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The Wireless Remote Dimming Control for Chandelier Bulbs

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***Abstract*—*The motivation of this paper is to use HT-12D and HT-12E encoder and decoder ICs for wireless remote dimming of the chandelier, which can remotely control the working status of the chandelier. In addition to controlling a particular light (or all lights) in the chandelier to be turned on or off, it can also make the bulbs of the chandelier light up in a sequential cycle to produce a change effect. If the chandelier is replaced with colored bulbs, it can be used with remote control to create a stage effect to improve the convenience and versatility of use.*

Keywords*—*Wireless remote control, binary encoder and decoder ICs, adjustment of light, chandelier

I. INTRODUCTION

With the progress of the times, infrared transmission technology is now widely used in life, and should be used in various situations in our lives, such as: TV, audio, security systems, etc. However, with the advent of computerization and networking, we want to make a more effective integration of transmission technology and computer applications. So we have tried to integrate these functions in this paper.

Most of the commercially available remote controllers are divided into two types: infrared and radio remote control. Infrared remote control has space limitations, which are generally applicable to the control of home appliances. The radio is used over a longer distance and without directionality, and has a wider range of applications, such as anti-theft security applications [1-4].

In life, we often use multiple remote control systems, but often can not be integrated, resulting in the use of the trouble. Therefore, we want to use a remote control to control multiple power sources, and even use the computer to control the switch, so that it can make life more convenient, and more effective control of home appliances and monitoring. Only then will we not waste too many resources, and we will have more resources to use.

Chandelier bulb change effect has 9 kinds of changes: 1. When SW1 is pressed 1~5 times, it can control individual light bulbs. 2. When SW1 is pressed 6 times, all light bulbs will be lit. 3. When SW1 is pressed 7 times, even light bulbs will be lit. 4. When SW2 is pressed, all the above changes of the light bulb will be interrupted and stopped immediately.

II. SYSTEM ACTION FLOWCHART

The system action flow chart is shown in Figure 1. We press the control switch, the system starts to encode, and then the transmitter module sends the signal command across the space. The receiver circuit uses a 315MHz frequency receiver module, and the HT-12E is the Encoder IC. Pin1~pin8 are connected to DIP switch, finger switch to set the password. When the transmitter module and receiver module have the same password setting, the transmitting and receiving operation can be performed. The HT-12D is a decoder IC, and its Pin10~Pin13 are the control signal output pins, which generate different actions with the signal at the transmitting end. The signal command is then sent to the control circuit, so that the system can output the lamp to light up or extinguish according to the signal command.

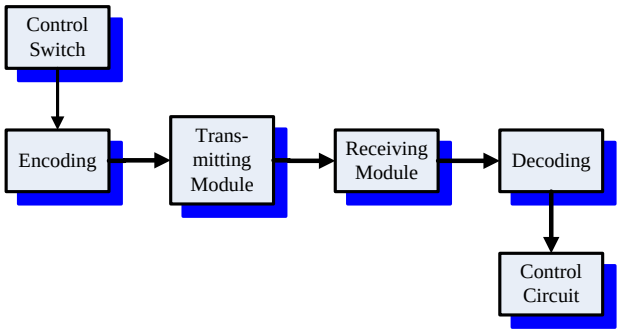

Fig. 1. The system action flow chart.

III. MAIN COMPONENTS DESCRIPTION

Among the HT-12 series codec ICs, we will explain the HT-12D and HT-12E in the followings. 1.HT-12D and HT-12E apply CMOS technology, which has the advantages of power saving and anti-noise. 2. The operating voltage is between 2V~12V. 3. The IC contains an oscillating circuit, and only one additional resistor is needed to provide the operating frequency. The transmitting circuit is shown in Figure 2. The receiving circuit is shown in Figure 3.

