# Chapter 34
# IOT Intelligent Monitoring Terminal Based on ARM+Linux

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**Abstract** Based on acknowledgment of the Internet of things, this paper builds the Linux system on the ARM9 platform with researches of industry application needs and the key technologies of the intelligent monitoring terminal. Moreover, combining with the corresponding drive and service, it integrates with the video signal and analog monitoring information and uses B/S architecture to implement the system, and put forward a complete design of the intelligent monitoring terminal and corresponding network system.

**Keywords** The Internet of things · Intelligent monitoring · ARM+Linux · B/S

## 34.1 Introduction

With the social economy development and the urban modernization acceleration, there increases the various potential safety hazard and improves the prevention complexity. Therefore, we need to develop the basic safety supervision, security monitoring, predetermination, precaution, management, rescue, and the research of technology security system. Determine the security monitoring through bringing the new technology. Moreover, the various systematic solutions will apply into the security monitoring that headed by the IOT technology. How to strengthen the system engineering level of safety production monitoring and improve the present

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monitoring efficiency will be the important assignment and development direction during the period of safety in production and monitoring [1].

Embedded system's center is the application. The special computer system has district requirement in system function, cost, size, and power dissipation. Beside, it has the characteristics of small power dissipation, high performance, low cost, and strong instantaneity. Therefore, this system obtains the wild application in industry control, transportation, security, finance, communication, and other industries.

This article researches the present security monitoring system and find out the existed high cost of building and maintenance, worse compatibility, and the problem of single function. Moreover, the article will combine various functional module s on the ARM platform, comprehensive use the embedded system, communication system to design the terminal of security monitoring in order to provide one set of application system design with strong function.

## 34.2 Internet of Things Introduction

Following the definition of ITU, Internet of things is the network that goods associate with goods. The English name is 'The Internet of Things'(IOT) . By using the sensor, video identification technology and the global positioning satellites, the Internet of things can real-time monitor any thing that need monitoring, communication, interactive objects, or process. Moreover, collect the specified information of sound, heat, light, electricity, chemistry, mechanics, organisms, and geographic position. At last, it can achieve the communication of objects between object, objects between human to finish the intelligent perception, identification, and management of object and process [2].

Through the intelligent perception and identification technology, the Internet of things applies with the wild network and ubiquitous computing. It is the third information industry revolutionary period after computer technology and Internet . The Internet of things' essence and core center is the business and applications as well as the application continuation in the objective material world [3]. Therefore, the application innovation about the Internet of things is the assurance to keep the development. The application development of user center is the target and standard to develop the Internet of things.

From the information technology, the Internet of things is the identifying objects with perception and intelligent processing ability. Based on the standard operated communication protocol, and under the support of broadband mobile communication, next generation network and the cloud computing platform, the Internet of things can obtain and process the objects or the environmental information around. Moreover, it can judge the event development, provide management, and control decision in order to form the global information system of information acquisition, object management, and control [4]. The Internet of things is combined with information object technology, automatic network technology, and the intelligent application technology [5].

On the various parts of the Internet of things industry, different enterprises and organizations will explain its meaning from the own view. However, the industry has the unique understanding about the completed system. In basically, the Internet of things includes three layers: perception layer, transport layer, and the application layer [6]. The perception layer is responsible for the total perception of the objects that need to be monitored and identify the identification or information collection. The transport layer takes charge of supporting the transport channel for the reliable data. It can transport the collected perception information to the application layer through the different wire or wireless communications. The application player means to do the intelligent processing when receiving the perception information and use or express the data after processing.

## 34.3 Design of IOT Intelligent Monitoring Terminal

### *34.3.1 System Structure*

Based on the system requirement evaluation, the terminal needs to collect the site video information, temperature, and concentration sensor data. At the same time, it needs to start the Web Service, and provide data service for the browser or Smartphone client through inserting the Internet. Clients can check the monitoring information while control the IO point output by browser (Fig. 34.1).

Based on the function design of terminal system, there need to include processor module, camera, sensor signal collection, network processing module, IO control interface, display module, power module, and other basic function modules.

### *34.3.2 Hardware Model Selection*

Embedded system has the center of application and computer technology is the basement. Moreover, we can clip the hardware and software for applying into the special computer system that has strict requirement on function, reliability, cost,

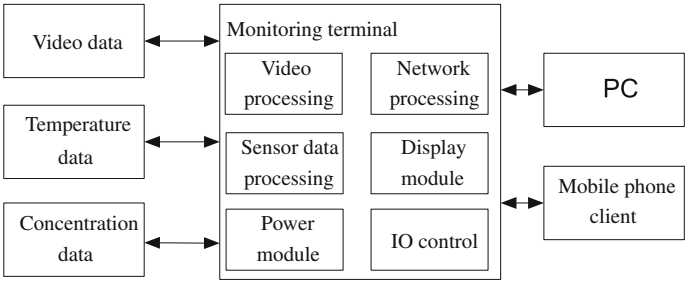


**Fig. 34.1** The figure of terminal system function

size, and the power consumption [7]. The technology of embedded system belongs to the arrangement of object control technology. ARM9 processor is the 32 positions processor with low power consumption. It is suitable for the low consumer of cost and power consumption that has been wildly applied into the filed of industry control, network equipment, and data communication.

Connect the processor module with other modules can take charge of all the control and data processing. It includes single chip and other outside circuits such as ROM, RAM, and clock generator. Processor module needs the high operation frequency and processing speed that can load into the embedded Linux system.

