# Design of Indoor Environment Monitoring System Based on Single Chip Microcomputer

Haifang Cong, Chenjie Zhang

Changchun University of Science and Technology, China

## Abstract

House is an important place for people to live and entertain, as a result, the indoor environment for people's health has a pivotal position. This paper combines sensor technology and single-chip microcomputer control technology to realize the environmental temperature humidity and the formaldehyde concentration collected and read, using ADC0809 analog-to-digital conversion, will be converted with single-chip microcomputer data processing and uses the LED digital tube display technology to complete the design of the environmental temperature, humidity and display circuit. When the formaldehyde concentration exceeds national standard 0.08 mg/m3, system starts alarm and exhausts fan.

## Keywords

Single Chip Microcomputer, sensor, Formaldehyde, LED

## 1. Introduction

House is an important place for people to live and entertain, as a result, the indoor environment for people's health has a pivotal position. Temperature and humidity is an important factor affecting people's health. The indoor temperature is too high that will cause vasodilation, rapid pulse, heart rate due to poor heat dissipation. Otherwise, the indoor temperature is too low that will make human body metabolism function decline, respiratory rate, skin vasoconstriction, excessive skin tension. Also the humidity is too large or too small, will cause the body's discomfort. Formaldehyde is a colorless gas with a strong pungent harmful odor. In summary, it is meaningful to the research of indoor environment monitoring which is beneficial to the body's health, comfortable life.

## 2. Overall design scheme

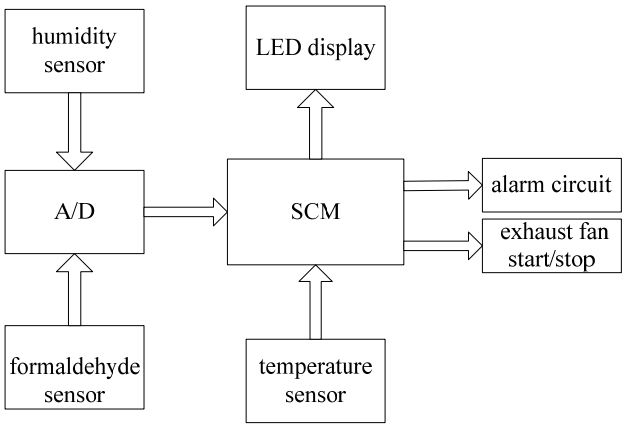


Fig.1 the hardware design of indoor environment monitoring system

This system with the AT89S51 as the core, mainly includes temperature and humidity sensors, gas sensors, A/D conversion, digital tube display, etc. The system can realize real-time display of

temperature and humidity, set the security value of formaldehyde content. When detecting the content exceeds safe value, sound and light will alarm, then the exhaust fan will start to work. The hardware design is as shown in fig.1.

## 3. The key circuits hardware design

### 3.1 Temperature monitoring module design

Digital temperature sensor DS18B20 is a small, low-cost hardware, anti-interference ability and high accuracy sensors. Its working voltage range is from 3.0 V to 5.5 V. The temperature measurement range is from 55 ° C to + 125 ° C with the accuracy of 0.5 ° C in - 10 ° C to + 85 ° C. The default resolution is 12, corresponding to temperature resolution is 0.0625 ° C. Through a single interface DS18B20 sends or receives data. So there is only a wired connection between the central microprocessor and DS18B20, temperature conversion for reading and writing and the power line itself can be obtained from the data. The material object is as shown in Fig.2.

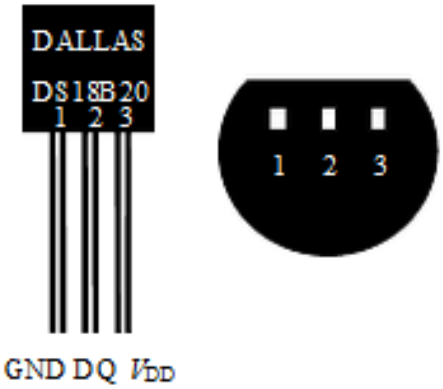


Fig.2 the material object of temperature sensor DS18B20

### 3.2 Formaldehyde monitoring module design

Electrochemical formaldehyde gas sensor produced by Dart sensor company is truly continuous monitoring sensor, which adapted to most environments. Output current value of formaldehyde in the air sensor from 0 to high concentrations of formaldehyde concentration is linear. Output signal will be amplified and temperature compensated based on the accuracy. The preferred method for output signal amplification is to use a direct current voltage to operational amplifier for amplifying the signal generated by the sensor OPA177 amplified to a voltage signal, the voltage signal is filtered, and the ADC0809 are connected. Hardware connection is as shown in Fig.3.

