

Exploration of Key Technologies of Smart Logistics Based on Big Data

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Abstract—Modern smart logistics is an important infrastructure for the new business and new economy, which is a socialized logistics collaborative platform driven by big data. Through the introduction of the system feedback information, intellectualization of logistics management and logistics operation is realized with the support of big data technology. At the same time, through the creation of more logistics products and scenes, the efficiency of end-to-end supply chain is enhanced, so that an ecological logistics with adaptive characteristics come into being.

Keywords—Ecological Logistics; Intelligent Logistics; End to End; Big Data

I. INTRODUCTION

With the rapid development of China's economy, the logistics industry is also in a period of rapid development. In 2015, the total amount of social logistics in China reached RMB 220 trillion. According to incomplete statistics, about eighty or ninety million people were engaged in the logistics industry, including 30 million truck drivers. China has become the world's largest logistics country.

The Internet of things was mentioned firstly at the International Conference on Mobile Computing and Networking held in the United States in 1999 [1], and was put forward formally at the World Summit of Information Society held in Tunisia in 2005. The intelligent logistics, which is closely related to the Internet of things, is also called smart logistics, which is the concept firstly proposed by China Logistics Technology Association Information Center, China Internet of things and the editorial department of Logistics & Material Handling in the industry in December 2009. The national 12th Five-Year Development Plan of Internet of Things points out that during the "12th Five-Year" period, China will actively carry out application demonstration in 9 key fields including the intelligent industry, intelligent agriculture, intelligent logistics, intelligent transportation, smart grid, intelligent environmental protection, intelligent security, intelligent medical treatment and intelligent home to complete a batch of application demonstration projects. Under the background of the extensive application of the research achievements of artificial intelligence, through the introduction of big data technology, excavate the values of information hidden behind the data, and lead traditional logistics to develop towards a more high-end smart logistics [2]. In this paper, key

technologies of smart logistics model based on big data are explored, and a new scheme of information feedback is proposed, which has a certain theoretical guiding significance for the development of smart logistics in practice.

II. THE ARCHITECTURE AND KEY TECHNOLOGIES OF SMART LOGISTICS

A. The typical application of logistics technology

Logistics should be the first application field of the Internet of Things, which can be considered as the main application field of the narrow sense of the Internet of Things to a certain extent. Internet of things technology has been applied in Military Strategic Logistics (military logistics) of each country since it came into being. The earliest application cases of Internet of things can be traced to the Vietnam War, when more than 20 thousand "tropical tree" sensors (or dust technology) were launched in "Hu Zhiming path" in dense forest by the US Army through the aircraft. The sensor was composed of vibration and sound sensors, whose wireless antennas, camouflaging into branches, would automatically send to the command center after detecting the vibration and sound of the Vietnam's motorcade to cooperate with the military operations of the US Army. With this technology, 46 thousand trucks were destroyed or damaged by the US Army. During the Gulf War in 1991, the US Army transported 40 thousand containers to the region. Because of the unclear identification, it was impossible to visualize the containers. The US Army had to register 25 thousand of the containers manually and then rejoined them in the logistics, which directly caused the economic loss of about USD 2 billion. In the second Gulf War of 2003, the US Army adopted the RFID technology to realize the three-dimensional visualization of the 40 thousand containers sent to the Gulf, which reduced the shipping volume by 87%, reduced the air transport by 88.6%, and saved billions of dollars for the United States Department of Defense [3].

B. The architecture of intelligent logistics

As shown in Figure 1, the architecture of the intelligent logistics system consists of four layers [4, 5]: the bottom layer is the perception layer, the second layer is the network transport layer, the third layer is the data storage layer or the support layer, and the top layer is the application service layer.

