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The Design of Temperature and Humidity Automatic Control System for the Supermarket Fruits and Vegetables

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Abstract. Temperature and humidity automatic control system is widely applied in various fields more and more gets the welcome of people, because it can greatly reduce the human resources, and it has the characteristics of highly efficient and accurate. the temperature and humidity automatic control system based on STC89C52,Alarm module, GSM module,LCD1602 liquid crystal and the key threshold setting module.

1. Introduction

Food is kept in a specific temperature and humidity environment, in order to make food preservation more sustainable, a scientific and advanced management method is needed to maintain real-time monitoring of the temperature and humidity required for food preservation. The temperature and humidity control technology is widely used in the field of automatic control of single chip microcomputer.

2. The Project Design

2.1 Function Requirements

(1) Complete the design of the automatic control system for the temperature and humidity of the supermarket, including drawing, typesetting, printing, finishing and debugging.

(2) Data collection can be carried out on the temperature and humidity environment in the special cabinet, and the collected data is displayed and analyzed through LCD1602 with the corresponding results. When the temperature and humidity anomalies can send SMS alarm to inform the user, and deal with it timely.

Using STC89C52 single chip microcomputer as the main hardware control of the whole system. STC89C52 is fully compatible with the functions of 89C51 series single chip microcomputer with the ISP download function. The program memory is 8K and the program occupies enough storage for using, so it is suitable for this subject.

3. System Principle and Hardware Design

3.1 System Principle

In this design, STC89C52 single chip microcomputer is used as the control chip, and the set relief valve value is stored in the memory 24C02. The temperature and humidity data collected by the DHT11 temperature and humidity sensor shows the corresponding values through LCD1602, and then the security comparison is made by the single chip microcomputer. If the current data is in an unsafe range, the alarm will be issued, the buzzer alarm will be sent to the user's mobile phone with the current data exceeding the relief valve value, so that the user can understand the situation in time, and can control the opening of the relay in the environmental regulation module to adjust the internal



temperature and humidity environment of the special cabinet. The user can also send instructions to the GSM module via the mobile phone, and make the control of the environmental regulation module. **3.2 Structure and Function of STC89C52.**



Figure 1. STC89C52 physical figure

The highest operating frequency STC89C52 single-chip microcomputer can reach 35 MHZ, baud rate can choose 6 clock or 12 clock. When choosing work under 6 clock mode, STC89C52 single-chip computer speed will be twice than the other 51 series microcontroller. **3.3 Pin Structure of STC89C52**

1			
	p1.0	VCC	40
	p1.1	P0.0	39
	p1 2	P0.1	38
	p1 3	P0 2	37
50	p1.4	P0 3	36
6	p1.5	P0.4	35
T	p1.6	P0.5	34
8	p1.0	P0.5	33
91-	PST/Ve	F0.0	32
10	-2.0		31
11	p3.0	EA/vpp	30
12	p3.1	ALE/PROG	29
13	p3.2	PSEN	28
1410	p3.3	P2.7	127
1510	p3.4	P2.6	36
16	p3.5	P2.5	125
	p3.6	P2.4	<154
	p3.7	P2.3	-153
10	XTAL2	P2.2	150
	XTAL1	P2.1	122
20	VSS	P2.0	1

Figure 2 STC89C52 pin diagram

3.4 Microcontroller, s Clock Circuit.

This design drives the single-chip clock mode for its internal clock mode. The crystal oscillator with the frequency of 11.0592MHz is connected to the pin XTAL1 and ZTAL2, and then the load capacitance of the two capacitors is connected to a parallel resonant circuit, connecting them to the amplifying feedback loop, which makes up the single chip clock circuit, as shown in figure 3.



Figure 3. Clock Circuit

The STC89C52 microcontroller is provided with a specific oscillator signal by the crystal oscillator, Y1, to produce a specific clock signal. Physical principle: in the two quartz crystal plate with an electric field, crystal will produce the physical mechanical deformation, if the two pieces of plate applied mechanical force deformation, two pieces of plate also can produce the corresponding charge, this reaction called piezoelectric effect.

3.4.1 The Minimum System of Microcontroller.

The minimum system of microcontroller can also be called the minimum application system, and its components are: single chip microcomputer, reset circuit, clock circuit and power supply circuit and any part of them cannot be saved. It is the system that can meet the normal operation of the single-chip microcomputer in the case of the least peripheral circuit. Single-chip microcomputer is the control core of the whole minimum system, complete processing data and control the task. The microcomputer minimum system is shown in figure 4.



