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Design of Packing Machine Based on Motion Controller

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Abstract. A kind of control system of packaging machine is designed based on motion controller. The overall design and the design of software system are introduced. The use of motion controller can increase the system flexibility and portability. And it can improve the reliability and efficiency of packaging machine. It provides a new idea for the automatic control of the packaging machine.

Keywords: Packaging machine; Control system; Motion controller

Introduction

There is still a certain gap between packaging industry in China and developed countries, of which the most important is that the packaging machinery products are relatively backward [1]. In many enterprises, there also take the artificial work to package, which consumes a large amount of manpower, the packing cost is relatively high, but the efficiency is low [2]. With the rapid development of electronic industry and the chemical industry, synthetic materials gradually developed, and were applied to the packaging equipment, which has a vital significance to the development of the packaging industry [3]. The electromechanical integration technology brings the new power to the development of the packaging industry, the automatic packing machine start to use in the packaging industry, the production efficiency is greatly improved. The automatic packaging machine occupies big proportion in the machinery industry, and it is still in a state of rising [4]. The automatic packing machine uses the complex relay system to control mostly, relay system wiring is very complex, once faults occur, it is very difficult to carry on the repair. And most of the relay control systems are special system, they can only be used in the packaging machine on specific. If the packaging machine need to replace, it also need to redesign the relay control system, which is in trouble [5]. In recent years, the application of the motion controller in the control field gradually is increasing, the motion controller which not only contains a PLC function, but also can realize control task, it has fast response speed, high control precision, also has the scalability and portability, it is suitable for the design of open control system [6]. Aiming at the defects of the traditional automatic packing machine, this paper designed a control system of packaging machine based on motion controller, which aims to provide a new idea for the development of packaging industry in China.

Packaging machine system design

Packaging machine overall design. As shown in Figure 1, packing machine is mainly divided into two parts, respectively they are the mechanical part and control system part. Mechanical equipment is mainly composed of three parts of a feeding device, a transporting device and a packing device. The feeding device is a conveyor belt B1 driven by a motor M1, the goods to be packaged are put on the feeding device in advance, goods are driven to move forward through a conveyor belt, a freely lifting baffle D1 is on the front of the feeding device, if a packaging process has not yet been completed, the system will control the baffle D1 rising to stop the goods in the behind moving forward. The transporting device is a conveyor belt B2 driven by the motor M2, the goods through a feeding conveyor B1 transport to the transporting belt B2, B2 drives the goods to move on, until they reach the packing device. In the transporting device there is a freely lifting baffle plate D2, the system detects that the goods move to the designated location, the baffle D2 rises, which can stop the goods to moving on, packing action will be finished. When packing action is completed, the baffle D2 gets down, the finished packing products will be sent out the machine, and the machine will continue with the next cycle. Packing apparatus needs to perform the strapping, cutting and

heat-sealing action, these actions are completed through a cam mechanism driven by the motor M3. In the packaging machine there are many sensors, they are used to detect the position of package, and the location of the feedback signal to the system, system will control the motion of packing machine.

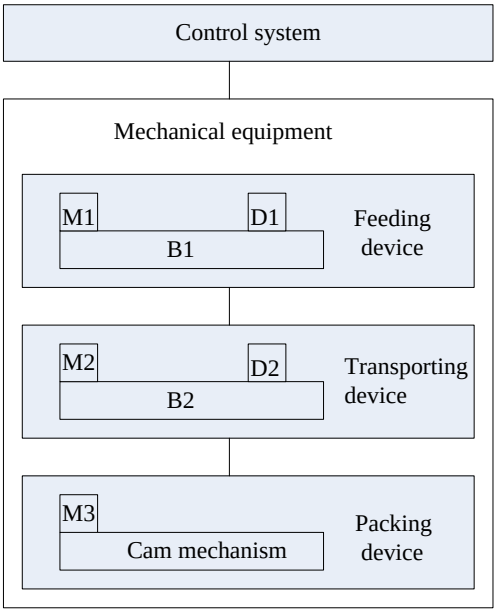

Figure 1.Overall design

Packing machine control system. As shown in Figure 2, packing machine control system is mainly composed of motion controller, touch panel, servo driver, the detection device and the execution device. Motion controller is the core of the whole control system, it is used for processing signals and controlling motion. The touch screen is used to set the relevant parameters and do status display. Servo driver is used to drive the servo motor, servo motors drive the conveyor belt and the cam mechanism to move. The detecting device includes a variety of sensors, they are used to detect packaging machine running state and package location. Executive device includes a variety of indicators, they are used to indicate the working state of packaging machine.

