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Web Based Tour Package Selection Recommendation Information System Using Algorithmscontent Based Filtering

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ABSTRACT

Advances in information technology have facilitated easier access to information in various fields, including tourism. One of the challenges faced by tourists is choosing a tour package that suits their preferences and needs amidst the many available options. This research aims to design and build aWeb-Based Tour Package Selection Recommendation Information Systemusing algorithmsContent-Based FilteringThis method works by matching user profiles based on their preferences with descriptions and attributes of available tour packages. The system was developed using the PHP programming language and MySQL database, and implemented on a web platform for widespread access. Test results show that the system is capable of providing tour package recommendations relevant to user preferences, thus facilitating quick and accurate decision-making. This system is expected to improve the user experience in selecting tour packages and make them more satisfying.

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1. Introduction

The rapid development of information technology has driven digital transformation across various sectors, including the tourism industry. Digitalization has enabled tourism services to become more efficient, interactive, and personalized. Users can now easily access a variety of tourism information through digital devices, search for destinations, book tickets, and even choose tour packages online. This has fueled the need for systems that not only present information but also provide relevant recommendations tailored to user preferences [1][2].

On the other hand, the development of information and communication technology, especially the internet, has opened up new opportunities in providing digital tourism information and transaction services [3]. Tourism itself is a leading sector that contributes significantly to regional and national income. Indonesia, with its natural and cultural wealth, offers a variety of attractive tourist destinations. One region that has great potential for tourism development is North Sumatra and its surroundings. This region is known for its natural beauty such as Lake Toba and Samosir Island, as well as other exotic destinations such as Sibolga, Kalimantan, Mursala Island, Sabang, Banda Aceh, Banyak Island, Singkil, Padang, and Nias. This potential is utilized by travel agents such as Trip Nikmat Sumut, which provides various tour packages to explore these destinations [4].

One travel agency active in this field is Trip Nikmat Sumut, which offers various tour packages to prime destinations in the Sumatra region. Trip Nikmat Sumut caters to various types of tourism, including

nature, culture, history, religion, and adventure, with flexible services tailored to customer needs. However, in practice, prospective tourists often experience difficulty in selecting the tour package that best suits their preferences, interests, or budget. This is due to the large number of available options and the lack of a system capable of providing personalized and accurate recommendations.

This problem highlights the need for a recommendation information system that can assist users in choosing tour packages based on their preferences. To address this issue, one suitable method is the Content-Based Filtering algorithm. This algorithm works by analyzing the characteristics or attributes of each tour package, such as destination, duration, price, tour type, and facilities, and then matching them with user data or preferences. Content-Based Filtering excels in providing specific recommendations tailored to user interests, especially when user interaction data is limited.

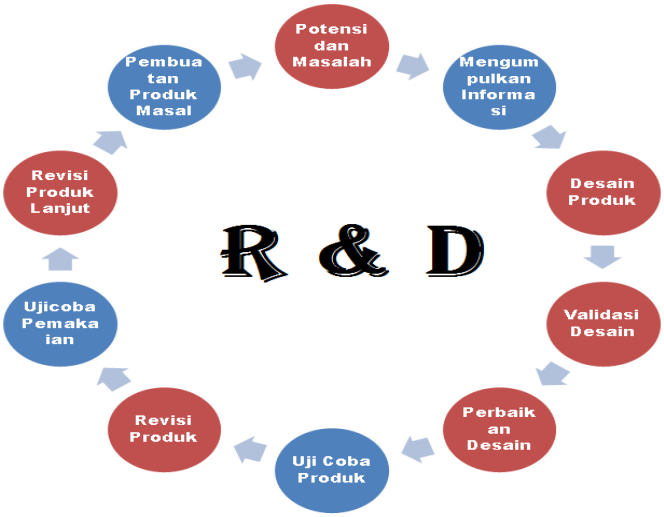
One effective approach in developing a recommendation system is the content-based filtering algorithm [5]. This algorithm works by analyzing the attributes of a tour package (such as location, type of activity, price, duration) and matching them with user preferences based on history or initial input [6]. This way, users can get more relevant and personalized recommendations, making the decision-making process faster and more efficient [7].

