Accelerate the Construction of Low-Carbon Smart Logistics System Under the Global Carbon Reduction Goal

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Abstract. At present, climate warming, the shortage of oil resources and the decline of air quality are prominent problems in the world. In order to better protect the environment, governments have vigorously advocated the realization of low-carbon and sustainable development. The main purpose of this paper is to explore how the logistics industry should build a smart logistics system to promote the sustainable development of logistics enterprises. This paper adopts the qualitative research method, selects the representative low-carbon automatic driving technology and new energy vehicles, and analyzes their application status and feasibility in the logistics industry. Accordingly, the problems existing in the construction of intelligent logistics system in the logistics industry are found out, and the corresponding countermeasures are put forward. The research conclusion of this paper can provide new ideas for the logistics industry, promote the large-scale application of autonomous driving technology and new energy vehicles in logistics enterprises, and accelerate the construction of low-carbon intelligent logistics system.

Keywords: automatic driving · smart logistics · new energy vehicles · low carbon

1 Introduction

In the context of the big goal of global carbon reduction, and with the continuous development of data information technology and 5g communication technology, governments began to promote the application of big data and intelligent technology in the logistics industry and establish a low-carbon and intelligent logistics system. Therefore, more and more manufacturing enterprises and high-tech enterprises all over the world have joined the low-carbon smart logistics industry to provide power for the transformation and development of the logistics industry.

The first core point of low-carbon smart logistics is low-carbon. At present, the development of new energy vehicles has attracted great attention all over the world. New energy vehicles can improve global prominent problems such as oil energy shortage and urban air environment deterioration. Recently, many European countries have publicly

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announced plans to ban the sale of fuel vehicles, and China's Ministry of industry and information technology has also publicly stated that it is studying and formulating a timetable for the prohibition of fuel vehicles. Under multiple international and domestic pressures, the logistics industry with fuel vehicles as the main means of transportation and distribution faces great challenges and opportunities. The transformation of vigorously promoting the use of new energy vehicles in the logistics industry must be the general trend. The continuous development of data information technology and 5g communication technology and the application of big data and intelligent technology in the logistics industry have promoted the development of intelligent logistics in the logistics industry [1]. At the same time, with the guiding role of national policies, more and more manufacturing enterprises and high-tech enterprises have entered the new energy vehicle industry, which provides power for the development of new energy vehicles and brings the rapid development of new energy vehicle logistics industry.

The smart logistics system of low-carbon smart logistics is developing vigorously with the continuous development of data information technology and 5g communication technology and the application of big data and smart technology in the logistics industry [2]. The rapid development of artificial intelligence technology is promoting the profound change of human production and life style, and the most remarkable field of automatic driving has become the main battlefield of industrial intelligent revolution. When it comes to automatic driving, we all think of the passenger car industry, but in fact, the passenger car industry is the place with the highest commercial landing and cost of automatic driving. Automatic driving is easier to realize in the commercial vehicle industry, such as the logistics industry with low scene complexity. With the advantages of electrification and intelligence of new energy vehicles as logistics vehicles, automatic driving can better play its role.

This paper will discuss the important role of autonomous driving and new energy logistics vehicles in the construction of low-carbon smart logistics system for logistics enterprises. At the same time, it will also put forward the possible problems of logistics enterprises in the construction of low-carbon smart logistics system, and give corresponding countermeasures and suggestions. It is hoped that this research can help promote logistics enterprises to accelerate the construction of low-carbon smart logistics system and achieve the global common goal of carbon neutrality as soon as possible.

2 Development of Smart Low-Carbon Logistics System

2.1 Application of New Energy Vehicles in Logistics Industry

In recent years, China's production and sales of new energy vehicles have ranked first in the world for many consecutive years, and the government has also formulated many policies to encourage the development of new energy vehicles [3]. The logistics industry actively responds to the national call and uses new energy logistics vehicles in urban distribution. Urban distribution vehicles are mainly Van trucks, with a range of 200-300km. New energy logistics vehicles have brought convenience to urban distribution in terms of service, efficiency and cost.

