

# Research on the Model of Intelligent Passenger Information Service System based on Multi-Agent

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## Abstract

With the improvement of people's living, the requirement of railway facilities and the service quality is much more than before. Considering to the problems of the existing RPISS, the multi agents-based system design method is adopted, and a model of intelligent passenger information service system based on multi-Agent is designed, which provides personal information services by the collaboration of the independent multi-Agent for passengers.

**Keywords:** Passenger Information Requirement; Multi-agent Technology; Information system; Personal Service

## 1. Introduction

With the rapid development of railway in our country, the higher requirements of the station facilities and service quality are put forward by the passengers. To improve the information environment for the passengers and staff, the problems of updating, integration the information from the existing Passenger Information Service System is becoming crucial.

At present, the facilities and the humanity Passenger Information Service Systems (PISS) have been constructed in some developed countries such as Japan and German. Then the train information can be released by network, mobile communications equipment, and so on.

Addition to releasing information by radio, television, LED displays, LCD monitors and other equipment in the trains and stations, the systems provide the convenient information service to passengers also. In Some countries, the Railway Passenger Information Service System (RPISS) connected to the Internet, Which make it possible to provide information by site. And it reflects the visitor-oriented business philosophy fully<sup>[1]</sup>.

In our country, the information systems have been constructed by the Ministry of Railways Railroad Bureau and station such as ticket sale and reservation (TRS), the Railway Command System (TDCS), PA system, guidance system, and so on. For all that, the information service level is still backward. The problems exist as follows<sup>[1]</sup>:(1) The information service way is mostly unidirectional. So the passengers accept the information passively. (2) The information service way is self-contained, and the information network is not formed. (3) Some decision-making are disturbed by the redundant, obsolete, incorrect information. In short, the system is in a status of dispersive management, multiple publish channels.

Aiming the problems, a model of intelligent passenger information service system based on multi-Agent is designed. This model is composed of many agents that it can realize the information push, sharing, and conformity.

## 2. RPISS Requirement

### 2.1. System Information Analysis

According to the actual travel behavior, the behavior of the Passengers can be divided into five phases including of the travel route determining, ticket-purchasing, pulling in, waiting and boarding. And the information required are various at different phase. The information can be divided into four categories including of train basic information, ticket information, service information of station and social.

#### (1) Basic train information

At first, passengers available the basic train information through the Internet and other means. And they are include of train number, running section, operation time, the departure station and destination station, destination time, transfer information and so on.

#### (2) Ticket information

The travelers need the ticket sale information, such as ticket pre-sale time, methods of tickets acquisition, ticket fares, ticketing outlets, the number of Residual tickets and seats, etc.

#### (3) station service information

The information can be provided in the station, such as the location of the station's main service facilities (i.e. the check port, the outlet, the hall, waiting room, etc.) and the train operation message (i.e. arrive/departure and delays, ticket-checking, etc.) and so on.

#### (4) social service information

Addition to railway information, some social information as well as tourist Sites, transportation, weather forecast, accommodation and entertainment are needed also.

### 2.2. System Function Design

Base on the information analysis, the system composed by follows: (1) information collection model. It fulfills the task of information collection, management

and sharing. (2) Information retrieval model. It can perform function of retrieval according to the passengers' requirements. At the same time, it can eliminate the isomerization of data model and semantics in different information sources. (3) Information push module. It can push the retrieval results to the relative users and devices through man-machine interface.

## 3. System Models

### 3.1. Overview of Agent Technology

Agent is a concept accompanied by the development of AI field. It is widely used in the area of enterprise information system, information retrieval, and fault diagnosis and so on. It is generally considered as a program entity with the ability of perception, problem solving, and collaboration. It can solve the distributed intelligence problems in a method of loose coupling.

Multi-Agent System (MAS) consists of some loosely coupled and coarse-grained intelligent Agents. The characteristics of them are as follows:(1) Solving ability is strengthened. It can resolve the complex problem by the collective intelligence of Agents. (2) Solution efficiency is enhancement. Adopting distributed data structures, it solves the problems parallel. (3) It has the feature of scalable and tolerance. They work coordinately. Then there will no effects about decision-making when the agent is error.

### 3.2. System Structure

For the features of the Agent, RPSIS base on Multi-Agent can provide intelligent, personalized information for travelers. According to the research result in the information retrieval field, an information retrieval system is constituted by a series of Agents. It includes of user interface Agent, information cooperation queries Agent, information collection Agent, in-

formation analysis Agent, and information transmission Agent and so on. Reference for the information retrieval system idea, the Intelligent Passenger Information Service System based on Multi-Agent (IPISSMA for short) is designed.

