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Research Article

Vegetable Greenhouses Intelligent Temperature Control System

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Abstract: This study is designed for microcontroller-based system to monitor the data greenhouses, especially to ensure that a constant temperature inside the greenhouse to ensure the crop. By DS18B20 temperature measurement and display and LCD were working with the information obtained to adjust the device so that the temperature control and thus achieve the optimum production temperature and increase production.

Keywords: DS18B20, intelligent temperature control, vegetable greenhouses

INTRODUCTION

In China's northern region, due to its high latitude, the four seasons and a relatively large temperature difference between day and night and the long and cold winter, which suitable crops (Long *et al*., 2013). Therefore, the development of a comprehensive solution can detect temperature information systems, especially to be able to multi-point temperature measurement system is very important. Relying on the experience and the human cost is too high, while it does not have the science, susceptible to interference and influence production capacity, is not conducive to the controller to make the right decision.

The main topic of vegetable greenhouses to achieve intelligent temperature control: temperature display, temperature setting, alarms, data communications, temperature control, etc. Lower machine functions (MCU section):

- **Temperature warning:** When the environment temperature exceeds a preset range, the use of sound and light devices alarm
- **Data communication:** The use of serial or wireless communication (GPRS) and the temperature information in real time to spread the host computer (PC) and stored (Yan *et al*., 2014a)
- **Temperature control:** According to the temperature setting, the thermostat device turned on or off in time
- **Temperature display:** The use of the LCD display shows vegetable greenhouse temperature. PC functions:
  - To accept and store temperature data
  - Temperature parameters set
  - With temperature display, query and analysis (Line chart) (Yan *et al*., 2014b)

The aim of this study is that the temperature in vegetable greenhouse gets on real-time monitoring and control system, temperature control system witch designed achieves the basic temperature control (Yan *et al*., 2013).

MATERIALS AND METHODS

System hardware components: This design is an automatic detection and automatic temperature control system (Nakamoto *et al*., 1997), lower computer system hardware mainly contains: AT89C51 microcontroller, sensors, LCD displays, motors and alarm buzzer LED devices. Composition is shown in Fig. 1.

As shown in Fig. 2, AT89C51 is the central system. First, it is detected by the temperature, the results of the previous step are on the motor to automate the control and display the results. If the detected temperature is higher than the set value, an alarm to start the motor, the corresponding air-conditioning system is turned on.

The working principle of DS1820: As shown in Fig. 3, DS1820 pin I/O-bit data input/output (single wire bus) is an open-drain output. If connected to an external pull-up resistor, this is often the case is high. VDD 5V power supply terminals can be used for an optional external power supply, often require ground when not in use. GND is the ground pin and NC is empty feet.

Alarm circuit: Circuit alarm siren alarm is the main component, its main advantage is that by constantly issuing pronunciation components siren judge line on or off. And buzzer alarm circuit produces about 3 Hz shock sound received between 3V and 5V DC power supply will be able to achieve. The circuit is shown in Fig. 4.

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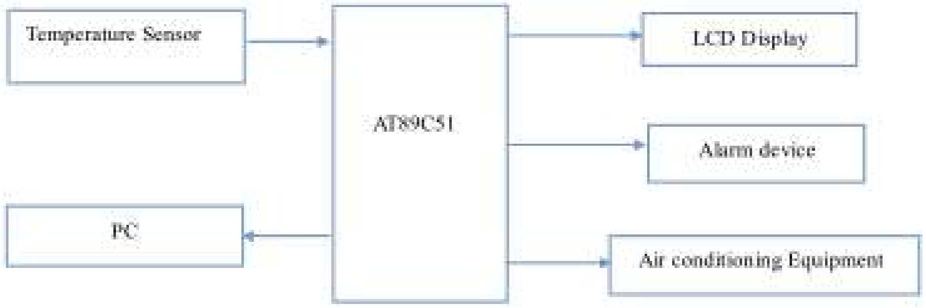

