

MASTER OF TECHNOLOGY

(INTELLIGENT SYSTEMS)

PROJECT REPORT

Intelligent Reasoning Systems

TavelHelper

Team Members

Liu Ding
Zeng Hanyu
He Mingyang

1. Executive Summary

Nowadays, traveling is becoming a more and more popular way for people to enjoy their life. To make the arrangement easier, various companies have released diverse applications to help users make decisions, such as Booking, TuNiu etc. Those applications have recommendation systems to recommend the best hotel or the best attraction to the customers, and this recommendation function is now becoming popular among the users.

Our team found that the current travel apps on the market only recommend attractions and hotels based on the user's geographic location and the user's filtering criteria, and there are no interesting personalized recommendations. So we decided to design a web page app that helps customers plan their entire itinerary from the start, including travel locations, air tickets, hotels, attractions, etc. According to the customers' living habits, hobbies and other factors, we can help them plan the most suitable travel plan in every detail.

In our Travel Helper, there is not only an inference system, but even an NLP model we trained. They can help us give customers a better user experience and make itinerary more accurate and interesting.

2.Business Case

2.1 problem statement

More and more people would spend their free time traveling to different cities to enjoy themselves. To bring better service to customers, most traveling service applications release some function to help the users to make decisions, such as ranking the various attractions, collecting users' opinions about everywhere they have visited during their journey and use those comments to help their recommendation system to get a more accurate result.

Undoubtedly, those progressions help customers have a better experience while using those products. But my teammate told us that she thinks the recommendation systems are not targeted enough for users, and she thinks just using the search engine in the application to get the results may not meet her requirements fully. So she suggested we design a chat bot to collect the information of users during chatting, and by using that information, the recommendation model can provide a complete and suitable traveling plan for our customers. And all of us thought her suggestion was interesting, so we started to design the whole project.

2.2 proposed solution

2.2.1 project objectives

To outcome a recommendation system and a chat bot.

Recommendation system: It is a system which will recommend the hotels, the airplane tickets, the attractions, and the restaurants. It will help you to plan for every step in your vacations, and it will also consider your personal information and provide some personalized recommendations to different customers. To confirm that our recommendations are accurate enough, we also did market research to help our recommendation model get more accurate data from customers.

Chat bot: A chat bot involves a NLP model, which will gather intelligence during chatting with customers. With the information it gathered from the previous communication, this chatbot will make some smooth transitions

to ask more questions in order to obtain more accurate user portraits, which really help our recommendation system to get better performance. By using those two programs, we hope that our project will provide a very suitable traveling plan in every detail.

2.2.2 Market Research

We have designed a questionnaire, and sent it to 700 people. Due to resources and influence constraints, our biggest target of the research is the students in NUS, this may lead to some bias in our final system.

<p>07 What is your preferred means of traveling transportation and why? *</p> <p><input type="radio"/> Long-distance bus, because _____</p> <p><input type="radio"/> Train, because _____</p> <p><input type="radio"/> Airplane, because _____</p> <p><input type="radio"/> Driving car, because _____</p> <p><input type="radio"/> others _____</p>	
<p>08 How much will you spend for each trip: _____ *</p>	
<p>09 My preferred hotel star rating is: _____ *</p>	
<p>10 My preferred type of restaurant is *</p> <p><input type="radio"/> Western Restaurant</p> <p><input type="radio"/> Chinese Restaurant</p> <p><input type="radio"/> Japanese Restaurant</p> <p><input type="radio"/> Korean restaurant</p> <p><input type="radio"/> Thai Restaurant</p> <p><input type="radio"/> others _____</p>	
<p>11 The type of attraction you prefer *</p> <p><input type="radio"/> historical landmark</p> <p><input type="radio"/> lively city center</p> <p><input type="radio"/> countryside</p> <p><input type="radio"/> mountains or rivers</p> <p><input type="radio"/> parks</p> <p><input type="radio"/> museum, library, or exhibition</p> <p><input type="radio"/> others _____</p>	
<p>12 My opinion on having a chatbot that helps me plan a suitable travel plan is: _____ *</p>	
<p>13 And my advise for this chatbot is: _____ *</p>	

