



Intelligent Curtain System Based on 51 Microcontroller

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Abstract: In the 21st century, China's overall appearance has undergone a radical change, and people's demand for quality of life level is getting higher and higher. In view of this situation, this project designs an intelligent curtain based on 51 microcontroller control, which is opened remotely by the user, and the corresponding functions are accomplished by collecting environmental data through photosensitive materials and temperature sensors and transmitting the data to the microcontroller for the operation of the motor. The system realizes four modes of light control, temperature control, manual and remote control, and upholds the concept of green, convenient and stable when creating, in order to bring the maximum degree of safety, convenience and comfort to the user experience.

Keywords: 51 microcontroller, intelligent curtains, light and temperature integrated control, motor

1. Background

With the continuous development of science and technology in the new era, the Internet of Things, a strategic product of life as if it were a sprout bursting out, and its emergence breaks people's consistent perception of technology, but also makes people realize that the era of technological home has quietly come. Facing a large number of consumers, in the smart speaker, smart door locks are widely popularized, the curtain industry is also undergoing transformation and upgrading from electric curtains to smart curtains. The curtains to STC89C52 microcontroller control as the core of the operation, infrared remote control for people to operate the way, in the induction aspect of the use of photosensitive components and temperature sensors to feel the intensity of different light as well as the transformation of different environments. According to the design requirements, when the surrounding light is dark, the intelligent curtains automatically open, when the surrounding light is bright, the intelligent curtains automatically close, that is, the light control mode. At the same time, users can also manually control the lifting and lowering of curtains according to their own needs and make special adjustments according to special circumstances. The product adheres to the concept of green, comfortable, convenient, safe and environmentally friendly, which is compatible with people's lives and greatly improves home comfort and humanization. At the same time the promotion and application of intelligent curtains also has an important practical significance, one is to change people's way of life, the convenience of a single-chip computer as the core of the control makes the family environment become warm and comfortable, only a remote control can be manipulated and detected throughout the house curtains, to a large extent, to change the people's traditional way of life and improve the quality of the standard of living. The second is to move a large number of industries, with the continuous progress of modern society, people's work pressure continues to become greater, the quality of life requirements have also become higher, and intelligent curtains are oriented to the quality of life of the user, so its prospects are undoubtedly broad, and will attract a large number of visionary investors and various types of real estate focus of the focus of the fine decoration. Under the trend of home integration and networking, home integration will become the trend. In all kinds of related talents under the vitality injection, more and more professional, beautiful, intelligent home integration products will also appear one after another. This paper combs through the design of smart curtains and the overall program to achieve the function, aims to comprehensively present the product form of this smart curtains and the future development pattern[1].

2. Overview at home and abroad

In Europe and the United States and other developed countries, smart curtains have been widely used. About ten years ago, the corresponding intelligent system has been introduced into our country, but has not been vigorously promoted. With the two years of the country's continuous attention to electronic technology and vigorously develop, smart home system slowly began to appear in people's field of vision, in the market also gradually have a competitive edge. It is understood that the world has up to more than 170 patents related to smart curtains, but its internal core technology is still similar. Despite the initial influx of this technology into the Chinese market, but many of China's powerful business giants have been involved in the industry, began to promote smart curtains, such as Qingdao Haier, Tsinghua Tongfang, TCL, etc., and emerged a num-

ber of representative enterprises such as the Shanghai Sobo Intelligent Electronics Company Limited, Beijing Jiuzhou Ease of Living Science and Technology Company Limited, Tianjin Ruilang Intelligent Home Electronic Technology Company Limited, Shenzhen Zhenxingtec Technology Co. Ltd. According to statistics, the annual new market demand for intelligent curtains is not less than 20 million sets, the annual output value of curtains controlled by microcontroller as the core has reached hundreds of millions of dollars. At the same time, in the next 20 years, intelligent curtains will be accepted and used by most people, whether it is a first-tier city of high-grade neighborhoods or ordinary countryside will see the figure of intelligent curtains, so its prospects are undoubtedly very broad.