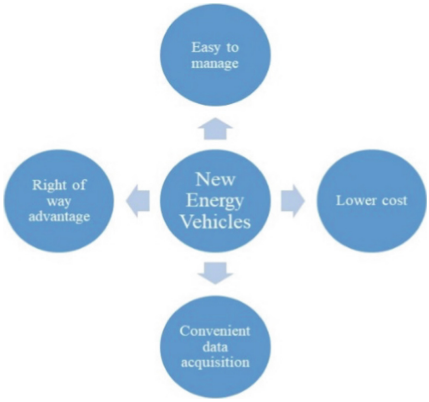

Fig. 1. Advantages of new energy logistics vehicles

(1) Easy to manage: New energy logistics vehicles can significantly reduce the number of vehicle management, and the power consumption is easier than oil management.
(2) Lower cost: The electricity price used by new energy logistics vehicles varies significantly in different regions and periods. Compared with the fuel price, it can reduce costs and save expenses.
(3) Convenient data acquisition: New energy logistics vehicles are generally equipped with a complete data acquisition system, which can be online in real time, and the data during operation can be recorded accurately, which is conducive to improving the efficiency of enterprises.
(4) Right of way advantage: Because the new energy logistics vehicle will not cause air pollution to the operation location, it can obtain more right of way advantages and reduce the cost of transportation.

2.2 Application of Automatic Driving Technology Based on Big Data and Artificial Intelligence in Logistics Industry

There are hundreds of logistics hubs in China, connecting more than 160000 km of expressways. These logistics hubs and the traditional infrastructure of expressways have formed a rapidly growing logistics and transportation network in the past 10 years (Fig. 2).

According to statistics, in 2020, the total amount of social logistics in China will be 300 trillion, about 70% of which will be transported by trucks, and road transportation will still dominate. The increase of highway freight volume year by year, the shortage of drivers in the logistics industry, the high incidence of accidents and high operating costs seriously restrict the development of the logistics industry. Therefore, the application of automatic driving technology based on big data and artificial intelligence in the two scenarios of highway trunk transportation and unmanned distribution at the end of logistics will have a good prospect. As shown in Fig. 1, it is predicted that the potential economic benefits of China's self driving trunk logistics will reach 1404.5 billion yuan and the market scale will reach 853.9 billion yuan in 2030. The nearly trillion level

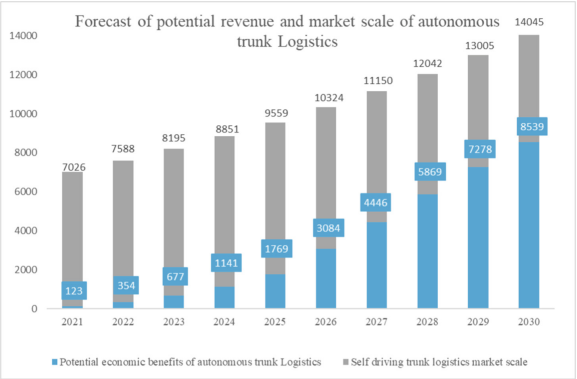

Fig. 2. Example of a figure caption

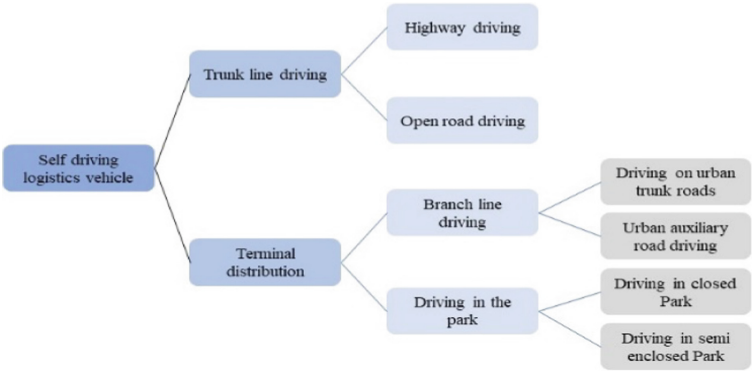

Fig. 3. Application scenarios of self-driving logistics vehicles

market scale of automatic driving trunk logistics track attracts technology companies, mainframe manufacturers, logistics platforms and other parties to jointly dig for gold (Fig. 3).

(1) In the scenario of highway trunk transportation: Automatic driving can reduce fuel consumption and driver's cost, so as to reduce transportation cost. At present, L3 self driving trucks are usually equipped with lidar, visual camera, millimeter wave radar and high-precision map [4]. Visual AI is used for object recognition and lidar is used for map positioning. The algorithm chip is used for perception fusion. It is planned to release the control signal of the whole vehicle, use the technology of big data and artificial intelligence, and use the algorithm to control more than 99% of the mileage. The driver only needs to make accidental operation (Fig. 4).

