Design of Control System of Restaurant Conveyor Belt

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Abstract: ***In order to stop the conveyor belt in place, the conveyor belt is driven by brushless DC motor and controlled by single chip microcomputer. The components of the control system include: control module, drive module, brushless DC motor and power supply. Control module contains MCU, keyboard and LCD display. The meal position is input into the single chip microcomputer by the key, the single chip microcomputer gets the starting motor after the meal position, counts the Hall pulse produced by the motor, and stops the motor after turning to the accrual value of the meal position. The experimental results show that the control system can realize the control of conveyor motion and stop the conveyor band accurately after delivering to the meal position.***

Keywords: MCU, Brushless DC Motor, Hall Signal, conveyor belt

1. Introduction

In the catering industry, waiters need to return to deliver meals, work intensity, need to improve the way of delivery. The cost of personnel input through manual delivery is very high. Food delivery errors can easily cause consumers to be dissatisfied with waiters. Therefore, there is an urgent need to develop a new type of restaurant delivery system. At present, the restaurant delivery workers are developing the use of robot delivery [1, 2], car delivery [3], conveyor belt delivery [4] and other ways. Using the conveyor belt to deliver meals is an interesting way to deliver. The conveyor belt is driven by the motor, and the starting motor can deliver meals automatically very smoothly and reduce the working intensity of the waiter. To accurately deliver food to the table, you need to measure the displacement of the food being transmitted. In order to facilitate the measurement work, this design adopts brushless DC motor to drag the conveyor belt, and uses the Hall signal generated by brushless DC motor itself to measure the displacement of the food transmitted.

2. Overall Design Scheme

The purpose of this paper is to design a control system for a linear conveyor belt. The components of the control system include: control module, drive module, brushless DC motor and power supply. Control module contains MCU, keyboard and LCD display. During the delivery of food, the waiter first uses the keyboard to enter the table number, and LCD the display to display the input table for the waiter to check. If there is no error, the MCU starts the DC brushless motor, counts the Hall pulse signal and the LCD display shows that the food is being transmitted. As the food arrives at the table, stop the brushless DC motor immediately and display the conveyor LCD the display.

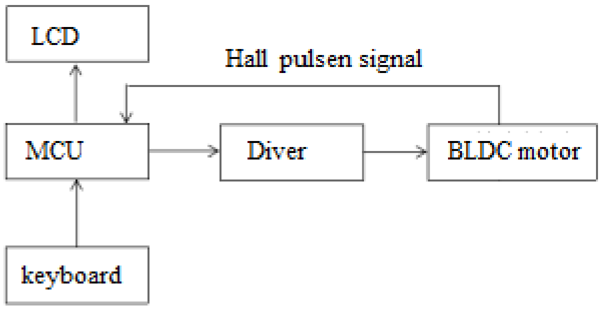

Figure 1: System diagram

3. Hardware design

In order to smooth the conveyor process, it is necessary to select the brushless DC motor with appropriate power. The 57 BL75S10-225TF9 brushless DC motor produced by time Supergroup Company is selected here. Its rated voltage is 24 V, rated power is 100 W, rated speed is 2500 r/min, which can meet the needs of this design. Also selected the time supergroup company to provide the matching ZM-6405E driver. The control module takes STC89C52 single chip microcomputer as the core, including matrix key and LCD1602 display. 24 V DC power supply is used to supply DC brushless motor. Single chip microcomputer is used to control the motion of DC brushless motor through driver. Brushless DC motor itself carries Hall sensor. When the motor rotates 90, Hall sensor will send out 4 pulse signals. When the food is transferred to a certain meal position, the brushless DC motor is required to turn the corresponding angle, and the Hall sensor outputs the corresponding pulse number. All meal positions have corresponding pulse numbers.

STC89C52 single-chip microcomputer is 80C51 series single-chip microcomputer produced by STC company. The internal resources meet the needs of this design. The P0 port of single chip microcomputer is connected with the D0~D7 of LCD1602 display screen for data conveyor. The P2.5、P2.6 and P2.7 interfaces of single chip microcomputer are connected with the RS、R/W and E of LCD1602 LCD respectively. The P1 port of single chip microcomputer is connected with 8 data lines of 4×4 matrix keyboard. MCU P3.2 port connected to Hall pulse. The P3.3 brushless DC motor driver of single chip microcomputer is used to output PWM square wave signal control driver. The keyboard has 16 keys. Key 0-15 corresponds to 15 meal positions. The last button is used as the confirmation button.

4. Software design

Program modules of the software system mainly include keystroke scanning program, display program, PWM output program and main program. The keystroke scanning program is used to input the meal position data, the LCD display program is used to drive the LCD1602 display, and the PWM output program can generate PWM waves with adjustable pulse width. The pulse count interrupt program is used to stop the motor after the meal is in place. In the main program, first initialize the timing / counter and LCD1602, then scan the key, start the brushless DC motor when the input table is correct, wait for conveyor, stop the motor after in place. When starting and stopping the motor, the speed of brushless DC motor can be adjusted by adjusting the pulse width. After initialization, the LCD display displays the prompt to enter the meal position. In the scanning keystroke program, when entering the meal position, display the meal position and record the meal position; when the input is determined, exit the scanning keystroke program.

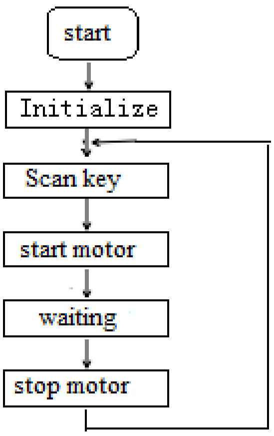

Figure 2: Flow Chart

5. Results and Conclusions

After boot, input the meal position, the LCD displays the input meal position. If you find an input error, you can re-enter the meal position; if the input is correct, press confirm. The transport belt starts to speed up, then runs smoothly, decelerates before arriving at the table, and stops after arrival. If the new meal position is larger than the original meal number, the motor rotates forward and the transport belt transmits forward; if the new meal position is smaller than the original meal number, the motor rotates in reverse and the transport belt transmits backward. After debugging, we can meet the requirements of delivery work and reduce the working intensity of waiters.

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