

The Application and Significance of Autonomous Driving Technology in Industrial Production

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Abstract: In this study, we first gave an overview of autonomous driving technology and focused on its application in industrial production. By analyzing the types and characteristics of autonomous driving technology, we introduced key types such as unmanned vehicles, automated robots, and drones in detail. Subsequently, this paper selected three specific application cases of logistics transportation, warehouse management, and production process automation to deeply analyze the actual application effects of autonomous driving technology in industrial production. In addition, this paper also explores the significance of autonomous driving technology in the industrial production process and its impact on industrial production efficiency and cost. The study found that the application of autonomous driving technology can not only improve production efficiency, but also significantly reduce operating costs. Through this study, we hope to provide theoretical guidance and practical reference for the application of autonomous driving technology in the field of industrial production in my country.

Keywords: Artificial Intelligence; Autonomous Driving; Smart Warehousing; Logistics and Transportation; Automation.

1. Introduction

With the rapid development of science and technology, artificial intelligence has gradually become an important strategic technology in China and even the world. As one of the key technologies in the field of artificial intelligence, autonomous driving technology has achieved remarkable results in recent years and has been widely used in many fields [1]. Autonomous driving technology has not only made breakthrough progress in the fields of intelligent transportation, drones, robots, etc., but also has shown great potential in industrial production. This paper aims to explore the application status, types, specific cases of autonomous driving technology in industrial production and its impact on industrial production efficiency and cost.

The introduction will focus on the development background of autonomous driving technology, the current status of research at home and abroad, and the purpose and significance of this article. Against the backdrop of the accelerating global industrialization process, autonomous driving technology is gradually changing the model of traditional industrial production with its advantages of intelligence, efficiency, and safety [2]. This chapter will briefly review the development history of autonomous driving technology, analyze the main challenges it currently faces, and its future development trends. At the same time, this article will explain the importance of autonomous driving technology in industrial production, laying the foundation for the development of subsequent chapters.

2. Application of Autonomous Driving Technology in Industrial Production

In the field of industrial production, the application of autonomous driving technology is becoming more and more widespread, bringing revolutionary improvements to production efficiency and safety. The application of autonomous driving technology in industrial production is mainly reflected in the following aspects:

First, autonomous driving technology can realize

automated logistics transportation in the production process [3]. Through unmanned vehicles, enterprises can complete the automated transportation of raw materials, semi-finished products and finished products, reduce manual operations, improve transportation efficiency, and reduce safety risks during transportation. In addition, autonomous driving vehicles can plan and adjust routes according to production needs, achieving flexibility and efficiency in logistics transportation.

Secondly, autonomous driving technology also plays an important role in warehouse management [2]. Through automated robots for inventory, handling and storage of goods, the intensity of manual labor is greatly reduced, the utilization rate of warehouse space and the accuracy of goods management are improved. At the same time, autonomous driving technology can also realize real-time monitoring of the warehouse environment, providing guarantee for safe production.

Thirdly, autonomous driving technology has important applications in the automation of production processes. In some high-temperature, high-pressure or dangerous environments, unmanned driving equipment can replace manual labor to complete production operations, ensuring the safety and stability of the production process. In addition, autonomous driving equipment can maintain high precision and high efficiency during continuous production, improving product quality.

In short, the application of autonomous driving technology in industrial production not only improves production efficiency and reduces production costs, but also provides a strong guarantee for the safe production of enterprises. With the continuous development and improvement of autonomous driving technology, its application in the field of industrial production will be more extensive, contributing to the transformation and upgrading of my country's industry. The following is a specific application case analysis, which will be expanded in detail in subsequent chapters.

3. Specific Application Cases of Autonomous Driving Technology in Industrial Production

3.1. Logistics and Transportation

In industrial production, logistics and transportation are crucial links, and the application of autonomous driving technology is gradually changing the traditional appearance of this field. In the field of logistics and transportation, the involvement of artificial intelligence technology is mainly reflected in the following aspects:

First, autonomous vehicles play an important role in logistics transportation. By integrating high-precision GPS positioning, sensors and advanced algorithms, autonomous vehicles can achieve precise navigation and autonomous driving from the starting point to the end point. This not only improves transportation efficiency, but also reduces the risk of human operational errors. For example, the transportation route planning system based on artificial intelligence can collect traffic data in real time, dynamically adjust the route, and ensure the efficiency and safety of the transportation process.

In specific applications, self-driving trucks have begun to replace traditional manually driven vehicles in large-scale logistics scenarios such as mines. These trucks can significantly increase the frequency and efficiency of transportation, and greatly ensure the safety of workers. Take Jinchuan No. 2 Mine as an example. This mine is the first in China to realize the automated driving of mining trucks. Operators do not need to enter the working face, eliminating safety risks and greatly improving safety. At the same time, automated mining trucks have greatly improved overall efficiency[4].

In addition, autonomous driving technology also shows great potential in the package delivery process. Drones and automated robots are used for terminal delivery. They can accurately deliver packages to designated locations, especially in remote areas or traffic-congested city centers. This advantage is more obvious.

During the transportation process, artificial intelligence can also realize real-time monitoring and management of vehicles. For example, the system can monitor the vehicle's operating status, fuel consumption, fault prediction, etc., provide data support for logistics companies, and help them optimize transportation strategies.

In short, in the logistics and transportation link, autonomous driving technology not only improves transportation efficiency, but also reduces costs, while enhancing the safety of the transportation process.

3.2. Warehouse Management

In the field of warehouse management, the application of autonomous driving technology is gradually changing the traditional warehouse operation model. The integration of artificial intelligence technology makes the cargo handling, sorting, inventory and other links in the warehouse more intelligent and automated.

