

Labview-based Sorting System

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Abstract: Industrial automation is the trend of today's society. With the gradual advancement of the Internet of things and smart factories, there will be fewer and fewer laborers in the factory, more machines and automated production lines. Now many weighing and sorting work in food processing plants is still done by workers. The sorting system based on labview can not only realize automatic sorting, but also develop the software of the upper computer, which saves a lot of labor and improves production efficiency. Achieve visual operations, reduce production costs, and improve the overall competitiveness of enterprises. We have developed an automated production line that includes mechanical components, control cabinets and software.

Keywords: sorting system, labview, control cabinet, front panel.

1. INTRODUCTION

Labview is a program development environment. The obvious difference between labview and other computer languages is that other computer languages use a text-based language to generate code, while labview uses a graphical editing language to write programs. The resulting program is in the form of a block diagram [1,2]. The traditional sorting work is done by the labor force. The enterprise not only needs to pay the expensive wages of the workers, but also needs to provide the workers with various welfare benefits. When the order volume increases, the worker can only work overtime to complete the work task, which not only requires a lot of overtime work, but sometimes it is impossible to complete the order on time. In the process of sorting, there are many uncertain factors, which may make the weight of the food not within the specified weight range, resulting in substandard products, especially in the process of overtime work, the product failure rate will rise linearly. In order to reduce labor costs and improve production efficiency, we have developed a sorting system based on labview. Not only reduced the number of workers, but also greatly improved the product qualification rate. Since the weight calculation of the sorting system is done by computer, it is fast. In order to improve the efficiency of enterprises, the automatic sorting of materials has become the only choice for enterprises [3]. At present, most distribution centers and logistics enterprises in China are manually sorted [4,5].

2. CONTROL CABINET

The control cabinet uses a switching power supply to power each module, and 10 electronic scales are used in the automated production line. The electronic scale supports the Modbus RTU protocol. Through the 485 interface, we can read the weight on each electronic scale to the computer. You can set the parameters of the electronic scale according to your needs. The number of electronic scales can be increased according to the size of the production capacity, and the automated production line can be adjusted. At the same time, our program is also easy to expand.

Since the sorting system is used in the factory, in order to improve the anti-interference ability of the system, we use shielded wires to connect the electronic scale and the control cabinet. The PCI2361 board was selected and the board was inserted in the selected industrial computer. At the same time, we used two A20P-II terminal boards. One of the terminal blocks is used to read the status of each of the travel switches, and the other terminal block is used to drive each of the DC motors. Each electronic scale needs to be equipped with 2 stroke switches and one DC motor. One stroke switch consists of two wires, one DC motor contains three wires, so each electronic scale contains 7 wires, and 10 electronic scales require 70 wires. Therefore, pay special attention to distinguishing lines during the process of making control cabinets. Of course, the terminal block does not directly drive the DC motor, and a relay module is required between the terminal block and the DC motor. At the same time, the relay module needs to be used with a switching power supply. The output voltage of the terminal block is 5V, and the power is too low to drive the DC motor. PCI2361 can be widely used for counting, timing, frequency measurement, frequency generation, digital control, especially in the fields of counting, frequency measurement and other fields can be flexible and convenient combination to meet a variety of different needs of users. In particular, channel 0 can provide positive and negative outputs, which can conveniently control the gate terminals of the remaining channels to facilitate frequency measurement. The PCI2361 has nine count timers, each of which is independent of each other. We mainly use digital excites. It has 32 digital inputs and 32 digital outputs. Taking into account the number of travel switches and motors, 10 electronic scales can be supported to work simultaneously. The digital port meets the standard TTL electrical characteristics, input TTL level, sink current less than 0.5mA, output TTL level, maximum pull-down current 20mA. PCI2361 board is shown in Figure 1, A20P-II terminal board is shown in Figure 2.



Fig. 1 PCI2361 board



Fig. 2 A20P-II terminal board

3. LABVIEW PROGRAMMING

When designing the labview program, you should design the labview front panel first, then design the labview program block diagram. The front panel includes a stop button, a start button, a lower weight input control, and a weight limit input control. It is possible to display in real time which foods on the scale are a combination and to display the weight of the food on each scale. At the the same time, the operating state of the motor next to each electronic scale can be displayed. The biggest advantage of labview is that it can quickly develop a beautiful front panel. The front panel is shown in Figure 3.



Fig. 3 The front panel of the sorting system

The most important thing in the sorting system is the sorting algorithm. The sorting algorithm was developed using the C language. When the computer reads the weight of the food on the electronic scale, it must select various combinations that meet the specified weight range. Perhaps the food on one electronic scale is just within the range, or the weight of the food on the two electronic scales may be added to the range. Of course, it may be correct to add the weight of the food on the three electronic scales. This requires the computer to make calculations quickly. In the past, these calculations were

done manually. Obviously, computers work more efficiently. How to write the correct selection algorithm requires us to have a clear idea. Sorting system as shown in Figure 4.



Fig. 4 Sorting system

The result of the algorithm is to develop a DLL file, and labview implements the picking algorithm by calling this DLL file. Compared with the graphical programming of labview, the DLL file developed by C language runs more efficiently. Because the main time consuming of the sorting system is in the running process of the algorithm, the pros and cons of the algorithm directly determine the robustness of the system. After the selection is completed, it is necessary to drive the motor to push the food on the scale to the conveyor belt. The worker's job is to put the food on the electronic scale. The PCI2361 board provides DLL files for labview calls, making it easy to manipulate digital inputs and digital outputs. In order to avoid an emergency during the use of the sorting system, an emergency stop button is set in the software. Of course, workers can also power down the equipment directly through the physical buttons on the control cabinet to stop the equipment. Several experiments were conducted in the laboratory, the sorting pass rate is significantly higher than the pass rate of manual sorting by workers. The sorting system can also generate production reports and count the amount of system sorting per day. At the same time, the production report for the current month can be generated, so that the production can be guided more scientifically. In order to achieve greater production efficiency, the number of automated production lines can be increased. If the number of electronic scales is increased based on the existing production line, the control cabinet must be perfected. Moreover, there is a need to optimize the selection algorithm, and every small improvement is a huge improvement in the system when faced with a huge amount of data. For example, each electronic scale's reading time is increased by 0.1 second, so the production capacity will increase dramatically during the day.

4. CONCLUSION

According to the actual needs of the factory, a sorting system based on labview was designed. The system meets the established target requirements, which not only improves work efficiency, but also reduces labor costs. This is the first step towards a smart factory. The sorting system includes the

control cabinet and the upper computer software, which realizes the automatic operation and visual monitoring of the production line.

REFERENCES

- [1] Li Zhang, Liang Cai. Design and Implementation of Virtual Signal Generator Based on LabVIEW, Foreign Electronic Measurement Technology, vol. 33 (2014), 82-85.
- [2] Honggang Li, Suping Zhang. Design of Multi-channel Data Acquisition System Based on MCU and LabVIEW, Foreign Electronic Measurement Technology, vol.33(2014), 62-67.
- [3] Wei Fu. Application of PLC in Material Automatic Sorting System, Manufacturing Automation, vol.6(2012),136-138.
- [4] Shengyu Xu. Automatic Sorting System and its Application, Logistics and Material Handling, vol.3(2002),33-39.
- [5] Information on <http://www.uuujd.com/products.asp?audience=188692>