

Chapter 13

Simulation of Computer Monitoring and Controlling System for Automated Multilayer Garage

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Abstract In order to design practice of automated multilayer garage based on S3C2440, ARM industrial control panel for large-scale automated multilayer garage was designed, it's structure and function were analyzed, and the development environment of the system as well as the control layer-built and administration flow chart were introduced. The system structure was realized with formation, dividing into three stories as of administration, monitoring, and execution in accordance with the function. The system was composed of such sub-systems as upper-level real time monitoring, garage management, management information, field spot industrial bus communication, and identification of in/out personality. It was shown by the applying practice that this system possessed expansibility, publicity, and operational convenience.

Keywords S3C2440 · Multilayer garage · Computer monitoring · Simulation

13.1 Introduction

With the popularity of the car, parking is difficult to have a static traffic problems faced by large- and medium-sized cities to become a social problem, and even to some extent, restrict the development of China's automobile industry, government and the community has paid great attention to the car parking problem. The three-dimensional (3D) garage automated 3D garage and to maximize use of space, large-scale 3D garage have developed rapidly [1].

Abroad in the research and manufacture of parking earlier, mainly Japan, South Korea and Germany, Japan in 1960 completed a four-car parking spaces, two-stage

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mechanical parking garage in 1971, began to develop assembly self-propelled 3D garage, Japan technology research and development aspects of the parking garage in a leading position, the number of completed parking and vehicle capacity is also highest in the world, Japan has put into use mechanical parking spaces over more than 300 million; South Korea in the 1970s of the twentieth century follow the example of Japan, with nearly 100 manufacturing enterprises, the annual growth rate of 30 % due to the attention of the government; the parking industry is very developed in Germany, production of parking equipment manufacturers, about 24, in which KLAUS and the OTT OWOHR two production accounts for about 80 % of the total output of Germany, have an advantage in the laneway type of product technology [2].

In the early 1990s, China started to develop and use mechanical parking equipment through the introduction of technology to fully digest and analysis, and the actual usage of domestic transformation and innovation, the path of independent development, has been the formation of new parking Equipment industry [3–5].

13.2 System Structure and Function

Automated 3D garage system is not directly for manual processing, transportation equipment can automatically multi-storey garage storage systems, warehousing operations system including multi-storey car parking spaces in the parking within the roadway to transport equipment out of storage and computer control and communications systems. Automated 3D planning and layout of the garage is related to the field of logistics and monitoring technology, computer application technology, communications technology, equipment and parking optimal management of technology, integrated project, it is characterized by a high-level 3D parking signs, complete sets of advanced handling equipment, advanced computer control technology as the main means highly efficient use of parking spaces and storage space, save time and effort out of storage operations. Among them, the computer monitoring system is an automated parking system core, is an important part of the stereo garage, and directly determines the level of automation of the 3D garage, to ensure the safety premise out of the library operating speed.

13.2.1 Computer Monitoring System Structure and Composition

According to the characteristics of the automated 3D garage and on-site needs, system architecture uses a layered approach to achieve the designed computer control system divided into functional management, monitoring layer, control layer 3, according to user requirements and the actual situation in management and monitoring layer merge management control layer, multimedia guide system equipment (card reader, display brand and identity, and charges for terminal

