

Analysis and Design of Logistics Distribution Information System Based on Big Data

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Abstract

With the rapid development of China's economy, this is both an opportunity and a challenge for the logistics and distribution industry. The tasks that the distribution industry needs to undertake are increasingly cumbersome and complex. Fast and accurate is the biggest requirement for the logistics industry at now, and the logistics enterprise is pursuing. Faster, better, stronger, but also need to improve efficiency and take the path of scientific development. With more information, network, flexibility and intelligence, it has become a new requirement for logistics development. This paper combines the data mining and analysis technology in the context of big data, uses GIS technology to obtain real-time dynamic information, design the logistics Distribution Information System under the support of big data technology by analyzing the requirements of logistics and Distribution Information System.

Keywords

Logistics and Distribution Information System, GIS, Data Mining.

1. Introduction

In the 21st century, the management information system in the big data environment has become an important channel for acquiring knowledge, publicizing and browsing information. The management information system in China's big data environment has also made great progress. For the management information system based on the big data environment, it is a product to meet the development needs of the times, and it also become an important application in the future. Management information system combined with data technology can handle large and complex database management tools or data sets. It can learn more information in future application prospects, and will be widely used in military, medical, construction, entertainment, etc. In the industry. Therefore, the management information system in the big data environment has positive significance for the process and basic composition of modern management information system and information system data processing in China. Due to the comprehensive promotion of the big data environment, the development of modern logistics has seen a new trend. More data, network, timeliness and intelligence have become the new requirements for logistics development. With the continuous development of computer technology and logistics distribution theory, the traditional logistics distribution industry began to introduce computers for management. For the logistics distribution system, the main problem is the optimization of the distribution route, but the distribution process is an organic whole with many links. If any link is to be optimized, it needs to be considered as a whole, in addition to the need to consider distribution. In addition to the route, it is also necessary to comprehensively consider the utilization rate of the delivery vehicles and the connection with the business before and after. Moreover, as the environment continues to change, the past optimization based on static scheduling tends to be more dynamic and real-time.

2. Related technical theory

2.1 Logistics Distribution Information System

Logistics distribution refers to the process of transporting physical objects from suppliers to customers. It is a dynamic flow process. Modern logistics distribution systems require informationization and networking. Logistics enterprises use computer technology and network technology to establish their own logistics Distribution Information System. The system can respond to the needs of users. According to the needs of user orders, the system makes a reasonable reference to the relevant geographical location and warehouse. Distribution plan. The goods can be delivered to the designated customers in the shortest time and in the most accurate and punctual manner, and can be adjusted in real time in the face of sudden delivery conditions. It changes the distribution mode of the traditional logistics distribution system. It makes the circulation of goods in the logistics faster, effectively reduces the pressure of inventory, and provides a more optimized distribution plan, which can shorten the delivery time, reduce the waste in the distribution link, and effectively save the distribution cost of the enterprise.

2.2 Application of GIS in logistics distribution system

Geographic Information System (GIS) is a computer-based geodatabase that digitally stores, processes, and analyzes geospatial distribution and attribute data in a geographic environment to establish an effective data management system. GIS is widely used in resource surveys, land management, urban planning, transportation and other fields that involve geographical factors.

In the logistics distribution system, GIS can effectively decompose the distribution task combination and realize the real-time tracking management of the distribution location. The system uses the GIS network analysis function to analyze the distribution customers and potential customers, simulate the location and scale of the distribution center, and establish a distribution center network composed of several appropriate logistics distribution centers. Each distribution center is responsible for the distribution business within a certain range of services. According to the delivery order, the distribution center confirms the delivery goods and the delivery location. The centralized distribution system determines the distribution implementation plan according to the regional transportation, the industry type of the distribution point, and the characteristics of the delivery goods. The dispatcher also can use the data received by the GIS to perform real-time data analysis, and complete the collection and dispatching of the target information.

