

Design of Automatic Identification and Sorting System for Parcels Based on Plc Control

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ABSTRACT:With the rise of the electricity industry, to the logistics sorting industry caused great pressure to design a PLC (programmable logic controller) based on control, combined with Kingview software, and the application of bar code recognition technology, automatic identification and sorting system. According to the structure of the system, the working principle of the system is analyzed, the control requirements are put forward, and the hardware design, software design and configuration process design of the control system are carried out. Using PLC as the next bit machine to improve the acquisition signal and control signal accuracy, and can be based on functional requirements on-site modification and commissioning procedures at the same time easy maintenance. Application configuration Wang as the host configuration software, users can easily adapt to their own needs to adapt to the data acquisition system, real-time monitoring system operating status, protection of information flow, very consistent with the needs of modern production.

Keywords: PLC, Barcode, automatic identification, automatic sorting

I. INTRODUCTION

With the continuous development of society, online shopping has become an indispensable part of the current life of a way of consumption, but thus the logistics industry has a huge pressure to express the package sorting a new request, the urgent need a package sorting system to improve labor efficiency and speed up logistics^[1]. The so-called package sorting is a lot of parcels in accordance with the destination assigned to the corresponding area of the work, generally can be divided into manual sorting, mechanical sorting and automatic sorting.

Manual sorting business is heavy, continuous operation time is long, error and other issues, so more and more sorting tasks are used automatic sorting system. The most critical step in the design of the system is to read the bar code of the goods^[2]. The design of the current selection of the more popular one-dimensional code to achieve the storage of information, so the goods to read the label is equivalent to how to convert the one-dimensional code to the problem, so the main problem of system design is how to use The specific instrument reads the one-dimensional bar code^[3]. Due to the powerful, easy to use, high reliability of the PLC, it is often used as a controller for field data acquisition and equipment. Kingview software as a user can customize the function of the software platform tools, can be easily on the PC can develop a friendly man-machine interface, through the PLC on the automation of intelligent control equipment. So the use of PLC technology, configuration software technology, bar code recognition technology to achieve the design^[4].

II. SYSTEM DESIGN

The system consists of two parts of the design: the hardware part of the selection, the software part of the design. Which part of the software, including PLC software design, configuration software design of these two parts. The PLC software part of the design is the core content. As the system site has a charged bar code reader and the number is not a lot of other controlled objects, therefore, select a medium-performance PLC can achieve all the control functions. In addition, in order to facilitate the user to use, you need to use Kingview software design corresponding man-machine interface, using the system shown in Figure 1 design.

