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APPLICATION OF EMBEDDED SYSTEM IN CERAMIC MACHINERY AUTOMATION

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ABSTRACT

This paper introduces the basic conception of embedded system, ceramic machine cloth system work flow as well as in this system the use of hardware Wincon8000 series automatic controller and i8092F motion control module and software development using embedded Visual C++ platform. The design and implementation of system in the preservation and processing of motion control parameters and the users' information database module、user management module as well as the control of servo motor motion control module. These modules are used GUI as the operation interface, facilitate the enterprise general operators use. Due to the adoption of pulse train output drive servo unit, improve the anti-interference ability greatly, and also improves reliability at the same time. Using PAC as the automatic controller can greatly reduce the cost, and it is easy to expand, and also the ceramic production enterprises are of great significance.

Keywords: *Embedded System, Ceramic Machine Cloth System, Automatic Controller*

1. INTRODUCTION

In recent years, as users of the open architecture of strong demand and desire, and also the development of information technology and change rapidly, so that based on the PC technology development for many years the industry computer in the automatic control field to rise, it is foreseeable future with the development of the calculation technique, communication technology and software technology development will tend to use an open hardware platform、operating system and unified programming tool. One of the most key technology lies in the embedded PC system， support a variety of field bus I/O module，In line with the IEC-61131-3 standard programming software.[1]

At home and abroad are still commonly used PLC as the automatic control device now, but as a result of industrial product demand grow with each passing day and the International competition Aggravate, enterprises in reducing the cost of production to ensure product individuation and diversity trend, This represents a new generation of manufacturing and processing technology have more flexibility and efficiency. Computer application in industry can conform to the trend of development in the future. Therefore, a flexible and efficient manufacturing system under the mechanical and electrical integration usually requires operating system as a whole in order to deal with the huge information, including communications, display and mathematical calculations and data acquisition hardware and driver to achieve higher efficiency and as a peripheral interface and control the core data exchange and signal processing of the bridge.

Based on the above reasons, the system uses PAC (Programmable Automation Controllers) to replace the now widespread use of PLC. To sum up, PAC has the following advantages：

Using a single controller saves cost；

Database / network connection；

High information security；

A multiple speed deterministic application；

Easy to replace；

A real time operating system；

These reasons we choose PAC instead of PLC to realize the automatic control. A PAC system can be completely realized early on by several PLC and an IPC (Industrial PC) control system composed by. The system selects the Taiwan case science and technology production Wincon －8000 as the automatic controller to achieve the pottery machine of distribution system automation control.

This paper presents the design and Implementation on the pottery machine cloth system save and the processing of motion control parameters and the user information database module、user management module as well as the control of servo motor motion control module.

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2. EMBEDDED SYSTEMS[2, 3]

Embedded system is based on microprocessor as the core to embed in the other devices in the computer system. Application environment f the embedded system is the decision of the embedded system has some special properties.

Embedded computing technology challenges derived from basic technology swift and violent development and user requirement. In the design, the function of the system for general purpose computer system and embedded systems are very important, but with the universal desktop computer system design, the design of embedded systems has many special requirements, mainly manifested in the following aspects：

1. Real time. Most embedded systems need to work in real time mode. The system will cause error if the data or control information in a certain period of time can not reach. In some embedded system, real-time performance can not be met is not acceptable, over time will lead to life danger or harm, such as high speed train controller, control message timeout will cause the train fault even the dumper. In some other embedded system, over time not dangerous but can also cause some accidents，when the printer printing, if control information response the timeout, it will make the printer confusion.

2. Multiple rates. Most embedded systems are not only the requirement of real time, but also need to run multiple simultaneous real-time tasks, the system must also control the action, although these movements are slow, and some quick. Multimedia application system is a typical example of multi rate behavior, a multimedia data stream audio and video portion at a different speed playback, but they must be in sync.

3. Power waste. In general a desktop computer system, power is not a major consideration, but in the embedded system especially in the battery power in embedded system, this is one of the main factors to consider. The power consumption directly affects the hardware costs and the influence of power supply and heat dissipation problem of life.

4. Low cost. In most cases, embedded system that is low cost. Manufacturing cost is determined by many factors which contain the hardware cost and cost of software. The cost of the hardware is mainly determined by the use of a microprocessor 、the memory requirement and the corresponding peripheral chip ； Software costs are usually difficult to predict, but a good design method is helpful to reduce the cost of software.

5. Environmental correlation Embedded system is not independent, but with the other being closely related to embedded device. Therefore, when embedded system designs, we must consider the analog signal、digital signal as well as the switch signal input and output；System anti interference；Temperature；Humidity and so on.