2.3 Application of Data Mining Technology in Logistics Distribution System

The management of logistics and distribution includes the formulation of distribution plans, the optimization of distribution routes and the distribution of delivered goods. This requires the management of the distribution center to take reasonable steps to achieve the goal of improving service levels and reducing distribution costs. In the logistics distribution business, reasonable determination of the distribution route is an important means to improve service quality, reduce distribution costs, and increase economic efficiency. Since the logistics distribution path optimization problem is an NP problem, the use of Heuristic Algorithm is an important research direction. Based on the mathematical model of logistics routing optimization problem, the genetic algorithm for solving logistics routing problem optimization problem is constructed. The experimental results show that the genetic algorithm is a kind of heuristic search method with excellent performance. This method can easily and effectively obtain the optimal solution or satisfactory solution for the logistics distribution path optimization problem. The constructed genetic algorithm for logistics distribution path optimization, including the cleverly designed individual coding method, the calculation method of individual fitness value, and the selection, crossover and mutation operator, have certain reference value for solving similar combinatorial optimization problems. Combining other search methods with genetic algorithms and constructing a hybrid genetic algorithm will greatly improve the optimization quality and search

efficiency, and thus achieve good calculation results. Hybrid genetic algorithm will be an important direction for the development of genetic algorithms.

3. Functional Analysis of Distribution Information System

The logistics industry is developing faster and faster in China. At the same time, the fierce competition in the logistics market, modern logistics information gradually changes from qualitative to more precise quantitative requirements, which requires the distribution information platform to provide a large number of accurate and timely information data.

3.1 Analysis of functional requirements of logistics distribution system combined with data analysis

The logistics Distribution Information System is mainly an information management platform for real-time monitoring and management of all aspects of logistics and distribution. With the help of applications such as computers, real-time networks and real-time data analysis, the process of tracking and managing various resources such as transportation tools and routes, personnel, and transportation plans in the logistics distribution process. The Distribution Information System plays a key role in logistics, as shown in:

- (1) The query function is accurate and timely, and is easy for users to use. When the user uses the query function, he only needs to input the invoice number of the goods, and can query the relevant information of the goods.
- (2) Improve the accuracy and timeliness of the delivery of goods, thereby improving the level of service. By regularly inquiring about the relevant information of the goods, it is timely to know whether the goods are delivered to the customer's hands on time. For goods that fail to be delivered according to the specified time, it is necessary to find out the cause and correct in time, so that there is less probability of error.
- (3) Enhance the advantages of competition and improve the level of differentiated logistics services by improving the efficiency of logistics and distribution.
- (4) Improve the utilization of information, realize the sharing of logistics information through the distribution system, make full use of and share this information, and enable customers to understand the delivery status of goods and prepare for receiving goods.
- (5) Improve the analysis and application of data, and provide qualitative and quantitative analysis of the past distribution data of the enterprise, and use professional data mining tools to extract favorable information from a large amount of data, thereby providing the basis for decision-making by decision makers.

The working flow chart of the Distribution Information System is shown in Fig. 3.1.

Totally, the Distribution Information System is mainly for the management of transportation vehicles, personnel and transportation in the process of logistics distribution. Therefore, it should have the following functions.

(1) Loading schedule

Based on the real-time transportation situation, combined with the previous large-scale data analysis, the overall scheduling management of the distribution tasks, to form a reasonable distribution plan. The transportation information that can be referred to includes the weight, volume of the cargo, the driver's information, the condition of the vehicle, the route of transportation, and the like, thereby making an optimized distribution plan. The stowage scheduling includes the following three aspects of work.

Line selection. The route selection mainly refers to the selection and matching of the routes for the delivery of goods, and the solution of the shortest delivery route, the lowest distribution cost or the shortest delivery time is realized through setting various parameters, and then the distribution route is

combined with the big data platform. The road conditions and delivery time are analyzed to make a reasonable distribution plan.

