

Research on Low Carbon Logistics System Based on Internet of Things

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ABSTRACT

Low carbon logistics is the trend of the future logistics development. By the analysis of the Internet of Things technology, this article discusses its application in low carbon from the aspects of the enterprise, between enterprises, and after-sales recovery. It also establishes a low carbon logistics system based on the Internet of Things, to realize the enterprise internal between enterprise, and eventually the whole supply chain of low carbon logistics.

1. INTRODUCTION

With the development of Internet of Things, it has become widely known and used; more and more people discuss and research the Internet of Things. Since the Copenhagen Climate Conference, low carbon logistics is attached by the whole society as the trend of development. This paper analyzed the low carbon logistics by Internet of Things and low carbon logistics. Based on the Internet of Things, the author established the model of low carbon logistics. This model aims to reduce carbon emissions and low carbon operation in logistics activity, and at last achieve the purpose of low carbon logistics.

2. INTERNET OF THINGS

The IOT (Internet of Things), is a huge web to achieve intelligent recognition and management, which links all things together with the Internet through various kinds of information sensing devices, such as RFID, infrared sensor, GPS and laser scanner. Internet is the core of the IOT, which is used to share information. So IOT is a new application of Internet (Huang, et al., 2011), as well as E-mail, BBS, FTP, blog, web service, with which we are familiar. Taking information as its object, IOT achieves storing, managing, circulating and using entities through sharing the information with all subjects involved.

1) The critical technologies of Internet of Things: The international report online states that Internet of Things has four key application technologies. They are Radio Frequency Identification technology, Sensor technology, Smart technology and Nanometer technology.

2) The landmark characteristics of Internet of Things (Wang, 2009): Used only

for thing information, UID/EPC coding, RFID tags storage and RFID reading device non-contact reading and uploading.

3)The description of Internet of Things model: The proprietary works to realize the IOT are the pretreatment of the network information in Internet before uploading and the construction of the RFID system.

According to relevant documents and application situations, we can draw the conclusion that parts of the IOT have been applied, and focused on that the rapid access to information ability and perception ability. The IOT saves resources by improving some aspects of the work efficiency of logistics.

3. LOW CARBON LOGISTICS

Due to the low carbon economy and the motion proposed in the Copenhagen Environment Conference, low carbon logistics is rising on the way. Low carbon logistics is based on the theories of the scientific development concept, low carbon economy and logistics management, with the basic requirements of energy-saving emission reduction, low carbon development. Low carbon logistics could inhibit the pollution of logistics activities on the environment and reduce resource consumption. The use of advanced low carbon logistics technology could help to plan and implement low carbon logistics activities. Its use is suggested for the current environment of the Earth's climate and resources so as to meet the needs of the low carbon economy. At the same time, it is harmonious with the carrying capacity of resources, in line with the concept of sustainable development, and it is an inevitable trend of global economic integration.

At present, low carbon logistics has been heavily researched. Part of its focus is on the establishment of the carbon emissions measurement model, the other part uses the IOT technology to optimize the entire logistics process, such as the application of RFID technology, sensor technology, and building the corresponding information system. The carbon emissions measurement model establishes quantifiable evaluation criteria for the establishment of carbon emitters in the logistics industry. The IOT technology to optimize logistics, such as during transport route optimization, the use of packaging materials and packaging in the packaging process, can reduce the energy consumption to reduce carbon emissions.

Low carbon logistics is not simply to reduce energy consumption and carbon emissions, but to reduce the carbon intensity. The nature of low carbon logistics is through a policy of logistics planning and logistics, logistics rationalization sterile standardization, logistics information technology and low carbon logistics technology. It can achieve the requirements of the logistics capabilities to meet the social and economic development of moderate growth, but also to alleviate the pressure of energy supply. That is the effective way of the energy efficiency of the logistics field. The early understanding of low carbon logistics is to reduce carbon emissions; the fundamental purpose is to reduce the carbon intensity (carbon emissions per unit of

GDP, which is calculated carbon dioxide emissions / GDP). Therefore, to follow the purpose of low carbon, we can take advantage of the IOT technology for the logistics industry in the output of the premise of certain energy consumption and energy inputs to maximize the input field of logistics. The IOT technology applications can be used to integrate the resources of the entire logistics industry, to change the traditional mode of logistics, logistics management, logistics management information, and to reduce the risk of the entire supply chain.

