# Design of the Multi-Channel Temperature Inspection System

Fei Quan[1], Wei Wei[2*]

[1]Shanxi Polytechnic Institute, Xianyang 712000, China

[2]School of Computer Science and Engineering, Xi'an University of Technology, Xi'an 710048, China
*Corresponding authour: Wei Wei, taneo@126.com

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**Abstract.** The Multi-Channel Temperature inspection has been designed based on MSP430g2553 and temperature sensor. Through the MCU control peripheral circuit automatic inspection of 4 channel temperature is realized, and the results are displayed on LCD12864. How to design the temperature inspection including hardware and software is mainly described in detail. With the low power consumption of the MCU, the low power consumption of the system is realized in a simple structure which is of stable performance, economic and practical.

## Introduction

In the modern industrial production, the accurate real-time collection of temperature has a high demand, at the same time in the face of the bad environment and the need for multiple detection situations, the staff of the site collection is not convenient. Therefore, there is a need to have a real-time multi-channel temperature acquisition device for accurate collection of the site temperature. Multi-channel temperature inspection system based on MSP430g2553 changes the traditional method of temperature measurement. It can collect the temperature of the field, and the simulated temperature value can be converted to the digital value displayed on the terminal LCD, through real-time detection of temperature, to achieve the purpose of monitoring of multi scene. This method can make the measurement accuracy, high stability and low power consumption [1-9].

## The Overall Design

The system takes the MCU as the main controller of digital temperature inspection, with four different temperature sensors as the temperature information acquisition unit, the liquid crystal display and the driving element as the display unit. The basic block diagram of the system is shown in Fig.1.

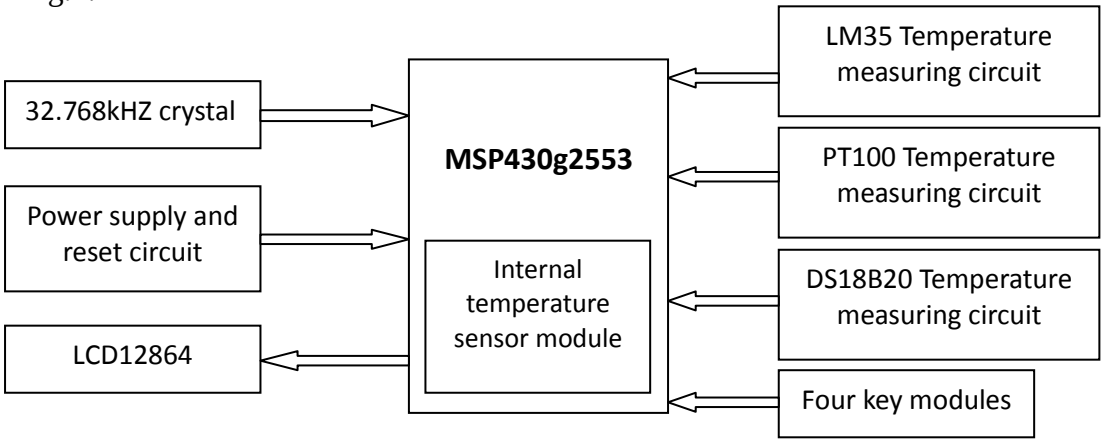


 

Fig. 1 General design of the system

## Hardware Design

The multi-channel temperature inspection system has three kinds of temperature sensors, which are DS18B20, LM35 and PT100. MSP430g2553 single chip microcomputer system can use three kinds of temperature measurement module on the different temperature sensor and MCU internal temperature sensor to realize the temperature of the inspection. These three kinds of temperature measurement module through the MSP430g2553 microcontroller I/O port and ADC10 connection, to achieve real-time monitoring of temperature.

**LM35 Temperature measuring circuit** The voltage and temperature from the LM35 collected into a linear relationship, the formula is: Vout=10.0mV/℃ * T℃, T is the actual temperature value. The hardware circuit connected with MSP430g2553 is shown in Fig.2.

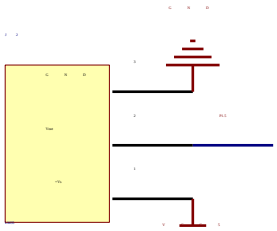

Fig. 2 LM35 hardware circuit connection diagram

**DS18B20 temperature measurement circuit** DS18B20 is characterized by the ability to directly output digital temperature, it is through the data line of DQ to communicate with MSP430g2553. It's hardware circuit connected with MSP430G2553 is shown in Fig.3.

