Design of EIB-Bus Intelligent Control System Based on Touch Screen Control

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Abstract: Based on the EIB-Bus bus, the hardware design and function implementation of intelligent lighting control system is realized. In the hardware design, the lighting control during the whole process is achieved by using Schneider’s EIB-Bus intelligent control device as the main control part. In the software design, the control of object setting in the group is completed by using Schneider’s EIB-Bus programming software ETS2. And finally, the multiple dimming, switch and scene parameter settings and information display are completed by using touch screen programming software to achieve the ultimate purposes of control the hotel lights with the touch screen.

1. Overview
With the development of automatic control technology, the touch screen as interactive input device is becoming more and more popular in the lighting control system. Touch screen has the advantage of quick response speed, space-saving, easy communication and so on. It gives a new brand-look to the lighting control system and it is an attractive new interactive device [1][2].
Infrared sensor and smart panel as input device has limited functions in the scene of EIB-bus intelligent lighting control system, and it can’t edit more complex scenarios. The touch screen is used as the input device, and various instructions are issued to complete different operations. It has the characteristic of simple operation and fashion which is the best choice to meet the needs of users. And it has applied families, hotel and other fields to meet the distinct light requirements in psychological and physiological of different people in various occasions. The goal of saving energy is also achieved [3][4][5].

2. Hardware design of intelligent lighting control system
2.1. Principle of the system
All digital, modular, distributed bus-based EIB control system will dispersing control functions to various functional modules[6][7]. And the central processor and the functional modules communicate directly through the network bus. The network structure is: all EIB devices are connected to the network by a pair of communication signal lines (twisted pair). Each unit device (except power supply) has a built-in microprocessor and storage unit, and each was set a unique address by ETS2 software. It is realized to control each load circuit through the output unit and establish correspondence between the group address and the output unit by the input unit. When there is input, the input element converts it to EIB signal which is then broadcasted on the system bus. And all the output elements receive it...
and make judgments, control the corresponding output loop.

In this design, the address of output relays and dimmers was set through EIB software, multi-channel lighting scene was set by programming software on the touch screen. The operator can switch the scene mode of the light by the soft key on the touch screen according to the illumination requirement. Lighting scenes can be preset elaborately according to different time and usage, which achieve the purpose of producing novel visual effects on people and saving electricity. EIB intelligent lighting control system is shown in Figure 1.

![Figure 1. EIB intelligent lighting control system schematic diagram](image)

### 2.2. Hardware selection

The system hardware selection includes three categories. The first category is system unit a part containing power supply module, logic module and bridge module, the main function is to provide control power and system clock to EIB system. The second category is input unit parts containing intelligent control panel, touch screen, infrared detector and dry contact receiving module, which is used to trigger control and convert the external control signal to EIB signal propagating on the bus. The last category is output module parts containing relay, dimmer, analog output module and DMX signal output module, which is used to receive signals on the bus, directly control signals, and control the corresponding loop output to achieve load control.

According to the control requirements of the comprehensive EIB system, the key configurations, which realize the intelligent control of given region, is shown in table 1.

| The serial number | The name                                      | The model          |
|-------------------|-----------------------------------------------|--------------------|
| 1                 | 640mA power supplier (Emergency power supply) | MTN683890          |
| 2                 | KNX Logic module                              | MTN676090          |
| 3                 | 10 inch IP touch screen                       | MTN683090          |
| 4                 | 8way 10A switch actuator module               | MTN649208          |
| 5                 | Multiple 4 way 250W universal dimming module  | MTN649325          |

Model MTN683090 touch screen have those properties: settings of scene, dimming, switch, delay, timing, multi-function graphical interface and control page; password protection; remote control; background light control adjustment; clock and date display; system self-diagnosis; Ultra-light; EIB bus power supply and so on. With the optional display software, users can write touch-screen programs that can be controlled in a visually and interactive way.

### 2.3. Hardware design

In the intelligent lighting control loop, a total of 11 dimming circuits are designed, among which 3 circuits have power above 3 kW, 6 circuits above 1 kW, and the remaining two circuits have power
below 1 kW. Comprehensive consideration of cost, engineering construction and other factors, three EIB output components 4 road 250 W universal dimming modules for controlling are selected. The remaining 6 road switches are controlled by 8 roads 10 A switch control module numbered MTN649208. EIB intelligent lighting control system is shown in Figure 2.

Figure 2. Intelligent lighting C-bus control system structure schematic diagram

What are needed to pay attention are as follows: dimmer minimum resistive load 30 W; minimum inductive load 50 VA; minimum capacitive load 50 VA. The bus current consumption of dimmer is 5 mA, and the relay is 10 mA. So try to choose multiple power modules. The EIB line is the smallest unit in the EIB system, each one can accommodate up to 64 EIB devices. The total length of each line is no more than 1000 meters. And there is no more than 700 meters between each two devices.

When EIB-bus dimmer circuit configuring the module, we should pay attention to load type and dimming mode of the dimming circuit. The module should have a margin. The power of the circuit needs to be given a certain power factor.

3. Intelligent lighting control system software design

3.1. Software design
The design uses Schneider Electric MTN683090-type touch screen to control the lighting. The operator manually touches the screen and passes this as input to the CPU of the touch screen. MTN683090 touch screen can realize the control functions of light switch, dimming, time setting and user preset [3]. Touch screen programming software has many functions, including self-diagnostic tools, multi-functional graphical interface design, the main screen and multi-level sub-screen design. Design
cycle of intelligent lighting control software is shown in figure 3.

3.2. Touch screen design
The system is designed for six basic scenarios: Daily mode (Day), Daily mode (Night), Sweep mode, Welcome mode (Day), Welcome mode (Night), and Full mode. Functional design is shown in Figure 4.

The regional control design is mainly focused on centralized control and energy saving. Different
daytime and night-time scene selection makes light control easy and convenient, and the regional lights can be controlled individually which give the control to the users completely.

There are switch and dimming function in the design of optional control, which sets the dimming control for the chandelier and the spotlights, and sets the switch control respectively for the lamp band and LED spotlights. Some of the same type of lighting centralized management and control make users have their own autonomy control much more.

After designing the scene interface, it is set the specific scene state in the touch screen programming software, where the scene name and scene can be adjusted according to the need, including the brightness percentage of dimming, scene state and so on.

4. Conclusion

The hardware and software design of the intelligent lighting control system is achieved by using Schneider EIB-Bus bus. The group settings of control object are completed by combining EIB-Bus control module with ETS2 software, and the touch-screen control program editing is completed by using touch-screen programming software. This design has applied to the lighting control of a government agency building. The design of the intelligent lighting control system mainly achieves two purposes: one is improving the control and management level of the lighting control system to reduce the maintenance cost, another one is saving energy and reducing the operation of the lighting control system cost.

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