INTERNATIONAL JOURNAL OF APPLIED ARTIFICIAL INTELLIGENCE AND ROBOTICS
E-ISSN: 0000-0000, DOI: 00.000/XXXX.YYYY.II.NNN
Vol. 1 No. 1 2025 pp. 01-10

Decision Support System for Determining Tourist Attractions in Aceh Using the Android-Based Simple Multi-Attribute Rating Technique (SMART)

Nurul Azqiya[1], Mahdi[2*], Muhammad Arhami[3]

[1,2,3] Department of Information Technology and Computers, Lhokseumawe State Polytechnic
Jl. Banda Aceh-Medan Km. 280 Buketrata 24301

[1] nurulazkiya290@gmail.com
[2] mahdi @pnl.ac.id (Coresponding Author)
[3] muhammad.arhami @pnl.ac.id

Article info: Received 02/10/2025, Revised 10/10/2025, Accepted 15/10/2025

This is an open access article under the CC BY-SA license.

Abstract

Choosing a tourist attraction often involves many complex factors that make it difficult for tourists to make tourist choices. Various aspects such as facilities, distance, transportation, entrance fees, parking spaces and road accessibility need to be evaluated systematically to facilitate decision making. This research develops an Android-based Decision Support System (DSS) using the Simple Multi-Attribute Rating Technique (SMART) method. The SMART method is used to assess tourist attractions based on six main criteria and several sub-criteria. The system development process includes planning, user interface design, implementation, and testing. Criterion weights are normalized to produce an objective final score. Functionality testing is carried out using the black-box method to ensure the reliability and effectiveness of the application. The application developed successfully underwent functionality testing with satisfactory results, achieving a pass percentage of 95.5%.

Keywords: Decision Support System, Tourist Attractions, SMART Methodfirst

1. Introduction

A Decision Support System (DSS) is a system designed to provide support to managerial decision-makers in semi-structured decision situations. DSS aims to be a tool for decision-makers to enhance their capabilities without replacing their judgment [1]. A decision support system can be defined as a system intended to support managerial decision-makers in unstructured decision situations [2]. A Decision Support System can be described as a system capable of supporting ad hoc data analysis and decision modeling, being decision-oriented, future-planning oriented, and used on unusual occasions [3].

Tourism encompasses various activities related to travel, has diverse dimensions and disciplines, and emerges as a necessity for individuals and nations [4]. It involves the interaction between tourists, local communities, fellow tourists, the central government, local governments, and businesses, as explained in Article 1, paragraph 4 of Law Number 10 of 2009 concerning Tourism [5]. Based on this law, it is shown that the objectives of tourism involve increasing economic growth, community welfare, poverty alleviation, tackling unemployment, preserving nature and the environment, cultural development, enhancing the nation's image, fostering a love for the homeland, strengthening national identity and unity, and promoting friendship between nations.

The government pays special attention to the infrastructure sector within the tourism domain, as the tourism sector not only functions as a contributor to state foreign exchange but also drives the growth of other economic sectors. Along with the development of civilization, human needs are no longer limited to primary and secondary needs but also involve the need for recreation or holidays, which has become an important aspect in the lives of modern society. For over the last 10 years, tourism has experienced growth and become one of the rapidly

developing economic sectors [6]. Technology can have a significant impact on the tourism industry, both in marketing, tourist experiences, and other related sectors [7].

Aceh Province is located in the westernmost region of Indonesia, on the island of Sumatra. Aceh has various potentials and assets that support national development. This province has the nickname "Veranda of Mecca" because the Islamic religion and culture have a very large influence on society in carrying out daily life [8]. Aceh Province is one of the tourist destinations in Indonesia. Currently, the provincial government is focusing on developing the tourism sector. Opportunities in the tourism sector are considered very promising because Aceh has many attractions in that field. There are many amazing tourist objects in Aceh, ranging from culinary, natural, historical, educational, to cultural tourism that amaze us [9].

The development of the tourism sector in Aceh is becoming increasingly important given its role in improving the local economy and opening up investment opportunities. In their daily activities, most people certainly have the desire to travel to a place, but determining the destination tourist object is actually not easy [10]. One decision that must be made carefully is choosing a tourist object, including in Aceh Province. The current procedure for selecting tourist objects has several problems, namely:

1. Prospective tourists often feel confused, considering the variety of available choices.
2. Selecting the right tourist destination requires careful consideration due to various factors, such as the object itself, distance, cost, public transportation, and available facilities.

