A New Control System of Point Light Source

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Abstract. The spotlight source control system includes a single control mode spotlight source control system. A single controller controls 32 points through video signal to differential control to achieve single point control ,and arbitrarily sets the white balance of a certain point through the menu; The main and auxiliary machine online mode spotlight source control system, the controller and controller are connected by DMX signals, which can realize 1000 controller cascades (that is, a total of 32,000 points of cascade control can be realized), The system comes with a variety of effect modes, you can freely change the effect mode, connection mode and so on. The system has a wide range of applications in the landscaping of urban night scenes.

1. Introduction

With the acceleration of urban construction in China, in order to improve the overall image of the city, beautify the urban environment, and implement design lighting and lighting projects for urban buildings and public space, various decorative spotlight sources are needed. In addition, with the improvement of people's living standards, the development of cultural performances, in the stage lighting decoration, also requires a variety of special stage lighting, the need for various types of spotlight source[1], thus, the spotlight source system developed in this paper. There is a broad market application prospect.

Compared with the traditional method, it is only suitable for large-scale multi-point control. It has a high resolution pixel-based engineering scheme and has to be completed video signals or image display[2-3]. No matter the size of the construction project, the whole system needs to be completed before the performance can be performed. The cost is often quite expensive. For each different engineering construction layout, it is necessary to edit the special-shaped processor program to achieve superior playback performance, and additional power supply is required for every 48 points, and the construction wiring is also required[4-5].

This paper compared to traditional methods and has the following features and innovations.

i. The DVI signal is used between the new controller and the point source to control the color and brightness of the LED point source. The power and signal required for the point source is directly provided by the new controller;

ii. The DMX512 signal is used between the controller and the controller to transmit the performance data;

iii. Can be performed in a single machine (32 spotlight sources);

iv. performance, up to 1000 groups (32,000 spotlight sources);

v. The general DMX512 console can be used to perform point programming on the point source via a different controller.

The composition of the spotlight source control system, the working principle of the system, the system test results are detailed in the paper, and the conclusion is drawn.

2. Control system of spotlight source

Main and auxiliary machine online mode: The DMX signal is connected between the controller and the controller, which can realize 1000 controller cascades (that is, a total of 32,000 points of cascade control can be realized). The system has multiple effect modes. Freely change the effect mode, connection mode, etc. The main and auxiliary machine online mode block diagram is shown in Figure.1.

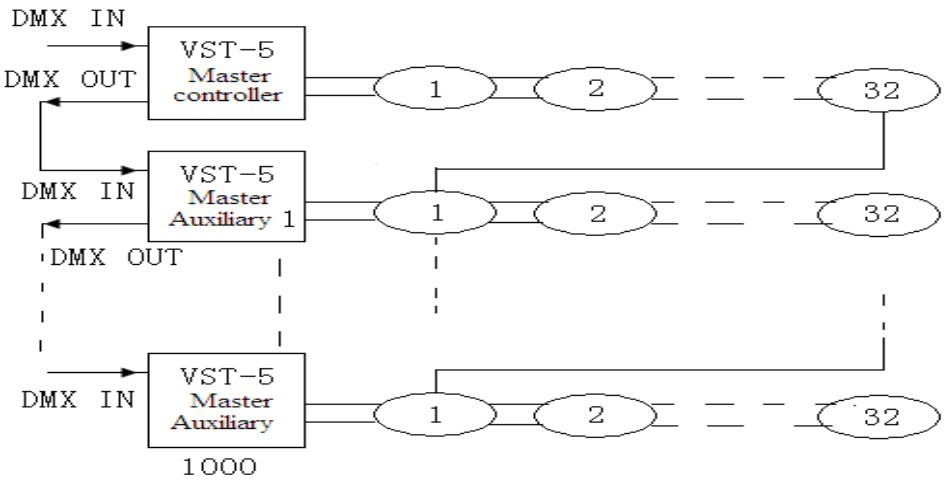

Figure.1. Block diagram of main and secondary machine online mode

3. Principle of the system works

3.1. Control mode

The control mode adopts the DMX512 protocol, and the DMX512 protocol applies a point-to-multipoint master-slave communication protocol. The interconnection form adopts a multi-point bus structure. This structure does not have the problem of information path blocking, and the connection is simple and highly reliable. Each data packet consists of several data frames, each of which includes a 1-bit low start bit, 8 data bits, and 2 high-level stop bits. The DMX protocol requires a baud rate of 250 kbPs for data transmission, that is, a transmission time of 4 us per bit, and a transmission time of 44 us per frame. It supports up to 512 frames of data transmission, and each frame of data is associated with a corresponding control branch. correspond. Packets are transmitted in accordance with certain format and timing requirements. The data format of the DMX512 signal is divided into the following parts, as shown in Figure.2.