3. HARDWARE AND SOFTWARE PLATFORM DEVELOPMENT ENVIRONMENT

This section describes system related to development of a variety of hardware as well as the software development platform. The hardware mainly comprises a ceramic manufacturing equipment and Wang Taiwan grid company production of embedded controller Wincon8000. Software development platform is embedded Visual C++(EVC).

3.1 Ceramic Machine Feeding System

Ceramic floor tiles production through the gravel 、Cloth、Suppress、Calcination、Polishing, the cloth system determines the ceramic floor tile pattern style and cloth system decides the products produced beautiful degree. Therefore, distributing process in ceramic production occupies a very important position. In the whole process, must ensure that cannot produce error otherwise it may result in equipment damage[4].

3.2 Wincon－8000 Automatic Controller

Wincon－8000 is the Taiwan case science and technology to create the most novel embedded controller, with traditional PLC (programmable logic controller) convenience and PC window ability, Wincon － 8000 by Windows CE.NET endowed with strong ability, and the window procedure design style into the personal computer PLC world. Application developers can in Microsoft Visual Studio.NET and embedded Visual C++ direct the development of automatic control application, and then will download to Wincon－8000 and execution it. In addition to the use of Microsoft official development toolsdevelopers can use third party tools.

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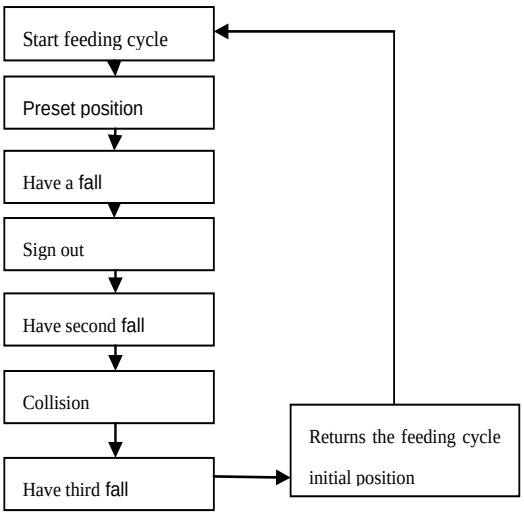

Figure 1 Cloth System Operation Process

Wincon－8000 combination with the industrial computer and PLC function, it provides the function of industrial computer like VGA、LAN、PS/2 Keyboard / mouse、USB、Compact Flash、Serial port and provides a variety of PLC functions such as data input and output、analog input output, counter, frequency measurement and motion control.

Wincon-8000 working voltage is DC 24V, the use of ARM as microprocessor, the frequency of 206MHZ, static random access memory (SRAM) size 64M, Flash Memory is 32M, erasable read-only memory (EEPROM) for 16K. There is an Ethernet interface, facilitate the enterprise future central control system, a VGA port can be directly connected with display, 2 PS/2 port are connected with the mouse and keyboard, 1 USB interfaces connected to the USB or USB mouse driver. Two serial ports are respectively RS232 and RS485. In addition to the seven slots are respectively inserted into the production of a variety of modular card case, including analog input and output, digital input and output, 2 or 4 axis motion control card and so on.