Based on these problems, a Decision Support System is needed by applying the SMART method to help prospective tourists determine suitable tourist objects according to specific criteria effectively and efficiently. In this research, the researcher will provide recommendations regarding tourist objects in Aceh. The objective of this research is to facilitate tourists in choosing tourist objects that match their criteria when visiting Aceh. Overall, the implementation of the Decision Support System for selecting tourist objects in Aceh will not only enhance the tourist experience but also support the overall growth and development of the tourism sector.

2. Research Methodology

2.1. SMART Method

The Simple Multi-Attribute Rating Technique (SMART) is a multi-criteria decision-making method developed by Edward in 1977. This technique is based on the theory that each alternative consists of several criteria, each having specific values and weights that reflect its relative importance compared to other criteria. These weights are used to evaluate each alternative to obtain the best possible option.

SMART applies a linear additive model to predict the value of each alternative. It is a flexible decision-making method and is widely used due to its simplicity in responding to the needs of decision-makers and its transparent analytical process, making it highly comprehensible and acceptable to users. The general steps in the formulation of the SMART method are as follows [9].

1. Determine the criteria for alternatives. Identify the criteria used to solve the decision-making problem. Data from decision-makers are essential for defining the criteria to be used.
2. Assign weights to each criterion. Assign weights ranging from 0–100 for each criterion, depending on its level of priority.
3. Normalize the criterion weights. Calculate the normalized weight of each criterion by comparing the criterion weight values using the following equation:

$$w_i \frac{w'i}{\sum mj=1\ Wj} \quad (1)$$

Keterangan:
wi = normalized weight for criterion i
$w'i$ = raw weight of criterion i
wj = aw weight of criterion j, where j = 1,2,3,...,m (number of criteria)

4. Assign values to each alternative for every criterion. Provide a quantitative (numerical) or qualitative (poor, fair, good, very good) score for each alternative.
5. Determine the utility value.Convert each criterion score into a standardized value (utility). The utility value depends on the nature of the criterion and is calculated as follows:

$$Ui\ (ai)\ = \frac{(Cout\ i\ -\ Cmin)}{(Cmax\ -\ Cmin)} \quad (2)$$

Keterangan:
$ui(ai)$ = utility value of criterion i for alternative a_i
$Cmax$ = maximum criterion value
$Cmin$ = minimum criterion value
$Cout\ i$ = observed value of criterion i

6. Calculate the final score. The final score is obtained by multiplying the normalized weight of each criterion by its utility value, then summing all results:

$$u(a_i) = \sum^{m}_{j} = 1\ w_j.\ u_j\ (a_i) = 1, \ldots, \mathrm{n} \quad (3)$$

Keterangan:
$u(ai)$ = total score for alternative i
wj = normalized weight for criterion j
$uj(ai)$ = utility value of criterion j for alternative i

7. Rank the alternatives. Rank the alternatives based on their total utility scores, from highest to lowest. The alternative with the highest final score is considered the best option.

2.2. General Architecture of the Decision Support System (DSS) Using the SMART Method

The Simple Multi-Attribute Rating Technique system architecture is a framework used to evaluate and rank multiple alternatives based on relevant attributes. This process involves analyzing data for each alternative by considering the weights of each attribute to determine the best ranking.

