Design of the Lamp Wireless Household Control System

BIQING LI, ZHAO LI, WENYA LAI, YANGMING CHEN, HUILIANG HUANG, HUANHUA HUANG, SHAOHONG HUANG, YANKUI ZHAO and LIUREN WEI

ABSTRACT

With the development of wireless communication technology, the demand for lighting is increasing by people in daily life. The design consists of STC89C52 microcontroller, NRF24L01 wireless RF module, ADC0809 analog to digital conversion module button, LCD1602 display components. The design control by the microcontroller chip STC89C52, then use two wireless modules were set NRF24L01 transmitter module and receiver module, the system through the data forwarding the data to the monitoring center control lighting, completion of sending and receiving signals. The system realizes the light switch control, and can be adjusted according to the brightness of the surrounding environment, while intelligent lighting settings set time period. This design has a modern, energy-saving, comfort advantages of wireless communication technology knowledge and research has important significance.

KEYWORDS
NRF24L01; STC89C52; LCD1602; wireless control.

DESIGN REQUIREMENT AND SELECTION OF SCHEME

Functional requirements

(1) The system can realize intelligent timing control of ON/OFF of lamp.
(2) The system can control switch and brightness of lamp
(3) The design can switch between normal mode and flashing mode.

Selection of schemes

SCHEME OF MAIN CONTROL CHIP

The scheme takes STC89C52 SCM as master core control device, which teems with utility functions, consumes less and has good stability. It does not only have basic functions of 51 SCM, but also has the most significant characteristics of bearing 2K memorizer, thereby providing adequate space for program to run thereon.
SCHEME OF WIRELESS COMMUNICATION MODULE

The scheme adopts NRF24L01 wireless RF module. The NRF24L01 chip does not only have very low power consumption and high sensitivity of data transfer, but also can work stably, hence it is widely applied to fabricating many electronic products, with far transmission range, relatively low price and simple and convenient operation.

HARDWARE CIRCUIT

System principle

The wireless home lighting control system is an important part of smart wireless home lighting system. The design is a wireless sensing network based on NRF24L01 wireless module, and is divided into emitting module and receiving module. Each module is mainly composed of a STC89C52 chip and 1 NRF24L01 wireless module to use STC89C52 SCM as control chip to independently control the network. Via controlling keying commands, it wirelessly controls switch of lamps, automatically regulates brightness of light sensed, switches between normal mode and flashing mode, controls ON/OFF of lamps within set period, and emits and receives signals.

Main sub-circuit

CLOCK CIRCUIT OF SCM

The application scope of clock circuit is rather extensive, including all electronic devices usually used. Crystal oscillator is connected to SCM's pins XTAL1 and XTAL2 and externally connected to CY1 and CY2 whose capacitance is 30pF to constitute a parallel resonant circuit, which is connected in the amplification feedback loop to form clock circuit of SCM [2]. The circuit diagram of SCM clock is as shown in figure 1.

![Figure 1. Circuit diagram of SCM clock.](image)
RESET CIRCUIT

The reset circuit offers reset function to STC89C52 SCM by providing reset low-level signal for RST pin of SCM when key SW-PB is pressed. The connection way of circuit is as shown in figure 2:

Display module

LCD1602 LCD is a dot-array type LCD module which is able to display letters and characters, etc. The picture of real object is as shown in figure 3:

Simple and convenient in programming, 1602 LCD consumes less power, has flexible configuration and simple interface with SCM, characterized by advantages of high stability, clear display, convenience and practicality, etc., hence its extensive application in SCM application system. The content of LCD1602 liquid crystal module is 16X2, i.e. on the display have altogether two lines of data displayed, and each line can display 16 characters maximally.

DS1302 clock circuit

The setting of ON time of LED can be controlled via clock circuit, which uses DS1302 chip. In the designed circuit, DS1302 and STC89C52 SCM can communicate with each other simply by the synchronous serial form, and the way of connecting SCM port is very simple with multiple signals and data able to be transmitted in one time.

