Decision-making System of Travel Route Price Comparison Based on Cloud Computing

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Abstract. In the context of rapidly growing number of domestic tourists and travel routes provided by travel websites, tourists have run into trouble in choosing the optimal route. Under such circumstance, decision-making system of travel route price comparison based on cloud computing is designed to integrate travel route information on the existing travel websites by distributed web crawler technology. In this way, users are provided with centralized platform of inquiry and comparison to plan the best travel route, which avoids the tedious comparison of routes among different websites. web crawler technology, spring mvc technology, word segmentation technology, java swing technology, decision-making model, MySQL cloud database and MongoDB are used in this system.

1 Introduction

With the fast development of economy in our country, there is increasing number of tourists. According to National Bureau of Statistics, tourism consumption is climbing year by year. Domestic tourism consumption survey data [1] conducted by Cai liyun show that tourism consumer expenditure is rising with each passing year. Take Tuniu, a tourism website as an example. More than 300 routes for 5-day travel from Beijing to Sanya cause travel route choosing problem for tourists. Traditionally, users have to compare information like route price, travel time, beauty spots arrangement among different routes, which obviously place a heavy burden. To solve such problem, this paper will elaborate on decision-making system of travel route price comparison based on MVC frame [2] from two aspects: detailed function and specific technology implementation. Meanwhile, MVC frame improved on model layer based on Spring proposed by Zhang Yu is applied to the system[3].

It is well-known that cloud computing, an internet-based super calculation pattern, can provide convenient and efficient website access with such advantages as super-large scale, virtualization, high reliability, universality and high scalability[4]. By cloud computing technology, we can build our application fast with more flexibility and expansibility, solve some particular scenes, and shorten production design cycle, thus cutting down the cost of putting up infrastructure. Due to large information and many resources required by this system, before system development calculation principles and methods[5] of elastic cloud computing suggested by Schahram Dustdar are consulted and an internet-based distributed decision-making system of travel route price comparison, which closely bond human and software service.

2. Analysis on system function

At present, the realized software function is to screen out optimal travel route on the basis of starting point and destination input by users. It provides inquiry function like site name, starting point, destination, days of travel, price, route brief introduction, route arrangement, route source (corresponding to URL, which can skip to websites by clicking), route appraisal and ranking. See fig 1 for the realized specific function.

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The system mainly has four functions: inquiry, screening, management and appraisal, among which inquiry function includes route information and scenery spot information. In route inquiry, specific route information, including price, days of travel, price, route brief introduction, route arrangement, means of transportation and accommodation arrangement can be inquired by inputting starting point and destination. Screening function helps users to do conditional filtering form inquired routes with price, date of departure, travel websites. Appraisal function is built for introducing our own appraisal system, in which users can assess and grade every travel route. The accessing and grading information will be saved in corresponding database as part of comprehensive appraisal of travel routes. Management function is mainly designed for system administrator. Because the travel route information is constantly updating every day, administrator can update and add information to guarantee the information instantaneity. It has two functions of super administrator and general administrator, and the former has all the privilege to add, modify and update database, while the latter can only update it.

