Temperature and Humidity Monitoring System Based on GSM Module

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Abstract

This paper presents a wireless temperature and humidity monitoring system. When the temperature sensor captures the phone from the user,it sends a request to the abnormal temperature or temperature data to TC35i. The SHT10 temperature and humidity collected data were through the microcontroller coding, andthen sent to the user via the TC35i GSM network to enable accurate, real-time remote temperature monitoring.

Keywords: remote monitoring; GSM; AT89S52; SHT10

1. Introduction

Measurement and control of temperature and humidity in the agricultural production process is widely used in food storage and greenhouse for plant cultivation where temperature and humidity need to be monitored. In these particular environments, temperature and humidity values tend to remain within a certain range. Therefore, beyond the scope of the field you need to adjust the temperature and humidity. Conventional monitoring systems require personnel at the scene to collect data to determine whether the temperature and humidity is within a limited range, resulting in waste of manpower and time, and inconvenience.

In this paper, AT89S52 as the core controller with the temperature and humidity sensors SHT10 [2] was used in the system detection module with GSM mobile network for intuitive short message or telephone, sending an alarm signal to the target cell phone with remote monitoring capabilities.

2. The Overall Design

System hardware includes the control section and the signal processing component detection section. Signal detection is part of the module including temperature and humidity detection module (SHT10). The overall system block diagram is shown in Figure 1:

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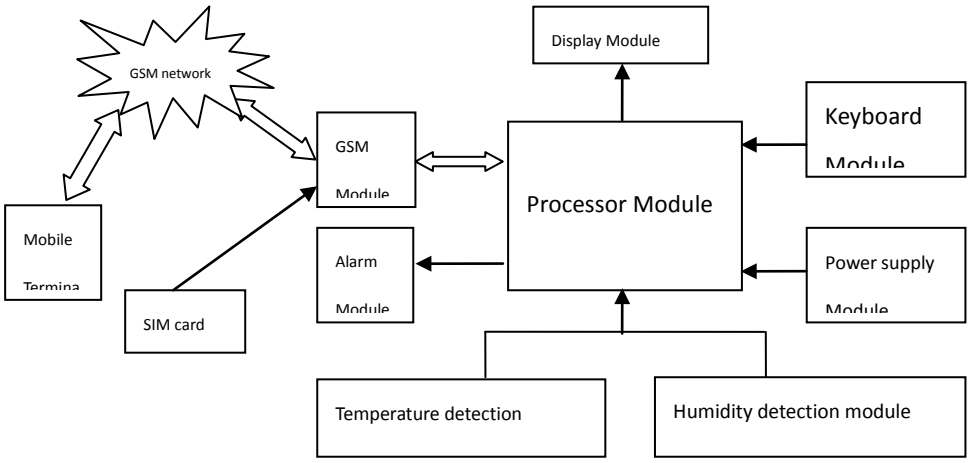

Figure 1: The overall block diagram of the system

2.1 GSM Network Module

GSM (Global System for Mobile Communications) is a mobile communications technology standard originated in Europe, For the second-generation mobile communication technology, Its purpose is to allow developers around the world to work together using a mobile phone network standard, and enable users to use a mobile phone lines all over the globe. GSM systems include GSM 900 (900MHz), GSM1800 (1800MHz) and GSM1900 (1900MHz), and several other bands.

TC35i is from Siemens (Siemens), who has introduced a highly inherited module with new generation of dual-band 900/1800MHz GSM wireless communication. It can quickly and reliably secure the system program data, the transmission of voice, short message service (Short Message Service), and fax.

T3c5i module consists of six parts: GSM baseband processor, GSM RF module, power supply module A (SIC), flash memory, ZIF connector, and antenna interface. As the core of TC35, the baseband processor mainly handles voice, data signals within the GSM terminal, and a cellular radio equipment covering all analog and digital functions. No additional hardware circuitry is needed to support RF, HR and ERF voice channel coding as shown in Figure 2:

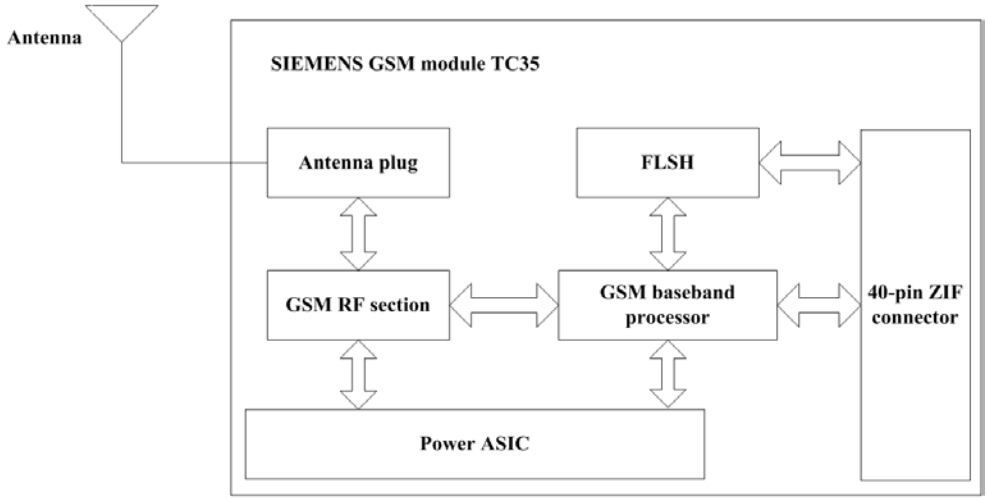

Figure 2: TC35i module structure diagram

2.2 Circuit Design Temperature and Humidity

The microprocessor uses two serial digital interface of SHT10 temperature and humidity sensor chip communication, and the hardware interface design is very simple. SHT10 is for collecting the ambient temperature and humidity, and its working voltage is 2.4 ~ 5.5v, measuring precision of ± 4.5% RH, and 25 ℃with the temperature measurement accuracy of ± 0.5 ℃, using SMD chip package. SHTl0 uses two serial line data communication with the processor, and SCK line is responsible for the data communication processor and SHTl0 synchronization. DATA tri-state gate is for reading the data. DATA SCK clock after the falling edge of the state is only valid on the rising edge of SCK clock. During data transmission, when the SCK clock is high, DATA must remain stable. To avoid signal conflicts, the microprocessor should drive DATA low. Indirectly a capacitor is used for power supply filtering in the VCC and GND. Figure 3 shows the connection diagram for SHT10 and microprocessors.

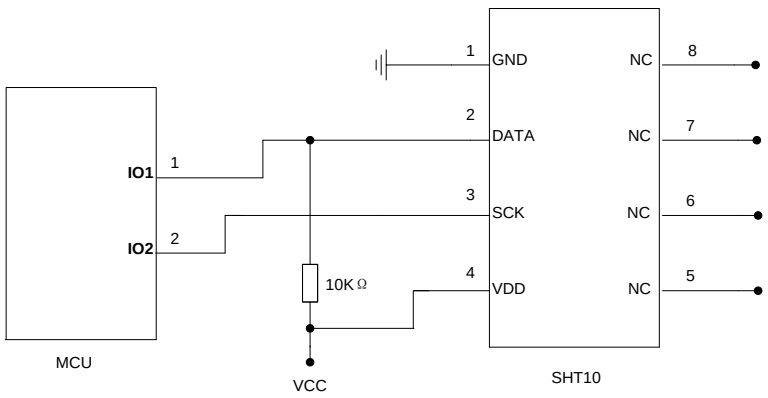

Figure 3: microprocessor hardware connection diagram with SHT10

2.3 Circuit Design

After the performance and price were compared between LCM1602, LCM3310 and 12864, the system was decided to use 12864 as the system display. Its greatest feature is the large display characters with rich content, and cheap price of 18-25 Yuns. 12864LCD can support graphical display and images. 12864 LCD moduleis shown in Figure 4.

Nokia3310LCD modules were connected with the microcontroller circuit as shown in Figure 5.

