Application research of mechatronics technology in intelligent manufacturing

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Abstract: With the vigorous development of intelligent manufacturing in China, the manufacturing industry, especially the cigarette label gift box packaging, also ushered in a new development opportunity, and mechatronic integration technology can be said to be an important battlefield of artificial replacement automation of gift box, which has brought new development opportunities for the field of intelligent manufacturing. This paper briefly expounds the concept of intelligent manufacturing and mechatronics technology, and analyzes the advantages of mechatronics technology in intelligent manufacturing of gift box packaging. By analyzing the specific application of mechatronics technology in the field of intelligent manufacturing in automatic detection and quality control technology, automatic logistics and warehousing technology, automatic assembly and disassembly technology in the industry, it aims to promote the rapid development of cigarette label packaging industry to automation and intelligence, and promote the further prosperity of the economy.

Key words: intelligent manufacturing; Mechatronics technology; Packaging and processing

Introduction

In the process of the rapid development of China's social economy, the manufacturing industry has developed rapidly, and has made great contributions to the social and economic construction. As an important part of the development of manufacturing industry, mechatronics technology has been widely used in intelligent manufacturing, which has promoted the continuous improvement of the level of intelligent manufacturing in China. Therefore, in the upstream and downstream industries of cigarette production, especially in cigarette label packaging products, in-depth study of mechatronics technology in the specific scenario of intelligent manufacturing has important practical significance.

I. Overview of intelligent manufacturing and mechatronics technology

1.Intelligent manufacturing

Intelligent manufacturing refers to the intelligent and automated transformation and upgrading of the manufacturing process through computer information technology, sensor technology, Internet of Things technology, artificial intelligence and other advanced technical means combined with automatic control technology. It combines the traditional packaging manufacturing industry with modern information technology to realize the digitalization, networking and intelligentization of the production process, improve production efficiency, reduce costs and improve product quality.

Intelligent manufacturing Compared with traditional manufacturing, mechatronics technology under intelligent control plays an important role. It organically combines the mechanical control system with the computer system, endows the mechanical equipment with the ability of memory, analysis, prediction, etc., and replaces the manual for a long time to monitor the working state of the equipment from the direction of vision, quantity, precision and so on. Intelligent manufacturing, to some extent, can replace the mental judgment of some old production employees. Through the cooperation between people and intelligent machines, it can further improve manufacturing efficiency, reduce errors caused by fatigue and other factors, and promote manufacturing activities to the highly integrated, intelligent and flexible direction. Compared with the traditional manufacturing mode, intelligent manufacturing can significantly save manual costs, improve manufacturing accuracy and efficiency, and become the inevitable trend of the future automation development of gift box manufacturing industry.

2. Mechatronics technology

Mechatronics technology is a technology that combines mechanical control engineering and electronic information engineering to realize intelligent control technology and automatic operation of mechanical equipment. It uses advanced sensors, actuators, control systems and information technology, the mechanical equipment and electronic equipment closely integrated, can be computer information technology, modern sensing technology, automatic control technology and servo drive technology and other comprehensive application to the manufacturing industry, found can greatly improve the accuracy and precision of mechanical control. Mechatronics technology can realize real-time adjustment of system operating parameters and status, which can be more comprehensive and effective to ensure that the system operates under safe conditions, reduce the probability of dangerous accidents in the process, and improve the effectiveness of system operation. The characteristics are as follows:

First, intelligent. The main characteristic of mechatronics technology is the integration of intelligence into equipment, which is also its main development approach. For example, in the manufacture of gift boxes, the use of automatic control systems to control the production line can effectively improve the quality and efficiency of gift box manufacturing, and can also replace the instability in the thickness of the glue layer caused by manual gluing.

Second, miniaturization. Mechatronics technology is typically integrated into miniature control modules for application. For example, in the field of cigarette label printing, small-scale machine vision, microcomputer control technology, and microcontroller technology are used to automatically reject cigarette label products with visual defects in the production line. These modules tend to become increasingly smaller.

Third: networking. The future mechatronics system will be more networked, and the interconnection between devices will be realized through the Internet of Things technology to achieve information sharing and collaboration. This will promote the overall optimization and coordination of the production process and improve production efficiency and flexibility. In the actual production process, flexible and adjustable production line equipment is networked using LTE-U or 5G communication, while fixed-position equipment is networked using wired connections.

Fourth: self-adaptability. The mechatronics system supporting the production of packaging gift boxes will have a stronger flexible production capacity, and can independently adjust and optimize according to the changes in the collected data, environment and working conditions. Through learning and adaptability, the system can continuously improve its own performance and adapt to different production needs and process requirements, so as to achieve flexible production. For example, in our packaging production, there are often inner page labels are upside down, artificial visual judgment are used, and the waste boxes are removed. And after the use of machine vision and micro-control circuit, the machine is removed and the start and stop together, once the inner box is upside down, at the same time, the machine is stopped immediately when the mold is not taken out.

