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Implementation of the Simple Additive Weighting Method to Select Tourist Attractions in Jayapura City

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A B S T R A C T

The study explores the implementation of the Simple Additive Weighting (SAW) method for the selection of the best tourist attractions in Jayapura City. The SAW method is used to calculate the tourist attraction rating based on the criteria that have been established. The study aims to provide recommendations for the best tourist attractions for travelers visiting Jayapura City. Data on various tourist attractions and relevant criteria are collected, then analyzed using the SAW method. The results of research show that the SAW method can be effectively used in selecting the best tourist attraction, helping tourists make better and more satisfactory decisions. Target the test results of the system to the test accuracy level based on a 100% blackbox method, which means the system can be implemented.

INTRODUCTION

Today, tourism can be seen as an important part of the growth of large industries that are continuously growing, making this sector a second source of income for the region. The popularity of tourism for local and international tourists is due to the availability of tourist attractions that can relieve the congestion of various activities(Marlina & Hidayati, 2023). Tourism is one of the important economic sectors for a region, including the city of Jayapura, which has a rich natural and cultural potential as well as a variety of natural tourist sites that attract local and international tourists.(Samsudin Arifin Dabamona, 2023)In the digital age and growing information technology, the use of information systems in decision-making is becoming highly relevant. However, the problem faced by the prospective tourists is to determine the choice of the tourist destination they will visit. The prospectives often feel confused and rely on personal thinking because of the information about the destination is incomplete, which can result in less optimal decisions for the tourists. This also increases the likelihood of the prospect tourists change their minds or even do not engage in tourist activities due to the confusion or the length of time required in determining the selection of the destination they are going to visit. The selection of tourist attractions in Jayapura, as in other areas of Indonesia, is governed by a number of regulations and laws aimed at regulating and developing the tourism sector. (Ekaristi et al., 2023). Therefore, it is necessary to build a system that can help prospective tourists in deciding to choose a tourist destination in Jayapura by using the Simple Additive Weighting (SAW) method in the decision support system. A good decision-support system in the selection of tourist destinations can help tourists to determine the tourist place that suits their preferences, as well as enhance their experience during their holiday in the city of Jayapira. The Simple Additives Weighing method is known as the term weighted aggregation method, where the basic concept is to find a weighed aggregate of performance ratings on each alternative in all attributes. Some of the jurisdictional paths to be taken into account include the Tourism Act (No. 10 of 2009) which regulates the main aspects of tourism in Indonesia, including management, development and promotion of travel with the aim of improving the quality of tourist services. In addition, there is the Government of the Republic of Indonesia Regulation No. 50 of 2011 on Tourism which provides more detailed guidelines on tourism development in Indonesia including the management of the tourist sites.

LITERATURE REVIEW

The first study was entitled "Implementation of simple additive weighting (SAW) methods in the selection of beneficiaries of social funds for poor families". The aim is to provide a more efficient and effective solution in the selection of beneficiaries of social funds for poor families, so that the funds can be targeted precisely to those in need.(Vaneza et al., 2021).

The second study is entitled "System of decision support in the selection of student accommodation (cost) with simple additive weighting (SAW) method". The aim is to develop a system that can help students in choosing

accommodation according to their needs and preferences, as well as provide an understanding of the SAW method in the context of the choice of accommodation.(Adriantama & Brianorman, 2021). The third study is entitled "Application of simple additive weighting methods to decision support systems to select the best employees". The aim is to use the technology and methods of SAW calculation to create a system that helps companies to make better decisions in the selection of the best employees, with a focus on the performance and dedication of employees.(Sukaryati & Voutama, n.d.). The fourth study is entitled "Application of simple additive weighting (SAW) methods to decision support systems in internet service package selection". The aim is to develop a decision-making system in the selection of Internet service packages, to help Internet users in choosing the service package that suits their needs.(Febri Triani Sopian et al., 2021). The fifth study, entitled "TOPSIS-based tourist location decision support system in Central Aceh", aims to develop and implement a decision-support system that helps in the location selection of tourist attractions in central Aceh. In this context, the system uses the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method to help tourists in choosing a tourist destination that meets the criteria.(Ridaini, 2022). The sixth study, entitled "System of decision support for tourist attraction selection using the AHP method", aims to develop a system that can help potential tourists in choosing tourist attractions in Purwokerto as well as ensuring that this system is well received by users.(Kollied Anwar et al., 2021). The seventh study, entitled "System supporting the selection of natural tourist attractions in Yogyakarta Special District with the fuzzy Tsukamoto method", aims to develop a system that can help tourists in choosing the nature tourist attraction in the Special District of Yogyakarta more easily and effectively.(OR Putri, 2021). The eighth study, entitled "System of decision support for selection of the best tourist attraction in Sragen district with weighted product method", aims to make application of the decision support system in the selection of Best Tourist Attractions in Sragen district.(Muqorobin & Ma'ruf, 2022). The research uses the weighted product method as a basis for ranking tourist attractions based on significant criteria, such as location, facilities, cost, and security. With this application, the research aims to provide support to the tourism service in decision-making to determine the best tourist attraction.