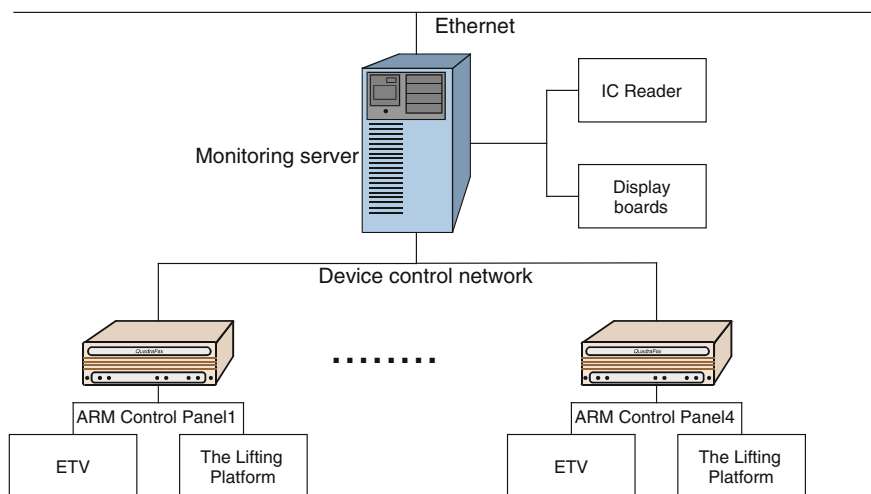


Fig. 13.1 Block diagram of system configuration

system equipment) reader layer monitoring server connection directly with the management and monitoring system constitutes Fig. 13.1.

Automated parking computer monitoring system consists of host specific real-time monitoring system, garage management system, management information systems, field bus communication system, the ARM device control system, the storage authentication system, and other subsystems. Among them, the PC monitoring system responsible for automatically assigned parking spaces, enter the operating instructions, monitoring equipment operation, determine the state of equipment and fault; garage management system responsible for the processing of parking management, ID card management, charge management, permissions management, etc.; field bus communication system is responsible for the upper control and lower equipment real-time communications, transmission operating instructions and garage parking spaces and equipment state; ARM control panel device control system according to the operating instructions to control the operations of the equipment order; responsible for the user card system out of storage a personal identification system, access to information, the storage card and operating 3D garage under the control and management of the monitoring system to complete the entire garage automatically ordered high-efficiency operation.

13.2.2 Main Functions of the System Implementation

- (1) Automatic allocation of parking spaces, a variety of operating instructions sent to the ARM control panel, control equipment operation, real-time monitoring, display, record the state of equipment, and parking spaces in use for 24 h

unattended automatic deposit/pick up the car, identity verification and management fees, the overall compact automated parking Kuguan control the integration.

- (2) Four sets of equipment can operate in parallel automatic deposit/pick up the car, authentication, and charging management.
- (3) Four sets of stackers, lift adjacent stacker, lift mutual backup software can be set to switch stackers, to achieve near-zero system downtime, maintenance time, to achieve high system reliability and high availability.
- (4) Authentication charges the credit card equipment using non-contact RF card technology, security, identification, storage/pick up the car, and charges to use the voice prompts and digital display of the two interfaces at the same time convey information from/to to take the car user-friendly and convenient .
- (5) And the concerted action of the library fire protection system, fire alarm occurs can command stacker abort the current task return to a safe area with the fastest speed.
- (6) The levels of operating rights management and database encryption, automatic backup, have a good data security.
- (7) To achieve real-time record of equipment failures and alarms, equipment, health records, to provide data for equipment maintenance.
- (8) Automatically optimizes the shortest path for bicycles, and pipeline operations in accordance with the instruction serial number of each car provides continuous access to an average speed of 86 s.
- (9) The three-tier design, management information systems using C/S structure, the overall system has good scalability and good versatility.
- (10) The completion of the implementation of the records, management of the garage to run a variety of information, such as the unusual circumstances of the equipment, instructions, fees, etc. improve the current data and historical data query capabilities, the flexibility to generate and print a variety of statistical reports.
- (11) And friendly man-machine interface, real-time dynamic display of the garage operation of equipment, work location, the state of equipment, parking spaces occupied.

13.3 System Design and Development

The actual project development for the system's functional requirements, design the operating environment of system development and system management control process is as follows.

13.3.1 System Development Operating Environment

- (1) ARM9, 200 MHz; SDRAM, 64 M; NandFlash, 128 M;
- (2) Windows 2000 Advanced Server; Microsoft SQL Server7.0
- (3) Visual C++, wince.