A. Transmitting Module

Figure 4 is a schematic diagram of a transmitter module, using a transmitter module with a frequency of 315MHz. HT-12E is an encoding IC, its Pin1~Pin8 are connected to DIP switch, adjust JUMP to set the password. When the transmitter module and receiver module have the same password setting, the transmitting and receiving operation can be performed. The HT-12D is a decoder IC, and its Pin10~Pin13 are the control signal input pins, which receive external ON/OFF signal..

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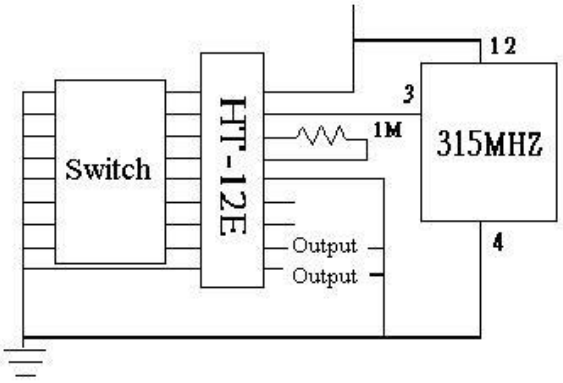

Fig. 2. The transmitting circuit.

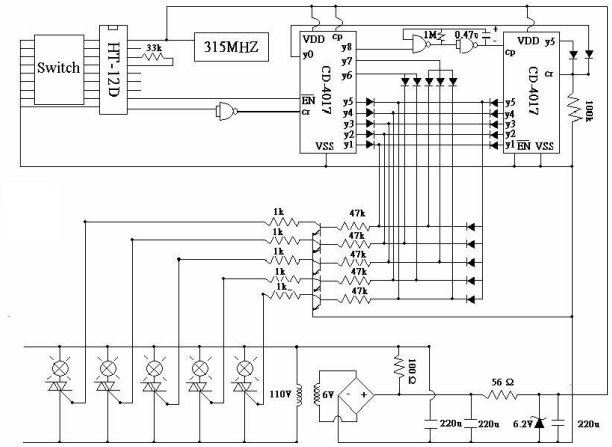

Fig. 3. The receiving circuit.

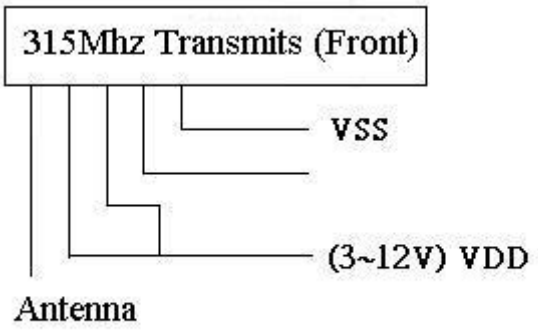

Fig. 4. A schematic diagram of a transmitter module.

B. Receiver Module

Figure 5 is a schematic diagram of a receiver module, using a receiver module with a frequency of 315MHz. HT-12E is an encoding IC, its Pin1~Pin8 are connected to DIP switch, adjust JUMP to set the password. When the transmitter module and receiver module have the same password setting, the transmitting and receiving operation can be performed. The HT-12D is a decoder IC, and its Pin10~Pin13 are the control signal output pins. Different actions are generated with the signal at the transmitter, such as high and low potential.

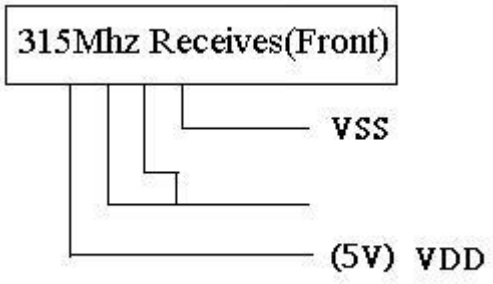

Fig. 5. A schematic diagram of a receiver module.