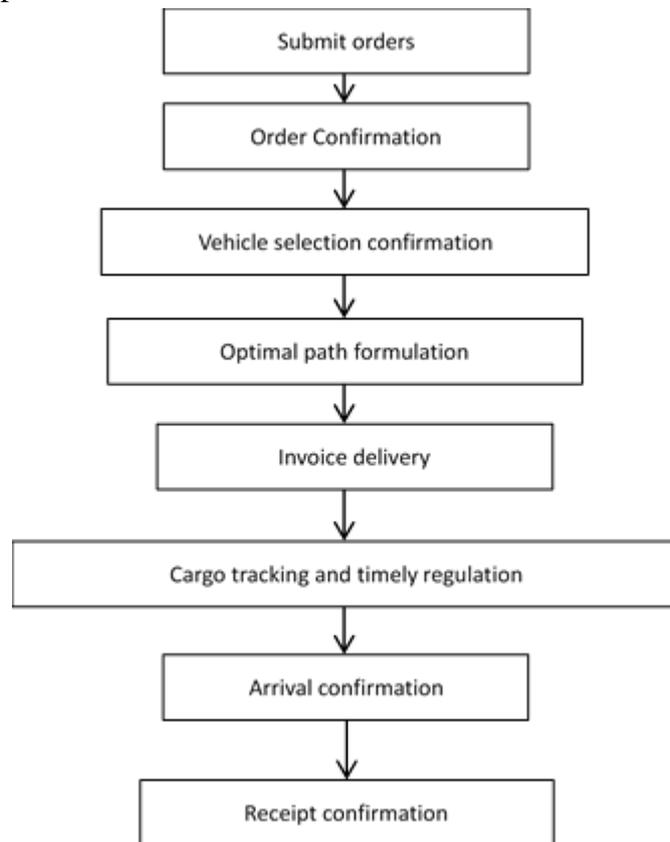


Fig. 3.1 Distribution Information System work flow chart

Loading plan. Loading planning refers to the plan of assigning goods to specific vehicles. There are mainly two ways of distribution, manual allocation and automatic allocation. And depending on the form of the manifest, it can be divided into a single multi-car, a single multi-good or a single multi-point.

Vehicle scheduling. Vehicle dispatching is mainly the management of transport vehicles, including the allocation of vehicles, dispatching and management of vehicle information. It is one of the important functions of the distribution management system. This function mainly records the information, scheduling, repair, reservation and others. For the vehicle, and facilitates the management of the vehicle information.

(2) Transportation and distribution process control management

It mainly records and evaluates the loading status and exercise status of the vehicle. The main contents are the driving list printing, the on-going sign, the driving order cancellation, and the exit analysis table.

(3) Distribution resource management

The main task of distribution resource management is to manage various resources of the distribution center, including the relevant staff of the distribution center, vehicles used for transportation, drivers, and so on.

Personnel management is mainly for the unified management of the personnel of the transportation center. The main contents include the maintenance of basic personnel information, the setting of personnel authority and the record of personnel attendance. **User management** is mainly to add, modify and delete system users.

Vehicle management. Mainly for the statistical management of transported vehicles. The system will carry out relevant statistics and analysis according to the department to which the vehicle belongs,

thereby improving the efficiency of vehicle use. It mainly includes the following contents: vehicle file management, vehicle maintenance, route management, and vehicle repair.

(4) Tracking and scheduling

The primary role of tracking and scheduling is that the Distribution Information System center monitors the transportation vehicles in real time, including real-time GIS positioning data of the vehicle, driving data and strain data under special circumstances. The real-time data of these vehicles, as a dynamic data stream, is an important aspect of data analysis on big data platforms. Mainly used is dynamic data stream processing.

Another important function of the Distribution Information System center is to use the data mining and analysis methods in these dynamic data streams, analyze the distribution route conditions in real time, and timely deal with the sudden new traffic routes under the influence of traffic congestion and traffic accidents. And time planning to support the scientific and rational management of transport vehicles and improve the efficiency of transportation. When these accidents or emergencies occur during the transportation process, it can also send an alarm to the center, so that the center can get in touch with the surrounding traffic management departments in time, so that the transportation vehicles receive timely support.

According to the analysis of the characteristics and needs of the Distribution Information System, the system divides the functions of the distribution management platform into two main parts: the information center and the decision center, which are designed and implemented separately.

