International Journal of Computational Intelligence Systems and Applications. Volume 4, Issue 1, (2016) 29-34
http://www.cayley-nielson.com/ijcisa/

Design of Distance-data Acquisition System Based on GPRS

Xiaodi Zhou[1], Jun Xiao[1], Nianmin Bei[1], Ning Yang[2]
[1]Electrical Department of Zhenjiang Technician Institute , Zhenjiang, China
[2]School of Electrical and Information Engineering, Jiangsu University,Zhenjiang, PRChina
Corresponding author: Xiaodi Zhou
E-mail: *497891066@qq.com, 674129543@qq.com, 1294996354@qq.com, yangning7410@163.com*

Abstract

This paper mainly discusses and designs a remote data acquisition system based on GPRS network communication. It discusses a scheme, which uses AT89C52 micro-controller to control G20 and make use of SMS to complete remote data acquisition. For the remarkable advantage of GPRS communication technology applied to middle and low speed rate date transmission, GPRS wireless data acquisition system is of high feasibility and high performance price ratio. The scheme is all- purpose and can be applied to many fields, such as industry control, finance industry and transportation .etc. The design of remote data acquisition system based on GPRS service will be of vast prospect of development.

Keywords: GPRS, Data acquisition, SMS, and Micro-controller.

1. Introduction

Now days in china, there are still no economic and practical automatic remote data acquisition system which can be used to monitor the nature resource such as water resource, electricity system, natural gas .etc[1-3]. In most application areas, those kind of monitoring work still relies on manpower[4]. Due to the large distribution of monitoring station, there are still many problems in the existing remote data acquisition system such as telephone line transmission, power carrier transmission, which includes small coverage, large maintenance of the basic line system as well as the unreliability of transmission caused by noise pollution of the carrier wave[5]. As the development of digital wireless communication network based on the GSM and GPRS, which could provide a new approach to those problems mentioned above[6-7]. In this paper, a brand new data acquisition by using short message to realize the remote data acquisition based GPRS network had been introduced, which could also be used to monitor and acquire data of remote environment and nature resource.

2. The relationship between GPRS and GSM

2.1 GPRS technology

GPRS is the abbreviation of General Packet Radio Service based on the foundation of GSM network, called 2.5th mobile communication technology, combining the wireless communication with Internet closely[2,5]. GPRS has a lot of advantages playing as a fast, efficient, economic wireless communication system, including large network coverage, wide bandwidth of data transmission, strong adaptability, the cost calculation relies on the data flow, always online .etc. which is especially applied to intermittent and paroxysmal data transmission or frequent and little data transmission as well as large amount of data transmission occasionally[4]. So, GPRS can be used to acquire and monitor the both way data transmission. As the development of GPRS technology in the mobile communication, many filed

ISSN 2331-1924 /
April, 2016

requiring the data transmission can also be realized by GPRS, also, it also has provided a new method of data transmission.

2.2 GSM short message service

GSM network is the most applied wireless communication network, which the widest coverage rate in china. In this paper, the SMS service has used to realize the functionality mentioned above. SMS service is a value-added services which could transport the user`s group message with the controlling channel of GSM network and accomplish the storage and front turn signal of data with short message service center, so it is especially applied to little data transmission. In the other way, SMS use the common controlling channel so the communication will not be influenced by the short message. The advantages of short messages service include low-cost of single data, no occupation of voice service. By using those kinds of advantages and both-way transmission performance, remote data acquisition and remote controlling can be realized easily. So attempting the short message of GSM network as a data transmission method has many advantages such as wide network coverage, low investment and low operating costs .etc. It has the incomparable advantages when used in large distribution and unstable monitor station.

2.3 Relationship between GPRS and GSM

There are many advantages when GPRS used as the carrier of sending a message, GPRS network system could contribute to overcome the defects of low data transmission rate, and it also can divide the information into group with the support of advanced core network signaling applications. Because of using the same short message system, so it has no influence on the service and customer and the service environment won`t be influenced by the extension of network, in this condition, short message service and GPRS system can complete each other. In one hand, short message system can provide wide and easy access to the service, on the other hand, GPRS has improved the functionality as well as provide all the advantages while adding the short message service in data acquisition and transmission.

3.System architecture design

The remote data acquisition terminal is composed of sensors, MCU, GPRS communication module and so on. Analyze and process the data from the remote data. Meanwhile, it also accord to the order from remote data acquisition module. The corresponding action is completed by the remote data acquisition module.

