Retraction

Retraction: Smart City Rail Automatic Fare Collection System Under the Background of Big Data (J. Phys.: Conf. Ser. 2146 012013)

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Smart City Rail Automatic Fare Collection System Under the Background of Big Data

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Abstract. With the rapid development of Internet technology, the process of urban construction is accelerating and the level of urbanization is further improved. In the smart city rail automatic fare collection system, there are a large number of data information and data that need to be processed manually. The traditional manual method not only consumes human, material and financial resources, but also has low efficiency. Therefore, this paper proposes a smart city rail automatic fare collection system based on big data design. Firstly, this paper expounds the concept of smart city rail transit and studies the function of automatic fare collection system. Then it studies the definition and characteristics of big data, designs the method of system development, and tests the performance of the system. The test results show that the system runs smoothly, accounts for a relatively small amount of memory, has a fast response speed and low delay. Most passengers are satisfied with the system.

Key words: Big Data, Smart City Rail, Automatic Ticketing, Ticket Checking System

1. Introduction

With the development of big data, smart city rail intelligent fare collection system will become a trend and be introduced into daily work. The system adopts advanced technology and means to realize automatic identification, analysis and other functions [1-2]. Through the information collection of various areas in the city, sort out and summarize the data [3-4].

Many scholars have studied the smart city rail automatic fare collection system. Some scholars analyzed the demand status of the current toll collection system and the problems existing in the payment method. Starting from the pain points of passengers and operation, they analyzed the different payment concepts of the automatic toll collection system, reduced the operation and maintenance cost, improved the innovation ability of the industry to provide a better solution for the diversified payment of the light rail automatic ticket collection system [5-6]. On the basis of expounding the design objectives and existing problems of the automatic fare collection system, other scholars analyzed the demand and technical development trend of the automatic fare collection system under the smart city rail, and reached some conclusions [7-8]. The above research has laid a foundation for this paper to improve the smart city rail automatic fare collection system according to big data technology.

This paper adopts the B / S structure mode for development and use. Through the analysis of the technical requirements required by the smart city rail information system, the overall scheme of the
data information collection and processing process of the intelligent customer service department is completed, and the overall architecture is planned and determined.

2. Discussion on Smart City Rail Automatic Fare Collection System Under the Background of Big Data

2.1. Smart City Rail Transit

Intelligent transportation represents the profound application of the new generation of information technology in the transportation field. Technically, intelligent transportation is the combination of perceptual transportation, digital transportation and transportation portability. Intelligent transportation is the product of the deep penetration and integration of information technology and modern transportation modes. Sensors are embedded in various infrastructure and transportation elements such as highways, bridges, tunnels, ports, railway stations and vehicles, aiming to connect these elements to form the social and system interaction of the Internet of things [9-10]. Intelligent transportation controls the whole process of traffic management, transportation, public transportation and other transportation fields, as well as the whole process of traffic construction management, so that the transportation system has the ability to capture, connect, analyze, predict and control traffic. More time and space in the city and in the future, fully ensure road safety, improve the efficiency of transportation infrastructure, improve the operation efficiency and management level of transportation system, and serve the good operation of public transportation and sustainable economic development [11-12]. Intelligent transportation is supported by a new generation of information technology and characterized by knowledge engineering, with more emphasis on humanization, interaction, sustainability and integrity. Intelligent transportation system integrates technologies such as electronics, information, communication, control, vehicles and machines. It is applied to traffic, quickly and accurately understand traffic conditions and provide solutions to improve traffic conditions.

2.2. Automatic Ticketing System

With the continuous construction of light rail transit, the light rail transit software support system is also in continuous research and development. China has led a large number of domestic software enterprises to develop almost completely domestically, and the quality is also improving. Many organizations and companies specializing in the research and development of such software were born. Automatic ticketing system includes line center computer system, automatic teller machine, entrance and exit gate, etc. The central line computer system is the heart and the most important part of the whole line. The central line computer system consists of central computer server, central LAN, data storage system, central line system, reporting subsystem, communication subsystem, coding subsystem and sorting system. Manual ticketing can not meet the need to provide services for tens of thousands of passengers in a short time. Automatic device shall be adopted to deal with the ticket purchase time of passengers immediately. The automatic toll collection system uses automatic equipment to provide passengers with tickets for self travel in the subway, and uses automatic ticket selling control equipment to facilitate passengers to get on and off. It can also centrally process data, collect and count various operation data at any time. The automatic toll collection system has the operation and management functions of ticket sales, ticket control and commercial sales. The whole charging system is responsible for operating the computer connection. The system can be divided into three levels: automatic toll collection equipment, station processing system and central processing.