The processor uses S3C2440 clip from SAMSUNG Company. This clip uses 32 positions RISC command set, and provide the microcontroller solution with lost price, los power consumption and high function for the handheld device and common applications. This chip has the ARM core, uses the design of los power consumption, the dependent 16 KB command Cache and 16 KB data Cache. Moreover, it reduces the system cost and useless components that specially design for the low power consumption. S3C2440 has the high practical applicability [8].

Processor, RAM, and ROM combine the data processing system module. Onboard ROM includes one clip 2 MB nor Flash of onboard BIOS and one clip ROM of 256 M N and Flash System; two circumscribed 64 MB SDRAM clip, and include the 12 MHz clock generator circuit and other outside circuits. The S3C2440 needs the 1.2 V core power supply and 3.3 V outside power supply. Therefore, the module needs to bring two kinds of power supply interfaces.

The sensor is the electronic element that transmits the physical quantity into the electrical parameter. The design uses one temperature sensor. There have been various temperature sensors and based on the measurement mode, they can divide into contact and noncontact. Based on the electrical element character it can divide into thermal resistance and thermocouple [9]. The design uses temperature sensor to collect the present environment temperature and transmit the collect data through processor and communication module in order to support for client request and record.

The common temperature sensor uses 0–10 mA or 4–20 mA standard circuit output. However, it needs the 24 V direct-current power supply. At the same time, it cannot satisfy the design requirement of low power consumption. Therefore, this design uses stainless steel package DS18B20 digital temperature sensor. The sensor has small size, wear resistance, long operating life, convenient usage, good antiexplosion that can suite for the boiler, tunnel, generator room, refrigerator, air-condition, storage tank, and other measuring temperature places. At the same time, the antiexplosion design can satisfy the requirement of antiexplosion filed. DS12B80 can use the single line port to achieve the double communication with the microprocessor [10].

PerkinElmer Company produces TPS2534 series of gas concentration sensor. It is the infrared thermopile gas sensor of nonspectral two-channel. This sensor has small size, high precision, high applicability, and rapid response. It is designed aiming at the gas concentration detection that has been widely applied into the various detection of infrared gas concentrations.

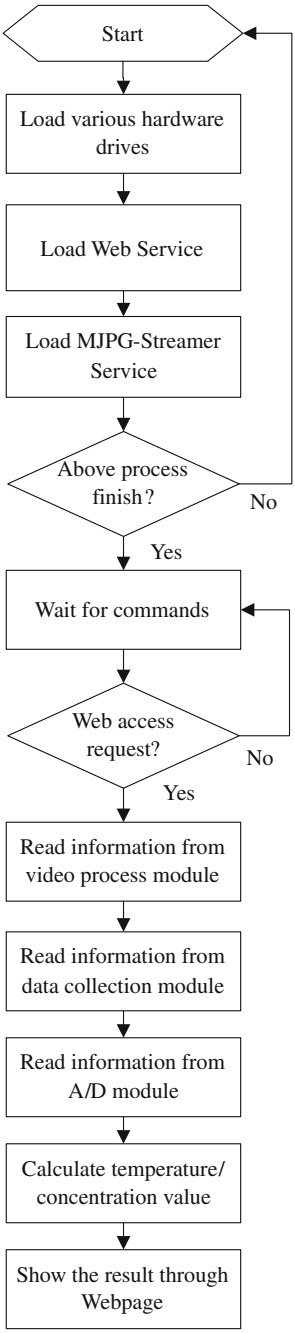


**Fig. 34.2** The figure of terminal system function

TPS2534 infrared thermopile gas sensor of nonspectral two-channel uses TO-5 package with whole sealing nickel metal case that filled with dry nitrogen. TPS2534 sensor has two infrared sensing windows with the sensitive response area of $1.2 \times 1.2$ mm$^2$ and $2.6 \times 2.3$ mm$^2$. We can use it to calculate and refer to the channel light intensity. Otherwise, the internal TPS2534 uses 30 Ωk thermistor can detect the element outside temperature as the reference variable of the temperature compensation. TPS2534 has four important pins they are gas channel pin, reference channel pin, temperature channel pin, and the ground connection pin.

### *34.3.3 Software Design*

The software design is collecting relative data and start the network service at the same time. The various normal functions depend on the software structure and function. This system is building base on the Linux operation system. It has the multitier function processing that need the communication. Except the arithmetic code, there includes system core, various drive programs, algorithm programs, and different service programs. The completed assignment process is shown in Fig. 34.2.

As Fig. 34.2 shows, when the system power up, start the Linux operation system, we need to initialize the various outside equipments in the first place. Moreover, we load various corresponding drive programs (especially the drive of temperature and concentration sensor). Then, we load Web Service and MJPEG service to prepare for the information display and video streaming. After everything is ready, the system will begin to wait for the request information from WEB. When receiving the request, the system will send request to the module of video processing and sensor data processing. After receiving the real-time video data and original data of temperature and concentration, we can obtain the detailed value through analog digital conversion. At last, we send result to the terminal users through the Web service.

## 34.4 Summary

This article provides the design proposal of intelligent monitoring terminal that is based on S3C2440 processor and Linux operation system, through inserting the internet, use Web Service to integrate video and sensor information for providing users to check. This design has the character of low cost and wide application. At the same time, it has the strong function, and the high systematic instantaneity. The ARM architecture chip is more suitable for the wild application of multimedia portable productions on the cost control. Therefore, we can use the low cost to build the security-monitoring network that has strong functions.

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