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Research Article

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Traffic vehicles: Design of temperature control of automobile air conditioning system

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Abstract With the development of social economy and the improvement of people living standards, the number of cars per capita is rising. People have higher requirements for the safety and comfort of cars. The temperature control of car air conditioning system plays an important role in the comfort satisfaction of passengers. Therefore, the use of single-chip microcomputer technology to control the temperature in the car, select a more suitable temperature sensor and its installation position, further improve the accuracy of temperature detection, achieve faster and more accurate adjustment of the temperature in the car, solve the operation trouble caused by the temperature discomfort in the car, and improve the comfort, safety and stability of driving.

Keywords Air conditioning system; temperature control; singlechip; position

1. Introduction

People are more in pursuit of high-quality life and intelligent products. The requirements for the scooter are not limited to being able to take the scooter, but more concerned about the appearance and performance of the car. Among them, the temperature in the car is particularly important for the driver and passengers. The appropriate temperature can not only make the people in the car feel comfortable. In addition, it can ensure the safety and stability of driving, avoid traffic accidents and prevent automobile spontaneous combustion caused by too high temperature in the car.

At present, the traditional temperature control of automobile air conditioning system can not accurately keep constant according to the temperature set by people, which is not conducive to the driver & apos;s manipulation experience. Therefore, an air conditioning system that can automatically adjust the temperature in the car is developed to meet the requirements set by the driver, which can not only reduce the cumbersome operation of the driver when driving, In addition, it can also prevent the occurrence of scalding events caused by excessive temperature in the car in summer.

Masatoshi mitsuiu is based on PID algorithm [1]. Compared with the traditional thermal control valve, the effect of this method is better. The disadvantage is that the temperature in the vehicle fluctuates up and down too much in this way. He uses this method to operate the compressor and expansion valve through the characteristics of the surface temperature of the evaporation tank and the temperature difference between its outlet and inlet, when Leighton made further research on the comfort of automobile air conditioning temperature to passengers, he adopted the fuzzy control method. When matsuei and others studied the car air conditioning mechanism, the

core of the car air conditioning comfort control is the neural network method, and the key standard for evaluating the comfort is the thermal feeling.

Domestic research status: at present, most domestic automotive air conditioning systems use microcomputer as the control core, relying on a series of parameters, such as the air supply mode of air conditioning, the conditions required for real-time detection of climate sensors inside and outside the vehicle, the start and stop state of refrigeration compressor, the temperature of relevant components of refrigeration cycle, etc, To achieve the purpose of comparing the setting signal and outputting the corresponding control signal. Finally, the corresponding actuator is used to adjust and improve the air environment in the vehicle.

Research status of new science and technology of vehicle air conditioning system: with the rapid development of world economy and the improvement of scientific level, the technology of vehicle air conditioning temperature control system has also reached a qualitative leap. The intelligent regulation of vehicle temperature and the purification of vehicle air have been greatly improved compared with the old technology. Nowadays, the sensors of automobile air conditioner can transmit information faster and consume less energy. In addition, they can also monitor the changes of gas composition and temperature in the air in the car, and then transmit the sensed information to ECU. Then ECU can judge the information, adjust the temperature in the car in time and purify the air in the car,So as to realize the comfort and health of riding.

2. Design

Temperature regulation principle of air conditioning box steam is the cornerstone of automobile air conditioning temperature regulation system. The role of blower and internal and external circulating air is to change the air volume and air source of air inlet respectively. In order to accurately regulate the temperature of air, the mixing damper is adopted, which can control the ratio of cold air and warm air suction, and the mode damper is adopted to control the position of air outlet, so as to change the air flow field in the automobile, then it is consistent with the temperature set by the driver [2].

2.1 Working principle of air conditioning system

Refrigeration process of automobile air conditioning system: liquid refrigerant is generally used to cool down by gasification and heat absorption through its physical change as shown in Fig. 1.