2.2.1. Definitions

As an emerging concept, big data has long ceased to exist in the human field, but relevant institutions and scientists at home and abroad have conducted research and analysis on it at different levels. At present, there is no unified statement on the concept of big data. The concept of big data is defined from the perspective of static attributes and technical application of big data in combination with
relevant research.

(1) From the perspective of static properties. The coverage of big data has far exceeded the traditional standards. It is impossible to collect, analyze, optimize and store information with traditional software and tools. Generally, it should be "TB".

(2) From the perspective of technology application. In view of the value of big data, big data is an information asset with the characteristics of large quantity, high growth rate and diverse forms. It uses new processing models to improve decision-making, understanding, analysis and process.

Considering the technical characteristics of big data, big data represents a new technical framework different from the traditional data structure: efficient information retrieval can be realized through rapid acquisition, comparison and analysis. On the basis of massive and efficient data, extract valuable information, form intelligent analysis activities and obtain business advantages. Therefore, big data is also an analysis.

2.2.2. Features

(1) Large amount of data
In terms of size, big data is a changing group, and the storage capacity of a single data set is usually about 10 TB. Due to the rapid development of network information technology, the world population and the number of Internet users are increasing year by year, resulting in more and more data information.

(2) Diverse and complex data
There are three types of big data: one is structured data, which refers to data with predefined data models or organized and stored in predefined ways. It mainly includes various databases. The second is unstructured data, that is, it is not artificially organized and does not rely on any model to ensure the storage, processing and access of data, which is mainly composed of different texts. The third is semi-structured data, which is related to forms that are not suitable for formal relational database models or other sequence sources. In the first three categories, the proportion and quantity are the largest, mainly including e-mail, HTML and reports.

(3) Fast data speed
The speed of data can be understood from three aspects: first, the speed of data generation. Due to the rapid development of information technology, the number of Internet users is gradually increasing. We constantly generate data through the Internet. Secondly, the data must be processed in time. "One second law" is the premise of processing big data. The real-time value of data requires that the analysis results be completed in a few seconds. Third, the data refresh is fast. Due to the fast data generation and update speed, we need to "clean up" the generated data within an effective time range in order to obtain useful information.

(4) Authenticity of data
Data authenticity is mainly about finding high-quality data. Due to the large amount and different types of data, it is inevitable to mix incorrect and unnecessary data. We need to know how to use data sorting and analysis methods to extract chaotic data information and chaotic data. The authenticity and high quality of data help us make scientific decisions, reduce decision errors and avoid unnecessary waste of resources.

2.2.3. Apriori algorithm
Today, data mining technology supports all areas of life. Data mining is a technology covering all knowledge fields. Before data mining technology came into the market, we mainly judge the value of data according to past experience. However, with the emergence of data mining technology, especially the advent of the big data era, data mining technology has been given new power. With the increase of
the amount of data, the traditional data mining technology has brought many challenges, such as large amount of data, diversified algorithms, changeable data types and so on. The implementation of a priori algorithm is based on breadth first search strategy. The main idea of Apriori algorithm is to browse the database, use hierarchical iteration, compare the support of each candidate element set with the minimum support, find the common element set, and then generate association rules based on the minimum trust.

For rule X, Y:
The support calculation method of \( X = Y \) is:
\[
\text{Support}(X > Y) = P(X \cup Y)
\]  
(1)
The confidence of \( X = Y \) is calculated as follows:
\[
\text{Confidence}(X = Y) = \frac{P(Y | X)}{P(X)} = \frac{P(XY)}{P(X)} = \frac{P(Y \cap X)}{P(X)}
\]  
(2)

The support and confidence of rules are two very important concepts.

