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Design and Fabricate the Remote Monitor on the Scenic Spot Based on Integrated Sensor System

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Abstract: Based on the embedded Linux system, established the integrated sensing system to monitor the scenic spot and transmit the collected data to the users. The platform based on the ARM11 development board as the hardware of the system. Used the sensors to collect the different data and pictures and then they were transmitted by the wired and wireless mode. Set up the small Web server by the Boa (small Web server) and realized the integrated Web technology and CGI (Common Gateway Interface) program. According to the difference information of the scenic spot, the mobile platform collected the needed data and transmitted it to the control platform by the ZigBee wireless module and displayed in the embedded platform. The administrator can realize monitoring all the spots of the scenic and control the terminal equipments in the whole day. *Copyright © 2014 IFSA Publishing, S. L.*

Keywords: Sensor system, Embedded Linux, Remote monitoring, B/S mode.

1. Introduction

Today, all kinds of remote monitoring alarm system with its convenience, intuitive and variable attracted more and more people [1-3]. Especially with the rapid development of sensor technology, the remote monitoring system based on embedded device emerged, and has been widely used in all walks of life [4]. In this paper, a new B/S (browser and server) embedded remote monitoring system was developed and used in the scenic spot. Used the terminal equipment to monitor all aspects of spots. At the same time, user can through the browser to control the terminal equipment. It reflected the human-computer interaction perfectly and greatly reduces the cost of the system development.

2. System Structure and Function Design

2.1. The Integrated Design of the System

The remote monitoring system was divided into three layers: the equipment layer, the transmission layer and the interface layer. The architecture of the system was showed in Fig. 1.

In the terminal equipment layer, the ARM11 embedded board connected with USB camera [5], infrared sensor, sound sensor, light sensor and the temperature (humidity) sensor to monitor the spot information. Using the TCP/IP protocol [6], the information transmission layer sends the data which came from the terminal equipment layer through CGI interface to the user interface layer [7]. In the interface layer, the user login in and view the real-time data from the transport layer through the browser. The user can input the control information from the interface and control the terminal sensor. Through the three layers' complete information, the system realized the purpose of the display and control the monitoring spots in real-time.

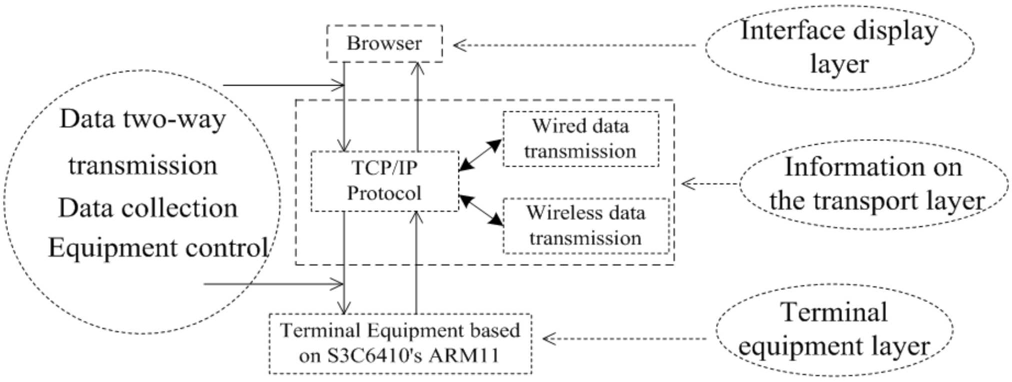

Fig. 1. Structure diagram of the whole system.

2.2. Hardware Structure of the Monitoring System

For the various considerations of safety, stable and transmission distance, the system transmitted the data in two ways; the wire transmission and the wireless transmission [8-9]. Different transmission modes corresponding to the different hardware and the hardware design as shown in Fig. 2.

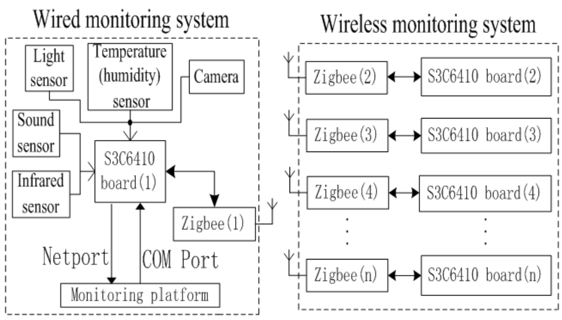

Fig. 2. Hardware structure of the system.