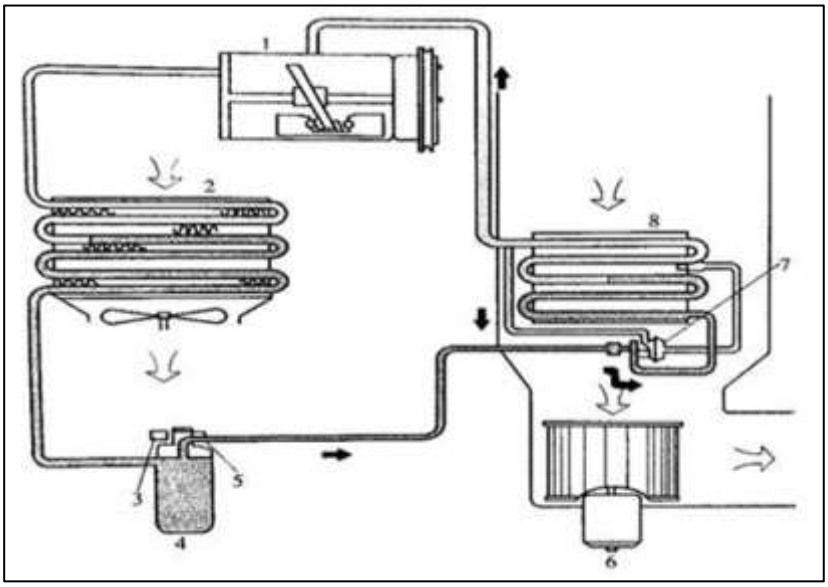

Figure 1: Working principle diagram of refrigeration system

The specific working process is as follows: the automobile engine can transfer kinetic energy to the compressor, which compresses the low-temperature and low-pressure gas in evaporator 8 into high-temperature and high-pressure gas, and then sends it to condenser 2; After arriving, it exchanges heat with the outside air to release heat. When the temperature is as low as about 50 ℃, the refrigerant changes from gaseous state to liquid state; After the liquid high-temperature and high-pressure refrigerant reaches the liquid storage drying tank 4, the impurities and moisture are removed, and then transported to the expansion valve 7 through the high-pressure liquid pipe; Because the expansion valve has the function of throttling, the liquid refrigerant is transformed into mist and then sprayed into the evaporator to absorb heat in the air, vaporize and evaporate to achieve the effect of cooling; Because of heat absorption, when the refrigerant gas reaches the evaporator outlet, the temperature will rise to about 5 ℃: if the compressor runs continuously, the compressor will inhale the vaporized refrigerant again, and the above process will continue to cycle to achieve the refrigeration effect [3].

In winter, we often encounter a problem when driving. When sitting in the car, our exhaled gas and body will generate heat, the temperature in the car will rise, and the windows will fog or frost due to temperature changes. When driving, it will interfere with our sight and is not conducive to normal driving. At this time, we can turn on the heating switch, it can not only quickly clear the frost and fog on the windshield, but also heat up the car. This structure that sends warm air into the car is called heating system.

At present, the heating devices of automobile air conditioning system are generally divided into two categories according to different heat sources. One is independent and the other is non independent. Non independent is generally the most common in life. Because it does not need to consume too much unnecessary energy, and it is also the most convenient. The structure is relatively simple and the noise is relatively small.

Working principle of non independent type: for the heater composed of motor and heat exchanger, its heat source is the coolant from the engine. After the air of the heater is heated, it is transmitted to the vehicle, so as to raise the temperature in the vehicle.

2.2 Design of system hardware

The designed system can be divided into four units [4]. Single chip microcomputer control unit, temperature acquisition unit, LCD display key unit, can bus driving unit. The general idea is to take the single chip microcomputer as the control center of the system, then connect the other parts of the structure, pass the information to the single chip microcomputer through the other parts of the structure, and then make judgment and processing. When the car stops at the roadside, the system will automatically connect the battery. The single chip microcomputer controls the operation of the temperature sensor and displays the temperature on the LCD screen. The driver can set a temperature to meet his own needs according to his own needs. If the temperature is higher or lower than the preset temperature, the single chip microcomputer will control the air conditioner to start through the CAN bus and reasonably adjust the temperature in the car [5].

MCU: STC89C52 is a microcontroller with built-in reset circuit, which has the advantages of low energy consumption and strong performance. The components are 8-byte flash, reset circuit, external interrupt, timer and counter. Programming flash in the system is very suitable for embedded control application system and can play a greater role [6]. Its chip is shown in the Fig. 2.

