# Proposal for a Novel Sightseeing Trip Plan Search Service

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Abstract. Creating effective sightseeing trip plans requires consideration of both positive factors, such as travelers' preferences and the type of experience they want, and negative factors, such as travel time and travel costs. However, it is difficult for travelers to create completely satisfactory trip plans. Additionally, although it is easy to outsource trip planning to a travel agency or use an existing travel tour, the resultant plans often cost extra or are unsatisfactory. The purpose of this research was to facilitate the creation of highly satisfying sightseeing trip plans that meet the needs of travelers. In this study, a database was created of sightseeing trip plans that included positive and negative factors and had relatively high satisfaction levels. A sightseeing trip plan search service is proposed that allows users to search for sightseeing trip plans that meet their needs. To confirm the effectiveness of the proposed service, a web-based system was built that allows users to view 72 sightseeing trip plans created by students at Yamato University in Osaka and Iwate Prefectural University in Iwate, Japan. A database system was then constructed that allows users to input and search for trip plans. This paper provides an overview of these systems, evaluates the effectiveness of the proposed service, and highlights future issues to consider in fully implementing a search service for sightseeing trip plans.

Keywords. Search service, trip plan, database system, user satisfaction, support planning, factor analysis

# 1. Introduction

According to the Japan Tourism Agency, domestic travel consumption was reduced from 2020 to 2021 owing to the effect of the COVID-19 pandemic; however, it has steadily recovered since 2022 [1]. Recently, the number of foreign tourists (inbound tourists) visiting famous tourist destinations such as Kyoto, Tokyo, and Kamakura City has rapidly increased, and the resulting congestion and antisocial behavior has had a substantial effect on the lives of local residents. The Japanese government has termed this problem "over tourism," and it is becoming apparent that this problem reduces tourism satisfaction [2]. In contrast, because of low publicity and poor transportation links, the number of tourists in rural areas is not increasing, despite the fact that such areas contain attractive tourist resources. As a countermeasure, it is necessary to disperse tourists who are concentrated at famous tourist destinations to rural areas. It is therefore important to identify and recommend tourist destinations tailored to individual travelers and to create individual sightseeing trip plans that are highly satisfying.

The author has previously been involved in projects such as the identification and recommendation of tourist destinations tailored to individuals [3]-[6] and educational trip support focused on disaster prevention and sustainable development goals to help increase the number of tourists to fewer famous areas [7], [8]. The author has also

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conducted research on a travel planning model that takes into account differences between urban and rural areas [9], and a day trip planning model that considers levels of travel satisfaction and travel fatigue [10]. The results of these studies have shown that the creation of a sightseeing trip plan must consider both positive factors, such as traveler preferences and objectives, and negative factors, such as travel time and cost. However, it is difficult to consider all these factors and create travel plans that completely satisfy travelers. Therefore, the author analyzed a range of factors involved in creating a sightseeing trip plan and proposed a method for creating trip plans that considers both positive and negative factors [11].

This paper first describes the process of planning a sightseeing trip. Then, a search service of sightseeing trip plans is proposed. To confirm the effectiveness of the proposed service, a web-based system was developed to view sightseeing trip plans created by university students in different regions. Each trip plan was created according to the author's suggested flow of a sightseeing trip, considering both positive and negative factors. Next, the creation of a database system is described. This system allows users to input and search sightseeing trip plans. Finally, the paper introduces the developed prototype system, discusses the effectiveness of the proposed search service, and identifies future issues that must be considered in fully implementing the proposed service.

#### 2. Flow of creating a sightseeing trip plan

Figure 1 shows the flow of creating a general sightseeing trip plan. The prerequisites comprise the tourist destination (approximate destination), traveler characteristics (who is traveling and when), and means of transportation. Next to be considered are the purpose of the travel (what the traveler wants to do) and the route to reach the destination, which will be determined according to individual hobbies, preferences, and characteristics. All these are positive factors. At the same time, the travel budget and timing (season, climate conditions) are considered.



Figure 1. Flow of planning a sightseeing trip. SDGs, sustainable development goals.

The negative factors in the plan include cost, congestion at the destination, level of fatigue, and travel time. An attractive trip will be planned to provide the maximum satisfaction and to reduce cost, physical fatigue, and delay (although these factors are complex and interrelated).

The author conducted a questionnaire survey on the effects of positive and negative factors in the process of creating travel plans. The findings showed that the most positive factors affected the attractiveness of the experience, and the main negative factors were travel time and cost [12]. However, these findings were considered to be inconclusive, as the positive and negative factors depend on the travel destination and preconditions.