13.3.2 System Management and Control Processes

In this system, the computer monitoring system to assume the role of management and central control, assume a storage management, a database management, stocktaking management, query, print, and display the garage economic and technical instructions to calculate and analyze management functions, which include online management and away from the through line management, master anti-tone rotating lifts, stackers, contact smart car out of storage; control and monitor the running of entire automated 3D garage, and run under the management or operation of the command-organizational processes, as well as monitor the field devices and field device status, monitor vehicle flows, and also has the right equipment for fault detection and inquiry forms printing. In short, the garage monitoring system, the management and control software system is an organic whole, mainly to complete the following work:

- (1) Real-time monitoring of the operation of the system throughout the 3D garage;
- (2) ETV, and storage transmission equipment and vehicles operating position;
- (3) Shows the current operating status of all tasks;
- (4) Error alarm can be able to control the operation of all equipment in case of emergency, the management control process shown in Fig. 13.2 in accordance

Fig. 13.2 Control flow chart

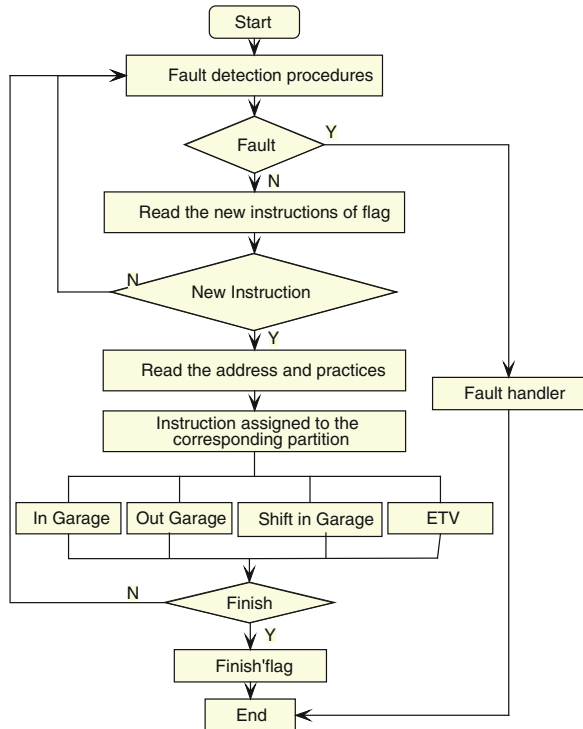
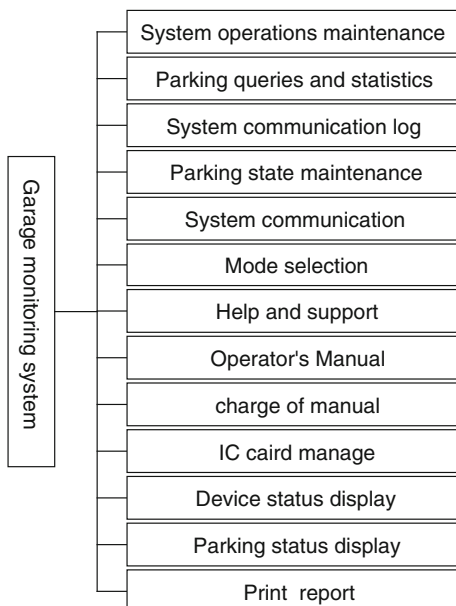


Fig. 13.3 Structure of software system



with the flow of information and the process can be divided into the automated garage monitoring software system shown in Fig. 13.3 of 13 modules.

13.4 Conclusion

Analog scale of the system up to 160 3D garages, uninterrupted operation many times that the design is feasible. Non-contact IC technology, the RF data communications technology, 3D garage tends to fully automated; modular monitoring software design makes the software design process more clear, and set aside the interface has been expanded, the system has the scalability and openness.

Computer monitoring, equipment and information management, systems integration, field bus control technology, radio frequency card technology, voice and display to guide the optimization of technology, equipment operation, the automated parking control and information management, including automatic real-time monitoring of work orders generated and sent, 3D storage and transfer equipment, real-time control, information recording, automatic a/warehousing operations, as well as automatic management of user accounts, fees and other information.

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