

The Design of Multi Degree of Freedom Manipulator Controller Based on 485 Bus

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Abstract—According to the requirement of high efficiency, convenience and accuracy for the robot, this paper presents a system of multi degree of freedom manipulator based on 12 Series MCU. Through the man-machine interface to control the robot joint motion of the motor, the panel shows the actual position of the current joint as well as the current status of the motor and other information, and the whole device can realize the linkage of 6 joint motor. The experiment shows the design of multi degree of freedom manipulator has high reliability, strong anti-interference ability, high efficiency and simple, low price, and it's easy to realize the communication of point to point, point to many.

Keywords—485 bus; SCM; multi degree of freedom manipulator

I. INTRODUCTION

As one of the best tools to replace human labor, robots will be the best assistants of human beings from the date of its birth to the present and the future, and are widely used in industrial production and agricultural applications. Robot joint control^[1] is the core part of the robot system. Every complete robot system is composed of a single robot joint driver. Manipulator is a combination of mechanical technology, electronic technology and automatic control technology. It is an important branch of robotics, and has broad application prospects. As a highly potential advanced robot technology, robot joint control is widely used in special working environment such as military industry, nuclear industry, space and deep sea exploration, and plays an important role in the fields of biomedicine, minimally invasive surgery and underground mining. The robot joint controller is the core of the control system. Its performance directly determines the stability and reliability of the system.

Robot joints control has been developed in the United States, Britain, Singapore, France, Australia and other countries. For example, the concept model of Toshiba's trial home robot is equipped with a newly developed open robot driver and controller using distributed object technology, so it is easy to add new functions. The company also established an open robot driver architecture using decentralized object technology, and developed other controllers based on the architecture. The IRC5 driver with modular design is the fifth generation robot joint controller launched by ABB company in the near future. Its birth marks a major innovation and progress in the field of robot control technology. The research on robots in China started in the early 1970s. In the period of "85", "95" and "15", the National 863 plan has formulated a series of corresponding high-tech research and development plans^[2]. Through the start of "75", "85" and "95", our country has basically mastered the core technology of robot manufacturing and design technology,

control and driving system design technology, and robot software and programming.

The development of multi degree of freedom robot hand has greatly expanded the workspace of traditional robot, and its application field is more and more widely. Its important development direction is to realize full autonomy^[3]. Due to the limitation of the conditions, this paper only completes the control and design of every joint driver of the robot. That is the part of the red box in Figure I.



FIGURE I. INDUSTRIAL MINITYPE MANIPULATOR

II. DESIGN SCHEME

The robot intelligent joint driver of the multi degree of freedom manipulator control system is based on 12 series single chip microcomputer and LM629 high precision motion controller, and uses 485 Fieldbus to communicate with other equipment[4]. The whole system includes upper computer, slave computer and 485 bus part. The master block diagram of the overall design is shown in Figure II below.

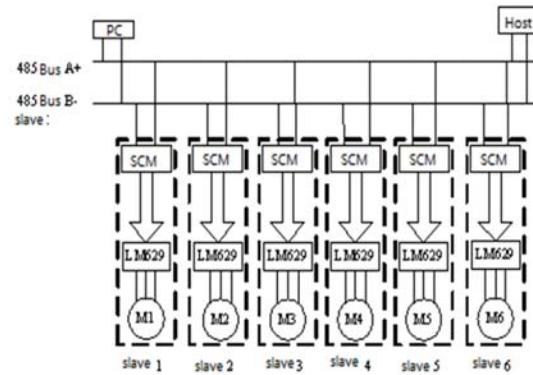


FIGURE II. THE OVERALL STRUCTURE DIAGRAM OF CONTROL SYSTEM

III. THE SOFTWARE DESIGN

The operation process of the VB interface operation interface^[7] is shown in Figure V (A), (B), (C), (D), (E): the system that enters the VB man-machine interface, chooses to click the function to click in, and then hits the first step, and enters the first step interface. Input the required motion parameters (rotation angle, speed and acceleration). After opening the serial port, click start. Then the instructions are passed to the slave machine through the 485 bus, and then the data is processed through the lower machine, so that the corresponding motor can complete a series of operation. After waiting for the motor to complete the specified action, click Save again, and store all the parameters before input into the Excel form. After saving data, the interface will go back to the interface of Figure V (b). Click on the second step, enter the second step to try the interface, repeat the last operation, and complete the second step comparison. Such a cycle of operation 10 times, completed a set of actions of all tests, and each step of the trial and data are saved to the Excel table