METHODOLOGY

A. Simple Additive Weigthing Method (SAW)

One method to solve a problem on a decision support system is Simple Additive Weighting (SAW), (Effendi et al., 2021; Pawan et al., 2020). The SAW method is an approach that is able to find the best alternative of a number of available alternatives. (Kaliszewski & Podkopaev, 2016; Pawan et al., 2020; Setiawati et al., 2021), where the alternative meant in this context is the tourist attraction in Jayapura City.Further to calculate the normalized performance can use the formula as in the equation 1.

$$r_{ij} = \begin{cases} \frac{x_{ij}}{Max\, x_{ij}} \; when\; j\; is\; the\; benefit\; attribute \\ \frac{\min x_{ij}}{x_{ij}} when\; j\; is\; cost\; attribute \end{cases} \quad \text{…….. (1)}$$

Description:
rij : normalized performance rating value
xij = : attribute value of each criterion
max xij : maximum value on each criterion
min xij : The smallest value on each criterion

Calculate the value of the preference weight on each alternative using the formula as in equation 2.

$v_i = \sum_{j=1}^{n} w_j r_{ij}$ (2)

Description:
Vi : preference value on each criterion
Wj : the weight value of each criterion
rij : Normalized performance rating

B. Testing methods

Software functionality testing using the blackbox method involves observing execution results through data processed on the designed software. (Raffin et al., 2022; Uminingsih et al., 2022). The blackbox test results can be seen in table 1.

Table 1. Test scenario

No	Test scenario	Expected Results	Description
1	Enter the appropriate username and password	Application leads to the dashboard menu	Valid
2	Adding Alternatives	The system displays the alternatives that are added to the database	Valid
3	CRUD Function	Add, view, update and delete data desired by the user	valid
4	Printing Scale Results	The application successfully displayed and printed the score based on the criteria and weight of the input	Valid

RESEARCH RESULT

Application of the Simple Additive Weighting (SAW) method in the selection of the best tourist attraction using the tourist attractions sample as an

alternative aimed at choosing one of the many attractions or alternatives that will be visited on the basis of previously defined criteria.

1. Criteria

As to the criteria used can be seen in Table 2.

Tabel 2. Kriteria

Criteria Code	Criteria	Weight	Remarks
C1	Distance to sightseeing (A1)	20%	Cost
C2	price ticket (A2)	15%	Cost
C3	The beauty of nature (A3)	25%	Benefit
C4	Facilities (A4)	20%	Benefit
C5	Rating from previous visitors (A5)	20%	Benefit

On table 2 is a list of criteria used as a reference in choosing the best alternative or tourist attraction.

2. Alternative

in the selection of the tourist attraction to be visited use several alternatives like in table 3.

Table 3. Alternative List

No	Alternative Code	Alternative
1	A01	Peak of jayapura city
2	A02	Sand beach 2 holtekamp
3	A03	Tobati mangrove tour
4	A04	Jokowi Hill
5	A05	Base beach g
6	A06	The beach of holtekamp jayapura
7	A07	The mountain of the necklace
8	A08	Mountain teletubies
9	A09	Hamadi Beach
10	A10	Kupang-kursi panjang dok 2
11	A11	The hill of hope
12	A12	Lake love-lake imfote
13	A13	Amai Beach
14	A14	Mount Hawe
15	A15	Nolokla Waterfall
16	A16	Cyclops waterfall
17	A17	Genius blue times
18	A18	Cross Mountain
19	A19	Mandala swimming pool

On table 3 is a list of alternative or tourist attractions used as a sample on the decision support system. Giving the code to each alternative aims to facilitate the calculation. As an example, Jayapura City's alternative summit is given the code A01.