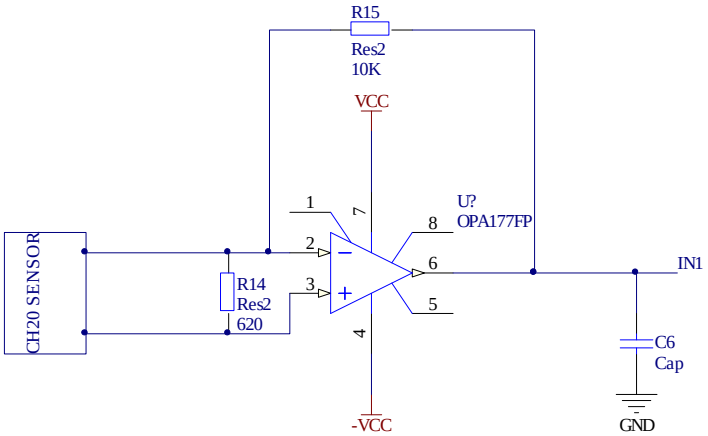


Fig.3 the hardware connection of the sensor OPA177

### 3.3 A / D conversion and control module design

ADC0809 produced by national semiconductor company is a CMOS process 8 channels, 8-bit successive approximation A / D Converters. It has an internal 8-channel multiplexer, which can signal the address code latched decoded only one of the eight analog input strobe signals to carry on A/D Conversion.

AT89S51 is a low power, high performance CMOS 8-bit microcontroller chip containing 4kBytes ISP Flash ROM which can be repeatedly rewritable 1000 times. AT89S51 has been widely used in many embedded control applications systems.

Data after A / D conversion should be obtained promptly transmitted to the microcontroller for processing. The key question is how to transfer data to confirm the completion of A / D conversion because the datum can be transferred only after the conversion is complete. It can be used in two ways, query mode and interrupt mode. In this paper the system adopts the interrupt mode. The system control unit connection is as shown in Fig.4.

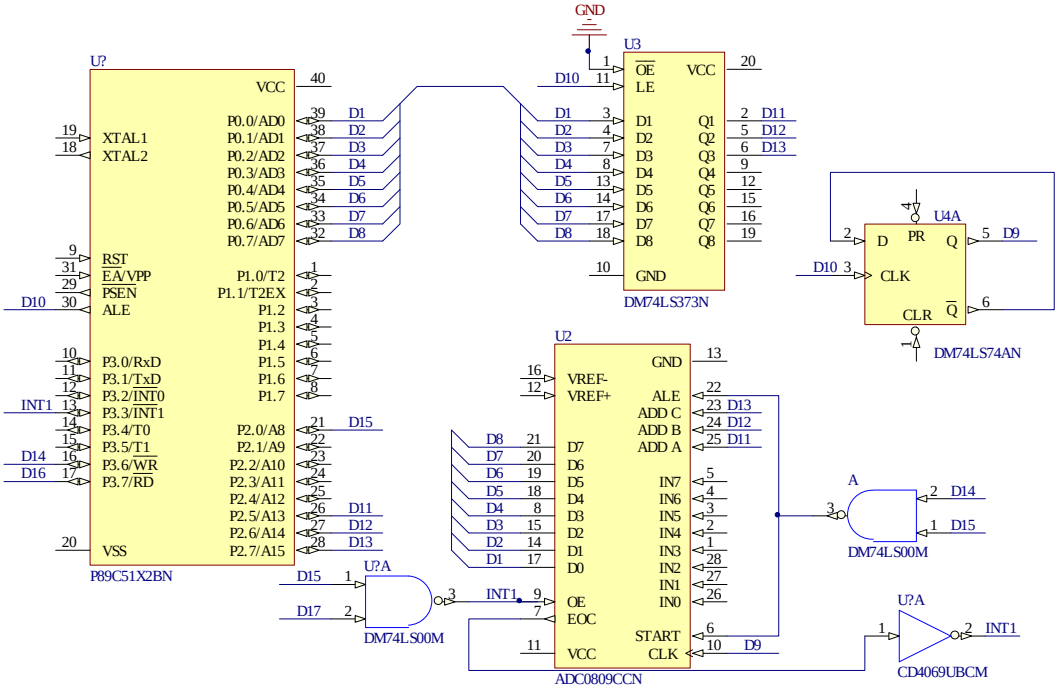


Fig.4 the system control unit connection

## 4. Conclusion

With the improvement of income and living standard, city environment pollution is more and more serious, people also pay more and more attention to the indoor environment. This paper describes the indoor environment monitoring system design based on single chip microcomputer. Due to environmental restrictions and conditions the system was tested only temperature module during debugging. The experimental results meet the design requirements.

## References

[1]HPCOOLREV HUMIDITY SENSOR HS1101 http://wenku.baidu.com/link?url=U-BatsF, 7th June 2002.

[2]English DART SENSORS. FORMALDEHYDE SENSOR http://www.dart-sensors.com, 9th December 2013.

[3]BURR-BROWN. Precision OPERATIONAL AMPLIFIER. http://wenku.baidu.com/link, August 1997.