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E-Homestay Application Based on Decision Support System for Optimizing Tourism

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Abstract: Pagar Alam City, a growing tourist destination, has seen a steady increase in visitors each year, driving greater demand for accommodations, especially homestays. Homestays are often favored by tourists due to their affordability compared to hotels. However, many tourists face challenges in selecting a suitable homestay that meets their preferences and needs. To address this issue, this study proposes the development of a web-based Decision Support System (DSS) integrated into the e-homestay platform. The system utilizes the Simple Additive Weighting (SAW) method, chosen for its capability to assess multiple alternatives based on specific weighted criteria, including price, facilities, location, distance, and guest ratings. This approach is designed to assist tourists in identifying the optimal homestay that aligns with their preferences and budget, thereby enhancing their overall travel experience in Pagar Alam City. Moreover, the platform has the potential to promote local economic growth by supporting digital marketing of homestays, while also contributing to sustainable tourism development and management.

Keywords: *e-homestay, Simple Additive Weighting, tourism*

INTRODUCTION

Pagar Alam City is one of the growing tourist destinations, with the vision of becoming an Agrotourism and Tourism City (Rais et al., 2023). According to data from the Pagar Alam City Tourism Office, the city experienced a rise in tourist numbers from 2019 to 2021, totaling 891,822 visitors, and in 2022, it attracted 343,335 tourists (BPS, 2023). The continuous development of Pagar Alam City's tourism sector has led to various challenges, one of which is accommodation (Arif Prambayun, Della Oktaviany, 2022). The increasing number of tourists has resulted in the government being unable to provide sufficient accommodations, creating the need for the involvement of business actors and the community to develop guesthouses or homestays managed by local residents (Rais et al., 2023)(Susanti et al., 2023). Currently, hotel prices in Pagar Alam range between IDR 400,000 – IDR 1,200,000, while guesthouse prices range between IDR 150,000 – IDR 250,000. Due to these relatively high costs, homestays have become the best option for tourists. According to data from 2022, 50% of tourists in Pagar Alam chose homestays, 35% opted for villas and hotels, and 15% chose camping in the tea plantation areas and on Mount Dempo. This trend is also reflected in the increasing number of homestays in Pagar Alam, from 15 homestays in 2021 to 43 in 2022. Homestays can accommodate more than five people, with prices ranging around IDR 250,000.

Homestay owners also struggle with promotion, especially for new homestays, as guests often come based on recommendations from previous customers or through personal connections. Developing a decision support system to help tourists choose the right accommodation is crucial for better vacation planning, avoiding overspending, optimizing time, and enhancing the overall travel experience, which will increase bookings, satisfaction, and word-of-mouth promotion, while also contributing to the sustainable development of the homestay industry (Jiang et al., 2022).

E-homestay is a form of digital-based accommodation development. E-homestay is an application that facilitates tourists in finding information about accommodations and tourist locations while also helping homestay owners promote their properties online (Febriansyah & Muntari, 2021)(Febriansyah; Anggraini, 2024)(Kirana, Chandra; Wahyuningsih, 2021). Through digital marketing using the e-homestay platform, both tourists and business owners can benefit greatly, contributing significantly to the advancement of the tourism industry (Prihatin Dwihantoro ; Dwi Susanti & Fildza, 2023)(Indah et al., 2023)(Ohyver et al., 2020).

In this study, to optimize the performance of the e-homestay platform, a Decision Support System (DSS) is integrated. The DSS utilizes information and communication technology to help tourists select the right homestay (Syam; & Fauzan, 2022). By using a web-based framework, the e-homestay DSS can be accessed from anywhere

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and at any time through a user-friendly web interface (Candea et al., 2023)(Febriansyah; Muntari, 2023). In its implementation within the e-homestay platform, the DSS can assist tourists in selecting the right accommodation and tourist destination, helping them plan an efficient vacation that meets their needs. The DSS is built on multivariable decision-making methods, involving complex mathematical calculations and processing large amounts of data (Cioca & Breaz, 2023). DSS can use algorithms and models to produce optimal decisions based on specific criteria, tailored to the habits and needs of tourists.

One method that can be applied within the DSS is the Simple Additive Weighting (SAW) method, which evaluates alternatives based on predefined criteria values and preference weights. The SAW algorithm can select the best alternative from several options by ranking them after determining the weight of each attribute (Syam; & Fauzan, 2022)(Simanullang & Simorangkir, 2021)(Ahmad & Kurniawan, 2020)(Septani et al., 2019).

