

The control system of garment tailoring machine based on Trio motion controller

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Abstract. Garment industry development causes increasing competition, the traditional manual cutting has been unable to meet market demand, NC formation becomes the inevitable trend. In this paper, a kind of garment tailoring machine control system is designed based on Trio motion controller, the hardware and software are designed. The system uses a modular design, the system is brief and clear, it greatly improves the efficiency of software development. Upper and lower computer mode is applied, double CPU mode enables real-time and non real time programs running separately, which improves the operating efficiency of the system, so as to ensure the precision of control.

Introduction

With the continuous development of the garment industry and the increasing competition in the market, China's garment manufacturing industry is facing a new challenge [1]. The development of global integration introduces a large number of foreign clothing to China, which caused a huge impact on China's clothing market. China's clothing manufacturing enterprises are facing double competition from home and abroad [2]. In order to improve the competitiveness of enterprises, clothing manufacturing enterprises must reduce the production cost, and improve production efficiency [3]. The cost and efficiency of clothing are related to raw materials, manufacturing and other aspects of the sale [4]. The material utilization rate and the production efficiency are important indexes, at this stage, China's garment processing method is relatively simple, degree of automation is low, small and medium-sized enterprises most also take artificial cut [5]. In view of the above situation, in this paper, a kind of garment tailoring machine control system is designed based on Trio motion controller, the system uses the mode of "PC + motion controller" to build, the upper computer and the lower computer run respectively to perform different tasks. The system uses a modular design, which can improve the flexibility and reliability of the system.

Tailoring machine hardware

Overall design. As shown in Figure 1, the tailoring machine is mainly composed of a mechanical part and a control part, the motion controller is the core of the whole control system, to further improve the openness of the system, motion controller must be open, the system is built based on open motion controller structures, which can lay the foundation for the extension for the follow-up system function. After comparison, Trio motion controller is adopted in this paper. TRIO digital motion controller is a kind of digital motion controller developed based on micro processing technology of high precision and high function by Trio motion technology Ltd. TRIO digital motion controller has good expansibility and provides a variety of functional modules, it can configure according to the application requirements of on-demand portfolio and it improves the system openness and portability. There are many connections with the servo driver.

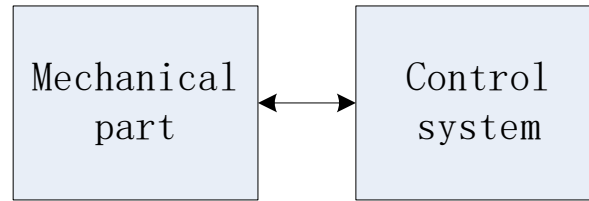
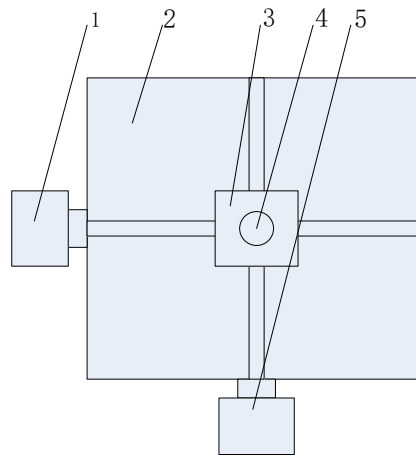


Figure1. Overall design

Mechanical part design. A The mechanical structure of the garment tailoring machine is shown in Figure 2. When garment tailoring machine at work, the fabric tailoring is finished according to the design parameters, tailoring machine is mainly composed of a cutting head and cutting workbench, wherein. Workbench is used for fabric fixation to guarantee tailoring quality. The cutting head is driven by a servo motor. The servo motor is connected with the ball screw, the head moves according to control motor. Cutting head is a cutting knife, and cutting knife is controlled by motor, in tailoring process, motor control cutting knife direction to tangent to the cloth.



1.X axis motor 2.Workbench 3.Cutting head 4.C axis motor 5.Y axis motor

Figure2. Mechanical part

Control system design. The control system of the garment tailoring machine is shown in Figure 3. All movements of the garment tailoring machine are done under the control system. The core of this system is the Trio motion controller, it is used to complete motion control and logic control, and to ensure the smooth running of the system. Control system also includes servo system, actuator and sensor etc. Servo system adopts Panasonic A5 series, the X and Y axis servo motor drives the cutting head two-dimensional movement on the workbench, the C axis rotation angle motor control cutting knife attitude to ensure the quality of cutting.

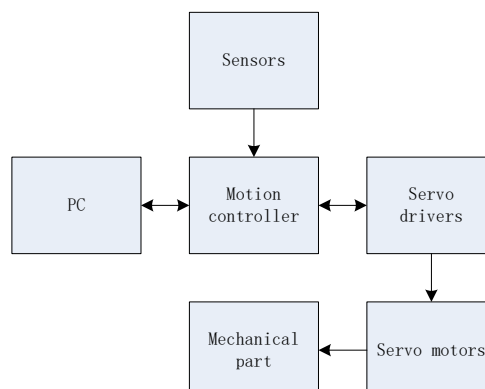


Figure3. The control system

Software design

Software structure design. Tailoring machine system is mainly used to control cutting knife for cutting fabric, as shown in Figure 4, according to the system hardware design, software takes the upper and lower computer design. The upper computer software is used to complete the non real-time tasks, the lower computer software is used to complete the real-time tasks. PC program is developed on the PC based on Windows system, programs of the lower computer is written through the PC, trio motion controller provides special programming software Motion Perfect, communication between the upper computer and the lower computer is through Ethernet, it is used for program debugging and transmission.

