

The intelligent guard control system based on CPLD^{*}

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Abstract: This article puts forward the scheme of an intelligent guard control system in small residential district based on CPLD. It emphasized on CPLD with MCU in design and realization. This system has highly reliable record subsystem, alert subsystem and identify subsystem. It is great worthy of application.

Keywords: intelligent guard control; guard control; CPLD

1. Introduction

With our country's high speed of economic development and joined WTO, A small residential district make progress towards intelligentize and digital equipping. A new conception has been break out – intelligent district, since computer networks and electronic technology were used in people's life.

This article introduces an intelligent guard system in small residential district based on CPLD. The system works in CPLD and MCU. It stands out the advantages of CPLD and MCU. This architecture improved system's reliability and ability of anti-jamming, and furthermore, it provides a geniality operation interface. Based on the two components, system can update software or hardware by obey the user's order that automatically download software or hardware from location or host in distance. Because of excellent expandability, the system set up a lot of sensors to accommodate high level of security design requirement. And, the user's validity is distinguished by IC card and user's password. As using, system can record user's operation in detail and working with high dependable alert subsystem and identify subsystem. So system gains good security and fit the needs of a majority of intelligent districts.

2. Design plan and principle

The intelligent guard control system in small residential district, usually use MCU to construct our system. It has lot of advantages such as low prices, simple circuit structure, ripe technology and short develop circle. But it has evident shortcomings. When it is used in large system, the jam appeared, the program design becomes hard and easy to fly. So we use CPLD integrated MCU. It resolved the design of complex system. On other hand, it improved ability of anti-jamming. The system great increased flexibility to circumstance.

This system consists of service host, program controlled main processor, user-processors, locks controlled by electricity, sensors and so on. The framework of system is show in fig.1.

Main functions of each part are listed as below:

Service host: Manages each program controlled main processor. The main processor can download newest software or hardware. And, it can inform janitor of alert information in time, manage user's IC card in distance, or inquire about user's information.

Program controlled main processor: It consists of MCU and CPLD, and offers basic service functions about communicating with user-processors, controls of gates. They can also guard the gates, collect signal form sensors, exchange data with communities host, offer service for guests, offer informers or ads service. Janitor can use them to manage user's data-base on location. The function on opening door by IC cards which improved security of system.

User-processors: Offer communicating with main processor, open gate, user's alerts and help, image monitor display and so on.

Locks controlled by electricity: Advanced and reliable electric locks improved security. On other hand, they decreased noise of gate and make users feel more comfortable.

Sensors: They are series of vibration sensors, poison gas sensors, temperature sensors, infrared ray sensors. These sensors were made safeguard for users.

The IC card's kernel chip is SLE4442 that develops by SIEMENS and accords with the standard of ISO7816-3. There are 256-Bytes EEPROM in the chip. It can record user's information with security code. It has 3-bit security error counter. Once input does not accord with password, it set one bit to zero. It will invalidate forever and can't be restored, when the error counter set to zero.

