Application of Vehicle Network Technology in Smart Logistics

Qianyu Wang

Traffic and Logistics Engineering, Shandong Jiaotong University, Jinan, Shandong Province, China
Email: 792898340@qq.com

Abstract—**China's car networking technology is still at the primary level of development. In order to fully understand and attach importance to all aspects of car networking technology. This article analyzes the development status of modern logistics and the development prospects of vehicle networking technology, and explains the advantages and necessity of the application of vehicle networking technology in smart logistics. Car networking brings new development space to the logistics industry.**

Index Terms—**Car networking; smart logistics; development prospect; technology application**

I. LOGISTICS DEVELOPMENT AND OPPORTUNITIES

A. Status Quo of Logistics Development

In recent years, the logistics industry has developed rapidly and has shown rapid development. The logistics industry is a comprehensive service industry for the tertiary industry. It includes transportation, warehousing, freight forwarding, and information. The formation and development of the logistics industry is an inevitable result of the constant development of modern industry. Logistics is a necessary and irreplaceable intermediate link. Logistics combines production and sales to form a complete flow of goods. Logistics can quickly and efficiently deliver the products and services of production companies to customers so that they can easily access a wealth of goods and services. Today, with the development of economic globalization, traditional industries have changed under the impact and influence of the "Internet Plus". The logistics industry itself is not invariable, but it actively absorbs the latest scientific development achievements and continuously guides the global logistics industry's innovation and development trend.

Compared with traditional logistics, modern logistics services are no longer limited to pure freight. Now, it needs to stand at the merchant's point of view to carry out inventory warehousing and cargo logistics distribution, so that the entire business process can form a good benign development. The ultimate goal of modern logistics is to meet customer needs with the lowest possible cost in the logistics process. The government and companies have recognized the great influence and role of modern logistics on the country's production and life. From the macro perspective of social and economic development, government agencies use modern logistics to support the sustainable development of the national economy. Government agencies improve social economic benefits through modern logistics, reduce production and living costs, allocate social resources, and curb inflation.

B. Problems in the Logistics Industry

With the rapid increase of China's economic level, many logistics companies have developed rapidly under the background of the prosperity of the logistics industry. At present, the scale of China's logistics industry has ranked first in the world. In particular, in terms of e-commerce courier, regardless of the number of parcels, cost and cost-effectiveness have occupied the first place in the world. According to statistics from the China Federation of Logistics and Purchasing, total social logistics in China was 252.8 trillion yuan in 2017, a year-on-year increase of 6.7%. The development of e-commerce logistics has brought development opportunities to the logistics industry, but a large number of express parcels have also brought tremendous pressure on logistics companies. For logistics companies, how to make a large number of parcels delivered to customers quickly, accurately, and safely is a complex logistics process. The solution to the problem is to jointly dispatch goods and optimize the allocation of logistics resources. The difficulty and complexity of logistics management has increased dramatically. Due to the large scale of logistics, the problem of backwardness in the level of informatization management of domestic logistics companies has gradually emerged. Many problems such as high logistics costs, unreasonable allocation of logistics resources, low efficiency of logistics and transportation organization, and low service quality are gradually exposed. In addition, the frequent occurrence of traffic accidents in logistics and transportation vehicles and the loss and damage of goods are also common [1].

C. Smart Logistics Solutions

In order to solve the above-mentioned problems in the logistics process, on the one hand, logistics companies have improved the level of information management, optimized the allocation of logistics resources, and improved service quality. On the other

hand, they actively introduce and integrate other related industries, especially the advanced technologies of the Internet of Things. The Internet of Things technology has improved the company's own core competitiveness. At present, the domestic logistics industry has changed from a traditional manual mode to a semi-automated mode, and is now developing into an intelligent mode, which is also called "smart logistics." Smart logistics is the combination of information processing and Internet technology. It applies bar code technology, radio frequency identification technology, satellite positioning system, wireless sensor technology, and other advanced Internet of Things technologies to the basic activities of the logistics industry to improve the transportation of goods. The process will increase the degree of automation, reduce logistics costs, reduce resource consumption and waste, and thus achieve the goal of improving the quality of service in the logistics industry. Smart logistics is an inevitable trend in the development of the logistics industry [2]. The Internet of Things provides a theoretical basis and a practical platform for the realization of intelligent, informatization, and automated intelligent logistics, so that the logistics industry can better integrate traditional logistics and intelligent systems.

II. CAR NETWORKING TECHNOLOGY OVERVIEW

Internet of Things technology is based on the Internet, using a variety of information sensing equipment to connect all items with the Internet, forming a huge network to achieve intelligent management and identification of items. It can monitor all networked items via the Internet.

