Design of Multi-function Electronic Clock based on Single Chip Microcomputer

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Abstract. The electronic clock mainly uses the electronic technology to make the clock computerization, the digitization, with the clock precision, small size, scalable performance and other characteristics. It was widely used in the life and work. This design applies AT89C51 as a core chips, with 7 LED digital displaying, using DS1302 real-time clock chip to complete the basic function of the clock/calendar. At the same time the design uses of DS18B20 temperature sensor to collect the environmental temperature. The method has the advantage of being simple circuit, reliable performance, good real-time, high precision of the time and temperature, simply operation, easy programming.

Keywords: AT89C51 DS18B20 Electronic clock.

1. Introduction

Electronic clock is widely used in daily life and work with accurate time, small size, friendly interface, extensible characteristic. At first electronic clock is digital clock display or timer. On the basis of this people can add other features, such as timing alarm clock, calendar, environmental temperature, humidity, ambient air quality detection, USB extension function, etc.to make electronic clock application more widely according to different requirements.

2. Electronic clock system design

Electronic clock system consists of the second signal generator, time display circuit, key circuit, power supply, alarm circuit and so on. In addition, the design requirements for the electronic clock can collect environmental temperature, so temperature acquisition chip is needed. Hardware circuit diagram is shown in figure 1.

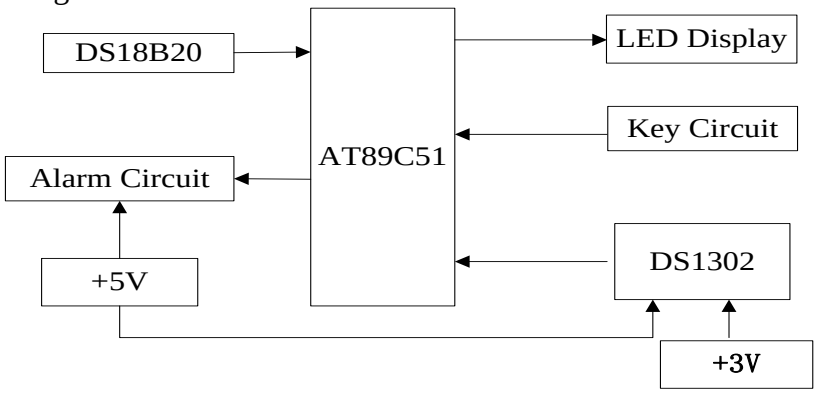

Fig.1 Multi-function electronic clock hardware system block diagram

The system uses AT89C51 to control the main circuits. By reading the data's of calendar clock chip DS1302 and temperature sensor DS18B20 the system can complete the main function--acquisitions of environmental temperature and clock/calendar signals. The system adopts 8 digital tube section of the common cathode to display(one of them as the clock/calendar proofreading or alarm clock mark).Due to the requirement of alarm function the alarm circuit is designed.

The whole circuits adopt two kinds of power supply, one is +5V power supply for the whole circuit; the other is +3Vpower supply for DS1302 (as backup power).When the + 5 v power supply is cut off,

the + 3 v power supply is enabled, which can keep the DS1302 continue to work. When the + 5 v power supply is restored, LED can still display the current time. The system won't be reset to the initialization time because of outage.

3. The key circuits hardware design

3.1 The clock circuit design

In the electronic clock design, some real-time clock chips are commonly used such as DS12887, DS1216, DS1643, X1203, DS1302. The main clock function is basically the same for each chip. From the consideration on the price and supply of goods, this design uses the real time clock chip DS1302 calendar.

Created by DALLAS Company DS1302 is a real-time calendar clock chip with high performance, low power consumption, wide working voltage from 2.5 V to 5.5 V and double power supply? It can be set standby power charging ways, provide the backup power supply for trickling water current charging capacity. The real time clock can provide second, minute, day, week, month and year, less than a month of 31 days can be automatically adjusted, and has a leap year compensation function. The clock hardware circuit connection is as shown in figure 2.