When implemented in the e-homestay platform, the SAW algorithm can help tourists choose accommodations and tourist destinations according to their preferences and needs by considering criteria such as price, location, facilities, distance, and ratings (Kabelen, 2020). With the integration of DSS into the e-homestay platform, tourists can more easily plan their budgets and vacation schedules, improving their overall travel experience. This will increase bookings, customer satisfaction, and word-of-mouth promotion, while contributing to the sustainable development of the homestay industry. This digital advancement not only provides significant economic benefits to the local community but also supports sustainable tourism management, preserving the environment and culture while offering a more satisfying experience for visitors.

LITERATURE REVIEW

E-Homestay

E-homestay is a form of digital-based housing development, serving as an application that facilitates tourists in finding accommodation information and tourist destinations, while also enabling homestay owners to promote their properties through the internet (Febriansyah & Muntari, 2021)(Febriansyah; Anggraini, 2024)(Kirana, Chandra; Wahyuningsih, 2021). Digital marketing via the E-homestay platform offers significant benefits for both tourists and business owners, contributing substantially to the advancement of the tourism industry (Prihatin Dwihantoro ; Dwi Susanti & Fildza, 2023)(Indah et al., 2023)(Ohyver et al., 2020). Additionally, E-homestay enhances the image of homestays and increases visitor numbers through reviews reflecting the quality of service provided by guests(Ohyver et al., 2020).

Decision Support System

A Decision Support System (DSS) is a method for organizing information intended to assist in decision-making, typically built to solve a problem or evaluate an opportunity. Some define a DSS as an approach to support the decision-making process, particularly in situations that are less structured and involve unclear criteria. DSS utilizes data, provides a user-friendly interface, and integrates the decision-maker's thought processes, enabling management to perform analytical tasks more effectively. Therefore, a village assessment decision support system is essential to achieving specific goals or objectives (Febriansyah & Muntari, 2021)(Kabelen, 2020).

SAW

The Simple Additive Weighting (SAW) method is also known as a weighted summation method. The basic concept of SAW involves calculating the weighted sum of performance ratings for each alternative across all attributes. SAW evaluates alternatives based on predefined criteria values and preference weights. Additionally, the SAW algorithm can select the best alternative from several options through a ranking process, which is conducted after determining the weight for each attribute. The SAW algorithm enables accurate and quick assessments, as its calculations are fundamentally straightforward and based on the established criteria values and preference weightings (Simanullang & Simorangkir, 2021)(Ahmad & Kurniawan, 2020)(Septani et al., 2019).

METHOD

The research method follows four stages: Analysis, Prediction Calculation, System Design, and Implementation (Andianggara et al., 2019), as shown in Figure 1.

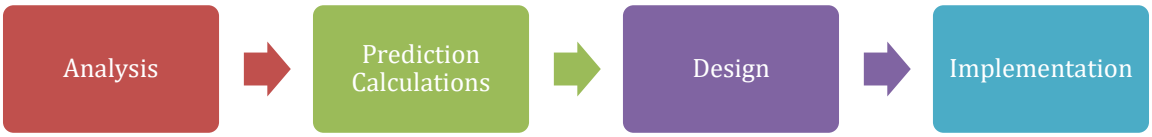

Fig 1. Research Method.

Analysis

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In this stage, the researchers collect data through observation by directly examining the business processes at the Tourism Office and several homestays in Pagar Alam City. This is done to identify the problems, solutions, and system requirements for the intelligent system to be developed. Additionally, interviews are conducted with tourists, homestay owners, and the Tourism Office to determine the factors that can optimize homestay services, enhance the tourist experience, and improve the quality of homestays and tourist locations. These factors will then serve as the criteria for calculations in the Simple Additive Weighting (SAW) algorithm.

Prediction Calculation

The Simple Additive Weighting (SAW) method, also known as the weighted sum method, is used in this stage. The core concept of SAW is to find the weighted sum of performance ratings for each alternative across all attributes (Setiadi et al., 2023)(Ahmad & Kurniawan, 2020). The steps in the SAW method are as follows:

Determine the Criteria (Ci)

The criteria used for selecting homestays include price, location, facilities, distance, and user ratings.

Assign Weights to Each Criterion (W)

Weights are assigned to each criterion based on expert knowledge, reflecting the importance of each criterion in the final decision.

Assign a Suitability Rating for Each Alternative on Each Criterion

The suitability ratings are assigned for each alternative in relation to the criteria and then converted into fuzzy numbers.

Normalize the Decision Matrix

The decision matrix is normalized to calculate the values for each criterion, assuming they are either cost or benefit types.