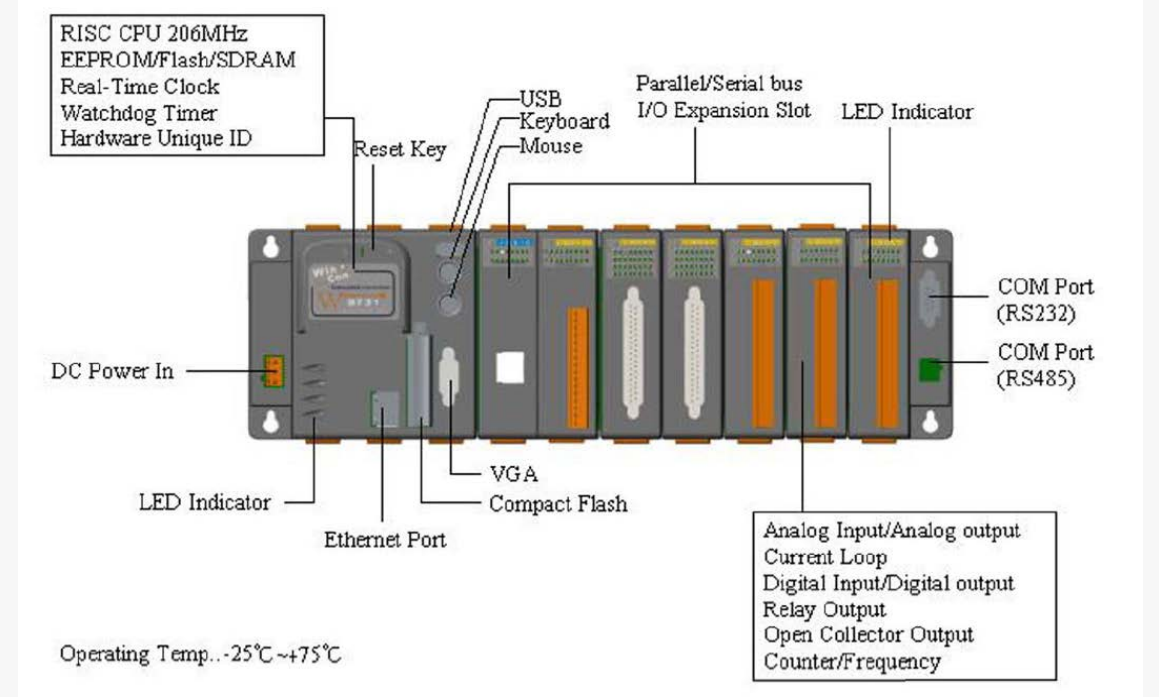

Figure 2 Wincon8000 System Architecture And Interface

3.3 EVC Development Environment

Due to Wincon8000 using Windows CE as the operating system, therefore the use of Microsoft EVC development environment is ripe. Following is a brief description of the EVC development environment.

EVC development environment for the standard Windows interface, a set of integrated window、tools、menus、toolbar and other components, it can build development, Test and debug Windows CE application program. As a result of the development of the environment and the VC have

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many similarities， the same part will no longer introduction. The following details with EVC remotes tools.[5]

This tool similar to Windows Explorer， to displays the WINCE on the target device and file directory hierarchy. Through the tool, can remove the WINCE object files，it can make a desktop computer files downloaded to WINCE target device, WINCE can also be the target device files uploaded to the desktop computer.

4 . SYSTEM SIMULATIONS

The pottery machine cloth system uses a large number of servo motor，and heavy machinery, if there is an accident; consequence is more serious, so the servo motor motion control becomes very important. This system is used in Wincon8000 and i8092/F stepper / servo motor motion control module through programming servo system. Servo system refers to the actuator in accordance with a control signal for action：a control signal before the arrival, the controlled object is stationary；after receiving the control signal, the controlled object according to the requirements of action；control signal disappears, the controlled object and can automatically stop.

I8092/F is a support of 2 axis stepper / servo motor motion control module, with the Wincon8000 use, i8092/F motion control module for general motion control applications, provides many motion control function, for example 2 axis linear interpolation, circular interpolation, T/S 2 axis acceleration curve, origin of sports. I8092/F in the implementation of the above-mentioned functions without requiring a Wincon system resource, CPU can monitor other execution state, because only consumes a small amount of system resources, so it can be inserted with a plurality of Wincon 8000 on i8092/F so as to achieve multi-axis control.

I8092/F can achieve 2 axis control, the use of pulse output signal, the maximum output pulse rate for 4M PPS (pulse per second), the precision is 1PPS～ 500PPS (precision from the maximum speed of decision), can achieve constant speed, symmetric / asymmetric linear acceleration, symmetric S type speed reducer, wherein, can use automatic or set. I8092/F encoder input can be selected for the A, B or Up/Down input pulse input, can choose 1, 2 and 4 times frequency divide. I8092/F also provides a limit position input signal, in response to each axis has two limit positions, respectively is limit and negative limit can select high level trigger, and touch the limit position of the deceleration stop and emergency stop. In addition i8092/F receiving servo motor other input signals such as warning, servo in place, servo ready.

I8092/F to connect to the Wincon, turn off the power first, and then insert the i8092/F into the Wincon empty slot, and the connection and DN-8237 connection terminal board.

Introduce DN-8237 connection terminal board. DN-8237 designed for i8092/F and servo motor connection is used, figure 3 shows the DN-8237 location map.

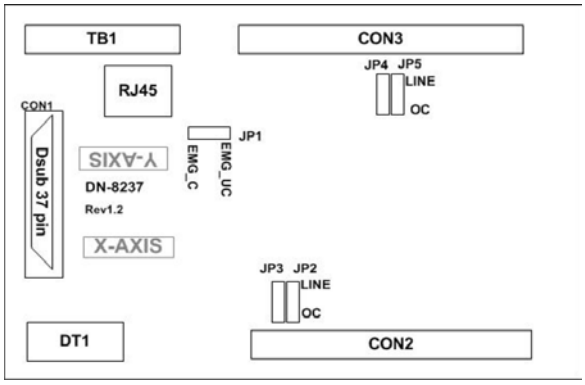

Figure 3: DN8237 Location Map

Table 1 DT1 Signal Connections

Pin name	Description
EXT_PWR	extended power 24 V
EXT_GND	expansion of power supply grounding
N/A	no definition
FGND	terminal board ground

When you click the "Manual Update" button, will appear as shown in Figure 4-14 dialog. The dialog box to not use i8092F input is instead of using external input manual movement. In the stage of installation and debugging, the use of hand motion will be very useful, because in the stage of installation and debugging, and can ensure the system normal movement, thus requiring the use of manual low pulse slow motion control system, to see if the system is working properly, if an error occurs, and necessary, will not cause serious consequences. In manual module can test hardware limit position, the software limit position、origin、near the origin、servo ready、and servo alarm and so on. These functional tests are achieved manually, when the closed or open a switch shaft, corresponding iconwill be, it shows that the function is normal. In normal use before first manual debugging, later in the use process can

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reduce the possibility of errors; the industrial production is very meaningful. Button "Servo on All" will start the X and Y axes, button "Servo off All" will stop the X axis and Y axis.

