

Intelligent Warehouse Management System

Binghua ZHANG^a, Weigang PAN^{b, *} and Zhencai HU^c

School of Information Science and Electrical Engineering, Shandong Jiaotong University, Jinan, China

^a514801065@qq.com, ^bpanweigang1980@163.com, ^c1164032081@qq.com, * corresponding author

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Abstract. The system is based on the motor controller L298N chip, near field communication RC522 and network communication W5500 module as the core device to MSP430F5529 microcontroller as the system master control unit, control relay (motor) work, RF reader RC522 read data, 12864 display Content, network module W5500 TCP / IP protocol encryption to transfer data to the computer PC system, motor control of the container switch and the mechanical device to achieve the warehouse cargo intelligent management system card activation system, network encryption transmission, computer host computer remote control and monitoring, key selection of the designated container code container automatic switch, mechanical equipment to pick up and so on.

Introduction

Modern social intelligent management system has entered all walks of life, the innovation of this product is for warehouse intelligent management, it can make management convenience and intelligence, saving manpower and material resources, and can make full use of warehouse high altitude space, saving cargo area; especially for the management of precious goods, we set the authority card activation device operation, and can operate the record to encrypted TCP / IP protocol through the network to send the computer's host computer system by network, the computer can real-time detection The use of records; for small and medium enterprises and courier companies and other warehouse management, can reduce costs, improve efficiency, safety performance is also very reliable.

Theoretical Analysis and System Composition

Program Demonstration. Controller Module. MSP430 series of single-chip, which is the 16-bit single-chip produced by TI company, the main feature is ultra-low power consumption, with a reduced instruction set of mixed-signal processor, instructions are single-cycle instructions, strong, fast running, The internal hardware multiplier and a large number of registers provide a guarantee for storing data and operations. Its ultra-low power consumption characteristics for instrumentation and other design, here use 430 series single-chip as our switching power supply control module in line with our design requirements.

Network Module. YIXIN_W5500 Ethernet module is a Ethernet module based on the WIZnet W5500 chip , is a good performance, cost-effective Ethernet module. Module integrated hardware TCP / IP protocol; internal 32K bytes of memory as a TX / RX cache; support 10 / 100Mbps network transmission rate; support 8 independent ports running at the same time the module also supports 3.3V or 5V power supply, 5V power supply can also output 3.3V voltage, user-friendly in a different microcontroller system to use; module and single-chip system communication is simple and convenient SPI bus communication. The specific work process is: the Ethernet module set up a virtual server, in its communication program to write the computer's IP address and port number, and then use the host computer system, create a client on the computer, after the server starts successfully, wait for the remote server to connect [1]. When the network is connected smoothly, the port 0 of the W5500 will automatically establish a connection with the server to transmit and

receive the data.

Near Field Communication Card Reader Module. R radio frequency identification technology is an automatic identification technology which has rapid development and very wide application prospects. The entire system includes readers, tags and antennas [2]. The reader mainly completes the reading and writing of the electronic tag data and uploads the data as needed. The choice of credit card module because the campus student's campus card is IC card. So we need to choose to read the IC card information card chip and circuit. Here we choose MF RC522 as our card number reading module. The MFRC522 internal transmitter section is capable of driving a reader / writer antenna design with ISO / IEC 14443 / contactless card reader cards and transponders without additional active circuitry. The receiver part of the ISO / IEC 14443 / contactless card reader compatible card and transponder provides a demodulation and decoding circuitry that have a powerful and efficient implementation signal. The digital processing section completes the ISO / IEC 14443 framework and error detection. MFRC522 supports non-contact card reader classic (such as non-contact card reader standard) products. MFRC522 supports non-contact communication using a non-contact reader for higher transmission speeds up to 848 Kbit/s. Various host interface implementation:

- (1) Highly integrated analog circuit demodulation and decoding response
- (2) The buffer output driver connects the antenna with the minimum number of external components
- (3) Support ISO/IEC 14443/contactless card reader
- (4) Typical operating distances are communicated in read / write mode, depending on the size of the antenna.
- (5) Support non-contact reader classic encryption in read / write mode

The system through its read and write register operation, to obtain each IC card storage sector of some of the features of the content, through the microcontroller write program control, you can achieve the specified IC card set permissions, so that by entering the authority IC card, you can set the device to permission operation, after pay by card , the device to start their own power; no authority card will be prompted to operate without permission.

DC Drive Motor Control. Control of container access, use screws reduction motor [3].The working principle is: the nut is fixed on the container, then fixed motor in the back of the container, so that the screw of the screws reduction motors is able to pass through the center of the nut, and do not receive the friction of the container edge [4]. The motor is turned up can promote the container movement, and the positive and negative reversal of the motor can realize the container's access.