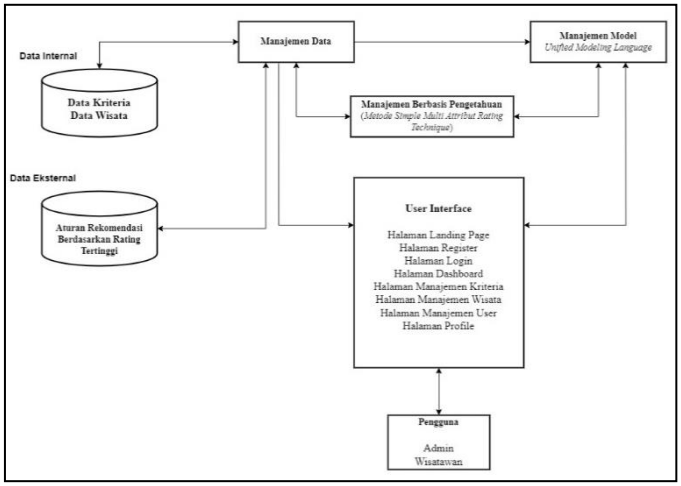

Figure 1. General Architecture of the SMART Method-Based Decision Support System

Fig. 1 above illustrates the system architecture that implements the Simple Multi-Attribute Rating Technique (SMART) to provide tourism destination recommendations. This system consists of several main components: internal data, which includes destination criteria; data management to handle this information; and knowledge-based management, which uses the SMART method to perform evaluations based on attribute weights. The result of this evaluation process yields external data in the form of destination recommendations with the highest ratings. Furthermore, there is a model management component that uses Unified Modeling Language (UML) to document the system flow, as well as a user interface that provides various pages for administrators and tourists to manage data and view recommendations. All these components interact to generate relevant recommendations according to user preferences.

2.3. Data Collection

The data for this research involves the assessment of tourist destinations based on criteria such as Facilities, Distance, Transportation Options, Entrance Fee, Road Accessibility, and Parking Area, with sub-criteria including parking, restrooms, cafeteria, distance in kilometers, type of transport, cost range, and type of road surface. The data was collected through field surveys and information sources available on the internet for use in the Decision Support System (DSS). The criteria and sub-criteria data can be seen in the following tables.

Table 1: Criteria Data

Kriteria	Objek
Fasilitas	30
Jarak Ke Objek Wisata	20
Sarana Transportasi	10
Biaya Masuk	15
Aksebilitas Jalan	20
Lahan Parkir	5

Table 1 above shows the criteria data. There are a total of six criteria overall: Facilities, Distance to Tourist Attraction, Transportation Options, Road Accessibility, and Parking Area. Users utilize several criteria, sub-criteria, and values in determining a tourist destination. The sub-criteria used by the users can be seen in the following Table 2.

Table 2: User Sub-criteria Details

Kriteria	Sukriteria	Nilai
Fasilitas	Parkir, Toilet, Kantin dan Musholla	100
	Parkir, Toilet dan Kantin	75
	Parkir dan Toilet	50
	Toilet	25
Jarak Ke Objek Wisata	<= 2 km	100
	> 2 s/d <= 5 km	75
	> 5 s/d <= 8 km	50
	> 8 km	25
Sarana Transportasi	Bus, Taxi, Labi-Labi, Becak, dan Ojek	100
	Labi - labi	80
	Taxi	60
	Becak	40
	Ojek	20
Biaya Masuk	<= Rp 5.000	100
	> Rp 5.000 <= Rp 30.000	80
	> Rp 30.000 <= Rp 70.000	60
	> Rp 70.000 <= Rp 100.000	40
	> Rp 100.000	20
Aksebilitas Jalan	Beraspal	100
	Beton	75
	Berbatu	50
	Tanah	25
Lahan Parkir	<= 10 m^2	100
	>10 m^2 <= 15 m^2	80
	>15 m^2 <= 20 m^2	60
	>20 m^2 <= 30 m^2	40
	>30 m^2	20

Tabel 2 di atas menunjukkan subkriteria dan nilai yang digunakan dalam penentuan objek wisata berdasarkan enam kriteria utama: Fasilitas, Jarak, Sarana Transportasi, Biaya Masuk, dan Aksebilitas Jalan. Setiap kriteria memiliki subkriteria dengan nilai yang berbeda sesuai dengan kualitas dan kondisi yang ada, yang memudahkan untuk evaluasi.

2.4. Use Case Diagram

A Use Case Diagram is a graphical representation of the interactions between actors (users or other systems) and the system under development. In this system, there are two primary actors: the Administrator and the Tourist. The Administrator is responsible for managing tourist destination data, while the Tourist uses the system to search for and select destinations that match their preferences. The designed Use Case Diagram for this study can be seen in Fig. 2.

