

Design of intelligent robot visual detection system

Qi Li¹, Xiaohong Cheng²

¹Beijing Information Technology College, Beijing, China

²Beijing Wuzi University, Beijing China

liq@bitc.edu.cn, bj201801@163.com

Keywords- industrial robot, vision system, PLC

Abstract—Industrial robot technology represents the highest achievement of mechanical and electrical integration, is one of mankind's greatest achievements in twentieth Century. Industrial robot although only nearly forty years of history, but because of its unique adaptability and anthropomorphic, become an important development direction in the field of industry. With the progress of science and technology, the development of information technology, the robot will also appear in our field of vision, and its application in the field of constantly widening. Especially the emergence of industrial robots, has played an important role for the industrial automation in China, promoting China's industrial development.

Introduction

The industrial robot is a modern manufacturing industry, electronic, mechanical, set computer, control, sensor, artificial intelligence and many other advanced technologies and disciplines in one of the important automation equipment. The use of robots in the service of automatic production process, is the development trend, the current at present, artificial robot instead of specific process, have implemented the project evaluation of the value of production. Industrial robots and intelligent vision system sorting goods compared with the manual sorting based on activities, not only high working efficiency, accuracy, and are unable to replace the manual operation advantage in terms of quality, hygiene and other aspects; compared with the traditional mechanical sorting operation, based on. industrial robots and robot sorting intelligent vision has a range of adaptation wide, can transform the sorting process and transform the job object advantage at any time.

The robot's future development should be combined with the actual production needs more. The sorting operation is an important part of most production line. Sorting technology of industrial robot is a organic combination of robotics and vision technology, some developed countries in Europe and America, in sorting technology various production fields application of robot has been quite popular, the robot sorting system and our country is really implemented is still in the growth stage. According to the current market demand situation of our country and relevant technical basis, research, development and has the very vital significance sorting technology application of robot.

Experience in the use of the developed countries that brings the industrial robot technology benefits: can the product cost and reduce scrap rate the use of industrial robots, improve the utilization rate of the product, reduce the labor intensity of workers, improves the production efficiency and product quality assurance. The labor saving, provides a safer working environment, reduce labor risk, improve the competitiveness of enterprises.

According to the use of industrial robots, intelligent vision system, PLC control system and Ethernet system body structure and control system are combined, to industrial robots and intelligent vision technology and advanced control technology as the foundation, has designed a set of industrial robots and intelligent vision system based on the function more powerful object automatic recognition system and sorting system. And gives the structure, the software design and the control process of the system. The use of PLC as the core of information processing, improve the signal and control signal acquisition precision, and can modify the program site, easy maintenance. To realize real-time data monitoring and management, ensure that the information in the whole range of unimpeded, to adapt to the need of intelligent management. The main realization intelligent

positioning, object number recognition and automatic import warehouse operation control, and ultimately achieve the full automation intelligent unmanned management objective.

The overall scheme of the system

The design of this system mainly includes two parts: hardware design, software design part. The hardware part consists of six degree of freedom industrial robot, intelligent visual detection system, the RFID data transmission system, PLC control system and a set of feeding, conveying, assembly, storage mechanism, can realize the high-speed transmission of the workpiece on the sorting, handling, assembly, testing, storage and other operations. The software part mainly includes the robot control program, PLC program, intelligent visual program design software programming part. The design of PLC, part of the robot is the core content of. The structure of the control system as shown in figure 1-1.

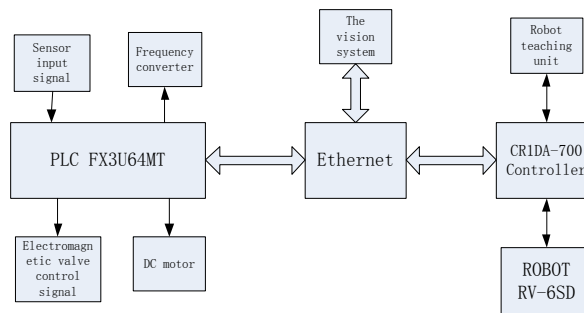


Figure 1. Schematic diagram of system structure of 1-1

The functions of the system are as follows: firstly, the basic process of workpiece assembly process editing software workpiece assembly process to PLC, PLC to the assembly process to save, to repeat the assembly. The workpiece has different number, color, height, workpiece material base to detection of the workpiece, workpiece material base of different time-sharing launch their workpiece, and an endless conveyor belt, conveyor belt running straight start; launch of the workpiece by the circular conveyor line forward, reaching the RFID detection unit for detecting. Then, the main controller PLC reader RFID to operate within the workpiece, read label information, judging whether PLC workpiece for assembly need or don't need, and control of industrial robot sorting into workpiece assembly box on the table. Then, grasping the industrial robot visual camera to take pictures of the workpiece box; at the same time vision processor analysis (number, color and height ratio), and the detecting result is output to the manipulator. Finally, the industrial robot as the qualified workpiece workpiece cover boxed, moving to the workpiece warehouse.

the structure of system hardware

The system consists of six degree of freedom industrial robot, intelligent visual detection system, the RFID data transmission system, PLC control system and a set of feeding, conveying, assembly, storage mechanism, can realize the high-speed transmission of workpiece on sorting, detection, handling, assembly, storage and other operations.

1. From the industrial robot robot, robot controller, teaching unit, input and output signal converter and capture mechanism, equipped with a range of fixture, sucker, measuring tools, tools, the workpiece can crawl, absorb, handling, assembly, polishing, measurement, the disassembling operation, also can grab the intelligent vision camera on the workpiece the assembly process, real-time visual inspection operation.