Machinery. When the container is opened, there must be a mechanical device to extract the goods or to place the cargo, which requires the master control PWM to control the two motors and the steering gear control mechanism to move back and forth accurately [5].In the container just above the security rails, the stepper motor fixed to the side, the use of gears to drive the rails move left and right; rails through a control rope lift motor connected to the mechanical device to achieve the release of goods. The mechanical device is having master drive steering control manipulator [6].

Structure Diagram. According to the above analysis and program design, the overall structure of the system block diagram shown in Figure 1.

Theoretical Design

(1) The use of MSP430F5529 single-chip control relay work, so I/O output high and low level control motor forward and reverse; control stepper motor turn the number of steps to achieve the effective work of the control cargo hold.

(2) RF reader RC522 read data, through the master to identify the data of the IC card, then determine whether have the corresponding authority and sent to the computer through the network system;

(3) Use 12864 to show each time to read the card number, the cardholder's name and whether the authority of the operation and so on;

(4) Network module W5500 through the TCP / IP protocol and set the encrypted way to transfer data to the computer host computer system, and the host computer control instructions sent to the master to make the appropriate control action;

(5) The motor Positive or Inversion the control of the container switch and The steering gear controls the mechanical device Take the goods.

(6) The system master will be based on the clock module to do a good job in response to the format of access to the record, and sent to the host computer through the TCP/IP protocol, and through the host computer to achieve exporting a certain period of use of the record table.

electric supply 220v

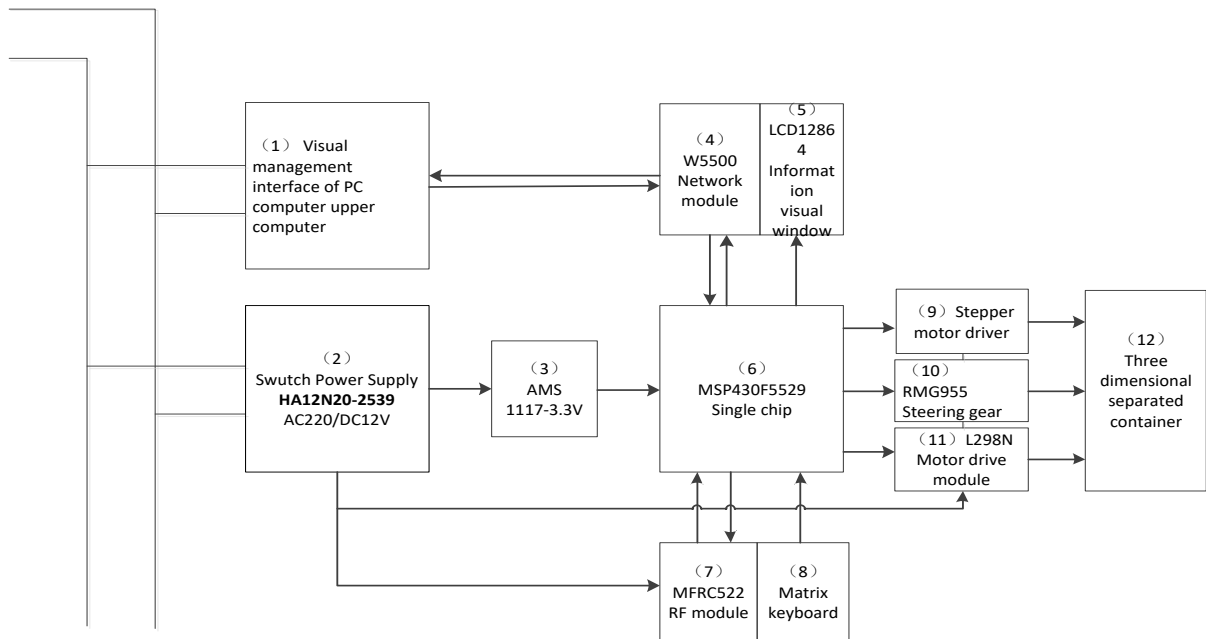


Fig.1.System diagram

System Hardware Circuit Design

Based on the system composition shown in Fig.1, the following system hardware circuit is designed.