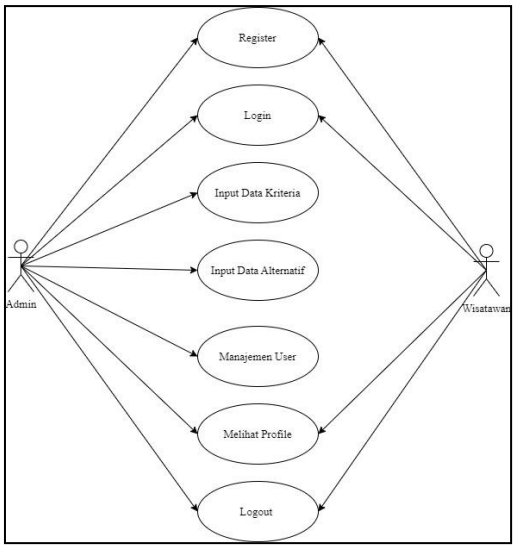

Figure 2. Use Case Diagram

Figure 2 shows the use case diagram involving two actors—the Administrator and the Tourist—within the Decision Support System for selecting tourist destinations in Aceh. The Administrator has broader access privileges, including capabilities such as registration, login, inputting criteria data, inputting alternative data, user management, viewing profiles, and logging out. In contrast, the Tourist is limited to registration, login, profile viewing, and logout functions. The Administrator plays a vital role in managing and maintaining both the criteria and alternative destination data required for the SMART method calculation process.

2.5. Activity Diagram

An Activity Diagram is a type of UML diagram that models the flow of activities or processes in a system. In this system, Activity Diagrams are used to illustrate sequences of activities, offering a visual representation of the processes that occur during system operation. The Activity Diagrams for this system are as follows:

1) Activity Diagram for Criteria Data

The Activity Diagram for Inputting Criteria Data illustrates the process of entering criteria data into the system, as shown in Fig. 3 below.

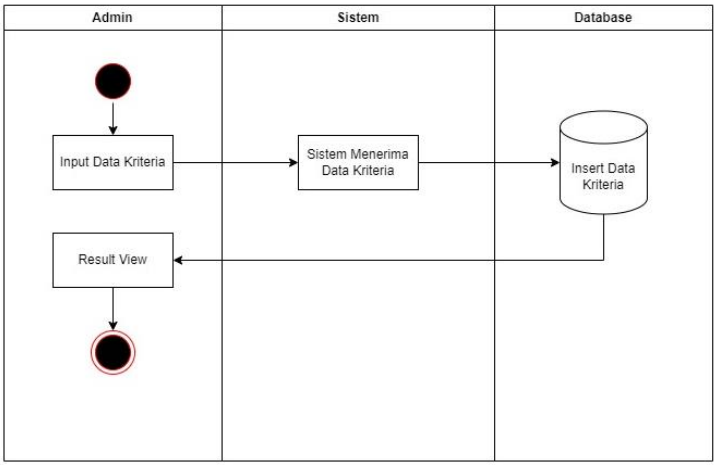

Figure 3. Activity Diagram for Criteria Data

Figure 3, the Activity Diagram for Criteria Data, outlines the process of inputting criteria data into the system. The diagram displays the steps that occur when an administrator inputs the required criteria data into a provided form. Once the criteria data is submitted, the system receives and processes the input. The data is then stored in the database for use in subsequent processes.

2) Activity Diagram for Inputting Alternative Data

The Activity Diagram for Inputting Alternative Data illustrates the process of entering alternative data into the system and the subsequent calculations using the SMART method, as shown in Fig. 4.