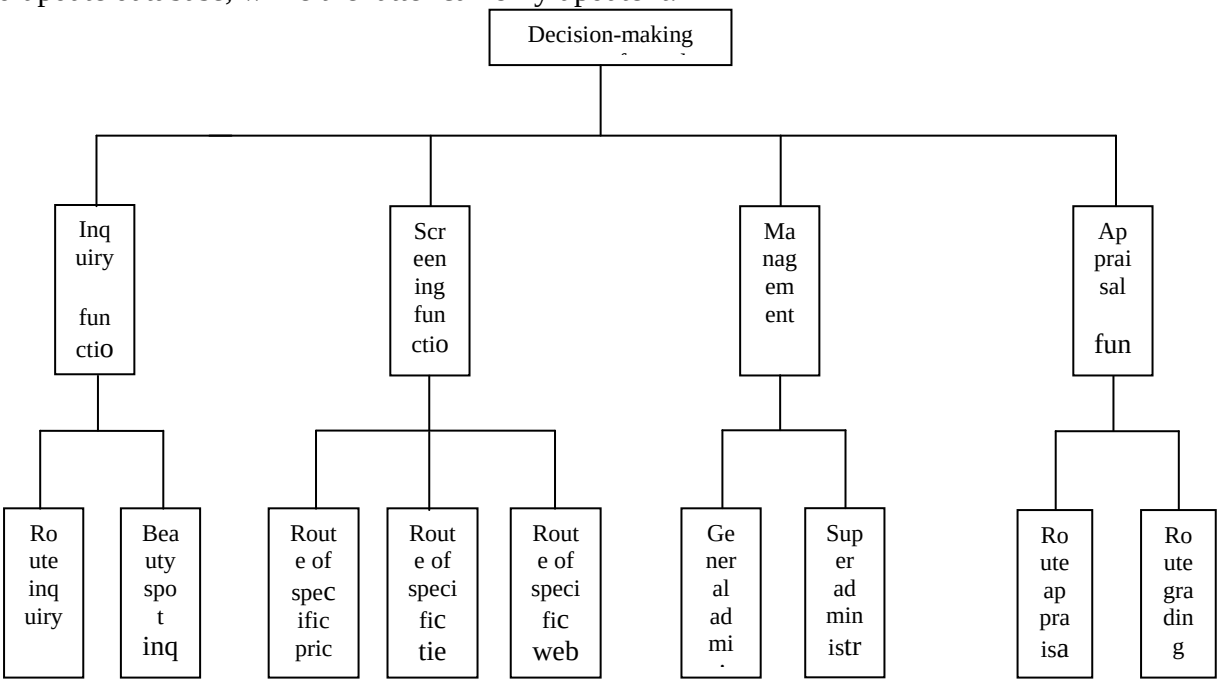

Fig.1 Functional diagram of Decision-making system of travel route price comparison

3. Architecture design of the system

Decision Support System (DSS), aiming at semi-structured problems, is an intelligent man-machine system supporting decision-making based on management science, operational research, control theory and behavioral science, by the means of computer technology, emulation technique and information technology. Decision-making system of travel route price comparison developed in this paper adopts MVC pattern with sound man-machine interactive function, reusability, high maintainability and accurate decision-making.

As is shown in fig 2, decision-making system of travel route price comparison is composed of user view layer, control layer, system function layer, system logical function layer and data layer. User view layer is front-end interface, with which users can enjoy good user experience by interface inputting decision-making condition and corresponding feedback. Control layer, as the interaction bridge between user front-end interface and system function layer, is in charge of forwarding users' request and asking for handling. System function layer, the core of the whole system, contains the following modules as optimal route decision-making system, crawler system, word segmentation system and travel routes information management system, which can be seen in fig 3. Database layer integrates and stores various travel websites information.

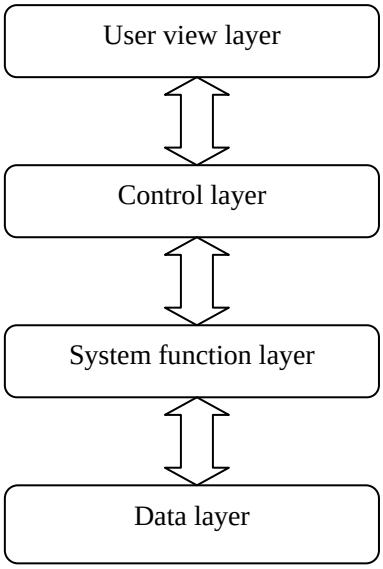

Fig. 2 Architecture of decision-making system of travel route price comparison

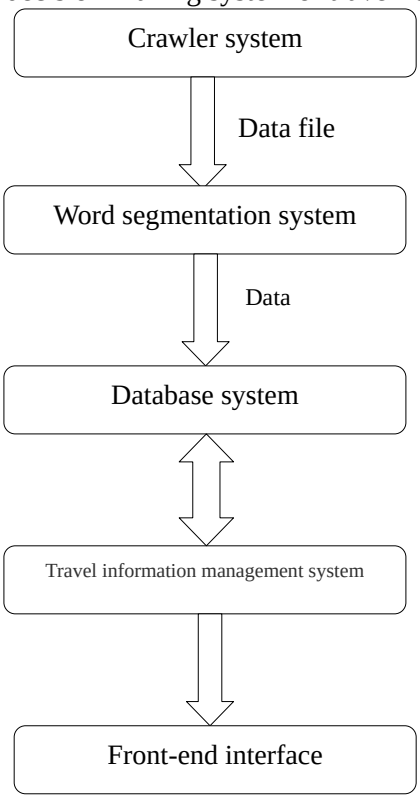

Fig. 3 Architecture of system function layer

4. Design and realization of various function module in the system

4.1 Crawler system design

With the rapid development of network, internet has become the carrier of mass information, which makes it a great challenge to extract and use information efficiently. Crawler in this system is focused crawler, extracting mainly specific information on the internet. Crawler is composed of task