The information center is mainly responsible for the effective management and integration of various information, including customer information, vehicle source information, distribution information, and administrator information. The information center needs to update and review the vehicle source information, delivery information and customer information in a timely manner. After receiving the delivery information submitted by the customer, the information center will record the information. The background mainly realizes function information management (vehicle source information management, source information management, leased line information management, warehouse information management, distribution information management), user management (personal user management, enterprise user management).

The GIS application mentioned in the analysis decision center mainly refers to the process of using unique geospatial data analysis function to provide services for logistics distribution. In the cargo distribution process, there are a lot of information and data with certain spatial characteristics, such as the service scope of the enterprise distribution point, the geographical location of the warehouse, the detailed geographical location of the customer, the traffic route and the traffic status information, etc. all contain a lot of spatial information. Data, at the same time, optimization of logistics distribution routes, construction of major trunk roads in cities, etc. are also related to geographic information data. The geographic information system can combine the attribute data with the associated geospatial data on the map, query and analyze the object from the spatial geographic information and the attribute information, and display the result visually through the image.

3.2 System Security Analysis

(1) Security of the operating system platform

The operating system is the foundation and support of the logistics information system. Security in the operating system mainly includes reliability, confidentiality and stability. Generally, operating system security mainly provides security protection from both memory access and file operations. The protection of the memory includes services such as fence protection, relocation protection, basic boundary protection, flag protection, and segmentation protection.

(2) Data security

In order to ensure the security of the logistics information system, the system will ensure the security of confidential information within the system from the following three aspects. First, control the storage and retrieval of internal information of the system. For the information output from the system, it is necessary to record and inspect in time to avoid accidents and provide a basis for accident handling. For the information input to the system, the authenticity and integrity of the data should be checked, the logic of the input information and the format of the data should be checked to prevent the wrong information from being entered into the system, causing the system to malfunction. Second, manage database security. Take certain measures to ensure the security of database access and prevent unauthorized users or software from tampering with and destroying data. Third, take certain data encryption measures to ensure data security.

(3) Security of access control system access control

The core content of the Distribution Information System security mechanism is access control, which mainly includes three aspects: protecting the accessed object; granting different users access rights to different functional modules, and regularly managing and updating the access rights; Share resources to the greatest extent possible while ensuring system security. The essence of access control is to grant access to different functional modules to different users. In other words, any function in the system can only be accessed and used by authorized users, but not by unauthorized users.

4. Design of Distribution Information System

4.1 Design purpose of the system

Combined with the design scheme of the distribution system on the current network, the system mainly achieves the following objectives:

- (1) The interface design is beautiful and easy to operate.
- (2) Perfect function and clear structure
- (3) Ability to query vehicle source information quickly
- (4) Able to accurately fill out orders
- (5) Ability to fulfill order inquiry and print
- (6) Ability to process receipts
- (7) Logistics distribution line inquiry and browsing function
- (8) Ability to add, modify, and delete vehicle source information
- (9) Ability to manage customer information
- (10) Provide timely inquiry of delivery information
- (11) Provide full tracking of logistics and distribution
- (12) Provide planning and road emergency forecast for optimal route of distribution
- (13) Good database system support
- (14) The system runs stably and has good safety performance.

4.2 Distribution Information System Overall Design

Combined with the requirements analysis and the contents of the system objectives, the architecture design and functional module division of the Distribution Information System are shown in [Fig. 4.1](#) and [Fig. 4.2](#).

The system collects real-time distribution related information through GIS geographic information system, and then combines the data mining analysis technology of big data to design the Distribution Information System. In addition to realizing the functions of traditional Distribution Information System, the biggest innovation of this system lies in the utilization. The real-time information generated by GIS adopts dynamic data stream processing method. The data in GIS is dynamically updated, and the real data conforming to reality can accurately grasp the spatial geographic

information, which is beneficial to the planning of vehicle distribution path. The road information and road conditions in the GIS are used to assist the decision-making vehicle deployment and route planning, so as to optimize the logistics distribution function.