C. HT-12E Encoder IC

The pin description of the coding IC, as shown in Figure 6, is the pin diagram of the HT-12E. A0~A7 is the bit setting of the password. There are 256 different combinations in total. D0~D3 are data input bits. DATA OUT is the data sending end. HT-12E is an IC that can transmit infrared rays with bit coding, and can be controlled by the 122TE pin for bi-level transmission. The bits of A0~A7 can be used as address function, pin10~pin13 can be used as serial transmission, and the oscillation frequency of HT-12E can be adjusted with RC.

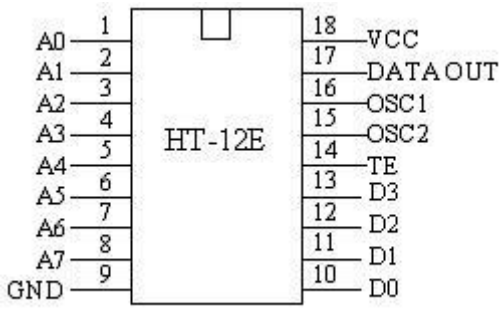

Fig. 6. HT-12E encoder IC pin diagram.

D. HT-12D Decoder IC

The pin description of the decoding IC, as shown in Figure 7, is the pin diagram of the HT-12D. A0~A7 is the bit setting of the password, there are 256 different combinations in total. D0~D3 are the data output bits. DATA IN is the data receiving end. When HT-12D and HT-12E are used together, use 8 sets of DIP switches to set the passwords required for A0~A7. When the two passwords are the same, the 4-bit metadata sent by the HT-12E will appear on the D0~D3 pins of the HT-12D. This article is to install 4 button switches (Pin10~Pin13) on the HT-12E, and control the pins (Pin10~Pin13) of the HT-12D through the wireless transceiver module to present a high/low potential signal. With other application circuits, the wireless remote control function can be achieved. We use this decoding IC with HT-12E, that is, the first 8 bits of data transmission are used for decoding of address transmission, and the last 4 bits are used for decoding of data transmission. Moreover, the DATA BIT uses the parallel digital signal as the OUTPUT, so that the signal can be transmitted to the next level of circuitry.

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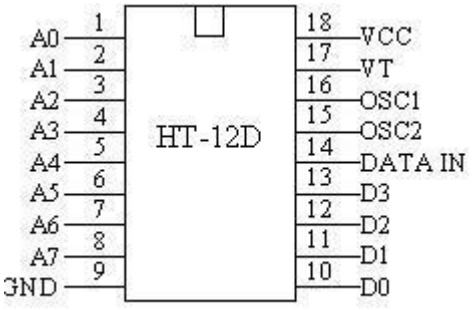

Fig. 7. HT-12D decoder IC pin diagram.

E. Advantages of Codec ICs

The advantages of the HT-12D are as follows: 1. Allowed operating voltage is 2.4 volts to 12 volts, with the coding level can be configured with different high and low levels. 2. CMOS technology is used to eliminate noise. 3. 12-bit data transmission can be decoded. 4. It can do three times confirmation of the received signal.

The advantages of the HT-12E are as follows. 1. Allowable operating voltages of 2.4 volts to 12 volts, which can generate different emission frequencies for different VCCs. 2. CMOS technology is used to eliminate noise. 3. When supplying 5 volts, it can generate a stable current of about 0.1uA. 4. The HT-12E is capable of transmitting 4 bits of data in series at a certain frequency.

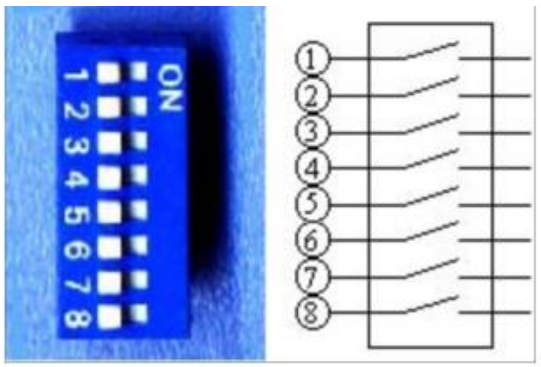

Fig. 8. DIP switch.