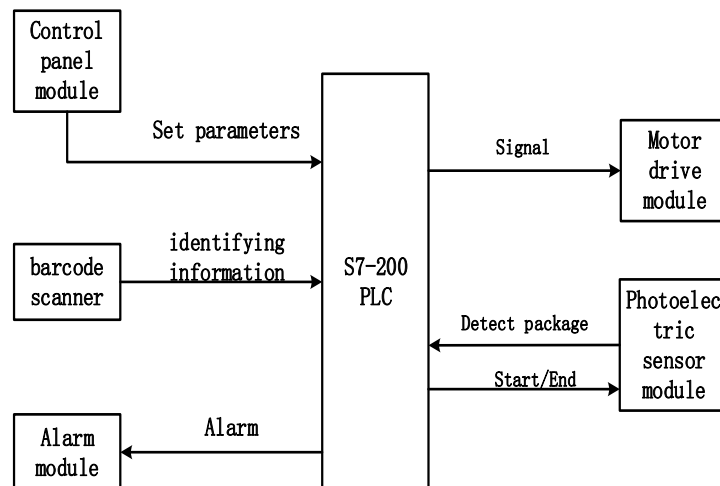


Fig.1 system structure

- 1) PLC controller: the control core of the system. The digital and analog signals of the objects, such as the motor, the bar code reader and the cargo position, are first input to the registers of the PLC. The PLC converts and processes the various signals, and outputs the signal to the monitored object and uploads the key information in real time The host computer, while the implementation of the host computer to send control instructions to complete the real-time and on-site equipment and automation control.
- 2) control panel: the control panel is equipped with a configuration of Wang software, industrial computer as the host computer. Host configuration monitoring system to complete the following three aspects of the task: First, the host computer from the serial port to read the value of the PLC register, these values are displayed in the human-computer interaction interface, followed by real-time to the PLC to send the corresponding control instructions, Machine to PLC to upload the value of a certain deal, the information in the form of historical data stored in the system database to report the form of storage, to facilitate future inquiries.
- 3) information collection module: the main use of bar code reader to collect the bar code information on the goods, and through the serial port to the data sent to the PLC, followed by the operation of the PLC. A barcode is a symbol of certain information that consists of a set of bars, empty, and corresponding characters in a particular rule. Barcode recognition technology is the photoelectric scanning equipment to obtain the bar code symbols for collection and processing, on the basis of the use of machine identification of goods, and accurate and quickly transfer the converted digital signal to the PLC.
- 4) photoelectric sensor module: photoelectric sensor is the use of light detection object sensor collectively, by the transmitter part of the launch of the optical signal and the object is detected by the reflection, block and absorption, and then accept the part of the detection and conversion to the corresponding electricity The signal is used to detect whether the area is wrapped.
- 5) motor drive module: through the PLC out of the control signal to achieve the movement of the load motor control.
- 6) alarm module: through the sound and light equipment on the system is not the normal operation of the state alarm.

III. INFORMATION RECOGNITION SYSTEM DESIGN

2.1 Barcode recognition method and principle

Barcode is divided into one-dimensional bar code and two-dimensional bar code. One-dimensional bar code is only in one direction (usually horizontal) to express information, and in the vertical direction does not express any information [5]. A complete one-dimensional bar code is composed of blank spaces on both sides, starting characters, data characters, check characters (optional) and terminating characters and characters for people to read. Different types of bar codes, there are different code systems and coding methods. There are two bar code coding methods:

- 1) width adjustment method: bar code bar (empty) wide width set different, wide unit that binary "1", narrow unit that binary "0". The so-called 39 yards, Kudba bar code and cross 25 yards are part of the width adjustment method coding.
- 2) module group with the law: bar code symbols in each bar code characters of the strip and the air were

composed of a number of modules, a module wide bar that binary "1", a module wide empty said binary "0". General merchandise bar code (EAU code and UPC code), 93 yards, EAN128 code belongs to the module group with the law encoding^[6].

128 code in 1981 after the launch, has been rapid development and application. 128 code consists of a set of characters whose length is not fixed and the continuity is unknown^[7]. The main structure is divided into the starting code, data code, termination code, check code and other four parts, the four parts of the check code can be omitted. Code 128 code that includes ASCII 0 to ASCII 127 total 128 symbols, so referred to as 128 yards. 128 code to support the number of characters than the number of one-dimensional code to be more, in addition to different encoding can be cross-use, so the use of flexibility is also more flexible. Figure 2 is an example of 128 yards and results.



Fig. 2 code128 code basic structure

128 code has three different types of digital coding (see Table 1), for the choice of what kind of coding, it depends on the contents of the start code. Termination code Whether it is A, B, C what coding, 128 yards of the termination code are fixed for a performance, the logical type are 1100011101011. The current implementation of the 128 yards is EAN a 128 yards, EAN a 128 yards is based on EAN / UCC a 128 yards as a standard to convert the data into bar code symbols, and 128 logics, with integrity, tightness, connectivity and high Reliability of the characteristics. The coding of EAN-128 is shown in Table 2.

Table 1 1128 code encoding

Start code	Coding category	Logical form	relative value
CODE	A	11010000100	103
CODE	B	11010010000	104
CODE	C	11010011100	105

Table 2 EAN-128 coding instructions

Code number	length	Description
A Application identification code	18	00 The contents of the subsequent documents for the transport container serial number
B Packaging performance indicator	1	3 Represents an undefined wrapper code
C Prefix code and company code	7	9 Represents the EAN preamble and company code
D Compile serial number on its own	1	Specify the serial number by the company
E Check the code	4	Check the code
F Application identification code		On behalf of the subsequent information content for the

		distribution of postal code
G Delivery post code		On behalf of the distribution of postal code

2.2 Ommunication Method of PLC and Bar Code Scanner

Siemens S7-200 series PLC is a small programmable controller, with a small structure, multi-functional, low price, itself integrated CPU, I/O points, power, while providing a simple, open communication. Cost-effective, communications and real-time advantages, is the development of more complex automation system solutions ideal^[8].

The system uses Siemens CPU226. It integrates two serial ports, port0 port as the connection between the man-machine interface and CPU interface, the other end port1 used to connect bar code scanning gun. As the bar code scanning gun for the 232 interface, two free communication port for the 485 port, so the need to use 232-485 conversion module to achieve communication.