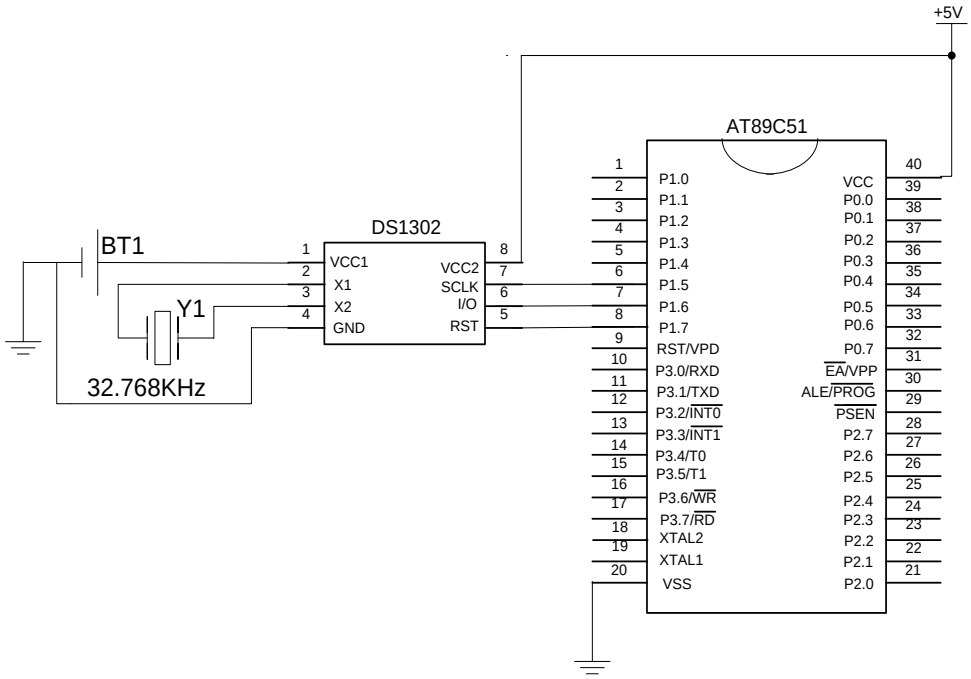

Fig.2 the clock hardware circuit connection

In Fig.2, AT89C51 P1.7 directly connects the RST end of DS1302.After AT89C51 is powered on, P1.7 foot output is high level automatically where P1.5 as the serial clock interface, P1.6 as clock data I\O. In particular, the X1 and X2 connection on both ends of the Y1, the vibration frequency is 32.768 KHz.

3.2 The environment temperature acquisition circuit design

In the daily life and agricultural production they are often used to detect and control temperature, such as temperature sensor AD590 and DS18B20. In this design the temperature sensor DS18B20 is as to carry on temperature acquisition and conversion. The measured temperature can be directly converted to digital signals to be processed by AT89C51 without an external power source. This design not only saves hardware, but also effectively avoids interference problems of analog mode.

In this design the system uses DS18B20 to collect environmental temperature and convert signals. In fig.3, AT89C51 P3.4 foot that is used for data input and output connects with the I\O foot of DS18B20.When Resistance R11 as the pull-up resistors of DS18B20's I\O foot is reading at the end of the time slot, the I/O pins will be back to high level by the pull-up resistor.

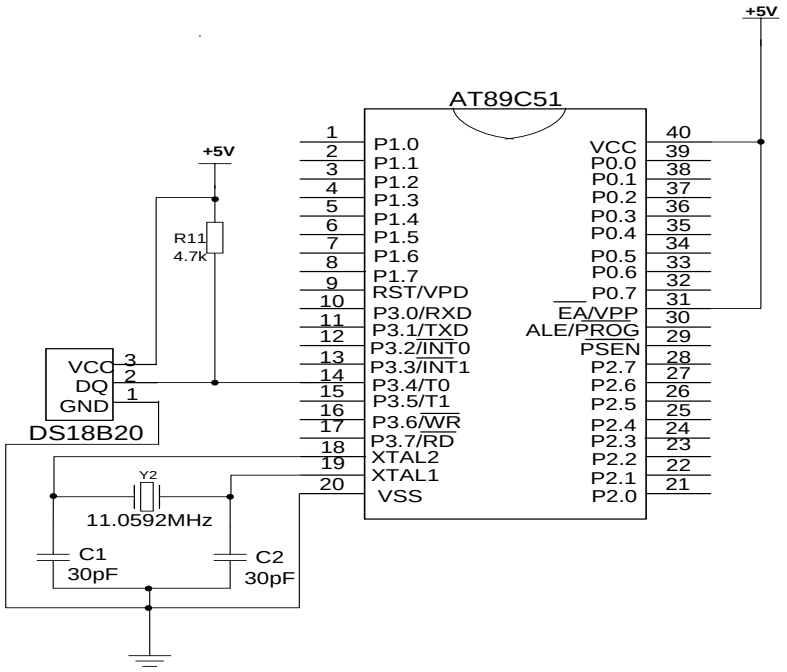

Fig.3 System environment temperature acquisition circuit

4. Conclusion

There are varieties of implementation plans to design electronic clock which can achieve many functions. In this paper, the electronic clock can display the time and date and proofread manually. Clock chip can operate normally after the power is cut off. Without clock correction the system can operate normal after re-up electricity. Meanwhile it can collect real-time temperature and display.

References

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