database, seeds injector, seeds administrator, browser behavior stimulator, crawler message manager and grabber. Task database is responsible for storing crawling task url seeds with selected database Mongo，MongoDB of high-performance, deploying easiness, fast inquiry and storage and automatic pieces processing to support expansibility of cloud computing. Its great function can improve the crawler's efficiency. In the task database, the crawled URLs are marked crawled, otherwise the uncrawled to support break crawling. Seeds injectors are in charge of injecting task URL to browser behavior stimulators. Seeds administrators are to submit, update, mark and screen seeds task. Browser behavior stimulators, as the core module of crawlers, are like embedded browsers and in charge of sending requests to URL page and receiving webpage. Crawler message managers are in charge of managing information, for example, asynchronous processing of crawled information, and multithreading processing of crawlers. Grabbers are for extracting and sending URL of the new pages. Json and jsoup are responsible for analyzing and screening HTML elements in the pages, slf4j supports crawler's log system, and mongo-java-driver drives mogo database. fig 4 is crawler's architecture design.

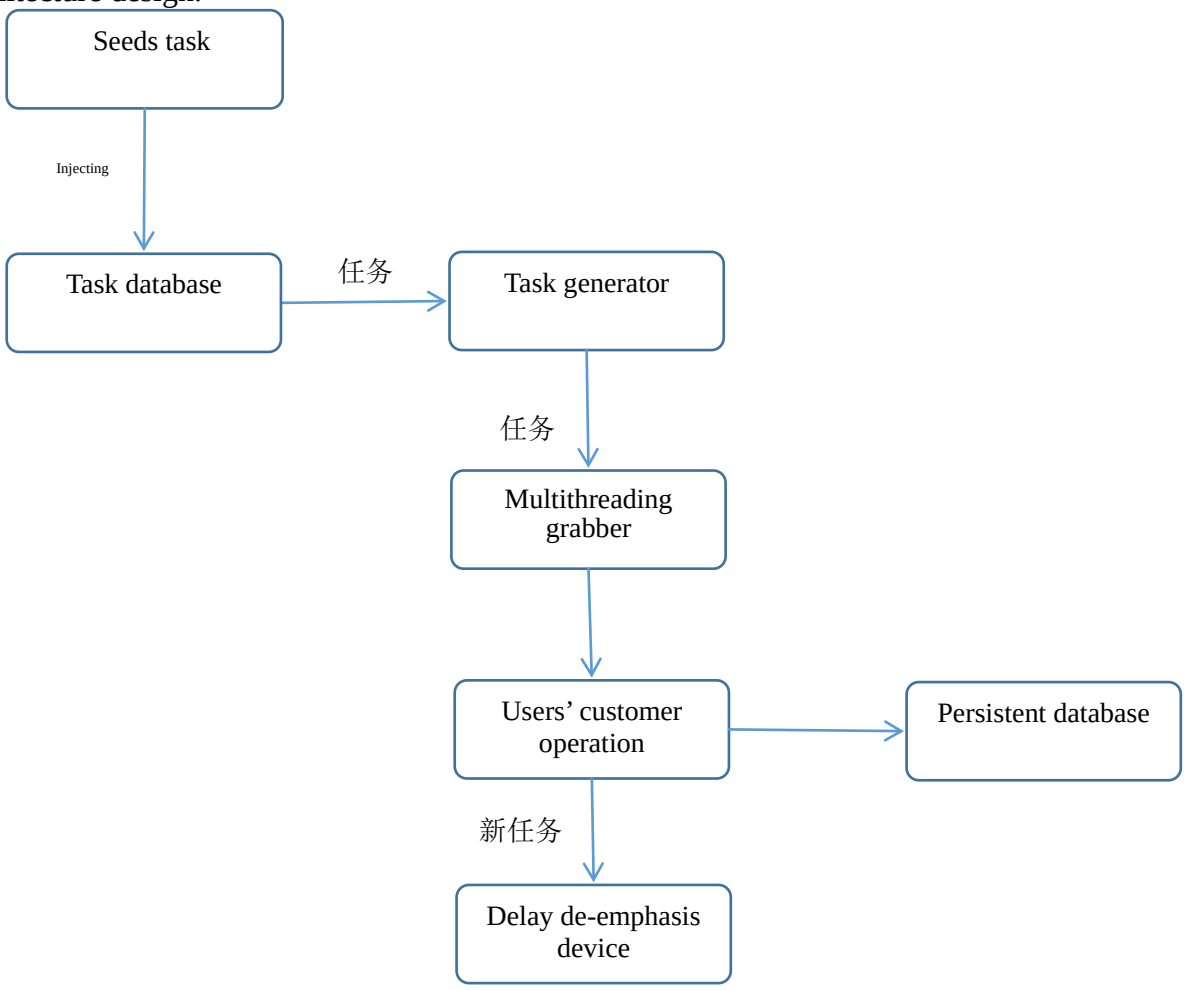

Fig. 4 Crawler's architecture design

4.2 Word segmentation system design

Word segmentation technology in this paper is based on lucene word segmentation[6] technology. There are two functions: one is segmenting words of irregular information crawled by crawler to normalize them, the other is to create indexes through word segmentation to improve data inquiry efficiency.

