The Design of Single Door-Controller Based on Intelligent Door-Entry System Through CAN Bus

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Abstract. In view of the faults of the traditional single Door-Controller,a single Door-Controller Based on intelligent Door-entry system through CAN bus is designed which combining the CAN bus with infrared coded remote control technology.The controller consists of STC89C55 single chip,CAN controller,data memorizer,the real time clock,the keyboard and display circuit,it can realize the function of remote controlling-unlock,display real-time clock,CAN data communication,keyboard control,modify and save password.Based on the function of the key management technology of CAN bus,it make the controller highly reliable and real–time.

Introduction

Different from the traditional security equipment,a new generation of entrance guard and management system change from passive to active monitor[1],it has become one of the main security system for its higher security.By contrast,our country are generally the mechanical lock,its shortcomings is code less,frequent operation,easy to duplicate the key and not easy to enter the password[2-3],another electronic lock also generally use a fixed keyboard which leads to lack concealment.Based on this situation,the design realize a single controller of intelligent access control system based on CAN bus,the control mode of CAN bus[4] is more adapted to the access control system,through senting the information(e.g.,card number) of people who answered the door to the host,and the host checks the legality of the user,thereby increasing the security of the system,it is convenient for the host to store the information(time or data) for a query or processing, the computer also can set various parameters of the local lock.

In a word,it is more conducive for the system'expansion and multilevel management using the CAN bus. At the same time,it also adopts the method of infrared remote control,using infrared ray as the carrier, modulate the instruction signal on a carrier,then transmit it through the infrared emission diode,the receiving end will restore the original instruction signal after receiving modulation signal,the infrared remote control mode not only ensure reliability and can effectively isolation the electrical interference,in addition,the system also can realize the expansion function of timing.

The introduction of system hardware

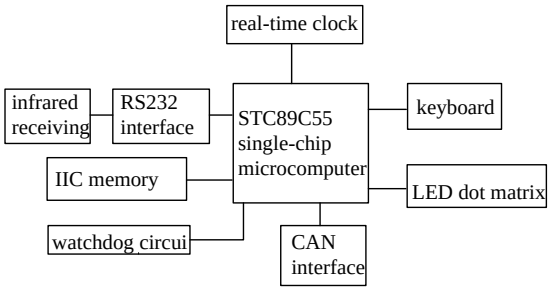

Fig.1 The system principle diagram

The system consists of STC89C55 single-chip microcomputer,an infrared receiving circuit,RS232/RS485 interface circuit,IIC memory,real-time clock circuit,watchdog circuit,CAN interface circuit,LED dot matrix,4X4 keyboard circuit, the system diagram as shown in fig.1.

Among them,STC89C55 chip is the core of system.This single-chip microcomputer is a micro controller of 8 bit CMOS and it is low power consumption and high performance which studied by ATMEL company based on 8031 MCU,and using ATMEL'flash memory technology,its internal function and pin are compatible with 80C51 microcontroller.The system can realize the functions of remote control unlocking,real time clock display,CAN data communication and display,keyboard control,modify password and save.

The main hardware circuit

The main controlling circuit and the interface circuit of CAN

The main controlling circuit is composed of STC89C55 microcontroller and SJA1000 which as shown in fig.2.

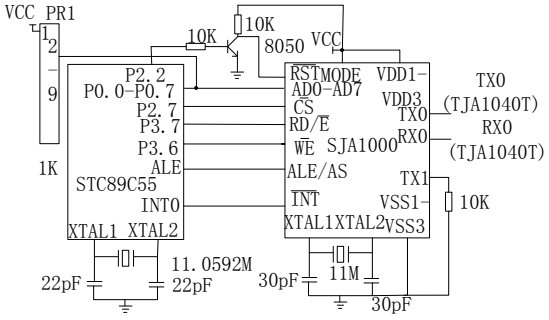

Fig.2 The main controlling circuit of system

From Fig.2,it can be see that the STC89C55 is the core of whole system which responsible for the management and control of system'resources,SJA1000 is the CAN controller which is used to realize reliable data communication.