In terms of cargo handling, self-driving robots such as automated guided vehicles (AGVs) and smart forklifts can automatically complete cargo handling tasks according to pre-set paths or navigation instructions generated in real time [5]. These robots have functions such as autonomous obstacle avoidance and path planning, which greatly improves the

efficiency and accuracy of cargo handling while reducing labor intensity.

During the inventory process, the autonomous intelligent inventory robots can scan and identify goods in the warehouse in real time, and automatically record the storage location and quantity information of the goods. Through artificial intelligence algorithms, these robots can accurately predict inventory changes, provide data support for inventory management, optimize the warehouse management model, and effectively ensure the safety and quality of goods in the warehouse [6].

In addition, autonomous driving technology also plays an important role in shelf management. Shelf placement robots can automatically drive to the target shelf according to system instructions and automatically place or remove goods on the designated shelf. This type of robot achieves efficient and high-quality automated operations, replacing inefficient and high-consumption manual operations and solving the problems that plague enterprise development [7].

Overall, the application of autonomous driving technology in warehouse management has achieved the following improvements: first, it has improved warehouse operation efficiency while ensuring accuracy; second, it has optimized inventory management and improved management quality; third, it has replaced inefficient and high-consumption human operations and reduced production costs. The further application of autonomous driving technology will continue to promote the development of warehouse management towards intelligence and automation.

3.3. Automation of Production Processes

In the industrial production process, the application of autonomous driving technology is gradually changing the traditional production model. By introducing autonomous driving technology, companies can make significant progress in the automation of production processes.

In the production line, autonomous driving technology mainly uses automated robots to achieve material handling, assembly, testing and packaging. These automated robots have a high degree of freedom and precise control capabilities, and can replace manual labor to complete repetitive, high-intensity and high-risk work. Through autonomous driving technology, the following aspects of the production process are optimized:

First, the self-driving robot can achieve 24-hour uninterrupted production, improving production efficiency. Second, due to the precise control of the robot, the quality and consistency of the product are greatly improved. In addition, the self-driving robot can be quickly adjusted and switched according to production needs, improving the flexibility and adaptability of the production line.

For example, welding is a very important work link in various industrial fields. However, with the rapid development of industrial technology, traditional welding methods are difficult to meet the requirements in terms of efficiency and quality. Automatic welding robots have become an important part of modern industrial production upgrades with their high efficiency, precision and stability [8].

In short, the application of autonomous driving technology in production process automation not only improves production efficiency and quality, but also brings higher market competitiveness and economic benefits to enterprises. With the continuous advancement of technology, autonomous driving technology will be widely used in more fields and

links in the future, further promoting the intelligence and automation of industrial production.

4. The Significance of Autonomous Driving Technology in Industrial Production

The application of autonomous driving technology in industrial production has far-reaching significance. First of all, autonomous driving technology can improve the level of intelligence in industrial production and promote industrial transformation and upgrading. By introducing autonomous driving technology, enterprises can realize the automation and precision of production processes and improve production efficiency and quality.

Secondly, autonomous driving technology helps optimize industrial production links. With the support of autonomous driving technology, companies can more reasonably arrange production line layout, logistics and transportation, reduce resource waste and improve resource utilization.

advantages in industrial production :

First, it can improve the safety factor of production. Autonomous driving technology can replace manual work to complete some high-risk and high-intensity tasks, reducing the probability of safety accidents.

Second, it improves production flexibility. Autonomous driving technology can adjust operating tasks and paths in real time according to production needs and adapt to complex and changing production environments.

The third is to reduce labor costs. Autonomous driving technology can reduce dependence on manual labor, especially in areas with high labor costs, which can help companies reduce operating costs.

Fourth, promote the coordinated development of upstream and downstream enterprises in the industrial chain. The application of autonomous driving technology will drive the development of related industries such as sensors, control systems, and artificial intelligence algorithms, forming a good industrial ecology.

In short, the application of autonomous driving technology in industrial production is of great significance in promoting industrial intelligence, improving production efficiency, reducing costs, and ensuring production safety, and it will help my country's industry achieve high-quality development.

5. Potential Problems in Applying Autonomous Driving Technology to Industrial Production

Although the application of autonomous driving technology in industrial production has brought many potential advantages, it also faces some issues worth reflecting on:

1. Potential safety issues : Autonomous driving systems need to cope with changing working conditions in complex industrial environments, such as bad weather, various obstacles in the factory, etc. System failure or misjudgment may lead to serious production accidents and property losses, and even endanger personnel safety.

2. High development difficulty : Developing autonomous driving technology that can be actually applied to industrial production requires a huge amount of data training. Among

them, how to overcome the "curse of scarcity" and other issues is still a challenge today. These challenges have greatly affected the safety verification of autonomous driving technology and increased the difficulty of development [9].

3. Cybersecurity risks: Autonomous driving systems rely on advanced communication and data processing technologies, which makes them easy targets for cyber-attacks. Unauthorized access or data tampering may cause production line disruptions or machine damage, affecting production efficiency and product quality.

4. Legal and liability issues: The application of autonomous driving technology in industrial production involves complex legal and liability issues, such as the attribution of responsibility for accidents caused by equipment failure, how to ensure that the equipment meets safety standards, and data privacy protection.

5. Ethical and social impacts: The widespread use of automation and autonomous driving technologies may raise a series of ethical issues, such as transparency and fairness of automated decision-making, respect and protection for workers, and impact on the environment.

In summary, although autonomous driving has broad application prospects in industrial production, companies need to fully consider these potential problems when promoting the automation process and formulate corresponding response strategies to ensure the sustainability and effectiveness of technology applications.

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