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Wireless Network Based Mines Safety System Using ARM9

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ABSTRACT

The method of Mine Safety Monitoring System is becoming very important for the safety of the human [5]. The underground environment conditions (such as gas, temperature, humidity and other environmental indicators) will not be constant. This underground environment becomes hazardous and it is difficult for the humans to work in the underground. To make the safety of the worker, many safety systems are introduced. In early days, the safety system was only mechanical. The system is equipped with the hardware design of both the microcontroller and the ZigBee sensor [5][6]node and system software design.
The hardware system used here is MINI2440 microcontroller [4] as the main processing board, the AT89S52 8 bit controller [7] is used to acquire the sensor data as sensor board. The system uses S3C2440 32 bit microcontroller which has ARM9 processor. The system is based on Linux operating system. The software system is developed in the Linux platform [10] for the processing board and the application program is developed in the C++ language. The sensor board software is developed in Embedded-C language.

Key words: 89S52 Microcontroller, ARM9, HTML, HTTP, LINUX, MINI2440, OPENCV, RS – 232 and ZigBee [5] sensor.

1. INTRODUCTION

A system is something that maintains its existence and functions as a whole through the interaction of its parts. E.g. Body, Mankind, Access Control, etc A system is a part of the world that a person or group of persons during some time interval and for some purpose choose to regard as a whole, consisting of interrelated components, each component characterized by properties that are selected as being relevant to the purpose.
• Embedded System is a combination of hardware and software used to achieve a single specific task.
• Embedded systems are computer systems that monitor, respond to, or control an external environment.
• Environment connected to systems through sensors, actuators and other I/O interfaces.
• Embedded system must meet timing & other constraints imposed on it by environment.

An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market. An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc .Lower end embedded systems - Generally 8,16 Bit Controllers used with an minimal operating systems and hardware layout designed for the specific purpose. Examples Small controllers and devices in our everyday life like Washing Machine, Microwave Ovens, where they are embedded in.

2. SYSTEM WORKING

This project contains MINI 2440 Development Board which is of Friendly Arm Company. The Board consists of S3C2440 microcontroller with ARM9 processor which is having in built in memory of 1GB Nand Flash where we store program.

The ARM9 board [3] uses a 5v power supply. We have serial communication port which is interface directly with RS232 [8] cable to the PC. The program is transferred inside the memory by using the tool DNW. The program is programmed using QT creator which supports C++, in pc where Linux os is installed supported with OPENCV [11]. The board is supported by Ethernet connection for real time system and in built touch screen LCD monitor for display. The output of the project i.e.., viewing of videos can be seen inbuilt touch screen LCD monitor as well PC with LAN connection. The images are saved in external memory i.e.., SD card which is connected to the MINI 2440 Board as well as internal memory (NAND flash which is of size 1GB).

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2.1 Flow Chart

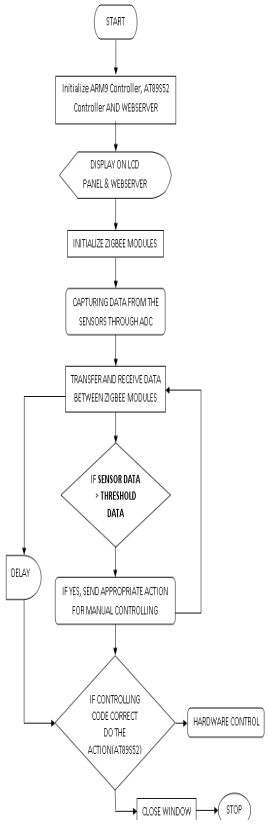


Figure1. System Software Design

3. HARDWARE DESIGN

The hardware, MINI2440 is a main controlling unit and AT889S52 is a sensing unit. The controlling unit receives the information from the sensing unit through the zigbee interface. And the controlling information from the controlling unit to the sensor unit is done through the zigbee. The zigbee module is interfaced through the RS – 232 [8]to the controlling unit. The zigbee module in the sensor board is interfaced to the Tx and Rx port of the at 89S52 controller. These zigbee module at both the microcontrollers are paired, which are bounded when they are powered.