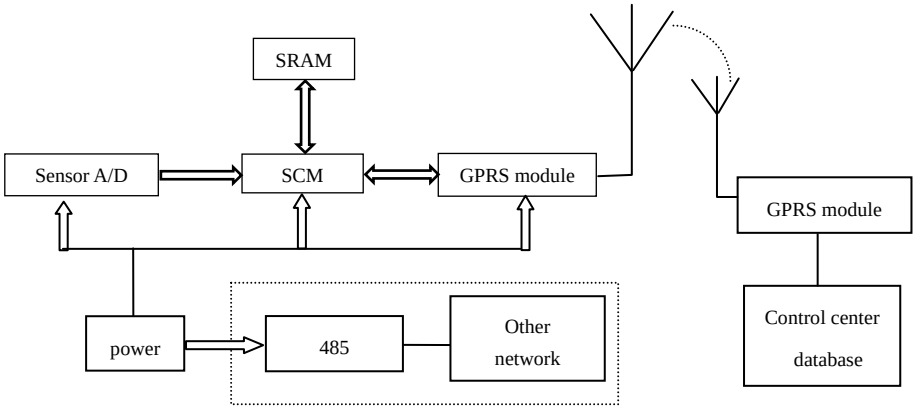

Fig. 1. The remote data acquisition terminal is composed of sensors, MCU, GPRS communication module and so on.

The scheme of the system design is to use the short message to collect remote data though the GPRS communication module, so we should make a acquaintance with sending.G20 supports order set from GSM07.05.This order set was published from ETSI , including the controller of SMS. Using the Serial port of AT89C52 send a series of orders from AT To achieve the purpose of controlling the G20 to send and receive SMS. Through asynchronous communication interface to achieve the SMS control has three kinds of protocols: AT based Text command set Mode AT, based on the Block command set of Mode PDU and Mode.PDU Mode is a method of sending and receiving SMS. The SMS text is transmitted after sixteen code started.

4. Design of system hardware

This system use G20 module to realize the remote data collection in GPRS network coverage area.G20 , Wireless dual band modem , was published by MOTOROLA , mainly use to speech transmission, sending message and providing data service with radio interface, G20 integrate a complete RF circle and a GPRS base band processor. Particularly suitable for the development of some of the GPRS wireless applications. such as monitoring, scheduling, vehicle and remote control system. It also can become a internal product to transmit voice and data, it has a very wide range of using.

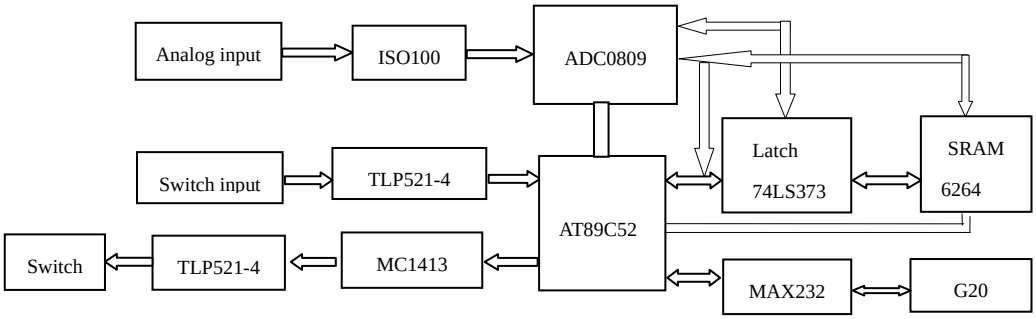

Fig. 2. The whole process of the system

The whole process of the system is as follows: the internal data become standard signal through sensors, transmitter and so on after linear photo electrical isolation, though the A/D convert, converted into digital; The switch`s input after though photo-couples, MCU use to control switch output. The output is driven by the reverse driver and the photo-couples. The data collected and the state of the switch are transmitted through the main control program of SCM and GPRS modem(20 module).This system is sent by short message, the sent introduction code stays in short message, when the message is received from the host computer and decode the short message to extract control command, execute the correspond operation, the operation result is encoded into short message and sent back to host computer. All kinds of state information will be known when the host computer receives the short message from the machine through decoding.