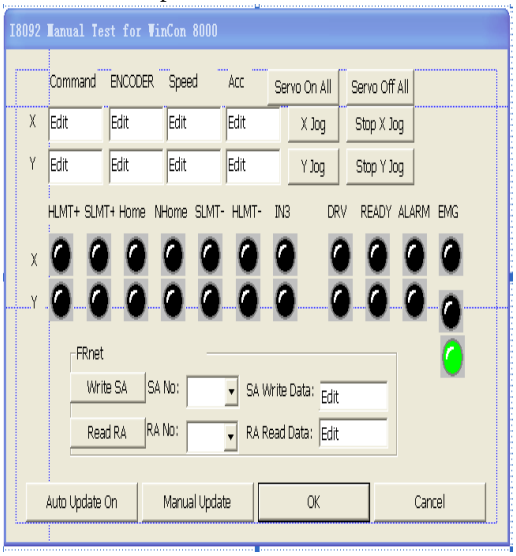

Figure 4: "Manual Update" dialog box

When you click the "Motion Test", figure 4 dialog box will appear.

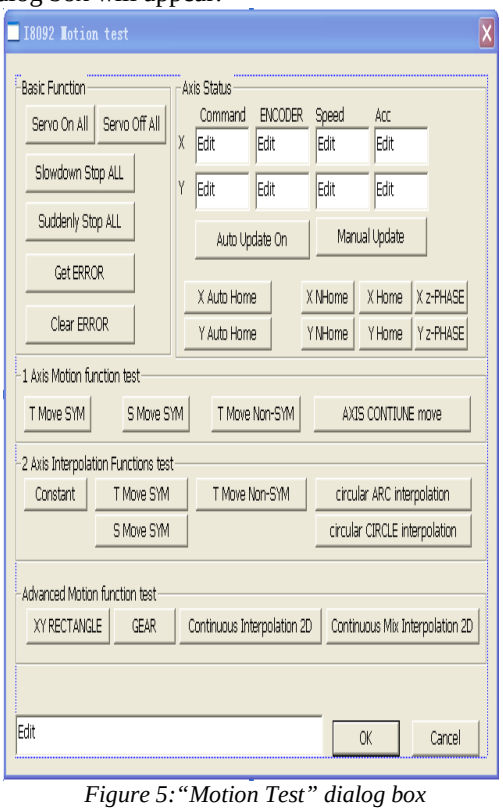

Figure 5:"Motion Test" dialog box

In this dialog box, "Basic Function" within the region of the button set servo is started or not as well as the X and Y axis stop mode. In "Axis Status" area can observe the output to a servo motor pulse number、motor speed、acceleration memory servo motor with encoder feedback, the following button to put the X and Y axes for recent origin、the origin and the Z signal input. In the "1 Axis Motion Function Test area" can set the single axis motion, are symmetric T curve、the symmetric S curve、asymmetric T curve and continuous motion curve. In "2 Axis Interpolation Functions test" can set the two-axis interpolation motion. In "Advanced Motion function test" area can set the advanced motion mode, including the two rectangular interpolation、a multistage continuous interpolations and so on.[5]

Through the above procedure setting as well as the servo encoder settings, are able to perform various control servo motor in order to achieve the required by the various functions. At this point, completes the control of servo motor operation.

5. CONCLUSION

With the rapid development of the embedded system, embedded system in industry control field are widely used. PAC industrial controller will PLC and PC function together, is a powerful control ability and significant cost savings, use PAC to replace now frequently used PLC realize industrial automation and control to the enterprise has great significance.

Through the industrial automatic control equipment are studied in detail and the corresponding development, the results obtained are as follows:

Complete the hardware selection. The choice of hardware mainly includes automatic controller、servo motor、various terminals and so on.

Database user module development and movement control module development. This is the focus of this paper, mainly related to a variety of industrial control devices and related software content.

Electrical schematic draws. To complete the entire design and electrical principle diagram drawing in order to complete the entire system design.

The system has a good scalability, with the development of enterprise information system, the improvement of the degree of network; the use of the system can be very convenient for the expansion of functions and centralized control for enterprises to lay a good foundation.

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