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# THE DESIGN OF THE AUTOMATIC DOOR CONTROL SYSTEM

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## ARTICLE DETAILS

## ABSTRACT

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This design is based on single-chip microcomputer for auto-door control system, mainly by the master and the human infrared induction parts, motor parts, clock, display segments consists of five parts. PIR sensor acquisition by being able to identify the human body the human body signals, then sends the signal to the AT89C52 MCU processing. After SCM process, on the one hand the motor driver IC L289 control trigger signals, thereby by the motor driver IC motor control forward and reverse, and when he opens the door, reverse the door when closed, so as to realize the opposite control; Alarm devices, display control on the other hand, when an alarm signal is triggered, sound and light alarm, and display of date and time on the display in order to achieve functional purpose.

## 1. OVERALL DESIGN

If someone approaches a door, the infrared induction part will read body signal and transmit it to master control part. The SCM issues instruction to motor driving part according to signal and the motor driving part drives motor to turn, thereby opening and closing the door. When someone stands at the door for long, the master control part communicates instruction to alarm part to alarm to prevent hindering other people from going in and out [1-3]. In the meanwhile, the clock part, display part and SCM constitute a time system to display current date, thus multi-functionalization is realized.

The SCM often uses 51 series, such as AT89C52 SCM. The infrared induction part can select distributed circuit dominated by BISS0001 chip, or use body infrared integration module [4]. The display part usually uses Nixie tube, LCD 12864 or 1602. The clock part adopts chip DS1302. Alarm part often uses buzzer and LED light, etc.

## 2. HARDWARE DESIGN

The system design mainly comprises SCM minimal system and sub-circuit for each part. The sub-circuits are divided into infrared induction, motor drive, alarm, clock, key, and power supply. While SCM minimal system is the most crucial part of whole hardware. The sub-circuit parts are connected to different I/O ports of minimal system, wherein the infrared induction sub-circuit and key sub-circuit are connected to input port of minimal system [5]. The alarm sub-circuit and drive sub-circuit are connected to the output port of minimal system. The rest parts are connected to corresponding ports according to properties. SCM uses programming instructions to control them.

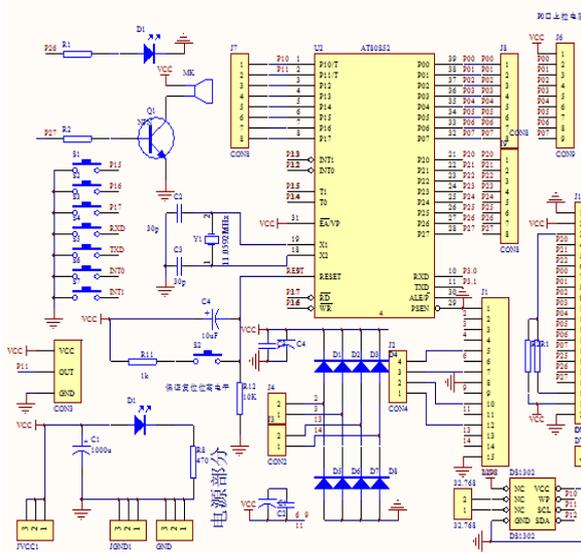


Figure 1: General elementary diagram of system

2.1 SCM minimal system

XTAL2 and XTAL1 of SCM AT89C52 are clock pins, being respectively input interface and output interface of oscillating circuit, which are connected to 11.0592M quartz crystal here to form internal clock circuit with capacitor C1 and C2 to provide clock control signal of SCM.

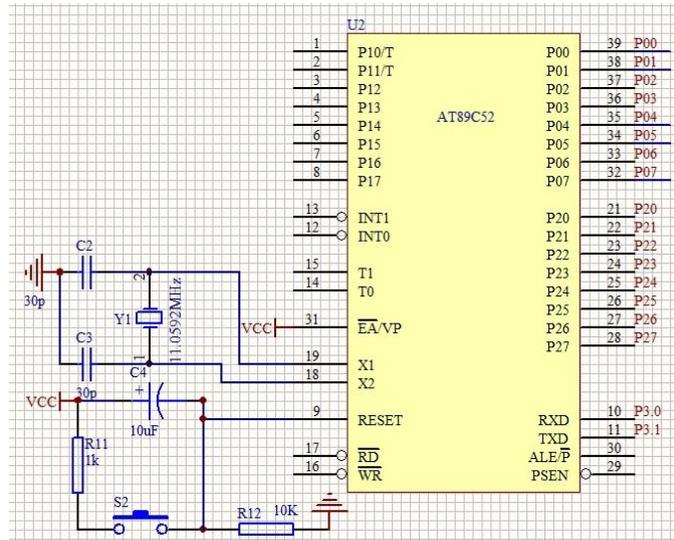


Figure 2: SCM minimal system

2.2 Infrared induction sub-circuit

The design adopts HC-SR501 body induction module which comprises three external ports, wherein the two on left and right sides connect the cathode and anode of power respectively, and the middle port is OUT signal output end and connects input interface P11 of SCM, from which interface induction signal are delivered to SCM.

