Data Acquisition System of Water Treatment Equipment Based on GSM

Yuan Huijiang

College of Automotive Engineering,Weifang University of Science and Technology

Shouguang , 262700,China

email: 542428979@qq.com

Keywords: STC12C5A60S2; GSM network; Data collection

Abstract. The system uses STC12C5A60S2 microcontroller as control core of the system, the use of special ADE7763 energy metering IC to collect data to construct a developed a high precision, small water treatment equipment data acquisition.Collect real-time data storage and transmission timing via GSM network to the host computer, the system has high accuracy, good stability.

Introduction

With the shortage of water scarcity, for the re-use of treated water is particularly important, so it is imperative to raise the level of water treatment equipment, monitoring and control of the parameters of how the era of high-precision water treatment equipment, water treatment equipment is conducted in important performance indicators.The system mainly uses micro-control technology will be collected temperature, humidity, and device current, voltage signal is saved and uploaded regularly.

Structure and Working Principle of the System

System structure shown in Figure 1. This system uses STC12C5A60S2 microcontroller as core, mainly by the acquisition module, GSM transmission module, data storage module and power module.

System works: the system, the data acquisition module belonging to the monitoring center with water treatment equipment, the data acquisition module will transmit the data after the simple analysis to the microcontroller, after extracting the valid data stored in the data storage module.When the data acquisition module exceeds the limit set by the system or the lower limit of a certain time interval, the system should send alarm information to management personnel for maintenance on staff. Data collection terminal regularly collected data uploaded to the host computer database for management analysis. And thus periodic water treatment equipment for data acquisition and transmission.
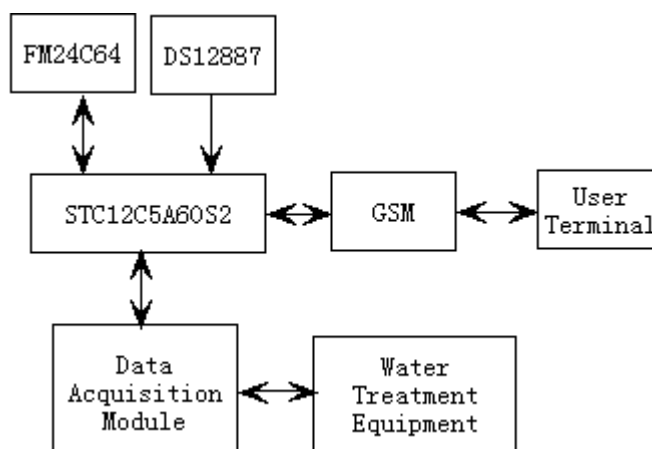

Fig.1 System Block Diagram

The Hardware of the System

MCU Selection. The system microprocessor selection STC12C5A60S2 microcontroller, STC12C5A60S2 51 is the next generation single-chip microcontroller Acer Crystal Technology's high-speed, low power consumption, super anti-jamming, the instruction code is fully compatible with the traditional 8051, but the speed of 8 to 12 times, Operating voltage at 3.3V ~ 5.5V (5V MCU), the working temperature -40℃~+85℃[1].In particular, the work requirements in line with the external environment, STC12C5A60S2 microcontroller biggest advantage is internal non-volatile EEPROM features can be used to store a variety of data, but also has two full-duplex serial communication interface, for this system, serial Port 1 can be used to collect data, two serial ports to connect GSM module for sending data to the host computer.

Data Acquisition Module. STC12C5A60S2 SCM also provides a serial communication interface --SPI interface, SPI is a full-duplex, high-speed, synchronous communication bus, SPI interface measurement chip ADE7763 and data memory FM25256, the microcontroller via SPI bus data intermittently the cycle of acquisition and storage, but not simultaneously. Connected as shown in Figure 2.