If j is a benefit attribute:

$$rij = \frac{Xij}{\text{Max Xij}} \quad (1)$$

If j is a cost attribute:

$$rij = \frac{Min\ Xij}{\text{Xij}} \quad (2)$$

Explanation:

R_{ij}	Normalized performance rating
X_{ij}	Attribute value of alternative
Max X_{ij}	Highest value for criterion
Min X_{ij}	Lowest value for criterion
Cost	When a lower value is preferred
Benefit	When a higher value is preferred

Determine Preference Weights (W)

The weighted normalized values are summed, and ranking is performed. The decision is based on the alternative with the highest score.

System Design

The system is designed to meet user requirements, with a web-based platform incorporating DSS features into the e-homestay application. The design includes Context Diagrams and Use Case Diagrams to model the system's functionalities.

Implementation

In this stage, the system is developed as a web-based e-homestay application according to the previous design. The purpose of e-homestay is to help tourists select suitable homestays and tourist destinations. The DSS, using the SAW algorithm, assists in providing the best alternative recommendations for homestays and tourist spots based on the criteria provided by the tourists.

RESULT

This research resulted in the development of a web-based e-homestay platform integrated with a Decision Support System (DSS) using the Simple Additive Weighting (SAW) algorithm. The platform allows tourists to input specific homestay criteria such as distance from key attractions, available facilities, price range, location, and user ratings. Based on the input criteria, the system employs the SAW method to rank and recommend the most suitable homestay options tailored to the tourists' preferences and budget.

The system not only simplifies the homestay selection process for tourists but also provides new marketing opportunities for homestay owners by improving their online visibility. This feature is particularly beneficial for newly established homestays that may struggle to attract visitors. By improving customer service, user experience,

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and word-of-mouth promotion, the platform helps attract a larger number of tourists and enhances their satisfaction. In addition, it supports sustainable tourism growth by driving local economic development and boosting revenues for tourism-related businesses in Pagar Alam City.

Furthermore, the platform promotes efficient tourism management by allowing local authorities to track accommodation trends, ensuring that the city's hospitality sector continues to grow in line with increasing visitor demand. This integration of technology helps Pagar Alam's homestay industry evolve into a key driver of economic empowerment and sustainable tourism development.

DISCUSSIONS

This research has developed the E-homestay application using the SAW method, aimed at helping tourists find the most suitable homestay for their needs. By utilizing a Decision Support System (DSS) with the SAW algorithm, the system can provide optimal alternatives in the form of homestay and tourism recommendations based on the criteria input by tourists. The calculation process using the SAW method follows these steps:

Determining Criteria

At this stage, the criteria related to optimizing homestays, from both the tourist's and the homestay owner's perspectives, are determined. Based on interviews conducted with the Pagar Alam City tourism office, homestay business owners, and several tourists, key criteria influencing tourists' choice of homestays were identified: price, location, facilities, distance, and rating.

In the SAW method, there are two types of criteria: benefit and cost. Benefit criteria are those where an increase in value indicates a better outcome, whereas cost criteria are those where a decrease in value is more favorable. Based on this, the criteria types used in the SAW method are shown in Table 1 below.

Table 1. Criteria Types

Criteria Code	Criteria	Type
C1	Price	Cost
C2	Location (from city center)	Cost
C3	Facilities	Benefit
C4	Distance	Cost

Determining the Weight of Each Criterion

Each of the established criteria is assigned a weight. The sum of these weights equals 1. The weight assigned to each criterion is shown in Table 2 below.

Table 2. Criteria Weights

Criteria Code	Criteria	Weigt
C1	Price	**0.25**
C2	Location (from city center)	**0.20**
C3	Facilities	**0.30**
C4	Distance	**0.25**
C5	Rating	**0.15**
Total		**100% = 1**

This weighting system reflects the relative importance of each criterion in the decision-making process, ensuring that the recommendations provided by the system align with the preferences of the users.

Constructing the Alternative Table

In this experiment, three homestay data points will be evaluated based on the criteria outlined in Table 3 below.

Table 3. Alternative data

Homestay	Price (Rp)	Location (km)	Facilities (1-5)	Distance (km)	Rating (1-5)
A	Rp. 500.000	2	4	5	4.2
B	Rp. 600.000	1	3	3	4.5
C	Rp. 550.000	3	5	2	4.0

Normalization of the Decision Matrix

At this stage, normalization of the criteria for the predetermined alternatives is performed. This normalization is necessary to adjust the values so they can be aligned with the weights using the following normalization formulas:

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- If (j) is a benefit attribute:

$$rij = \frac{Xij}{\text{Max Xij}} \quad (1)$$

- If (j) is a cost attribute:

$$rij = \frac{Min\ Xij}{\text{Xij}} \quad (2)$$

Calculation of Normalized Values

Calculate the Price Criterion (Cost)
Min Xij = Rp. 500.000

$$R_{homestay\ A} = \frac{500.000}{500.000} = 1; \quad R_{homestay\ B} = \frac{500.000}{600.000} = 0.833\ ;\ R_{homestay\ C} = \frac{500.000}{550.000} = 0.909$$