image1.the most valuable questions are shown above

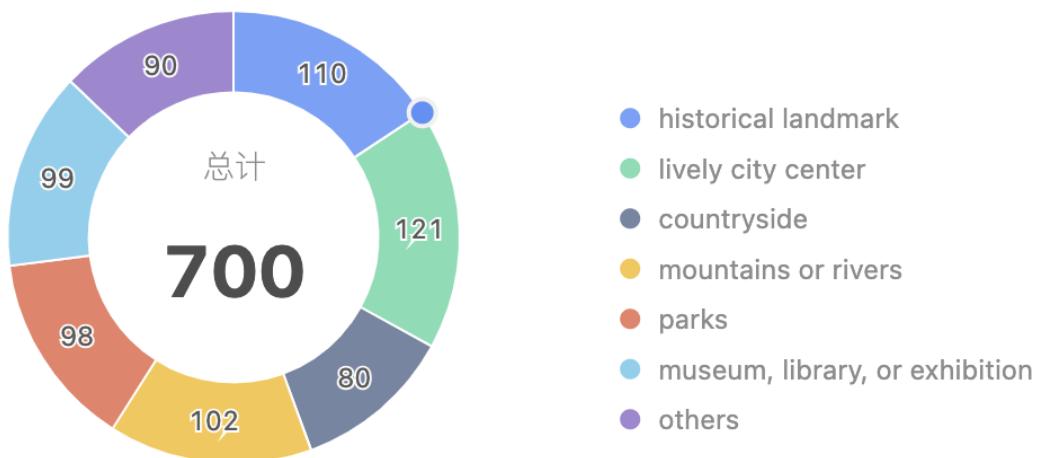
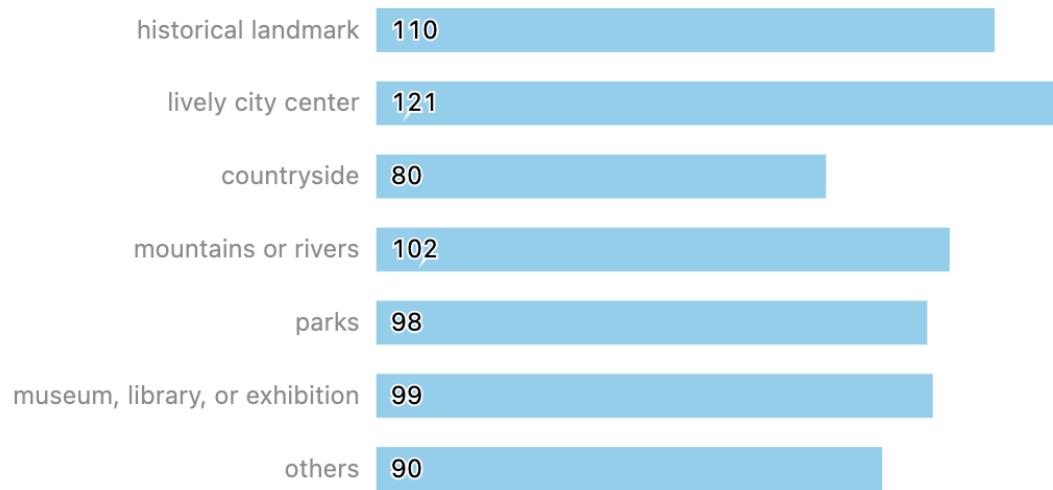


image2. places of interest survey results

For the bar chart and ring graph above, the proportion of each type is almost the same, that means different people have different interests in attractions, so our idea is trying to provide users with as many options as possible as that they can more easily find places they are interested and plan a more reasonable trip in limited time.

