Computer Application of Automatic Paint Spraying System for Automobile Vertical Buoy Based on PLC

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Abstract. Based on PLC, the automatic production of automobile pressure plate painting is realized, and the code carrier memory function is used to automatically recognize the automobile pressure plate painting process. In this paper, the automatic painting system of automobile buoys is the research goal. The PLC control technology is used to solve many problems in the process of automatic painting of buoys, such as low work efficiency, high production costs, and high work intensity. Practice shows that the automatic painting system of vertical buoys is extremely Dadi raises the level of the pressure plate spraying line.

Keywords: Road Signs, Painting, Automation, PLC

1. Introduction
Road signs are artificial signs that indicate the direction, boundaries, and obstructions of the channel, and help guide cars to drive and locate. They play an important role in the safe driving of cars [1-2]. The paint on road signs mainly has two major functions: color development and anti-corrosion. Good paint is an important condition for ensuring the normal performance of navigational energy efficiency of road signs [3-4]. The weather resistance, durability, and corrosion resistance of paint are not only directly related to the quality of the paint itself, but also to the quality of painting [5-6]. When road signs are placed in the waterway, car collisions, seawater corrosion, paint aging and discoloration will cause road signs to lose their proper navigational functions[7-8], so they need to be maintained by professional departments in accordance with relevant regulations to ensure The road signs are in a good technical state [9-10]. There is a road sign maintenance center under the road sign office, which is a professional department responsible for the maintenance of return road signs. It has the ability to design, manufacture and maintain steel buoys[11-12].

In order to improve the spraying efficiency and spraying quality of the pressing plate, based on the analysis of the spraying process and related control requirements of the pressing plate, an automatic paint spraying production line control system based on PLC as the control core is designed, which changes the traditional The spraying method meets the optimized spraying requirements of different shapes of the compression plate, and greatly improves the automation level of the compression plate...
spraying.

2. Overview of automatic painting of automotive vertical buoys
The area under the jurisdiction of the road signs is relatively large, especially in the Pearl River Delta area, and there are many navigation aids such as road signs and lighthouses on the waterway. The road sign maintenance center maintains more than 300 road signs every year, and the number is increasing year by year. The road sign maintenance work is heavy. It is understood that the current painting process in the road sign maintenance industry uses two traditional methods of horizontal buoy semi-automatic painting and manual painting. There are more tasks that require manual participation. The main problems are the following: The efficiency is low, and it can no longer meet the increasingly heavy demand for road sign maintenance operations, and increasing labor will increase labor and management costs; there will be differences in manual operations in the painting process, and the composition and thickness of the paint film need to be more Experience can only be controlled, and human factors will have a certain impact on the quality of painting; outdoor painting methods are susceptible to adverse conditions such as temperature, rain, and dust. Climate and environmental factors will make it difficult to guarantee the quality of painting; During the brushing and drying process, harmful substances such as benzene, formaldehyde, toluene and xylene will be volatilized. Long-term close contact with these harmful substances by manual painting will have a greater impact on the health of the operators; the staff at the road sign maintenance center at the road sign are older. The labor force is increasingly scarce.

Faced with the above problems, the Road Signs Department organized technical forces to set up a research group for the automatic painting system of buoys, and carried out research on the automatic painting system of buoys.

3. Research process and results

3.1. The composition of the system
The spraying process of the pressure plate of the detachable plate heat exchanger mainly includes spraying, drying, putty scraping, and polishing. Construct an automatic spraying production line according to the spraying process of the pressure plate, as shown in Figure 1. The spraying production line is mainly responsible for the spraying of the outer surface of the heat exchanger pressing plate, and consists of a lifting platform, a spraying room, a leveling room, a topcoat drying room, a putty scraping room, a putty drying room, and a putty polishing room. The functions of each part are as follows:

(1) Lifting platform (loading and unloading place): The pressing plate is sent to or unloaded from the production line by lifting equipment. Before loading the material, the code carrier technology is introduced to each compression plate through PLC to load the compression plate painting process.

(2) Paint spraying room: mainly complete the spraying of the top coat of the heat exchanger pressing plate. According to the different production process of the heat exchanger pressing plate, the number of spraying times of the plate top paint varies, and the thickness and density of the top coat attached It is also different. The spray booth adopts a dry spray booth, and the equipment consists of a chamber body, an air-conditioning air supply system, a paint mist treatment device, an activated carbon adsorption exhaust system, and a fire fighting device.

(3) Leveling room: Mainly make the paint drops sprayed on the surface of the material after spraying, and make the solvent evaporate to prevent pinholes on the paint film from baking too fast. The leveling chamber is mainly composed of the chamber body, exhaust system, lighting system, etc.

(4) Drying room: Its function is to dry the pressure plate after spraying to ensure that there is no water on the surface. The drying room is composed of a heat preservation chamber, a gas hot air circulating filter device, a circulating fan and pipelines.

(5) Putty scraping and polishing chamber: After painting, the heat exchanger pressure plate usually has dents, pores, scratches, steel belt joints and other defects. Putty is often used to fill and smooth.
The putty scraping and polishing room consists of a closed room, a dust treatment system, and an exhaust system.