3. System overall program

The curtains use STC89C52 controller as the core component to realize the core control of the intelligent curtains, and control its connection to the various modules, including the clock module using DS1302 clock chip, which has a trickle of fine current charging ability, high power, low power consumption, can be on the year, month, day, hour, minute, second timekeeping, and the signals received by the transmission to the LCD1602 LCD module to display, light acquisition and temperature acquisition module respectively, the light acquisition and temperature acquisition module. The light acquisition and temperature acquisition modules use photoresistors, ADC0832 digital-to-analog converter and DS18B20 temperature converter respectively[2].

4. System design introduction

4.1 STC89C52 microcontroller

The STC89C52 is a low-power, high-performance 51-core CMOS 8-bit microcontroller that uses the MCS-51 core as well as a general-purpose 8-bit central processor and an 8kFlash memory unit that is easy to use and very inexpensive. It has the following features: 8k bytes of Flash memory, 512 bytes of RAM, 32-bit I/O port, three 16-bit timers/counters, four outside interrupts, and a full-duplex serial port. The STC89C52 also supports two software-selectable power-saving modes. In idle mode, the CPU stops working, allowing the RAM timers/counters, serial port, and interrupts to continue. In power-down protection mode, the RAM contents are saved, the oscillator is frozen, and all work on the one-piece machine stops until the next interrupt or hardware reset. The system pinout is shown in Figure 1.

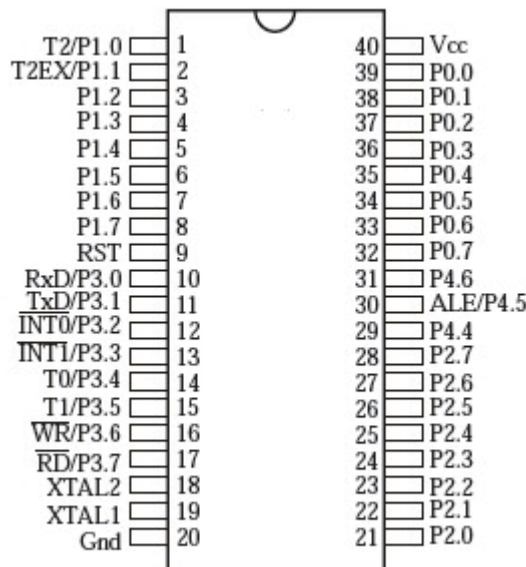


Figure 1. STC89C52 Pinouts

(1) Main power supply pins VCC and Gnd STC89C52

The power supply VCC is connected to 5V, and Gnd is connected to ground, the common reference ground.

(2) Clock circuit pins XTAL1 and XTAL2

An inverting amplifier is set up inside the chip, XTAL1 is the input of the amplifier, XTAL2 is the output of the amplifier. When using the self-excited oscillation mode, XTAL1 and XTAL2 are connected to an external quartz crystal, and the

internal oscillator oscillates at the frequency of the crystal to generate a clock signal.

(3) Control signal input

a. RST: reset terminal, high level active, the width of 24 clock cycles above the width, so that the microcontroller reset

b. INT0: external interrupt 0 input

INT1: external interrupt 1 input

c. RXD: Serial port input Figure 2 STC98C52 pin diagram

TXD: Serial port output

d. T0: External input of timer/timer 0

T1: External input of Timer/Timer1

e. WR: Off-chip data memory write-select signal output

RD: Off-chip data memory read-select output

f. Parallel I/O port P0~P3 pins

① P0 port (P0.0~P0.7) 8-bit drain-switch type bidirectional I/O port. It can be used as a general-purpose I/O port, but a pull-up resistor must be added.

② P1 port (P1.0~P1.7) 8-bit quasi-bidirectional I/O port with internal pull-up resistor.

③ P2 port (P2.0~P2.7) 8-bit quasi-bidirectional I/O port with internal pull-up resistor.

④ P3 port (P3.0~P3.7) Internal 8-bit multi-function bidirectional I/O port with pull-up resistor.

