

# THE DESIGN AND REALIZATION OF EMBEDDED WIRELESS DATA COLLECTION SYSTEM

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**Abstract:** The paper gives a method that greenhouse data collection and supervisory system based on GPRS (General Packet Radio Service) network is designed and implemented. It discusses chiefly a scheme, which uses ARM microcontroller to control GPRS module and make use of SMS(Short Messaging Service) to complete greenhouse data collection and supervision, and supplies a design program of the hardware and software, the communication way has better timeliness ,without room limitation.

**Keywords:** GPRS, SMS, ARM, Data Collection

## 1. INTRODUCTION

The data collection and supervision in the greenhouse profession still is limited to the local area network with the 485 communication protocol. Although this way can meet the data supervision and processing, but the cover scope is small, the line maintenance quantity is big, the noise pollution in the electric power carrier will cause the correspondence not to be unreliable, moreover, intelligence supervisory system of greenhouse based on GPRS uses GSM/GPRS wireless network as the communication way, not only can solve the above problem, but also can widely be applied in other professions.

## **2. SYSTEM PROFILES**

Intelligence supervisory system of greenhouse is a set of comprehensive computer system used in the upscale greenhouse, each greenhouse installs one, supervises the greenhouse warm target and so on humidity through sensors and carries on the automatic control to the greenhouse corresponding equipment to realize the climate parameter value which the greenhouse needs. Realizing one to multi-spot communication through the GPRS network, according to certain communication protocol, it may realize data gathering, the user forces to intervene the active state of the microcontroller and the equipment failure long distance reports to the terminal.

## **3. SYSTEM REQUEST AND FUNCTIONAL DESIGN**

The system construction needs to meet and complete some basic long range data gathering and the transmission request, simultaneously, considering the demand of satisfying the market development and the economical dispatchment, having the dominative ability for input or output of switch quantity and prohibiting disturbance ability. According to the system demand, the function which the system needs to provide is as follows:

(1) data collection function: voltage or electric current standard signal which converted through the sensor and bridge circuit turns the digital data after A/D transformation, These data may carry on the GPRS long-distance transmission through the monolithic integrated circuit by the short news way.

(2) data submission function on SMS: the control center may transmit the communication order to carry on the data collection, phone terminal number revision and to force to control the running state of switch quantity.

(3) control ability: the controller can dominate pad\_pump、evaginable window、fan and so on through supervising the temperature and humidity in the greenhouse.

## **4. HARDWARE DESIGN**

### **4.1 Hardware structure**

The remote data collection terminal is consisted of the sensor, the monolithic integrated circuit, the GPRS module and so on, it chiefly completes the environment data gathering and communicate with phone

terminal device through certain protocol, its realization principle of hardware is shown in figure1.

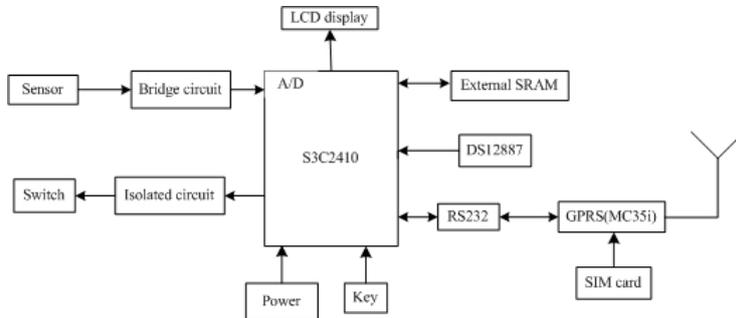


Figure 1

## 4.2 Hardware explanation

(1) CPU: The S3C2410 offers outstanding features with its CPU core, a 16/32-bit ARM920T RISC processor designed by Advanced RISC Machines. The ARM920T implements MMU, AMBA BUS, and Harvard cache architecture with separate 16KB instruction and 16KB data caches, each with an 8-word line length.

(2) Data collection: the Pt100 of temperature sensor can output 4~20mA standard electric current through bridge circuit, the humidity sensor SA801 applies standard current output so that it does not carry on the non-standard electric quantity transformation.

(3) Store unit: data storage can deposit the data outside which gathered, it selects 32kb static RAM, because of the battery in its interior, so, after the system power failure, it can preserve each gathering data and the user setting values.

(4) Clock part: it selects the DS12887 of American DALLAS corporation which arrives precisely the second and reads the current time for CPU.

(5) Serial port part: because GPRS module brings the RS232 level by itself, but MCU serial port is the TTL level, so, it should carry on the level transformation through the MAX232 chip.

(6) Man-machine contact surface: the data display part uses the LCD12864 liquid crystal, the keyboard response part uses the THINK82C79 control.

(7) Control output: in order to reduce the electromagnetic interference, the output unit uses the photoelectricity isolation technology, thus, selecting light pair MOC3061 and the silicon-controlled rectifier Z4090 chip.

## 5. SOFTWARE DESIGN

### 5.1 AT instruction

For realizing SMS transmission, we must conform to AT instruction of the GSM communication, AT instruction which chiefly used in the article is shown in table1.

