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Design of wireless monitoring system based on GPRS

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Abstract
In industrial production and daily life, there are many occas ions where wireless technology is required, especially in high-risk locations, where no w iring or una ttended location can be found. This paper proposes an em bedded wireless m onitoring system based on GPRS , which uses the ARM processo r as the co re, collects data and im ages by the cam era and sensor, and transm its the data wir elessly by GPRS net work, to realize the purpose of wireless rem ote m onitoring. This paper introduces the overall framework of the system, and the re alization of hardware a nd software are analyzed, and also analyzed the techn ical principle and protocol, fi nally re alizes tha t th e user can send control commands by the m obile phone term inal, and the comm ands can be transmitted to the m onitoring term inal through the GPRS network. According to the command, the proces sor carries o ut the data acquisition and im age shooting, and then sends those data back to the user term inal, so as to realize th e wireless remote monitoring of data and images.

With the developm ent of computer technology and the m aturing of im age processing techniques and algorith ms, monitoring system based on embedded system[1] [2] play s a n incr easingly im portant ro le in industrial technology and da ily life. Especially in the warehouse unattended, high-risk environment or rem ote places, th e dem and of wireless monitoring is very urgent. In this paper, we present a wire less rem ote monitorin g system based on GPRS, and the overall design of the system according to the functional requirements of the system. The function of the system can be divided into thr ee parts: the command receiving part, the field data acquisition detection part , and the rem ote data transmitting part, the d esign of ha rdware an d software for the sys tem are introdu ced in this paper.

1 GPRS Technology

GPRS is the abbreviation of General Packet Radio Service, which is a new packet data radio service based on the GSM [3]. GPRS is not suitab le for the frequent transfer of lar ge amounts of data, but very suitable for the use of the sudden, interm ittent, frequent, and a sm all amount of data transm ission, and for occasionally m assive data transm ission. This feature is v ery suitable f or the applica tion of dynamic shift Internet.

Compare to the trad itional se rvices, GPRS has great advantages as follows:

1. Real tim e online. th at is, u sers can keep in touch with the network anytim e and anywhere without interruption;

2. Low cost of system communication. Users can always online, but the system charges according to the num ber of data packets which the users have received and sent, no data traffic, no charge;

3. Fast and convenient system login. GPRS users can directly co nnected to the GPRS network as long as the phone is turned on, and use the network anytime only by a fe w seconds' activation;

4. Quickly transm it. The GPRS system adopts packet switching technology . The maximum r ate of data transm ission can reach 171.2kb/s in theory . Th e basic structure

diagram of GPRS is shown in Figure 1.

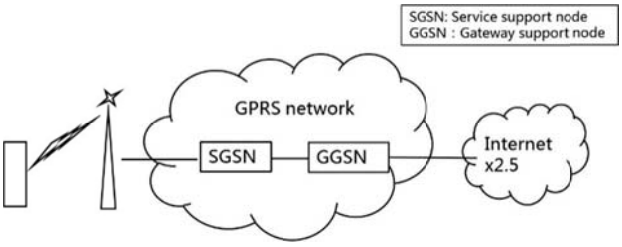

Fig.1 GPRS basic structure diagram

2 Structure and function of the system

2.1 System structure

The system is mainly divided into five parts: the monitoring part, the GPRS receiving and sending part, the embedded processing part, the image and data acquisition part, and the display part. The structure diagram is shown in Figure 2.

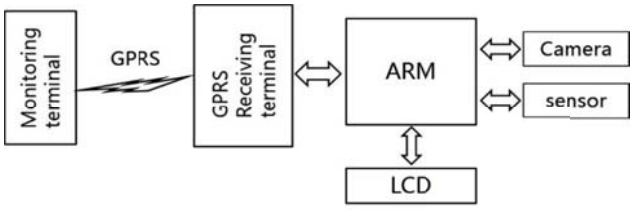

Fig.2 Structure diagram of wireless monitoring system

2.2 System function

The system can use ARM processor to control camera to collect image [4], and use the sensor to collect other parameters. After being processed in the ARM processor, the data can be sent to the monitoring end through the GPRS.

3 The main part of the system design

3.1 System platform

The embedded platform, S3C6410 platform, which is based on the SAMSUNG 16/32 RSIC microprocessor S3C 6410X is used in this system. The microprocessor, with a core ARM1176JZF-S, is generally used for handheld devices and the development of the mobile communication terminal.