Several previous studies have addressed travel recommendation systems. A study by (Nugroho et al., 2020) used a collaborative filtering algorithm for destination recommendations, but encountered limitations in handling new users (cold-start problems). Meanwhile, a study by (Putri and Rahmadani, 2021) developed an Android-based travel recommendation application using a rule-based approach, but did not utilize an automated content-based approach. Both studies did not specifically apply content-based filtering to the context of comprehensive web-based tour package selection, so this study fills this gap.

Based on the above problems, it can be concluded that a system development is needed that can provide personalized recommendations to users in selecting tour packages that suit their preferences. Therefore, this research, entitled "Web-Based Tour Package Selection Recommendation Information System Using Content-Based Filtering Algorithm", aims to design and build a web-based recommendation system with a content-based filtering approach on the Trip Nikmat Sumut platform. This system is expected to improve the efficiency of tour package selection, increase user satisfaction, and support the overall digitalization process of tourism services.

2. Research Method

This research uses the method Research and Development (R&D), which is a method aimed at producing a specific product and testing its effectiveness. In the context of this research, the product developed is a web-based information system for recommending tour package selection using an algorithm [8]. Content-Based Filtering. Therefore, the author developed the existing data set and it is hoped that with the R&D method (Research and Development) can solve the problem.



Gambar 1. Research and Development (R&D) [9]

The stages of the R&D research method (Research and Development) is as follows:

1. Potential and Problems

Possibilities and problems can be the basisResearch and Development (R&D). Problems can arise if the expected goals are not achieved. To overcome the problem, the method Research and Development

(R&D) can be used to investigate the problem to find the right solution, pattern, or approach. The results of this research can be used to solve the existing problem.

2. Gathering Information

Collecting various information from sources and experts in the field and literature studies that can be used as material for designs that are expected to overcome existing problems.

3. Product Design

This phase is called system design, represented by a diagram or drawing.

4. Design Validation

The process of evaluating product design to determine whether the product will be more effective than the way the old system worked.

5. Design Improvements

After validating the product design, the designed product is updated based on the identified deficiencies.

6. Product Trial

Products that have been made will be tested after the product is finished being produced.

7. Product Revision

After conducting previous testing, changes were made to the product due to incomplete test data.

8. Usage Trial

After conducting product trials and making revisions, the product is tested again. Testing is conducted in a real-world environment to evaluate product deficiencies.

9. Advanced Product Revision

Under- or over-utilization in real-world environments is addressed even though product updates are required to activate the system.

10. Mass Production

If the product is confirmed to be safe and effective for use or production, then this step is complete.

2.1 System Development Methods

In developing this information system for recommending tour package selection, the method used is Waterfall as a software development approach [10].Waterfall is a system development method that is sequential and systematic, where each stage must be completed before proceeding to the next stage. This method was chosen because it is suitable for projects with clearly defined needs at the outset and provides an orderly work structure [11].

Method waterfall has the following stages:

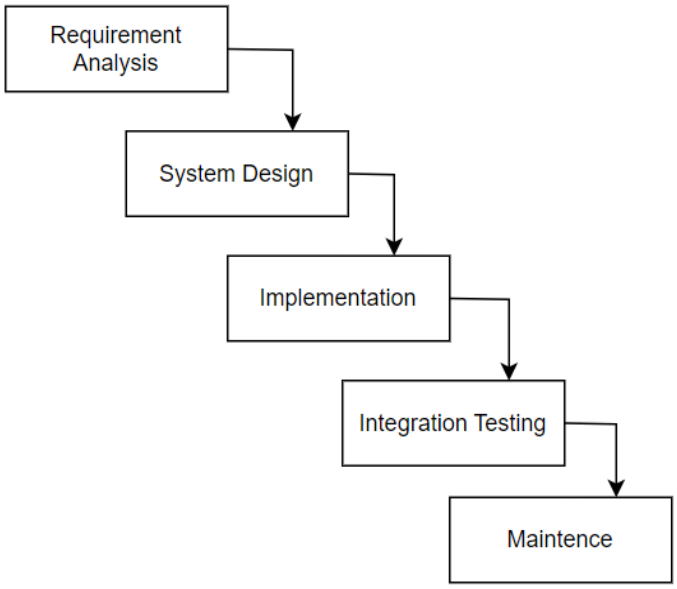


Figure 2. Method Waterfall [12]

1. Requirement Analysis

At this stage, an analysis of the needs of the recommendation information system to be built is carried out, such as user identification, functional needs, and non-functional needs.

