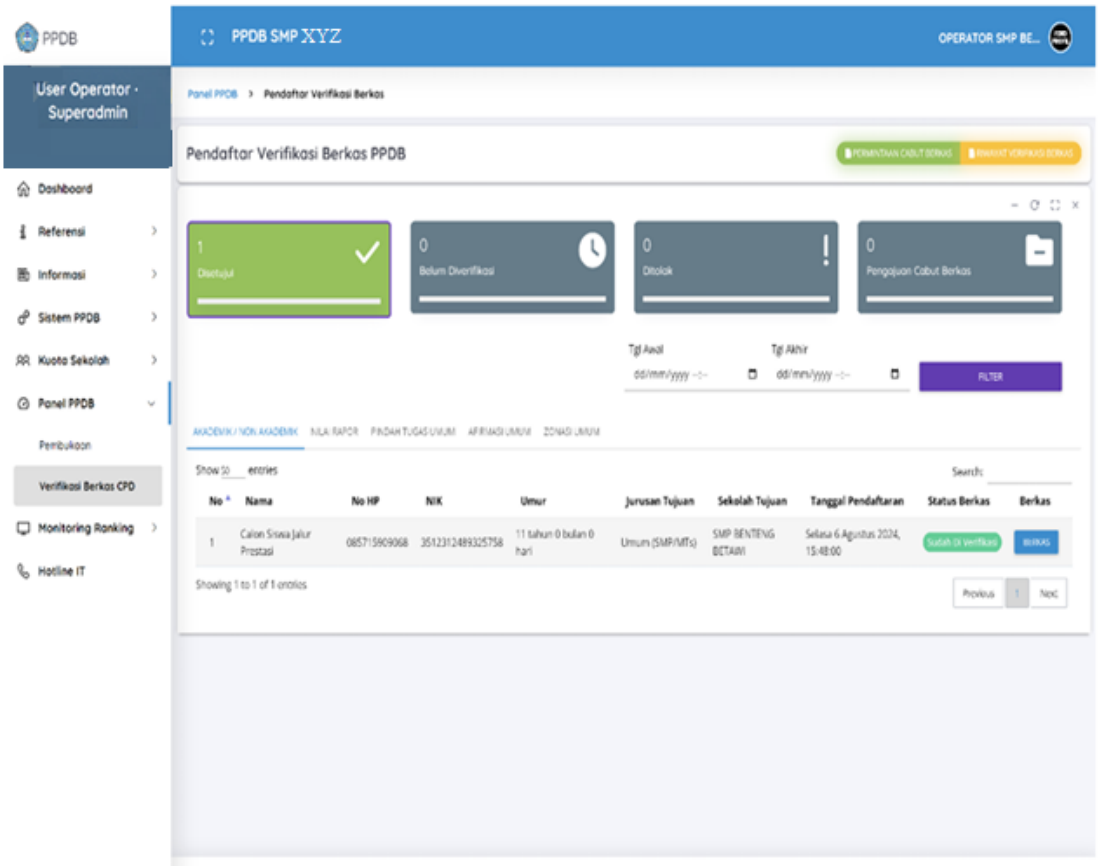

Fig 7. Document Verification Page

Figure 7 explains the page used by SMP XYZ, represented by the school operator, to verify documents for each admission track selected by the applicant (prospective student). On this page, the school operator is required to manually verify the documents to ensure whether the uploaded documents are valid or not. If there are any invalid documents from the prospective student, the school operator can provide a notice or message to inform the student about the errors so that they can re-upload the correct documents. Prospective students who do not pass the document verification stage will not be included in the ranking. Therefore, these students will be declared not accepted.

