

# Surveillance System Based On Zigbee Using ARM

Chetankumar Selukar

Department of Computer Technology  
Yeshwantrao Chavan College of  
Engineering, Nagpur, India  
[chetan.selukar@gmail.com](mailto:chetan.selukar@gmail.com)

Pooja Kullarkar

Department Of ECE  
TGPCET, Nagpur, India  
[pooja.kullarkar@gmail.com](mailto:pooja.kullarkar@gmail.com)

Shailesh Kamble

Department of Computer Technology  
Yeshwantrao Chavan College of  
Engineering, Nagpur, India  
[shailesh\\_2kin@rediffmail.com](mailto:shailesh_2kin@rediffmail.com)

**Abstract**— This is an application of surveillance system is used to implement a monitoring and controlling system using arm intelligent monitoring and Controlling System which uses Samsung's processor (S3C6410) as its key component. The ecological conditions within laboratory can be monitored using sensors and other devices are connected to sensor controlling board with the help of Zigbee technology. We are distributing predefined standards from sensor board to ARM11 board through RS-232 cable which is linked to UART port of ARM. Lab surveillance by webcam and streaming transfer it to controller which transmits data to remote PC through Ethernet. User can observed continuous streaming and also sensor's values. If user want to control devices based on sensor's values is possible through web page from remote location using HTTP protocol which always requests the server for controlling devices. We developed GUI applications using Qt and Linux drivers for various types of sensors.

**Keywords:** - FTP, HTTP, QT, RS-232 cable, UART, Zigbee.

## I. INTRODUCTION

Need of Monitoring and controlling a remote location such as lab, etc has been increasing in day to day life. This makes easy to control and monitor ecological condition of remote location from isolated place. This system has sensor controlling board with 8-bit microcontroller as the main component along with different sensors. Intelligent monitoring centre consists of ARM11 processor, several media and graphic co-processors and various peripherals. It is feasible to have significant high performance 32-bit microprocessors such as S3C6410, embedded Linux system and Qt / embedded GUI application to practical industrial control in certain occasion.

At present the management of the Domestic laboratories in the research institutes has issues of deprived real time, high cost and low accuracy. It is complex to identify the quality of the environment of the laboratory. So the Intelligent Monitoring and Controlling System should be developed for giving early warning, remote control, and additional functions. This paper focuses on the process and complex points in the application of embedded GUI based on Qt / Embedded and Linux device driver in the laboratory environment intelligent monitoring system.

Typically, programming, digital logic design and often a computer architecture course are prerequisites for the more advanced embedded systems or microprocessor design course that is the focus of this paper. For software development in the embedded systems industry, the C/C++ family of languages is still used in the large majority of new designs. Embedded

systems, microcontroller, or microprocessor design courses started out with low-cost 32-bit processors, but now a day development effort has moved on to modern System on-a-Chip (SOC) 32-bit devices that contain a reduced instruction set computer (RISC) processor with different memory and a wide variety of standard I/O interfaces, all on a single chip. According to annual industry surveys of embedded designers, 70% of new designs now utilize an operating system (OS), and 59% include networking. The widespread development of these new embedded devices with networking. Now that a single-chip microcontroller already contains the processor, memory, and numerous I/O interfaces, it is appropriate to use a higher level of abstraction. The application programming interface (API) of embedded C/C++ is used to enhance the performance and operating system operation. This paper describes the experience gained developing a laboratory to support development of these devices; it will primarily focus on the new technologies used in the student instructional laboratories during the first three offerings of the new course.

## II. SYSTEM TOPOLOGY

We developed the GUI applications based on Qt/Embedded and the Linux drivers for various types of sensors in the Intelligent Monitoring System using Qt (Embedded Environment) on the Linux platform. On basis of pedagogical outcomes from several laboratories, the design and development of this system has been carried out. The whole system has two parts which are Intelligent Monitoring System which contain ARM and Sensor Controlling System.

## III. OVER ALL SYSTEM PLAN

The block diagram of whole system is shown in figure 1.

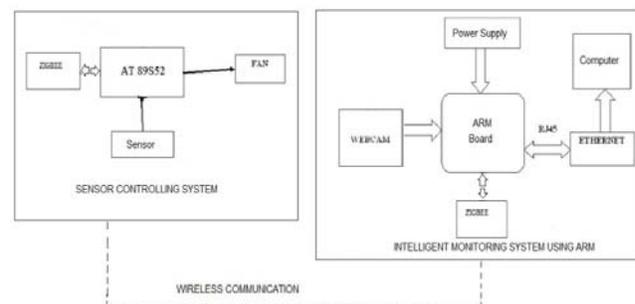


Figure 1: Block Diagram



Figure 2: ARM Board

The sensor controlling board contain one IC 8051 and monitoring system have ARM 11 development board. The Zigbee sensor technology is used for transmission and receiving data from controlling board to monitoring system and vice versa. ARM 11 board acts as computer or controller having the speed up to 533 to 750 MHz S3C6410X consists of ARM11 processor. ARM11 processor is connected to several memory controllers through 64-bit AXI-bus. IC 8051 is having speed up to 12MHz and is externally connected to ADC but don't handle USB camera that is shown in figure 3. This camera is connected to ARM 11 that has two USB port. In this system, we implement only one USB which connect to camera.

