Weather monitoring system based on STM32 and OneNet Internet of Things platform

Ji Zhenglin, Ren Bin*

School of Electronic Engineering and Intelligence, Dongguan University of Technology, Dongguan China 523808

*Corresponding author’s e-mail: renbin@dgut.edu.cn

Abstract: The weather monitoring system is based on the Internet of things platform, which is used to monitor the computer room and other places with strict requirements on environmental factors (such as temperature and humidity). It is of great significance to study how to obtain external meteorological information and internal environmental factors, to conduct visual design, and to deal with abnormal data alarm. The weather monitoring system designed in this paper USES STM32F103ZET6 as the main control chip, and the atk-esp8266 and SIM800C as the auxiliary module, and USES the tft-lcd LCD module as the display (to achieve the purpose of meteorological visualization), develop in the ‘keil u Vision4’ development environment using the C programming language.

1. Introduction
Meteorological monitoring system is a weather station and alarm system designed around the city weather and indoor temperature. The weather station realizes the visualization of urban weather and indoor temperature. In addition, it also uses the OneNet China mobile Internet of Things platform to realize the indoor environment state view at any time and anywhere on the mobile phone and PC. In addition, the alarm system is an emergency response to rapid temperature changes, which can effectively avoid unnecessary losses caused by excessive temperature.

The meteorological monitoring system is based on STM32. With STM32F103ZET6 as the core and ATK-ESP8266 module as the main transmission tool, the weather server is connected in STA mode, the weather information packet is captured, and the data parsing is realized in the central processor.

Through the above steps, the weather information of the day and the next three days can be obtained. By using the interface design, it can be displayed on the TFT-LCD screen, which is equivalent to a weather client. In addition, indoor temperature can be measured by DS18B20 temperature sensor ambient temperature, the value can also be displayed on the screen, easy for users to compare indoor and outdoor temperature difference. When the user is not indoors, it can be viewed through mobile phone terminal. In addition, when the measured temperature is compared with the weather temperature and reaches the severe condition, the alarm system will be triggered and the user will be informed of the situation by sending a short message through SIM800C.

2. Hardware platform design
In this paper, the hardware platform is independently designed and developed, and its main control chip is STM32F103ZET6. Reset circuit, vibration starting circuit and filtering circuit are built to constitute the minimum system. The peripheral device is equipped with ATK-ESP8266 and its peripheral circuit to achieve WiFi networking function and communicate with the server through TCP/IP communication.
protocol; The peripheral device is equipped with SIM800C module and its peripheral circuit to realize
GSM communication. 3.4-inch TFT-LCD display displays program running status and weather
information. In the power supply part, voltage regulator module and buck module are used to output 5V
and 3.3V voltages for the system.

From circuit schematic diagram drawing and PCB layout and wiring to final debugging and welding,
the hardware platform is completed independently.

2.1 Power circuit design
The power supply circuit is responsible for providing the power supply needed for the operation of the
entire hardware system.

Because the TFT-LCD display screen used requires large power, so select 12V rechargeable battery
and voltage regulator module and step-down module integrated IC, can output 5V and 3.3V voltage.

![Figure 1. Power supply circuit](image)

2.2 Peripheral circuit design
The peripheral circuit mainly includes liquid crystal screen circuit, ATK-ESP8266 module circuit,
SIM800C module circuit, DS18B20 single bus circuit, key circuit and filter circuit. The LCD screen
circuit is mainly controlled by the chip’s own FSMC interface TFT-LCD. In addition because the LCD
screen interface display needs to use the font, so here to increase an external storage font W25Q128
(FLASH) to provide the font.

![Figure 2. ESP8266 and SIM800C circuit diagrams](image)  
![Figure 3. W25Q128 chip circuit diagram](image)
3. Overall design of software system

In terms of overall software programming, we transplant the UCOSIII kernel files, create different tasks, assign priority and stack space for various tasks, use kernel files for task scheduling and management, and make use of the communication between tasks. The tasks created mainly include: screen display task, weather information acquisition and analysis task, LED task, information upload task, temperature acquisition task, alarm task. The screen shows the task with the highest priority.

The general process of the program is as follows: First, WiFi obtains the weather information packet from the server, and displays it in real time in the LCD screen after the analysis is completed. In addition, the temperature data obtained through DS18B20 is also displayed in the display screen after processing, and transmitted to OneNet China Mobile Cloud Platform through 2G network through SIM800C. If the temperature is abnormal, the SIM800C module needs to inform the user of this abnormal situation through SMS, so as to take measures to avoid losses.

3.1 Weather information acquisition program design

ESP8266 module communicates with the main control chip through USART2. Firstly, ESP8266 is configured as TCP passthrough mode through AT instruction, and then connects to the target TCP server. After successful connection, passthrough begins. The cJSON data stream obtained from the target TCP server is stored in the serial port buffer. Once the data is obtained, CJSON data parsing begins. First of all, FATFS file system was transplanted to manage the required files in the parsing process and the display font library. The GBK12 font library was used in this paper. In the process of CJSON parsing,
C language structure, enumeration and other programming ideas are used to build all kinds of structure containers, write related functions to realize data packaging parsing, so that the parsing algorithm is more optimized.

3.2 Program design for obtaining and uploading temperature data
The DS18B20 selected in this paper is a "one-wire bus" temperature sensor launched by Dallas Semiconductor Company. It is a new digital temperature sensor with small size, wide applicable voltage and simple interface with microprocessor. The one-wire bus structure has the characteristics of simplicity and economy, which enables users to easily build sensor network, thus introducing a new concept for the construction of the measurement system. The measurement temperature range is -55~+125℃, and the accuracy is ±0.5℃. The field temperature is directly transmitted by the digital way of "one line bus", which greatly improves the anti-interference performance of the system.

It can directly read the measured temperature, and according to the actual requirements through simple programming to achieve 9~12 digital value reading way. It operates in the voltage range of 3~5.5V. After obtaining the ambient temperature value every minute, the system will upload the temperature data to the Internet of Things platform, so that users can view the temperature situation and the change rule of temperature objectively on the webpage.

3.3 Implementation of alarm procedures
Filtering is achieved in the obtained temperature value, when the system ambient temperature is 50 degrees higher than the atmospheric temperature in five consecutive measurements. It sets off an alarm. The warning method is that SIM800C sends The user "The temperature is too high!" by sending a short message. This text message is to inform the user.

4. Result Analysis
The design of this paper is carried on the UCOSIII operating system, which has good real-time performance and good system stability. At the same time, the algorithm optimization solves the problem that ESP8266 and SIM800C modules are easy to send instruction failure, which affects the work of the whole system.

In general, the whole system has good stability and strong extensibility.

5. Conclusion
This paper designs a weather monitoring system based on urban weather and the Internet of Things. The system realizes the visualization of urban meteorological information and environmental temperature, and analyzes the data, and takes warning measures to inform users of abnormal data in abnormal circumstances. The system realizes real-time and effective monitoring, which can greatly reduce the workload of temperature measurement. In addition, the design of this paper combined with the OneNet Internet of Things platform, in line with the development trend of The Times.

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