Figure 4. The microcomputer minimum system

The model used in this design is STC89S52. In the minimum system of single chip microcomputer, the effect of crystal vibration is especially large, which provides the basic clock frequency signal for the minimum system of single chip microcomputer. The higher the clock frequency provided by the crystal oscillator, the higher the efficiency of the single-chip microcomputer, but it is also limited (no higher than 40MHZ). Usually in a minimum system, a crystal oscillator is used in order to keep the clock of each module consistent.

3.5 Threshold Setting Module



Figure 5. Schematic diagram of button setting module.

The principle of threshold setting module diagram as shown in figure 7. The function of the threshold setup module is to set the value of the safety valve that the user feels. It is composed of four keys of S1, S2, S3 and S4, and each key is respectively connectable with that $P2.0 \sim P2.3$ of the single-chip microcomputer, and the other end is connected to the ground, and when one of the keys is pressed down, the level of the pin connectable with the single-chip processor is low, and the method is used to judge whether the key is pressed or not.

3.6 LCD1602 Liquid Crystal Display Circuit



Figure 6 LCD1602

The physical picture of LCD1602 liquid crystal display is shown in figure 8. In most cases, LCD1602 is used with a single-chip microcomputer. It cannot be used alone. It is just a piece of waste glass without a single-chip microcomputer. Another name for LCD1602 liquid crystal display is LCD1602 character liquid crystal, and symbols, Arabic numerals, English letters and other symbols can be displayed well.

Characteristics of LCD1602:

- (1) dc 5V voltage, contrast is adjustable;
- (2) It contains reset circuit;
- (3) Provide various control commands;
- (4) There are 80 bytes of display data memory DDRAM;
- (5) 160 font character generator CGROM is built inside;
- (6) 8 user-defined character generator CGRAM.



Figure 7. Schematic diagram of LCD1602 connection.

3.7 DHT11 Temperature and Humidity Sensor.

The DHT11 digital temperature and humidity sensor is a temperature and humidity composite sensor with the output of calibrated digital signals. The DHT11 digital temperature and humidity sensor includes a resistive sensor and an NTC temperature measuring element and is connected to a high-performance 8-bit single-chip microcomputer [8]. The signal transmission distance can reach up to 20 meters [8]. The physical object is shown in figure 8:





Figure 8. DHT11

As a digital temperature and humidity sensor, DHT11 temperature and humidity sensor has the advantages of excellent quality, super-fast response, strong anti-interference ability and high cost performance.

(8) Ultra-low energy consumption.

The connection method between the DHT11 temperature and humidity sensor and the main control circuit is not difficult. The circuit connection is shown in figure 9.



The pin description of the DHT11 temperature and humidity sensor is as follows:

VCC: power supply, single +5V;

GND: connect with the ground

NC: No connection, please suspend;

Dout: Serial data, single bus.

3.8 Introduction of GSM Module

Its English name is Global system for mobile communications. GSM belong to the second generation of mobile communication technology, also known as "global", as the name implies, a mobile phone can be achieved in the worldwide, allowing everybody to communicate at anytime and anywhere.



Figure 10. SIM900A module connection diagram.

The pin description of SIM900A is as follows: VCC: the positive pole of SIM module power supply; GND: the negative pole of SIM module power supply; DTR: data terminal ready; TX: data transmission; RX: data reception; SP: audio output; MIC: audio input; **RESET: SIM card reset.** Part of code as follow, #include <reg52.h> #include <intrins.h> #include <absacc.h> #include <math.h> #include "uart.c" #include "delay.h" #define uchar unsigned char #define uint unsigned int sbit Led_jiashi=P3^2; sbit Led_qushi=P3^3; sbit Led_jiangwen=P3^4; sbit Led_shengwen=P3^6; sbit Key_SET = $P2^{0}$; sbit Key ADD = $P2^{1}$; sbit Key_SUB = $P2^2$; sbit Key_OK = $P2^3$; sbit SCL = $P1^{0}$; sbit SDA = $P1^{1}$; sbit DATA = $P1^7$; sbit buzz=P3^5; sbit E=P1^3; sbit RS=P1^2; Uchar U8FLAG, U8temp, U8comdata, U8RH_data_H_temp, U8RH_data_L_temp, U8T_data_H_temp, U8T_data_L_temp,U8checkdata_temp; uchar U8RH_data_H,U8RH_data_L,U8T_data_H,U8T_data_L,U8checkdata;

