

# Design of indoor environment monitoring system based on STM32 MCU

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## Abstract

with the worsening of air pollution, the influence of indoor environment on people's health is becoming more and more obvious. An intelligent indoor environment monitoring system based on STM32 is proposed. A variety of sensors are used to detect and collect indoor air pollution factors such as formaldehyde and dust, as well as indoor air quality factors such as temperature, humidity and CO<sub>2</sub>, which are displayed on the LCD screen. If the detection parameters exceed the threshold value, the system will automatically send out an audible and visual alarm .

## Keywords

STM32; Indoor environment detection; Sensor; Concentration.

## 1. Introduction

With the global warming and the increasing pollution emissions, the harm of air pollution to human health can not be ignored[1]. More than 500 kinds of volatile organic compounds (VOCs), including 20 kinds of carcinogens, were found in indoor air. In addition, more than 200 kinds of pathogenic viruses were found in indoor air. World Health Organization (WHO) also confirmed that 68% of human diseases were related to indoor air pollution[2].

According to China environmental protection online report, the first indoor environmental pollution survey in China was launched in 2014, which investigated the environment of tens of thousands of households in 100 large and medium-sized cities across the country, comprehensively understood the pollution of PM<sub>2.5</sub> and formaldehyde in urban and rural households, improved consumers' awareness of environmental protection, advocated the concept of new ecological life, and created a healthy indoor environment[3,4].

The detection of indoor air condition is the basis of improving indoor environment, so it is necessary to develop an intelligent indoor environment detection system for indoor environment detection. This paper presents a design of indoor environment detection system, which realizes the detection of indoor air pollution factors such as formaldehyde and dust, and indoor air quality factors such as temperature, humidity and CO<sub>2</sub>, and displays the current indoor environment parameters through LCD in real time. When the pollution quality factor exceeds the preset warning value, the detection system will automatically send out an audible and visual alarm.

## 2. Hardware design of indoor environment monitoring system

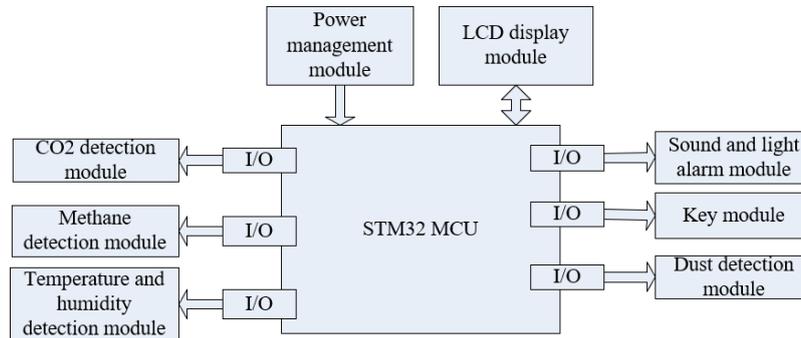


Fig 1. Hardware block diagram of indoor environment monitoring system

The hardware design of indoor environment monitoring system (as shown in Fig 1) provided in this paper includes power management module, LCD display module, CO<sub>2</sub> detection module, methane detection module, temperature and humidity detection module, sound and light alarm module, key module, dust detection module and other circuit modules. LCD display module is composed of 128×64 LCD screen; CO<sub>2</sub> detection module is composed of CO<sub>2</sub> sensor (GE6603 sensor of GE, USA ); formaldehyde detection module is mainly composed of formaldehyde sensor, analog switch SST177 and operational amplifier AD8629; temperature and humidity detection module is mainly composed of temperature and humidity sensor SHTII; dust detection module is mainly composed of dust sensor (SM-PWM-01A dust sensor of GE, USA); the sound light alarm module is mainly composed of buzzer and LED light.