Design of Main Control Circuit. System of the main control circuit, mainly by the 430 single-chip and its smallest system components, Figure 2 for the schematic:

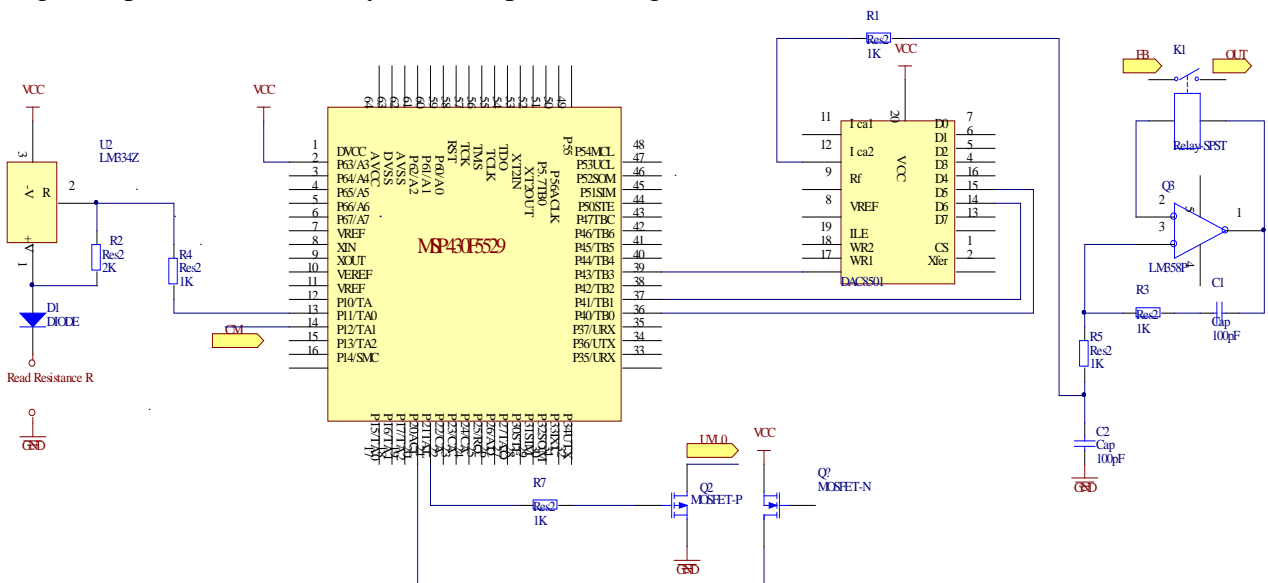


Fig.2. Main control circuit

Design of RC522 RF Circuit. Rc522 RF circuit contains the rc522 chip and its surrounding

antenna design, the schematic is as follows:

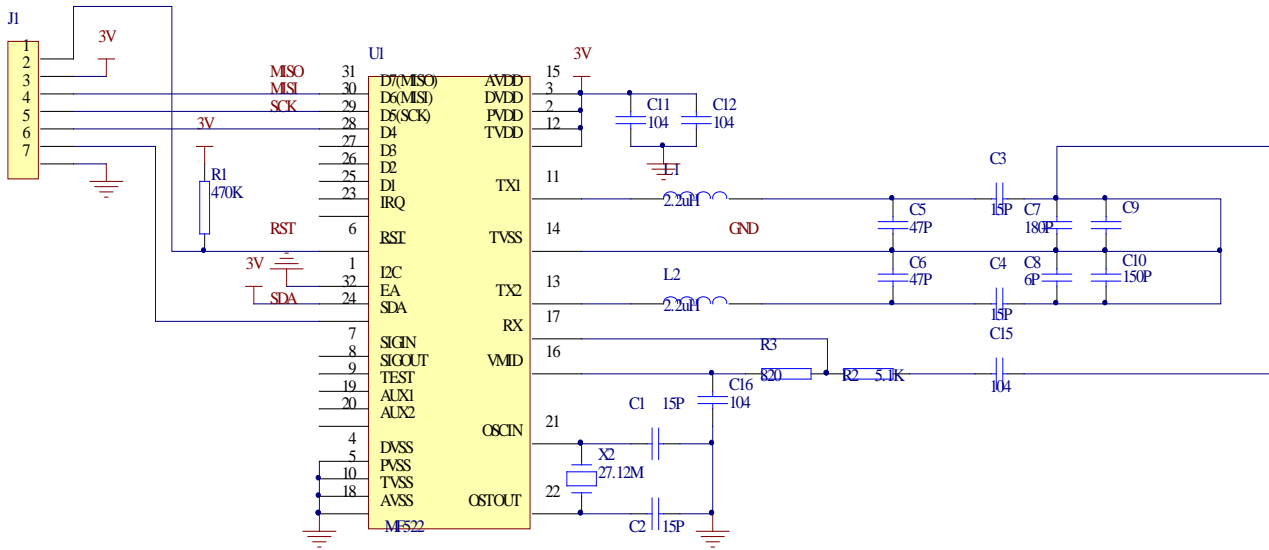


Fig.3. RC522 RF circuit

RC522 Power Supply Circuit Design. Rc522 chip operating voltage of 3.3v, so the need to use ams1117 chip make the voltage from 5v to 3.3v, the schematic is as follows:

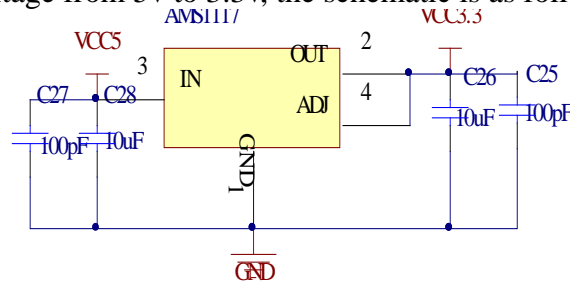


Fig.4. RC522 power supply circuit

Design of W5500 Network Module Circuit. W5500 network module circuit, introduced the chip pin to connect the circuit components, the schematic is as follows:

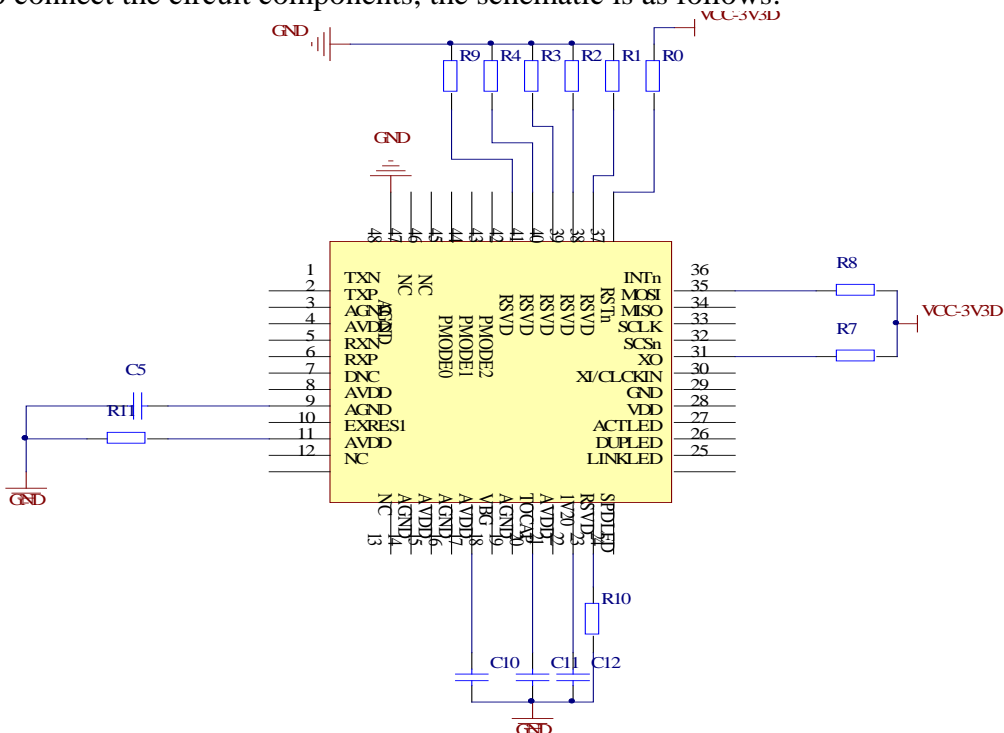


Fig.5. Design of W5500 Network Module

Button Selection Module Circuit Design. Through the matrix keyboard to reduce the use of single-chip pin, and to achieve more function keys, the schematic is as follows:

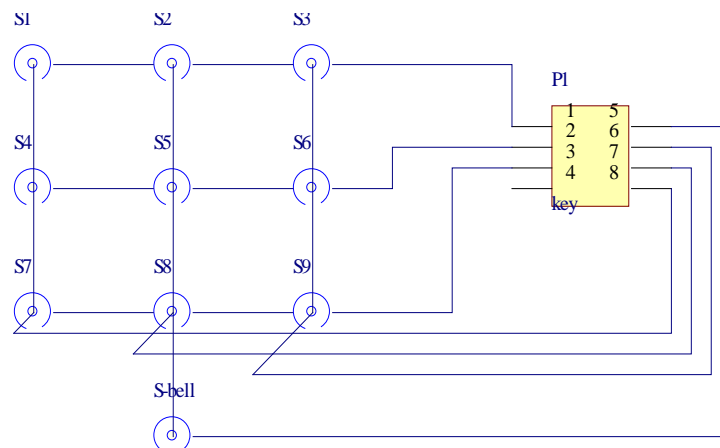


Fig.6. Button selection module

Software System Design Section

Software Design Choice. There are two options for master control chip selection.