2.2.1 Special registers

- (1) Control word register SM130: Port1 communication mode The protocol is set by SM130. The system set SM130 00001001 as a free port protocol, baud rate of 9600, the data length of 8, no parity.
- (2) communication to accept the character buffer SMB2: SMB2 is a transient register, used to store in the free mode to receive the current characters, in the next step should be removed from the contents of which, through the programming control will receive the characters one by one Move to receive buffer.
- (3) Communication test result flag SM3.0: PLC according to SM130 specified parity mode to check the received data. If the check is wrong, then SM3.0 set 1, no error is set to 0. If an error occurs, send this error message to the barcode and request a retransmission.
- (4) Working mode flag SM0.7: S7-200 series PLC in the RUN state to carry out free port mode communication, STOP state can only use PPI mode communication. When the PLC is in RUN state SM0.7 = 1, otherwise SM0.7 = 0, it can be used to determine the status of free port communication.

2.2.2 Receiving data and communication procedures

S7-200PLC communication port port0 port has three interrupt events: to accept the character 8 interrupt, send and receive 9 interrupt, receive signal 29 interrupt. The global interrupt can be enabled by the ENI instruction in the user program. All interrupts are disabled with the DISI instruction. A single interrupt can be opened and disabled independently by the ATCH and DTCH instructions. Communication port 1 port has 24, 25, 26 three interrupt events^[9]. The system calls the 24th interrupt to receive characters, communication procedures shown in Figure 3.

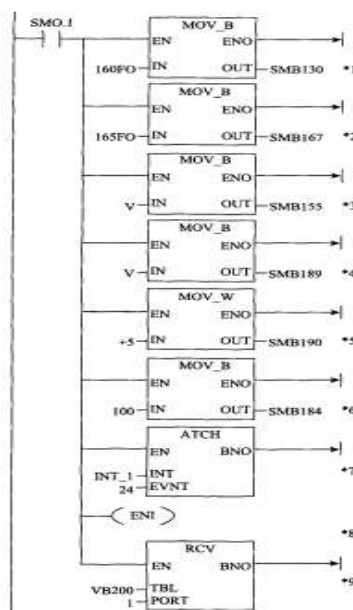


Fig. 3 communication procedures

III. DESIGN OF PLC CONTROL SYSTEM

3.1 PLC hardware

The control system has the following requirements: economical and practical, able to adapt to the scene, improve the reliability of equipment; to facilitate the modification of on-site data, with a certain degree of flexibility; to ensure accurate data collection, improve productivity; improve equipment automation rate. Based on the above requirements, the system uses Siemens S7-200 series PLC, which integrates the power unit, CPU unit, basic I/O unit, special function unit and communication unit.

According to the input and output points and functional requirements, PLC port wiring as shown in Table 3, Table 4 shows.

Table 3 Input Assignment Table

input	name	function
I0.0	run/stop	system run
I0.1	code scanner sensor	control code scanner
I0.2	sensor 1	detect whether the goods in channel1
I0.3	sensor 2	detect whether the goods in channel2
I0.4	sensor 3	detect whether the goods in channel3
I0.5	sensor of conveyor	detect
I0.6	Manual control switch 1	Manual control drive belt
I0.7	Manual control switch 2	Manual control motor 2
I1.0	Manual control switch 3	Manual control motor 3
I1.1	Manual control switch 4	Manual control motor 4
i1.2	Manual control switch 5	Manual control motor 5

Table 4 Output Assignment Table

output	name	function
Q0.0	Motor 1	drive belt
Q0.1	Motor 2	control motor 2
Q0.2	Motor 3	control motor 3
Q0.3	Motor 4	control motor 4
Q0.4	Motor 5	control motor 5
Q0.5	Sound and light alarm system	alarm

3.2 PLC software

3.2.1 Software architecture

Software overall structure of the main program, calibration procedures, data conversion procedures, mechanical sorting subroutine, hand automatic conversion procedures. The overall flow chart shown in Figure 4.

- 1) mechanical sorting subroutine: mainly according to the host computer to deal with the corresponding cargo information, according to the bar code to provide the basic information in accordance with the corresponding rules of the goods for different treatment. The design is mainly reflected in the different goods through the conveyor belt sent to different channels, so that the next unit for other operations.
- 2) alarm processing subroutine: the main completion of the system failure and communication anomalies and cargo identification failure alarm.
- 3) hand automatically switch subroutine: According to the design function requirements, when the system fails, cannot be completed in the automatic control mode, the manual will be selected according to the specific circumstances of manual control.