Fig. 1: Control systems

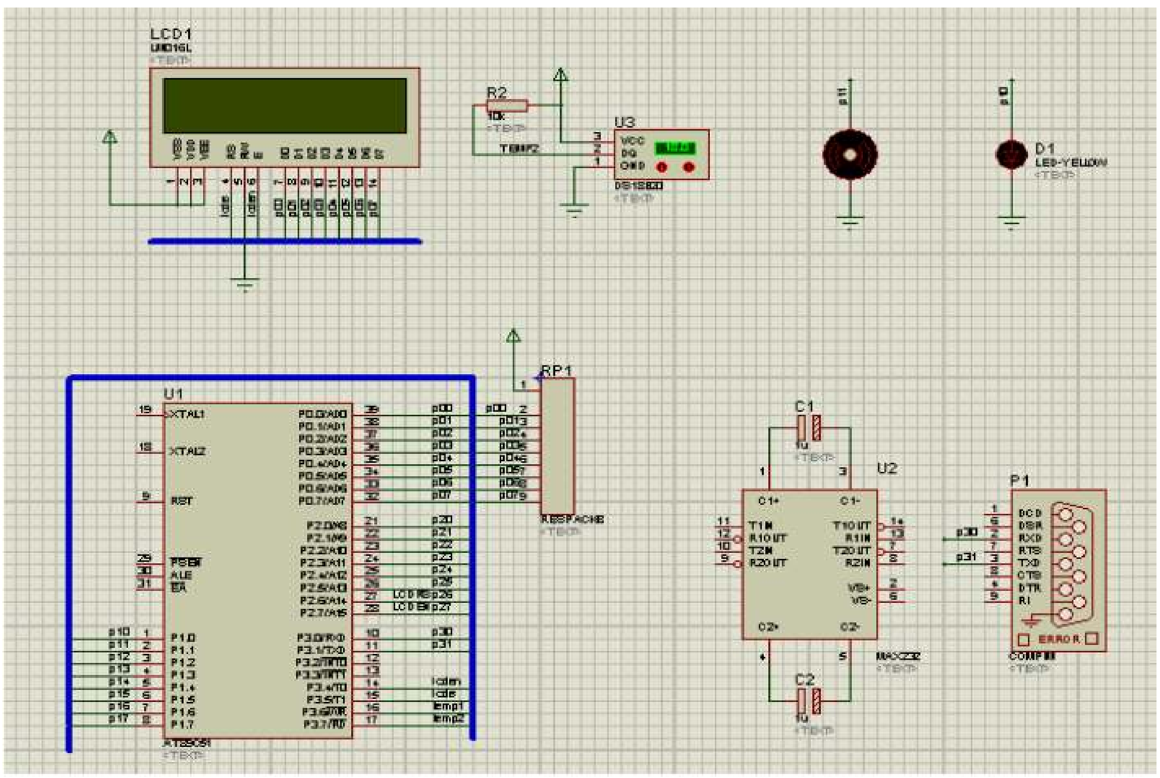

Fig. 2: System simulation

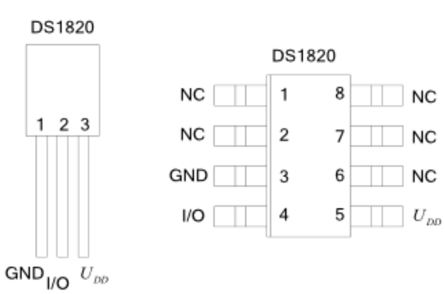

Fig. 3: DS1820 pin map

RESULTS AND DISCUSSION

Overall summarize, the general software can be divided into four categories: The first type is a measure