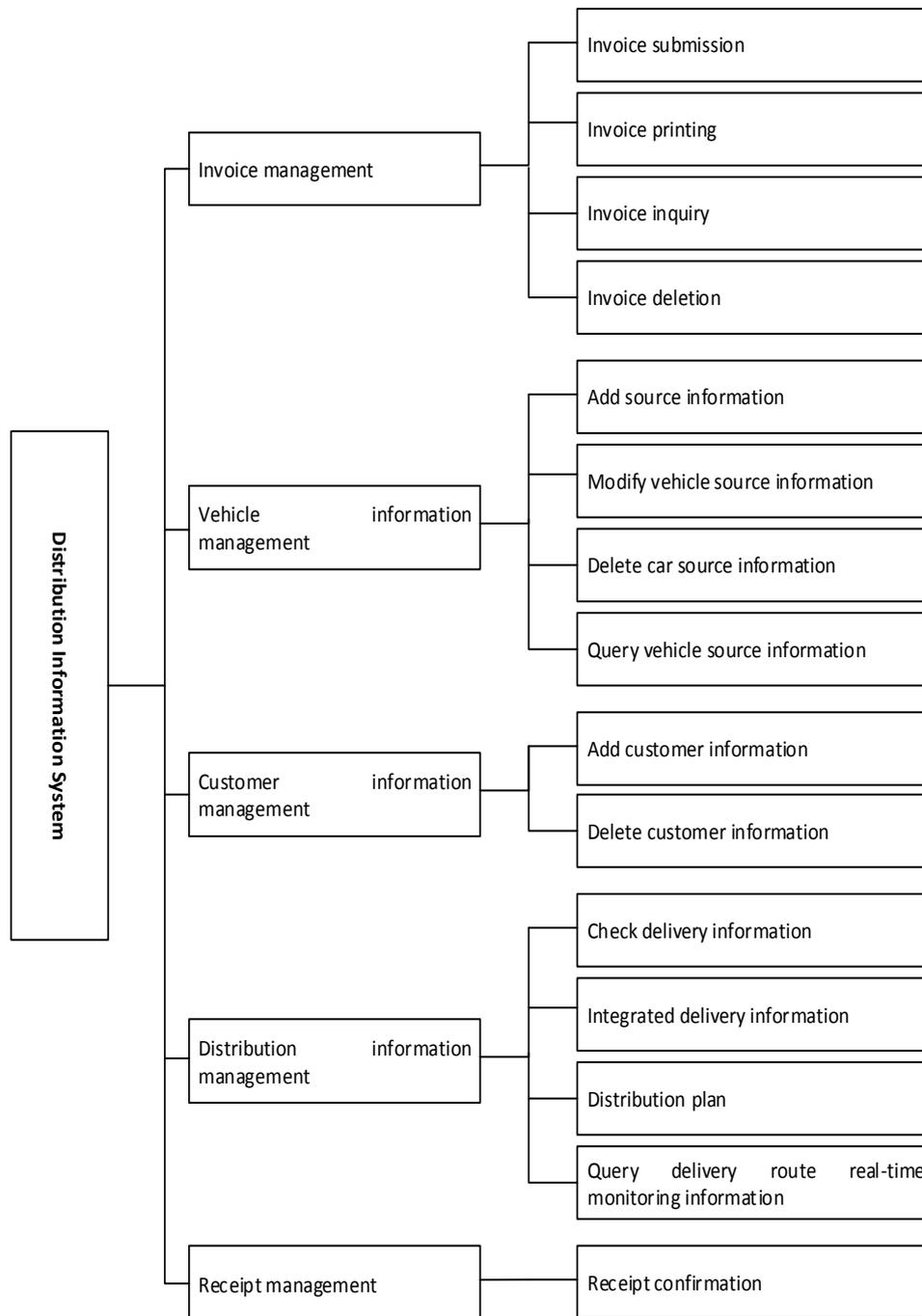


Fig. 4.1 System architecture diagram

The main job of the Information Center is to effectively process and integrate various information to facilitate the relevant personnel to view. The information center should update and review the vehicle source information, delivery information, and customer information in real time. After receiving the delivery information submitted by the customer, the information center records and sorts.