Figure 4: 12864 LCD Module

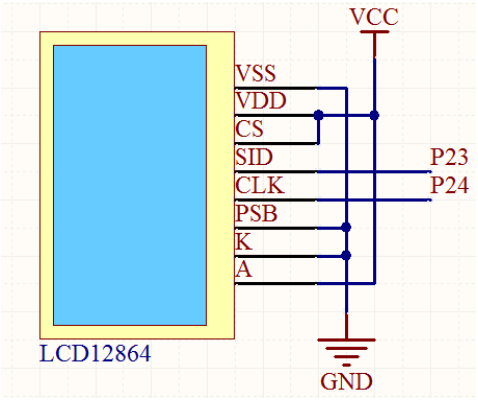

Figure 5: SCM and 12864 connection diagram

2.4 Alarm Circuit Design

Interface circuit design just consisted ofa commercially available piezoelectric buzzer, which is then driven through the beep sound of a microcontroller port lines. Piezo buzzer is about 10mA drive current to drive a transistor. In the Figure 6, P1.3 input terminal was connected to the base of the transistor. When P1.3 outputs a high level "0", the transistor was turned on at both ends of the piezoelectric buzzer about +5 V voltage tweet; When P1.3 outputs a low "1", the transistor is turned off, and the buzzer stops sounding. Voice circuit is shown in Figure 6, and LED alarm circuit is shown in Figure 7. LED lights are from top to bottom, in turn, with upper and lower temperature and humidity alarm limit alarm.

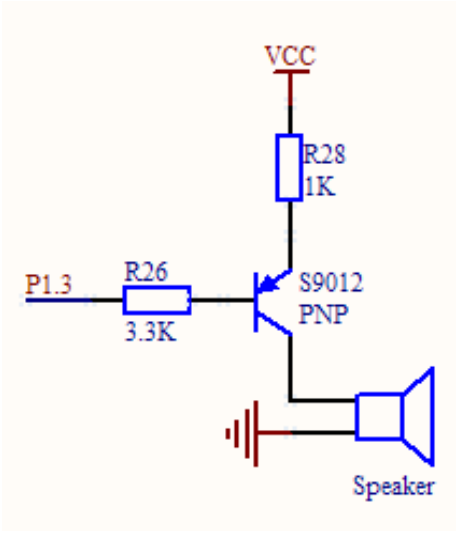

Figure 6: Transistor drive circuit buzzer sounds alarm

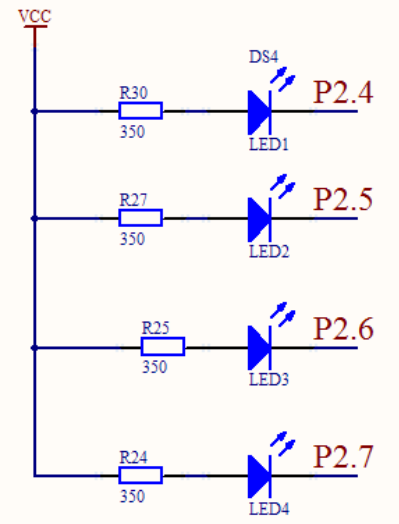

Figure 7: LED alarm circuit

This design is the lower limit of the temperature and humidity, and temperature and humidity measurements are prompted to do beyond the police, and the interface is located at SCM P1.3 mouth.

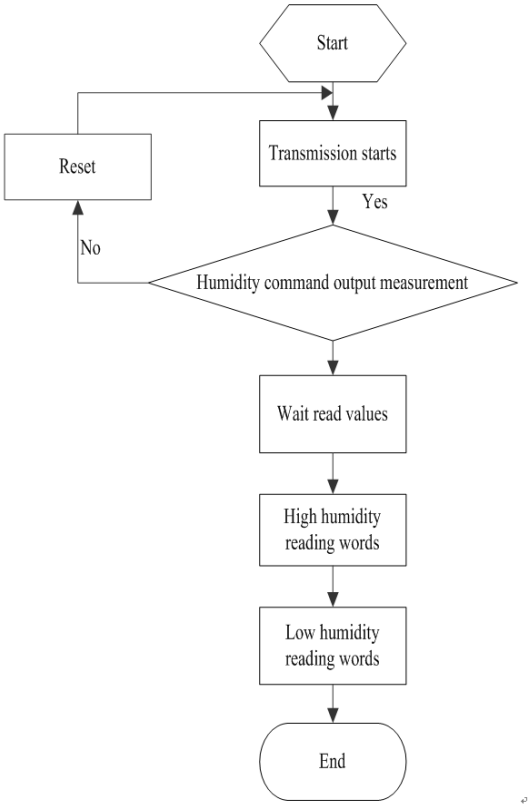

Figure 8: Program flow measuring temperature and humidity

3. System Software Design

3.1 Temperature and Humidity Measurement Program Design

DHT11 temperature and humidity sensor program is divided into two parts: data reading program, temperature and humidity reading program. Data reading program only reads school inspection data of temperature and humidity. Temperature and humidity reading program includes sending the start signal, the data read and data checksum, and the response needed to be judged on the DHT11. If school inspection is successful, it just reads the temperature and humidity. Temperature and humidity measurement subroutine flow chart is shown in Figure 8.