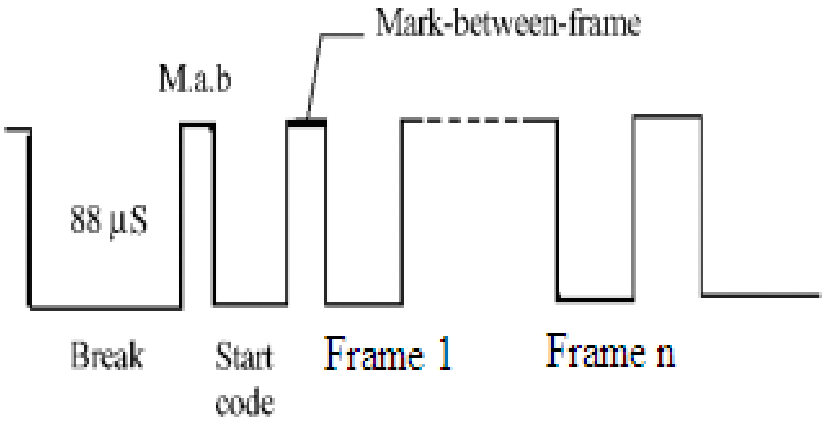

Figure.2. Packet format of DMX512

The DMX512 system consists of four parts: the main controller that sends the data, the cable that transmits the data, the slave controller that accepts the data, and the terminal matcher. The master controller issues a packet that satisfies the DMX512 timing, and the slave accepts data in this address range based on the local address. The connection cable of the DMX512 system must conform to the EIA485 specification. It is fully braided twisted or twisted wire and shielded with metal foil. The voltage drop is small. The terminal matcher must be installed on the last slave of the system, that is, a matching resistor with the same impedance as the transmission line is connected to the end of the bus to absorb the reflected wave and prevent signal distortion caused by the reflected wave.

3.2. Display system module

The 32-point display system module consists of a serial-change register 74HC595, a non-inverting logic gate driver chip SN7407, a triode S9013, a pull-up resistor and an LED connected to the microcontroller. The module is simple in structure, the components are common devices in the classic circuit, the product is easy to form modular, the performance is relatively stable, and the overall function of the display module is guaranteed. The display system structure is shown in Figure.3.

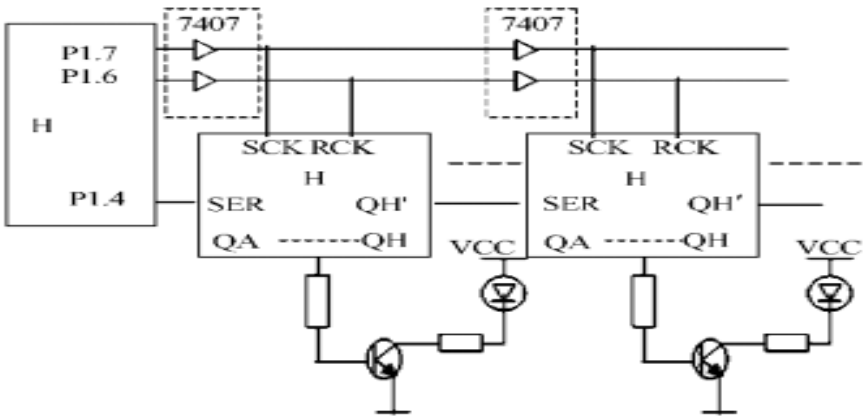

Figure.3. Structure diagram of display system

The controller receives the received data from the serial output to the cascaded serial-to-serial data latch 74HC595, and the LED driver is driven by the latch. The driver drives the RGB tri-color lamp at each pixel of the LED color screen to obtain the expected Display. It should be noted that the SCK and RCK terminals of the 74HC595 are respectively connected in parallel with the P1. 7 and P1. 6 of the MCU, and each MCU should control dozens or more of the 74HC595, in order to ensure that there are enough SCK and RCK ends. To sink the current, the same direction driver SN7407 must be installed after every N 74HC595 according to the actual situation. It is known from the principle of LED

illumination that LED is a current control component, and its luminance is proportional to the average current passing through the LED chip. By controlling the LED current value, the brightness of the LED lamp can be controlled. The system uses a pulse modulation (PWM) method to control the duty cycle of the LED on and off by software to achieve brightness control.