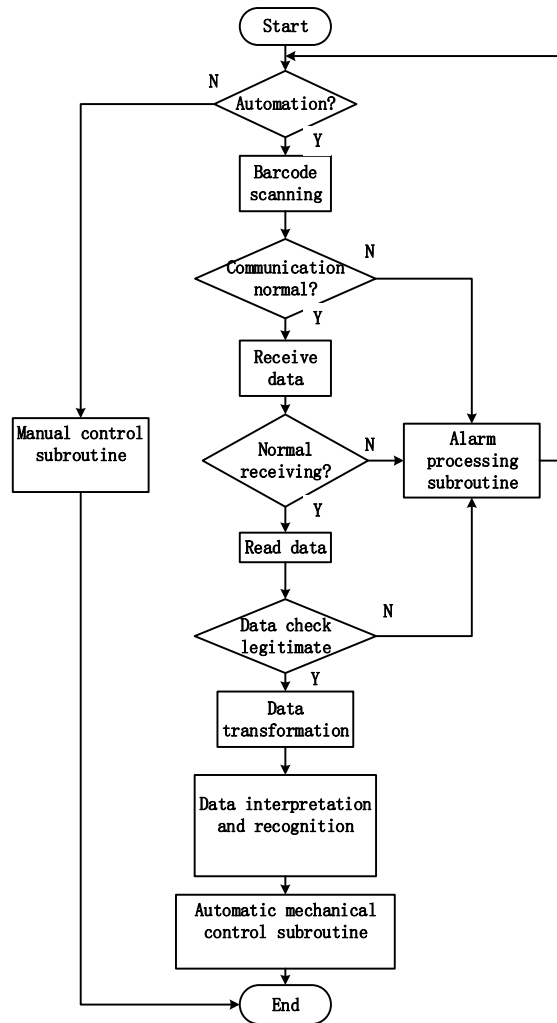


Fig. 4 System program flow chart

2.2.3 Mechanical sorting program specific process

The core part of the software is the mechanical sorting subroutine, in order to achieve the correct sorting parcels, as shown in Figure 5. The specific process is as follows:

- 1) detection system communication is normal, if normal, then open the system, the implementation of initialization procedures.
- 2) When the package is in a low power state, the package is detected and the package is transported to the scanner for scanning.
- 3) The scanner sends the processing result to the PLC for information matching.
- 4) If the match fails, then the package is not the area, the sorting device will not perform the sorting action, the parcel continues along with the conveyor belt.
- 5) If the match is successful, then the package in this area, the matching results will be sent to the PLC input, the corresponding area of the sorting device will perform sorting action, the package into the appropriate area.

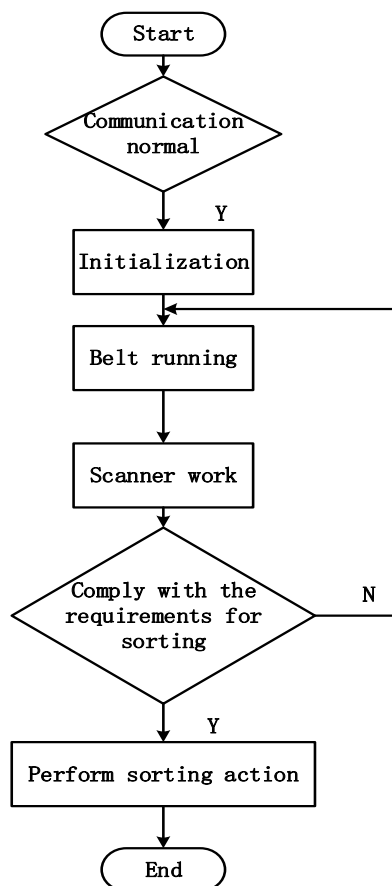


Fig. 5 Control subroutine

IV. CONFIGURATION INTERFACE DESIGN

"Configure" means "configuration", "set", "set" and so on, refers to the user through similar "building blocks" in a simple way to complete their own software needs, without the need to write Computer program, that is, the so-called "configuration". In short, the configuration software can achieve the automation process and equipment monitoring and control. It can extract all kinds of information from the automation process and equipment, and display the information in a way that is easier to understand, such as graphics, and transmit important information in various ways to the relevant personnel, carry out the necessary analysis and processing of the information, Issue control instructions and so on.