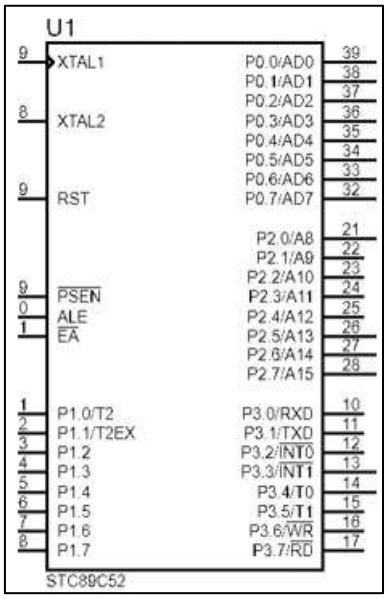

Figure 2: STC89C52 chip diagram

The temperature detection module detects the temperature signal and adjusts the feedback information by using the temperature sensor DS18B20 [7] as shown in the Fig. 3. It is characterized by simple structure and no need for external components. The data line itself can provide power supply to complete reading and writing and temperature conversion, so it no longer needs to be connected with external power supply. DS18B20 (see Fig. 3) completes the task of detecting and measuring temperature according to the number of clock cycles experienced by the low temperature coefficient oscillator during the opening of the door.

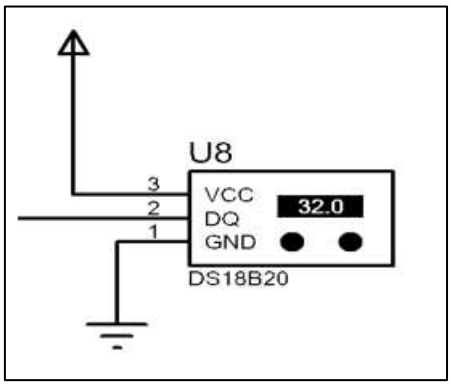

Figure 3: DS18B20

The DS18B20 sensor can directly change the temperature signal into a 16 bit digital signal, and then output it serially to the microprocessor in this form for calculation and analysis. The measuring temperature ranges from minus 55 ℃ to 125 ℃, and 0.0625 ℃ is the highest accuracy. Because of the uniqueness of each DS18B20 64 bit serial number, each bus can connect any number of DS18B20, so that the multi-point temperature measurement of single bus can be realized. Generally, the register resolution can be set into four forms through program setting (brackets are the corresponding temperature accuracy), which are 9 bits (0.5 ℃), 10 bits (0.25 ℃), 11 bits (0.125 ℃) and 12 bits (0.0625 ℃).

LCD screen is a liquid crystal module that reflects the required information in the form of symbols, letters, numbers and Chinese characters (as shown in the Fig. 4). This component has many advantages, such as beautiful appearance, affordable price, convenient operation and so on. In the market, 8 5 * 8 or 4 5 * 11 dot

matrix characters can be customized according to the user. We choose this to display the real-time temperature and the temperature set by ourselves in real time, so that the driver can clearly see the displayed temperature information when driving at night. Tap the switch to act as a separate key. It is an electronic switch. When in use, if you want to connect the switch, you only need to press the switch button gently. When you take away your hand, the switch will be disconnected [8].

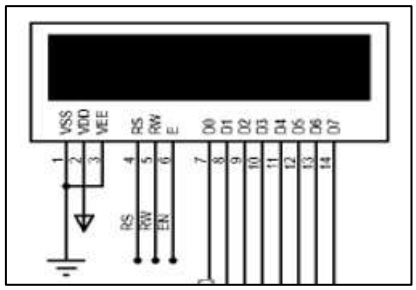

Figure 4: Structural diagram of LCD1602

The transmission between the system and the air conditioner is completed through the high-speed can transceiver tja1042t. The transmission information speed can reach 1 Mbits / s, which is fully compatible with the iso11898-2 standard. In this system, the speed of 500kbit / S is used for communication, so this chip is fully compatible. The blower driving circuit can complete the regulation of the air conditioner by the single chip microcomputer through the stepping motor driving circuit [9].