3. Decision Matrix

In table 4 is the matrix of the decision is the value of each alternative on each criterion that has been specified.

Table 4. Decision Matrix Table

Alt	C1	C2	C3	C4	C5
A01	5	20000	10	1	2
A02	10	5000	17	2	3
A03	15	15000	14	1	1
A44	20	20000	8	5	2
A05	25	25000	12	2	3

Description : Alt = Alternative C= Criteria

4. Normalization

Normalization begins with the successfully collected value of each alternative and its criteria, the calculation of the normalization matrix is done as follows: Calculation C1 of A01 – A05 with the Maximum value of C1 is 100 because C1 represents cost:

$$A01 \quad \frac{\min[5,10,15,20,25\}}{5} = \frac{5}{5} = 1$$

$$A02 \quad \frac{\min[5,10,15,20,25\}}{10} = \frac{5}{10} = 0{,}5$$

$$A03 \quad \frac{\min[5,10,15,20,25\}}{15} = \frac{5}{15} = 0{,}33$$

$$A04 \quad \frac{\min[5,10,15,20,25\}}{20} = \frac{5}{20} = 0{,}25$$

$$A05 \quad \frac{\min[5,10,15,20,25\}}{25} = \frac{5}{25} = 0{,}2$$

Calculate C2 from A01 to A05 with the maximum value of C2 being 3 because C2 is cost:

$$A01 \quad \frac{\min[200000,5000,15000,20000,25000\}}{5000} = \frac{5000}{20000} = 0{,}25$$

$$A02 \quad \frac{\min[200000,5000,15000,20000,25000}{3} = \frac{5000}{5000} = 1$$

$$A03 \quad \frac{\min\{200000,5000,15000,20000,25000\}}{2} = \frac{5000}{15000} = 0{,}33$$

$$A04 \quad \frac{\min\{200000,5000,15000,20000,25000\}}{4} = \frac{5000}{20000} = 0{,}25$$

$$A05 \quad \frac{\min\{200000,5000,15000,20000,25000\}}{3} = \frac{5000}{25000} = 0{,}2$$

Calculate C3 from A01 to A05 with the maximum value of C3 being 10 because C3 is a benefit:

$$A01 \ \frac{10}{\max[10,17,14,8,12\}} = \frac{10}{17} = 0{,}58$$

$$A02 \ \frac{17}{\max[10,17,14,8,12\}} = \frac{17}{17} = 1$$

$$A03 \ \frac{14}{\max[10,17,14,8,12\}} = \frac{14}{17} = 0{,}82$$

$$A04 \ \frac{8}{\max[10,17,14,8,12\}} = \frac{8}{17} = 0{,}47$$

$$A05 \ \frac{12}{\max[10,17,14,8,12\}} = \frac{12}{17} = 0{,}70$$

Calculate C4 from A01 – A05 with the maximum value of C4 is 1 because C1 is a benefit:

$$A01 \ \frac{1}{\max[1,2,1,5,2\}} = \frac{1}{5} = 0{,}2$$

$$A02 \ \frac{2}{\max[1,2,1,5,2\}} = \frac{2}{5} = 0{,}4$$

$$A03 \ \frac{1}{\max[1,2,1,5,2\}} = \frac{1}{5} = 0{,}2$$

$$A04 \ \frac{5}{\max[1,2,1,5,2\}} = \frac{5}{5} = 1$$

$$A05 \ \frac{2}{\max[1,2,1,5,2\}} = \frac{2}{5} = 0{,}4$$

Calculate C5 from A01 to A05 with the maximum value of C5 being 2 because C5 is a benefit:

$$A01 \ \frac{2}{\max[2,3,1,2,3\}} = \frac{2}{3} = 0{,}66$$

$$A02\ \frac{3}{\max[2,3,1,2,3\}} = \frac{3}{3} = 1$$

$$A03\ \frac{1}{\max[2,3,1,2,3\}} = \frac{1}{3} = 0{,}33$$

$$A04\ \frac{2}{\max[2,3,1,2,3\}} = \frac{2}{3} = 0{,}66$$

$$A05\ \frac{3}{\max[2,3,1,2,3\}} = \frac{3}{3} = 1$$

Next, the result of normalization is converted into a form of normalisation matrix, the value of preference is determined, and in the final stage, it is multiplied by the weight on each criterion.

$$R = \begin{bmatrix} 1.00 & 0.25 & 0.58 & 0.20 & 0.66 \\ 0.5 & 1.00 & 1.00 & 0.4 & 1.00 \\ 1 & 0.33 & 0.82 & 0.2 & 0.33 \\ 0.25 & 0.25 & 0.47 & 1.00 & 0.66 \\ 0.2 & 0.2 & 0.70 & 0.40 & 1.00 \end{bmatrix}$$

Weight value W = {20,15,25,20,20}

A1 = (1x20)+(0,25x15)+(0,58x25)+(0,20x20)+(0,66x20) = 55,78

A2 = (0.5x20)+(1x15)+(1x25)+(0,4x20)+(1.00x20) = 78

A3 = (1x20)+(0,33x15)+(0,82x25)+(0,2x20)+(0,33x20) = 56,25

A3 = (0,25x25)+(0,25x15)+(0,47x25)+(1x20)+(0,66x20) = 53,84

A3 = (0.2x20)+(0,2x15)+(0,70x25)+(0,40x20)+(1x20) = 52,64

5. User Interface

In the design of the best tourist attraction decision support system, made based on the website and using the PHP programming language as well as MySql as a database, generally the system of decision support consists of several modules namely the dashboard, the tourist object data module, the criteria modulus, alternative modules, calculation modules and user modules. The Dashboard module can be seen in Figure 1.

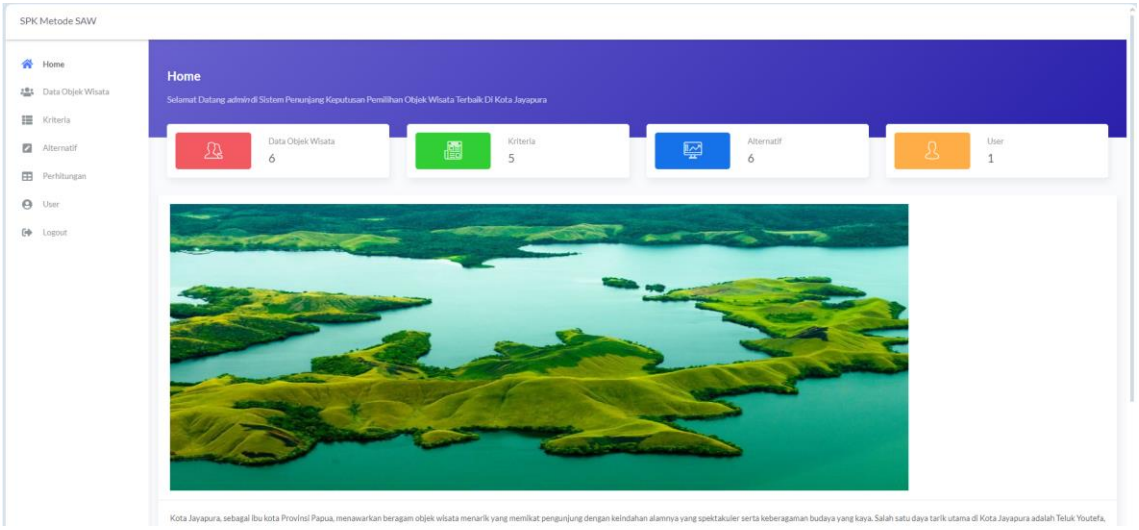


Figure 1. Dashboard Menu

The dashboard menu is an initial view if an administrator accesses the application. Further on the tourist destination data form the user can view, edit and add tourist object data that can be seen in Figure 2.