F. DIP Switch

The principle is to integrate the switch into one, by adjusting the JUMP switch to set the password. This paper uses 8 sets of switches, as shown in Figure 8, the combination of codes up to $2^8 = 256$. With this password setting feature, we can use one transmitter to multiple receivers, or multiple transmitters to one receiver, increasing the range of applications.

IV. Initial Production of the Transmitter Circuit

Fig. 9 shows the test photo of transmitting circuit, Fig. 10 shows the test of receiving circuit, Fig. 11 shows the PC board of transmitting circuit, and Fig. 12 shows the transformer.

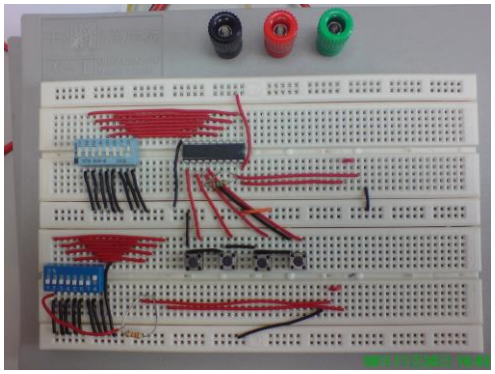

Fig. 9. Transmitter circuit test.

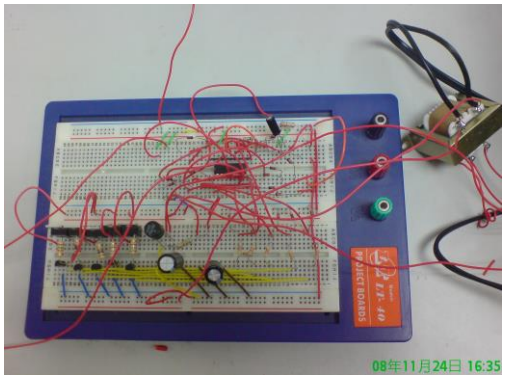

Fig. 10. The test of receiving circuit.

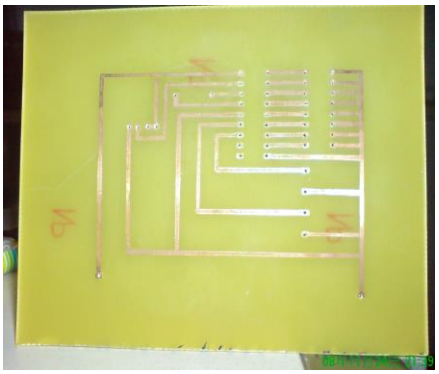

Fig. 11. The PC board of transmitting circuit.

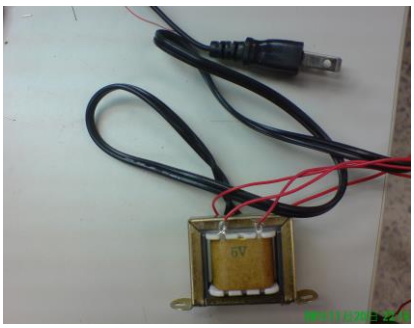

Fig. 12. Transformer 110V / 6V (AC).

V. Complete the Assembly of Receiving and Transmitting Circuits

Figure 13 shows the transmitting circuit board, Figure 14 shows the receiving circuit board, Figure 15 shows the

transformer and receiving circuit combination, and Figures 16 and 17 show the finished product.

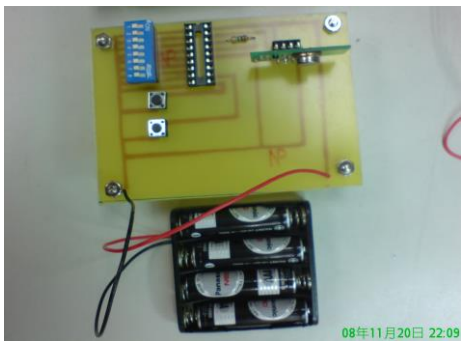

Fig. 13. The transmitting circuit board.