3. Experiment

3.1. System Development Method

The method of software development is an ideological and theoretical system different from various effective ways of thinking in the long-term development process. Object oriented emphasizes the use of methods and principles widely used by human thinking in daily logical thinking, such as abstraction, classification, inheritance, aggregation and encapsulation, so that software developers can think more effectively and comprehensively. Object oriented software engineering method is the comprehensive application of object-oriented method in software engineering. It includes object-oriented analysis, object-oriented design, object-oriented programming, object-oriented testing and object-oriented software maintenance. Software development is the understanding and description of the problem domain. From understanding things, it provides a method to analyze and understand the problem area in the analysis stage. From the description of things, it provides a means for the gradual transition from problem domain to programming language in the analysis and design stage.

System analysis is the stage of directly contacting the problem domain in the process of object-oriented software development. It is very important to use these principles as comprehensively as possible for high-quality and efficient analysis. System analysis represents the level of direct contact with the problem domain in the process of object-oriented software development. For high-quality and efficient analysis, it is essential to apply these principles as fully as possible.

1) Abstraction: discarding the non essential individual features of many things and extracting the common and essential features is called abstraction. Abstraction is a necessary means of concept formation. Abstractions are mainly process abstractions and data abstractions.

2) Classification: classification is used to classify objects with the same attributes and services in a category. Use class abstraction descriptions similar to these objects.

3) Aggregation: a complex thing is regarded as a collection of several simpler things, which also simplifies the description of the case.

4) Association: association is used in object-oriented to clearly express the static relationship between objects in the system model.

5) Behavior control:
1) Determine the mandate and scope of action;
2) Recognize the interdependence of behavior between things;
3) Understand the simultaneous behavior of the system;
4) Recognize the influence of the object's state on behavior.

3.2. System Design Tools

The system software design mode adopts the mixed mode of B/C and C/S. For the information management part, if hardware equipment control is not involved, the terminal software adopts B/S architecture design and C/S design mode. B/S system architecture adopts J2EE design scheme and
A flexible multi-architecture to provide flexibility of system design. The C/S architecture scheme is designed with powerful Delphi development tools and carved architecture model. The product design tools mainly use Microsoft Visio, rose, PowerDesigner and project planning tools, the development tools use WSAD and Delphi, and the database uses oracle.

4. Discussion

4.1. Performance Test of Automatic Fare Collection System

Table 1 is the performance test data diagram of automatic fare collection system.

| Test module                  | Fluency  | Amount of memory occupied (k) | Reaction speed | Delay time (s) |
|-----------------------------|----------|-------------------------------|----------------|----------------|
| Ticket Module               | Excellent| 3496                          | 1.9            | 1              |
| Check the ticket module     | Excellent| 3459                          | 1.6            | 2              |
| Ticket management Module    | Excellent| 3485                          | 1.5            | 4              |
| Data statistical analysis module | Excellent | 3479                          | 1.9            | 3              |

![Figure 1. Data comparison](image)

This paper tests the performance of four modules of intelligent smart city rail automatic fare collection system, which are ticket selling module, ticket collection module, ticket management module and data statistical analysis module. As can be seen from Figure 1, the system runs smoothly, occupies a relatively small amount of memory, has fast response speed and low delay.

4.2. Passenger Satisfaction Test
Figure 2. Mass satisfaction

Figure 2 shows the people's satisfaction with the smart city rail automatic fare collection system, which is mainly divided into 4 groups, with the maximum score of 5 and the minimum score of 0. Therefore, it can be seen from the figure that most of the people are satisfied with the smart city rail automatic fare collection system.

5. Conclusion

The application of big data in smart city has penetrated into all walks of life. With the strong support of national policies, the government has put forward higher requirements for the construction of smart city rail. Therefore, how to effectively carry out the work of electronic fare collection system has become a top priority. This paper mainly uses literature analysis, questionnaire and systematic methods to collect information about automatic fare collection. According to the problems and deficiencies of big data technology in the development of smart city, and combined with the actual situation, make corresponding solutions and suggestions.

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