The sensor unit is designed with the different sensors, the output of the sensors is interfaced to the multiplexer and ADC. The sensor unit is designed to control the external electrical appliances (like air blowers, lights etc). The sensor unit is powered with 5V power supply.

The MINI 2440 controller is based on the ARM9 architecture and this controller is interfaced with the LCD. The controller works on the 32 bit RISC architecture [1][2], the memory of the controller is used in the NAND mode. The controller is equipped with four USART ports; one of the ports is configured for the zigbee module. The controller is interfaced to the RJ – 45. The controller is connected to the webserver [12] through this interface on the private IP address.

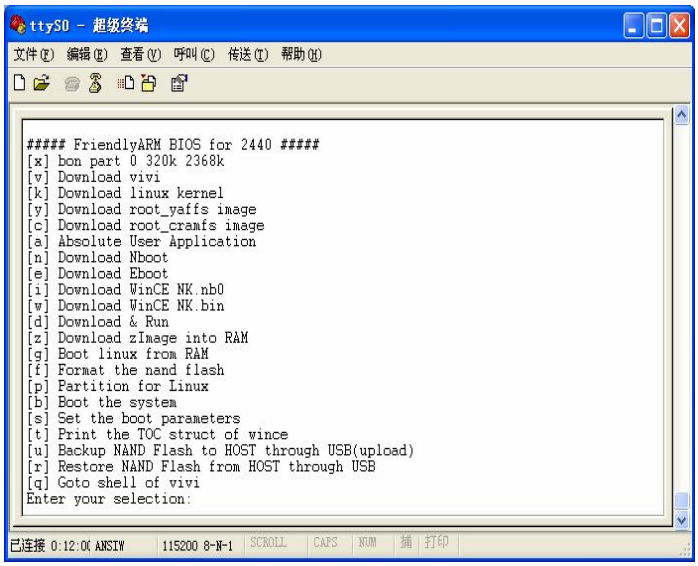
4. SOFTWARE DESIGN

The software for the mini 2440 controller is written in the linux 2.4 platform. OPENCV is used to develop the application, the application program is written in C++. DNW is the editor used to develop the application program and it is compatible with the OPENCV library packages.

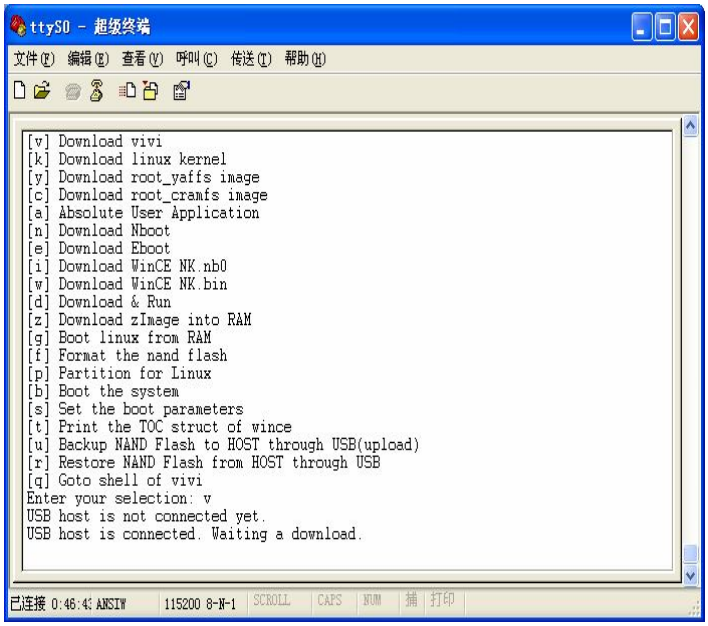
The mini 2440 software design are

Boot Loader, Linux Kernel [9], Root File System and application programming.