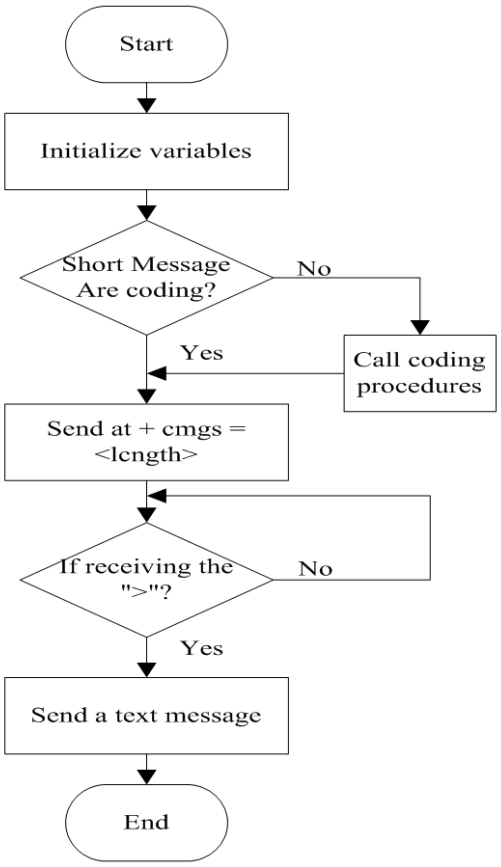

Figure 9: SMS program flow

3.2 Microcontroller Programming Send Message

Sending a short message is as follows:

1).The short message center number, other numbers, and short message content are encoded into PDU format;

2). To calculate the length of the short message, Send AT + CMGS = <long><CR>, <CR>representatives , and carriage is ASC Ⅱ code 0x0D;

3). Wait TC35i module returning ASC Ⅱ characters ">" ,PDU data can be entered. PDU data CTRL + Z end (sending 0X1A) as a terminator. Send Message flow chart isshown in Figure 9.

3.3 Short Message Programming Microcontroller Read

Receiving short messages uses a timer periodically serial query. After a short message arrives, the computer can receive instruction <CRLF> + CMTI ": SM", INDEX (short message storage location) <CRLF>. PDU data reads command AT AT + CMGR = INDEX <CRLF>, and executes the command module returning in PDU format just received short message content. After receiving a short message in PDU format, the short message is decoded withthe decoded message including the sender's phone number, a short message transmission time, and a short message content. Receiving short messages flow chart is shown in Figure 10.

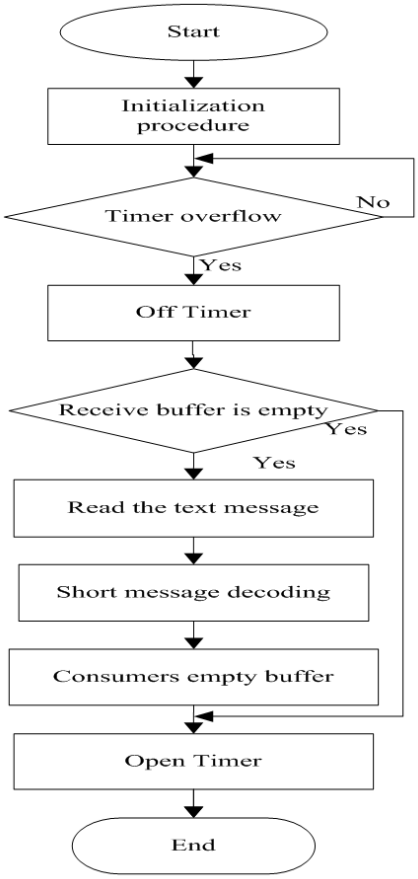

Figure 10: Receiving SMS program flow

4. System Test

4.1 System Test Environment and Requirements

The test used serial debugging assistant V2.2 as a serial communication tool. System testing hardware before inserting the first power-SIM card is shown in Figure 11. System will eventually be able to achieve real-time temperature and humidity of the scene in the form of short messages fed back to the control center. Due to the controller data storage space limitations, system control commands uses GSM module identification number to identify the monitoring center. When identifying a control center module on the specified phone numbers, it automatically sends short messages of spot temperature and humidity in Chinese. The system

sets temperature limit at 30 degrees, and the upper limit of the humidity is 80% RH. When the system temperature and humidity reach the short-range limit, it automatically sounds and lights alarm, in the form of short message sending information back to the user's mobile phone. Chinese short message system automatically sends in the form: the current system is XX.X degree temperature, humidity XX.X%.