Calculate the Location Criterion (Cost)
Min Xij = Rp. 1 Km

$$R_{homestay\ A} = \frac{1}{2} = 0.5\ ; \quad R_{homestay\ B} = \frac{1}{1} = 1\ ;\ R_{homestay\ C} = \frac{1}{3} = 0.333$$

Calculate the Facilities Criterion (Benefit)
Max Xij = 5

$$R_{homestay\ A} = \frac{4}{5} = 0.8\ ; \quad R_{homestay\ B} = \frac{3}{5} = 0.6\ ;\ R_{homestay\ C} = \frac{5}{5} = 1$$

Calculate the Distance Criterion (Cost)
Min Xij = 2 km

$$R_{homestay\ A} = \frac{2}{5} = 0.4\ ; \quad R_{homestay\ B} = \frac{2}{3} = 0.667\ ;\ R_{homestay\ C} = \frac{2}{2} = 1$$

Calculate the Rating Criterion (Benefit)
Max Xij = 4.5

$$R_{homestay\ A} = \frac{4.2}{4.5} = 0.933\ ; \quad R_{homestay\ B} = \frac{4.5}{4.5} = 1\ ;\ R_{homestay\ C} = \frac{4}{4.5} = 0.889$$

Based on the results of the above normalization calculations, the normalized matrix is structured as shown in Table 4 below.

Table 4. Normalized Matrix

Homestay	Price (Rp)	Location (km)	Facilities (1-5)	Distance (km)	Rating (1-5)
A	1	0.5	0.8	0.4	0.933
B	0.833	1	0.6	0.667	1
C	0.909	0.333	1	1	0.889

Calculation of Preference Values

At this stage, the calculation of preference values involves summing the products of the normalized values and the weights assigned to each criterion. Each normalized value from the normalized matrix is multiplied by its corresponding weight to derive a weighted score for each criterion. Following this, the weighted scores for each homestay are summed to obtain the overall preference value. Finally, the homestays are ranked based on their total preference values, with the highest value indicating the best choice for tourists. This systematic approach ensures that the recommendations provided are data-driven and tailored to the tourists' preferences, thus enhancing their decision-making process in selecting the most suitable homestay.

$$Homestay\ _A = (1 * 0.3) + (0.5 * 0.2) + (0.8 * 0.2) + (0.4 * 0.15) + (0.933 * 0.15) = 0.75995$$
$$Homestay\ _B = (0.833 * 0.3) + (1 * 0.2) + (0.6 * 0.2) + (0.667 * 0.15) + (1 * 0.15) = 0.81995$$
$$Homestay\ _C = (0.909 * 0.3) + (0.333 * 0.2) + (1 * 0.2) + (1 * 0.15) + (0.889 * 0.15) = 0.82265$$

After the calculations are completed, the next step is to rank the alternatives based on the obtained preference values. The results of the ranking can be seen in Table 5 below.

Table 5. Ranking Results

Homestay	Price (Rp)	Location (km)	Facilities (1-5)	Distance (km)	Rating (1-5)	Final Result

*name of corresponding author

A	1	0.5	0.8	0.4	0.933	0.75995
B	0.833	1	0.6	0.667	1	0.81995
C	0.909	0.333	1	1	0.889	0.82265

Based on the results of the preference value calculations, the highest score represents the best alternative. The highest-rated option is Homestay C, with a final score of 0.82265, making Homestay C the recommended choice.

CONCLUSION

The findings of this study indicate that the E-homestay platform effectively supports travelers in selecting suitable homestays in the city of Pagar Alam. By applying the Simple Additive Weighting (SAW) method, the system successfully identifies optimal homestay options based on five key criteria: price, proximity to the city center, facilities, distance to tourist attractions, and rating. Preference score calculations reveal that SAW assigns the highest scores to homestays offering comprehensive amenities, competitive prices, and strategic locations. For instance, the homestay with the top preference ranking achieved a score of 0.82, indicating a high alignment with user preferences according to the defined criteria.

Although the SAW method's straightforward process yields an accuracy rate of 82% in matching recommendations to user needs based on test data, this accuracy can still be improved. Future research is encouraged to explore alternative methods such as the Analytic Hierarchy Process (AHP) or Weighted Product (WP) to achieve more accurate and consistent outcomes. Comparing these approaches is expected to reveal which method offers the best decision-making outcomes for homestay selection, providing deeper insights for system developers to enhance user experience.

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