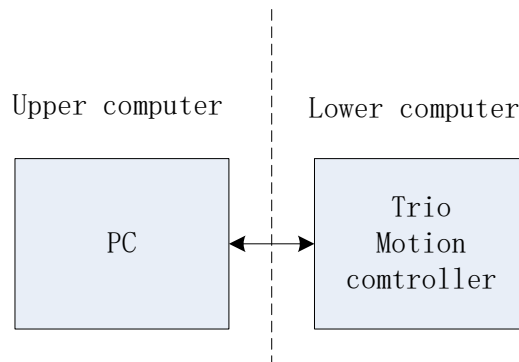


Figure4. The structure design of software

The upper computer software design. In order to further improve the openness of the system and makes that the interface is friendly, the PC program is designed using Visual Basic language based on the windows platform, as shown in Figure 5, the main function of PC software are: system configuration, parameter management, program writing and system diagnosis. The system configuration is used to initialize the system, and make the system to be in working state. Programming is used to write procedures for the preparation of tailoring program; parameter management is used for parameters settings and system state display. The system can display the history of the fault by system diagnosis, it mainly monitors the system fault.

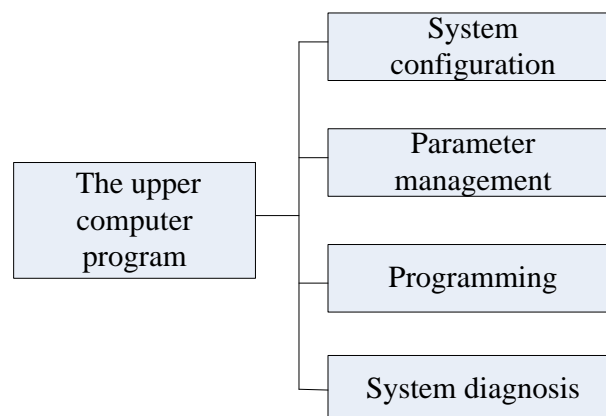


Figure5. The upper computer software design

The lower computer software design. Lower computer is mainly used to complete real-time applications, as shown in Figure 6, main function of lower computer software are: program explaining, servo driving, logic control, input and output. Program explaining is used to make the conversion between tailoring program and lower computer perform code; servo driving module orders servo

driver, servo driver control the movement of the servo motor through the pulse; logic control is used to control the logic relationship between the variables to replace the function of PLC; input and output module is mainly used for receiving external information, and system information will be transmitted to the upper computer.

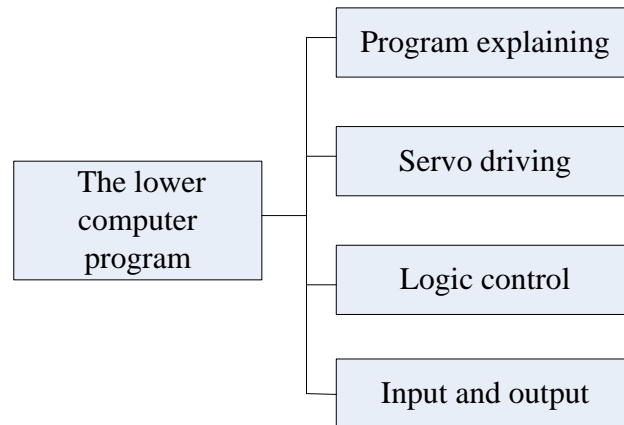


Figure6. The lower computer software design

System interface design. Reception of the position signal of the system and the indication signal transfer is completed through the I/O interface of controller. The system I/O design is shown in Table 1.

Table1. System I/O design

| Input | | Output | |
|-------|-------------------|--------|---------------------|
| IN0 | Position signal 1 | OUT0 | Indication signal 1 |
| IN1 | Position signal 2 | OUT1 | Indication signal 2 |
| IN2 | Position signal 3 | OUT2 | Indication signal 3 |
| | | OUT3 | Indication signal 4 |
| | | OUT4 | Indication signal 5 |
| | | OUT5 | Indication signal 6 |

Summary

Aiming at the existing problems of garment processing industry, a CNC tailor machine is designed. The system uses PC+ motion controller for the construction of the system, which is in line with the idea of the open system. The system hardware and software are designed, system uses modular design, it can improve the flexibility of the system, users can increase in new hardware and software to expand the system function on the basis of the original. The use of double CPU can guarantee the speed of processing tasks, ensure the corresponding speed and control accuracy of the system. This system has some practical significance for the development of the garment industry.

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