2. System Design

At this stage, system design is carried out based on the requirements analysis that has been conducted. This design includes database design, user interface design, and system architecture.

3. Implementation

At this stage, the recommendation information system is implemented or developed according to the design that has been created. Implementation includes programming and algorithm integration.Content-Based Filteringand unit testing.

4. Integration Testing

LevelIntegration Testing In this case, integration testing is carried out to ensure that all system components work well in an integrated manner.

5. Maintenance

At this stage, system maintenance is also carried out to ensure system performance and system security.

2.2 Content-Based Filtering

Product recommendations based on the description of similarities between the product and user preferences is the basic principle of the algorithm.content-based filteringIn this approach, user profiles are formed based on the characteristics or attributes of a product. For example, the characteristics of a document can be seen from the words it contains. Each attribute that describes user preferences is assigned a specific weight according to predetermined parameters. The resulting recommendation is the product with the highest similarity score, calculated using the methodcosine similarity [13].

Stages of implementing the algorithm content-based filtering involves several steps. First, the system breaks down an object into vectors based on its constituent elements or features. Second, the system builds a user profile by utilizing the weights of the feature vectors using the method Term Frequency-Inverse Document Frequency (TF-IDF) [14]. Value Term Frequency (TF) shows the number of occurrences of a term in a document, while the valueInverse Document Frequency (IDF) calculated using the formula:

$$idf_i = log\left(\frac{n}{dfi}\right) \quad (1)$$

With Df is the number of manuscripts that haveterm i, whereas nis the total number of manuscripts.

Next, the system compares the user profile with the feature vector of each product to estimate the user's level of liking for that product. If the system predicts that a product matches the user's preferences, then the product will be recommended to the user [15].

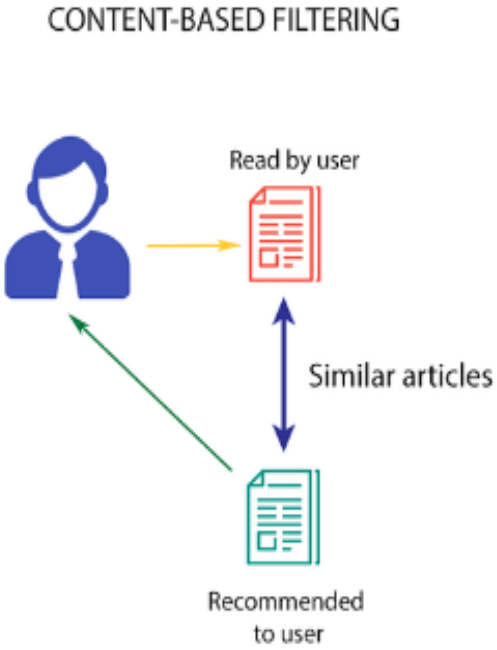


Figure 3. Concept of Content-Based Filtering Algorithm.

3. Result and Discussion

The data used in this study are tour packages from Trip Nikmat Sumut. The data model used is as follows:

Table 1. Data is represented.