Scheme 1: MSP430 series of single-chip, which is the 16-bit single-chip produced by TI company, the main feature is ultra-low power consumption, with a reduced instruction set of mixed-signal processor, instructions are single-cycle, strong function and fast running.

Scheme 2: 51 series of single-chip. The series of microcontroller have 8-bit , using a complex instruction set, the application is widely wide, for the speed requirements are not very high system can be applied, and low prices.

As a smart warehouse management system design, we need to take into account the power consumption and processing speed of the problem, where the intelligent warehouse management system through the network and the host computer for information exchange. This requires the main controller to have high-speed running capacity and strong information processing capabilities. The MSP430 family of microcontrollers is known for its ultra low power consumption and is therefore suitable for use as our main controller. So here we choose MSP430F5529 microcontroller as the main controller of the software part.

Software Design Part of The Flow Chart. The following is the system software design flow chart, specifically describes the system card operation and mechanical device action.

Working Principle and Performance Analysis

When the IC card with the operating privilege is close to the card reader, the card reader reads the card number of the valid IC card to verify through(the invalid card will be reminded on the display).Device to start their own power, and with the network module through the TCP / IP transmission protocol to encrypt the way to send each charge card record to the computer's PC operating system, in order to achieve remote monitoring operation, and the host computer can also send instructions through the network control device to start, to achieve remote control.

After the system is started, the number of the container to be opened can be selected by the matrix keyboard (two digits). After the container is opened, the operating mechanism is moved to the just above of the container and the goods are removed from the container (or placed in the container). You can set the time for the container to stay. To be completed after the completion of the container automatically restored to the original location, this time press the reset button is complete one pickup. When the press off the button system power, waiting for the next access card open.

After the model is finished, the physical model of the work is shown in the Figure 8.

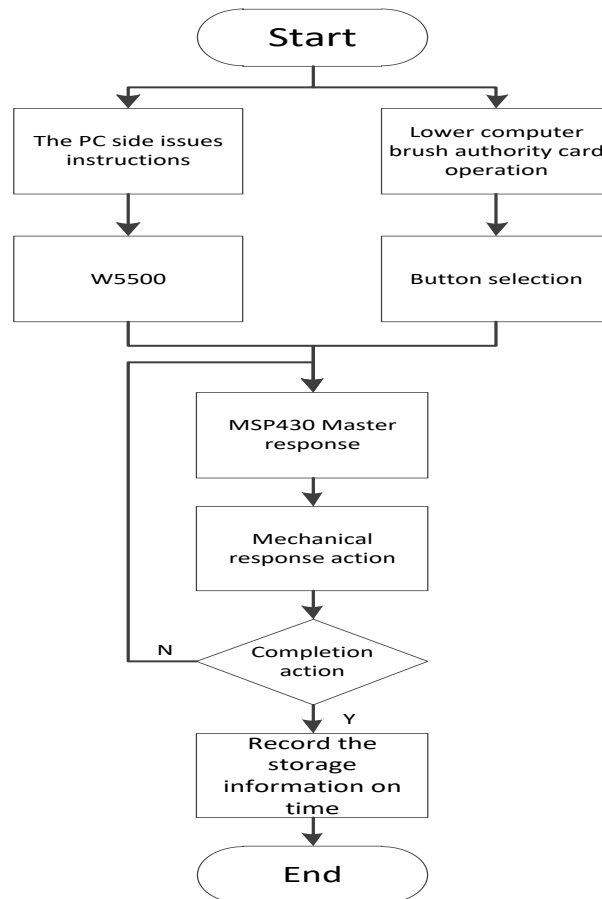


Fig.7. Software design part of the flow chart



Fig.8. Physical model

Summary

Intelligent warehouse management system is mainly used in courier companies and some small and medium-sized enterprise warehouse management, to achieve warehouse management automation, intelligent, small and economical. Intelligent warehouse management system applications to ensure that all aspects of cargo warehouse management data input speed and accuracy to ensure that enterprises timely and accurate grasp of the real inventory data, reasonable to maintain and control business inventories. Through the scientific code, can easily manage the inventory of goods batches, shelf life. The use of the system's location management functions, but also can grasp the current location of all inventory of goods, is conducive to improving the efficiency of warehouse management.

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