uchar Mode, humidity, temperature;

char TH,TL,HH,HL;



bit bdata FlagStartRH,hot,cold,humid,dry,BJ,flag_1,flag_2;//flag_1

4. Summary

Through months of continuous learning and practice, my graduation design was finally completed. It has the characteristics of highly efficient and accurate. the temperature and humidity automatic control system based on STC89C52,Alarm module,GSM module,LCD1602 liquid crystal and the key threshold setting module.

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References

- [1]. B.Q LI, Y.F LING, H.Y ZHANG, S.Y ZHENG: The Design and Realization of Cherry Tomato Harvesting Robot Based on IOT. International Journal of Online Engineering, 12(12), 23, (2016).
- [2]. B.Q LI, W.L GUAN, S.Y ZHENG, X.G Yue: OPTIMISATION DESIGN OF CORN PRECISION SEEDER BASED ON MULTI-ROUTE AND MULTI-CHANNEL CONTROL. JOURNAL OF THE BALKAN TRIBOLOGICAL ASSOCIATION, 21(4A), 1215, (2015).
- [3]. B.Q LI, X.M YANG GUAN, S.Y ZHENG, Internet of Things-based Simulation Study on Lijiang River Water Environment Monitoring. Journal of Coastal Research, 79, 1-5, (2017).
- [4]. B.Q Li, et al, Intelligent Control Management System and Its Application, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON ECONOMICS AND MANAGEMENT INNOVATIONS, Wuhan, China, 2016, PP.68-71.
- [5]. B.Q Li, et al, Design and Implementation of Tanks War Game Based on the Android Platform, in: PROCEEDINGS OF THE 2016 2ND WROKSHOP ON ADVANCED RESEARCH AND TECHNOLOGY IN INDUSTRY APPLICATIONS, Dalian, China, 2016, PP.963-966.
- [6]. B.Q Li, et al, Design of a Tea Garden Antifreezing Control System, in: PROCEEDINGS OF THE 2016 6TH INTERNATIONAL CONFERENCE ON MACHINERY, MATERIALS, ENVIRONMENT, BIOTECHNOLOGY AND COMPUTER (MMEBC), Tianjin, China, 2016, PP.736-738.
- [7]. B.Q Li, et al, Design of Electronic Compass, in: PROCEEDINGS OF THE 2016 6TH INTERNATIONAL CONFERENCE ON MACHINERY, MATERIALS, ENVIRONMENT, BIOTECHNOLOGY AND COMPUTER (MMEBC), Tianjin, China, 2016, PP.1240-1243.