4. THE CONSTRUCTION OF LOW CARBON LOGISTICS MODEL BASED ON THE INTERNET OF THINGS

To realize low carbon logistics, it is necessary to analyze the major carbon source in logistics activities. Throughout the supply chain network, low carbon can be defined by the following three models: reduction, cycling and low carbon in logistics activities. On this basis, we analyze the properties of the network. It should make full use of the advantages of the IOT in the information processing, such as access to information, intelligent sensors, and real-time tracking, thus achieving reduction, recycling, low carbon in logistics activities, and ultimately achieving the purpose of low- carbon logistics (Zhu, et al., 2011).

The goal: based on the construction of logistics information platform, the IOT will be used to optimize operations to achieve low carbon logistics from internal enterprises to the whole supply chain.

Key technologies of the IOT: RFID technology, GPS technology and sensor technology.

The application of the IOT: internal production, packaging, warehousing, loading and unloading, transport and distribution between enterprises, post-market and recycling.

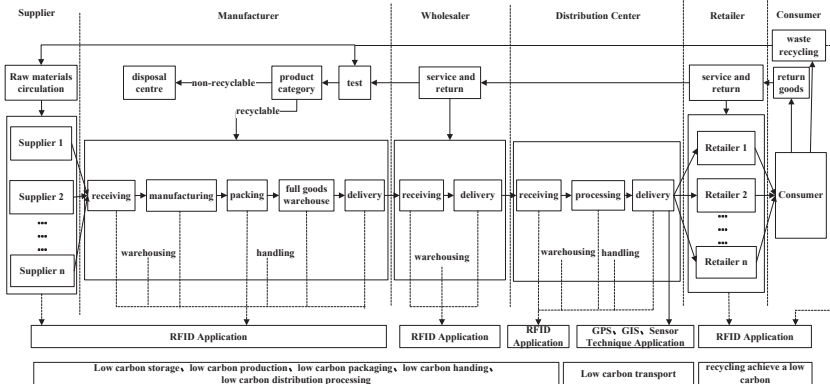


Figure 1. Low Carbon Logistics Model Based on the Internet of Things

1) Using the IOT technology inside the enterprise can achieve low carbon and reduction in logistics activity.

First, the application of RFID technology can achieve low carbon production. An automatic production line can be established based on RFID, such as identification and tracking of raw materials, components and parts, semi-finished products and finished goods, which can reduce the artificial identify cost and error rate and improve energy usage in the logistics system.

Second, the application of RFID technology can achieve low carbon packaging. Packaging throughout the logistics process is the basis of the logistics activity. Without perfect packaging, there is no modern logistics. Low carbon packing can not only start with packaging materials and ways, but also can use RFID technology to make goods traceable. RFID can improve the efficiency of the supply chain by providing goods information including the transportation environment, storage location, distribution and retail information in the supply chain. In this case, RFID technology can provide assurances of goods safety; trace the information of the location, sales and other. In addition, RFID technology, sensor technology and other technology of the IOT application can improve the reuse of carton packaging (Tang, et al., 2012).

Third, the application of RFID technology can achieve low carbon storage. High inventory not only increases the cost of capital, but also storage expired deterioration, damage, move, handling and warehousing costs as well as the warehouse itself, the consumption of electricity, construction, steel, etc., which is not conducive to low carbon logistics. The IOT can improve the work efficiency of the logistics and warehousing system to meet the requirements of the cargo management, environmental monitoring and data transmission (Ren, et al., 2011). Through the RFID technology, a manager can efficiently complete a variety of business operations, which not only improve efficiency, but also reduce inventory costs. Enterprise uses the RFID technology for inventory control, can get the real-time product inventory and improve inventory management capabilities to reduce the average inventory levels. Adopting the advanced IOT technology can achieve the costs of inventory, stocks average a lower level, in order to achieve low carbon logistics operation, and reduction of logistics activities.