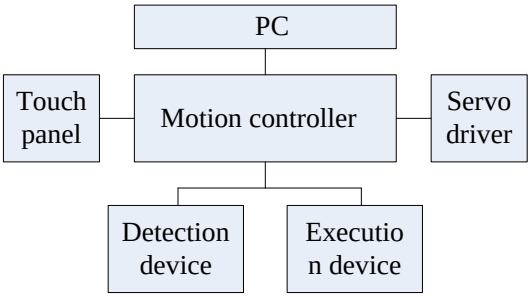

Figure 2.Control system

Packing machine software design

The software structure design. In order to make the control system of packaging machine have scalability and portability, the software design adopts modularization design way. Motion controller is based on PC to run, the motion controller does not have the programming conditions, so it needs to use the PC as a upper computer to carry on the programming and debugging. The modular system design is shown in figure 3. Process management module is developed on the upper computer, then the written logic control programs and motion control program are transmitted to the motion controller, the motion controller servo as motion control module. The touch screen is used to set the parameters and status display.

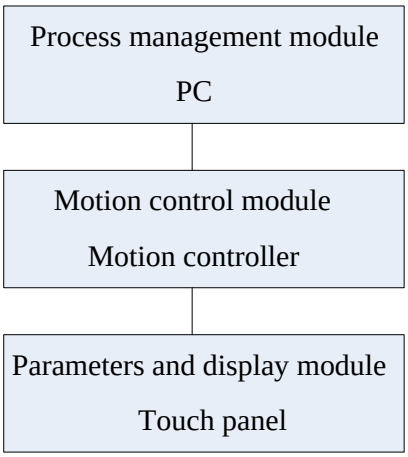

Figure3. The modular system design

The software function design. According to the characteristics and requirement of process of the packing machine, packaging machine adopt sequential operation mode. Software process is shown in figure 4. After booting the system initialization, system will detect the packaging machine state, if there is error, there will have an alarm indicator lights up, if there is no error, it continues to run. After the initialization, the feeding device starts, the goods starts running, system will detect the position of the goods, when arriving at the designated location, the packing device begins to package, at the same time, system continues to detect the location of behind goods, if the packaging has not yet completed, the goods cannot move. After the completion, the next cycle begins. If there is error in the half-way, the system will prompt the error, and the program jumps to the initialization state.

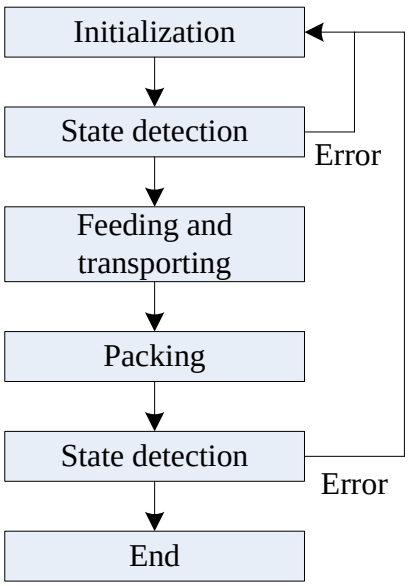

Figure4. Software process

I/O design. Detection and execution device system through the I/O interface of controller to do feedback and output, the design of system I/O is shown in table 1.

Table1. System I/O design

Input		Output	
IN0	Feeding photoelectric switch	OUT0	The indicator light 1
IN1	Limit switch 1	OUT1	The indicator light 2
IN2	Baffle switch 1	OUT2	The indicator light 3
IN3	Baffle switch 2	OUT3	The indicator light 4
IN4	Limit switch 2	OUT4	The indicator light 5

Summary

At the present stage, China's packaging machinery also exists some problems, which includes low efficiency, poor portability etc. According to these problems, a kind of automatic packaging machine based on motion controller is designed. The packaging machine can automatically complete the whole packing process of the feeding, packaging and feeding. Instead of traditional manual operation, it greatly improves the production efficiency, reduces the production cost. At the same time, using the motion controller as the core of control system can increase the system flexibility and portability, the user can collocate freely according to the actual needs, it can improve the service life of equipment.

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