

Decision Support System (SPK) For Determining Algorithms And Research Methods Using The Simple Additive Weighting (SAW) Method

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Abstract: - In a research, the title of the research is the main thing in a research in the research, and there is a research method/algorithm. Determining the right algorithm in a research title is important with the aim of solving a particular computational problem. The Decision Support System (SPK) that determines the algorithm/method here aims to find the right algorithm/method for a research/journal. The results of this research produce a decision support system (SPK) to find algorithms/methods for a research method obtained from reviews that already exist on the previous website. Decision Support System. This algorithm/method uses the Simple Additive Weighting (SAW) Method, where the results of the highest score ranking are the most appropriate to determine the research title algorithm needed by the researcher.

Key-Words: - decision support system; simple additive weighting; information system; information technology; research methodology; algorithm

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1 Introduction

This research is a process of data collection and analysis; research requires a method. The method itself is the way or procedure taken to achieve a certain goal. Research that has been published, either in the same algorithm or another. Research does not consist of only one algorithm, but there are several algorithms according to the problem and the purpose [1].

Many prospective undergraduates, especially undergraduates from the Informatics Study Program, need references or journal reviews with various methods. To help the search, it is necessary to have a facility to accommodate all research and reviews of the research, so that it is easy to find research with various desired methods. In helping to determine the search for research with certain methods, a Decision Support System (SPK) is needed that is able to provide alternative solutions.

The method used in SPK determines the algorithm/method for research using the simple additive weighting (SAW) method to provide a decision that has efficient results.

In this application, there will be a recommendation feature to make it easier to find algorithms/methods from a journal review that suit what is needed. And in this application, it functions to accommodate various kinds of journals/journal reviews about algorithms/methods by entering journals/journal reviews that have been made, according to personal data that has been registered from the beginning of personal data creation.

Design of Decision Support System (SPK) for Determination of Algorithms/Methods for Research using the waterfall model. The Waterfall model consists of the stages of analysis, design, implementation, and testing. SPK uses 4 types of access rights (roles), namely registration, search,

search, and research algorithm [2]. The system output is presented in the form of algorithm categorization results in AHP and TOPSIS, which can be further considered by the decision-making party. SPK is built on the website so that it can be accessed from various devices, from operating systems that have a browser.

2 Literature and Theory Review

2.1 Literature Review

The research was conducted by [3] with the theme of Bidikmisi Scholarship Acceptance Decision Support System in POLIBAN Using Web-Based SAW Method. This study contains problems about the education fee assistance program for prospective students who are economically disadvantaged and have good academic potential to pursue education in higher education. This system is used to determine alternative recipients of the Bidik Misi Scholarship at the Banjarmasin State Polytechnic.

The research was conducted by [4] Smartphone Selection Decision by Applying the Simple Additive Weighting (SAW) Method. This study contains problems about the development and sales of smartphones in the market that are rampant and compete with all kinds of available features. This is due to the emergence of smartphones with interesting capabilities. This research aims to design a smartphone selection decision support system by applying the Simple Additive Weighting (SAW) method.

Research conducted by [5] with the theme of Implementation of the SAW Method in the Decision Support System for the Selection of the Social Customer Relationship Management Model. In this study, the problem of requiring organizations to set the direction of business strategies by applying technology as needed in various activities, so as to be able to increase large-scale business change through the speed, accuracy, and efficiency of information exchange.

The research conducted by [6] explains that the Simple Additive Weighting (SAW) method is one of the methods used in the decision-making process. The basic concept of the SAW method is to find the

weighted sum of the performance ratings on each alternative on all attributes. The SAW method requires the process of normalizing the decision matrix (X) to a scale that can be compared to all existing alternative ratings. One of the applications of the Simple Additive Weighting (SAW) method is the selection of outstanding employees. The purpose of this study is to select outstanding employees at PT. Indomarco Prismatama Tangerang Branch 1. The results of this study show that the SAW method is appropriate for selecting outstanding employees because it can obtain quality employees in accordance with the expectations of the company and the leadership.