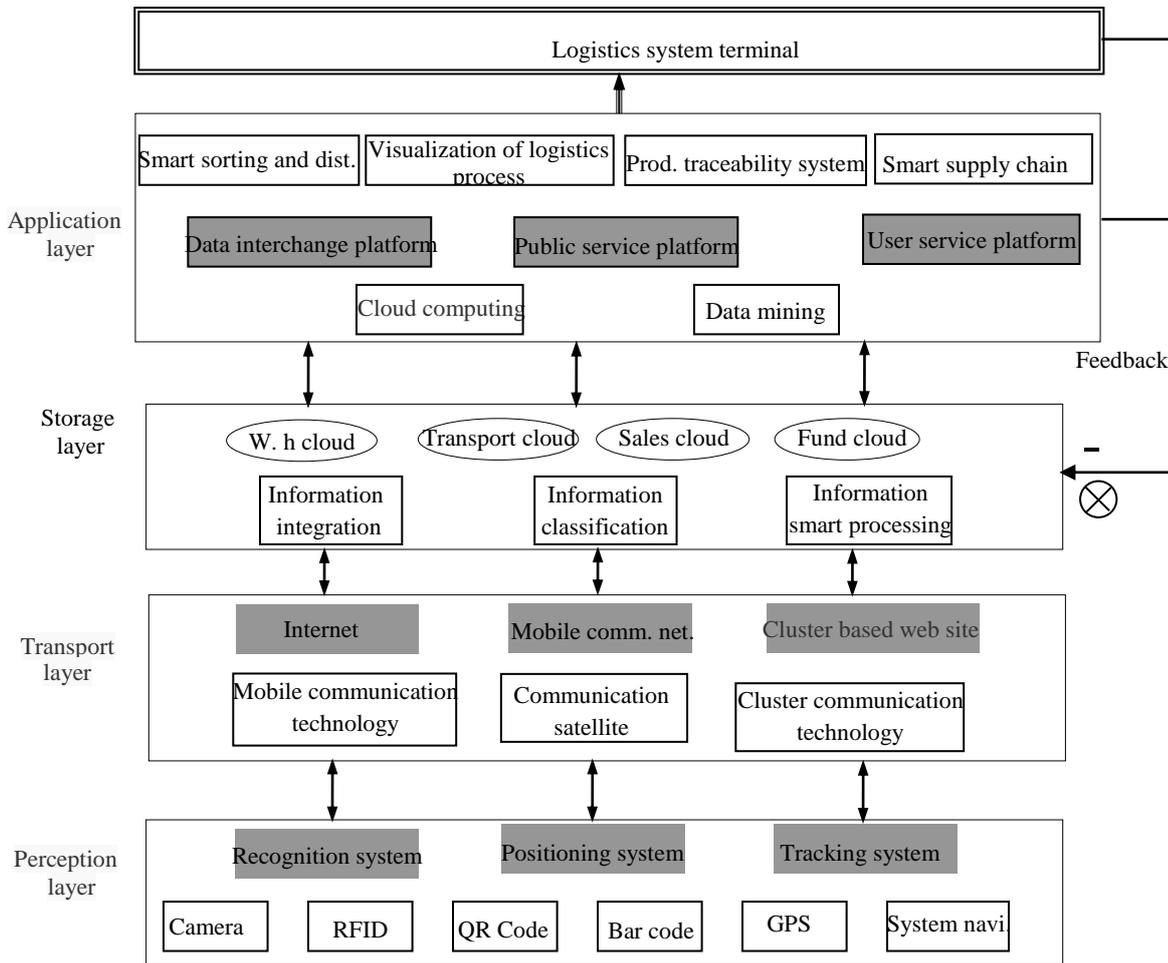


Fig. 1. Architecture of intelligent logistics system

Smart logistics perception layer. The perception layer focuses on the acquisition of the information of things and identification of the identity, which include the identification system, positioning system and tracking system. The system adopts a variety of information sensing technology equipment (RFID, barcode gun, sensor, etc.), uses the bar code recognition, image recognition and sensor detection, and combines the GPS and navigation system to acquire the information in each link of the logistics such as the production, transportation and storage in real time, and set up the corresponding database so as to lay a solid data foundation for the smart logistics system. For example, according to the advantages of real-time and on-line inspection of the machine vision system [6], the technologies of machine vision, bar code and RFID are adopted in the logistics sorting system to promote the intelligent sorting system from artificial to intelligent and reduce the labor intensity of the staff.