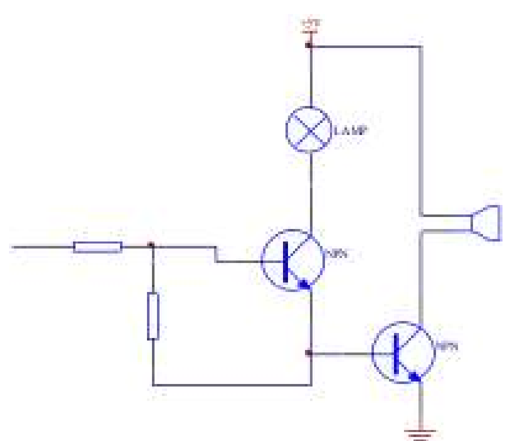

Fig. 4: Buzzer circuit

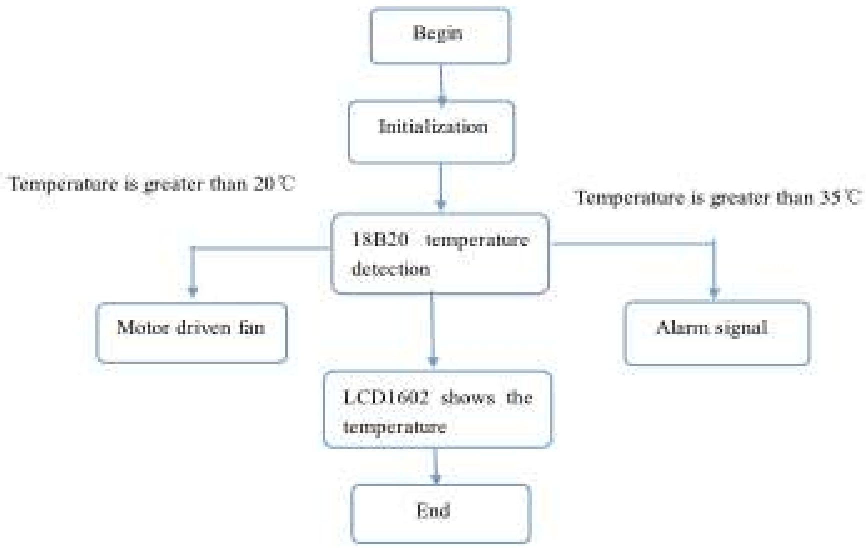

Fig. 5: Software design flow

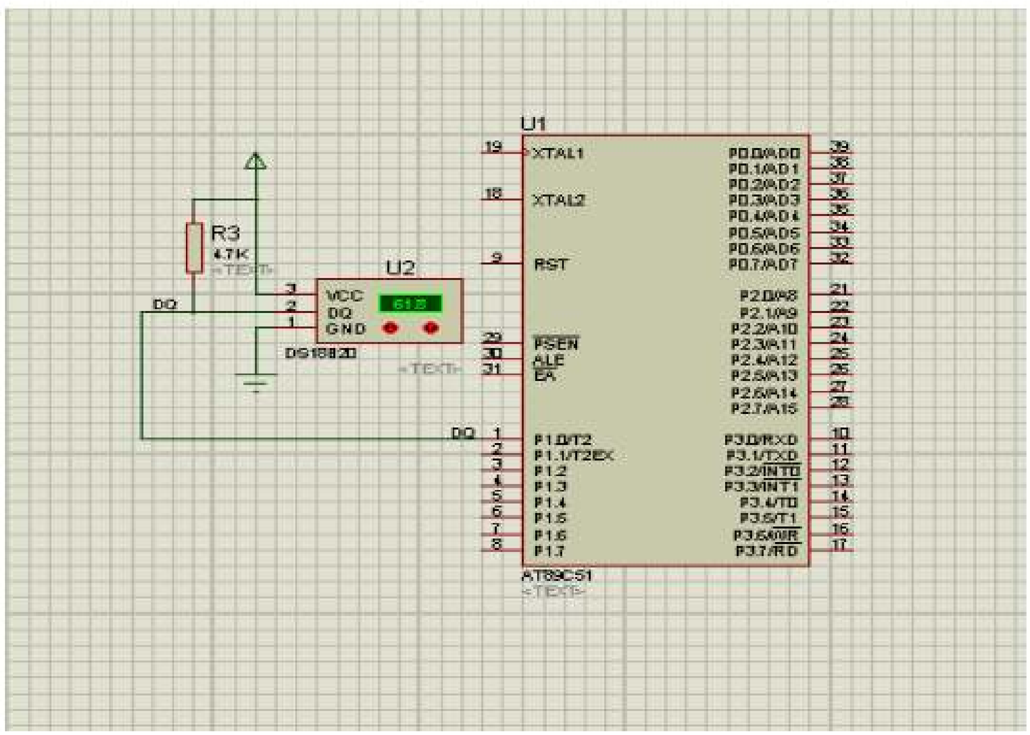

Fig. 6: DS18B20 connection with AT89 C51

of software, mainly for temperature monitoring. Second display portion for displaying the temperature detected at the time. Third, the regulation section for controlling the rotational speed of the motor. Fourth, when the temperature is higher than the set temperature threshold, the buzzer will automatically send an alarm signal. Figure 5 is a software design flow.

Read the temperature design: Figure 6 are AT89C51 and DS18B20.

Instrument obtained from a single bus power and when high signal lines energy stored on the internal capacitance, at the time of the low signal, the system will disconnect the power until the power supply is not only a low level. Moreover, external 5V power provides power to achieve DS18B20. As shown in Fig. 7.

Reading the temperature subroutine can read 9 bytes in RAM. When nine of the bytes are read, CRC will begin testing. When an error occurs after the check, it will not be rewritten temperature data.