The research was conducted by [7] with the theme of Designing a Decision Support System for Evaluating Employee Achievement Using the SAW, AHP, and TOPSIS Methods. In this study, the problem of managing the data of the best employee candidates to be selected still takes a long time because it does not have standards and still uses a manual system, so that the assessment process is still not transparent, accurate, and reliable. The system is used to recommend the best employees at Bank BJB based on the criteria that have been applied, namely individual performance scores, work unit performance scores, attendance, behavior, achievement of work targets, work periods, education, paper assessments, achievements, and interview results.

The research was conducted by [8] with the theme of Application of the SAW and Fuzzy Methods in the Scholarship Acceptance Decision Support System. This study aims to combine the Fuzzy and SAW methods as the basis of input values. The results obtained in this study are in the form of a ranking and recommendations that will then be made for scholarship recipients.

The research was conducted by [9] with the research title Principal Election Decision Support System Using the SAW and Profile Matching Methods. This research contains problems with the election of school principals. The decision support system (SPK) for the election of the principal uses the Simple Additive Weight (SAW) and Profile Matching methods. SAW is used to determine the criteria to be used as a reference in decision-making:

1. Assign a value to each alternative on each predetermined criterion.
2. Determine the match rating of each alternative at every criterion, then provide a weight value, which is also obtained based on the CRPIS value.
3. Normalize the matrix by calculating the normalized performance rating value:
If the attribute (j) is a benefit, then:
Equation (1)

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

If the attribute (j) is a cost, then

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

In addition to the above research, [10] explained that with SPK, the selection of majors with the SAW method can help in making decisions to evaluate students' majors based on existing data. In addition, with many samples used, the higher the level of validity.

2.2 Decision Support System (SPK)

The Decision Support System (DSS) or Decision Support System (SPK) [11] is a system intended to support managerial decision-makers in semi-structured and structured decision situations. SPK works as an addition or support to decision-makers, it can expand knowledge and possibilities, but does not replace judgment. This system is aimed at decisions that require assessment and decisions that can be processed algorithmically or technically.

The SAW (Simple Additive Weighting) method in DSS uses the following normalization formula:
Equation (2)

$$r_{ij} = \begin{cases} \frac{X_{ij}}{\text{Max}(X_{ij})}, & \text{if } j \text{ is a benefit attribute} \\ \frac{\text{Min}(X_{ij})}{X_{ij}}, & \text{if } j \text{ is a cost attribute} \end{cases}$$

Information:

r_{ij} = normalized performance rating of the A_i alternative on the C_j attribute

Max X_{ij} is the largest value of all the match rating values on each criterion.

Min X_{ij} is the smallest value of all match ratings on each criterion

Benefit attribute = if the largest value in that attribute is the best value

Cost attribute = if the smallest value in that attribute is the best value

After normalization, the preference value for each alternative is determined by summing the results of multiplying the normalized matrix by the weight value using the following formula:

Equation (3)

$$V_i = \sum_{j=1}^n w_j r_{ij}$$

V_i = preference value for each alternative

w_j = weight of each criterion

r_{ij} = normalized performance rating

2.3 Simple Additive Weighting

The Simple Additive Weighting method is a method that is widely used in decision-making and has many attributes. The SAW method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings [12]. In a nutshell, the algorithm of this method is as follows:

V_i = the ranking for each alternative.

n = the number (number) of alternatives.

W_j = the weight value of each criterion.

3 Research Methods

3.1 Research Flow Scheme

In this research, several stages of research were carried out, so that it ran well and was structured. The stages of the research are depicted using diagrams such as Figure 1.

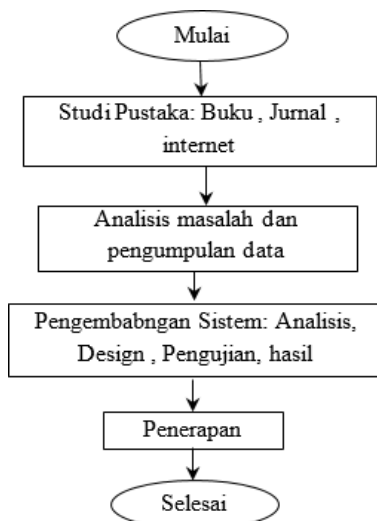


Fig. 1. Research Flow
Source: created by the authors

The research method used to create a Decision Support System for the determination of Algorithms/Methods for Research using the SAW Method starts with a literature study, problem analysis and data collection, system design, and application.