2.2.1. Hardware Design of the Wire Transmission

In the wired data transmission, using the No. 1 S3C6410 embedded board as the core board, through the SDIO extended port connected with the human body infrared sensor, the sound sensor, the light sensor and the temperature (humidity) sensor. Using the USB camera acquire the spot information of monitoring site. The embedded board connected to the PC and builds the LAN (local area network) through the network interface. The embedded board was controlled and programmed through serial port COM1.

2.2.2. Hardware Design of the Wireless Transmission

During the period of the wireless transmission, the system can virtual the same S3C6410 development board as a mobile platform named No. 2, 3, 4 … and etc. Because they have the same configurations with No. 1 embedded board, so the collected data can be send through the ZigBee module in real-time [10-11]. At the same time, the ZigBee module in No. 1 embedded board can be a receiver, the received data can be transmitted to monitoring platform.

2.3. Software Structure of the Monitoring System

2.3.1. Design of the Data Transmission Interface

In order to send the collected data to the user by a simple way and the user can view it directly [12-13]. The most ideal method is using Web Server based on the Boa, through the CGI public interface, to implement the data exchange interface, as shown in Fig. 3:

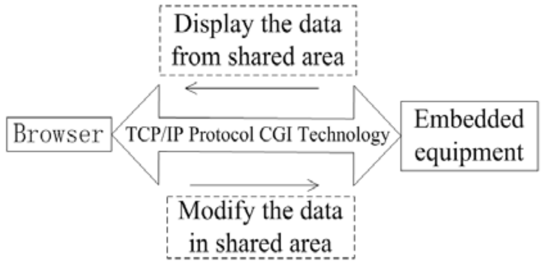

Fig. 3. Data transmission interface diagram.

In order to establish the Web server, the development environment was established on the PC platform through the Boa. In this process, several steps should be done: modify the configure files, modify the source code and compile the Boa program. After transplant the program to the development board, in the process of configure the Boa permissions, set the domain name, set the file storage directory, set the Web server. And then the data should be transmitted through the CGI coding technology.

2.3.2. Design the Software Program

The software of this monitoring system was developed and operated based on the Linux platform.

The control information can be viewed through the Windows or Linux platform. The system based on the B/S structure, using the TCP/IP protocol to transmit the data, to save the collected information through the established data sharing area and transmitted the sharing data to the monitoring platform. The sharing area is the database of the system with the function of the data control and maintenance. On the one hand, the collected data would be stored in shared area, and on the other hand, the system would determine the data whether abnormal or not. When the data is abnormal, the buzzer would alarm, when the data is normal, the alarm would be relieve. The specific process of software system as shown in Fig. 4.

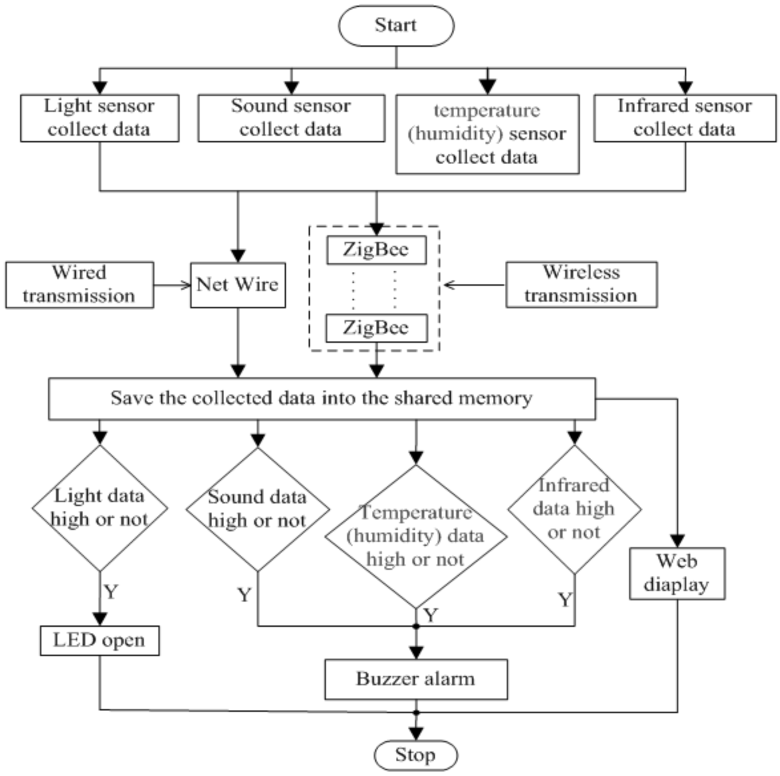

Fig. 4. Structure of the software architecture.