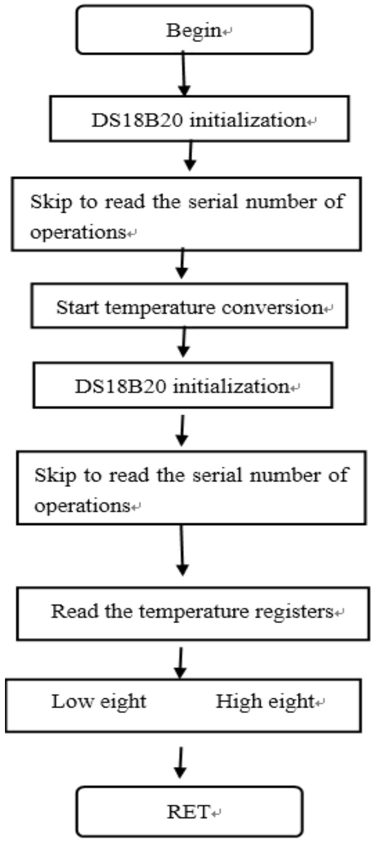

Fig. 7: DS18B20 read temperature flowchart

Each command of DS18B20 is particularly demanding of time, which must be completed in accordance with the requirements of the time. Among them, total reads 12-digit, 7-bit integer, four decimal places, a sign bit and in accordance with the low in the front, high in the back. Read the temperature of the main program as follows.

Unsigned int Read Temperature (void) (Hatipoglu *et al*., 2011; Altawil and Hajier, 2006):

```
{
unsigned char a = 0;
unsigned int b = 0;
unsigned int t = 0;
Init_DS18B20 ();
WriteOneChar (0xCC);
WriteOneChar (0x44);
delay (200);
Init_DS18B20 ();
WriteOneChar (0xCC);
WriteOneChar (0xBE);
a = ReadOneChar ();
b = ReadOneChar ();
b<< = 8;
t = a+b;
return (t);
}
```

Data obtained through the above process, which is the temperature fractional part after four TempLE, about 0.062°C. Integer part of TempH and TempL temperature is high four readings, TempH top four have expressed a positive number is 0, both one is negative. Fractional part of the following process: If more than 0.5°C, the bits into one; when less than 0.5°C, do rounding. If the processing data obtained negative, Then the data will be read out before dealing with the integer part negated plus one it is important to one-bit integer part can be replaced with a "-" indicates a negative number. Flowchart is Fig. 8.

Because the code and the actual temperature values after DS18B20 instruments treatment obtained need to be converted on the calculated values.

High temperature high byte 5 is stored for the positive and negative temperature, low and high bytes for the three low temperature.

The temperature of the fractional part is stored in the lower four bytes. This design accuracy of 0.0625, the actual value divided by 0.0628 is the true value which obtains the result to one decimal place, so the temperature of the paper is accurate to 0.1°.

Mathematical main program temperature data below:

```
str (0) = TempH/100; //Ten temperature
str (1) = (TempH%100)/10; //Ten temperature
str (2) = (TempH%100)%10; //Digit temperatures, with a decimal point
str (3) = TempL;
if (flag_get = = 1) //Time to read the current temperature
{
temp = ReadTemperature ();
if (temp and 0x8000)
{
str (0) = 0x40; //Sign flag
temp = ~temp; // Negated plus 1
temp + = 1;
}
else
str (0) = 0;
TempH = temp>>4;
TempL = temp&0x0F;
TempL = TempL*6/10; //Decimal approximation
flag_get = 0;
```

Monitor LCD1602: LCD 1602 character can display characters, numbers, symbols and so on. (1602 LCD) is composed by a number of characters such as 5X7 or 5X11 bit, from one of the characters can be displayed at anyone character. The spacing between adjacent and rows, because of this interval, is not perfect display graphics. Figure 9 is LCD display.