As a new technology formed by the convergence of the Internet of Things and smart car technologies, car networking refers to the use of sensors installed on vehicles to sense vehicle, road and surrounding environmental information, and to realize vehicles and vehicles, vehicles and roads, and vehicles through wireless communications. Human, vehicle and Internet information exchange and sharing information exchange network. Car networking through the Internet information platform to fully handle the vehicle upload information, according to different functional requirements to achieve vehicle monitoring, and provide a variety of intelligent traffic services. It can also be said that the Internet of Vehicles can be seen as the Internet of Things to the concept of "objects" to the car, road, and people [3].

III. DEVELOPMENT PROSPECTS OF VEHICLE NETWORK TECHNOLOGY IN MODERN LOGISTICS

The main task of the car networking technology is to provide intelligent services for the convenience and safety of future driving. As the huge information network and control network of the car networking

can cover all the motor vehicles, as part of the logistics industry, the future development will also be unavoidable. Car networking logistics information platform will be used to achieve the precise positioning of logistics vehicles, vehicle dynamic tracking, vehicle safety driving control, distribution route optimization and other functions, thereby effectively reducing logistics costs and improve service quality.
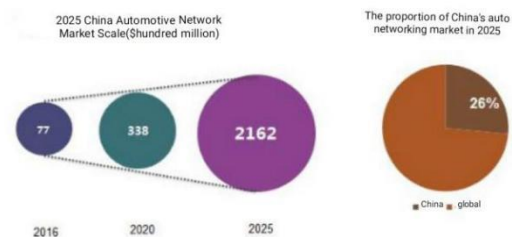

Figure 1. China's car networking market potential

Establish a smart logistics distribution system to achieve intelligent distribution. Combining the intelligent logistics distribution system constructed with information technology and distribution system, it can realize the functions of collection and processing of distribution information resources, distribution vehicle monitoring, load distribution and distribution route planning. Smart logistics distribution system can collect customer information through a variety of ways, including: delivery information, delivery information, and shipping information. The information system sorts and sorts the collected information, determines the category, and then the system automatically sends information to different departments according to the differences in the information processed. Most of the information is distributed to the vehicle dispatch system. By building smart mobile information systems, mobile vehicle information, ground information systems and system information networks form a whole. It can collect, store, exchange, and use information and help logisticians rationalize vehicle scheduling. The logistics delivery in the same city usually needs to complete the service within one day and deliver the goods to the customer in the shortest time. Therefore, cargo loading and distribution route planning is the first work that needs to be started. The two tasks of loading and delivery route planning are inseparable. The loading method can only be determined after determining the driving route of the goods delivery vehicle. The distribution route of a logistics vehicle must be based on the geographical distribution of distribution points. Therefore, logistics companies must combine real-time traffic information with the help of geographic information systems to provide the best travel route for each logistics vehicle, in order to ensure that the logistics vehicle travel route and operating efficiency to achieve the best. With the help

of the Internet of Things, Smart Logistics can deliver the highest degree of cargo-to-customer delivery in the shortest possible time. The increase in multiple delivery costs due to delivery delays has been avoided, increasing customer satisfaction [4].

With the development and promotion of related industries and technologies, the national automobile Internet development policy has also gradually improved. For the first time, the national strategic level will use the Internet of Vehicles as the core application of the Internet of Things. With a capital investment of up to 10 billion yuan, the development of car networking technology has become an inevitable trend. Through the introduction of car networking technology, logistics companies can build an Internet that covers cars, roads, people and things, effectively reduce physical costs, improve the safety of transport vehicles, optimize the route of travel, and solve long-standing problems in the logistics industry [5]. To achieve the logistics company's dream of "high quality of service, high punctuality, low cargo loss, low logistics costs" goal.

Today, the logistics industry is showing a new look driven by information technology. For example, taxi-style car sharing has quietly appeared in the logistics transportation process. At the same time, with the development of big data, the logistics industry's services are gradually becoming more active. Smart logistics in the era of future Internet connectivity can take these services to a new height.

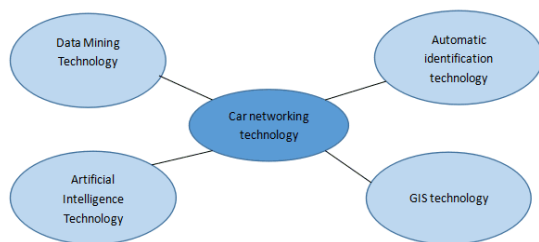## IV. THE APPLICATION OF CAR NETWORKING IN MODERN LOGISTICS

Figure 2. Car networking technology application.