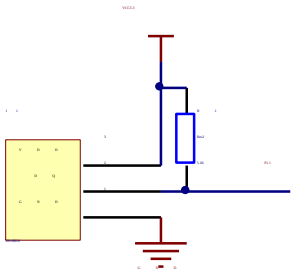

Fig. 3 DS18B20 hardware circuit connection diagram

**PT100 Temperature measuring circuit** PT100 is a platinum thermal resistance, the resistance will change with the change of temperature. In 0 degrees, the value of PT100 is 100 ohms, and in 100 degrees, the value of PT100 is 138.5. The formula of the platinum resistance is:

Rt=R0 (1+at+bt2) (0<t<850℃)

Rt is the resistance value of T degrees, R0 is the resistance value of 0 degrees celsius. The A and B coefficients in the formula are: a=3.90802*10-3℃; b=-5.802*10-7℃。The temperature measurement circuit of PT100 is shown in Fig.4.

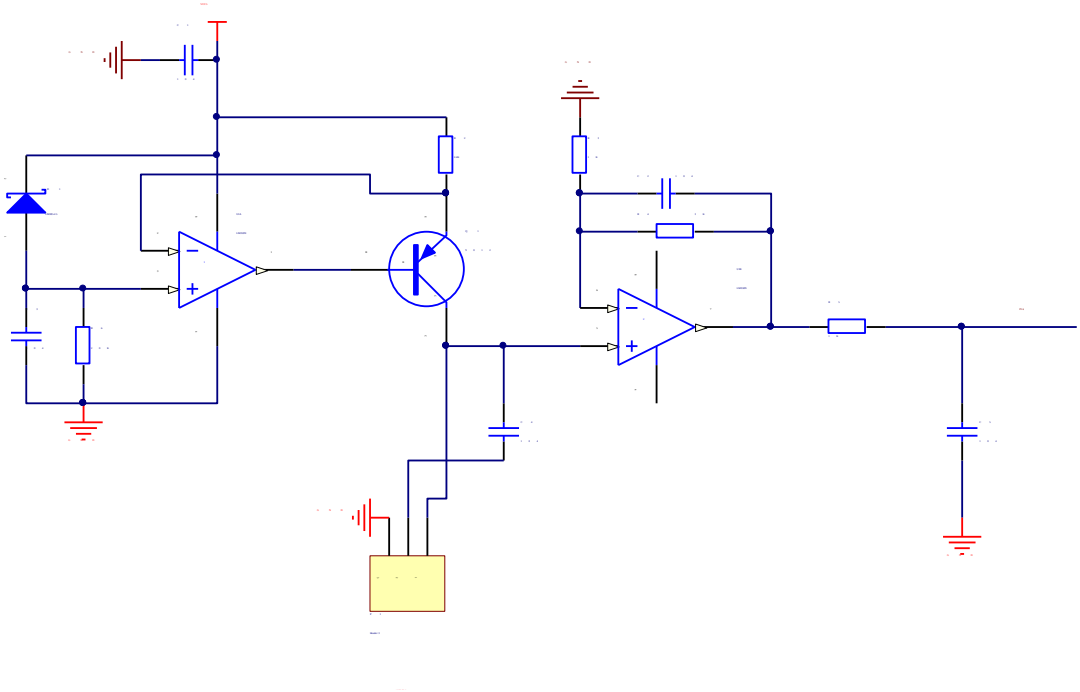

Fig. 4 PT100 hardware circuit connection diagram

**Key control module** The multi-channel temperature inspection system has four separate button which are respectively connected to the I/O ports of msp430g2553. The key of the system is used to realize the switching of the environmental temperature, which can display the temperature measurement value of the different temperature sensor. The function assignment value of the button is shown in Table 1:

Table 1 Button function table

| Button number | Corresponding I/O port | Function |
|---|---|---|
| **S1** | **P2.1** | Display LM35 temperature |
| **S2** | **P2.2** | Display DS18B20 temperature |
| **S3** | **P2.3** | Display PT100 temperature |
| **S4** | **P2.4** | Display temperature of internal temperature sensor |

## Software Design

Software design using CCS platform C language programming, the use of modular programming ideas, the different modules were programmed to facilitate the code of the transplant, call or modify. The software module is divided into 12864 basic modules: liquid crystal display module, LM35 temperature measurement module, DS18B20 temperature measurement module, PT100 temperature measurement module, internal temperature sensor temperature measurement module, button setting module.

## Summary

 

The temperature acquisition and measurement of the system is practical, and it can be used to measure the temperature. At the same time, the system in the hardware design fully takes into account the scalability, in the I/O port more than several temperature sensors to achieve more points of temperature inspection.

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