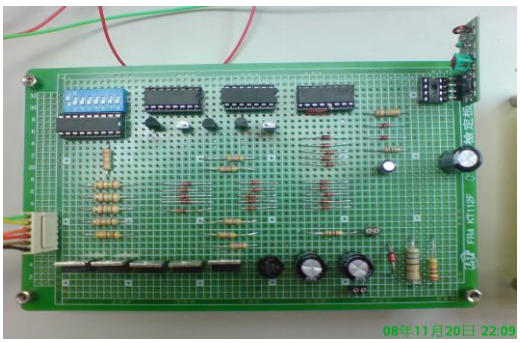

Fig. 14. The receiving circuit board.

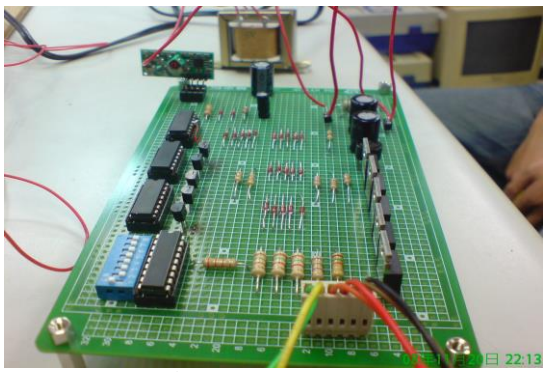
Fig. 15. The transformer and receiving circuit combination.

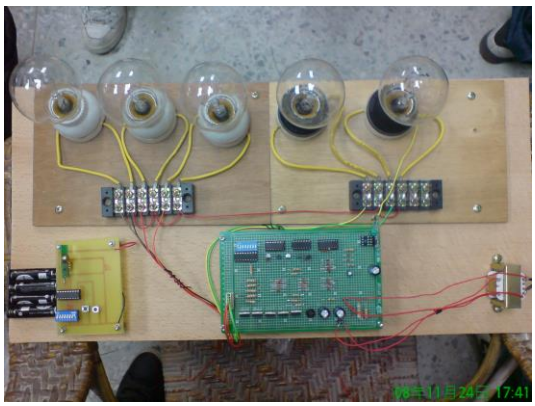
Fig. 16. The finished product.

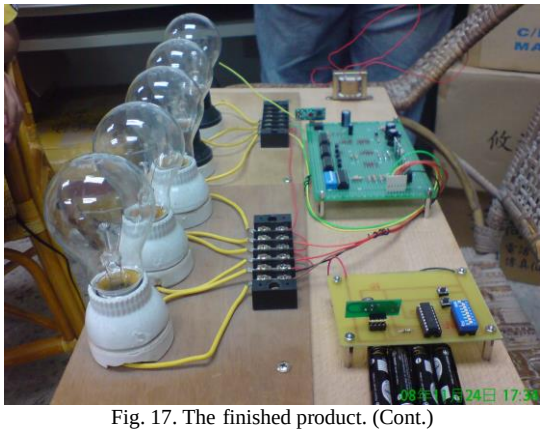
Fig. 17. The finished product. (Cont.)

VI. Conclusion and Future Research Development

This paper can achieve the purpose of wireless remote dimming control for chandelier bulbs. The future research development is described as follows.

1. Because the wireless remote control is directionless, the wireless remote control chandelier is more convenient than the traditional chandelier and infrared remote control in use.
2. Break through the traditional chandelier less variability, through the wireless remote control can produce a gorgeous variety of light changes.
3. If needed, this circuit can increase the number of light cannons and light change state.
4. In terms of light bulbs, we can use high brightness LEDs to achieve power saving and extend the service life.
5. Most of the commercially available remote controllers are divided into two types: infrared and radio remote control. Infrared remote control has limited space and is generally used for home appliances control, while radio has a longer distance and no directionality, and has a wider range of applications, such as burglary security.

Acknowledgment

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