- [8]. B.Q Li, et al, Research of Automatically Light-Adjusting Lamp, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON COMPUTER ENGINEERING, INFORMATION SCIENCE & APPLICATION TECHNOLOGY (ICCIA 2016), Guilin, China, 2016, PP.249-252.
- [9]. B.Q Li, et al, The Design and Realization of Fruit Harvesting Robot Based on IOT, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON COMPUTER ENGINEERING, INFORMATION SCIENCE & APPLICATION TECHNOLOGY (ICCIA 2016), Guilin, China, 2016, PP.261-264.
- [10]. B.Q Li, et al, A New Type of Automatic Opening and Closing Light-Operated Curtain, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON MECHATRONICS ENGINEERING AND INFORMATION TECHNOLOGY (ICMEIT), Xian, China, 2016, PP.66-69.
- [11]. B.Q Li, et al, Design of the Intelligent Air Humidifier, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON MECHATRONICS ENGINEERING AND INFORMATION TECHNOLOGY (ICMEIT), Xian, China, 2016, PP.201-203.
- [12]. B.Q Li, et al, The Design Implementation of the APP of Experiencing Guangxi Folk Custom, in: PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON ECONOMICS AND MANAGEMENT INNOVATIONS, Wuhan, China, 2016, PP.47-50.
- [13]. S.Y Zheng, et al, Digital Display Design of Ethnic Clothing of Nanling, in: PROCEEDINGS OF THE 4TH INTERNATIONAL CONFERENCE ON MECHATRONICS, MATERIALS.CHEMISTRY AND COMPUTER ENGINEERING 2015(ICMMCCE 2015), Xian, China, 2015, PP.2805-2808.
- [14]. S.Y Zheng, et al, Design and Implementation of Supermarket Personnel Management System Based On Java, in: PROCEEDINGS OF THE 2015 INTERNATIONAL CONFERENCE ON EDEDUCATION, MANAGEMENT AND COMPUTING TECHNOLOGY (ICEMCT-16), Hangzhou, China, 2016, PP.957-960.
- [15]. S.Y Zheng, et al, Brief analysis onHeYuanTongCampus Mobile Phone APP Design, in: PROCEEDINGS OF THE 2015 5TH INTERNATIONAL CONFERENCE ON COMPUTER SCIENCES AND AUTOMATION ENGINEERING, Sanya, China, 2015, PP.151-154.
- [16]. S.Y Zheng, et al, Social Work in Teen Addiction Correction Services Research under the New Situation, in: PROCEEDINGS OF THE 2015 4TH NATIONAL CONFERENCE ON ELECTRICAL, ELECTRONICS AND COMPUTER ENGINEEERING (NCEECE 2015), Xian, China, 2015, PP.252-255.
- [17]. B.Q Li, et al, The Design of Remote Temperature Monitoring System, in:International Conference on Green Energy and Sustainable Development MAY 27-28, 2017, PP.20-22.
- [18]. B.Q Li, et al, Design of Portable Valuables Touch Alarm Circuit,in:International Conference on Advances in Materials, Machinery, Electronics ,2017, PP.27-32.
- [19]. B.Q Li, et al, Design and Implementation of a Simple Acousto Optic Dual Control Circuit,in:5th International Conference on Computer-Aided Design, Manufacturing, Modeling and Simulation,2017, PP.78-80.
- [20]. B.Q Li, et al, Design of electronic lock based on single-chip microcomputer,in:4th International Conference on Electrical and Electronics Engineering and Computer Science ,2017, PP.55-60.



- [21]. B.Q Li, et al, The Design of Chicken House Electronic Intelligent Lighting Apparatus, in: International Conference on Mechanical, Electronic, Control and Automation Engineering, 2017, PP.15-20.
- [22]. B.Q Li, et al, Office Automation Sub-Summary of the Work and the Project Management System,in:International Conference on Mechanical, Electronic, Control and Automation Engineering,2017, PP.46-48.
- [23]. B.Q Li, et al, The Design of Intelligent Heat Dissipator Control Circuit,in:PROCEEDINGS OF THE 2017 2ND INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE, MACHINERY AND ENERGY ENGINEERING,2017, PP.22-25.
- [24]. B.Q Li, et al, The Design of IPv6's Transitional Scheme in University,in:International Conference on Materials Science, Energy Technology, Power Engineering (MEP) ,2017, PP.91-93.
- [25]. B.Q Li, et al, The Personal Receiving Document Management and the Realization of Email Function in OAS,in:International Conference on Materials Science, Energy Technology, Power Engineering (MEP) ,2017, PP.121-123.
- [26]. S.Y Zheng, et al, Design and Implementation of an Audio Indicator, in: 5th International Conference on Computer-Aided Design, Manufacturing, Modeling and Simulation, 2017, PP.21-23.
- [27]. S.Y Zheng, et al, Implementation and Application of ACL in Campus Network, in: International Conference on Advances in Materials, Machinery, Electronics ,2017, PP.151-153.
- [28]. S.Y Zheng, et al, The Design of Liquid Drip Speed Monitoring Device System Based on MCU,in:International Conference on Green Energy and Sustainable Development, MAY 27-28, 2017, PP.51-53.
- [29]. S.Y Zheng, et al, The Design of Hearing and hypnosis all-in-one Machine, in:International Conference on Mechanical, Electronic, Control and Automation Engineering, 2017, PP.66-68.
- [30]. S.Y Zheng, et al, Campus Network Security Defense Strategy,in:International Conference on Mechanical, Electronic, Control and Automation Engineering,2017, PP.30-33.
- [31]. S.Y Zheng, et al, Design and implementation of multifunctional charger,in:International Conference on Materials Science, Energy Technology, Power Engineering (MEP) ,2017, PP.71-73