6. Ranking Monitoring Page

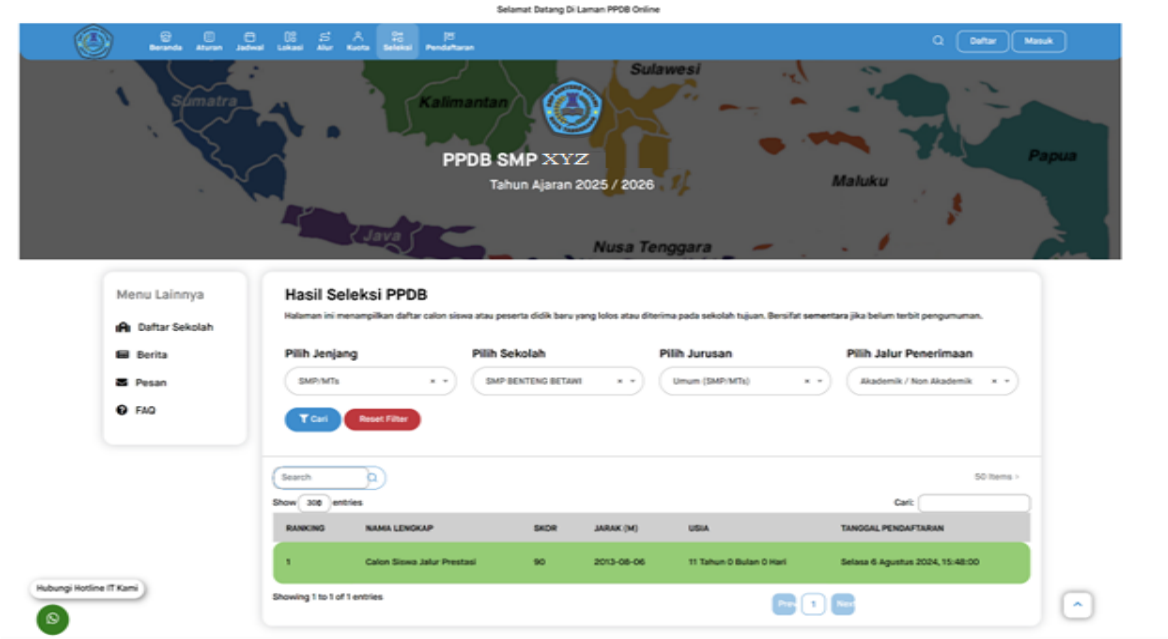

Fig 8. Ranking Monitoring Page

Figure 8 explains the page used by the principal user, school operator user, and prospective students to view the PPDB ranking selection results. This page will appear once the PPDB announcement schedule has opened. If the schedule or time has not yet reached the announcement date, no users can view the ranking selection results. To see the ranking selection data, users must select or filter the education level (SD/SMP), then choose the school name SMP Benteng Betawi, then select the General major, followed by selecting the admission track according to the registration path they want to view, and finally click the filter button at the bottom. If a prospective student is within the quota, a green block mark will appear indicating that the student has passed, whereas a red block mark indicates that the student is outside the quota or has failed the PPDB selection.

7. Re-registration Page

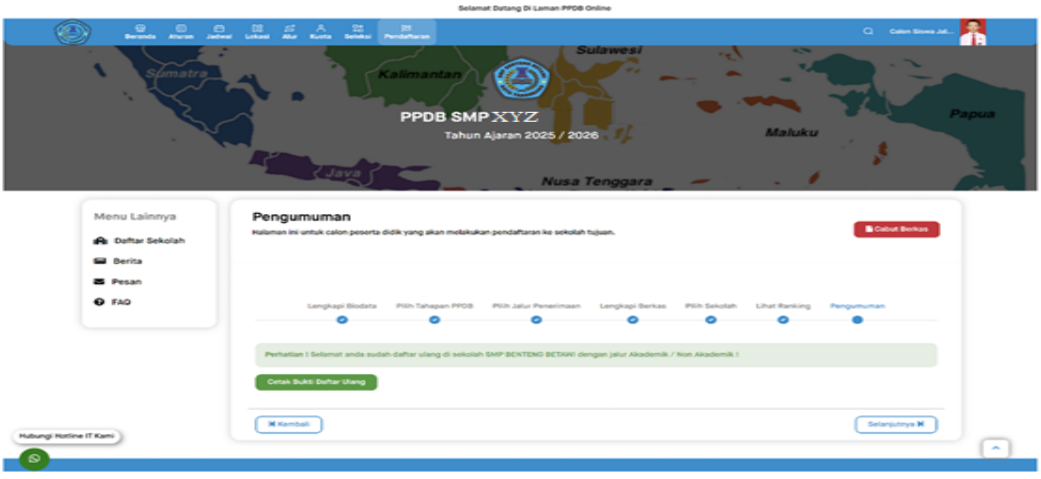

Fig 9. Re-registration Page

Figure 9 explains the page designed to be used by prospective students once they are declared accepted and the schedule for re-registration has arrived. On this menu, if a prospective student does not pass the ranking selection, they will not be able to perform re-registration. For prospective students who will re-register, simply click the re-registration button in green labeled "Re-register."

Once the re-registration is successful, the button will change to "Print Re-registration Proof. “This re-registration serves as information for SMP Benteng Betawi to consider how many prospective students are willing to enroll in the school and how many prospective students withdraw by not re-registering, so they can be replaced by other prospective students with the best failed ranking status.

V. Conclusion

Based on the stages of research carried out on the implementation of the Simple Additive Weighting (SAW) algorithm in the ranking process for new student admissions at SMP XYZ, it can be concluded that a centralized website or system for the school and prospective students has been successfully developed. This system effectively reduces processing time and improves operational efficiency at SMP XYZ.

The SAW-based new student admission selection system was applied to sample data of four student candidates (Anton, Rendi, Siska, and Daniel) with four criteria: Distance (C1), Age (C2), Report Card Score (C3), and Achievement (C4), with respective weights of 30, 25, 20, and 25. After normalizing the decision matrix and calculating preference values, the system successfully generated rankings, showing Siska as the top candidate with a preference value of 97.78, followed by Anton (75.33), Rendi (73.13), and Daniel (68.00). These numerical results confirm that the system can perform accurate multi-criteria decision-making using SAW.

The system has been successfully implemented as a web-based online platform, enabling prospective students and parents to monitor registration status and selection results easily and transparently. In addition, system testing and user testing confirmed the accuracy of calculations, reliability of results, and user satisfaction with the interface.

Suggestions for further development include:

1. Adding more criteria or weighting options to accommodate changes in school admission policies.
2. Integration with school databases to automate data input and minimize manual entry.
3. Mobile-friendly interface to allow easier access via smartphones.
4. Advanced reporting features to provide statistical insights on candidate performance and selection trends.
5. Security improvements to protect sensitive student data during online registration and evaluation.

Overall, this SAW-based web system not only streamlines the new student selection process at SMP XYZ but also enhances transparency, reduces human error, and provides a foundation for future improvements.

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