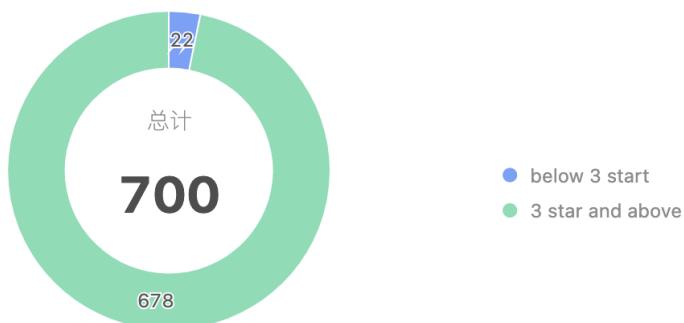
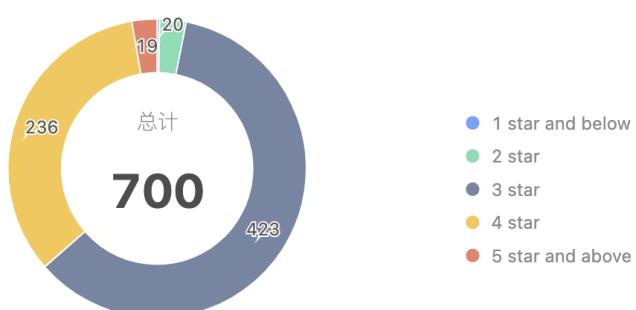
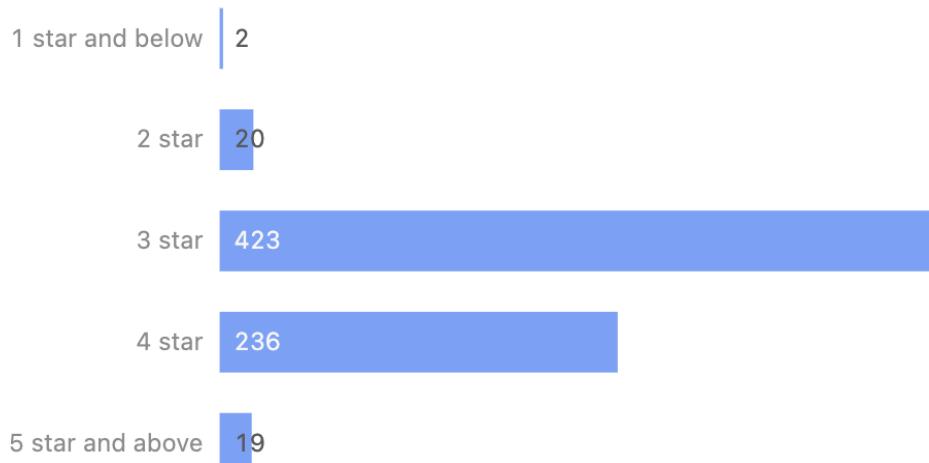


image3. preferred hotel star rating survey results

For the bar chart and ring graph above, we can find that 678 of 700 people prefer to 3 star rating above hotels, but in this group, only 19 people prefer 5 star rating above hotels, so our conclusion is that people would like to choose hotels that are above 3 star rating and below 5 star rating. We also do research about hotel prices on some hotel booking websites, most hotels in our target rank are below 400 dollars, so our system prefers to recommend 3 ~ 5 star rating to users.

3. Project Design

3.1 Main Features

As stated in section 2.1, the main goal of our group is to build an intelligent Travel Recommendation system using various open source libraries and off-the-shelf APIs. The system takes in text input from the customers, extract meaningful information from it and deliver it to integrated processing functions. As a result, the customer will receive satisfying feedback, which gives full useful details about their journey.

Customers can either have an explicit target location or get an interesting destination recommended by our system as long as they tell us where they are.

Customers do not need to input a strict structure like “My departure time is 2021-12-31” or “I am in Beijing now”. Just to express more naturally, “I leave from Beijing on Dec 31 2021”, that’s enough. Our system will handle it.