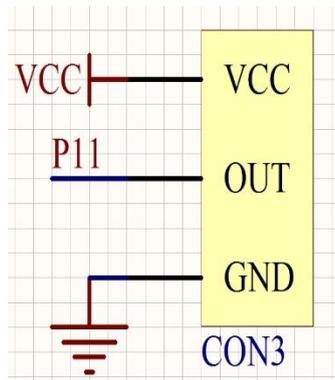


Figure 3: Diagram for infrared induction sub-circuit

2.3 Motor driving sub-circuit

In this design, pins 1 and 15 of L298 are not in use, so the device is directly earthed. Pins 5, 7, 10 and 12 are input ends which are connected to I/O port of SCM and controlled by SCM. Pins 2,3, 13 and 14 are output ends [6]. Pins 2 and 3 connect to a DC motor. Pins 13 and 14 connect to another DC motor to control rotation of motor. These four pins can also be used to control a stepping motor [7]. Pin 4 is earthed, pin 9 is power supply interface, pin 4 is driving voltage, pins 6 and 11 are enabling ends. If enabling ends are of low level, the output of four output ends are prohibited, so pins 6 and 11 are connected to power.

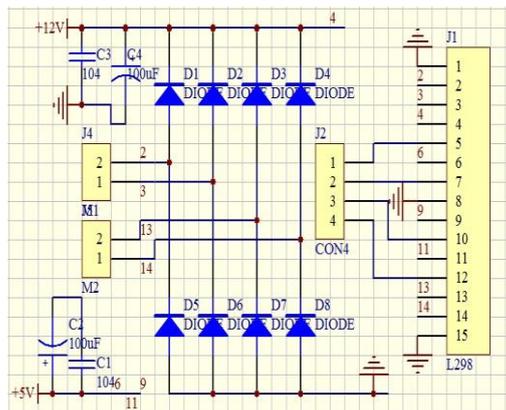


Figure 4: Motor driving sub-circuit

## 2.4 Key sub-circuit

The key circuit sets 7 switch buttons. One key switches automatic door between auto and manual modes. Two keys respectively control opening and closing door in manual state. The rest is control clock part [8]. One key is switch key setting year, month, date, hour, minute and second, also serves as the switch key for calendar form; one key adds 1, and another key deduces 1. The two keys adds or deduces when setting time and date [9]. Another key is confirmation key. They are connected to SCM I/O port and interrupt port respectively. Key sub-circuit is as shown in figure 9.

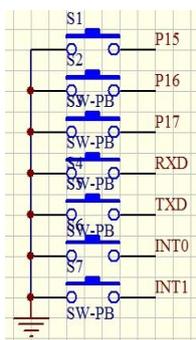


Figure 5: Key sub-circuit

## 3. DEBUGGING AND RESULT

Debugging result: in manual state, press open key, the motor rotates positively, representing the automatic door is opened [10]. Press close key, the motor rotates reversely, representing the automatic door is closed. In auto state, the motor rotates positively (automatic door is opened) when someone approaches the scope of about 1m from the door, and stops rotating when the maximal threshold is reached [11]. After about 10s, the motor begins to rotate reversely (automatic door is closed) after someone passes [12]. In closing door, when someone approaches the scope of about 1m from the door, the motor stops rotating reversely to immediately begin to rotate positively, i.e. the automatic door stops closing state and is re-opened [13,14]. When someone stands within 1m from the door, the buzzer sounds and indicator flashes to prompt not hindering others from passing this door; after people leave, the buzzer stops sounding and indicator becomes off. When carton or other non-people objects is placed within 1m from the door, the motor does not rotate (door is not opened), alarm does not sound, and indicator does not flash either. The design completely reaches the requirements of topic. Besides, the LCD displays current date, which can be adjusted by pressing keys, thereby enabling expansion functions [15, 16].

## 4. SUMMARY AND PROSPECT

The automatic door control system is very practical, and innovative to some extent, with some improvements on general automatic door: adding e-clock function, and having both functions of recognizing body signal, automatic opening, automatic closing and alarm of automatic door, and function of displaying time and date, to know time accurately when going in and out, which is more humanized and saves substantive resources.

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