

# The Remote Motor Control System Based on the Embed Web Server

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**Abstract**—In order to expedite the development of the control network, according to the newest fruition of the internet, the hardware and software of the system is designed. The test flat roof is set up of the remote control system. The control order of motor is sended by the client, and the running state of motor is feedbacked by the internet. The practice prove , the scheme realize the remote control of the motor by the small cost . And the system is convenient and safe. The definite reference value is offered to the offspring complex remote control system.

**Keywords**- remote control; embed Web server; CGI

## 1. Introduction

In recent years, information network develop rapidly but the development of the control of network compared is slow a lot. Compared with the information network, the control network's structure is more complex, it need to cross more filed. At the same time, control network requires a network with more security and fewer delays. The specificity of control network makes it far behind the development of the information network[1]-[2].

With the increasing scale of control systems in the field of industrial control, communications become increasingly popular, the traditional centralized control systems have been unable to meet the requirements, industrial control system began to development in distributed, asynchronous control mode[3]. For the status of the plant more and more geographically dispersed, to achieve the status of each production line monitoring and remote software downloads and equipment diagnosis and maintenance there are certain difficulties, there is an urgent need to control the systems and networks combined to achieve different regions of the resource sharing and coordination of operations[4]. At the same time an increasing number of measurement and control equipment with a serial communication ports, or network interface, which provides the interface preparering for measuring and control system of the network. With the development and expansion of information networks, relying on information networks to facilitate the control of the remote control will be the new trend of developments in the field[5].

In order to speed up the pace of control network development, so that the formation development of the control networks to fully learn the latest achievements of information networks, this article draws on the latest achievements in information networks, in brushless DC motor for the controlled object, study the control network and information network interface technology, to achieve control over the network seamlessly, completed a motor network control, breaking the traditional control method of space limitations, reasonable and efficient use of network resources to meet the needs of industrial decentralization so that the information network directly embedded control networks, simplifying the development process control network to accelerate the pace of development of the control network.

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## 2. The Control System Overall Scheme

Shown in Figure 1, the remote control system consists of on-site embedded WEB server module, the brushless DC motor control module based on the DPS, remote client module and the network module.

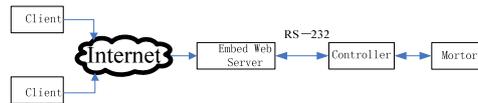


Fig.1 Control System Chart

Remote client through the WEB browser, log on the remote control page, this is just to provide an interactive page. Embedded Web server is the core of network control to achieve complete control of the remote client side and the local control information interactive features. On the one hand, through the RS232 bus to establish a connection with the local control terminal pass a command from the remote client to local controller. On the other hand, it does this by networking with the client connection, the local control devices the operational status of brushless DC motor transmitted to the remote client to the client on the local device monitoring,. Control side is that the controlled object, it is mainly a command to accept remote client to complete the closed-loop control of brushless DC motor, and feedback the motor's state of run to the remote client.

### 2.1. Remote Client Module

Remote client provide to the user an intuitive remote control of brushless DC motor interface through web , its main function is to complete the communication with the web server to provide a friendly and intuitive interface to user. Completion of user registration and login interface. Set of working parameters controlled object interface. The completion of the local data packet loss of processing algorithms. Brushless DC motor receives from the scene of the operating parameters, and dynamically displayed on web pages.

### 2.2. Network Module

Control network module corresponds to a series of physical network card, network lines and routers, which is used to connect remote clients and local servers. As a data channel, it does not do any processing of data, only to achieve the client and server-side connection and to ensure the smooth flow of access and security. It allows remote users to access the database within the competence of its operation, and interact with the on-site monitoring software to achieve real-time transmission of data.

### 2.3. The on-site embedded web server Module

The embedded web server module is the center of the whole system. It complete the remote user and the brushless DC motor control information between the interaction of the transit function. On the one hand, it is established and the connection between the remote client, which will send the motor running parameters in real-time transmission to remote clients. At the same time it will receive from the remote client information of all kinds, including the registration of remote client authentication information and remote clients motor control system parameter settings. On the other hand, through the RS232 bus, the establishment and control system for brushless DC connections will come from the remote client to set parameters passed to the next-bit machines, and receive real-time from the next-bit machine status information. At the same time, the part used to implement a time-event-based control algorithm, in order to address the impact of delay on the system. Second, it achieved HTTP protocol conversion and encapsulation of the database maintenance, to complete a user registration, login, authentication management, and record the motor control operation of the system log.

### 2.4. Brushless DC Motor Control Module

This module is charged with the entire system and the ultimate object of study. DSP is the core of the control system, through the R2136 driver to complete the brushless DC motor speed and position closed-loop control. The entire system has a powerful fault detection and protection features, and can exchange upper server's data and information through the RS232 interface.