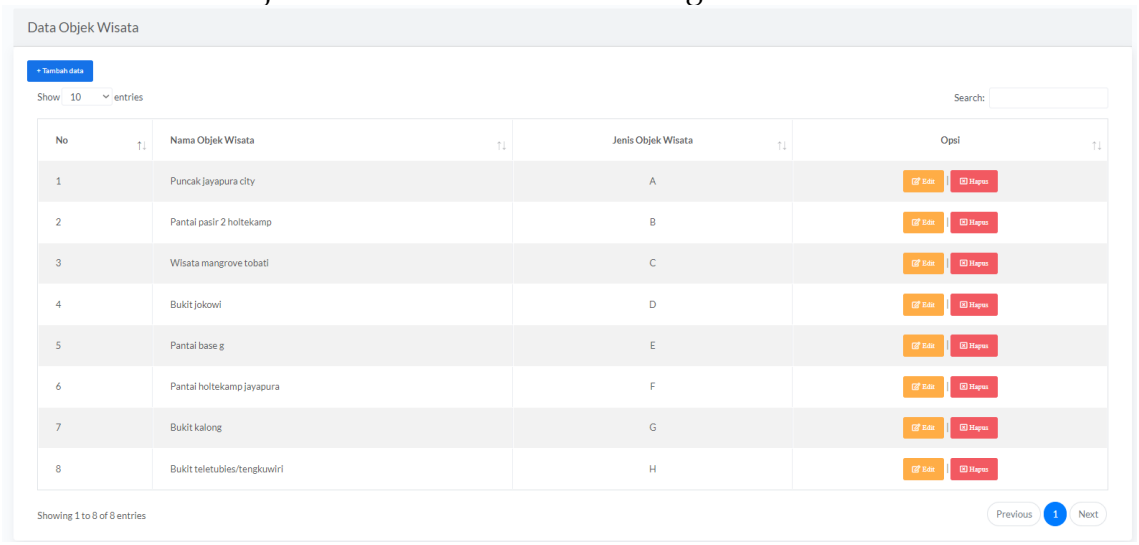


Figure 2. Tourist Object Data

Figure 2 shows the data of some tourist attractions, next on Figure 3 is an alternative data form.

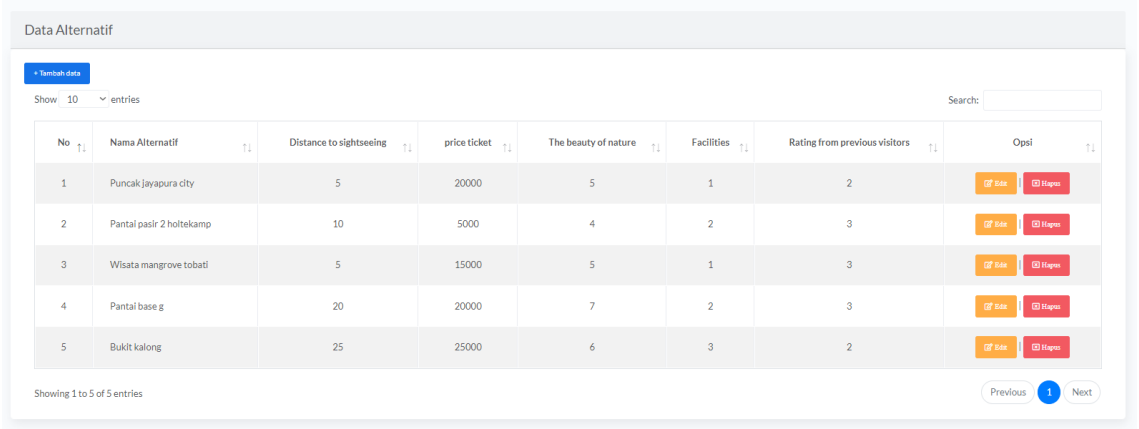
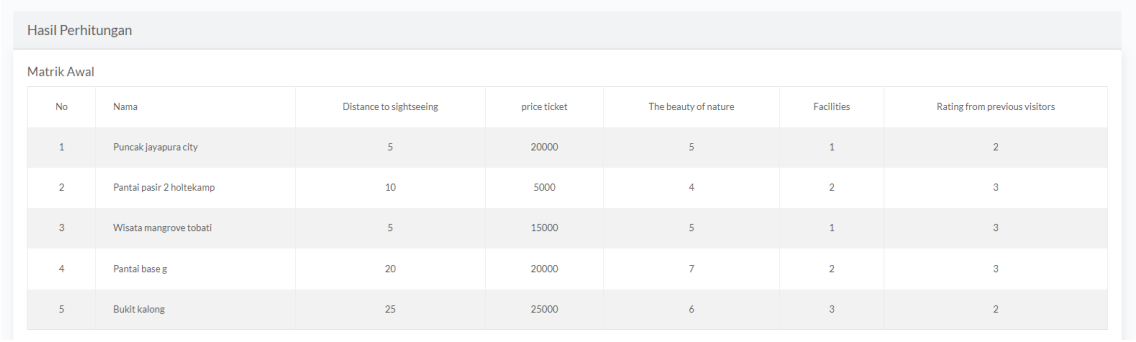


