Application Analysis of Internet of Things Technology in the Field of Intelligent Warehousing and Logistics

Jianing Wang[✉]

School of Automotive Engineering, Shandong Jiaotong University, Jinan, China
706411911@qq.com

Abstract. With the changes of the times and the rapid development of China's economy, our demand for warehousing logistics is increasing day by day. Due to the huge logistics demand, the current traditional warehousing logistics appears many problems and disadvantages, such as excessive demand for personnel, complicated sorting of goods, poor environment, which is not conducive to the storage of goods, and so on. In order to solve these problems, the emerging field of warehousing logistics is needed. Smart warehousing and logistics is a major trend in the future development of warehousing and logistics. This paper combines the Internet of things technology of "connecting things with things" with the field of intelligent warehousing and logistics, briefly introduces three levels and main factors of the Internet of things technology, and analyzes in detail the application of the perception layer technology in the field of intelligent warehousing and logistics. Finally, it points out the problems and challenges of the current Internet of things technology in the field of intelligent warehousing and logistics.

Keywords: Internet of Things Technology · Smart Warehousing and Logistics · Application Analysis · FRID Technology

1 Introduction

Since the 1990s, the concept of Internet of things technology has been widely concerned by the international community since its inception. Therefore, many countries have formulated policies and regulations on the development of Internet of things. After more than 20 years of development, Internet of things technology has also become stable and mature, and the warehousing and logistics industry has also made great development under the new wave of the Internet, but also faces many new opportunities and challenges. This gave birth to the idea of applying Internet of things technology in the field of smart logistics. The two complement, integrate and develop with each other, forming a new model of smart warehousing logistics, which has brought great significance to the innovation and development of the entire logistics industry and guided the revolution of the entire logistics industry. At the same time, the application of Internet of things technology in the field of intelligent warehousing and logistics has also solved the problems we are facing in the warehousing industry today.

2   Brief Overview of Internet of Things Technology

Internet of things means that things are connected and everything is interconnected. Different from the interaction between people on the Internet, the main purpose of the Internet of things lies in the interaction between machines as well as between machines and people. It achieves the interaction conditions between machine and Internet through various information sensing devices and technologies, such as infrared sensors, radio frequency identification technology (RFID). Nowadays, the Internet of things has been inseparable from our life. From the smart home, medical treatment and transportation around us to the emerging intelligent logistics and environmental monitoring, the wide application of Internet of things technology has greatly facilitated our life and made us move towards the future.

3   Development Trend of Smart Warehousing Logistics

Under the normalization of epidemic in world situation, in order to adapt to the "double-cycle" pattern and become a logistics power, constantly meeting the needs of our society and people, innovating and developing warehousing logistics in accordance with the new logistics requirements under the new Internet era, it is a new requirement and task faced by the warehousing logistics industry, enterprises and workers, which also intensifies the competition of logistics enterprises and promotes the gradual reform of warehousing logistics. Nowadays, smart warehousing and logistics is no longer an option, but a necessary condition for warehousing and logistics enterprises to develop in the future logistics field. For example, Alibaba Cainiao courier station and JD logistics unmanned warehouse have greatly reduced labor costs and increased logistics management efficiency through the integration of accurate digital transformation and Internet of things technology, and have become the benchmark for the development of smart warehousing logistics at home and abroad.

4   Application Significance of Internet of Things Technology in the Field of Intelligent Warehousing and Logistics

As a highly integrated and comprehensive application of the new generation of information technology, Internet of things technology has become the main strategic development direction at home and abroad. For example, in 2017, the National Telecommunications and Information Administration launched *the Green Book on Accelerating the Development of the Internet of Things* [1] and domestic strong support for IOT technology in recent years. There are many unavoidable problems in the traditional warehousing and logistics industry, such as the difficulty of identifying some materials, which can't get rid of the dependence on labor [2]. Through the combination of three technical aspects of the Internet of things and the warehousing and logistics industry: (1) comprehensive perception (2) reliable transmission (3) intelligent processing [3], which can better deal with and avoid these problems, accelerating the integration of warehousing logistics and intelligence, improving work efficiency and providing new opportunities for the development of warehousing logistics information technology and logistics industry. Figure 1 shows the technical architecture of the Internet of things.
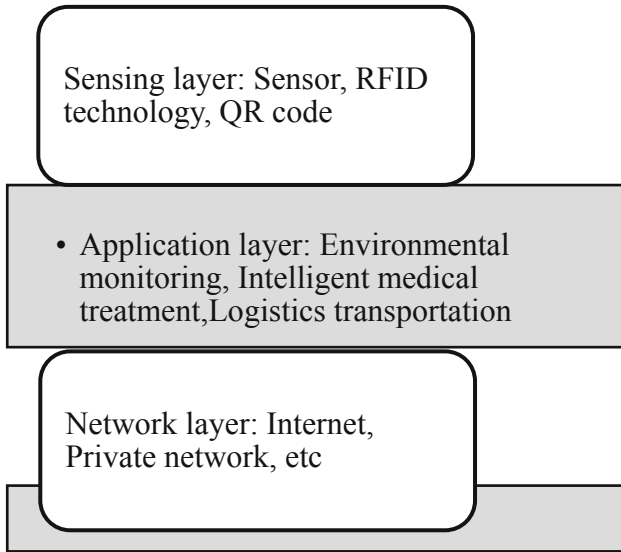
Fig. 1. Internet of Things Technology Architecture Diagram

