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Restaurant Recommendation Decision Support System Using Topsis System

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ABSTRACT

The vast technological development in the culinary aspect makes all kinds of information could be acquired easily. Information is needed to be one of some considerations when a person is going to book a seat in a restaurant. Hungryhub is a restaurant booking service provider which helps customers to be able to make a reservation online. This research background is in Hungryhub website development innovation which offers so many restaurants. This research aims to help customers make decisions with restaurants' recommended option alternatives. This research uses Technique for Other Reference by Similarity to Idea Solution (Topsis). Data is collected from documentation and interviews. The documentation is obtained from survey fulfillment by the users which would be processed and references of the restaurant recommendations for the users themselves. The interviews are done with the Hungryhub operational team to get the restaurants' data which have cooperated with Hungryhub. The topic method is chosen because it has a concept that chosen alternatives have the shortest range to the ideal positive solutions and the farthest range to the ideal negative solutions. The result of this research is a recommendation system that could display alternative restaurants' ranking results. Of 40 counting trial attempts that have been done, there are 7 or 17.5% of data which is failed, and 82.5% which is successful in the testing process.

Keywords: ***Decision Support System, Recommendation System, TOPSIS.***

1. INTRODUCTION

People might find difficulty in choosing where to eat. Fortunately, with nowadays convenience that is offered by technology people get help to do so online. There are varied applications that could help the users decide the place to eat, these applications offer different kinds of restaurants and the cuisines served there. HungryHub is one application that helps users book a seat in a restaurant until they order the cuisine to eat. The problem is there are too many restaurants offered by the app which often leads to confusion on which one to choose.

The research is aimed to solve this problem using recommendations for every user. The recommendation system could be applied by gathering data through surveys. The survey is given based on the restaurant types, menu prices of each restaurant, and users' location. The data is then processed by the recommendation system, giving restaurants recommendations as the output.

2. METHOD

Research Materials

Decision support systems form an integral part of computer-based information systems that provide alternative decisions for facilitating decision-making in organizations and enterprises [1], one of the techniques used in decision support systems is the TOPSIS method. TOPSIS method is used as a way to overcome Multiple Criteria Decision Making (MCDM) issues, MCDM includes all the aspects from the decision-making process with many criteria up to analytic or algorithm procedure, and also implementation to a decision-making supporting system [2], this method is based on the concept that a chosen alternative should have

the shortest range to the ideal positive solution (the solution that minimizes the price criterion and maximizes the benefit criterion) and should have the farthest range to the ideal negative solution from a geometric point of view using euclidean range to decide the relative proximity from an alternative to the optimal solution [3], thus, the researcher decided to use the TOPSIS method for this research.

To develop the recommendation decision support system, the researcher needs a data primer. The data primer are gathered from interviews with 2 company operational team which would then be processed by the system. The data primer are restaurants that would be recommended to the users where the users could order a menu or seat at a chosen time, restaurant address which places are around the location that the users want, and menu types which is the restaurants grouping based on its features, services, and served cuisines.

Research Tools

The researcher is using these hardware and software

Table 1. Hardware Table

Hardware	Specifications
Computer Type	Processor Intel Core i5-9300H CPU @ 2.40GHz
RAM	16.00 GB
Hardisk	500 GB
System Type	64-bit operating system, x64-based processor
GPU	NVIDIA GeForce GTX 1050 Ti
Monitor	1920 x 1080 (165 Hz)
Mouse	Logitech G304

Table 2. Software Table

Software	Specifications
OS	Dual boot Windows 11, Ubuntu 20.04
Database	MySql version 5.7
Database	DBeaver 23.0.4
Web Browser	Google Chrome
BackEnd Programming Language	Ruby
Framework	Rails
Frontend Programming Language	Flutter Web

Research Process

A researcher is using a waterfall system which starts with the system necessity analysis, design creation, program code writing, system testing [4], and system analysis in the problem interviewing the operational team to get the information needed for the research.

Design Creation after getting the data, the researcher then makes software planning in the form of this first stage, the researcher analyzes the flowchart system, data flow diagram, entity relationship diagram, menu structure, and input and output planning [5].

Program Code Writing a researcher then applies the output from the design process to code to make the system. The researcher is writing both backend and frontend code in two different languages as requested from the interview.

A researcher has developed an API to facilitate the integration and connection of two distinct applications [6], specifically, in this case, the researcher is utilizing a REST API. With this type of API, every request from a client includes a method, allowing the server to understand the desired action from the client [7], system testing in this phase, the researcher tested the made system to seek the truth of whether the made system fit with the data gathered in the analysis phase or not [8].