The suspension accumulation conveying system on this production line covers the entire spraying production line, and is the main conveying equipment for the pressure plate spraying. The pressure plate is suspended in the air through the conveying system, and different spraying processes are completed through different working areas according to the spraying requirements. The operation of the suspended accumulation transmission line is controlled by PLC.

![Composition of automatic spraying production line](image)

**Figure 1.** Composition of automatic spraying production line.

3.2. Current research results

At present, the experimental platform of the buoy automatic painting system is close to the actual spraying operation. The surface of the buoy after spraying is smooth, uniform in thickness, without sagging, and the spraying effect is good. The research results of this subject have obtained utility model patents, invention patents and related scientific and technological awards are being applied for and reviewed, and the transformation of research results is also progressing in an orderly manner. The system has high feasibility and practicability, and the research results can effectively solve various problems encountered in buoy maintenance operations if they are transformed into practical applications.

3.3. The features and achievable functions of the buoy automatic painting system

The parameters that need to be controlled for the pressure plate automatic spraying production line are the temperature of the drying room, the operating speed of the accumulation chain, and the start and stop of electrical equipment such as water pumps and fans. This system uses a monitoring system composed of touch screen and PLC to complete the real-time control of the spraying production line. Touch screen to input relevant parameters required for spraying production line control, modify, record and save related data, touch screen to display the running status of production line during the running process; PLC will implement corresponding control on the production line after analyzing and comparing various parameters, and run PLC for unqualified parameters. The alarm will be displayed and fault diagnosis will be performed. In addition to centralized control, the production line also sets up local control at the main process. In this system, the PLC uses Siemens S7-300, and the touch screen uses Siemens MP277. In order to control the production process of the entire spraying line, it is necessary to accurately and timely transmit the spraying process information to the pressing plate during the spraying process. Therefore, PLC is introduced as the control core at the front end of loading and unloading. A code carrier for storing information is installed on the accumulation suspension of each pressing plate, and the spraying process information is recorded from the pressing plate entering the conveying system, and the information is corrected and read at a specific station. The automatic paint spraying system for buoys studied in this subject is vertical rotary spraying, which maximizes the automatic operation under the existing cost and technical conditions.

4. Combination of buoy automatic painting system and shot blasting equipment
In the initial stage of the research and development of the automatic painting system, the research team took the realization of the automatic painting operation of the buoy as the starting point, analyzed in detail the overall situation of the road sign painting operation and the road sign maintenance operation, and finally selected the vertical suspension posture consistent with the shot blasting equipment for research and development, so that the automatic painting system has the conditions to connect with shot blasting equipment, and its practicability is greatly improved. The maintenance process of road signs includes disassembly of accessories, shot blasting, inspection and repair, painting, paint drying, and installation of accessories. During the maintenance operation, the buoy needs to be hoisted and lowered several times, and a forklift needs to be used to transport it between each process. The buoy has the characteristic of heavy weight, which causes not only time consuming to move the buoy, but also many safety risks.

After the automatic paint spraying system is connected with the shot blasting equipment, the buoy can move between different stations such as shot blasting room, paint spraying room, drying room, overhaul pit, etc. through the track, to achieve shot blasting, spraying, drying, spraying again, and drying again. In the assembly line operation of other processes, the pre-cleaned buoy is suspended. Only the button is used to control the buoy to move on the track, which effectively saves the time of road sign maintenance work, Which reduces the safety risk of the buoy during its movement.

5. Advantages of the system and areas for improvement
PLC integrates wireless radio frequency technology and embedded technology as the control core. It automatically collects the standardized and interoperable information stored in the electronic tag through the wireless data communication network to the central information system to realize the identification of items, and then through the open The sexual computer network realizes information exchange and sharing, and realizes "transparent" management of goods. The spraying environment of the pressure plate is relatively harsh, which has a greater impact on various detection components. The use of code carriers can minimize the impact of environmental factors such as corrosion, dust, and high temperature on the components. This paper integrates PLC technology into the PRIFIBUS fieldbus, and uses the advantages of network communication to better process data information, and realizes the tracking and positioning monitoring of the pressure plate across the board. The IDENT identification controller produced by Pepperl+Fuchs is selected, which can establish communication with PLC under the above-mentioned production conditions. The hardware configuration is shown in Figure 2. The main components of this system and their functions are as follows:

Figure 2. PLC is the hardware system that controls the core.
6. Conclusions
The pressure plate automatic spraying production line constructed by PLC, touch screen and other technologies has been put into use in a company. The operation results show that the system is reasonable in design, convenient to operate, reliable in performance, and simple in programming, which greatly reduces the labor intensity of the operators and shortens the spraying operation time. The application of large-scale sheet material automatic spraying and automatic identification and tracking technology provides convenient conditions for environmental management and mass production operations, and also provides a guarantee for the quality of detachable heat exchangers.

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Figure 3. Flow chart of automatic spraying control process
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