Don’t worry about where to play after arrival. Besides regular cheap and reasonable flight recommendations together with hotels, our system will tell you where to go with real images showing places of interest.

3.2 Process Flow

Before we go into the technical implementation of the project, designing a flowchart is a good way for us to understand the overall high-level structure of the intelligent system, as shown in the diagram below.

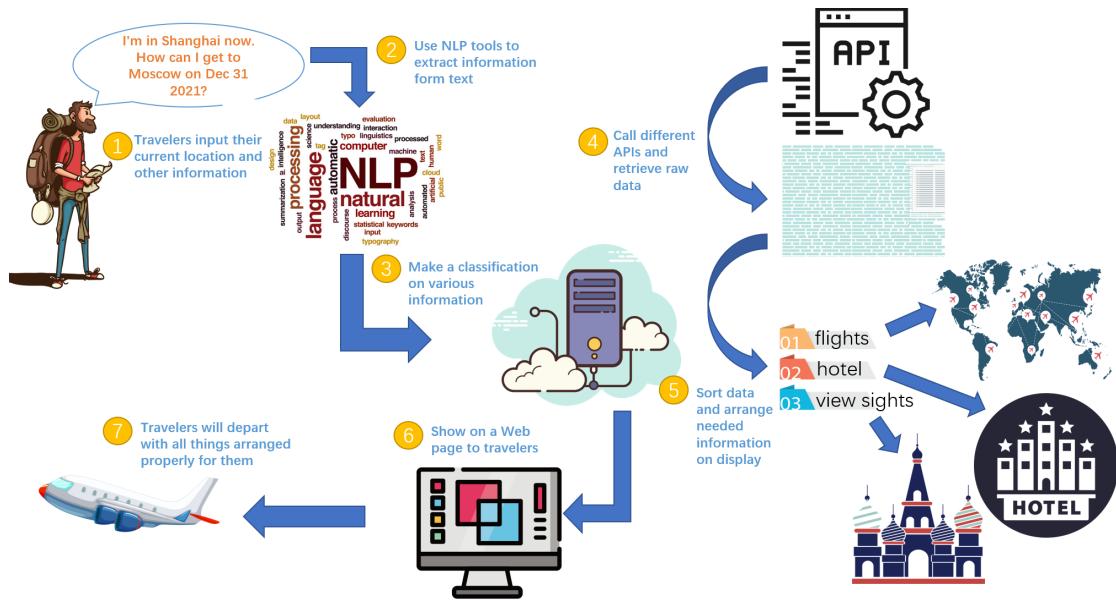


image4. process flow

TravelAI will get customers' inputs, extract useful information from input data using NLP and complement missing parts automatically. Then it will make use of information collected to generate a detailed travel plan by applying various APIs.