Embedded Linux operating system and web server run on the main controller to manage various types of peripherals such as sensors, camera. The sensors are atmospheric conditions sensing sensors like Temperature, Gas and LDR sensors. The conditions inside Lab are monitored by camera. RS-232 cable is used for Communication between sensor board and ARM board and done using UART. The monitored conditions are displayed on web page. The intelligent monitoring system (web server) has static IP. Using this IP user can view condition of lab. We use HTTP protocol to control devices from web page and link is established through Ethernet.

#### IV. SOFTWARE DESIGN OF ARM HOST CONTROLLER

##### A. Dumping of Linux Operating System

The transplant of Linux operating system is related with the hardware. Its modification prefers to the Linux operating system according to the concrete hardware platform to make it running on this hardware platform very well. The system's kernel edition is 2.6.32. The Linux operating system's transplant needs to complete three works: boot loader transplant, Linux kernel transplant and root filing system transplant. Boot loader is a small program which loads operating system kernel into memory and transfer control to it. The mainly role is initializing hardware equipment(including I/O, the special function register), establishing the memory space map and bringing the environment of the system's

hardware and software to an appropriate state. The Linux operating system's kernel be able to provide good support to the ARM processor and manage most of components which connect to the periphery of the controller. The embedded Linux kernel only requires providing support to the hardware which will be used; therefore we may cut the kernel according to the practical application.

##### B. System design

The overall software structure of the ARM main controller is shown in Figure. The system adopts Linux as the operating system of the ARM's main controller. The work needed to be done is: the porting of Linux in ARM11 board, the programming of the serial driver is used to read values from serial port and display the values on GUI window. The programming of touch screen driver is used for controlling the devices. The implementation of Web server is for monitoring and controlling from remote location. The system adopts of the graphical user interface based on QT/E and establishes a QT user interface to optimize the human-computer interaction environment.

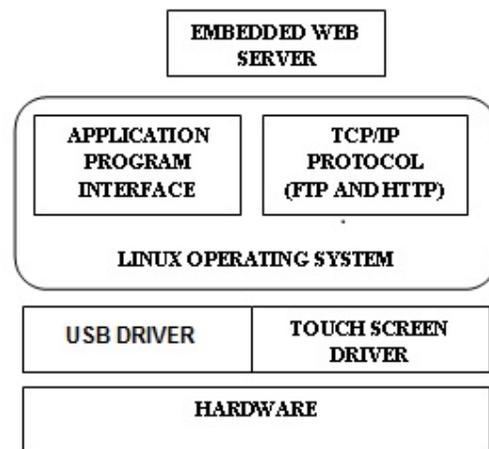


Figure 3: Software Structure of ARM 11 base controlling system

##### C. Data Management and Embedded GUI

The data storage, data analysis & data display and Storage of Sensor Data are three parts of data management for sensor networks. The ARM Intelligent Monitoring Center acquires sensor data via the sensor expansion board. Sensor expansion board with AT89S52 controller as its master chip is used for sensor and communicating with intelligent monitoring center. SCM software is the task of tracking and controlling changes in software include revision control and establishing baselines that used to obtain the status of each sensor and monitoring local data. It is able to send out an interrupt request signal. ARM intelligent monitoring center send control commands to SCM according to the definition of serial communication protocol, which returns the data of specified sensors according to the commands. The sensor local data is acquired and updated in a fixed time interval managed by SQLite database.

However, when the frequency of data acquisition is high, the data in the embedded database will be drastically increased and there is a need to clear the historical data, or the access performance of the database will gradually decline.

#### V. THE DESIGN OF GUI AND DEVICE DRIVER OF INTELLIGENT MONITORING SYSTEM

The design of GUI for embedded systems is different from that of traditional data computing class software, which frequently handles mouse or keyboard events to complete a explicit calculation, while the former mostly handle events caused by touch screen and other kinds of external devices. since the embedded systems is resource-constrained, the propose mode of the GUI of the conventional PC ,the memory consumption of which is relatively large and take up more CPU time, is not suitable for embedded systems. In this paper, RMCS uses Qt/Embedded under embedded Linux as its GUI application development platform, should be capable of fully satisfying the constraint of embedded system resources. As QT uses C++ as its programming language, it can implement hybrid programming with Linux C. The header files include both QT-API library and Linux system calls libraries. Write the Linux system calls as part of the slots functions which can respond to specific signals in order to achieve the combination of Qt / Embedded and Linux-C. Certainly, to achieve reading and writing of a specific device file, there should be device drivers which give reading and writing operation interface functions. Therefore, we require completing the preparing, configuring and modifying of the drivers of sensors, cameras and other external expansion device of S3C6410 microprocessor. The Laboratory Intelligent Monitoring and Controlling System use QT to complete GUI on the ARM head-end machine to achieve the graphical display of data collected by different sensors. This paper focuses on elaborating the design of the Linux drivers of various types of sensors and qtopia application in the system.