A. Data Mining Technology Application

The database first appeared in the mid-1980s. The purpose of the database is to process data from different sources and different structures in the database. The database allows the user to freely extract data without disturbing the normal operation of the service database. Data mining is the process of mining hidden, unknown knowledge and rules. These knowledge and rules have potential value for a large number of incomplete, fuzzy and random practical application data. It can be divided into descriptive data mining and predictive data mining. Descriptive data mining includes data aggregation, clustering and correlation analysis. Predictive data mining includes classification, regression, and time series analysis. Database mining technology can reveal the relationship between events through statistics, analysis and comprehensive processing of data. Database mining technology can predict future development trends and provide decision-making basis for decision makers.

B. Automatic Identification Technology Application

Automatic identification technology is a highly automated data acquisition technology based on computer, optical, mechanical, electrical and communications technology. It uses a specific identification device to automatically obtain the relevant information of the identification object and provide it to the back-end processing system to complete the relevant post-processing technology. It can help people collect and input massive data quickly and accurately. Automatic identification technology has been widely used in transportation, warehousing and distribution. After nearly 30 years of development, automatic identification technology has developed into an integrated technology consisting of barcode identification technology, optical identification technology, radio frequency identification technology, and biometric identification technology, and is being developed toward comprehensive applications. Bar code recognition technology is the most widely used automatic identification technology. It uses an optoelectronic scanning device to read the bar code symbol, thus enabling the automatic input of information. A bar code is a set of specific information symbols arranged by bar graphs and spaces according to specific rules. Different code systems have different combinations of bar code symbols [6]. Radio frequency identification (RFID) technology is a modern automatic identification technology developed in recent years. It can identify high-speed moving objects and can also read multiple objects at the same time. It is resistant to harsh environments and strong confidentiality. Biometric technology is a technology that uses human physical or behavioral characteristics to identify people. Biometrics include hand shape, fingerprint, face shape, iris, retina, pulse, ear pin, etc. Behavioral characteristics include signatures, sounds, etc. Due to the irreproducibility of human characteristics, the security of this technology is much higher than traditional authentication mechanisms [6]. People have developed six kinds of biometric identification technologies: iris recognition technology, retina recognition technology, facial recognition technology, signature recognition technology, speech recognition technology, and fingerprint recognition technology.

C. Artificial Intelligence Technology Application

Artificial intelligence mainly explores the use of various machines to simulate human intelligence, enabling human intelligence to be realized. It draws on bionic ideas and uses mathematical language to abstractly describe knowledge, imitating biological

systems and human intelligence mechanisms. The main methods include neural network, evolutionary computation and granularity calculation. Neural network: Neural network is a kind of human intuitive image thinking simulation based on biological neural network research. According to the characteristics of biological neurons and neural networks, neural networks classify and summarize a class of parallel processing networks [7].

The main functions of neural network are associative memory, classification clustering and optimization calculation. Although the neural network has the disadvantages of complicated structure, poor interpretability, long training time, etc., it has the advantages of high tolerance to noise data and low error rate. Various network training algorithms, such as network pruning algorithm and rule extraction algorithm, are constantly put forward and improved, making the application of neural network in data mining increasingly favored by the majority of users. Evolutionary Computation: Evolutionary Computation is a general problem solving method developed through the simulation of biological evolution theory. Because it originates from the biological evolution of the natural world, it possesses the extremely strong adaptability characteristics shared by nature's living organisms, and therefore it can solve the complex problems that are difficult to solve by the traditional methods. It uses a multi-point parallel search method. Through evolutionary operations such as selection, crossover, mutation and iterative iteration, under the guidance of individual fitness values, the evolution results of each generation are better than those of the previous generation, and are passed from generation to generation. Until there is a global best solution or a globally near-best solution. One of the most representative is the genetic algorithm, which is an adaptive optimization algorithm based on the evolution of natural biological genetic evolution mechanism.

D. Application of GIS Technology

GIS is a key technology and tool for creating smart logistics. GIS can build logistics maps. Order information, export information, delivery information, vehicle information, customer information, and other data are all managed on a single chart, enabling quick and smart ordering. Reasonably layout outlets, reasonable planning of transportation routes, and package monitoring and management.

GIS technology can help logistics companies implement map-based services. 1. Network point identification: Mark the network points and outlets (such as address, telephone, delivery information, etc.) of the logistics company on the map, which is convenient for users and business managers to quickly inquire. 2. Regional division: The management of big data from the perspective of "geospace" provides the basic business management services for the logistics business system, such as the division of the responsibilities of the logistics