3.3 System Highlights

3.3.1 Intelligent information complement

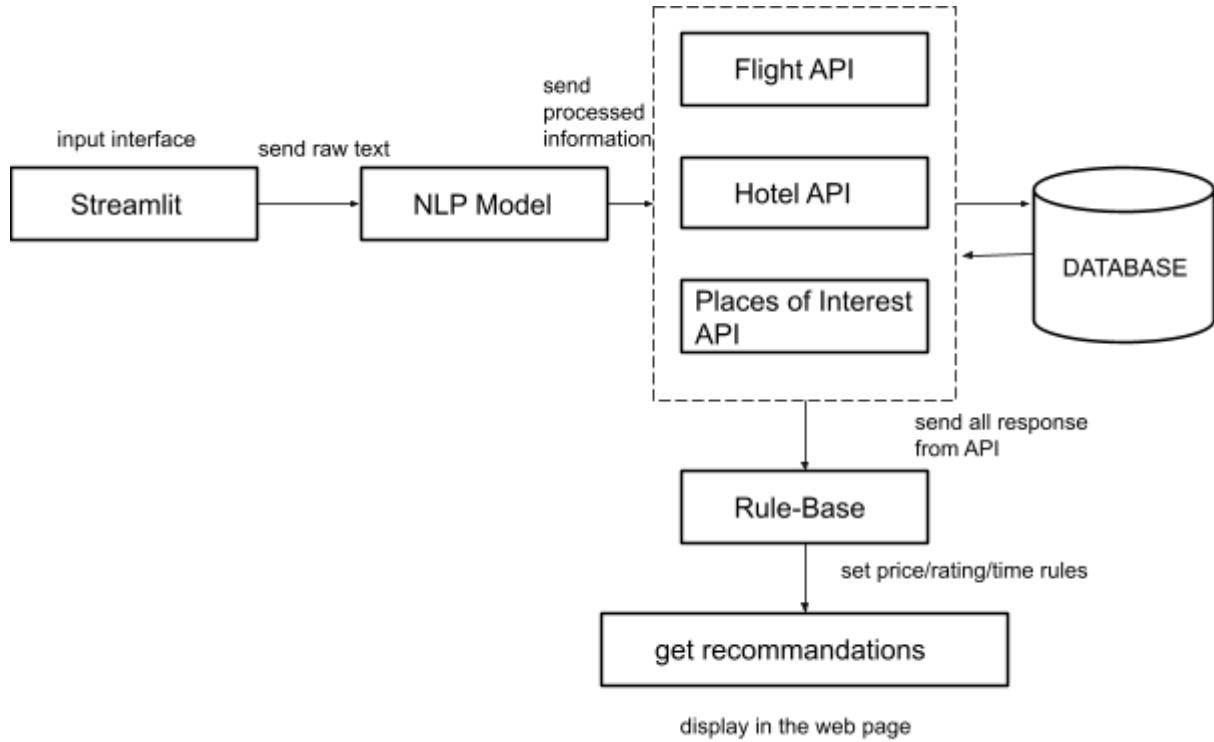
Our system allows customers either describe their trip covering every detail and corner or just give where they are and when to leave and rest will be arranged by an intelligent system automatically.

3.3.2 Adaptive strategy for different travelers

We also provide accurate filtering for travelers who care about details. Like hotel stars, preference for fast or cheap flights, economy or business class cabin, all in all, we always have a plan to satisfy everyone's unique taste.

4. System Modelling

4.1 Technical Flow



The diagram above is showing the technical workflow of our TravelHelper system. We use Streamlit as a user interface to get detailed information from users, and this raw text information will be sent to a NLP model to extract the key information we want like departure city, arrival city etc. Next, the processed message will flow to our backend logic which will then push it into the database. The backend logic will perform the interactions with the database based on the key information NLP model extracted, and retrieve all of the information they search, and then we will screen the returned information based on some rules. Finally, we will display the proper flight, hotel and places of interest plan on a web page.

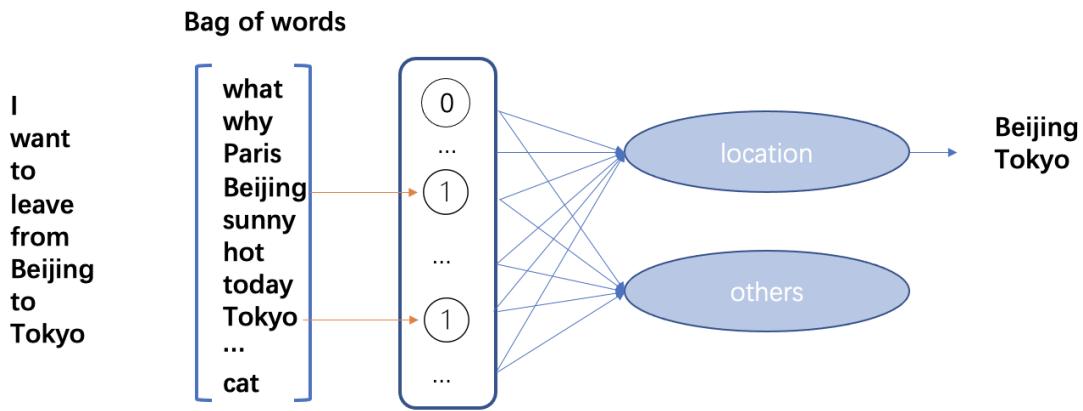
We will do detailed and further explanations in chapter 5.