Many people select tourist destinations by researching popular travel websites such as TripAdvisor and by word of mouth [13]. Research has been conducted on the role of search engines in travel planning [14]. There is also research on tourist recommendation systems and applications that use various methods, including collaborative filtering [15], two-way dialogue [16], traveler profiles [17], and group preferences [18]. Some research has focused on theoretical models that recommend tourist routes based on objective and subjective evaluations [19] or has visualized tourist behavior patterns by analyzing flicker location data [20]. Some research uses models that estimate traveler preferences based on social media data [21] - [23] or examines the use of theoretical models using machine learning [24] and multi-agents [25] to recommend tourist spots. However, these studies have mainly focused on the positive aspects of traveler preferences and behavior analysis. In addition, research on recommendation models remains theoretical, and is difficult to apply to the planning of sightseeing trips.

Figure 2 shows a general concept of travel planning. When planning a specific sightseeing trip, there are constraints on travel time and budget, so it is necessary to consider the balance of positive and negative aspects when creating a travel plan. To generate a practical sightseeing trip plan, many factors must be researched, including transportation timetables, travel times, fares, accommodation costs, and facility fees. It is difficult for travelers to generate a practical trip plan that is completely satisfactory. Furthermore, although it is easy to outsource the preparation of travel plans to a travel agency or to use existing travel tours, this often involves extra costs and may not produce a plan that completely suits the traveler.



Figure 2. General concept of trip planning.

In this paper, a very different perspective on this issue is proposed, and a new method described to generate travel plans. This method comprises the generation of numerous highly satisfying travel plans and the development of a database system to store the trip plans. The system allows users to search for travel plans that match their prerequisites and desires.

## 3. Proposed search service of sightseeing trip plans and related systems

## 3.1. Model of the proposed service.

Figure 3 is a model of the proposed trip plan search service. The service uses a trip plan database and a search system. A user who requires a sightseeing trip plan can browse the search system and decide on their travel plans if they have selected their travel season and destination. Users who have no specific destination in mind can also use the trip plan search service. This service is preferably provided by a travel agency that can provide a lot of trip plan information. Travel agencies can register and maintain trip plan information in the trip plan database, search for trip plans according to user requests, and customize trip plans to suit the needs of travelers. This database must be frequently managed and updated.



Figure 3. Model of trip plan search service.

#### 3.2. Approach to creating the trip plan search service.

The approach used to create the proposed service is as follows.

- 1) Create as many sample sightseeing plans as possible,
- 2) Develop a search system where users can view the samples,
- 3) Construct a prototype trip plan database where users can search for those samples,
- 4) Evaluate the effectiveness of the search service using the developed search system and the constructed trip plan database,
- 5) Identify issues and consider solutions to fully implement the proposed service.

#### 3.3. Creating trip plan samples.

The process and method of creating the samples of the trip plans is as follows. Each trip plan was created by a group of three to four university students from two different universities (Iwate Prefectural University in Iwate Prefecture and Yamato University in Osaka Prefecture, Japan). Each trip plan target area was specified by a teacher (the author). The group from Iwate Prefectural University created eight sightseeing trip plans whose departure and return points were in Iwate Prefecture. The group from Yamato University created 64 sightseeing trip plans whose departure and return points were in Osaka Prefecture. A total of 72 trip plans were created. Each trip plan took approximately 90 minutes to complete. In creating the trip plans, the students considered the positive aspects (attractiveness) and negative aspects (cost, travel time) of each tourist destination and aspects such as transportation timetables by researching internet websites. In creating the travel plans, the students considered a wide range of age groups, including families and older people. Therefore, each trip plan was realistic and targeted to a variety of people.

# 3.4. Evaluation of the sample trip plans.

Each of the 72 trip plans was introduced in a presentation lasting approximately 10 minutes and evaluated by 25 to 28 students. Five evaluation levels were used: 1: bad, 2: not very good, 3: average, 4: good, and 5: very good. Figure 4 shows the average evaluation score for the trip plans (only the top eight and bottom eight positions are shown).

Figure 4 shows that all trip plans obtained high ratings (over 3), and that trip plans to famous tourist destinations such as Kyoto and France did not necessarily obtain higher ratings. The findings indicated that the trip plans created using this method were realistic, generally of good quality, and suitable for recommending to travelers whose circumstances and prerequisites matched the plans.



Figure 4. Average evaluation score for the generated sightseeing trip plans.

#### 3.5. Development of the trip plan search system.

The author constructed the trip plan search system as a website that enables users to search for trip plans created by students for people who wish to travel in a specific season or to a specific area. Figure 5 shows an example of the search screen.