2.3 Design of system software

First, debug the temperature sensor. At this time, the temperature sensor senses the real-time temperature in the vehicle, and then the temperature information is converted into code and stored. Second, turn on the LCD display for initialization. The LCD display reads commands and data, then displays the actual temperature in the vehicle on the LCD screen, and sets the keys, serial communication and can bus communication independently. Third, manually set the required temperature. When the temperature is higher or lower than this temperature, can and serial communication will send information to the battery, the air conditioner will start, and each sensor will realize the feedback cycle. When the previously set temperature is reached, the air conditioning system will stop running. The system design is shown in Fig. 5.

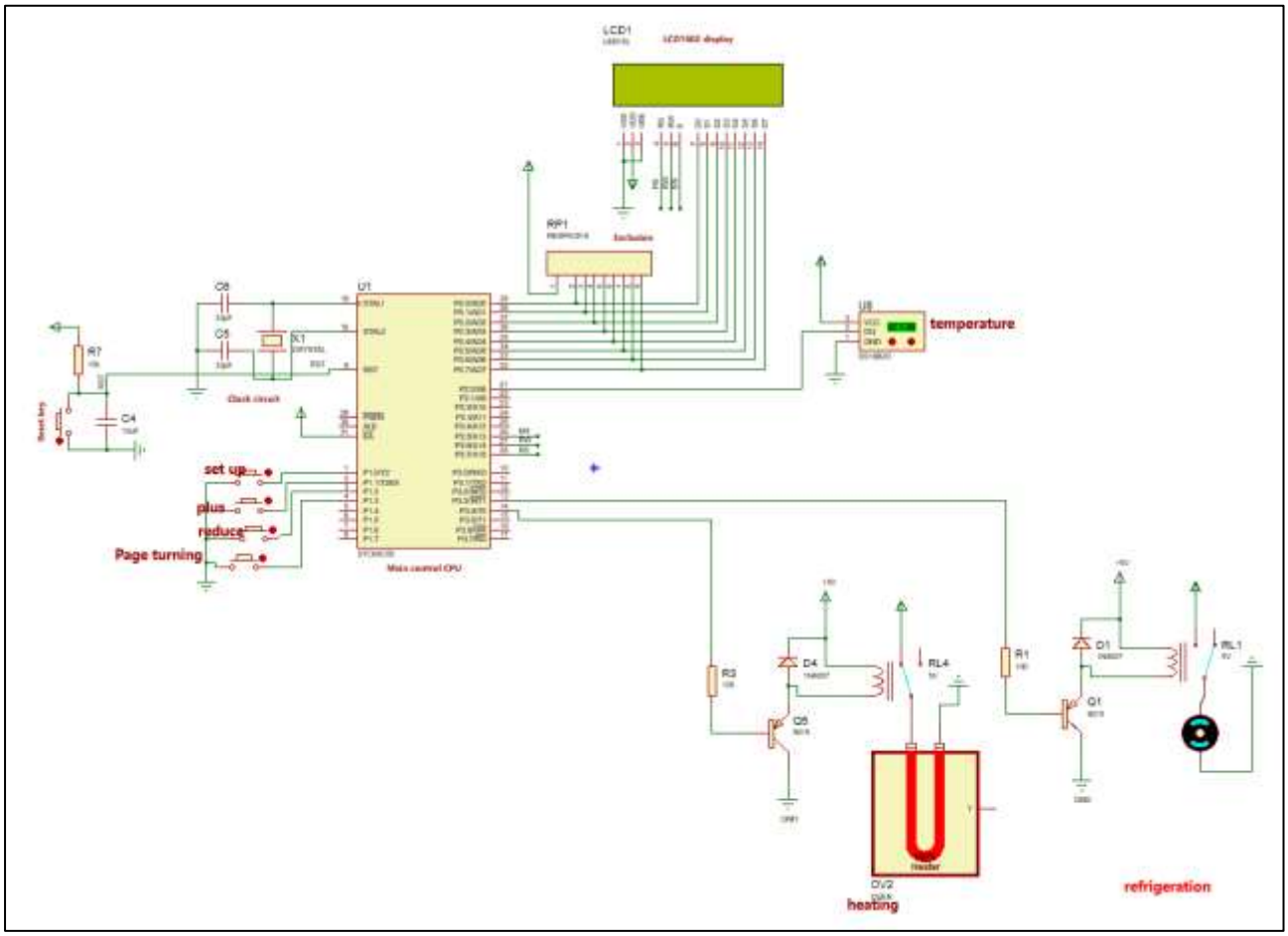

Figure 5: System design

The procedure flow chart is as follows:

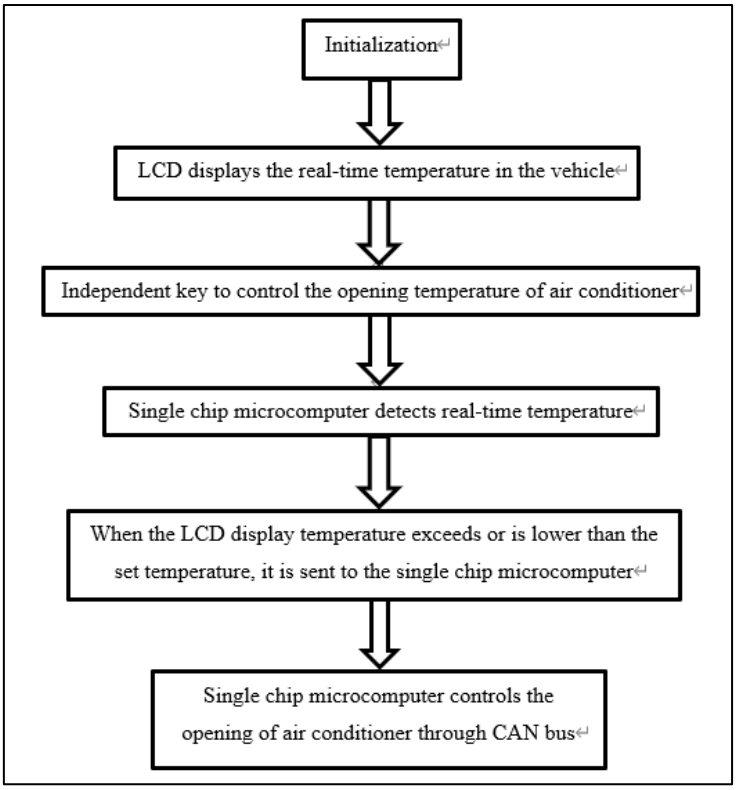

Figure 6: Software design flow chart

2.4 Results

In the experiment, the actual temperature of the sensor can be displayed on the display screen. The maximum temperature is 33 ℃ and the minimum temperature is 28 ℃. If the sensor temperature is 34 ℃, the motor starts (equivalent to refrigeration). If the sensor temperature is 27 ℃, the heating wire will emit light (equivalent to heating), as shown in Figure 8.

