Children's Playground oxygen concentration detection Display System Design and Simulation

Kunliang XU[1, a], Changqin Du[1, b], Yanlin TAO[1, c]

[1] School of Computer Science and Engineering, Qujing Normal University, Yunnan 655011, China;

[a]422078334@qq.com

[b]344162018@qq.com

[c]401004120@qq.com

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Abstract. Taking the current children's playground built indoors, most exist on the background of insufficient ventilation, C51 series AT89C51 single-chip design based on a playground detected oxygen concentration display system that can help managers make timely ventilation and ventilation to ensure indoor air quality, give your child a better playground.

Introduction

In the modernization process of urban development, with the vehicle, increase the flow of people, can let the children less and less free venues, a large playground recreation facilities construction is imperative. Currently, the playground build awareness not only for children of different ages, psychological, intellectual, physical development, training collective sense of responsibility and spirit of cooperation to conduct research building [1-2], but also to foster social cognitive abilities of children conducive to the formation of children's mental health and personality [3-4].

However, China's commercial space, children's play environment there is a small space, a serious security risk, such as lack of service facilities, inadequate [5-6]. Especially since the construction of recreational facilities in the interior, a large number of people concentrated in the interior, accelerated indoor air carbon dioxide generation, resulting in carbon dioxide concentration is too high, thus endangering the health and even the life of the museum staff [7]. In order to give children a better playgrounds, C51 Series Based on AT89C51 microcontroller design a playground detected oxygen concentration display system that can help managers make timely ventilation and ventilation, into the human flow control to ensure indoor air quality.

Hardware emulation circuit design

System Design.

The system uses chemical sensors to detect indoor air quality, into a voltage signal, data transmission to the microcontroller, the microcontroller for data processing, the LCD display shows the current oxygen concentration, to facilitate management personnel adjustments. System configuration diagram shown in Figure 1.

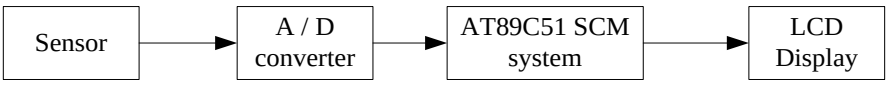

Fig.1 System Block Diagram

Introduction to Chemical Sensors .

Chemical sensors, sensor means will send a chemical reaction in the process of sensing physical quantities. Designed for use in the United States Teledyne's R-22MED oxygen concentration sensor, which is powered by built-in battery. After the oxygen-containing gas into the sensor, its internal chemical changes, the output voltage signal and the oxygen concentration showed a linear relationship[8].

Hardware emulation circuit.

Schematic design shown in Figure 2, the figure is 12 of TLC2543 A / D chip, with high accuracy, the sensor output voltage signal can be converted directly. In order to increase the resolution of signal acquisition, A / D converter reference voltage is selected as + 2.5V. Collection schedule is:

$$\frac{2500V}{2^{12}-1} \approx 0.61mV \quad (1)$$

The linear relationship between the oxygen concentration and the output voltage of the sensor, the relationship between the oxygen concentration must be calculated and the output voltageU_0 w is:

$$w = 21.0 + 1.6766 \times (U_{0-7.0}) \quad (2)$$

According to (2), when the R-22MED sensor output signal for each additional 0.61mV, in accordance with a corresponding increase in the oxygen concentration

$$\Delta w = 1.6766 \times \Delta U = 1.6766 \times 0.61 = 1.022\% \quad (3)$$

Because of the relationship between the output voltage followsU_0 and A / D conversion result D:

$$\frac{U_0}{2500} = \frac{D}{4095} \quad (4)$$

The (4) into (3), we can get the oxygen concentration is calculated with the A / D conversion result of D:

$$w = 21 + 1.6766 \times (0.6105 \times D - 7.0) \quad (5)$$

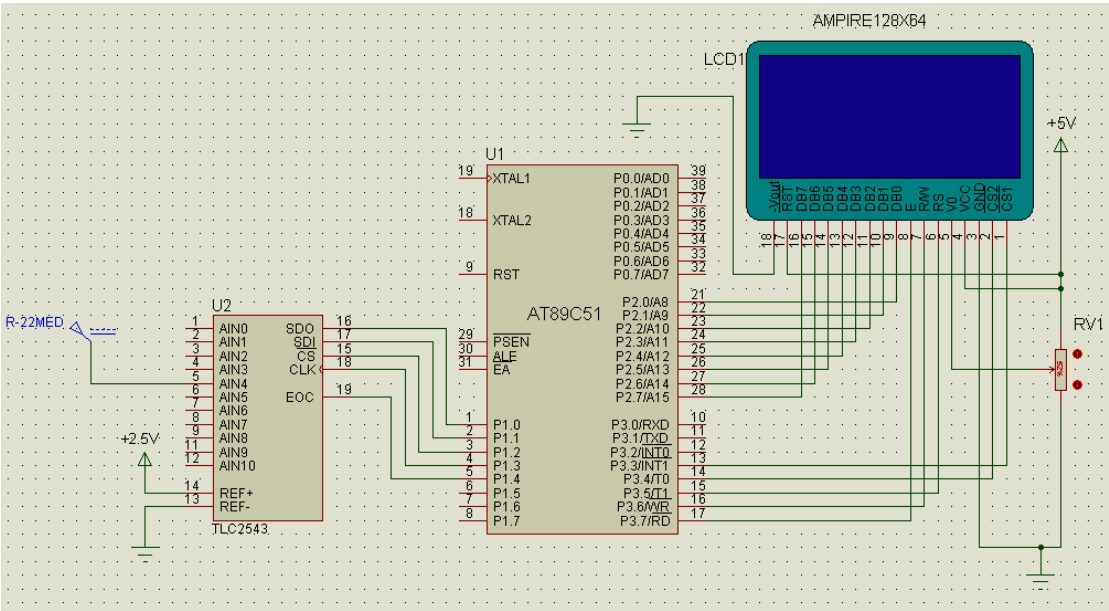

Fig.2 Oxygen concentration detection simulation schematic

Programming

Software includes the main program module, LCD LCD driver module and TLC2543 driver module three modules. The main program code is as follows:

Main program module. The main part of the complete collection of TLC2543 signal for A / D conversion, and the results in terms of traffic, the last call display driving section will flow display. The main code is as follows:

```
void main(void)
 {
        unsigned int N;
        float W;
   LCD_Init();
   while(1)
         {
          N=A_D(4);
          W=21.0+1.6766*(N*0.6105-7.0);
```

```
            gotoxy(3,48);
            DisplayResult(W);
          }
}
```

The LCD driver module. This module completes the specified location and displays the result, the main code is as follows:

```
void DisplayResult(float Q)
{
  unsigned char i,j,k,l;
  unsigned int N;

  N=(unsigned int)(Q*100);
  i=N/1000;
  j=(N%1000)/100;
  k=(N%100)/10;
  l=N%10;
        gotoxy(3,40);
        Display_English(pd[i]);
        Display_English(pd[j]);
        gotoxy(3,56);
        Display_English(dot);
        Display_English(pd[k]);
        Display_English(pd[l]);
}
void LCD_Init(void)
{
   ClearLCD();
        gotoxy(0,0);
   Display_Character(Ox);
   Display_Character(yg);
   Display_Character(en);
   Display_Character(tabc);
   Display_Character(on);
   Display_Character(ce);
   Display_Character(nt);
   Display_Character(ra);
gotoxy(3,0);
 Display_Character(ti);
   Display_Character(on);
        Display_English(Equ);
        gotoxy(3,80);
        Display_English(per);
}
```

Simulation Conclusion

Start the simulation, you can see the simulation results shown in Figure 3. The simulation results show that when the oxygen concentration sensor output voltage of 30mV, the corresponding oxygen concentration by the formula (2) calculated

$$w = 21 + 1.6766 \times (D - 7.0) = 59.5618\%$$

Actual simulation results for 59.41%, there is only a small amount of error, correct surface hardware and software design, it can play a role in oxygen concentration detection.

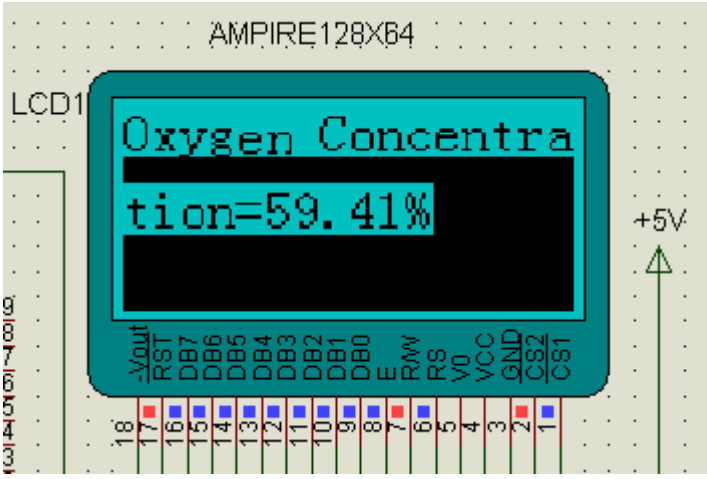

Fig.3 Simulation results

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