3.3. Process of system data communication

The DMX512 communication protocol is used to write the host computer and the lower computer data communication program, and the lower computer display program flow is shown in Figure.4.

The on-line debugging can complete the communication between the master and the slave well, and ensure the display of the display, but the displayed display is hopping and unstable. In order to obtain a stable, soft and gradual lighting effect, the design of the current duty ratio is adopted in the programming of the lower-level single-chip microcomputer, and the RGB color of each pixel of the point source is divided into 16 levels of depth, that is, each time The information of each RGB color of each pixel obtained by the host computer is four bits. After receiving the RGB information, the lower computer rewrites the number of pulses sent to each RGB driver, thereby outputting to the driver. In the 16th pulse, the number of RGB pulses of each pixel is different, and the number is determined by four bits of information, as long as the 16 sets of pulse information issued are within a time (about 40 us) that the naked eye can perceive. After that, what you see is a color mixing effect. Each pixel has RGB depth of 16 levels, so each pixel point can get 4096 color changes.

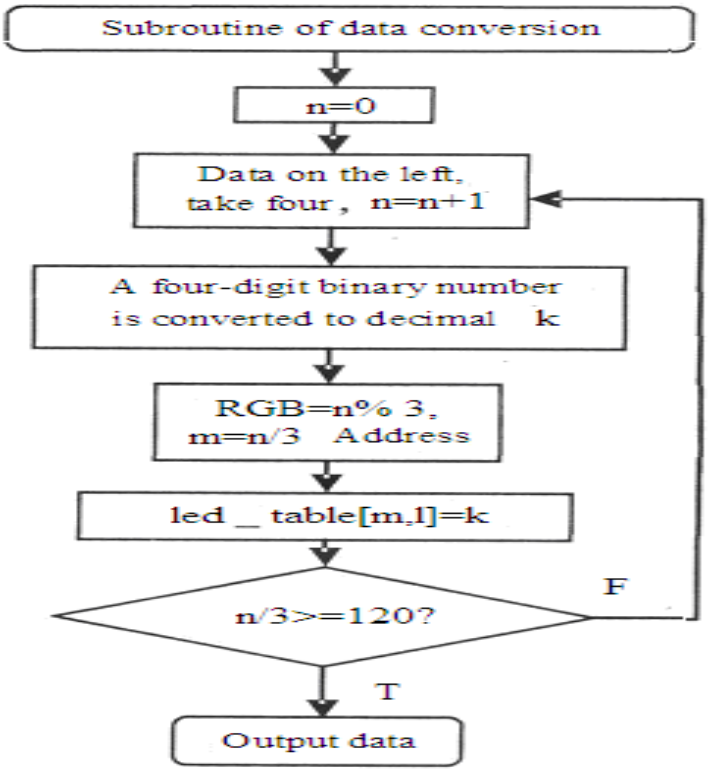

Figure.4. Display subroutine block diagram of lower computer

4. System testing

Functional testing of the point source system developed in the paper results in the following:

i. The menu operation can be changed by the LCD display panel, setting the address code, channel mode, selection performance mode, performance speed, and performance direction.

ii. The controller can control 32 spotlight sources through the video signal to differential control, which can realize single point control, and arbitrarily set the white balance of a certain point through the menu.

iii. Stand-alone performance mode allows you to perform performance on 32 point sources using the built-in program.

iv. The main and auxiliary online performance mode means that the controller and the controller are connected by DMX signals, and 1000 controllers can be connected in series (a total of 32000 spotlight sources are connected in series), and a variety of performance modes are built in the controller. Freely set the connection mode and select the built-in performance effect.

v. DMX512 console's signal control performance mode can be programmed with the standard standard DMX512 console or DMX512 software (using computer software to convert DMX512 signals through the interface box). There are three channel modes to choose from:

Mode 1, RGB_D channel mode, (32 points sync control color and dimming)

Mode 2, 96 channel mode, (32 point single point RGB control)

Mode 3, 4-channel mode, (32 point run mode)

vi. Support VD-T, CA-T automatically set address code

vii. Support XLR interface online upgrade built-in program (a remote DMX online upgrade program lighting and its control system)

5. Conclusion

The spotlight source control system developed in this paper is especially suitable for lighting projects without high resolution, such as outdoor building buildings, exterior wall contours, glass curtains, bridges, lighting projects for urban objects, and the spacing of light spots can be practical. The demand changes, can be arranged with the construction appearance, flexible space and variability, the user can achieve the most economical solution to achieve the effect of urban lighting project.

6. Acknowledgments

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