Low carbon handling refers to doing as much as possible to reduce carbon emissions and dust, smoke and other pollutants generated by the loading and unloading aspects of the modern loading and unloading means and measures. The RFID-enabled forklift system is based on the application of RFID technology, the installation of a powerful board computer, and can ensure maximum security and maximize efficiency. The forklift control device integration of the RFID control system is easy to operate. Navigation LED compatibility with wireless real-time position tracking optimizes the forklift path, reducing invalid handling, improving handling efficiency and loading efficiency, reducing the losses caused by leakage and

damage to goods, and achieving low carbon loading and unloading.

2) Using the IOT technology in the transportation and distribution between enterprises can achieve a low carbon reduction.

A low carbon transportation and distribution model is needed to intensify the accurate design of transport routes so as to eliminate unnecessary transportation, avoid waste and save resources. Meanwhile, it also needs to enhance the transportation's low carbon performance, reduce carbon emissions and maximize the efficient use of personnel, material and time, money and resources.

In the transport links, RFID technology allows enterprise to track from the specific inventory unit of the supply chain to a certain tray product during the transfer. In the process of turn outfit operation, using RFID can achieve automatic delivery processing, improve the accuracy load, reduce product transfer, enhance inspecting efficiency, improve the transport safety and improve transport asset utilization to make delivery turnover rate higher (Wang, 2011).

During the distribution process, The RFID technology can meet the high requirements, increase the delivery speed, improve the accuracy of the distribution process, and reduce distribution costs. Distribution centers can simplify the process of distribution operations and increase the transparency of the distribution management by using RFID technology.

In the intelligent delivery management, we can take advantage of the Internet of Things technology, such as GPS technology, wireless communication technology (CDMA or GPRS), and GIS geographic electronic information technology, to achieve real-time scheduling, vehicle security and other functions. For example, we can install GPS and Car Image monitoring system on delivery vehicles in transport and distribution to identify the truck location and status and improve the rapid reaction capability of the vehicle scheduling process. We can use GIS geographic information system to optimize the delivery route of the vehicle and reduce shipping costs.

The IOT technology used in the field of transportation and distribution can improve operational efficiency, optimize vehicle delivery routes, save energy, and achieve low carbon transportation and distribution at last.

3) Using the IOT technology in after-sales and recovery links can improve circulating logistics.

Low carbon logistics is required to use logistics resource and equipment in the process of logistics as many times as possible or in multiple ways. Traditional logistics focuses on the forward Logistics (products to consumers), and does not pay attention to reverse logistics. To achieve a low carbon logistics, it should develop the reverse logistics system of waste objects or materials from the whole system while establishing the finished goods entity distribution to complete logistics activities of circulation. The logistics cycle includes recycling of raw and packing materials, waste recovery and recycling, production waste collection and recycling, etc. In the logistics cycle, RFID technology can provide an efficient circulation.

In after-sales service and waste recycling, the RFID technology and management information is used to set up product files. From the first moment of the return or recycling of the product, bar code technology and wireless radio frequency technology is used to accurately record products information, and then these products are placed into recyclable and non-recyclable warehouses, respectively, tested by professional equipment according to the recording information, and are processed separately. This cyclic process, to a large extent, saves a lot of credit to the cost resources. In addition, RFID technology can also be used in tray, the turnover box and other goods on recycling in order to realize the public use of resources.

5. CONCLUSION

Low carbon logistics not only saves resources, but also improves the output of the logistics in the certain of capital and technology. The internal operations of enterprises use the IOT technology to realize the industry of low carbon, and between the enterprises the use of the IOT can realize low carbon logistics of the whole supply chain. So the low carbon logistics can realize the share of resources, and at last realize the Green Logistics.

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