Figure 11: GSM module physical map

4.2 System Analysis of Test Results

After turning on the power GSM module, Power LED is lit when 600ms / 600ms put out, and TC35i ongoing network logins. LED is lit while waiting 75ms / 3s put out, indicating TC35i logged into the network in the standby mode. Through the sending district serial port communication interface, AT, and press Enter, then sending and receiving area to return OK, As shown in Figure 12, the module is working properly. ATE can be turned off using the echo command, as shown in Figure 13.

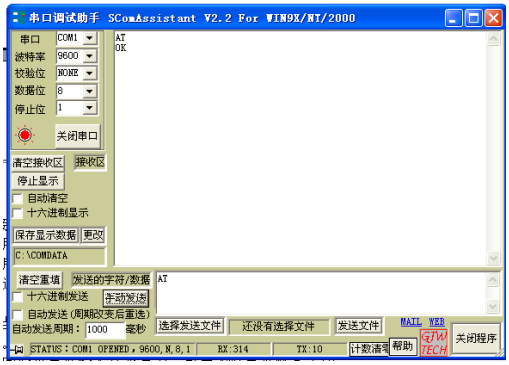

Figure 12: Module start properly

Figure 13: Echo interface

Normal test temperature display values are shown in Figure 14 and Figure 15.

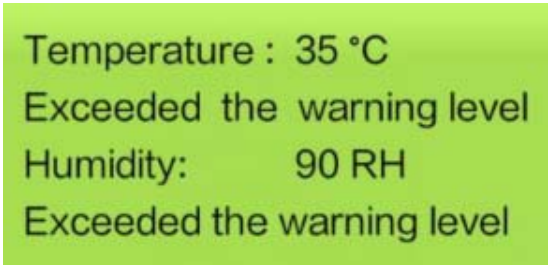

Figure 14: displays the temperature and humidity values

When the detected temperature and humidity exceeds the upper limit, a warning message is sent to all mobile phones, and alarm information are displayed as shown in Figures 15 and 16.

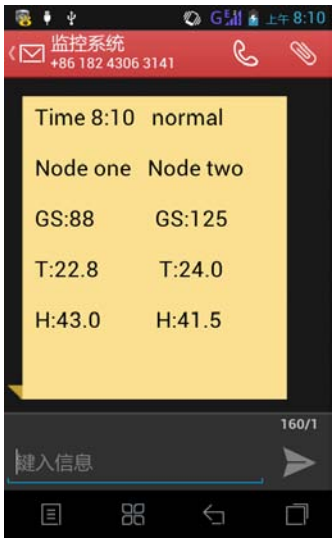

Figure 15: Temperature alarm

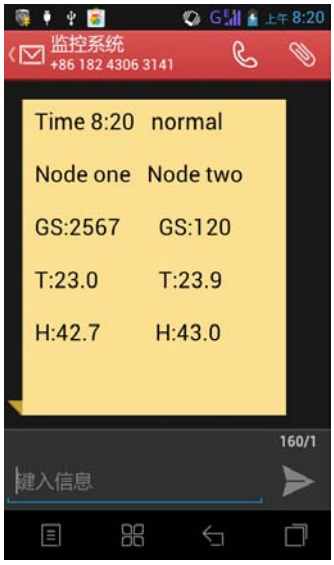

Figure 16: Humidity alarm

5. Conclusion

In this paper, the temperature and humidity of a GSM-based remote monitoring system was designed with AT89S52 as the core site monitoring terminal system so as to achieve the temperature and humidity with the collection, short messaging and human interface functions. TC35i GSM module through the monitoring central station communications accepts instructions and uploads information in real time so as to achieve an on-site remote monitoring center monitoring of temperature and humidity. Experiments show that the system transmission , which not only has low error rate and reliable communication with good market prospects, but also provides a new approach to achieve high-efficiency remote monitoring.

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