4.3 Database system design

4.3.1 Conception framework design (E-R Diagram)

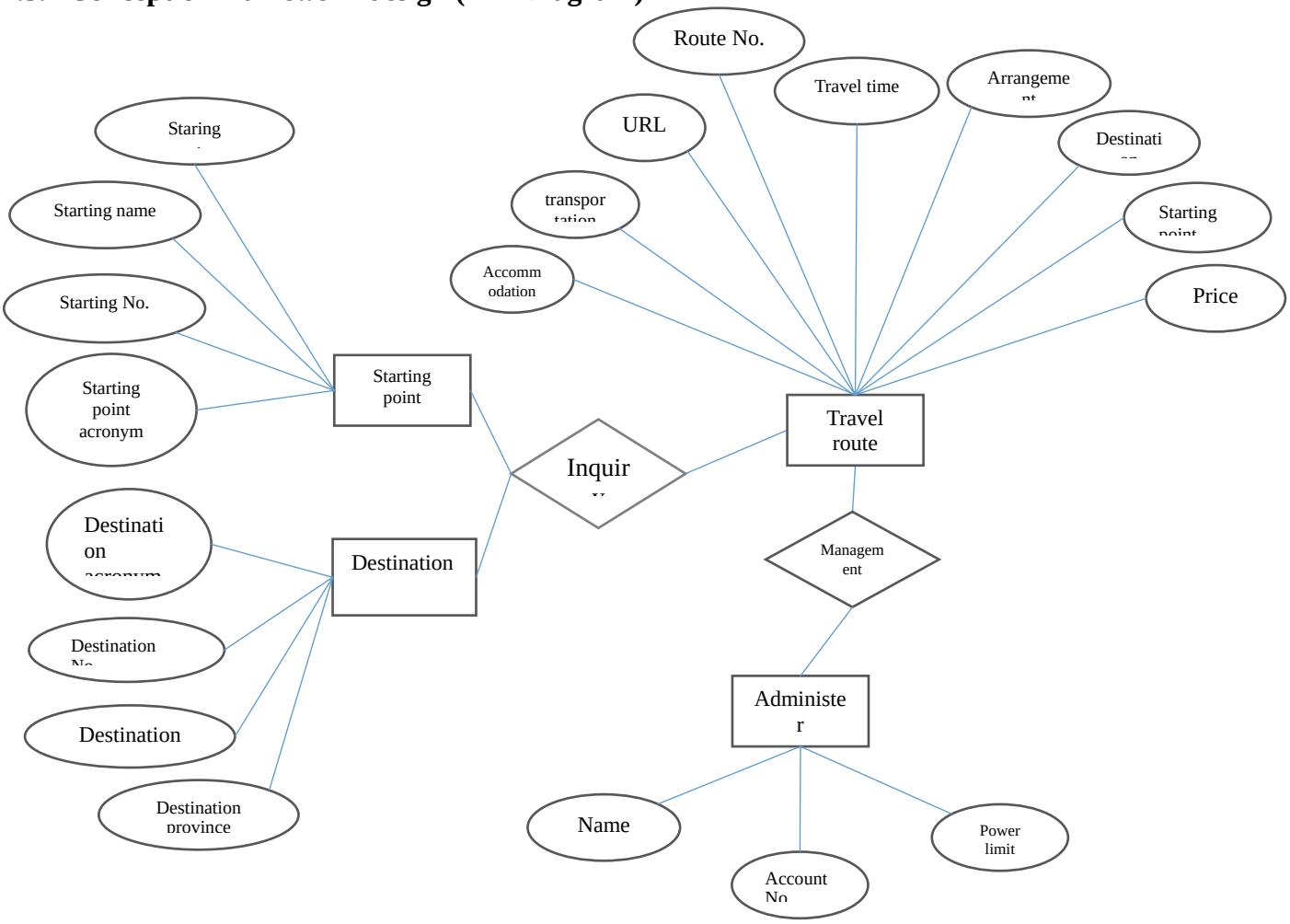

Fig. 5 E-R figure

4.3.2 Logical structure design (data flow diagram)

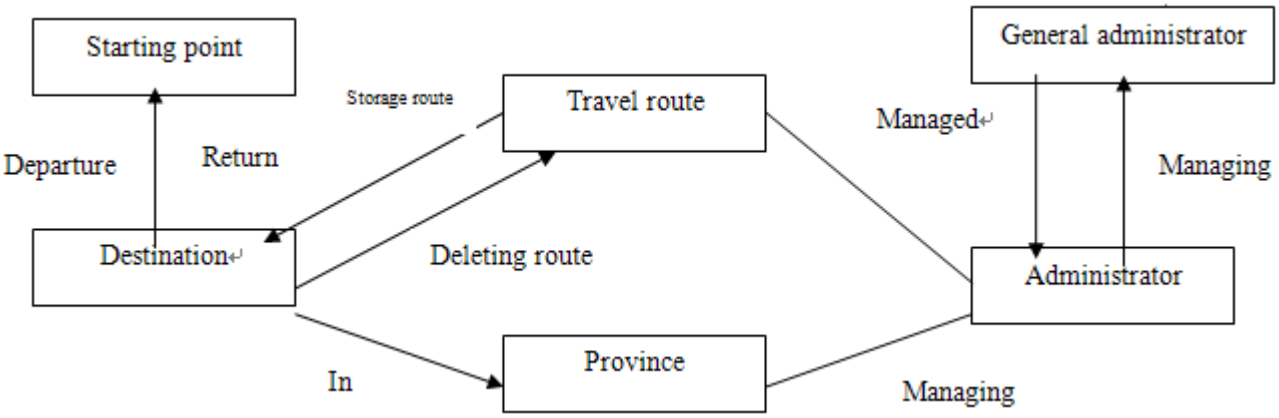

Fig. 6 Data flow diagram

4.3.3 Data dictionary design

Database System has many tables, among which Start table, End table and travel route stand out. Start table records the starting points of routs.

Table 1 Starting point

List-name	List name	Data type	size	Primary key?	comment
start-id	Starting point No.	char	10	Y	Primary key
start-name	Starting point	char	10	N	Not null
Short-name	Starting point acronym	char	25	N	Not null
province	Starting province	char	20	N	Unique

The destination table records ends of travel routes as is shown in Table 2

Table 2 End table

List-name	List name	Data type	size	Primary key?	comment
end-id	Destination No.	char	10	Y	Primary key
end-name	Destination	char	10	N	Not null
Short-name	Destination acronym	char	25	N	Not null
province	Destination province	char	20	N	Unique

Travel route table records some basic information in Table 3.

Table 3 Travel Route

List-name	List name	Data type	size	Primary key?	comment
Trip-id	Route No.	char	10	Y	Primary key
Start-id	Starting point	char	10	N	Foreign key
End-id	Destination	char	10	N	Foreign key
Trip-time	Travel time	Time	10	N	Not-null
Trip-content	contents	char	100	N	
Trip-net	Trip net	char	100	N	Unique
hotel	accommodation	char	100	N	
transportation	Transportation	char	50	N	
Price	Price	double	50	N	Not NULL
Trip-Sum	Travel summary	char	50	N	Not NULL

4.4 Travel information management system design

Travel information management system is to realize the functions of collecting, processing, storing, organizing and inquiring information. That is, the design of information collecting module, information procession module, information storage module, information organizing module and information inquiry module. Information collecting module collects information crawled by crawler system; information processing module extracts information by using word segmentation system; information storage module classifies and stores initially organized data by Mongo database storage function; information organizing module automatically deletes outdated information and adds new information regularly by employing the functions of increasing, deleting and modifying to better satisfy the needs of users; information inquiry module searches needed information to realize information inquiry by inputting inquiry information in the front-end page and screening page.