5. System Development & Implementation

5.1 Cognitive System

5.1.1 Natural Language Processing Model

slots detection

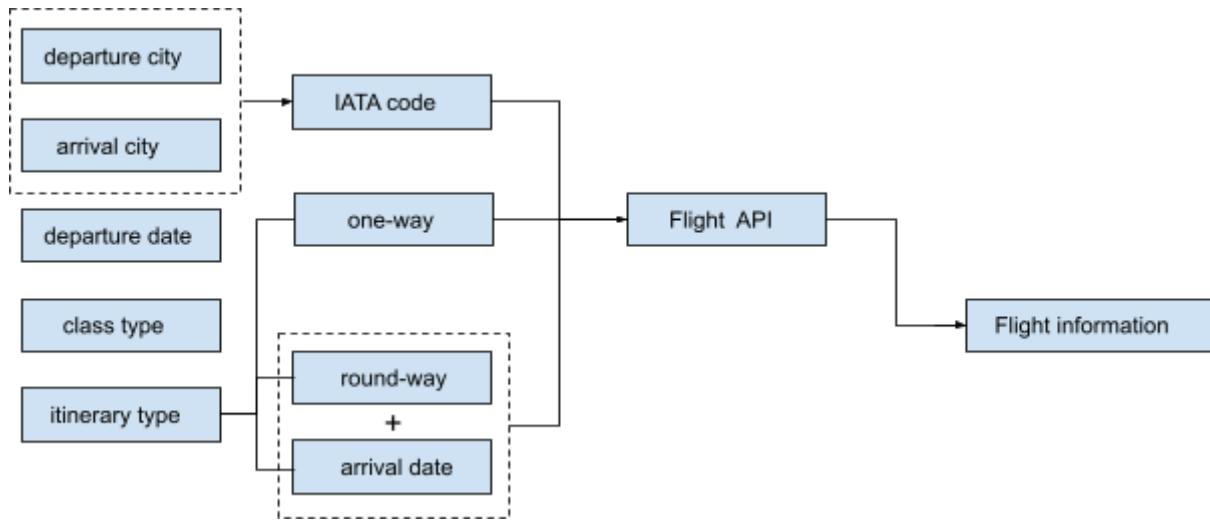


5.2 Flight API, Hotel API, Places of Interest API

5.2.1 Flight API

Priceline.com Provider API from Rapid API was chosen to obtain real-time flight details. We should offer the departure location code, departure date, arrival location code, class type and itinerary type as required parameters. First, we need to transform the departure city and arrival city to IATA code like 'New York' to 'NYC', and then send them to the API.

We can get all the flight information from departure location to arrival location, so we need to do some methods to sort the optimal information.



This is what we plan for you.