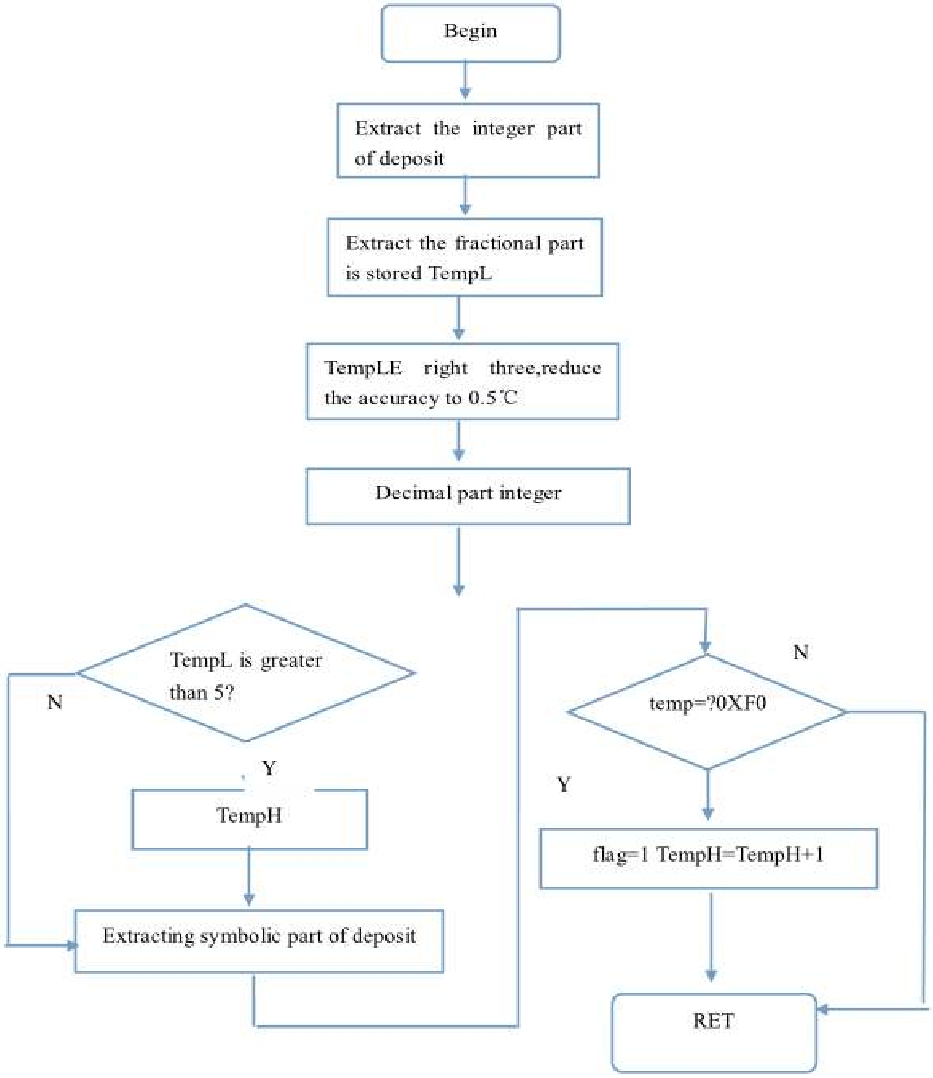

Fig. 8: Temperature data process

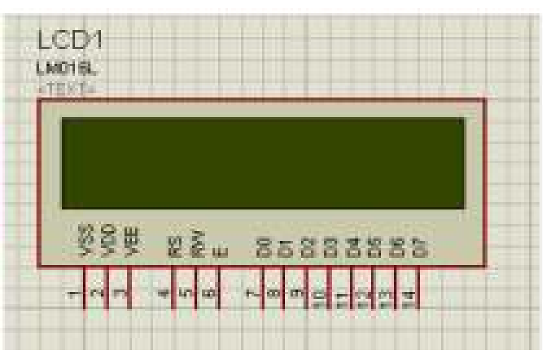

Fig. 9: LCD display

Motor control: If the temperature is below 28°C, at the time of the P1.7 angle output signal is one, the motor does not rotate. Temperature between 28-40°C, the motor starts to work, the duty cycle is 0.5. Temperature is between 25-30°C, the duty cycle is 0.75. Temperature is between 30-35°C, the duty cycle reaches 0.9375. The higher temperature, the easier to achieve balance.

CONCLUSION

This design is the application of microcontrollers and digital temperature sensor for design. The system can achieve the indoor temperature and humidity automatic adjustment and measurement can reduce the labor intensity of staff. In the northern cold season long, the biggest difference between day and night and seasonal temperatures is also great, is not conducive to the growth of crops, In this form, the development of high-precision, real-time high, the system can accurately to handle multi-site temperature information is essential. In contrast, currently the only rely on past experience and manpower to monitoring and control system could not be more scientific. In this environment, high-precision, high-availability, low cost, temperature management information measurement and control system to accurately place is essential.

ACKNOWLEDGMENT

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