The embedded platform S3C6410 is a high performance, general-purpose processing RSIC processor with high performance, which adopts the internal bus structure of 64/32 bit and the integration of AXI, AHB, APB bus, to provide the hardware performance optimization for 2.5G and 3G communication services, while relying on its widely used in terminal equipment on the features of low power consumption. The S3C6410 platform has good external memory interface, the interface communication speed, can meet in most communication service data bandwidth requirements, it still has a lot of hardware peripherals such as Camera interface, TFT 24bit true color LCD controller.

The system software platform based on embedded Linux and Qt/Embedded, completes driver transplantation of the Linux kernel, which includes network card, universal USB camera and LCD driver transplantation, while completes the QT graphics library with tslib-1.4 and lib jpeg libraries transplantation.

3.2 GPRS part

In this system, the GPRS module mainly completes the sending and receiving of information through the serial port AT command [5]. The command is control commands commonly used in the mobile phone, GSM/GPRS communication module, such as sending messages. At present most of the standard is the GSM07.07, which is the general standard of mobile phone communication.

In the actual application, manufacturers have modified the AT instructions accordingly, so the instructions are not exactly the same. The AT command usually has the following formats:

1.AT

2.AT+XXXX=XX

3.AT+XXXX="XX"

In system programming, the processor sends AT through the serial port to control GPRS as follows:

1. Set the parameters of serial port (115200);

2. Open the serial port;

3. Send the AT command according to

different requirements, and the n wait f or the module response, and the proce ssor is read y to receive the response interrupt;

4. After the return of the module is received, the processor processes the data;

5. The communication is co mpleted and the serial port is closed.

3.3 Image acquisition section

Video4linux2, re ferred to a s V4L2, is the kernel driver of Linux on the image acquisition, which can run in Linux. In Linux system, video image ac quisition i s consider ed to be the peripheral device file, which can read and write like ord inary fi les r ead-write device, the file path of video peripherals is in /dev/video0.

This s ystem use s V4 L2 to complete the image acquisition. V4L2 is mainly realized that equipment and opera tion of eq uipment wi th a series of callback function on the Li inux operating system, i t can set the cam era's frequency, frame r ate, vide o co mpression format a nd im age parameters. The i mage acquisition process is shown in Figure 3.

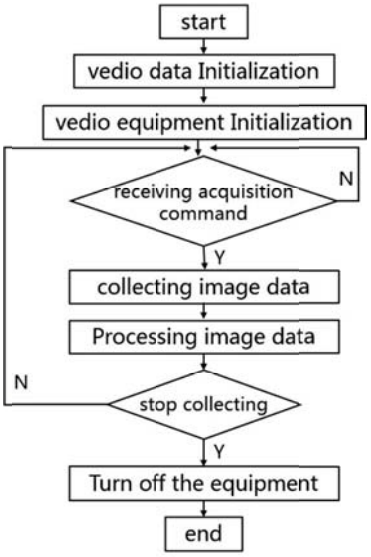

Fig.3 image acquisition flowchart

After t he sy stem collected i mage, the data was save d in kernel space, th e user can not operate on the memory mapping directly, so we map t he address of kernel space to the application me mory space by mapping the memory, that users can di rectly process the image data. I n the V4L 2, the MM AP functio n is used gener ally. After t he memory mapping is completed, t he em bedded platfor m S3C641 0 converts the image inf formation t o the dat a stream, and t hen trans mits the dat a stream t o the GPRS t hrough the se rial port o f the syste m with the AT command, a nd sends it to the client through the GPRS.

4 System testing

The syst em w as tested a fter being completed, t he comm unication is stable. Th e mobile phon e term inal sends test command, character com mands can be returned, and sends the im age monitoring command, real-tim e returned ima ges can be received s uccessfully. The co mmunication ti me is s hown in th e following table.

Table I Syste m testing result

mmunication massage type	GPRS receiving time (S)	Monitoring terminal receiving time (S)	Monitoring terminal average receiving time (S)
character	1～2	3～4	3
image （320*240）	1～2	19～22	20.5

5 Conclusion

The S3C 6410 proceessor and low powe r dedicated G PRS m odule was use d to des ign and im plement this sys tem. The s ystem use s GPRS to achi eve remote wireless transmission, which can fe d back the field i nformation an d image tim ely and stabl y accordin g to sim ple and convenie nt installat ion[6], can be used i n unattended e nvironment to m onitor high-ris k places, it can be withou t human p articipation, greatly saves manpower and material resources, the system is stable and meet the t ransmission of image and data of thhe wireless monitoring system.

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