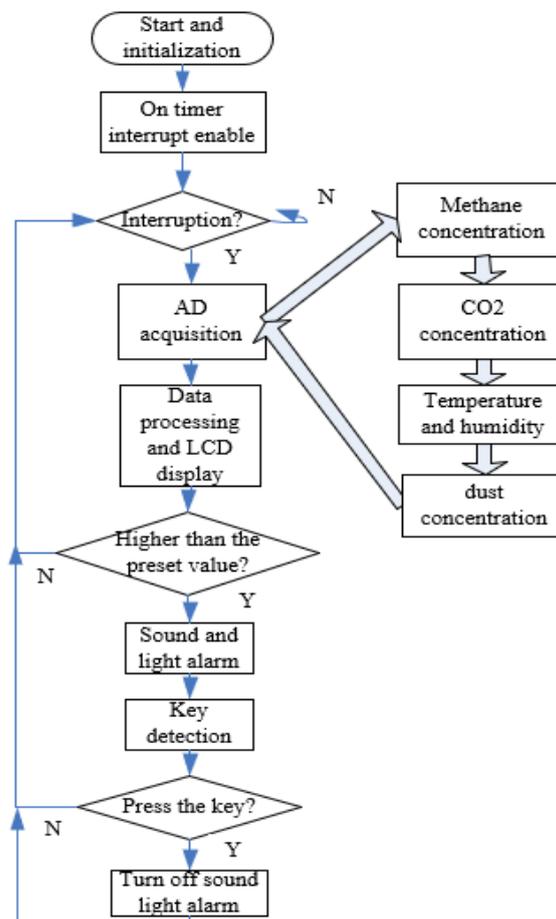


Fig 2. Program block diagram of indoor environment monitoring system

### 3. Software design of indoor environment monitoring system

This design mainly uses the modular programming method, as shown in Fig 2. This method can improve the efficiency of programming and make the program simple, easy to operate and easy to expand. The driver of each function module of the hardware is encapsulated as a callable function, and the main function realizes the complex functions and specific operations of the system by calling the sub-function.

The main operation process of the system program is as follows:

Power on and system module initialization program, including: system clock initialization, pin initialization, and LCD screen initialization;

2. Enable the timer and wait for the timer interrupt signal;

3. If the timer interrupt signal is obtained, enter the timer interrupt service program

(1) By calling the drive function of each hardware module, the sensors are switched to the working state;

(2) The data parameters (including methane concentration, dust concentration, temperature and humidity, CO<sub>2</sub> concentration, etc.) of each detection module are collected by analog-to-digital converter;

(3) Through data processing, the data of the detection module is restored to the actual parameter value, and the data is displayed on the LCD screen in real time through the LCD driver interface;

(4) Compare the actual data recovered in step (3) with the initial set value:

If the actual data greater than the initial setting value, the sound and light alarm sub function is executed, and the buttons are monitored in real time.

I. if the key is pressed, the sound light alarm will be turned off and the program will jump to step 3;

II. If the key is not pressed, the sound light alarm will not be closed, and the program will jump to step 3 directly;

If the actual data is less than the initial set value, perform step 3.

### 4. Conclusion

This paper introduces the design of an indoor environment detection system based on STM32 MCU. It mainly collects and displays the concentrations of indoor air pollution factors and quality factors, such as methane, dust, temperature and humidity, CO<sub>2</sub>, etc in real time. When the collected data exceeds the preset value, it will send out an audible and visual alarm which can be eliminated by pressing the key. For the detection system, it has the characteristics of simple operation, energy saving, strong maneuverability, low cost and good scalability. It can achieve real-time monitoring of the indoor environment and timely provide alarm information.

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## References

- [1] LAN Gaoyu, Bian Shuhai, etc. Design of indoor environment detection system based on STC12C5A60S2 MCU. Modern building electrical, (2012)No.10, p.13-18.
- [2] Chen Zhengjun, Wu Hua, Liu Ying, et al. Research and implementation of indoor environment detection based on SPCE061A. Computer knowledge and technology, Vol.12 (2010)NO.6 , p.3089-3090.
- [3] Yang Chenwei: *Development of wireless indoor environment monitoring system based on Embedded*(Master's thesis, Nanhua University, china 2012), p. 3-10.
- [4] Guo Tianxiang:C language course of new concept 51 single chip microcomputer: introduction, improvement, development and expansion(Electronic Industry Press, china 2009), p.50-100.