## 3. Hardware System

Brushless DC motor controller's control core is DSP. Six road, pulse-width modulation channels for PWM wave output, driving the main power circuit, three-way capture the channel. on the one hand it is used to capture the location of the state brushless DC motor, control motor operation. The other for the speed of calculation, speed the completion of the closed-loop operation. Serial communication port completes the upper and lower-bit machine information exchange, remote client through the internet to control information sent to the embedded web server, and then down through the serial-bit machine to send commands to achieve the control of the motor, while the next crew to motor real-time operational status through the serial port back to the remote client in order to monitor the motor running. In addition. The control system is also designed to power-surge protection, overvoltage, undervoltage and some basic over-current protection circuit.

### 3.1. Drive Circuit Design

After separation from the DSP came out 6-channel PWM wave signal and can not be directly sent to the main power circuit drive motor, it must be larger. The role of the driver circuit is to output pulse amplification to power a power transistor, or MOSFET. IR2136 is a voltage applied to the mother is not higher than 600V circuit in the power MOS gate devices, which may be the largest positive peak output drive current of 250mA, while the reverse peak drive current of 500mA. IR2136 has the over-current, over voltage, under voltage, logic identification protection, as well as the blockade and instructions such as protection areas, the internal bootstrap technique to make it available for high-pressure system, and the input signal and is compatible with TTL and COMS level. Drive circuit inductance, the general location of the capacitor as close to the IR2136, the size of bootstrap capacitor 10 times. R20, R25, R28, R19, R24, R29 in order to avoid being driven by the power MOSFET drain-source voltage between electrodes of the oscillation, thus avoiding therefore caused by RF interference and MOSFET subjected to high du/dt caused by the breakdown damage. R21, R26, R30, R22, R27, R31 is the same bridge arm in order to avoid rotation of the two MOSFET turn-on, the instantaneous short-circuit current caused by two MOSFET sets the voltage between the emitter oscillation. EN termination PC817 isolation, when the DSP to a low , EN-side enable, IRZ136 then be able to work properly. DSP issued by the 6-channel PWM wave through the internal circuitry IR2136 RP, amplified output, driving the main power circuit.

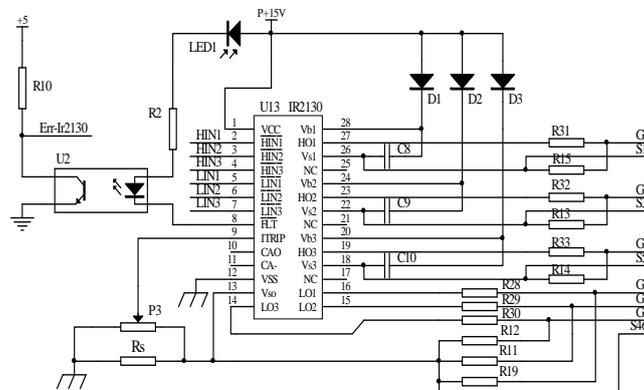


Fig.2. Driven circuit

### 3.2. Main Power Circuit Design

The system's main power circuit using three-phase full-controlled circuit. In this circuit, the motor for the Y-connected three-phase windings. V1 ~ V6 MOSFET, the switch from the role of windings, which are N-channel MOSFET, high conduction time. Their methods can be divided into 22 power conduction mode and 33 two kinds of conduction mode, the system conduction mode using 22 intervals of 1/6 cycle for phase one, each time a commutation power tube, each power transistor conduction angle of 120° electrical. In this way, whenever the motor is running 360° electrical angle, the stator there are six kinds of magnetic potential state, each difference 60° electrical angle, was leaps and bounds, non-continuous state.

## 4. Software system implementation

### 4.1. The overall framework of the software

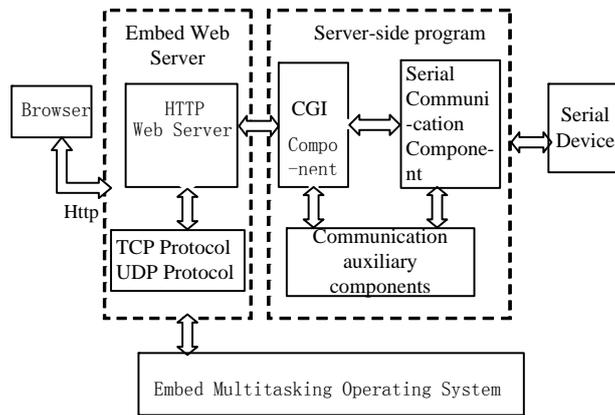


Fig.3. Total frame software.

Remote client through the WEB browser to log in remotely control the page, and send control commands, the embedded web server, by receiving control instructions and processes the data passed to the local controller after the brushless DC motor, the motor can also be embedded motion parameters Web server returns control page. Embedded WEB server, which work in the "serial channel mode", that is, all serial port to the data are automatically encapsulated as a TCP or UDP packets in the IP network transmission; the same token, to receive from the net mouth to the TCP or UDP packets will also be automatically unpacked out of the data and byte by byte sent to the serial port. Embedded Server in the system will automatically load when you start an embedded multi-tasking operating system, and a set of streamlined Web server. Web Server will be listening over the HTTP client sends the request, and its assigned to a server-side process to handle, the process is that the CGI program, which is responsible for receiving Web requests data, and serial communication for data processing, and processing results in a dynamic page in the form returned to the client. Software design, component-based thinking, the general framework shown in Figure 3.