The system use AT89C51 to control the main chip, it can omit the external program memory in the circuit design, reduce the area of the PCB board, and also improve the reliability of the whole system. Since the system is dealing with a short message string, 256 bytes of RAM is not enough to handle a large number of string data, so a static memory 6264 is connected to the chip, which has the capacity of 8K bytes to meet the requirements of the system. The analog to digital conversion circuit use ADC chip to complete the function of A/D conversion. In order to expend circuit, the system needs to add some

peripheral circuits, such as the switch input and output, in its input channel, in order to prevent disturbance from outside we should take quarantine measures. The common way of quarantine measure is transformer coupling or photoelectric coupling, transformer coupling only use to transmit alternating signal, the size and consumption are high, easy to product electromagnetic interference. But the photoelectric coupling can transmit various signals, it also has the advantages of small size, low power consumption, strong anti-interference performance and so on, so the system uses a photoelectric coupling. In the output channel, in order to control the high electrical equipment operation, generally with a driver, at the same time to prevent the strong electromagnetic interference or power frequency voltage through the output channel cross dressing into the measurement and control system, it also need channel isolation technology and photoelectric isolation technology, because light signals to transmit without electric field, magnetic interference can effectively isolate the electrical signal.

The system wireless data transmission module uses G20 GPRS MOTOROLA wireless module, through the way to dial in China Mobile's GPRS network.

GPRS wireless communication network based on GSM network is built, by GSM circuit transmit into packet switching, support the TCP/IP protocol, the theory of the highest rates of up to 171 KBPS , GPRS network is well suited for data quantity is little , transmit the environmental data wireless at once.CPU module through the integration of RS - 232 interface with the G20. Because the CPU module serial ports do not agree with the G20 module level between serial interface, so it should add level conversion circuit. In the system, using the G20 module to transmit data in data communications, used for receiving and sending data of equipment data terminal equipments that are called DTE. DCE is a equipment, used to connect the DTE and data communication network. In this system, the micro-controller is DTE, the G20 module is the DCE.

5. Design of system software

There is still a need of design of system software beside the need of hardware design. Due to the chosen single chip is MCS-51, so all the software is written in assembly language.

5. 1 Main program design

Main program is the description of all system charts (shown as fig.3). The functionality of this main program is completing the initialization after powered on, including the setup of baud rate is 9600bps, the working model of timer T1 is 2 and the timer T0 is 1 as well as the working model of serial port is 1, corresponding with ms, s, min as the initial value of calculation, other way, set INT0 as the edge trigger mode. After the initialization of the program, follows the cycle data acquisition of eight channel with 10 groups data of each channel and each time acquisition can be realized by the outside interruption of INTO. When the data acquisition has completed, the data would be proceed and waited to be send. In the next step, the on-off state data also will be stored in the cache and waited to be send after processed by input-output processing program, which is controlled by the time interrupt. All the data acquisition and on-off state data will be performed half an hour a time.

Data processing subroutine :Average filtering method is used for data processing, the sampling data accumulative sum 10 times in a row, at the same time, find out the maximum and minimum values, then minus the maximum and the minimum in accumulation, deposited average quantity, which according to the eight times the sampling value for a quick effective samples values in the send buffer .Turn signals (or rotate tracking). The composition of the GPS receiving system frame.

The working principle and process of the system is: after the signal from the antenna, after preamplifier to RF front end, under the RF front-end for frequency conversion, will into intermediate frequency signal, A/D transformation in intermediate frequency, into A digital intermediate frequency will be sent to the receiver channel for processing. The FFT of input signal multiply the local produce complex conjugate of the pseudo random codes of FF, finally to inverse transformation IFFT of product, and got all the chips interval relative value. If all the signal on the phase is smaller than the preset threshold, adjust the modulation signal to search local. Otherwise, stop to search into the track. By extracting pseudo range information from the carrier and phase tracking to a receiver processor, calculate the three-dimensional coordinate information.