No	Title	Description	Price	Duration (Days)	Capacity
1	Explore Lake Toba & Samosir Island	Enjoy the beauty of Lake Toba and visit Batak culture on Samosir Island for 3 full days.	1500000	3	20
2	Sipiso-piso Waterfall Tour in Berastagi	Explore the natural beauty of Berastagi and the stunning panorama of Sipiso-piso Waterfall.	950000	2	15
3	Bukit Lawang Nature Tourism & Orangutans	Exciting trekking in Bukit Lawang while seeing the life of orangutans in the tropical forest firsthand.	1750000	3	10
4	Wampu River Rafting Adventure	Experience the adrenaline rush of whitewater rafting on the Wampu River with views of exotic tropical forests.	1250000	2	12
5	Historical Tour of Medan City	Visit Maimun Palace, Medan Grand Mosque, and the legendary culinary center in Medan City.	650000	1	25
6	Mount Leuser National Park Expedition	Explore the challenging hiking trails and beauty of the tropical forest of Mount Leuser.	2500000	4	10
7	Enjoying the Sunset at Paropo Silalahi	Relax on the shores of Lake Toba and enjoy the stunning sunset from Paropo Silalahi.	850000	2	20
8	Nias Island Surf Trip Exploration	Enjoy the world's best waves on Nias Island, a paradise for international surfers.	3000000	5	8
9	Explore the Natural Tourism of Simalem Resort Park	Enjoy views of Lake Toba from the heights of Taman Simalem Resort and exciting outdoor activities.	2000000	3	15
10	Kampoeng Keling Heritage Tour Medan	Experience cultural tourism in the heritage area of Kampoeng Keling and Vihara Gunung Timur.	600000	1	25
11	Pandan Beach Marine Tourism, Sibolga	Relaxing holiday at Pandan Beach with white sand and blue sea in Sibolga.	1200000	2	18
12	Climbing Mount Sibayak	Enjoy a spectacular sunrise from the top of Mount Sibayak and soak in the hot springs of Berastagi.	900000	2	12
13	Exploring the Two-Color Waterfall in Sibolangit	Visit the unique waterfall with its stunning two colors of blue and white in Sibolangit.	700000	1	15
14	Tarutung Cross of Love Religious Tourism	Pilgrimage to the Tarutung Cross of Love while enjoying the panoramic view of the North Tapanuli mountains.	800000	1	20
15	Toba Caldera Geopark Exploration	Learn about the natural wonders and geology of the Toba Caldera through educational tours of various geosite spots.	1600000	3	20
16	Medan Culinary Tour Package	Enjoy a variety of Medan culinary specialties such as Bika Ambon, Lontong Medan, and Soto Udang Kesawan.	550000	1	25
17	Lumban Bulbul Tourist Village Tour	Family vacation on the shores of Lake Toba with water activities and local culture of Lumban Bulbul.	950000	2	20
18	Batak Cultural Tourism TB Silalahi Center Museum	Learn about Batak history and culture at the TB Silalahi Center Balige museum.	700000	1	30
19	Exploring the Sigura-Gura Waterfall in Asahan	Discover the highest waterfall in North Sumatra with an extraordinary panorama.	1800000	3	15
20	Samosir Island Full Trip Tour Package	Explore all sides of Samosir Island: Tomok, Ambarita, and Huta Siallagan in 3 days.	1700000	3	20

3.1 TF-IDF and Cosine Similarity Calculation

At this stage, the TF-IDF calculation was carried out on 20 tourism packages available on Trip Nikmat Sumut based on the user's preferences, namely nature, lake, and waterfall. The results presented below illustrate the relevance weight of each tourism package in relation to the user's preference profile.

Table 1. TF-IDF and Cosine Similarity Calculation

No	Paket Wisata	TF-IDF (nature)	TF-IDF (lake)	TF-IDF (waterfall)
1	Lake Toba & Samosir	0.48	1.1	0
2	Sipiso-piso Waterfall	0.48	0	1.65
3	Bukit Lawang Orangutans	0.48	0	0
4	Wampu Rafting	0	0	0
5	Medan City Tour	0	0	0
6	Mount Leuser National Park	0.48	0	0
7	Paropo Silalahi Sunset	0.48	1.1	0
8	Nias Island Surf Trip	0	0	0
9	Taman Simalem Resort	0.48	1.1	0
10	Kampoeng Keling Heritage	0	0	0
11	Pandan Beach Sibolga	0	0	0
12	Mount Sibayak Hiking	0	0	0
13	Two-Color Waterfall	0.48	0	1.65
14	Tarutung Cross of Love	0	0	0
15	Toba Caldera Geopark	0.48	1.1	0
16	Medan Culinary Tour	0	0	0

17	Lumban Bulbul Village	0.48	1.1	0
18	TB Silalahi Museum	0	0	0
19	Sigura-Gura Waterfall	0.48	0	1.65
20	Samosir Full Trip	0.48	1.1	0

3.2 Table Cosine Similarity

Table 2. Table Cosine Similarity

No	Paket Wisata	Cosine Similarity
1	Lake Toba & Samosir	0.64
2	Paropo Silalahi Sunset	0.64
3	Taman Simalem Resort	0.64
4	Toba Caldera Geopark	0.64
5	Lumban Bulbul Village	0.64
6	Samosir Full Trip	0.64
7	Sipiso-piso Waterfall	0.61
8	Two-Color Waterfall	0.61
9	Sigura-Gura Waterfall	0.61
10	Bukit Lawang Orangutans	0.24
11	Mount Leuser National Park	0.24
12	Paket lain	0.0