Problem Identification

The constraint which is faced by the users to decide the restaurant to book is the background of this research. The HungryHub application has many restaurants listed on the database. Operating this application, the users would directly see the homepage which displays so many restaurants on it. From this issue, the researcher would use the decision support system to help the users upon choosing the restaurant. By using a decision support system, the data gathered from the user's survey would result in restaurant recommendations that suit their references [9], and users' references would be gathered from users' answers from users' surveys. From this research flow the researcher decided to use the TOPSIS method.

Data Gathering

The researcher is using interviews with the operational team and documentation from users' surveys. Data gathering results the data restaurant consists of the restaurant name, address, starting and ending prices, serving time, longitude, latitude, and type amount.

Table 3. Sample Data

Number	Data
1	The Flora Cottage Soi Chang, Sai Ma, Mueang Nonthaburi District, Nonthaburi 11000 1040 – 1520 Baht 40min 100,4545323386 13,872378513 1 Type
2	Audrey Cafe Thonglor Soi 11 136/3 Thonglor Soi 11, Wattana, Bangkok 10110 400 – 2990 Baht 30min 100.5801801 13.73297123 2 Types
3	Rain Tree Cafe at The Athenee Hotel 61 Wireless Rd, Lumphini, Pathum Wan District, Bangkok 10330 1050 – 1750 Baht 30min 100.546787 13.74219 1 Type
4	Skyline at Avani+ Riverside Bangkok Hotel 257 Charoen Nakhon Rd, Samre, Thon Buri, Bangkok 10600 999 – 2400 Baht 30min 100.491311 13.70539 1 Type
5	Vertigo Rooftop Banyan Tree Banyan Tree Hotel, 21/100 S Sathorn Rd, Yan Nawa, Khet Sathon, Bangkok 10120 2499 – 6900 Baht 30min 100.539825 13.723098 2 Types

Criteria Definition

The topic method needs criteria that would be used in the research process. The used criteria in this research are the results after gathering these data:

Table 4. Criteria

Code	Criteria
C1	Menu Type
C2	Restaurant Address
C3	Price
C4	Serving Time

Table 5. Criteria Value

Criteria	Value
Menu Type	40%
Restaurant Address	30%
Price	20%
Serving Time	10%

Table 6. Value Declaration [10]

Value	Declaration
5	Very good
4	Good
3	Fair
2	Bad
1	Very Bad

Table 7. Menu Type Criteria Value

Menu Type	
Criteria	Value
0 menu	1
1 menu	2
2 menus	3
3-4 menus	4
> = 5 menus	5

Table 8. Restaurant Address Criteria Value

Range	
Criteria	Value
> 15 km	1
10 -15 km	2
8 - 10km	3
5 - 7km	4
< = 5km	5

Table 9. Restaurant Price Criteria Value

Price	
Criteria	Value
> 1200	1
900 - 1200	2
600 - 900	3
400 – 600	4
0 - 400	5

Table 10. Serving Time Criteria Value

Menu Type	
Criteria	Value
> 60	1
50 - 60	2
35 - 50	3
20 - 35	4
0 - 20	5

3. RESULT AND DISCUSSIONS

Research Result

Below are listed the research results done by the writer to solve the users' constraint to decide a restaurant to book which is solved by the decision support system using the topsis method. API List to show data on the client website the researcher needs some APIs as the intermediary from the client website and the website server; they are: GET Restaurant List

This is the API to get the restaurant data from the website server

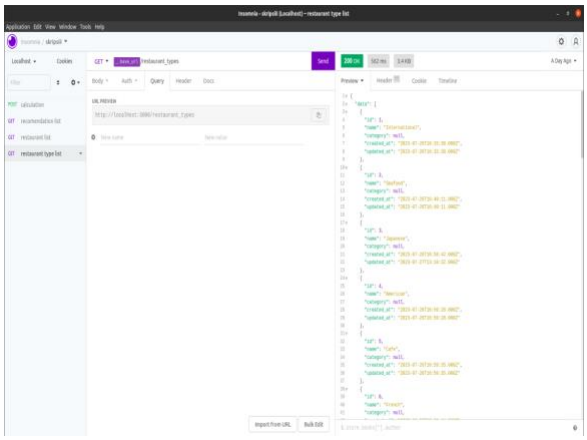

Figure 1. Example of GET Restaurant API

Get restaurant type list is the API to get the restaurant data type

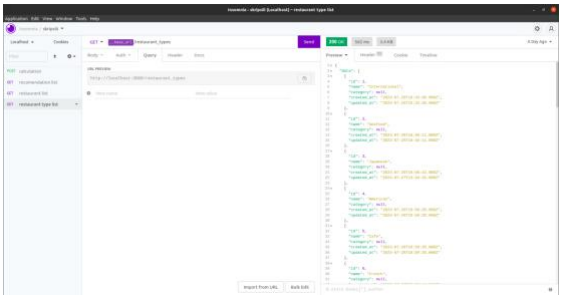

Figure 2. Example of GET Restaurant Type API

POST Calculation, this API consists of user criteria which would be input from the recommendation setting page and would be processed by the website server. Accessing this API, the client website would process the latitude and longitude from users' address input. The data is then used to do the recommendation counting based on users' address input and restaurant address.