Smart logistics transport layer. The transport layer is a bridge that connects the sensing layer and the storage layer. The transport layer includes all kinds of access network and communication technology, whose data information exchange technology and transport technology are transparent. As can be

seen from Figure 1, the configuration of the transport layer, in addition to the traditional Internet, mobile communication technology and cluster communication technology are widely used. Smart logistics system uses various transport networks and communication technologies to transmit the information collected by the sensing layer timely and safely.

Smart logistics storage layer. It is also known as the support layer. The cloud storage platform layer is located between the application layer and the transport layer, whose function is to process and manage the data acquired by the perception layer through the complete cloud storage and cloud computing technology. The data of all kinds of logistics information, logistics company information and demand side information are concentrated in the cloud storage. Through information integration and classification and intelligent processing technology, the storage cloud, transportation cloud, fund cloud and so on are formed. The high-speed processing of the mass data of the Internet of things can improve the scientificness and rationality of decision-making, provide personalized service for users, improve the service efficiency and reduce the application cost.

Smart logistics application service layer. The application layer is located at the top of the smart logistics, which directly connects with the terminal of the logistics system, including the data exchange platform, the public service platform and the enterprise user service platform. The application layer can compose the supplier module, customer module, after-sales service module and logistics enterprise module according to the individual needs of users. At the same time, users could get a variety of services through the interactive activities such as issuing instructions and receiving information on the terminal, and help them take the correct logistics decisions.

C. Construction of the key technology of smart logistics

As a strategic resource, big data is the basis of building a smart logistics. Smart logistics is connected with the consumer in one end, and in the other end it is connected with the supplier. Logistics enterprises produce a lot of data every day in the processes of storage, transportation, distribution and processing. With the wide application of cloud computing and big data technology in the logistics industry, enterprises have strengthened their competitiveness in the logistics industry through the excavation of the new business value of massive logistics data. Compared with the traditional logistics, the intelligent logistics system realizes the design of the intelligent logistics system through the reliable data source and processing technology and by virtue of the big data and its technology [5]. This research elaborates the design and construction of the system from the following three key technologies.

Business data intelligent sensing technology. The comprehensive perception of logistics information is the premise of building smart logistics system. Through intelligent sensing technology, the identity, time, location, position and state of the target object are determined, including the perception of the surrounding situation and the whole process of logistics where the customers are, what the customers need, what kind of goods are to be delivered, what kind of transportation is used, and how the goods are in the process of transportation. All this information is collected and placed in a smart logistics system and a database is set up to provide information support for subsequent cloud computing and intelligent decision-making. Relevant information acquired by each perception end is transmitted to the storage server on the network timely and accurately through the transport channel to form various storage clouds.

Big data processing technology and intelligent decision-making. The storage cloud, whose core is big data technology, provides a big data base for the application layer to implement diverse services. Through enough large training set, the end to end learning can be realized. That is through specific and low level features, such as color histogram, color autocorrelation graph, edge histogram, a more abstract and high level is formed, and attribute classes or features are represented by distributed characteristics of discovered data. In the field of smart logistics, intelligent decision system can be realized by big data technology. In the acquisition and processing of big data, large data acquisition, big data preprocessing, big data storage, big data analysis and prediction are the key technologies of smart logistics. In data acquisition, the existing RFID radio frequency technology, sensing technology, mobile internet data capture

technology, and so on, can basically meet the acquisition of multiple types of data. On data storage, the structured, semi-structured and unstructured data are the main components of the data, and 80% of them are unstructured data, representing the records of 'the behavior, service level, security, risk, fraud, and more operations of all users, such as. In data analysis, the development of a new generation of data mining technology, the discovery of the required models through large data analysis, the prediction and prevention of future running interruptions and performance problems, are also the final value of large data manifested in the logistics field.