Table 2 presents the Cosine Similarity values between the user's preferences (nature, lake, waterfall) and each tourism package. Higher similarity values indicate stronger content relevance. Six tourism packages achieve the highest similarity score (0.64) because they contain two relevant terms, namely nature and lake. Meanwhile, waterfall-oriented packages obtain a similarity score of 0.61 as they include only nature and waterfall. Packages with a score of 0.24 correspond to only one relevant term (nature), while those without any matching terms receive a similarity value of 0.00..

3.3 Unified Modelling Language (UML)

1. Use Case Diagram
2.

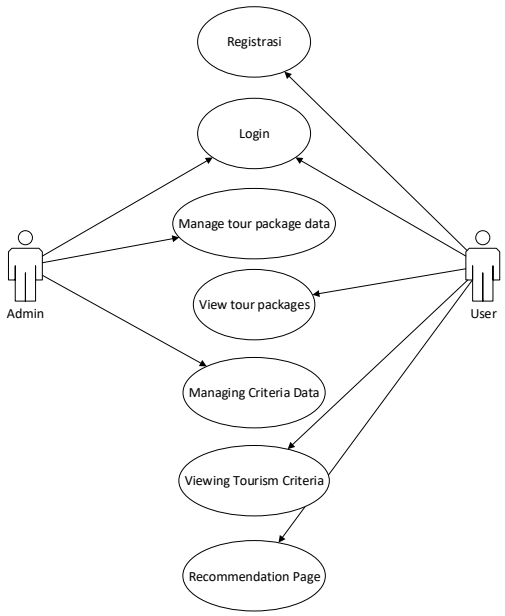


Figure 4.Use Case Diagram

The image is a Use Case Diagram that illustrates the interaction between the Admin and User actors with the Tour Package Selection Recommendation Information System. In this diagram, there are two main actors, namely the Admin and the User. Both actors can carry out the registration process to register into the system, as well as log in to access available features. The Admin has access rights to manage tour package data and manage tour criteria data, which includes adding, changing, or deleting data. In addition, the Admin can also view tour packages and view tour criteria to ensure the available data is appropriate. Users have the ability to view available tour packages, view the tour criteria used in the recommendation process, and access

the recommendation page that displays recommended tour packages based on the Content-Based Filtering algorithm.

3. Class Diagram

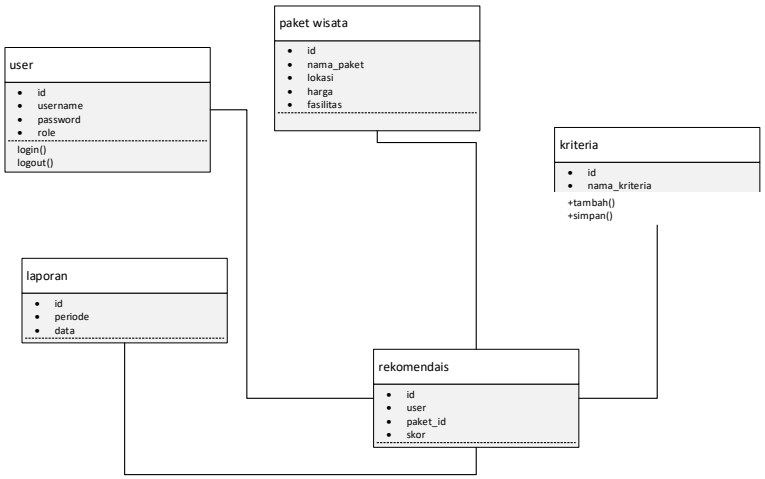


Figure 7.Class Diagram

The image is a class diagram that illustrates the data structure and relationships between entities in a tour package recommendation system. There are several main classes, namely user, tour package, criteria, recommendation, and report. The user class has attributes id, username, password, and role, as well as login() and logout() methods. The tour package class contains attributes such as id, package_name, location, price, and facilities. The criteria class stores the id and criteria_name with the add() and save() methods to manage criteria data. The recommendation class contains id, user, package_id, and score, which represent the results of the recommendation process generated by the system. Meanwhile, the report class has attributes id, period, and data to store a summary of the results of recommendations or system activities. The relationships between classes show data relationships, such as the connection between users and recommendations, tour packages and recommendations, and criteria with tour packages as a reference for filtering recommendations.