4.2 Clock module

Clock module is used in the United States Dallas company developed the DS1302 chip, which has the ability to calculate the year, month, day, hour, minute, second, astrological functions, and its operation is very low power consumption, keep the data and clock information when the power is less than 1mW, a wide range of operating voltage 2.0 ~ 5.5V, and the microcontroller can be simple to synchronize the serial way of communication between only need to use to the three lines: RES Reset, I/O data line, SCLK. Dual power supply tubes are added for main and backup power supply, providing the ability to charge the backup power supply with current, and the backup power supply pin can be fed from a battery or a high-capacity capacitor[3].

4.3 Light intensity acquisition module

Because the curtains need to use the light intensity as a reference quantity to confirm whether the curtains need to be opened or closed, this system adopts a photoresistor to participate in the sensing of the light intensity, which is a high-resistance state when there is no light, and the dark resistance is generally up to 1.5 MΩ. When there is light, the material excites free electrons and holes, and the resistance value decreases, and the resistance value decreases rapidly with the increase of the light intensity, and the bright resistance value can be smaller than 1 KΩ or less. 1KΩ or less. In the data transmission using ADC0832 digital-to-analog converter, ADC0832 is the United States National Semiconductor production of an 8-bit resolution of the A/D converter chip, its highest resolution of up to 256 levels, can be adapted to the general requirements of analog conversion as well as double data output can be used as a data calibration in order to reduce data errors, fast conversion speed and stability. With ADC0832 digital-to-analog converter will collect the light intensity analog into digital into the microcontroller, the microcontroller accepts the data after the operation of the motor in order to complete the curtains closed, ADC0832 and a piece of machine interface should be 4 data lines, respectively, CLK, DO, DI, CS. ADC0832 pin work diagram shown in Figure 2.

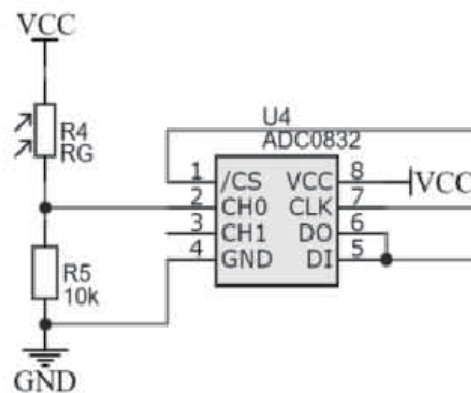


Figure 2. ADC0832 pin work diagram

4.4 Temperature acquisition module

This system can detect the room temperature, when the room temperature is too low when the curtains will automatically open part of the light into the room to ensure that the temperature, the same room if the temperature is too high will also pull down the curtains, the integrated economy and sensitivity, the use of DS18B20 temperature sensors to monitor the temperature, DS18B20 temperature measurement without any external components, you can set the resolution of 9-12-bit temperature range of -55 ~ +125 degrees Celsius, covering the real life may be dealing with a variety of harsh climate to make adjustments, and only requires a port to connect with the microcontroller, and “to” a variety of bad weather to make adjustments. ~ +125 degrees Celsius, covering a variety of real-life may cope with the harsh climate brought about by the temperature, so as to make adjustments, and only one port can be connected to the microcontroller to “single-wire bus” digital transmission mode transmission, greatly improving the anti-interference ability[4].

4.5 LCD1602 liquid crystal display module

The system uses LCD1602 liquid crystal display, LCD1602 liquid crystal, also known as LCD character liquid crystal, is a dot matrix liquid crystal template. The display can be used with the clock module to display the year, month, day, hour, minute, second, as well as the control mode, the temperature of the house and light intensity. The LCD uses the HD44780 controller, whose simple, powerful instruction set enables character movement and blinking. The controller consists of two 8-bit registers, data register (DR), instruction register (IR), display number RAM, character generator RAM (CGRAM), character generator RAM (CGOROM), address counter (AC). LCD1602 LCD module display high quality, each point in the acceptance of the signal to maintain a constant light, will not blink, the digital interface makes the LCD1602 pin diagram shown in Figure 3.