Commonly used configuration software InTouch, WinCC, MCGS, etc., here use the more popular configuration King software to develop configuration interface, it has a strong adaptability, openness is good, easy to expand, the economy, the development cycle is short and so on. Usually the king development system can be divided into control layer, monitoring layer, management three levels of structure^[10]. The monitoring layer is connected to the control layer, on the connection management layer, which not only realizes the real-time monitoring and control of the scene, and in the automatic control system to complete the upload and release, the important role of configuration development. According to the design requirements and the actual production needs, the system operation, mining

The data is integrated, and four function modules are set up: parameter setting module, data dictionary setting module, page setting module and authority setting module.

The specific steps are as follows:

- 1) Select the correct PLC driver, refer to the communication protocol to set the communication parameters.
- 2) in the browser inside the hardware device configuration. details as follows:

First, according to the different means of communication in the configuration of the king to set the corresponding. Kingview software has five main types of communication: serial communication, data acquisition board communication, networking communications, man-machine interface card communication, DDE or OPC

communication.

Second, the network node communication settings need to select the corresponding node name in the "Device" outline. When the communication mode of the lower computer is "network node", the "network node" needs to be selected. If the other communication mode is adopted, all communication modes other than "network node" can be used.

Third, set the I / O device parameters. System PC control interface will be real-time production status display in the human-computer interaction interface, this time the host computer control can replace the basic hardware control console based traditional control. Monitor all the operating buttons on the main interface and the goods feedback signal are input through the PLC digital signal, and the host computer driven by the PLC device is driven by auxiliary relay.

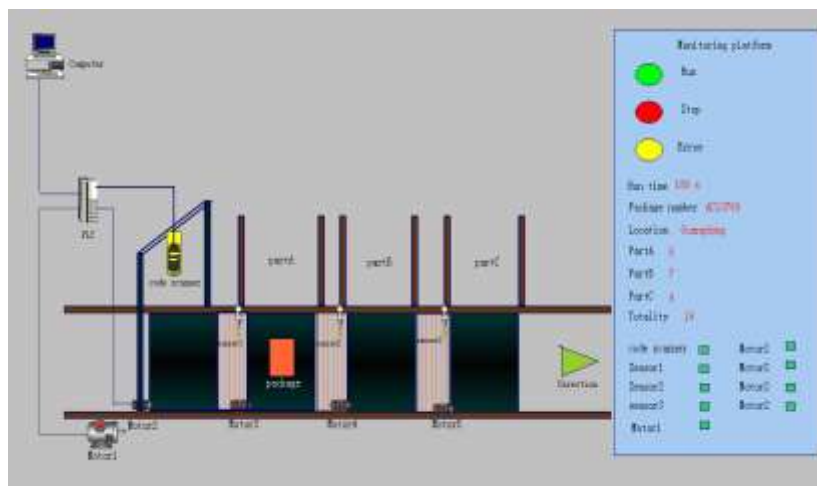


Fig. 6 monitoring system main interface

Figure 6 shows the monitoring system configuration screen, mainly used to display the cargo identification control effect. The left side of the screen indicates the connection between the computer and the PLC, the PLC and the controlled device. The main part of the picture is the movement of the pallet in the conveyor belt. The pallet is placed on the pallet, and a barcode is hung on the gantry. Through the goods information, the right side of the screen will be real-time display of the current scan cargo number, destination, the number of goods to be scanned and other information, while the system shows the current state of operation, the implementation of the operating elements and so on.

V. CONCLUSION

The system combines the programmable controller and the configuration software to study the cargo identification process and designs a set of effective automatic identification control system. The design mainly from the PLC main program, the host computer, configuration monitoring, and RS232C communication to complete the design task.

The main work to complete the following work:

- 1.introduced a low cost, stable and reliable serial communication, that is, the use of small programmable controller S7-200 free communication interface to achieve communication with the serial device, but also gives a bar code scanner to achieve communication programming Examples, providing a viable solution for low-cost communications.
2. PLC control system design. Combined with the control requirements given the PLC input and output ports of the distribution and wiring, and according to the operation process design procedures, including the main program, calibration procedures, data conversion procedures, mechanical sorting subroutine and automatic conversion procedures.
3. real-time monitoring of the screen design and implementation process. Based on the combination of software and PLC on the upper and lower computer, not only can real-time in the human-computer interaction interface to collect and display data information, but also to achieve the real-time monitoring and automatic control of the goods pipeline, save system data and fault information and other functions.

The automatic identification and sorting system designed in this paper has good scalability and flexibility in mechanical and control systems. Here only three areas as an example, the actual application can be extended to the needs of more areas, or even greater areas. This system makes use of the existing PLC technology, combined with the configuration king development monitoring screen, so that the courier company's sorting process becomes unmanned, automated, greatly increased the company's operational efficiency, with further promotion and research significance.

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