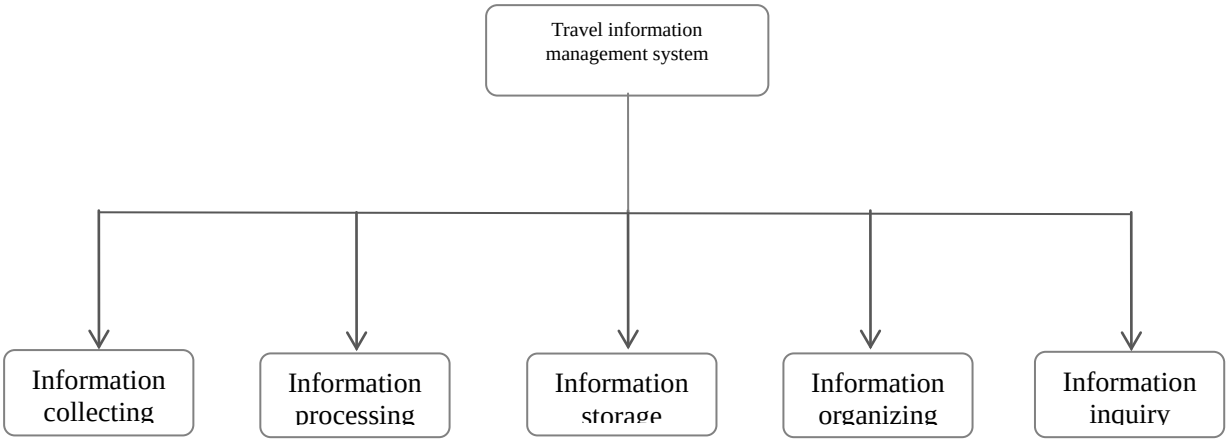

Fig. 7 Travel information management system architecture

4.5 Decision-making system of travel route price comparison

The main function of decision-making system of travel route price comparison is to compare and appraise the travel routes with the same starting points and destination. The established model proposed by referring to Ronaldo Gonçalves Junior is a multi-standard appraisal method based on non-functional requirements [7], and with composite grading the travel routes are listed comprehensively. This model supports horizontal expansion and the pair comparison matrix is set according to personal selection and individual preference. In this way, the matrix is in constant change with the actual needs of users (decision-makers) with flexibility and comprehensiveness. Due to the relatively complicated eigenvector and characteristic root of dimension matrix, the plan layers are further optimized, which only establish comparison matrix of routes with the same starting points and destination to improve solving effeciency.

The model used in decision support system is based on comprehensive assessment decision model and vague assessment model in AHP [8]. Optimal routes require appraising methods as theoretical support. The combination of relative subjective method of AHP and vague assessment model is used in this system to comprehensively appraise and list as is shown is Fig 8.[9]