SJA1000 is a separate controller which is used in local area network(CAN) control process[5] of ndustrial environments,it is a alternative products of the PHILIPS'PCA82C200CAN semiconductor controller,it has the characteristics of supporting for 11 bit and 29 bit identification code,1Mbits/s bit rate,it also add a new working mode(PeliCAN) which has reading and writing access error counter,programmable error alarm limit, the last error code register, in addition,it also support hot swappable,acceptance filter expansion, programmable CAN output driver configuration and the enhanced environmental temperature range.

The communication between system and PC realized through the CAN bus controller which used to transmit the access information, date, time and other related information to computer for storage, query or computer processing.The CAN bus is a remote network communication control method of advanced technology,high reliability, perfect function, reasonable cost,compared with the RS-485,CAN bus has the advantage of low cost,high data transmission rate,reliable error handling

and error detection mechanism and low communication failure rate,its communication distance is up to 10Km.The corresponding interface circuit as shown in fig.3.

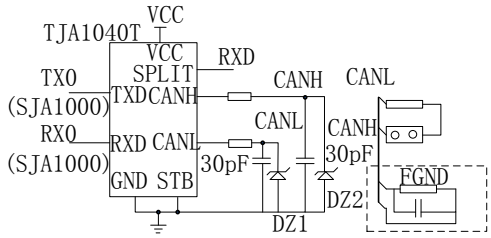

Fig 3 The interface circuit of CAN bus

LED dot matrix display circuit

The LED display circuit as shown in fig.4.The display process adopt the dynamic scanning mode which is used to display of password or a variety of prompt information, such as data or password confirmation prompt,it also can show the real-time clock while the system is idle.Each of the LED circuit in the display module are composed of 8X8 LED,the control part is composed of a line and a column driver circuitry, Among them,the signal of the driver circuitry use the transmission mode of serial input and parallel output,and 74HC595 is used as driver chip,this method can greatly reduce the number of export line.

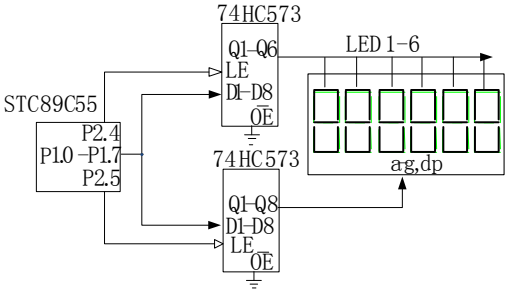

Fig 4 The LED dot matrix display circuit

The infrared remote control interface circuit

The infrared remote control circuit is mainly used to input and receive the local password which using infrared light as the carrier, and modulated the password command signal on the carrier,then Launch out it through the infrared emission diode,the receiving end will restore the modulated signa to the original instruction signal by limiting, filtering, demodulation process after receiving.

The transmission and reception circuit compose the general Infrared remote control system,among them, the transmitting part comprises a keyboard matrix,code modulation,LED infrared transmitter;and the receiving part comprises a photo electric converting amplifier,demodulation,decoding circuit.System use microcontroller'serial interface and an infrared transmitting and receiving circuit constitutes a specific infrared remote control interface circuit which as shown in fig.5.