5   Application of Internet of Things Technology in Warehousing and Logistics

5.1   Application of Sensing Layer Technology in Warehouse Logistics Management System

The sensing layer technology is widely used in the field of intelligent warehousing and logistics, among which the most common is RFID technology. RFID technology is a radio frequency technology that can automatically identify tags. Its advantage over traditional bar code technology is that it can store and analyze information while reading. This technology is more obvious in terms of security and efficiency [4].

AGV Robot
AGV handling robot is the most commonly used RFID technology in intelligent warehousing and logistics automatic equipment. By planning and setting the route in advance, the AGV robot transports goods from one designated place to another designated place guided by RFID. When encountering special transportation needs, the management personnel can also operate specially through the storage information terminal to achieve the purpose. At present, RFID guided technology is the most reliable and convenient among all technologies. It adapts to various complex environments and routes, and it is simple, flexible and easy to maintain.

Goods Storage
In the intelligent warehousing logistics system, the goods are first transported into the warehouse by the conveyor car, and each piece of goods will be marked with an RFID electronic tag. Before entering the warehouse, the information will be scanned by RFID

technology to transmit to other automatic equipment. The automatic sorting system uses sensor technology to identify the type of goods, and then transported to the empty space of the automatic shelf in the cargo warehouse by AGV robot. This kind of visual logistics information collection can identify and trace various items, and realize selection, collection, positioning and monitoring at the same time [5].

Storage and Inventory of Goods

Promote RF technology and information sharing mechanism, which is the basis of intelligent warehousing and logistics information network sharing [6]. Due to the unique advantages of RFID technology, after the goods are scanned and put into storage, they can be classified and sorted according to the information of the goods. By classifying the goods into normal temperature warehouse, cold storage warehouse, raw material warehouse and so on, it can not only effectively reduce the consumption of goods, but also create favorable conditions for the future delivery, sorting and transportation of goods.

Discharge from Warehouse

After receiving the requirements for goods out of the warehouse, the automatic shelf and AGV robot transport the goods out of the warehouse by scanning the code, and update the out of the warehouse information by scanning the code with RFID radio frequency technology, uploading it to the warehouse management information terminal, and verifying the accuracy of the information by the warehouse management personnel. In this way, it avoids manual picking and scanning, reduces personnel consumption, greatly improves the efficiency of goods delivery, and improves the accuracy of goods matching.

5.2 Application of Network Layer Technology in Smart Storage

The arrival of 5g era has provided great convenience for the development of smart warehousing and logistics. From a large perspective, the information barrier of traditional warehousing and logistics has been broken, and the warehousing and logistics information can be contacted in real time through the Internet, truly making the Internet of things interconnected with the Internet [7]. Smart warehousing logistics obtains the goods information through the perception layer technology, and then establishes its own smart warehousing private network based on 5g network, so that all automatic equipment in the warehouse can share the goods information. At the same time, the warehouse management center can also pay attention to the real-time operation status of automatic equipment under the private network so as to avoid unnecessary losses caused by improper cooperation, which greatly improves the durability and economy of smart warehousing logistics. Figure 2 shows the private network of intelligent warehousing and logistics.