3.2 Data Collection

The research method is the method used by researchers in collecting their research data.

a. Interview

This research uses an interview method by conducting direct interviews with resource persons, namely students who want to conduct research, conducted on September 21, 2021, in order to obtain information on what are the criteria for finding the right method for researchers.

b. Book

The data collection method is carried out by search techniques and data collection through related literature, such as related articles, decision support systems, and SAW algorithms.

3.3 Development Stages

The system development method used is the *waterfall method*. The *waterfall method* is a method that is often used in research[13]. The waterfall model is a process that developers can use for software development. It is called a *waterfall* because the stage-by-stage process must wait for the completion of the previous stage and run consecutively[14]. In general, the stages in the *waterfall* model can be seen in the following figure:

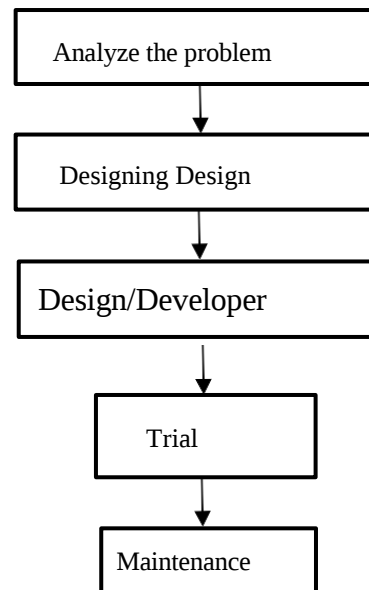


Fig. 2. Waterfall Stages
Source: created by the authors

The following is an explanation of the stages of the *waterfall* as shown in Figure 2:

1. Analyzing the Problem

At this stage in the problem is found, namely whether the software system to be created can help to find algorithms/methods related to the theme/title of the research.

2. System planning

This stage is the design of a system that will create a system for searching for article references using PHP and MySQL programming languages, according to the stages that have been designed.

3. Development

At this stage of development, the design can be made into a software program. The result of this stage is that the computer program must conform to the design that has been designed at the design stage. So the design must be transformed into a form that can be understood by machines, that is, into a programming language through the coding process. This stage is the implementation of the design stage.

4. System Testing

It is a stage of testing that is carried out on a system that has been created.

5. Maintenance

At this stage, it is carried out for the maintenance of the system that has been created, if repairs and changes are needed.

4 Results and Discussion

4.1 Calculation of the SAW Method

Determining the criteria (Ci) that will be the main thing in decision-making, where the criteria have been determined, the criteria are :

- Rating
- Difficulty level
- Many Wearers

Each criterion has a weight value or preference (w) that is different from the assessment as a follower.

Table 1. Criterion

Code	Criteria Name	Attribute	Weight
C1	Rating	Benefit	0,3
C2	Difficulty level	Cost	0,4
C3	Many users	Benefit	0,3

Source: created by the authors

Table 1 shows the sub-criterion weighting, where a sub-criterion variable will be changed into a value weight as follows:

Table 2. Rating Subcriteria

Criterion	Subcriteria	Weighting subcriteria
Rating (C1)	1 Star	20
	2 stars	40
	3 stars	60
	4 stars	80
	5 stars	100

Source: created by the authors

Table 3. Subcriteria of Distress Level

Criterion	Subcriteria	Weighting subcriteria
Difficulty level (C2)	1	20
	2	40
	3	60
	4	80
	5	100

Source: created by the authors

Table 4. Subcriterion of Multiple Users

Criterion	Subcriteria	Weighting subcriteria
Multiple users (C3)	0 – 20%	20
	21 – 40%	40
	41 – 60%	60
	61 – 80%	80
	81 – 100%	100

Source: created by the authors

Table 2, Table 3, and Table 4 determine the match rating of each alternative on each criterion on each criterion.