Acquisition metering chip ADE7763 module applications are Analog Devices has introduced a dedicated energy metering chip, with high accuracy, good stability, SPI-compatible serial interface advantages, enough to measure active power, apparent power, the instantaneous voltage and instantaneous current, the root mean square value of voltage and current data, such as electricity. there are two data collection system, one is set by the system cycle time regular data collection; the other one is when the user command is received in real-time data collection. This greatly improves the system microcontroller SPI bus utilization and efficiency.

In addition to the acquisition of voltage and current signals of water treatment equipment, but also capture the temperature and humidity and other parameters, the system selected Sensirion company's digital temperature sensor chip SHT11. The main advantage is the high accuracy and the sensor will measure temperature, humidity measurements, functional signal conversion, A / D conversion and heaters integrated in one; anti-jamming; simple communication with the microcontroller, saving time acquisition device space.[2]

Storage Module. The design of the storage module selection based on ferroelectric memory chip technology FM24C64, FM24C64 is 64kb serial ferroelectric memory chip RAMTRON provided, FRAM (Ferroelectric Random Access Memory) has a non-volatile, using the SOIC-8 package. Use I2C bus interface to achieve the data read and write operations between the microcontroller, the main achievement of the WP pin chip chip write protection, the pin is low, the chip can be written to the chip; the pin is high then on the part of the storage area of the chip as a hardware write protection,as it is the protected area data write operation can not be performed, but only read the data.

The design of the master host microcontroller STC12C5A60S2 SCL P3.1 and P3.0 port pin FM24C64 memory and SDA pins.In order to ensure proper reading and writing data between the microcontroller and FM24C64, must work program the microcontroller to generate the proper timing of serial data, and taking into account the make SCL, SDA remain high, the serial data line connection the pull-up resistor .Design principles storage module is shown in Figure 2.
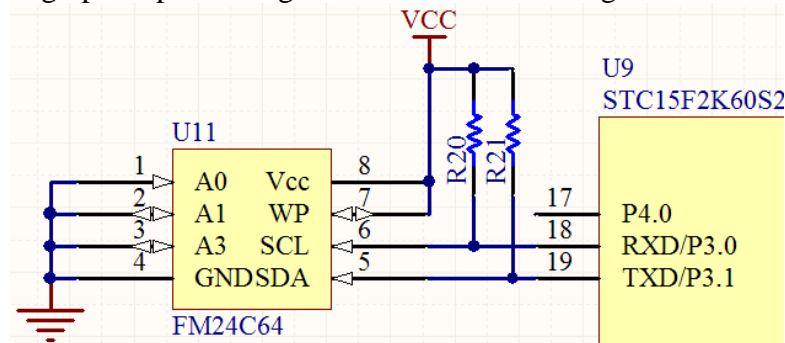

Fig.2 Single-chip peripheral hardware connection diagram

GSM module.GSM wireless communication module uses SIMCOM's SIM300 module, SIM300 is a tri-band GSM / GPRS module, the next may EGSM 900MHz in worldwide, DCS 1800MHz, PCS 1900MHz three frequencies, can provide up to ten New months, and supports a variety of coding schemes. SIM300 during use low-power design, the sleep mode current consumption of only 2.5mA.

GSM module and microcontroller serial STC12C5A60S2 2 connections, data processing capability serial port 1 priority 2, so to ensure the stability of the system for data collection and effectiveness. Upon receipt of the SMS commands and data acquisition time of conflict, will give priority to data collection. It is also widely used dual serial microcontroller STC12C5A60S2 main reason.

Part of the system software

The system software including the software with collection device and PC software with database software design , lower computer software acquisition system using C language, flexibility, portability and strong.