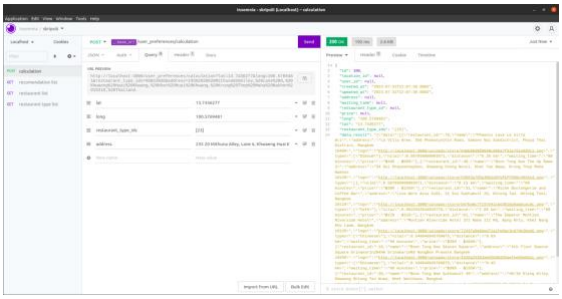

Figure 3. Example of POST Calculation API

GET Recommendation, this API could be accessed once users have done the data input on the recommendation setting to get an ID to access this API. This API would show the restaurants from rank 1 up to 6 after the system has done with the counting and ranking based on users' criteria

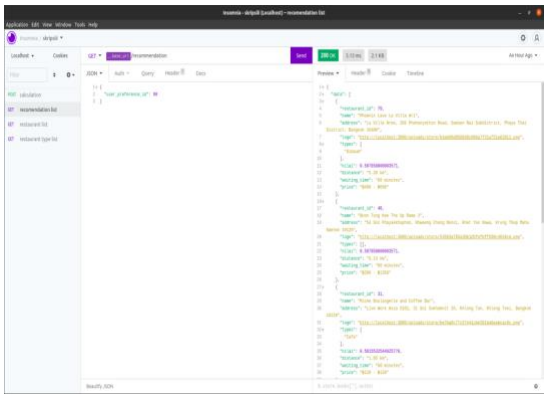

Figure 4. Example of GET Recommendation API

Homepage, this page displays all restaurant data from API GET Restaurant List. Users could see the logo, name, address, price, type, and serving time of a restaurant.

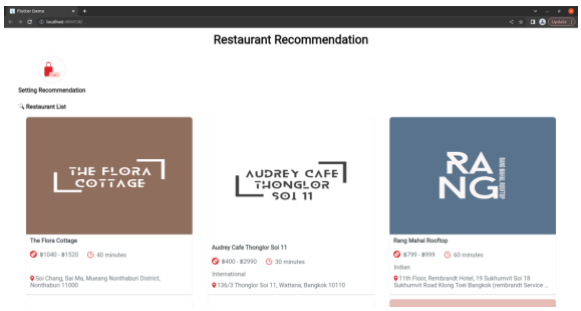

Figure 5. Homepage

Recommendation setting system, on this page, users can fill in the restaurant's criteria that they want. Users need to fill in the address data and desired restaurant types. Users could choose up to 5 available restaurant types.

Figure 6. Setting Recommendation Page

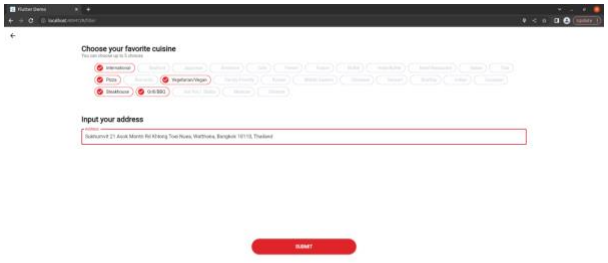

Figure 6. Example of Setting Recommendation

Homepage recommendation section, this section will be displayed once users input the criteria that they wanted on the recommendation setting page. This section would display up to 6 restaurants most suitable to users' criteria.

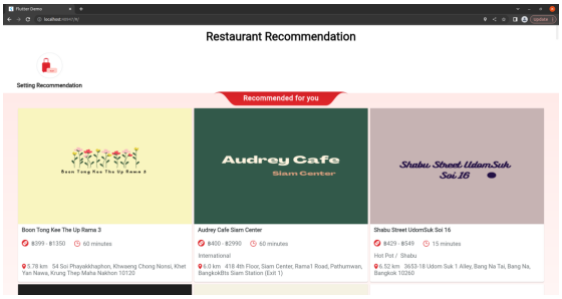

Figure 7 Recommendation Section

4. CONCLUSION

Of 40 counting trial attempts that have been done, there are 7 or 17.5% of data that failed and 82.5% were successful in the testing process. This issue is caused by the less valid API data address that the researcher used, so it hasn't covered new or specific addresses. This research hasn't been applied to real users.

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