The mini 2440 controller is connected to the webserver and configured with the HyperTerminal for loading the program.



Installing Boot Loader



Installing Linux Kernel

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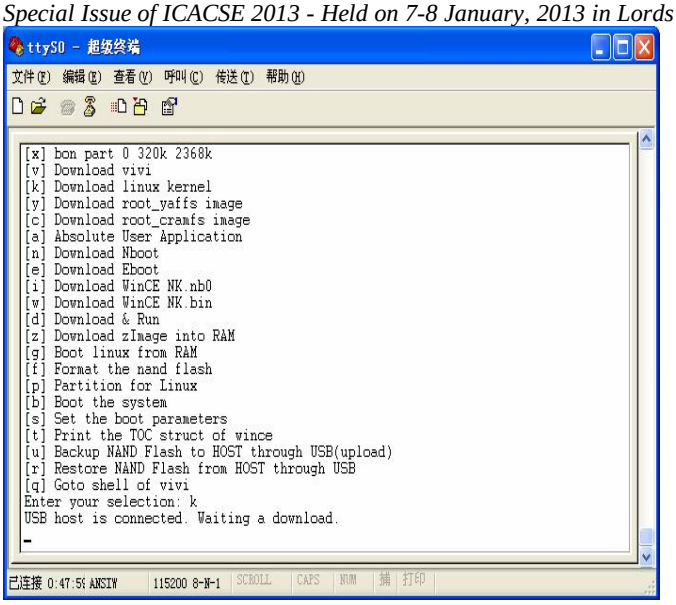
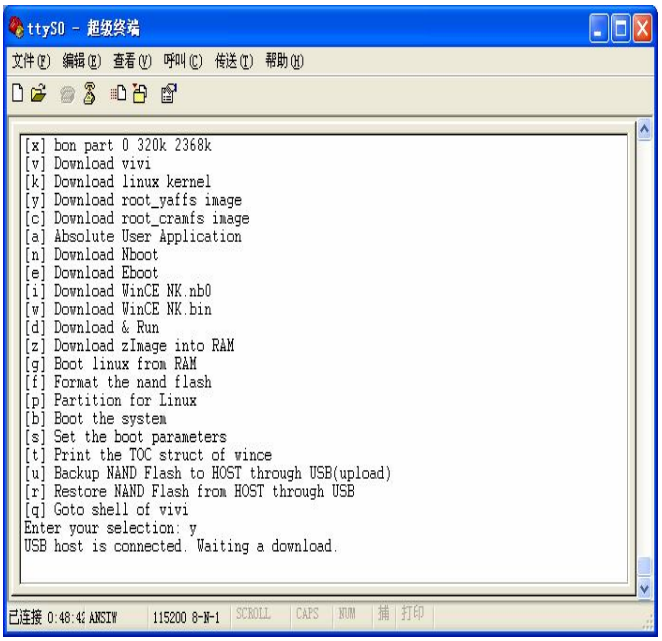


Installing Root File System



The software for the sensor unit is written in Embedded C. KEIL 3.0 uvision editor with C51 and ASM51 compiler is used for the development of the application program.

5. SYSTEM INTEGRATION

The controlling unit, with the zigbee module is placed at the controlling / monitoring station. There are more than one sensor unit in the field with individual zigbee modules. These modules are paired with the zigbee module at the monitoring station.

The sensor unit in the field continuously monitors the sensors reading and sends to the controlling unit time by time and this information is collected and displayed in the LCD. The same information is displayed on the webserver. The system software is designed to operate the electrical appliances in the field from the webserver or the controlling unit.

6. CONCLUSION

As a wireless communication technology, zigbee technology provides the safety monitoring problems in mines effectively. By using the controlling option in this system, the safety of the human becomes easy. By using the MINI 2440 ARM9 controller, sensor unit and zigbee technology, the system can be installed in the field.

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