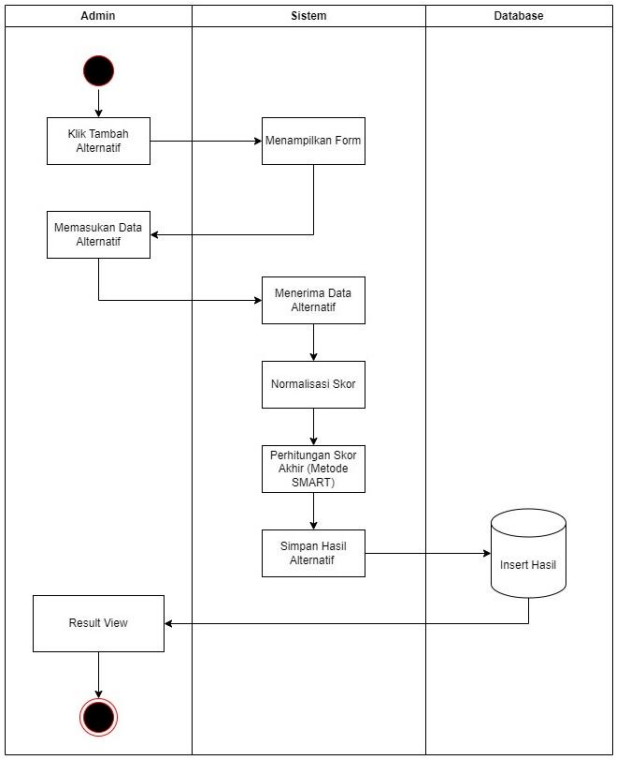

Figure 4. Activity Diagram for Alternative Data

Figure 4, the Activity Diagram for Inputting Alternative Data, describes the process of adding alternative data to the system. The diagram illustrates the steps that occur when an administrator selects the "Add Alternative Data" option. The system then displays a form to be filled out by the administrator with the required alternative data. After the data is submitted, the system receives the input and performs score normalization. Following this, the system conducts calculations using the SMART method to evaluate the alternative data. The results of these calculations are then saved to the database.

2.6. Sequence Diagram

A Sequence Diagram depicts the chronological sequence of actions and messages within a system. Each message signifies communication between objects. This section describes the Sequence Diagram for the Android-based Decision Support System for Determining Tourist Destinations in Aceh Using the Simple Multi-Attribute Rating Technique (SMART) Method.

1) Sequence Diagram for Inputting Criteria Data

The Sequence Diagram for Inputting Criteria Data illustrates the interaction between the user and the system during the process of entering criteria data, which can be seen in Fig. 5.

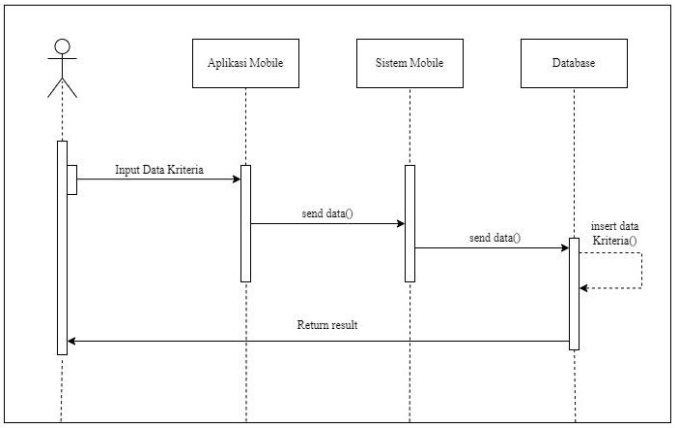

Figure 5. Sequence Diagram for Inputting Criteria Data

Fig. 5 explains the flow of steps for inputting criteria data performed by the user in the application. In this stage,

the user begins by adding data according to specific requirements. Each data element is input by following predetermined formats and rules to ensure consistency and accuracy. This data input process is designed to be user-friendly, minimizing the possibility of errors when entering information. After the data is input, the system sends this data to the server to be processed and stored in the database.

2) Sequence Diagram for Inputting Alternative Data

The Sequence Diagram for Inputting Alternative Data illustrates the interaction between the user and the system during the process of entering alternative data and the subsequent calculation using the SMART method, which can be seen in Fig. 6.

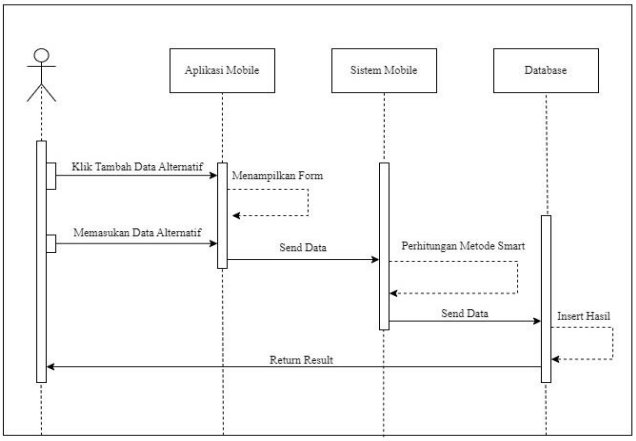

Figure 6. Sequence Diagram for Inputting Alternative Data

Fig. 6 shows the Sequence Diagram for Inputting Alternative Data, which describes the sequence of processes when an administrator inputs alternative data into the system. The diagram depicts the steps that occur, starting from the administrator clicking the "Add Alternative Data" option in the application, which then displays a form to be filled out. After the administrator completes the form with the alternative data, this information is sent to the system for further processing. The system then proceeds to perform an evaluation using the SMART method or the Decision Support System (DSS) calculation. The results of this calculation process are subsequently stored in the database.