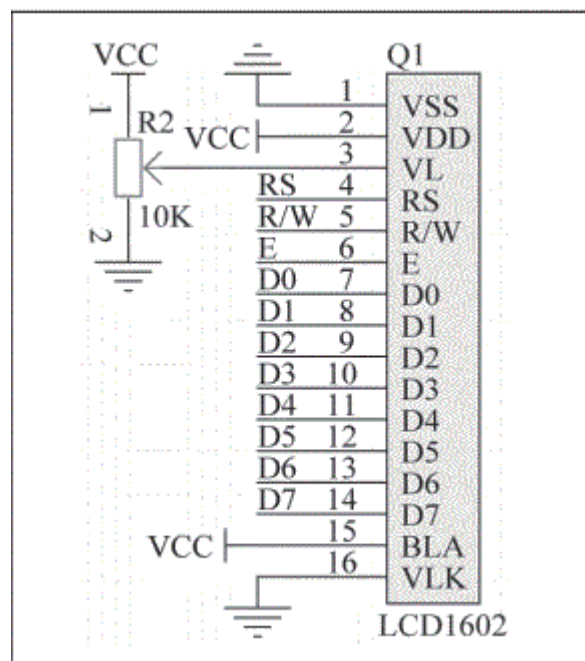


Figure 3. LCD1602 pin diagram

4.6 Motor Driver Module

ULN2003 IC is one of the most commonly used motor driver ICs, it is a high voltage, high current composite transistor array consisting of seven silicon NPN composite transistors. Used to amplify the circuit current to achieve sufficient voltage and current required by the load, its right pin connected to the controller for the input signal pin, after ULN2003 amplified through the left pin output to drive 28BYJ-48 four-phase five-wire 5V stepping motor to allow the microcontroller to control the curtains up and down.

4.7 Remote control input module

The infrared receiver is connected to pin 12 of the microcontroller, the transmitter is the remote control, which is used to organize the key commands read into signals to be sent, and the receiver is the infrared receiver which is used to compile, filter, amplify, and demodulate the signals to complete the commands with the remote control and the microcontroller.

5. Design results

This system design of intelligent curtains compared to the previous curtains developed more modes, such as manual, light control, temperature control, light and temperature integrated control and timing control. Users can control according to their different needs. In manual mode, users can manually control according to the remote control switch. In timer mode, users can set the time to turn on and off according to their actual situation. Light control, temperature control mode, the user can set the temperature, light intensity thresholds, the system sets the internal critical response value, when the external environment exceeds the range, the curtains will automatically respond. At the same time, the light and temperature integrated control meets the two simultaneous thresholds, which greatly improves the comfort of the house. At the same time, the stability of the stepping motor and the convenience of control and other advantages are more conducive to the stability of the curtain switch control[5]. The convenience of the user and the stability of the product is an indispensable condition of the design.

6. Conclusion

This system is based on 51 microcontroller to realize the development of intelligent curtains, the user can use infrared remote control or manual two aspects to control the curtains, based on the user's requirements for the light and temperature adjust the threshold to realize the intelligent curtains semi-automatic or automatic opening and closing, at the same time, the liquid crystal display can also bring the most intuitive feeling to the user. Adhering to the design concept of safety, comfort, convenience, efficiency, intelligence, environmental protection, the design as much as possible to make the product circuit is simple, efficient and stable components to achieve the function. At the same time, this curtain not only puts the strength on the intelligent system, but also shows in its exquisite appearance. Give the user a sense of comfort and experience at the same time can also be used as a decorative accessory to decorate each user's home, to bring users a new home living environment. But at present the biggest problem in the smart curtain market is still in its price, compared to ordinary curtains, smart curtains more intelligent things, multi-functional, high performance behind the higher cost, and the internal components, motors, pulleys, wear and tear also has a certain limit, resulting in a limited life. So this will become a new problem for the overall industry. But overall smart curtains provide users with far more benefits than drawbacks, I believe that in the rapid development of the level of science and technology in the motherland, the industry of smart curtains will get better and better, and in the age of science and technology to become a new phenomenal product.

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