Fig. 4. L3 automatic driving heavy truck

Fig. 5. JD's unmanned delivery vehicle

(2) In the scenario of unmanned distribution at the logistics end: Automatic driving can solve the problems of difficult employment and hidden dangers of road transportation safety. At the end of delivery, we often see that the courier encounters safety accidents or the freight has quality problems [5]. With the development of e-commerce, the demand for urban distribution is growing rapidly, and terminal distribution has a very large growth space. During the COVID-19 in 2020 and 2022, JD successfully used two unmanned delivery vehicles to deliver in Wuhan and Shanghai, avoiding mutual infection between people [6]. It also has a good application prospect to adopt unmanned distribution vehicles in relatively closed environments such as mines, ports and airports (Fig. 5).

3 Problems Existing in the Construction of Intelligent Low-Carbon Logistics System

(1) Different needs: New energy vehicles are mainly used in transportation and distribution in logistics enterprises. According to different transportation distances, they

can be divided into trunk transportation, branch transportation and terminal distribution. Among them, trunk transportation belongs to long-distance transportation, with large cargo volume, which requires the use of large logistics vehicles; The transportation distance of branch line is long, and small and medium-sized logistics vehicles are generally used; The delivery distance at the end is the shortest, using micro card or electric tricycle [7].

(2) Inherent limitations of new energy vehicles: The charging of new energy vehicles is difficult and takes a long time. The charging infrastructure is scarce and the charging convenience is poor. The load capacity is relatively weak, the battery accounts for more volume and weight, and the mileage is short, which can only reach 200 km at most. It is difficult to meet the average daily driving distance of trunk transportation and branch transportation. Therefore, if we want to apply new energy vehicles to trunk line transportation and branch line transportation, we must solve the problems of endurance and charging difficulty.

(3) From the technical point of view: During the evolution of auto drive system, due to functional safety, moral constraints, legal norms and endless corner cases, there is a huge watershed between L3 and L4 autopilot, which is difficult to cross in a short time. Although autopilot has made great progress in theory and technology, and has been successfully applied in some scenes, whether it can be popularized on a large scale still needs to be tried and practiced.

(4) The cost for logistics enterprises: First, the price of new energy vehicles is much higher than that of cars or diesel vehicles. However, the vehicle specification products of key components such as lidar and computing platform required for automatic driving are expensive, and the research and development of key technologies and components of auto drive system is difficult. Without government subsidies, the financial pressure of enterprises will be great.

4 Conclusion

This paper uses the qualitative research method to analyze the current application status and future feasibility of automatic driving technology and new energy vehicles in the logistics industry. This paper finds out the main problems, and the main conclusions can be summarized as follows:

(1) New energy vehicle manufacturers need to design different types of new energy vehicles to meet the requirements of trunk transportation and branch transportation respectively, and improve the endurance of vehicles. Mileage and charging time have always been the key factors restricting the electrification of trunk logistics vehicles. With the technological breakthrough and business model innovation, the electrification of trunk and cold chain logistics vehicles has ushered in the dawn. Breakthroughs in new battery technologies such as solid-state batteries and graphene batteries are also expected to double the range of electric vehicles to more than 1000 km.

(2) The government should build infrastructure charging facilities and increase financial investment in charging stations and charging piles, so as to solve the problem of

difficult charging of new energy vehicles. At the same time, the government should increase subsidies for new energy and self driving vehicles.

(3) The government should accelerate the test and demonstration application of high-grade automatic driving on expressways and urban expressways, improve the access standards and management rules, formulate the basis for automatic driving road test data management, and give greater play to the value of road test data. In addition, the government should establish the synergy of the demonstration area and promote the adjustment and improvement of standards, laws and regulations related to automatic driving, so as to help the commercial application of L3 or even L4 automatic driving new energy trucks and promote the continuous improvement of low-carbon intelligent logistics system.

In the future work, we will strengthen the research on automatic driving and new energy vehicle technology, and solve the problems existing in their application in the logistics industry as soon as possible, so as to promote the construction of low-carbon intelligent logistics system.

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