2. Intelligent vision system by visual controller vision camera and monitor, monitor etc.. For detecting characteristics of the workpiece, such as digital, color, shape, can also carry out real-time detection operation on the assembly effect. The connection to the PLC or the robot controller

through the I/O cable, also support the serial bus and Ethernet bus is connected to the PLC or the robot controller, transmission of test results and test data.

3.A programmable control unit. Programmable controller, digital quantity expansion module, simulation module, 232 serial communication module, Ethernet communication module, used to read and write RFID workpiece data system, robot control, motor, cylinder actuator, signal processing units, management workflow, data transmission and other tasks.

4. The RFID data transmission system. Install left arc conveying unit in the link, the electronic tag has been buried in the internal parts, detection distance of 40mm. When the workpiece from the ring conveying unit after left arc, RFID detection system can accurately read the label information in the workpiece, such as number, color, height and other information, the information through the industrial data bus transmission to the PLC, to realize the sorting operation of workpiece.

The system software design

Software programming including robot MELFA.BASIC programming, PIE programming and visual detection software programming 3 parts, to complete the sorting, handling, assembly of the whole robot system function. Using RT ToolBox2 ChineseSimplified software robot programming environment, with offline, online, simulation of multiple state for the user to debug program. The robot program cycle working process mainly includes the following parts: read the workpiece information from PLC; tracking grasping; transverse, vertical visual inspection; the workpiece, workpiece sorting assembly equipment, storage box lid.

Using GX Works2 software programming environment PLC, the program design mainly includes: system initialization, data communication through the RFID read the tag, the receiving signal and the robot communication, analog output control inverter, for material identification and detection by the sensor signal. In the RFID electronic tag should be used when reading, strictly abide by the communication controller RFID and third party's of no protocol communication, format: data length of 8 bits; odd; stop bit 1 bit transmission rate of 19200 bit / S.

Transmission line of workpiece after photographs the detection signal corresponding to the output of programmable controller. Visual inspection of software integration in FZ4 350 controller, display and edit to J through the liquid crystal displays. The operation process of the intelligent vision including preparation, editing process, try to analysis measurement, test run, management of the 5 step process, which provided the most important editorial content, detailed herein. Edit process mainly include image input, processing, color to grayscale measurements before filtering, search, classification, measurement of pretreatment, average color / color, scanning the edge position, serial data output link. The measurement of pre processing for image processing camera, make it convenient to measure the image, the default settings. The color filter is the color gray. Here in the number search as an example, explains how the detection result will be output to the robot: image detection judgment results stored in the u3.JG variable (Note: U3 represents the third step process of editing, JG said the search result of judgment), with L, do not meet for a 1; through $(U3.JG+1) / 2$, and a 1 output 0; finally multiplied by the workpiece number, can be detected qualified workpiece number output to the robot, the robot performs handling actions tell.

System debugging

The use of robot software and online, online - program, main, PRG, select "in the debug state", you can use the program to jump, single step operation, direct running operation, combined with teaching unit manual operation will be the position of the robot calibration and save. Online debugging, will PLC to "STOP", make the operation of power.

The use of robot software and online, online _ parameters of ---Ethernet set, COM2 set zone "in the line and equipment:" drop-down box to choose "OPT11", "COM3:" choose "OPT12" after the drop-down box; in the communication setting area after "NETIP" text box input controller IP address "192.168.1.20"; double equipment list "OPT11" where the line, set up the robot and intelligent visual communication parameters, the IP address for the 192.168.1.2 port number is 10001, the agreement

was 2, the server is set to 0, the end of coding was 0; by the same method in the "OPT12" in the line, the communication parameters settings with PLC, IP address is 192.168.1.9, the port number is 10002, the agreement was 2, the server is set to L, the end of code is 0. The vision system software used in the main interface of the upper left corner and click on "system", the choice of "communication", then select "Ethernet: no protocol (TCP)", enter the Ethernet interface settings, reference robot software and communication parameter intelligent vision set. Ethernet communication parameter FX 3UPLC is set by FX3U ENET-L Configuration Tool software. Commissioning phase (D: using robot software and online, online, program main.prg, right click on the selected "debugging under open program", you can use the program to jump, single step operation, direct running operation, combined with teaching unit manual operation will be in the program of robot position calibration and save. The use of robot software and online, online parameters parameter list, the parameter name after the text box, enter "TRMODE", click "read", enter L in the pop-up "parameter editor window, click the" write",said tracking allows, determines the write, determined to restart controller set. Principle of tracking the encoder will grab is a DC motor speed is sent to the robot controller, robot after contrast algorithm to track the workpiece. The use of robot software and online, online monitoring, monitoring program monitoring edit slots, the robot controller to manual, teaching unit of TBENABLE press, use the teaching unit track "procedures open" in manual mode, mechanical hand piece capture tracking program debugging.

Conclusion

Advanced technology of industrial robot and detection system of intelligent visual combination of the industrial robot, intelligent vision, RFID, PLC, inverter, encoder based on industrial production, design flexibility to the industrial field production task, for flexible manufacturing process of reproduction, through debugging running effectively improves the application of industrial robot control understanding and, and provides a way for application of industrial robot.

In future research, can try to combine the design scheme of the system, the image recognition technology of robot environment added, so that the manipulator can automatically display and analysis of workpiece assembly position environment image, promote the high-tech industrial production levels, to more applied talents training of industrial modernization. Has the high usability and humanized design.

Reference

- [1] Guo Honghong, an industrial robot using [M]. Science Press, Beijing, 2008.7
- [2] Zhao Chen, Wang Gang. The development of industrial robot industry of our country investigation report [J]. robot technique and application, 2009.4
- [3] Solemnly, Wang Wei, Yun Weiming. Control robot research status and development of [J]. technology in network based robot, 2002,24