sub-department, and is associated with the outlets. 3. Quick sorting: Using GIS address matching technology, search for positioning partition units and assign addresses to areas and outlets. And according to the attributes of the logistics zoning unit to find the responsible person to achieve the "last mile" delivery. 4. Vehicle monitoring and management system, from the goods out of the warehouse to the customer throughout the process of monitoring, to reduce the loss of goods; reasonable scheduling of vehicles, improve vehicle utilization; various alarm settings to ensure the safety of cargo drivers and vehicles, save corporate resources. 5. Using logistics and distribution route planning support system to assist logistics distribution planning. Plan the route rationally to ensure that the goods arrive quickly, save company resources, and increase customer satisfaction. 6. Data statistics and services: Visually display the data information of the logistics company on the map [2]. Through scientific business models, GIS algorithms, and spatial mining analysis, insights into trends and internal relationships that cannot be understood by other methods can be realized. Logistics companies can assist logistics companies in obtaining greater market opportunities through the development of GIS-assisted marketing strategies, logistics route planning, rational site selection analysis, and development trend forecasting.

V. THE APPLICATION OF CAR NETWORKING IN SMART LOGISTICS

The ultimate goal of smart logistics is to deliver goods to destinations faster, more securely, and more accurately. The so-called wisdom actually refers to a dynamic control reaction process. It will make timely judgments and controls based on the collected real-time information. Cargo transportation is a key part of smart logistics. How to ensure the safety and timely arrival of logistics vehicles and how to ensure the safety and integrity of goods in transit. The introduction of advanced automotive networking technology in logistics and transportation can achieve the purpose of intelligent logistics.

The basics of car networking mainly include automotive sensor networks and automotive wireless communication networks. Automotive sensor networks refer to wireless networks formed by sensors mounted on bodywork and transportation items. The inter-vehicle network is a wireless sensor network consisting of cars and roads. The vehicle-mounted wireless communication network is an on-board 3G/4G communication device that is responsible for sending key vehicle information to the company's servers.

During the transportation process, various sensors and GPS positioning terminals and other sensing devices are installed on the logistics vehicle to collect status information and road status information of the logistics vehicle during transportation. Through the vehicle network and other surrounding vehicles for

information exchange, comprehensive information on the current road conditions, and actively predict the occurrence of potential traffic accidents. It promptly reminds the driver to react correctly to possible collision accidents or traffic accidents in front of them to achieve traffic safety [8]. The vehicle can also obtain road congestion information on the road through the inter-vehicle network and the roadside communication unit. The driver selects the driving route according to the information, avoids congested road sections in front of the vehicle, and realizes efficient and low-cost traffic.

In the process of transporting goods, the sensors are installed to form an in-vehicle network. The sensor collects information about the status of the item itself and sends it via the in-vehicle network to a state-analysis device installed in the cab. More and more valuable items, such as jewellery, fragile goods and special items, medicines and chemical dangerous goods, are being transported throughout the country through logistics. These items usually require special environmental conditions for storage. In the course of logistics and transportation, major accidents such as damage, theft, loss of products, deterioration of cold and fresh foods, and leakage of chemical dangerous goods due to changes in environmental conditions are frequent. Customers and logistics companies are prone to significant losses. Monitor the status of items by installing state sensors and install environmental sensors to monitor the environmental conditions of items. When the state of the goods changes during transit or the surrounding environmental conditions change, the state analysis equipment installed in the cab will analyze the data uploaded by the sensors to the items to remind the driver to deal with them in time and avoid serious consequences [8]. The status information of the collected items is also sent to the logistics control center through the wireless internet. Customers can view the real-time information of the goods during the logistics transportation through the Internet. The full monitoring of the goods during transportation has greatly improved the safety of the goods.

VI. CONCLUSION

The development of logistics cannot be separated from the support of Internet information technology. With the gradual rise and development of logistics industry in China, and the continuous improvement of the level of logistics technology, more and more logistics companies attach importance to new technologies such as car networking. The popular "Internet +" concept is the driving force for the intelligent development of the logistics industry. Similarly, the development of car networking has also led to the development of smart logistics. In the logistics company's own actual logistics service, the rise and development of "car networking" technology has also brought more room for growth to many logistics companies and promoted the upgrading and transformation of the industry.

Under the automotive networking technology platform, logistics companies are more likely to accumulate customer source information, establish a complete enterprise logistics information system, rationally plan logistics routes, and provide more accurate logistics services. These combined with automotive networking technologies, rapid and innovative logistics service companies are rapidly occupying the market. The integration and innovation of vehicles and logistics internet is accelerating the socialization of logistics industry and forming the core competitiveness of logistics enterprises in the future. As the cooperation between automotive networking companies and the logistics industry has deepened, the networking of vehicles will increasingly become the driving force for the development of smart logistics. It is believed that with the help of car networking, smart logistics can achieve greater development.

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Qianyu Wang Male, 21 years old, Chinese Shandong. Wang is currently studying in the second year of the Bachelor of Communications and Logistics Engineering of Shandong Jiaotong University. The main research area is logistics engineering.