Design of PM2.5 Detector Circuit Based on Single- Chip Microcomputer

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Abstract. With the advent of the industrial age, the rapid economic development, followed by the deterioration of air quality, the increase in haze and weather and the increase of solid particles in the air seriously affect people's lives. Therefore, it is more and more important to detect solid PM2.5 in the air. The PM2.5 detector is mainly used to detect the particles which are larger than or equal to 2.5 microns in the air, to carry out real-time alarm monitoring and to provide suggestions for people.

This design uses AT89C52 single-chip microcomputer as the main controller, combined with module LCD12864, A/D conversion module, dust sensor module, etc., use dust sensor GP2Y1010AU to convert the current air particulate size into an obvious current or voltage signal, and finally display through the display device which is connected. The design also has alarm function. If the buzzer alarm starts and LED lights on,the dust concentration in the air reaches the set limit. This design circuit is simple with high integration, low power consumption and simple adjustment. The detection accuracy can reach 5V/(mg/m3) with high practicality.

System overall Plan

The dust sensor converts the air to be measured into an analog voltage signal and sends it to ADC0832. ADC0832 converts the analog signal obtained into a digital signal and sends it to single-chip microcomputer. The single-chip microcomputer chip sends the input digital signal to LCD and the bee alarm through processing.
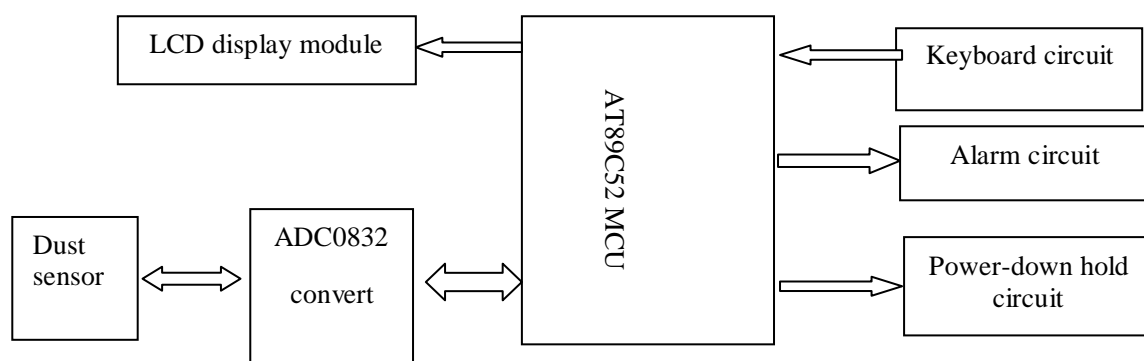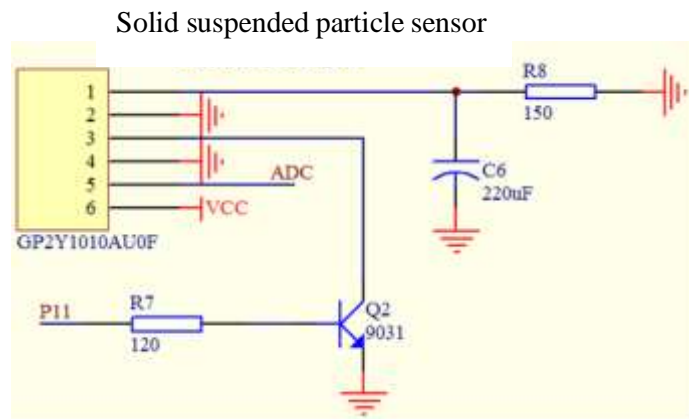

Figure 1.   Finite System diagram

PM2.5 Detection Circuit design

Dust Sensor Circuit Design. The circuit diagram of the dust sensor connected to the microcontroller is shown in Fig. 2. The fifth pin V_0 of the device is connected to AD converter, and the display of the third pin LED is realized through P11 control of single-chip microcomputer. In addition, the second pin and the fourth pin of the sensor are grounded. The first pin of the sensor is realized by a 220uF capacitor and a resistor ground. The sixth pin of the sensor is connected to the power supply, and the detection of smoke and dust particles is finally implemented.