NRF24L01 wireless module

The schematic diagram of NRF24L01 is as shown in figure 10. The wireless module herein includes signal emitting module and signal receiving module. They all take NRF24L01 chip which has functions of emitting and receiving as central device. NRF24L01 chip is a widely applied chip, with many modules fabricated with it available in the market. Besides, related electronic products, such as wireless mouse and toys, etc. can be seen in everyday life.

Figure 2. Reset circuit.
Above is the internal functional block diagram of NRF24L01 chip. The marks therein are some main pins of NRF24L01 chip and multiple functional modules in the chip. Wherein SIP functional block is provided with six control pins, through which, SIP cannot only select output power channels, but also can set related protocol. Other SCMs extract the data received by NRF24L01 chip just by pins of SIP functional block.

**ADC0832 A/D module**

The design adopts wireless transmission module to transmit information. The data signal to be transmitted needs to be subjected to A/D conversion to realize reading of
information, so the A/D modular converter is needed to enable this function. The figure below shows circuit of A/D modular converter.

RESULT AND ANALYSIS

First, the copperplate is printed and eroded according to circuit schematic drawing and PCB drawing. Before eroding, the copper wire shall be inspected for breakage, gaps or blur. Then welding is finished. After hardware welding, first it is needed to generally inspect the welding effect to timely find out whether there is rosin joint or breakage. If yes, patch welding shall be conducted timely. What follows is to download the written program into SCM. According to the requirements, the design shall be able to control switch and brightness of lamp, smartly control ON/OFF of lamp within set period, and switch between normal mode and recreation mode, i.e. the flashing function. Then the commissioning can be seriously done by connecting power to inspect whether each function can be enabled as designed.

SUMMARY

The paper is about the design of wireless home lighting control system to control switch of home light fittings, which is provided with LED1602 display to display perpetual calendar and keys that can regulate time. The design mainly uses NRF24L01 wireless RF module to emit and receive signal and constitutes a simple wireless home lighting control system together with SCM minimum system.

This work is supported the following fund:
2017 The student work subject program of Hezhou University: “college students' network addiction of the student work service research” (No, hzxysz201707).
2016 The higher education research subject project of Hezhou University: “between collaborative innovation researches of entrepreneurial talent cultivation system”.
2017 college students' innovative entrepreneurial project: “The agricultural robot autonomous operations research based on machine vision”(No,201711838096) &&”Multi-functional autonomous agriculture robot development”(No,201711838121) &&”Research and development of navigation system for agricultural robot”(No, 201711838008) & &”Research and development of data acquisition system and servo control system for mobile platform of agricultural robot” (No, 201711838075) &&”Research and development of visual navigation system for agricultural robot test platform”(No, 201711838076).
2017 Guangxi education science 'ten-three-five' planning project: “Based on zte's ICT education platform of fusion, work-integrated learning education training mode research” (No, 2017B107).

ACKNOWLEDGEMENTS

Corresponding Author: Wenya Lai, janliful@163.com, School of Information and Communication Engineering, Hezhou University, Hezhou Guangxi 542899, China;
REFERENCES

1. B.Q LI, Y.F LING, H.Y ZHANG, and S.Y ZHENG. The Design and Realization of Cherry Tomato Harvesting Robot Based on IOT. International Journal of Online Engineering, 12(12), 23, (2016).

2. B.Q LI, W.I GUAN, S.Y Zheng, X.G Yue. OPTIMISATION DESIGN OF CORN PRECISION SEEDER BASED ON MULTI-ROUTE AND MULTI-CHANNEL CONTROL. JOURNAL OF THE BALKAN TRIBOLOGICAL ASSOCIATION, 21(4A), 1215, (2015).

3. S.Y Zheng, et al. Social Work in Teen Addiction Correction Services Research under the New Situation, in: PROCEEDINGS OF THE 2015 4TH NATIONAL CONFERENCE ON ELECTRICAL, ELECTRONICS AND COMPUTER ENGINEERING (NCEECE 2015), Xian, China, 2015, PP.252-255.