With the help of QT designer, the programmer can quickly develop relevant GUI window and adjust the size and position on that window. Also includes buttons and labels. By using labels we are displaying the current temperature, Light intensity concentrations of carbon dioxide and harmful gases concentration in the laboratory environment and showing whether the infrared sensors open or not. Using radio buttons we can also control (turn on/ off) the devices.

#### VI. EXPERIMENTAL RESULT

The controlling and monitoring of sensors present in remote location such as laboratory and surveillance images of environment are transferred to the web server is shown in Figure 7 and 8. Also it can control the devices from remote location by using the IP address of ARM board act as aweb server which is shown in figure 9.

The zigbee based wireless monitoring and controlling system using ARM-11 implements both real time image monitoring and automatically captured images of ecological condition.

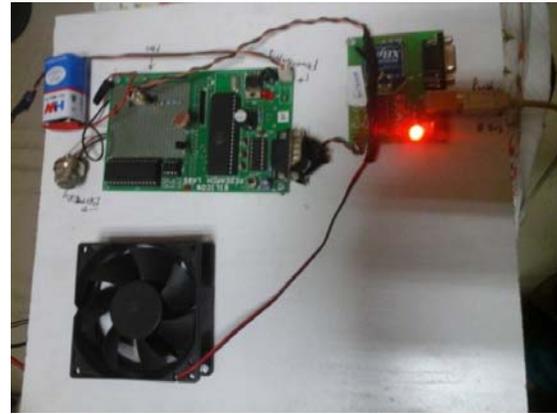


Figure 4: Sensor Controlling board



Figure 5: Monitoring and Controlling System ARM



Figure 6: Monitoring and Controlling System Based On Embedded Web Server

#### VII. CONCLUSION

Lab surveillance system based on zigbee using ARM-11 is used for monitoring conditions inside the laboratory and controls the ecological condition through embedded web server. It develops a laboratory wireless monitoring and controlling system with S3C6410 microprocessor as its major component. The development of the GUI applications based on Qt / Embedded and Linux drivers for various types of

sensors in the system. This system can implement for commercial purpose in large scale with better performance.

#### REFERENCES

- [1] Jacek W, "Embedded Internet technology in process control devices," *IEEE Internet Computing*, Vol. 34, 2000.
- [2] Douglas, "Engineering Web Technologies for Embedded Applications," *IEEE Internet Computing*, May/June 1998.
- [3] Wang Tianmiao, Publication: Embedded System Design and Case Development. Beijing: Tsinghua University Press, 2002.
- [4] Liu Yingshui, Xiao Zhengyu, and Sun Wei, "Embedded Web Server Based on ARM and Linux," *Microcontrollers & Embedded Systems*, june 2007, pp. 14-21.
- [5] Samsung Electronics Co Ltd. Users' Manual S3C6410 V0.12 [M] .March, 2004.
- [6] Yun Sin-quan, Lu Qiang, Qian Pei-del. One implementation of Linux application based on Qt / Embedded [J]. *Computer Application and Software*, 2006,23 (2): 105-107.
- [7] Trolltech. Online Reference Documentation [EB / OL]. [Http://doc. Trolltech. Com /](http://doc.trolltech.com/).
- [8] Chen Kun, Chen Yun-qiu, Liu Xin. Application design based on Qt / Embedded and embedded Linux [J]. *Computer and Digital Engineering*, 2009,37 (1).
- [9] Ying Feng, Feng Yu-fen. The design and implementation of home gateway based on SQLite database [J]. *Micro-computer information*, 2008, 24 (5-2): 24-26. 914
- [10] K. Ricks, D. Jackson, and W. Stapleton, "An embedded systems curriculum based on the IEEE/ACM model curriculum," *IEEE Trans Educ.*, vol. 51, no. 2, pp. 262–270, May 2008.
- [11] A. Behrens, L. Atorf, R. Schwann, B. Neumann, R. Schnitzler, J. Balle, T. Herold, A. Telle, T. Noll, K. Hameyer, and T. Aach, "MATLAB meets LEGO Mindstorms—A freshman introduction course into practical engineering," *IEEE Trans Educ.*, vol. 53, no. 2, pp. 306–317, May 2010.
- [12] J. Gómez-de-Gabriel, A. Mandow, J. Fernández-Lozano, and A. García-Cerezo, "Using LEGO NXT mobile robots with LabVIEW for undergraduate courses on mechatronics," *IEEE Trans Educ.*, vol. 54, no. 1, pp. 41–47, Feb. 2011.