3. Result and Discussions

This section discusses the implementation results of the method in the tourism selection decision support system using the SMART Method, as well as the results and testing of the developed system. The research findings and system testing will be explained in more detail as follows.

3.1. Dashboard Page

Equations should be placed at the center of the line and provided consecutively with equation numbers in parentheses flushed to the right margin, as in (1). The use of Microsoft Equation Editor or MathType is preferred.

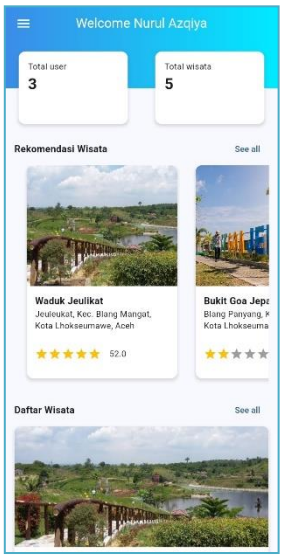

Figure 7. Dashboard Page

3.2. Sidebar Page

The Sidebar Page is a crucial navigation element designed to facilitate access to various features and functions within the application. This page displays main menus including options such as Home, Criteria Management, Tourism Management, User Management, Profile, and Logout. Each option in the sidebar is designed to provide clear and quick navigation to relevant sections of the application. The implementation of the Sidebar Page in this application can be seen in Fig. 8.

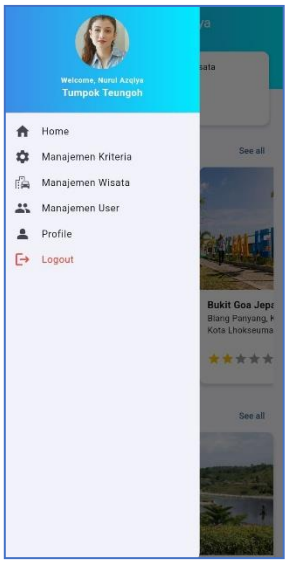

Figure 8. Sidebar Page

3.3. Criteria Management Page

The Criteria Management Page is an important feature in the application designed to manage various assessment parameters. This page allows users to add and manage criterion weights, including public transportation, tourist attractions, distance, cost, and facilities. With its structured design, users can easily manage and adjust the weight of each criterion to meet specific evaluation needs. This page aims to provide flexibility in assessment and ensure all important aspects are well considered. The implementation of the Criteria Management Page in this application can be seen in Fig. 9.

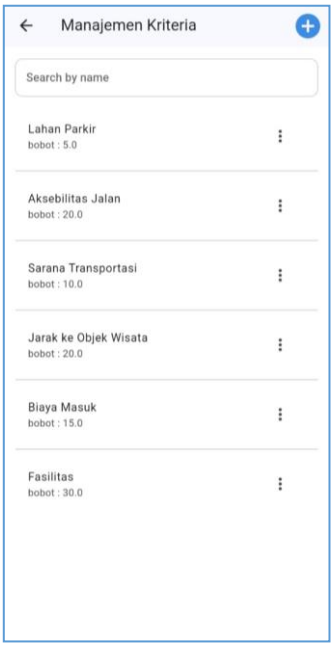

Figure 9. Citeria Management Page

3.4. Alternative Tourism Management Page

The Tourism Management Page is a feature for managing various travel destinations. This page allows users to search and add new tourist destinations, as well as edit and delete existing information. With its intuitive and structured design, users can easily manage tourist destination data, ensuring all relevant and important information is always available and up-to-date. The implementation of the Tourism Management Page in this application can be seen in Fig. 10.