Table 1

AT instruction	Function
AT+CMGF	Select SMS message format (0=TEXT, 1=PDU)
AT+CMGS	Send SMS message
AT+CMGR	Read SMS message
AT+CMGD	Delete SMS message
AT+CSQ	GPRS network exist?

For example, the article send short message by text model, the procedure transmission data as follows:

```

AT+CSQ<cr>
+CSQ: 21,99 //network exist
AT+CMGF=1<cr> // set text model
AT+CGMS="phone number"<cr>send message <ctrl/z>
    
```

condition. The SMS communication makes use of serial port interrupt characteristic of the MCU, it can reach the data collection and compulsion operation to the terminal device, its SMS procedure process is shown in figure2.

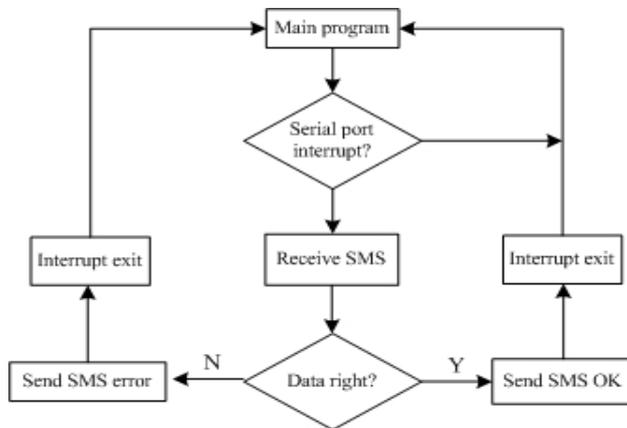


Figure 2

## 5.2 SMS subprogram

- (1) the subprogram that MCU receives AT instruction is follow:  
RECEIVE:LD AX,#BDH;storage unit  
LDB CL,#06H;datacount  
RECEIVE\_1:DI  
RECEIVE\_2:LDB BL,SBUF  
JBC SP\_STAT,6,  
RECEIVE\_2 STB BL, [AX]+ DJNZ CL, RECEIVE\_1 RET
- (2) the subprogram that MCU receives AT instruction is follow:  
SEND:LDB CL,#30H;data count// sen message to certain phone  
number+CMGS:199//sendback OK

## 5.3 Program design

The main program unceasingly compare with setting values of the user through gathering external environment condition, it will carry on the corresponding control command when satisfying the LD AX,#00H ;data base address

```
SEND1:LDB BL,#00H  
LDB BL,DATA4[AX]  
LDB SBUF,BL  
JBC SP_STAT,5,$  
INC AX  
DJNZ CL,SEND1  
RET
```

## 6. EXPERIMENT RESULT

The user can edit the corresponding communication instruction which sent to the GPRS(TC35i) module via AT command orders, in order to manipulate the controller, for instance, one group operating results are as follows:

- (1) access to the current temperature and humidity:

the back result which is shown on the cell phone by sending communication order LY1 is that: the temperature: 16.6°C and humidity: 26.6%.

- (2) open and off equipment: order LY2 which is sent denote that the equipment is ran ,on the contrary, it will close the one by the order LY3, the back result is: success, if the result do not return, it may the SIM card debt or equipment failures.

(3) host set: by sending order LY4, in order to a cell phone always can control single or multiple device, the back result : host lock.

(4) alarm on and off set: the back result on the cell phone is that the alarm setting is ran by sending order LY5, when it reach the alarm condition, it will send SMS to the host phone, on the contrary, it will close the alarm setting program by sending order LY6.

(5) targeted set: LY6+temperature number+humidity number of the order format is sent, for example, the order LY6+27+29 denote that current goal temperature: 27°C, humidity: 29%, the precision only can reach integer here, the back result: targeted set success.

## 7. CONCLUSION

Along with the constant development of industrial modernization and new technologies evlvement, data collection and remote supervision is entering a phase of rapid development. Because of adopting GPRS network, the system is a more advanced technology, it is easy to replace a lot of cable-based communications systems similar, whether for automatic meter reading system, or temperature measurements, environmental supervision, marine oil fields, have very good prospects for development.

## REFERENCES

- Aljadhai, A.; Znati, T.F.;“Predictive mobility support for QoS provisioning in mobile wireless environments”, Selected Areas in Communications, IEEE Journal on , Volume: 19 Issue: 10 , Oct. 2001, pp. 1915 — 1930.
- Application of Image Gather Based on the S3C2410 Platform and Embedded Linux [M].Micro computer Information, 2006, 22
- C. F. Grecas, I. S. Venieris, and D. -D. Koutsouris; “Uninterrupted Data Transmission over GSM and Application to Health.
- Camargo J.R. An evaporative and desiccant cooling system for the air conditioning in humid climates. Journal of the Brazilian society of Mechanical Science and Engineering[J], 2005,27(3):243-247.
- Eginton. Evaporative cooling saves energy costs. Engineering Technology[J],2005,8:39-408(6):1667-1675.
- Engineering and Manufacturing Co. Muskofgee, Oklahoma, 2003, 5 (7) :727~741.
- R. Pandya, “Mobile and Personal Communication System and Services”, IEEE Press , ISBN 0-7803-4708-0,2000.