The Analytical Decision Center is primarily responsible for making decisions about the distribution plan and developing a detailed and reasonable distribution plan. Based on the information integrated in

the information center, the analysis decision center uses the GIS function to develop a reasonable distribution plan. According to the delivery information submitted by the customer, the goods are inquired for the warehouse information to see if there is any goods that meet the customer's requirements. If there is, use the delivery address in the delivery information provided by the customer to query the GIS, formulate a detailed delivery route, then find the available vehicle source information according to the delivery route, find the reasonable vehicle source information, specify the delivery order and submit it to the relevant department for Ship.

The Analysis Decision Center is the most important part of the system. The GIS application mentioned in the analysis decision center mainly refers to the process of using the geospatial data analysis function unique to GIS to serve the logistics distribution. In the cargo distribution process, there are a lot of information and data with certain spatial characteristics, such as the service scope of the enterprise distribution point, the geographical location of the warehouse, the detailed geographical location of the customer, the traffic route and the traffic status information, etc. all contain a lot of spatial information data. The geographic information system can combine the attribute data with the associated geospatial data on the map, query and analyze the object from the spatial geographic information and the attribute information, and display the result visually through the image.

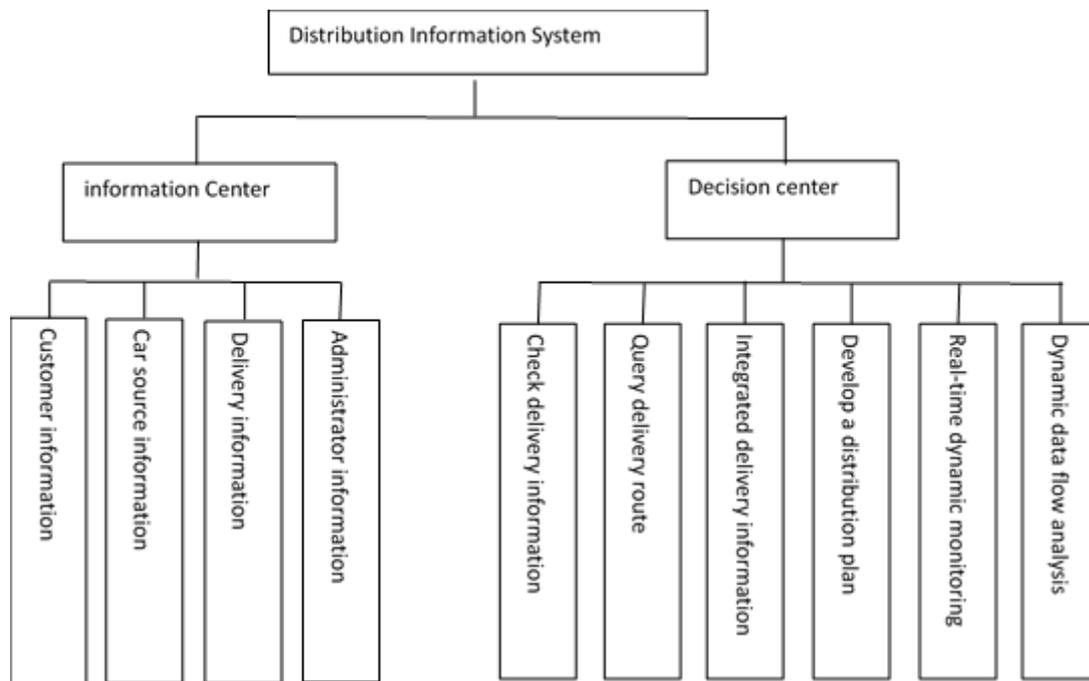


Fig. 4.1 System function module diagram

5. Conclusion

The logistics Distribution Information System studied in this paper uses the platform data of the open GIS, combined with the analysis and processing of the data stream, analyzes the planning decision of the distribution route, integrates it into the distribution system, and intelligently completes the order from the customer. A series of tasks to the source of the vehicle, the development of the route, and the delivery of the goods. In this paper, the demand of the Distribution Information System is analyzed firstly. After the requirements of the system are clarified, the design model of the logistics Distribution Information System is constructed.

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