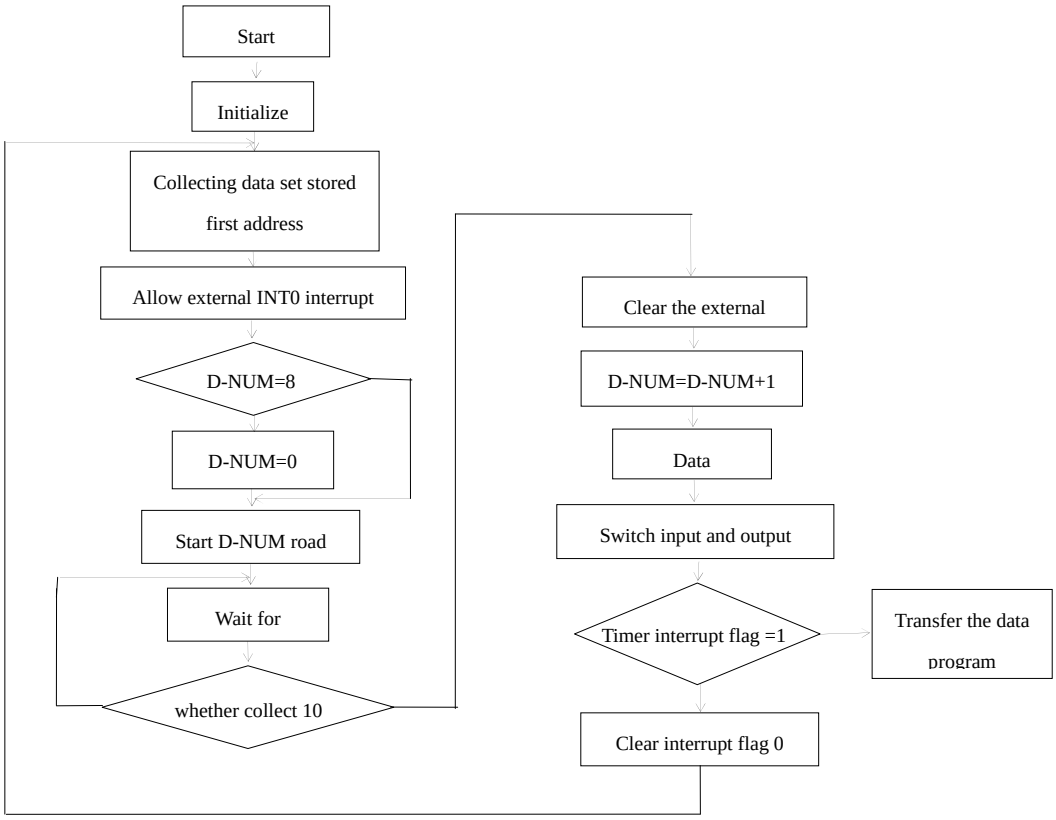

Fig. 3. Main program is the description of all system charts.

6. Conclusions

2 - DCCF satellite positioning signal receiving system has the following advantages:

Receiver system structure is simple. Simplify the design of antenna and RF signal processing part, Create the conditions for the development of high speed rotating cylinder micro small satellite positioning receiver.

Powerful software GPS receiver software. Compared with the traditional GPS receiver, the signal processing ability is stronger, especially in the harsh conditions through the storage and processing of information, which can realize to enhance information processing.

Innovative marketing assisted GPS receiver technology makes navigation precision is higher. GPS measurement space (3 d) position information, speed and time information (PVT) into the signal processor, processes the measurement data and calculation, to identify the actual trajectory; Resulting in a

navigation solution, provide the basis for trajectory correction fuze to carry on the simple guidance; At the same time, the fusion of inertial combination (accelerometer and gyroscope) measurement information, realize the two-dimensional trajectory correction fuze trajectory identification better.

Innovation point of this article is: to solve the two-dimensional trajectory correction (on a satellite receiving system in the rotation, location problem under the condition of high-speed stability. In fuze based on the analysis of the system, the reliable rotating under the condition of receiving satellite positioning signal circuit design is proposed based on software radio technology of rotating cylinder (satellite positioning signal processing algorithms, and GPS/IMU information fusion of two-dimensional ballistic trajectory correction fuze identification method.

References

[1] Yang, F. U., and Z. L. Li. "Design of embedded remote data acquisition system based on GPRS." *Application of Electronic Technique* (2009).

[2] Wang, Xiao Dong, et al. "A remote weighting data acquisition system based on GPRS." *International Electronic Elements* (2008).

[3] Jin-Yong, F. U., and A. W. Guo. "Design of data acquisition and transmission system based on zigBee wireless sensor network and GPRS network." *Electronic Design Engineering* (2011).

[4] Ionel, Raul, G. Vasiu, and S. Mischie. "GPRS based data acquisition and analysis system with mobile phone control." *Measurement*45.6(2012):1462-1470.

[5] Zhang, Xuemin, Z. Xiong, and S. Pan. "Design and Implementation of Bridge Remote Data Acquisition and Monitoring System Based on GPRS Network." *Proceedings of SPIE - The International Society for Optical Engineering* 7128(2008):71281B-71281B-6.

[6] Lianming, W. U., and S. Chen. "Remote Data Acquisition System Based on GPRS Communication." *Modern Electronics Technique* (2009).

[7] Jiang, Yi Feng, and H. U. Lin-Na. "Wireless Long-distance Copies the Table System based on GPRS Theresearch and the Realization."*Computer Knowledge & Technology* (2007).