Your Flight

Take off time

12-24T16:45

Landing time

12-24T21:00

Duration

255 mins

Flight cost

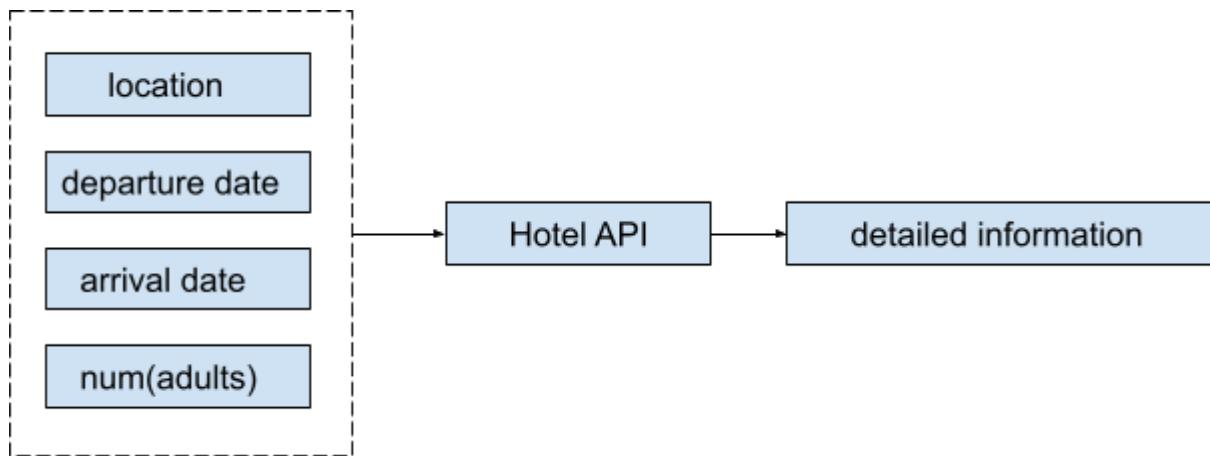
2085.3 USD

Airline

Air China

5.2.2 Hotel API

Hotel Search API from Rapid API was chosen as the API to obtain real time hotel details. The Hotel Search API returns a list of available hotels and relevant information for some given parameters. We can get hotel id, hotel address, price, star rating etc, and do rule-based selection.

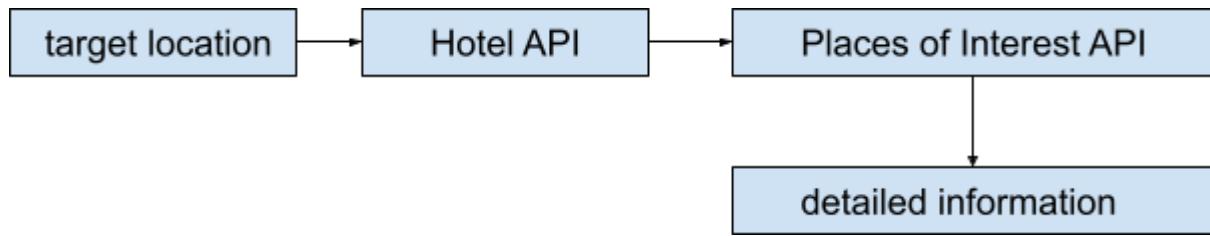


Your Hotel

	starRating	address	price	supplierHotelId
Lilix	3.0000	1-1-3 Okubo	\$35	49231267
Shinokubo-funhouse	3.5000	2-29-17 Okubo	\$37	49225143
Best Western Tokyo Nishi...	3.0000	6-17-9 Nishikasai	\$44	2562686
Hotel Oriental Express To...	3.0000	1-3-15 Minamikamata	\$45	32710854
The B Suidobashi	3.0000	1-25-27 Hongo	\$46	11017143
YMK Oshiage 202	3.0000	None	\$46	48195520
HOTEL MYSTAYS PREMIER...	3.5000	6-19-3 Minamioi	\$48	4132388
Hotel Wing International ...	3.0000	1-25-11 Hongou Bunkyou...	\$49	2530456
Hotel MyStays Ueno Iriya...	3.0000	5-5-13 Higashi Ueno	\$51	4993223

5.2.3 Places of Interest API

The Travel Advisor API on Rapid API was chosen as the API to obtain details of popular places of interest at least one of the following 10 categories: Sights & Landmarks, Nature & Parks, Water & Amusement Parks, Zoos & Aquariums, Fun & Games, Outdoor Activities, Museums, Tours, Shopping, Concerts & Shows. Our target is to offer users more ideas to plan their trip. But first we need to send the target location to Hotel API to get target latitude and longitude, and then send them to Places of Interest API.