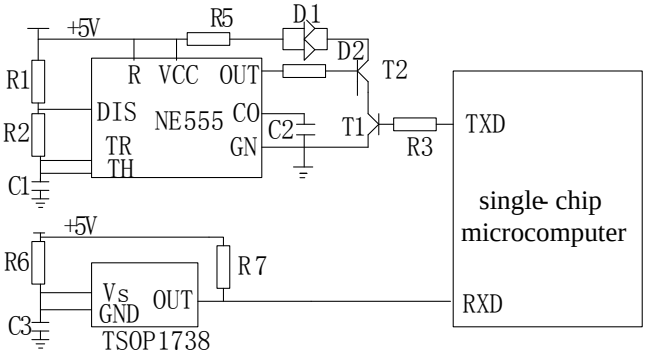

Fig.5 The infrared remote control interface circuit

Among them,the infrared transmitting circuit comprises a pulse oscillator,the driver pipe T1 and T2,infrared emission tubes D1 and D2,and a pulse oscillator made of NE555 timer,resistors(R1,R2) and capacitor(C1,C2) which is used to generate the the carrier(38kHz pulse sequence signal),the infrared emission tube D1 and D2 is TSAL6238(the production of Vishay Co) which used to emit 950nm infrared beam.In the work process, the serial output end of single chip TXD send the serial data and drive the T1,the digital “0” make T1 being on,it is modulated into 38kHz carrier signal by T2 and be sent out by the form of light pulse using two infrared transmitting tube(D1,D2).On the contrary,the digital “1” make T1 being off and D1 and D2 will not emit infrared light,each digit "0" is corresponding to the time sequence of 32 carrier pulse modulation signal if the transmission baud rate is set to be 1200 bps.

The infrared receiving circuit is selected with the infrared receiving module TSOP1738 produced by Vishay company,it is a three-terminal element which using single +5V as power,it has the advantages of low power consumption,strong anti-interference ability,high input sensitivity and insensitivity to other infrared wavelengths (beyond 950nm).First,change the pulse modulated infrared signal which carrier frequency is 38kHz into electric signal by internal infrared photosensitive element of TSOP173,then,amplify the signal by internal preamplifier and automatic gain control circuit,this signal filtered by band pass filter is demodulated by demodulator circuit, finally,it output from the OUT pin after inverse amplification and is sent to AT89C52 by RXD pin of singlechip.

The clock and data storage circuit

For the expansion of system function, the design can display real-time clock when the system is idle,it can modify the time,and ensure the time is not lost while power off. the clock circuit is realized by DS1307 circuit. in addition, in order to prevent password not lost while power off,the electronic password lock use the CAN bus chip as the key, and can complete the storage and modify of the password using EEPROM chip,the important password data are stored in 24C01.

24C01 is a 1K bit serial CMOS EEPROM which using advanced CMOS technology of 128 bytes,thereby,it can reduce the power consumption of device, it has a 8 byte page-write buffer with write protection which can be performed through the I2C bus interface. Specific clock and data storage circuit as shown in fig.6.

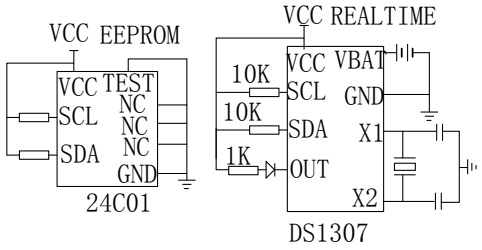

Fig.6 The clock and data storage circuit

The software design of system

The main program flow of system is mainly shown as follows,when the system starts,first,it complete hardware checking and initialization.Among them,the major part of hardware reset complete the interface inspection work of CAN bus controller which the methods used are writing and reading a specific data to the test register of CAN controller ,and read and it indicates that the hardware interface correctly if the data consistent, then enter the initialization program,otherwise, it show that hardware check error.The initialization after hardware include the initialization of the time, the password data, serial port, monitor.it enter the main program loop after initialization,in the main loop, first , check the bus-receiving flag, bus-sending flag or error flag,then, read the key and executive corresponding key-processing program according to the reading key, read infrared password data, perform and display time-extraction procedure etc.

Conclusion

Aiming at the shortcomings of the mechanical and fixed keyboard lock,design a single intelligent access controller based on CAN bus,combining CAN bus technology and infrared remote control technology,it realize the functions of remote control unlocking,real time clock display,CAN data communication and display,keyboard control,modify and saving password.The subject makes full use of CAN bus technology to realize the interaction,using the CAN bus chip as the key,complete the storage and modify password by EEPROM chip, so as to realize the saving of password while the power down,at the same time,the lock body adopts the single chip which greatly improved the safety, stability and practicability of the whole system.

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