Solid suspended particle sensor

Solid suspended particle sensor

Figure 2.   Finite Dust sensor circuit

Data Conversion Module Circuit. After adopting ADC0832 with dual-channel A/D conversion chip, the air pressure sensor converts the air to be measured into analog voltage value, and A/D converter needs to convert the analog voltage value into a digital signal and send it to single-chip AT89C52 for detection and processing and display it on   LCD12864. The circuit is shown in Fig. 3.
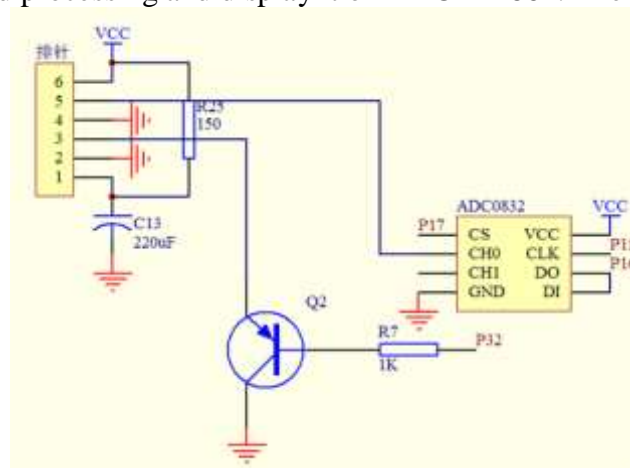

Figure 3.   Finite Data conversion module circuit

Display Circuit Design. The dust sensor converts the air to be measured into an analog voltage value, and the analog voltage value is converted into a digital signal by A/D converter ADC0832. This signal is sent to display LCD12864 for processing after being detected and processed by MCU. The circuit diagram of the display module is shown in Fig. 4. Figure P1.0 is connected to the enable terminal of LCD12864; P1.1 is connected to register selection terminal; P2.0~P2.7 are connected to the data line of LCD display, that is the digital signals detected and processed by single-chip AT89C52 is connected to the data line of LCD display through the port of the single-chip microcomputer and sent to LCD display.
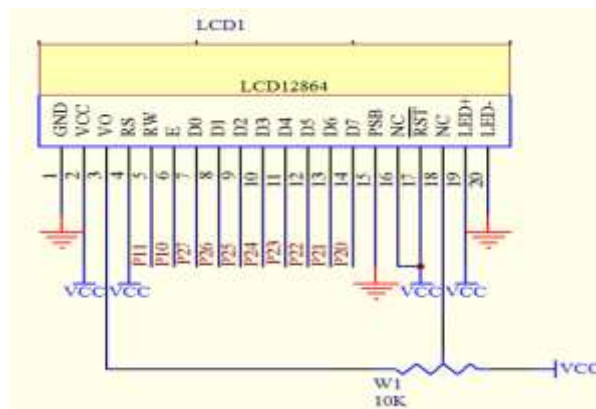
Figure 4.   Finite Display circuit

Buzzer Alarm Circuit. Considering the practical value and cost in design, buzzer alarm is used. The schematic diagram is shown in Fig. 5. The buzzer is controlled through I/O port. It should be noted that current limiting resistor connects to buzzer and buzzer cannot be too large, otherwise it is not loud enough. The current limiting resistor is 1K ohm.
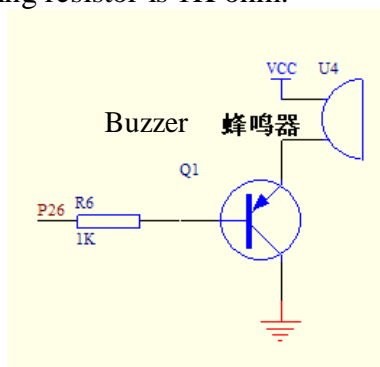

Figure 5.   Finite Buzzer alarm circuit

Conclusion

The design of the hardware circuit includes single-chip minimum system, PM2.5 sensor circuit, data processing circuit, display circuit and buzzer alarm circuit. This paper mainly introduces PM2.5 detection circuit design, including sensor GP2Y1010AU detection circuit, conversion circuit, display and alarm circuit, which can display current air quality in real time and alert people to make travel preparation.

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