Your fun



Dai-Ichi Life Gallery



Godzilla Statue



Path of History and Culture, Rekishi & Bunka no Sampomichi, Ginza & Tsukudajima Course



Tokyo Midtown Hibiya



Park View Garden



JTB Cruise Plaza Yurakucho



Idemitsu Museum



Yuraku Inari Shrine



Hibiwa Chanter

5.3 Rule-based & Deductive System

5.3.1 Rule-based system

Fight: We provide the most suitable flight information based on the flight situation of the day, consider the price of the ticket and the flight duration.

Hotel: We provide a list of hotel information based on requirements of the user like rating star, price ceiling etc .

5.3.2 Deductive System

When users do not know which city to travel to, we can recommend 5 cities based on departure city.

For example: the user just provides Beijing as the departure city, but does not provide the arrival city, we will provide [Shanghai, Guangzhou, Tokyo, Bangkok, Istanbul] to brainstorm users.

Please tell us where/when do you want to go

e.g. I want to leave from Beijing on 24 Dec 2021

Following are what we recommend for you

Shanghai Guangzhou Tokyo Bangkok Istanbul

5.4 User Interface

5.4.1 Streamlit

We use Streamlit to build a web page as a user interface. First we set two input areas to get users information about trips, after filling the designated areas, users should click the “let’s go” button to generate results. The returned results are also displayed in this web page.

Please tell us where/when do you want to go

e.g. I want to leave from Beijing to Tokyo on 24 Dec 2021

Please tell us some details about your journey

e.g. I prefer Economic cabin. We have three people in total. This is a single trip

Let's go

6. Conclusion

6.1 Conclusion

In this project, we build a intelligent travel recommendation system which can provide optimal flight information based on location user provided, and a group of hotel information based on location and other hotel requirements, we also try to provide places of interest as many as possible because based on our survey, different people have different interest point, so we want to provide all kinds of interest places for user to select themselves so that we can provide more humane services.

We build this travel system based on many techniques like Reasoning System, Machine Reasoning, and Cognitive System learnt in courses. We use Streamlit to build a web page app to Interact with users. We use the NLP model to understand information the user provided and use 3 APIs to retrieve information and process the returned information step by step, and then select this information based on some rules, finally display useful information on the web page.

6.2 Challenges

There are still some challenges in our travel system.

Rule-based System:

When there are two or more cities in the world with the same name, it will cause difficulties for our final return, because our user input is the city name, at this time it is difficult to determine which country the user wants to go.

NLP Model:

The NLP model does not have a good understanding of the text, and cannot semantically understand the difference between the date and the number of people, so it cannot provide the date and the number of people in a piece of text.

User Interface:

It is better to communicate more with users on the web page.

Market:

With the continuous expansion of the travel market, more and more companies have begun to launch travel applications. Their application functions are very comprehensive and the UI is also very beautiful, so the pressure of market competition is increasing

6.3 Future Developments

- Train a model that can be classified according to semantics.
- Improve application efficiency.

APPENDIX A. Mapped System Functionalities against Knowledge, Techniques and Skills of Modular Courses

Modular Courses	System Functionalities / Techniques Applied
Machine Reasoning(MR)	Knowledge Representation Rule Based System Supervised Learning Algorithms
Reasoning Systems(RS)	Deductive Reasoning
Cognitive System(CGS)	Cognitive System: NLP model Intent Detection & Slots Definition

APPENDIX B. Project Proposal

Refer to the following link for project proposal:

<https://github.com/HMY-icon/Travel-Helper/tree/main/ProjectReport>

APPENDIX C. Installation & User Guide

Refer to the following Github link for user guide:

<https://github.com/HMY-icon/Travel-Helper/tree/main/ProjectReport>

APPENDIX D. Individual Reports

Refer to the following link for individual reports:

<https://github.com/HMY-icon/Travel-Helper/tree/main/ProjectReport>