Table 5. Compatibility Rating

Alternative Names	Rating	Difficulty level	Many users
Review 1	4	4	10
Review 2	5	5	8
Review 3	2	2	6
Review 4	1	1	3
Review 5	3	3	2
Review 6	5	5	5

Source: created by the authors

- Provide a weight value that is also obtained based on the CRPIS value.

Table 6. Sub-criteria Weighting

Alternative Names	Rating	Difficulty level	Many users
Review 1	80	80	100
Review 2	100	100	80
Review 3	40	40	60
Review 4	20	20	20
Review 5	60	60	20
Review 6	100	100	40

Source: created by the authors

Table 5 and Table 6 show the process of calculating the value of each alternative, which is calculated based on the type of criteria that have a benefit or cost value.

4.2 Designing Interface Displays

Table 7. Normalization of The R Matrix

Alternative Names	Rating	Difficulty level	Many users
Review 1	0,8	0,25	1
Review 2	1	0,2	0,8
Review 3	0,4	0,5	0,6
Review 4	0,2	1	0,2
Review 5	0,6	0,33	0,2
Review 6	1	0,2	0,4

Source: created by the authors

Table 7 determines the preference value for each alternative by summing the results of the times between the normalized matrix and the weighted value.

4.2.1 Login Page View

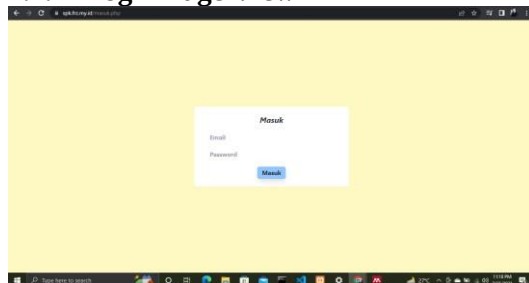


Fig. 3. Login Page

Source: created by the authors

4.2.2 Home Page View

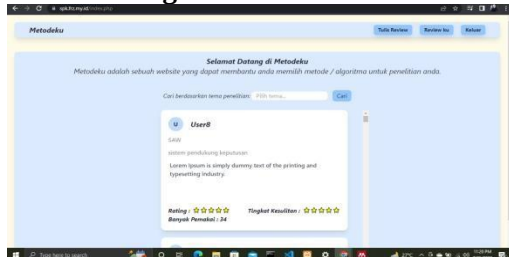


Fig. 4. Home Page

Source: created by the authors

4.2.3 Submit Review Page Display

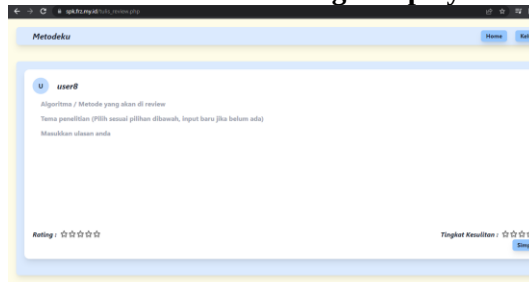


Fig. 5. Submit Page

Source: created by the authors

4.2.4 My Review Page Display

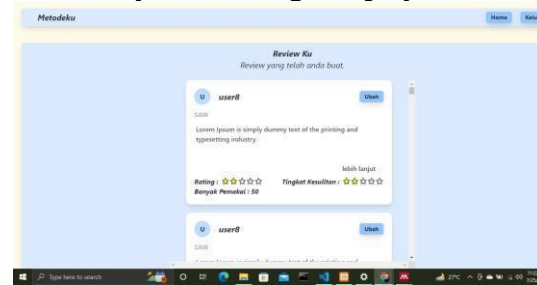


Fig. 6. Review Page

Source: created by the authors

Figure 3, Figure 4, Figure 5, and Figure 6 show the login process until the review process of the page.

5 Conclusions and Suggestions

Based on the results of the research on the decision support system for the determination of the algorithm using the simple additive weighting method, to get the right method/algorithm for a research title [15]. The results of this study are the criteria that the first rank is review 1 with a score of 0.64, and the lowest ranking is review criterion 5 with a score of 0.37. Suggestions for further system development. This system can be developed into an Android-based system with more tools and a more attractive interface.

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