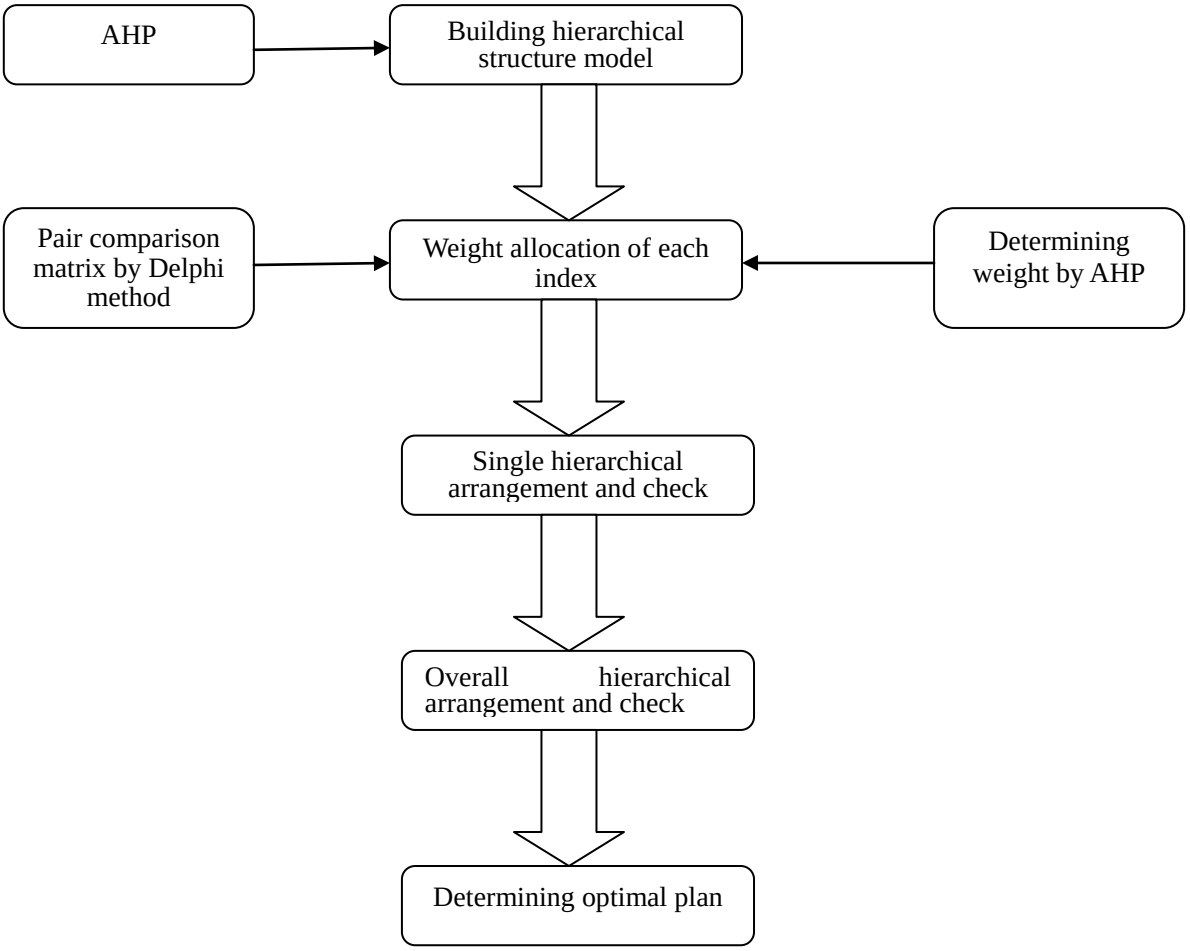

Fig.8 Decision Support model

4.6 The realization of system functions

Decision-making system of travel route price comparison based on java swing platform has two parts: client and server. The client receives and submits data by requesting the server, while the server processes data sent by the client.

4.6.1 The front-end users inquiry and screening

As is shown in Diagram 7, users can input departure city and destination city to inquire travel route. Search results will be listed by ascending sort shown in fig 9. Users can further screen in the page of search results for the desired route shown in fig 10.