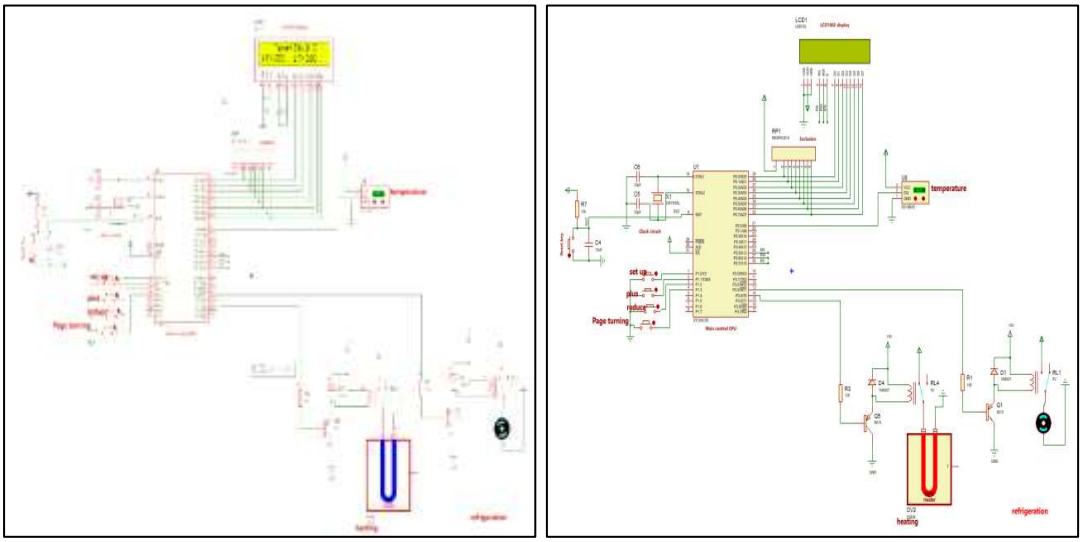

Figure 7: Refrigeration and heating startup diagram

2.5 Discuss

At present, in automobile manufacturing, in order to save cost and reduce process flow, temperature sensors are generally installed on the surface of air-conditioning evaporator. Because the sensor is almost on its surface, it can quickly detect and reflect its temperature, and then transmit the information to the chip, which makes instructions to directly control the operation of the compressor. In the real operation process, when the temperature value set in advance is higher than the evaporator surface temperature, the temperature sensor will feed back this information to the single chip microcomputer, and then stop running the compressor. In addition, when the temperature value set in advance is lower than the evaporator surface temperature, the single chip microcomputer will also send instructions to start running the compressor according to the collected information, as the compressor starts or stops according to the command, it can be adjusted again and again, so as to significantly adjust the temperature of the evaporator.

However, in the actual situation, the situation is not as we imagined. All devices are not ideal. Because of the structural differences of the evaporator, there will be a surface temperature difference, which can not be avoided by other devices. When the temperature of the position where the temperature sensor is located is low, the temperature transmitted will be low, and high temperature may occur in other parts, resulting in abnormal operation of the air conditioner due to high temperature [11].

The opening and closing results of the compressor in the automotive air conditioning system will be directly affected by the temperature sensor. The command of whether the air conditioning compressor operates comes from the temperature sensor. Therefore, if the position of the temperature sensor is placed in an inappropriate position, the transmitted temperature information will be greatly different from the actual situation, which will make the air conditioning system operate incorrectly. Therefore, when selecting the installation position, it is generally selected at the outlet surface of the evaporator and the place with low humidity. This can not only improve the accuracy of temperature detection, but also help us to identify the probability of frost on the surface of the evaporator [12].

When installing the temperature sensor, we should also realize that we should not only accurately obtain the temperature information of the air outlet, but also not increase the air resistance of the air outlet. In a word, we should not cause undesirable side effects. Therefore, in the actual installation operation, we need to measure the temperature distribution at the outlet of the evaporator. At this time, we can use platinum resistance, because its nature is relatively stable and will not be affected by the temperature difference, which is conducive to the measurement of temperature. Then, after measurement and comparison, select the position with lower temperature from the inside, and finally install the temperature sensor [13].

3 Conclusion

The control core of the automobile air conditioning control system is the control of the single chip microcomputer system. The single chip microcomputer control is relatively stable. This high-precision and high stability control provides a comfortable driving environment for passengers and drivers, and has certain practical value. Under the control of single chip microcomputer, we can set the upper and lower limits of temperature. When the sensor temperature is higher than the set temperature, the air conditioner will be started for refrigeration, and when the sensor temperature is lower than the set temperature, heating will be carried out, so as to effectively deal with the problem of temperature control and provide guarantee for the comfort and safety of driving.

Through the reasonable selection of hardware devices and the reasonable design of software system, we can effectively detect the temperature and make reasonable temperature regulation, which greatly meets people's needs. In addition, the selection of temperature sensor location is also particularly important, which is not only related to the best control of the whole automotive air conditioning temperature system, but also related to the key to the future development of automotive air conditioning. Temperature regulation lies in

the unity and coordination of the overall automobile system, rather than a unilateral role. In order to give full play to the maximum effectiveness of temperature control of the air conditioning system, we must select reasonable materials and devices to better improve the function of the automobile air conditioning system.

Disadvantages: when driving, whether cooling or heating, the electric energy required by the air conditioner is sufficient, but when parking, the electric energy will not be enough due to the battery. Especially in summer, when we park the car in the open air and expose it to the sun, the temperature in the car is very high, and sometimes we will be in danger of scalding, although we can set the temperature regulation, however, due to the battery capacity, it cannot be turned on for a long time, so as not to affect the starting performance of the vehicle.

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