The main body of the message is a series of serial port control commands to control the motor state, also contains a number of feedback messages, such as ACK and other communications. The general format of the message serial interface design such as shown in Table 1. STX and ETX were the message start tag and end tag; sub machine ID of the control commands on behalf of the receiving object; KEYWORD said the news categories, such as COMMAND, DATA, ACK, etc.; LENGTH said the length of the message body; MESSAGE as the message body, including the control commands sent to the controller and the controller returns the data; BCC checksum for the message used to verify the correctness of the message.

TABLE.1 SERIAL COMMUNICATION MESSAGE FORMAT

STX	ID	KEYWORD	LENGTH	MESSAGE	ETX
1 byte	2byte	1 byte	2byte	variable	1 byte

#### 4.2. CGI Component Design

CGI or Common Gateway Interface is a simple and efficient approach to web requests, which can handle multiple concurrent requests, support for Perl, C and many other development languages, and can be cross-platform[6]. CGI component is mainly responsible for processing the request and response, but will interact with the equipment, the work assigned to deal with serial communication component. There are 2 ways to submit requests, Get and Post methods means a request for the same, if presented in different ways, can also be assigned to different components of the CGI processing. Embedded WEB server, Lantronix-based CGI development of the CoBox Programmers Kit (abbreviated as CPK) API, using C language to development tools, the CGI component to C functions realized in the form[7]. Prototype:

```
int fonctionname( WCT *w, char *file, char *hdr );
```

Which w as a Web communications structure, including the Socket handle this connection, input buffer and output buffer pointers and other information, is used to control request data receiving and responding to data transmission; file as a CGI request, the name; hdr for the request head, you can reap the packet length, and Cookie and other information. Well CGI component development, you need to register at the Web server, the function name to associate with a CGI, so that when a user requests the URL, the server will automatically assigned to the function processing.

### 4.3. Serial Communication Component Design

In the CGI components are often required, and serial communication, extract motor control equipment operating status or actions, which need to develop a series of serial communication component. Serial specified in the message for the various control commands, respectively, the corresponding function designed to achieve an order to send and return data reception, and define the appropriate structure to save received data. To check equipment status command, for example, the function prototype is:

```
char gettxinfo (txReplay * r);
```

Where r is pointing device status information structure pointer. Taking into account the Web side there will be a multi-user concurrent requests, while the equipment side there is only one serial port, are bound to resource contention case, so the introduction of serial components of resource locking mechanism to control it.

### 4.4. Software system security mechanisms

Because HTTP is a stateless protocol, the server can not automatically determine whether the two requests issued by the same user, so users login, or a subsequent request can not be automatically recognized status. Traditional Web servers have adopted a mechanism to maintain Session state information, but in the embedded Web server, subject to resource constraints, generally do not support the Session, the user needs to customize the way to achieve the state to maintain. Session mechanism to achieve depends on the Cookie. Cookie is a server-side generated a short text, in response to customer requests, was appended to the response header sent to the client by the browser auto-maintenance; When a client requests the server again, the resources will be automatically attached to the Cookie At the same time to send in the request header, so that the server can determine the user's identity based Cookie[8].

RFC defined two kinds of Cookie header: Set-Cookie header for the server to the client to write Cookie, Cookie header for the client to the server upload Cookie. When the user first log on the server, activate the login CGI components for authentication, if validated, it is generated that contains the user identity information, Cookie string attached through the Set-cookie response header sent to the client; each subsequent times when the arrival of client requests, just from the Cookie request header to validate user identity can be determined, in order to provide the basis for access control support.

CGI design based on Cookie authentication and access control process for when users log on to extract the user name, write the role of Cookie, while extracting the network address of the host login, encryption, written after the Cookie. Each subsequent request processing, are first extracted Cookie in the user information, if there is to re-log; if it exists, respectively, and the Cookie request header to extract the network address information, the former encryption, and then compared with the latter, verification, if the line, and then extract the user roles from the Cookie information permissions validation.

## 5. Conclusion

Control equipment to use more traditional means of communication with the host computer serial port connection, it is difficult to achieve remote control. Introducing an embedded web server as a gateway to connect serial devices and networks to achieve the minimum cost can be web-based remote control. In the paper, brushless DC motor of the network control system, respectively, completed the upper and lower bit machine hardware and software design, has set up a remote test platform, and conduct the experiment. The client through the network to send control commands to the motor, while the motor is running the state through the network back to the client. Experimental results show the feasibility of a network remote control, remote control of the follow-up study of the complex has a certain reference value.

## 6. References

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