3.4 Implementation

1. Page Login

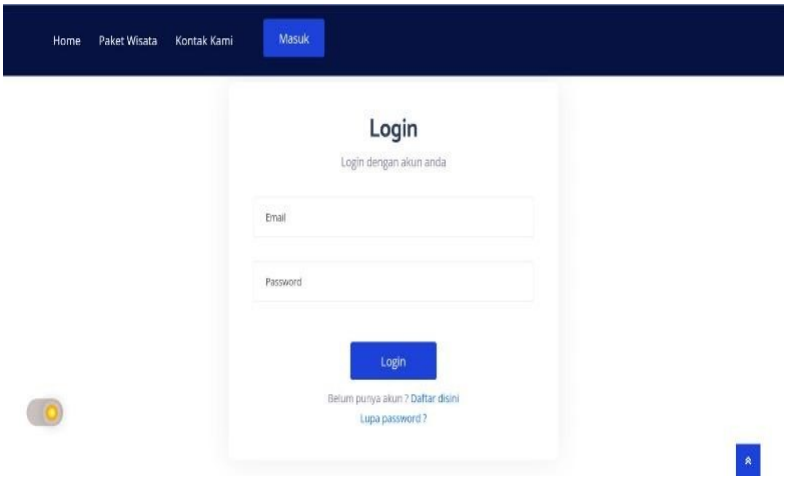


Figure 8. PageLogin

Page loginis a page used to enter the system asadmin And user. In the pagelogin there isformwhich must be filled withemail And passwordto be able to log into the system asadmin And userWhenemail And passwordentered correctly, the user will be redirected to the main page.admin And user.

2. Tour Packages Page

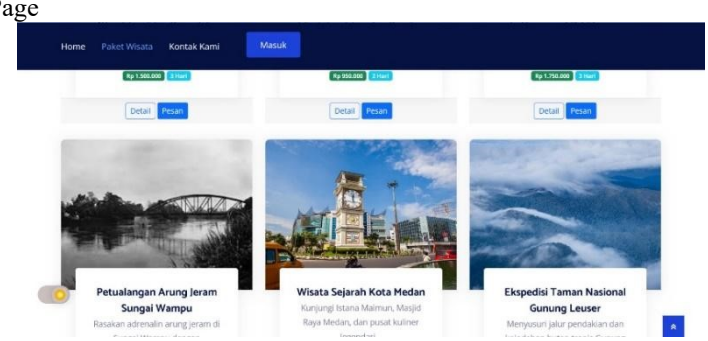


Figure 9. Tour Package Page

This image shows the tour package list page on a web-based recommendation system. On this page, users can see various tour package options displayed in the form of cards (card), each containing a destination image, package name, price, trip duration, and a summary description. Each card is equipped with a buttonDetailto see complete information and buttonsMessageto make a reservation.

The layout is responsive and structured using a grid to facilitate content exploration. The main navigation is displayed at the top of the page, including the menu.Home, Tour Packages, Contact Us, and buttonsEnter, thus supporting ease of access and an intuitive user experience (user-friendly).

3. Tour Package Details Page

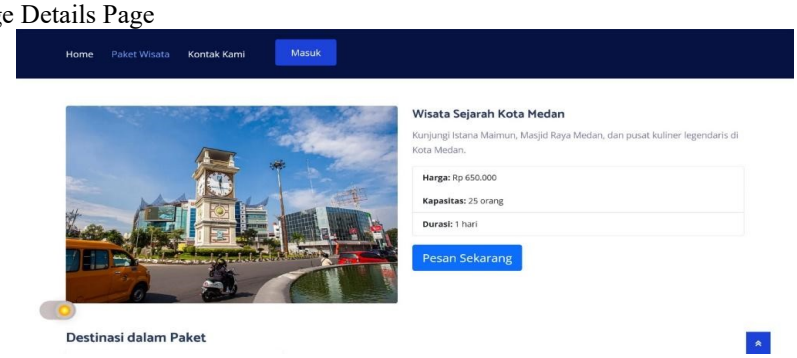


Figure 10. Tour Package Details Page

This image displays the tour package details page on a web-based recommendation system. The page provides comprehensive information about the tour package, including the package name, brief description, price, number of participants, and trip duration. The display also features images of key destinations and a Book Now button to facilitate user booking. The page design is informative and structured to support easy access to information and an optimal user experience.