In order to obtain the data from the range of the monitored spot, the development board connected the USB camera, the temperature (humidity) sensor, the infrared sensor, the sound sensor and the light sensor with the SDIO port. Due to all the sensors need store the collected data constantly into the sharing area, the multi-thread coding technology based on Linux system would be needed.

Using sharing memory in the Linux system, created the shared database to store the collected data. And established the configuration files to save the system login account information and the value of each sensor and the upper and lower limits of the temperature (humidity). Programed the CGI with the C language, displayed in the web page by reading the sharing area. Whenever refresh the web page, the data would be acquired from the sharing area. At the same time, read the input data configuration files from the web page and control the system.

3. Simulation Results

3.1. Terminal Setting

In this system, set up the web page interface, users can easily control the terminal equipment; terminal settings interface as shown in Fig. 5.

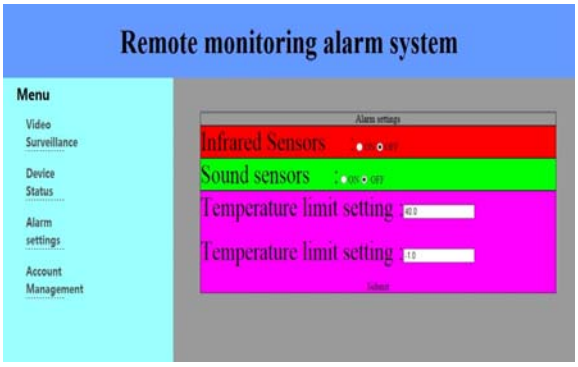

Fig. 5. Terminal setting interface.

The user can regulate the switch of the infrared sensor and the sound sensor to control the sensors in the monitoring spots, and the upper and lower limits of the temperature can be manually set.

3.2. Terminal Display

In the reality test mode, the system got the environmental data through the variable sensors. Form the human body infrared sensor, if someone located in the monitoring spot, the interface display “somebody”, or display “nobody”. From the sound sensor, if the environment sound exceed the upper limits, the interface display ”YES”, or display “NO”. From the light sensor, if the obtained ambient light bigger than the setting value, the interface display “bright”, or display “weak”. The temperature (humidity) sensors display the true value of the current environment in Fig. 6:

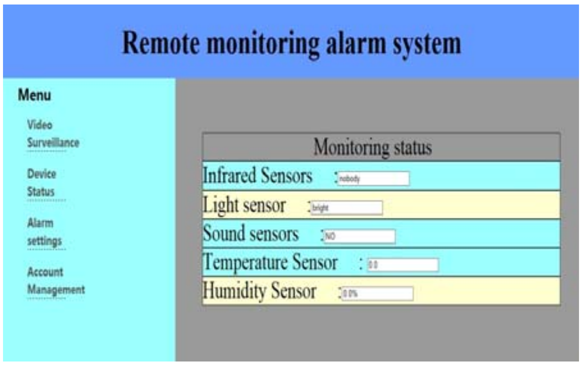

Fig. 6. Display interface.

Fig. 7 shows the various monitoring value in the acquisition monitoring area by each sensor.

4. Test Results

From the simulation results, the integrated sensor system can work very well in the monitoring spot. In this paper, the system was tested in the Huashan Mountain. The collected data was transmitted by the ZigBee wireless module in the situation without wireless signal. The picture was showed in the touch screen in the embedded platform and told other users the scene of the situation.

Fig. 7. Feedback test status data.

In the reality mountain spots, the wireless signals do not exist, so the mobile phone and the function of the mobile station will not be used. In this extreme situation, this integrated sensor system will help users to know the reality topography in time.

5. Conclusions

The remote monitoring system in this paper utilized the B/S mode, reduced the development cost and the maintenance is convenient. The integrated sensor system collected all the data and transmitted to the main control platform. The multi-thread data transmission mode guaranteed the wired transmission system safety and stable. For the wider mobility, the wireless data transmission system was developed. In this system, take the advantages of both transmission modes, protect the normal operation of the monitoring system and extended the mobile area and saving the resources.

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