System of intelligent application service platform. For smart logistics based on big data and Internet of things, its operation needs the support of the service platform. The common application service platforms include data exchange platform, public service platform and enterprise user platform. Each platform could establish various systems, such as commodity traceability system, freight bill tracking and query system, smart sorting and distribution system, and so on. The application layer analyses and processes massive data and information, and uses intelligent technologies such as data mining and cloud computing to provide users with personalized and diversified services. At the same time, the relevant information of the logistics terminal and the application layer is fed back to the storage layer (as shown in Figure 1). Through the state perception (perception), real-time analysis (memory) and precise execution (behavior) of the logistics system, the self-adaptive decision-making and learning promotion can be further achieved so as to form a smart logistics supply chain with self-adaptive characteristics.

III. CURRENT SITUATION, EXPLORATION AND PROSPECT OF SMART LOGISTICS

With the support of artificial intelligence, the diversified development of smart logistics has made remarkable achievements, and the distribution system of logistics enterprises is also basically sinking to the county or township. With the development of sinking strategy in various channels and the rapid development of the rural e-commerce, the strategy of getting through the downlink of rural consumer goods or the uplink of agricultural products has been mentioned on the agenda [7]. All the domestic logistics companies are using artificial intelligence to tackle this problem, and the unmanned aerial vehicle delivery should be one of the best solutions to the strategy of intelligent logistics sinking. At present, Jingdong and SF are doing the express delivery business of UAV. Liu Qiangdong claims that Jingdong will build all the unmanned warehouses managed by robots, and will have a future logistics layout. It is reported that Jingdong will establish 185 UAV airports in Sichuan province through collaborating with Sichuan, which will deliver goods from anywhere in Sichuan to any city in China within 24 hours.

The CAINIAO born with gold keys is regarded as the third growth pole of Alibaba after the e-commerce platform and ant gold clothing, which is a socialized cooperative platform driven by data, and is also an important jigsaw puzzle of Alibaba business strategy. While the rural logistics network continues to expand, the CAINIAO has started the "county smart logistics + of CAINIAO" project, in order to help the

production of agricultural products, reduce the cost of logistics, and quickly sell the high quality agricultural products all over the country, and penetrate with the construction of the smart community. Through big data technology, CAINIAO can predict the good sales in one of the counties and villages, which can sink the goods to the county-level operation center in order to improve the efficiency of distribution in the countryside. In addition, the CAINIAO has developed five major systems, such as cross-border, express, warehouse, rural and terminal distribution, providing big data connectivity, data enabling, data infrastructure products, etc. The problem of the “last one kilometer” distribution of the rural logistics will be solved gradually, and it will also help the logistics industry to extend more business in the supply chain. According to official data, there are 128 warehouses connected to the CAINIAO system, and more than 20 companies have access to the floor. As of March 2016, CAINIAO reached seven cities and 90 cities reached the next day. In addition, combined with the GAD’s map algorithm, the CAINIAO split all the addresses into a structured “four level address”, which enables the express company to achieve a precise matching of the parcels and nodes, and helps the realization of the sinking strategy of the smart logistics.

IV. CONCLUSION

Smart logistics has a great influence on the development of China’s national economy and society; with the development of artificial intelligence, the new advanced technology is constantly applied to the logistics industry, and promotes the continuous improvement of smart logistics. At the same time, in the process of the development of smart logistics, new contradictions are also constantly generated and emerging. This needs to improve the end-to-end supply chain efficiency through the conscious effort and hard exploration of the researchers in the new conflict field, and in combination with

the latest research results of artificial intelligence, so as to form an excellent ecological logistics.

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