The user first selects a season, and then recommended trip destinations for each season are displayed as icons on a rough map. Figure 5 shows an example of a trip plan for three people in spring from Takizawa City, Iwate Prefecture, to Ryusendo (Iwaizumi Town) and Kuji City, Iwate Prefecture, for 1 night and 2 days, with a budget of 18,100 Japanese yen per person. When a user clicks on the slide video, he/she can see information such as detailed trip schedules, places to visit along the way, meal options, attractive accommodation options, and prices.



Figure 5. An example screen for the developed website trip plan search system (the actual site language is Japanese).

#### 3.6. Construction of the trip plan database.

The process of creating a sightseeing trip plan differs depending on whether the purpose and destination are clear or unclear. If the purpose and destination are clear, it is relatively easy to plan the destination, accommodation, and other aspects of the trip by considering transportation time and budget. In contrast, if the trip purpose and destination are unclear, this is because the user is still undecided about where they want to go. The trip plan database is constructed so that people whose purpose and/or destination are unclear can still use the database.

To test the usability of the system, a database framework was created using Microsoft Access and the 72 trip plans generated by the students were entered to create a prototype database.

Figure 6 shows example screens for the input of trip plans and the prototype trip plan search system. Using the input screen shown in Figure 6 (a), a user can register the season, number of travelers, number of nights, destination, budget per person, and URL. On the search screen shown in Figure 6 (b), the user can narrow down the search results by trip season, number of travelers, number of nights, and maximum budget per person.

After the preferred travel conditions are entered and the search button is pressed, the database system displays the destination, budget per person, and URL of matching trip plans. The URL gives access to the developed website of the trip plan search system described above.

Input form c	of trip plans	4	
季節	۵ S	eason	
旅行人数	修学旅行	Number of Travelers	
泊数	2泊3日	Number of Nights	
出発地	大阪府	Departure Place	
目的地	広島県	Destination	
- 人あたりの予算	¥30,00	0 Budget	
URL	https://www.toursplan.net/blank-1		

(a) Input form of trip plans

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-	42.27		L De	parture Place	Upper budg	et per person	
子員	修学旅行	2泊3日	大阪府	広島県	× m / /	3000	0 https://www.t
春	2人	1泊2日	大阪府	福岡県		7052	0 https://www.t
春	4人	1 泊2 日	大阪府	台湾(台北)		8434	9 https://www.t
春	4人	2泊4日	大阪府	フランス~モナコ		32000	0 https://www.t
春	2人	1泊2日	大阪府	オーストラリア		43300	0 https://www.t
春	3人	1泊2日	大阪府	奈良県、生駒山上遊園	地、奈良健康ランド	1403	3 https://www.t
春	3人	1泊2日	滝沢市	龍泉洞、久慈琥珀博物	館	1810	0 https://www.t
春	4人	2泊3日	大阪府	東京23区内		4300	0 https://www.t
春	3人	1/82 日	大阪府	埼玉県		13115	1 https://www.t
春	4人	1/83 日	大阪府	湖南荘、富士急ハイラン	<sup>F</sup> Destination	6677	0 https://www.t
香	4人	日帰り	大阪府	京都市		895	0 https://www.t
春	3人	日帰り	大阪府	吹田市		827	0 https://www.t
春	3人	1782 H	大阪府	這頓堀、海避館、USJ		2222	9 https://www.t

(b) Search system of trip plans

**Figure 6.** Examples of the screen in the prototype database system; (a) input form of trip plans, (b) search system of trip plans (the actual site language is Japanese).

# 4. Evaluation of the effectiveness of the proposed service

# 4.1. Analysis of the trip plan creation process.

The effectiveness of the proposed trip plan search service was evaluated. First, 48 samples (40 domestic trips, 8 foreign trips) were selected from the trip plans created by a total of 133 students and a questionnaire survey conducted on the trip plan creation process and its website.

Figure 7 shows the frequency of terms that appeared in questionnaire responses about the trip plan creation process. The words "search" and "travel planning" were excluded because they were frequently used terms. Figure 7 shows that the terms "Sightseeing spots," means of "Transportation," "Routes," "Fee," and "Hotels" were important.



Figure 7. Frequency of terms appearing in questionnaire responses about the trip plan creation process.

Figure 8 shows the number of different categories of websites searched when creating trip plans. The most frequently searched websites were regional websites related to the trip destination. These were followed by general travel sites (e.g., "Jalan," "Toribako," "Rakuten travel," "Rurubu," and "JTB"), transportation sites (e.g., "JR" and "JAL"), and maps (e.g., "Google Maps"). The total number of internet information sources (e.g., websites and social networking services) used was 393.



Figure 8. Number and categories of websites searched in creating trip plans.