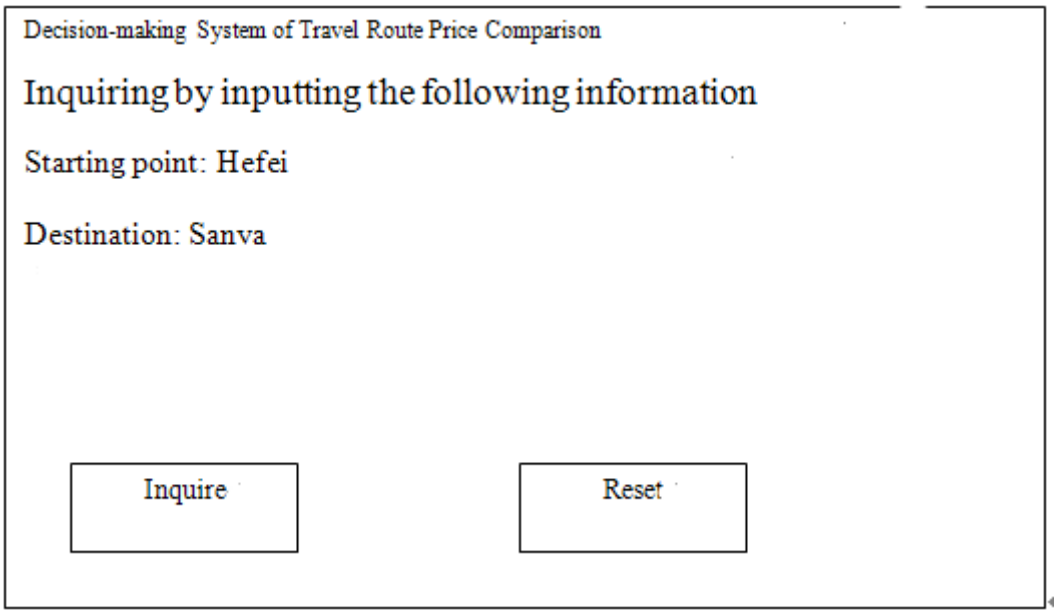

Fig. 9 Users inquiry interface

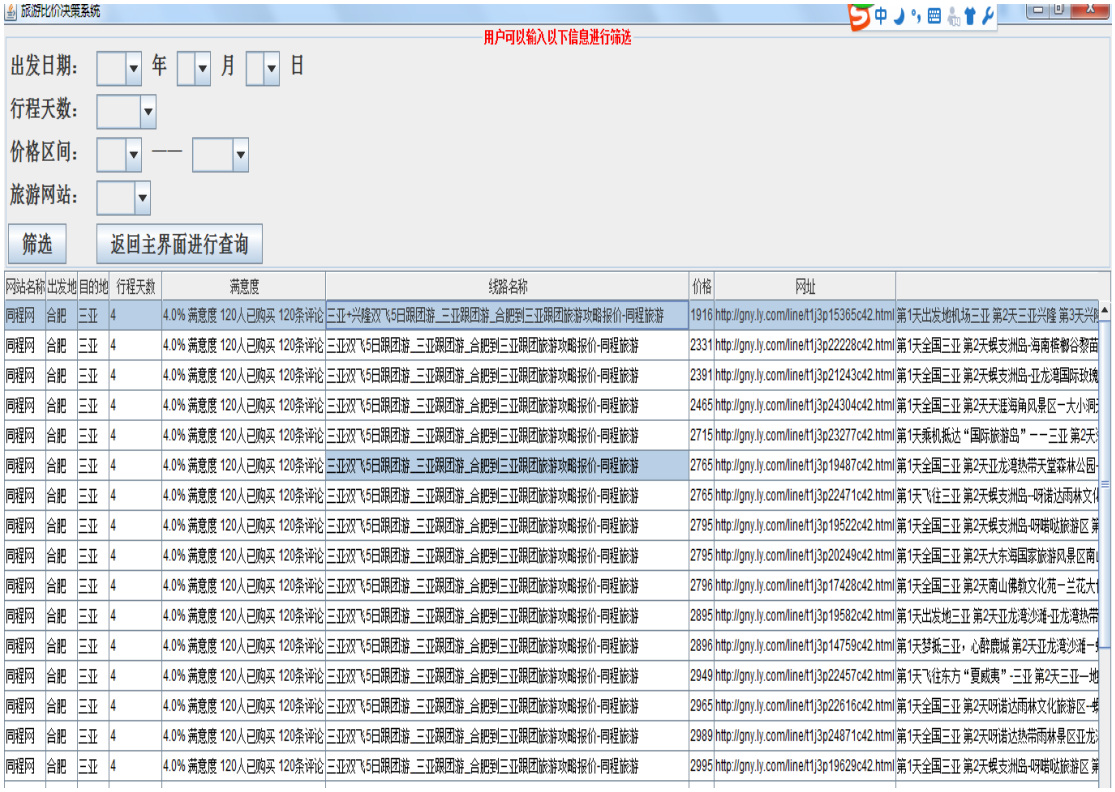

Fig. 10 Result display and users screening interface

4.6.2 Server

The background server is consisted of crawler system, word segmentation system, travel information management system and price comparison decision-making pattern system. Clawer system is responsible for extracting specific travel information on the internet and collecting mass data; word segmentation system does primary screening and organizing of the crawled data and stores them in the database in a distributed way; at last, travel routes information are classified and organized by travel information management system and price comparison decision-making pattern.

5. Conclusion

This paper introduces the design and realization of a decision-making system of travel route price comparison based on cloud computing and java swing platform and makes introduction and analysis on key technology involving in this system. By integrating travel plan information

provided by various travel websites, analyzing related routes and centralizing and comparing the price of the same route from different webs, this system helps users brings tourists much convenience by making optimal travel routes. Due to large data and fast data updating, crawling efficiency of the crawler, access efficiency of database and server code shall be optimized in the future to improve the data transmission utilization ration between client and server for efficient and stable operation of the system.

Acknowledgments

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