5.3 Application of Application Layer Technology in Smart Warehousing and Logistics

The application layer technology is mainly used to process all kinds of information collected by the operation sensing layer in the Internet of things technology, while
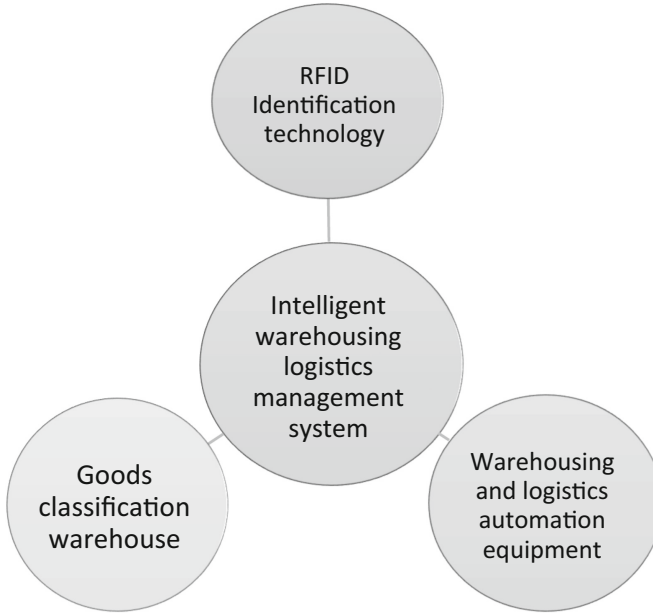
Fig. 2. Smart warehousing logistics private network

the application layer technology is used to process all kinds of information collected through the sensing layer in smart warehousing logistics. The sensing layer identifies and records the information of the goods through the perception technology, and transmits it to the sensing layer through the smart storage private network. After receiving the goods information, the sensing layer classifies, processes, calculates and finally uses the perception layer software to display it on the warehouse management information terminal, which is convenient for managers to visually inspect the warehouse operation and goods storage status.

The perception layer is closely related to the application layer. The two are the core of the Internet of things technology and the mainstay of intelligent warehousing and logistics. If the sensing layer is equivalent to the eye, then the application layer is equivalent to the brain. Only the close cooperation between the two can realize the control of goods, the management of equipment, and the purpose of the interconnection of things.

6 Problems Encountered in the Application of Internet of Things Technology in Smart Warehousing Logistics

Although Internet of things technology is widely used and developed in various industries, there are still many problems that have not been solved in the development of Internet of things technology in the field of logistics.

6.1 Break Through Technical Barriers

The maturity and development of the Internet of things technology has made it involved in all walks of life. Although the intelligent warehousing and logistics system appeared earlier, there are few complete intelligent warehousing and logistics systems based on the Internet of things technology in the world at present. The reason is that some technologies in the Internet of things are not mature enough to be applied in the field of warehousing and logistics, and technical barriers have not been broken through, resulting in the failure to realize some ideas. This requires advocating the relevant policies and regulations of the state to vigorously promote the development of Internet of things technology. Besides, the in-depth research and progress of researchers can make the new Internet of things technology more compatible, and various industries jointly improve the enthusiasm for the development of Internet of things technology.

6.2 Cost Dilemma

Although intelligent warehousing and logistics can greatly reduce personnel costs and the use of productivity, the high price and late maintenance costs of automation equipment still make many small and medium-sized enterprises out of reach. The essence of the solution to this problem is to break through technical barriers and reduce the production cost of automation equipment. Secondly, the government should publicize and improve the importance of smart logistics, calling on all enterprises to pay more attention to smart warehousing logistics.

6.3 Talent Issues

The traditional warehousing and logistics industry needs more human resources, but the threshold is low, while the intelligent warehousing and logistics system needs fewer personnel but has a high threshold, and most of them are highly skilled talents who are familiar with the Internet of things technology and warehousing management system. This requires enterprises to actively respond to national policies and calls, improve the treatment of talents to attract them, strengthening the shaping of enterprise culture and the training of enterprise staff technology, and promoting the efficient development of enterprises.

6.4 Safety Problem

Due to the lack of personnel control and the high degree of informatization, there will be hidden dangers in both network security and storage security. With the cooperation of Internet technology and Internet of things technology, when realizing the interconnection of things, the intelligent warehousing and logistics system is guaranteed through the Internet security system to monitor as well as protect the warehousing and logistics system in real time.

7 Conclusion

To sum up, Internet of things technology has promoted the development of warehousing and logistics industry, and intelligent warehousing and logistics has provided new challenges and directions for the progress of Internet of things technology. The transformation from traditional warehousing and logistics industry to smart warehousing and logistics is not only the progress of the industry, but also the development of the times. We should correctly view the integration of Internet of things technology and smart warehousing logistics, accumulate the development experience of smart warehousing logistics, and look forward to the future of smart warehousing logistics. Nowadays, the intelligent warehousing and logistics industry based on Internet of things technology is only the corner of the iceberg. It can also promote the integration and development of blockchain technology and warehousing logistics, realize distributed storage, point-to-point transmission, and improve the security and effectiveness of logistics circulation so as to realize a complete intelligent logistics system in all aspects, including production, processing, packaging, transportation, transfer and receipt. Nowadays, there are still a considerable number of systems and problems in the field of smart warehousing and logistics that need to be improved, solved and updated, which still requires our continuous efforts, common efforts and encouragement.

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