II. The advantages of mechatronics technology in the intelligent manufacturing of packaging gift boxes

It is conducive to improving the integration and collaboration of the production line. Mechatronics technology integrates the mechanical and electrical systems to achieve close collaboration and collaborative work between different components. This integration and synergy can improve the overall rhythm and efficiency of the production line, and reduce resource waste and energy consumption. The mechanical and electrical integration technology through automatic control and intelligent algorithm, can achieve the automatic operation and intelligent decision-making of the gift box packaging production process, through ERP/MES/MOM and other systems, to obtain production orders or workshop plans, according to the process, equipment and materials and other requirements, the formation of detailed scheduling plan and process operation plan, directly delivered to the machine.

Through the flexibility and customizability of digital, flexible adjustment and customized configuration can be made according to the needs of the production line. Through the intelligent control system, the production line can quickly adapt to the production requirements of different gift box products, and improve the flexibility and adaptability of the production line. Mechatronics technology can realize real-time monitoring and data collection of the production process, and through data analysis and optimization algorithm, potential problems can be found and timely adjustment and optimization. This can improve production efficiency, reduce costs, and optimize the operating state of the production line.

The mechatronics technology of intelligent manufacturing can realize the digital management of equipment maintenance, repair, spare parts, etc., and support the low-cost and highly reliable operation of the whole life cycle of the equipment. Through the intelligent fault detection and early warning system, potential faults can be discovered and solved in time, improve the reliability and stability of equipment, and reduce downtime and maintenance costs.

III. The specific application of mechatronics technology in intelligent manufacturing

1. Automatic detection and quality control technology

In intelligent manufacturing, mechatronics technology can be applied to the automatic detection and quality control of products, through the visual system to detect and distinguish products, to achieve automatic quality control, improve the consistency and stability of products. In the production and control process, more and more use of machine vision, so that the production process to achieve automatic control and management. The application of this vision system, to a large extent, improves the production efficiency and quality of manufacturing, effectively liberates the labor force, and at the same time, it also plays a vital role in improving the production quality of intelligent manufacturing and enhancing product performance.

2. Automatic logistics and storage technology

Mechatronics technology can apply automatic navigation and positioning systems, such as in automated warehousing and logistics systems, through the visual system to identify and locate goods, to achieve automated pallet handling and storage, improve logistics efficiency and accuracy. The mechatronics system can integrate high-resolution cameras and image processing algorithms through the visual identification and positioning of goods. For example, the system can use machine vision technology to scan and identify bar codes, QR codes or other identifications on goods to determine the type and location of semi-finished products in gift boxes. At the same time, the mechatronics system can use navigation algorithms and path planning algorithms to determine the best handling path and driving route according to the layout of the warehouse and the location information of the goods. The system can realize automatic navigation and obstacle avoidance functions by integrating map data and sensor information to ensure the safe and accurate arrival of the handling AGV to its destination.

3. Automatic assembly and gluing technology

By integrating the mechatronics system with high-resolution cameras and image processing algorithms, we can carry out visual identification and positioning of packaging accessories. Through the analysis of the shape, color, texture and other characteristics of the accessories, the system can accurately identify different accessories, such as: girth and base, etc., and determine their position and posture. In the process of automatic assembly, the mechatronics system can automatically grab the correct accessories according to the pre-set assembly sequence and requirements, and accurately locate them to the corresponding position. The system can remove the packaging accessories from the storage area or production line and place them precisely on the assembly position by means of mechanical arms, conveyor belts, conveyor lines and other devices. This can greatly improve the speed and accuracy of assembly and reduce human error. In the process of automatic gluing, the mechatronics system can automatically identify and glue the corresponding area according to the requirements of the gluing task. The system can grasp, disassemble and move the parts by means of mechanical arms, tools, suction cups and other devices. With the help of the vision system, the system can accurately judge the position of the accessories and the way of gluing, so as to achieve accurate gluing operation.

Peroration

Mechatronics technology has a wide range of application prospects in the field of intelligent manufacturing of gift box packaging. Through visual identification and positioning of goods, mechatronics technology can realize automated handling and storage of gift box finished products, improve logistics efficiency and accuracy, and greatly reduce labor. In addition, the technology can also be applied to the automatic assembly of the internal accessories of the gift box, through visual identification and positioning of the assembled materials, to achieve automatic assembly of the internal materials of the gift box, such as: moisture-proof bags, ribbons, gluing glue, etc., to improve production efficiency and reduce labor. We found that mechatronics technology still faces some areas to be optimized in the application process. First of all, high-resolution cameras and various model image processing algorithms need to be used to achieve accurate visual identification defect location of smoke labels. Secondly, a powerful control system is needed to realize automated handling, storage, assembly and disassembly. In addition, navigation and path planning algorithms and positioning systems are also the key to realizing the application of mechatronics technology. In order to promote the development of the intelligent manufacturing industry, relevant personnel need to pay attention to innovation and technological research, and apply theoretical knowledge to actual production. At the same time, it is also necessary to solve the problems faced by existing technologies, and constantly improve and perfect mechatronics technology to improve production efficiency and accuracy, and promote the intelligent manufacturing industry to move to a higher level.

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