4. B.Q Li, et al. Intelligent Control Management System and Its Application, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON ECONOMICS AND MANAGEMENT INNOVATIONS, Wuhan, China, 2016, PP.68-71.

5. B.Q Li, et al. Design and Implementation of Tanks War Game Based on the Android Platform, in: PROCEEDINGS OF THE 2016 2ND WROKSHOP ON ADVANCED RESEARCH AND TECHNOLOGY IN INDUSTRY APPLICATIONS, Dalian, China, 2016, PP.963-966.

6. B.Q Li, et al. Design of a Tea Garden Ant Freezing Control System, in: PROCEEDINGS OF THE 2016 6TH INTERNATIONAL CONFERENCE ON MACHINERY, MATERIALS, ENVIRONMENT, BIOTECHNOLOGY AND COMPUTER (MMEBC), Tianjin, China, 2016, PP.736-738.

7. B.Q Li, et al. Design of Electronic Compass, in: PROCEEDINGS OF THE 2016 6TH INTERNATIONAL CONFERENCE ON MACHINERY, MATERIALS, ENVIRONMENT, BIOTECHNOLOGY AND COMPUTER (MMEBC), Tianjin, China, 2016, PP.1240-1243.

8. B.Q Li, et al. Research of Automatically Light-Adjusting Lamp, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON COMPUTER ENGINEERING, INFORMATION SCIENCE & APPLICATION TECHNOLOGY (ICCIA 2016), Guilin, China, 2016, PP.249-252.

9. B.Q Li, et al. The Design and Realization of Fruit Harvesting Robot Based on IOT, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON COMPUTER ENGINEERING, INFORMATION SCIENCE & APPLICATION TECHNOLOGY (ICCIA 2016), Guilin, China, 2016, PP.261-264.

10. B.Q Li, et al. A New Type of Automatic Opening and Closing Light-Operated Curtain, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON MECHATRONICS ENGINEERING AND INFORMATION TECHNOLOGY (ICMEIT), Xian, China, 2016, PP.66-69.

11. B.Q Li, et al. Design of the Intelligent Air Humidifier, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON MECHATRONICS ENGINEERING AND INFORMATION TECHNOLOGY (ICMEIT), Xian, China, 2016, PP.201-203.

12. B.Q Li, et al. The Design Implementation of the APP of Experiencing Guangxi Folk Custom, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON ECONOMICS AND MANAGEMENT INNOVATIONS, Wuhan, China, 2016, PP.47-50.

13. S.Y Zheng, et al. Digital Display Design of Ethnic Clothing of Nanling, in: PROCEEDINGS OF THE 4TH INTERNATIONAL CONFERENCE ON MECHATRONICS, MATERIALS, CHEMISTRY AND COMPUTER ENGINEERING 2015 (ICMMCCE 2015), Xian, China, 2015, PP.2805-2808.

14. S.Y Zheng, et al. Design and Implementation of Supermarket Personnel Management System Based on Java, in: PROCEEDINGS OF THE 2015 INTERNATIONAL CONFERENCE ON EDUCATION, MANAGEMENT AND COMPUTING TECHNOLOGY, Tianjin, China, 2015, PP.1724-1727.

15. S.Y Zheng, et al. Analysis of Internet of Things Talent Training and Curriculum System Innovation, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON EDUCATION, MANAGEMENT AND COMPUTING TECHNOLOGY (ICEMCT-16), Hangzhou, China, 2016, PP.957-960.

16. S.Y Zheng, et al. Brief analysis on “He Yuan Tong” Campus Mobile Phone APP Design, in: PROCEEDINGS OF THE 2015 5TH INTERNATIONAL CONFERENCE ON COMPUTER SCIENCES AND AUTOMATION ENGINEERING, Sanya, China, 2015, PP.151-154.