Lower machine mainly includes acquisition system initialization, data collection, data processing, data transfer and alarm communications, the entire software flow chart shown in Figure 3.
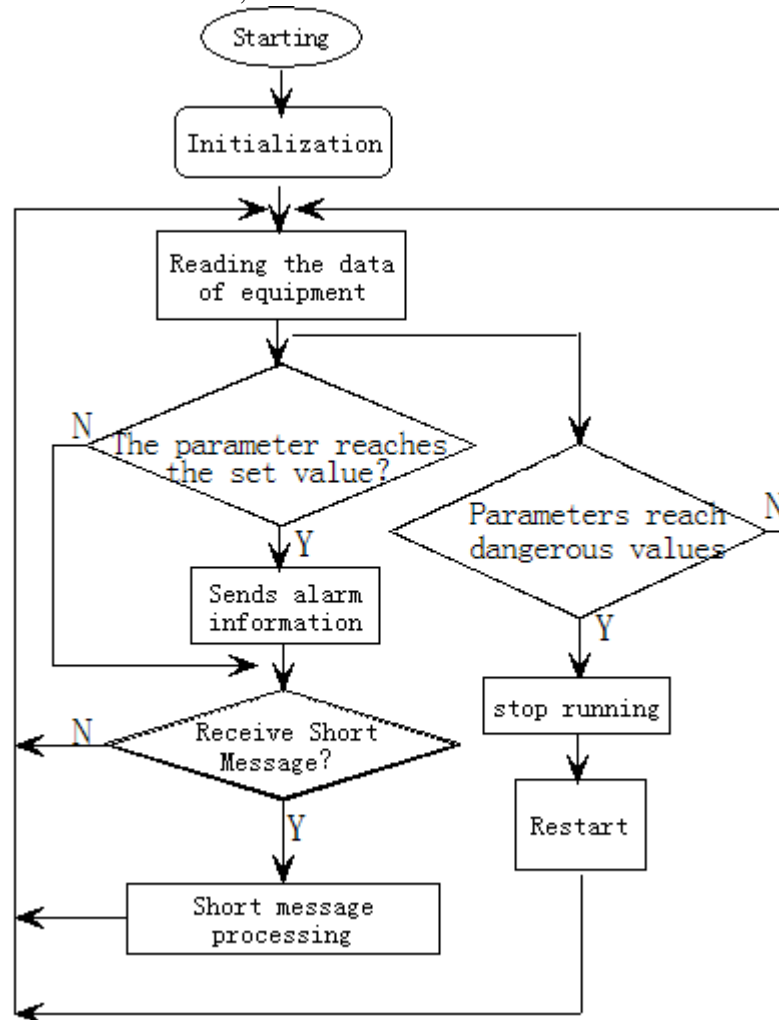

Fig.3 Lower computer software flow chart

Summary

This device utilizes the now mature GSM network resources, water treatment equipment is designed for the important parameters of the device acquisition, full use of the microcontroller STC12C5A60S2 dual serial ports, etc., by connecting the measurement chip ADE7763 and

temperature sensor SHT11, the system accuracy reliability and stability essential to meet user requirements. In the actual production, due to low cost of communication systems, has been vigorously promoting the use. But with advances in communication technology, 3G and other high-tech network-based data transmission will be over GSM networks .

References

[1] Dj.M. Maric, P.F. Meier and S.K. Estreicher: Mater. Sci. Forum Vol. 83-87 (1992), 119

[2] STC micro，STC12C5A60S2 Single chip device manual，http://www.stcmcu.com/；

[3] Feng Xianying，Ge Rongyu．The Temperature /Humidity Measurement and Control System Based on Digital Temperature /Humidity Sensor SHT11[J].Process Automation Instrumentation,

,2006(01):59-61.

[4] Li Fuwei．The Application of Ferro-Electric RAM to Data Processing and Correspondence of

SCM Data Acquisition System[J]．Programmable Controller & Factory Automation,2008.02

[5] FM24C64 Chinese Handbook：http://www.doc88.com/p-397369715216.html

[6] ZHANG Yong-qiang.Intelligence supervisory system of greenhouse on RS[C],Communication Technology,2006.ICCT'06.International Conference, 2006:1-3.