4. Recommendation Page

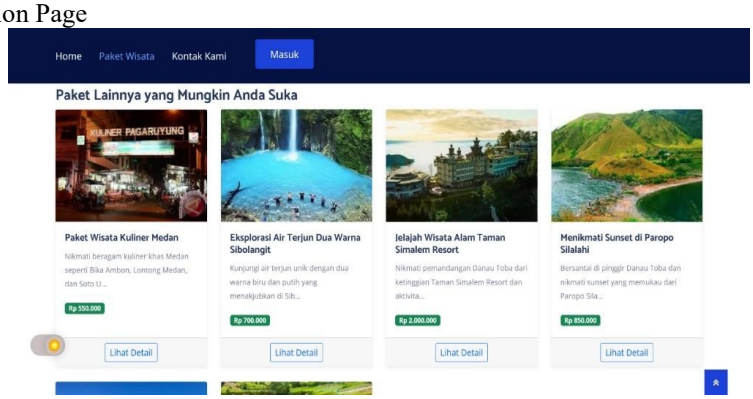


Figure 11. Recommendations Page

This image shows the tour package recommendation page in a web-based information system. The system displays tour packages relevant to the user's preferences, which are processed using an algorithm.Content-Based FilteringEach recommendation is displayed as a card containing an image of the

destination, the tour package name, a brief description, the price, and a View Details button for complete information. This display aims to provide alternative travel options that align with the user's interests quickly and informatively.

4. Page Booking

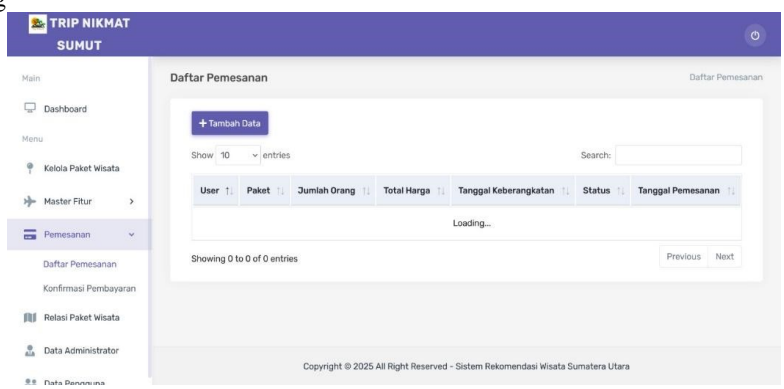


Figure 12. PageBooking

This image shows the booking list page on the administrator panel of the travel recommendation information system. On this page, the admin can view and manage booking data made by users. The information displayed includes the user's name, the type of tour package booked, the number of participants, the total price, the departure date, the booking status, and the booking date. The system also features a search function and data page navigation (pagination), and buttonsAdd Datato manually enter new orders. This view is designed to support the efficient and structured process of managing order administration.

4. Conclusion

Based on the research results, a web-based tour package recommendation information system using the Content-Based Filtering algorithm was successfully designed and implemented. This system is able to provide tour package recommendations that are relevant to user preferences through a process of matching the content and characteristics of each tour package. Test results show that the system provides accurate and responsive recommendations, and can help users in determining tour choices more effectively and efficiently. In addition, the application of a structured approach-based system development method allows for systematic design, implementation, and testing processes. Thus, this system is able to support the digitization of tourism information and provide a better interactive experience for prospective tourists in choosing tour packages that suit their needs.

Although the system has functioned well, this research still has room for further development. In the next stage, it is recommended to add other recommendation algorithms such as Collaborative Filtering or hybrid methods to improve the accuracy of recommendation results, especially for new users with limited interaction data. Integration of digital payment features, booking tracking, and user reviews and ratings is also recommended to make the system a more comprehensive and integrated tourism service platform. Furthermore, system testing on a larger user scale is needed to assess the system's performance and stability under real-world operational conditions. Furthermore, the development of a mobile application version is also expected to make tourism recommendation services more easily and practically accessible anytime and anywhere.

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