The results of this survey can be summarized as follows. In planning a trip as a group, the students first researched the travel destination and sightseeing spots, then chose transportation and accommodation. They then decided on a travel route, and elaborated the plan by considering factors such as budget and travel time, to produce a plan that all

group members could agree on. When asked about the difficulties they faced when creating trip plans, students reported that it took time to select sightseeing spots and transportation methods. Sometimes the travel time for the plans they had created was longer than expected, and the budget was too large. Students found that when planning overseas trips, it was very difficult to decide on factors such as transportation methods and sightseeing spots because they had insufficient knowledge of the geography of the destinations.

#### 4.2. Comparison between current method and proposed method.

Based on the results of the survey of students' methods of creating travel plans, the current trip plan creation method was compared to a proposed trip plan creation model. In Figure 9, (a) shows the current method and (b) shows a proposed model for creating a trip plan using the trip plan search service.



Figure 9. Comparison between current method and proposed method.

In Figure 9 (a) and (b), T<sub>1</sub> to T<sub>9</sub> indicates the time taken for each step of the process; namely, in Figure 9 (a),

T<sub>1</sub>: time taken to discuss prerequisites (season, number of travelers, number of nights, budget) as a group,

- T<sub>2</sub>: time taken to narrow down sightseeing spots in the travel area,
- T<sub>3</sub>: time taken to research and choose transportation methods,
- T<sub>4</sub>: time taken to decide on sightseeing spots, transportation options, travel routes, and accommodation.
- T<sub>5</sub>: time taken to decide on a trip plan based on the total cost and budget,
- T<sub>6</sub>: time taken to reach consensus on the final travel plan.

The survey results indicated that the average values for these steps were as follows:  $T_1 = 10$  minutes,  $T_2 + T_3 + T_4 = 60$  minutes,  $T_5 = 10$  minutes, and  $T_6 = 10$  minutes. The total time from  $T_1$  to  $T_6$  was 90 minutes at the shortest. If the cost exceeded the budget, the steps  $T_2$ ,  $T_3$ , and  $T_4$  were repeated, resulting in an additional 60 minutes.

In the proposed method,  $T_1$  and  $T_6$ , shown in Figure 9 (b), are almost the same as  $T_1$  and  $T_6$  in Figure 9 (a). Here,

- T<sub>7</sub>: time taken for searching; this is just the time it takes to press the search button, which is negligible and so can be discounted.
- T<sub>8</sub>: as the trip plan and the trip area are output, this step will take about 10 minutes, including confirmation time.
- T<sub>9</sub>: customization time can be set to 10 minutes, on the assumption that this time is equivalent to the  $T_4$  step of the process.

The total time for the proposed method in Figure 9 (b) is about 40 minutes, and it is estimated that the trip planning time can be reduced by approximately half of the time in the current method shown in Figure 9 (a). The proposed method is more effective because unlike the current method, it does not require replanning from  $T_2$  to  $T_4$  (when the total cost exceeds the budget).

# 5. Future issues regarding full implementation of the proposed service

The following issues must be considered before the proposed service can be fully implemented:

- Develop a web-based trip plan database: The current database was created using Microsoft Access. To enable more users to directly access the database, the author and students at Yamato University are currently creating a web-based database using the scripting language PHP and the relational database management system MySQL.
- 2) Expansion of departure and return locations: The trip plan samples in the current system were created by university students at only two locations, so the departure and return locations were limited to Iwate Prefecture and Osaka Prefecture. If the proposed search service is provided to more users, the departure and return locations need to be expanded to include other regions.
- 3) **Expanding the number of trip plans and making them multilingual**: To satisfy a larger number of diverse users, it will be necessary to register many more travel plans and ensure that they are multilingual.
- 4) **Investigation and implementation of satisfaction level of traveling according to the trip plan:** As the travel plan searched for was not actually used, user satisfaction with the plan cannot be assumed. Therefore, the travel plan needs to be tested with a real case so that information on satisfaction can be incorporated into the system.
- 5) **Consideration of potential disaster and accident risks when traveling:** The possibility of disasters, accidents, and other major problems at the travel destination should be considered and relevant information should be provided.

#### 6. Conclusion

To plan a satisfactory sightseeing trip, it is necessary to research many factors, such as sightseeing spots, transportation timetables, and hotel prices. This makes it difficult and time-consuming to create a suitable travel plan.

In this study, the process of creating a sightseeing trip plan that takes into account positive and negative factors related to the trip was investigated. The author developed a web-based trip plan search system and a database system that provided relatively satisfactory trip plans created based on this model. A trip plan search service using these systems was proposed. Furthermore, by analyzing and modeling the process by which students created travel plans, the current and proposed methods were compared, and the effectiveness of the proposed service confirmed. Finally, future issues that must be considered when fully implementing the trip plan search service were discussed.

It is hoped that these findings will facilitate the rapid development of an effective sightseeing trip plan service that includes a wide range of tourist destinations, including fewer famous locations.

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