According to the actual flow of the information management, the IPISSMA can divide into five-layer architectures including of the user layer, the user interface layer, the coordinated layer, the information retrieval layer and the data source. Its structure may describe as follows in a 5 tuples:

$$IPISSMA = \langle US, PA, CA, RA, DR \rangle$$

And US express the user set. Users can query information by mobile phone, computer, PDA and others; PA expresses the function Agent set of user interface; CA expresses the function Agent set of control and coordination; RA expresses the function Agent set of information retrievals; DR expresses the set of each kind of data source. The relationship of the various layers in the system can be showed as Fig 1.

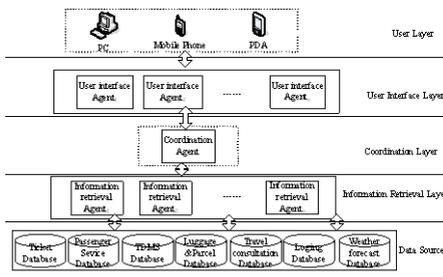


Figure1. The Model of IPISSMA

### (1) User Layer

User layer provide the information retrieval tools for the passengers. And the passengers can retrieval information by a variety of terminal.

### (2) User Interface Layer

User interface layer composed by a series of user interfaces Agents. And It is responsible for the input and output information between users and intelligent

information service system. The user interface Agents exchange the information with the users in a convenient, friendly, personal way. They receive information retrieval tasks given by the user and return the search results to the users. At the same time, they transfer the retrieval task to the coordination Agent, and receive the search results from the coordination Agent.

### (3) Coordination Layer

Coordination layer Agents are the core of the system. They are responsible for communication between Agents. Received the assignment sent by the user interface agent, they will decompose the assignment into subtasks based on the information type and requirements. Then they will notify the information retrieval layer Agent to excute the query task. And when the tasks complete, the result will be transferred to the user interface Agent by coordination Agent.

### (4) Information Retrieval Layer

Information retrieval layer is composed of some information retrieval Agents. They responsible for receive and execute the sub-query tasks from the coordinated layer. They eliminate the data model and semantic heterogeneous between the data sources. And they receive and execute the task from the coordination Agents. Finally, they transfer the result to the Agent of coordinated layer. They can be seen as intelligent encapsulation objects. And the details of data source such as location interface and others are shielded.

### (5) Data Source Layer

The data source layer is the basis of IPISSMA. It is the data set including ticket system data, the passenger service information data and meteorological information and so on.

## 3.3. Workflow of IPISSMA

The main workflow of the system is as follows: (1) The system transfer the task to the coordination Agent through the in-

terface Agent When users inquire the information by terminal. (2) According to the request of users and the type of information, the coordination Agent will decomposed them into sub-tasks and distributed them to the different information retrieval Agent; (3) Accepting the tasks from the coordination Agent , the Retrieval Agent return the retrieval results to the coordinator Agent; (4) Sorting and merging the results of the retrieval Agent submitted, the coordination Agent return the search results to the interface Agent; (5) Interface Agent presented results to the user finally.

#### **4. Key Technologies of the System Realization**

##### **4.1. Technique of Cooperation and Communication during Multi-Agents**

The multi-Agent system is suitable for the complex and opening distributional system. It uses the network composition structure and fulfills the task of solution through cooperation and correspondence between the agents. The correspondence is the foundation of cooperation. At present the most famous communication language of agent in international is KQML which proposed by Americans in the ARPA knowledge sharing plan and FIPA-ACL proposed by FIPA.

KQML is one kind of the most universal communication language of agent, and it contained a series of the expandable behavior performative. It can establish the high-level model of the agent interoperability. And FIPA-ACL is the part of agent communication language in the criterion.

##### **4.2. System Design and Realization**

The design of the overall system adopts the C/S pattern. Due to the united computing environment provided by JAVA and XML application development supported

by API, the KQML is packaged into the form of XML. So the system can accomplish the task of message passing by JMS mechanism of JAVA, and analysis the XML data through the JAVA parser. As JDBC provide the standard API, the system model can be constructed through JDBC to access the database, and the database application programs can be realized by JAVA API.

#### **5. Conclusion**

To promoting the service level of passengers information service and solving the problems of heterogeneous information integration under the conditions of railway information construction, the system design idea based on multi-Agent is adopted, and a five-layer system model of IPISSMA is proposed in this paper. A solution is provided for IPISSMA in the model, and the key technologies of the system realization is presented in this paper. And the system model should be improved in the practice, and it needs further study on the problem of how to modeling the personalized needs of users, the cooperation between the Agents, and so on.

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