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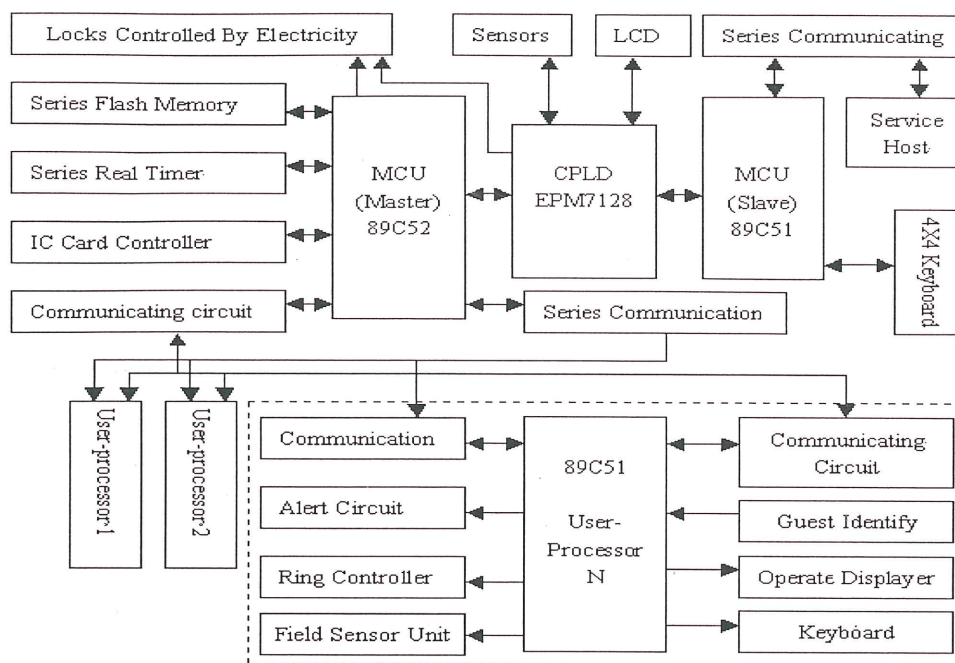


Fig.1 System Structure Frame

High performance and low power real timer is DS1302. The chip is developed by DALLAS. It has 256-Bytes internal high speed RAM. It counts with second, minute, hour, day, date, month and year. It's below 300nA under 2.5V power supplying. Just need a 32.768KHz oscillating crystal.

The memory can store user's data, operating record and alert record is I²C compatible EEPROM series memory 24WC256. It has excellences of nonvolatility, small size and low power. It can save about 2000 records and operating records during one week.

3. Application of CPLD

3.1 Deal with urgent event

It can easily expand external interrupts source such as respond form keyboard, IC cards' inserted and taken out, picked up the phone and sensor's signal. the sensors will be introduced here. This system has fire alert, vibration alert, prize gate alert and so on. These alerts need reliable. Sensors can accurately judge the signal is alert signal or jams form circumstance. We use time-delay and dual verify to ride off jams. For making signal consecutive, we have used interrupt queuing.

3.2 Double MCUs' parallel communicate

This method dexterously use source of MCU and CPLD to make the double MCUs' parallel into real. The I/O of CPLD can be defined as input, output, bidir. So communication with 000Data Bus just set I/O as three state I/O port. The data will be save into FIFO buffer, then communicate by handshake signal. It simplified MCU's program design, improved reliability

of transmit.

3.3 Control LCD display

LCD control timing logic is very complex and LCD holds a lot of I/O port. So the system using CPLD simplified the operate timing. Complex logical relations are covered into address operating. All operation of LCD 12864 converts into 8 addresses which form 0xFFF0 – 0xFFF7 and 4 command words. We just do write or read address operation and the remained can be done by CPLD. The programming of MCU becomes very simple.

4. Conclusions

This intelligent guard control system in small residential district has been developed successfully. Indicated by experiment, this system achieved the design demand. It runs steadily and unfliningly. With high ratio of performance to price, it has value of popularizer and great potency of market. The application of intelligent guard control system can improve the level of intelligent management, makes a comfortable and security circumstance. It is make advantage for life of user and management of janitor.

References

- 1 Lin ming, Fang yin-li. VHDL Digital Design And Top Layer Synthesis. Beijing: Electronics Industry Press. 2000 (in chinese).
- 2 Stefan Sjöholm, Lennart Lindh. VHDL for Designers. Beijing: TsingHua University Press. 2001
- 3 Wang ai-yin. Smart Card Technology—IC Card (II) Beijing: TsingHua University Press. 2002 (in chinese).
- 4 Zhang yi-gang, Peng xi-yuan, Tan xiao-jun. MCS-51 Microcontroller Design and Applications. Harbin: Harbin University of Technology Press. 2001 (in chinese).