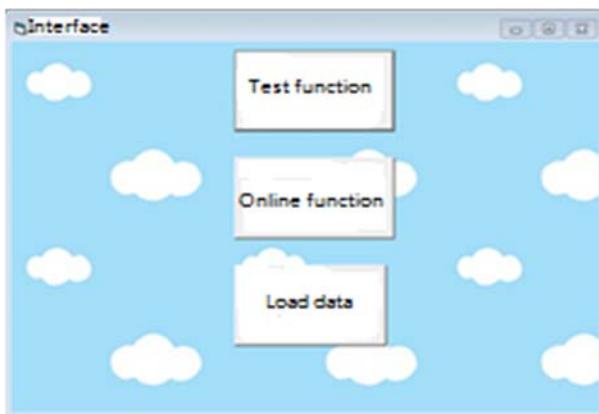


FIGURE V (A). SELECTING TEST COMPARISON FUNCTION

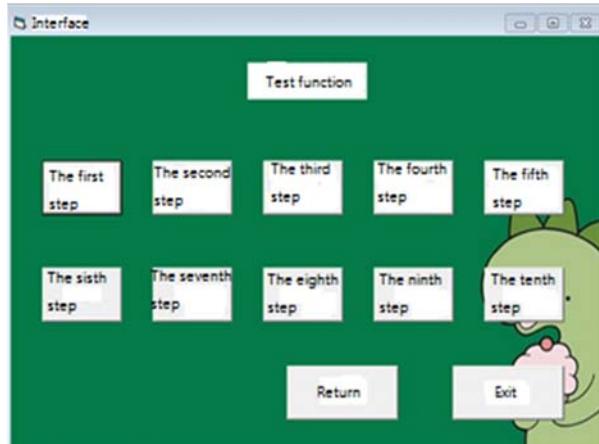


FIGURE V (B). ENTERING THE FIRST STEP

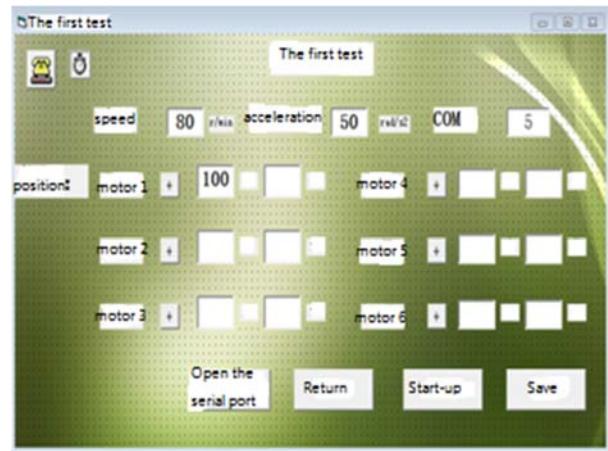


FIGURE V (C). STARTING THE FIRST STEPS SAVE DATA AFTER MOTION PARAMETERS



FIGURE V (D). ENTERING THE SECOND STEP

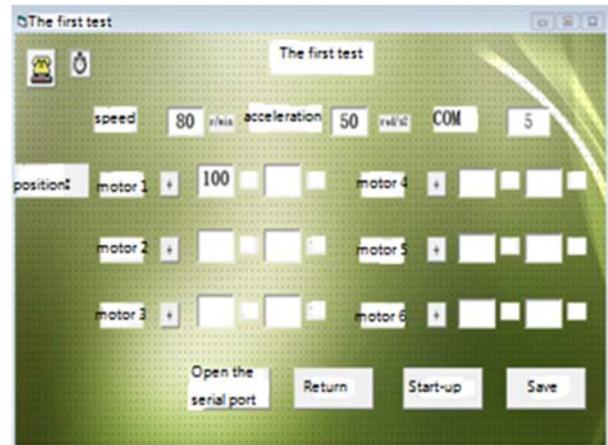


FIGURE V (E). STARTING THE SECOND STEPS AND SAVE DATA AFTER COMPARING ALL MOTION PARAMETERS

IV. SUMMARY

The design of multi degree of freedom manipulator is very typical, and other more complex and powerful operation processing system is also based on this area^[8]. After testing, it is found that the multi degree of freedom manipulator based on the

485 bus has stable performance and strong anti-interference ability, and the cost of development and production is relatively low. It can achieve good results in practical application, and can achieve the desired goal and have good promotion and utilization value.

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