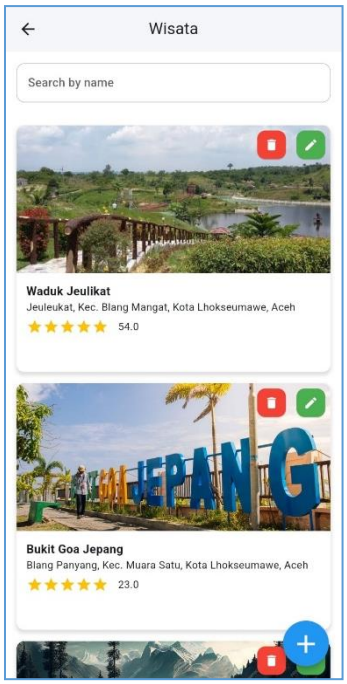

Figure 10. Alternative Tourism Management Page

4. Conclusion

The conclusions derived from the design and testing stages are as follows. The design of the Android-based decision support system was carried out through several main stages. First, system planning included determining the application's objectives, features, and technical specifications. Second, user interface design was conducted with the aim of creating an intuitive display to facilitate user interaction with the system. Third, the implementation and testing process involved developing the application using Android programming languages, followed by functionality testing and system validation.

In the implementation of the Simple Multi-Attribute Rating Technique (SMART) method in the decision support system, criterion determination and normalization were performed, where criterion weights were normalized to reflect each criterion's contribution to the final evaluation. Subsequently, assessment and score calculation were conducted, where alternative tourist destinations were evaluated based on the predetermined criteria, and utility values were calculated to produce final scores. These scores were used to determine the tourist destination with the highest rating as the primary recommendation. Black box testing results showed a system pass percentage of 95.5% and a failure percentage of 4.5%.

REFERENCES

[1] M. Sigala, A. Beer, L. Hodgson, and A. O'Connor, Big Data for Measuring the Impact of Tourism Economic [1] H. A. Septilia, P. Parjito, and S. Styawati, "Sistem pendukung keputusan pemberian dana bantuan menggunakan metode ahp," J. Teknol. Dan Sist. Inf., vol. 1, no. 2, pp. 34–41, 2020.

[2] I. H. Firdaus, G. Abdillah, F. Renaldi, and U. J. A. Y. Jl, "Sistem Pendukung Keputusan Penentuan Karyawan Terbaik Menggunakan Metode Ahp Dan Topsis," Semin. Nas. Teknol. Inf. dan Komun, pp. 2089–9815, 2016.

[3] M. Syafrizal, "Sistem Pendukung Keputusan (Decisin Support System," Data Manaj. dan Teknol. Inf. (DASI, vol. 11, no. 3, p. 77, 2010.

[4] M. Marjulita, A. Jonsa, and I. Ikhsan, "Pengelolaan Objek Wisata Aceh Jaya: Harapan Dan Kenyataan Dalam Peningkatan Ekonomi Masyarakat," Community Pengawas Din. Sos., vol. 5, no. 1, pp. 85–93, 2019.

[5] I. W. P. Jaya and I. G. P. Ariana, "Peran Undang–Undang Nomor 10 Tahun 2009 Tentang Kepariwisataan Dalam Perlindungan Dan Pelestarian Objek Wisata," J. Kertha Negara, vol. 2, no. 5, pp. 1–5, 2014.
[6] A. Muljadi and A. Warman, Kepariwisataan dan Perjalanan. Jakarta: PT Raja Grafindo Persada.
[7] K. M. Sukiakhy and C. V. R. Jummi, "Sistem Pendukung Keputusan Pemilihan Objek Wisata Aceh Menggunakan Metode Simple Additive Weighting (Saw," J-Icon J. Komput. dan Inform., vol. 9, no. 1, pp. 74–80, 2021.
[8] Ikhmah and A. S. Widawati, "Sistem Pendukung Keputusan Pemilihan Tempat Wisata Purworejo menggunakan Metode Saw'," Semin. Nas. Teknol. Inf. dan Multimed., pp. 91–96, 2018.
[9] F. Ramadan, R. W. Sembiring, and A. Wanto, "Utilization of the ELECTRE and SMART Alghorithms for Determining the Head of Administration for the Gunung Maligas Sub-District Office," JOMLAI J. Mach. Learn. Artif. Intell., vol. 2, no. 1, pp. 33–34, 2023.
[10] A. S. Honggowibowo, A. Pujiastuti, and S. Suryanto, "Sistem Pendukung Keputusan Pemilihan Destinasi Wisata Favorit di Propinsi YOGYAKARTA dengan Metode Weighted Product (Wp) Berbasis Android," Compiler, vol. 6, no. 2, 2017.
[11] Programmes: A Process and Quality Criteria Framework for Using Big Data. 2019.