Figure 3. Alternative data forms

On Figure 3 shows some alternatives used as samples in this study, next on Figure 4 is the calculation form.



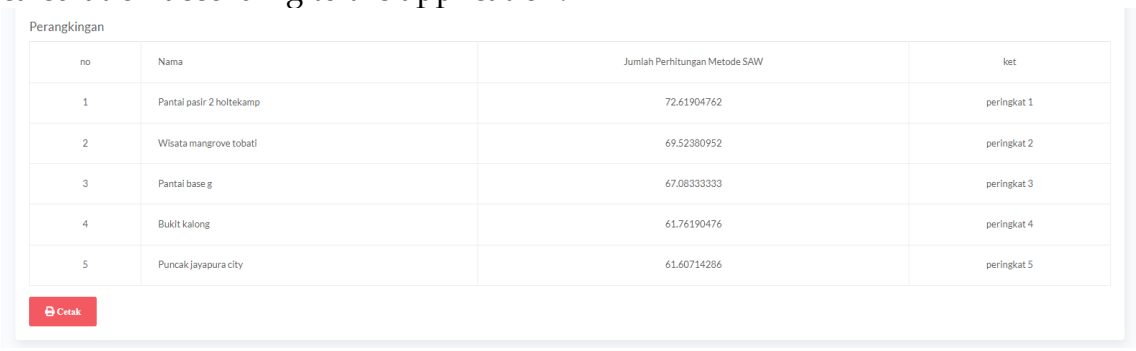
Hasil Perhitungan

Matrik Awal

No	Nama	Distance to sightseeing	price ticket	The beauty of nature	Facilities	Rating from previous visitors
1	Puncak jayapura city	5	20000	5	1	2
2	Pantai pasir 2 holtekamp	10	5000	4	2	3
3	Wisata mangrove tobati	5	15000	5	1	3
4	Pantai base g	20	20000	7	2	3
5	Bukit kalong	25	25000	6	3	2

Figure 4. Calculation Form

Figure 4 shows the calculations made on the system supporting the decision of selection of tourist attractions, next on Figure 5 is the result of the calculation according to the application.



Perangkingan

no	Nama	Jumlah Perhitungan Metode SAW	ket
1	Pantai pasir 2 holtekamp	72.61904762	peringkat 1
2	Wisata mangrove tobati	69.52380952	peringkat 2
3	Pantai base g	67.08333333	peringkat 3
4	Bukit kalong	61.76190476	peringkat 4
5	Puncak jayapura city	61.60714286	peringkat 5

Cetak

Figure 5. Form Scoring Results

CONCLUSIONS AND RECOMMENDATIONS

This research found that the SAW method is perfectly suited to the decision-support system for choosing the tourist attraction. It's because of the recommendations or the results of the SAW, which is a cross-reference, so it's very easy to choose an alternative. Secondly, the functionality test of the blackbox method shows that the system has 100% accuracy and compatibility. This study should make an Android-based system more user-friendly. Furthermore, to improve the accuracy of recommendations, SAW methods can be combined with AHP and TOPSIS.

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