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Design of Quick-sensing Device for Temperature Difference Generation Environment Based on Single Chip Microcomputer

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Abstract—A power generation device based on the waste heat utilization utilizes the energy conversion law in physics to generate the electromotive force by the temperature difference between the heat source and the normal temperature, and the amplifier is used to amplify the voltage for driving the small load. The main use of air conditioning in the indoor and outdoor temperature difference, charging to the lithium battery, and then separate the lithium battery to the single-chip measurement system power supply, so put the charging device and the measurement device was separated in the laboratory can also be lithium The battery is charged, increasing the charging path and avoiding the impact of the use of the measuring device because the laboratory temperature difference is too small. The system uses bus mode to combine signal acquisition, signal transmission and signal processing. It is a practical monitoring scheme to monitor the pressure, temperature and humidity of the laboratory in real time. The system achieves the basic function.

Keywords—Waste heat utilization; Energy conversion; Single chip; Environmental monitoring;

I. INTRODUCTION

With the rapid development of social modernization makes the demand for energy greatly increased[1], it forced us to save energy at the same time, but also from the utilization point of view to use some of the daily life is difficult to find and difficult to use energy, Life can be seen everywhere, so how to make it in our lives to play a role in learning more and more important.

II. SYSTEM DESIGN

Thermoelectric power generation is a kind of reasonable use of waste heat and other difficult to use heat and its conversion into electrical energy, and its structure is simple, easy to move, no noise, long life, the advantages of environmental stability, is a green Power generation method. The Sebeck effect is the theoretical basis of thermoelectric power generation[2], which has been discovered in 1821 and has undergone a breakthrough after two centuries of slow development and research. However, due to the low thermoelectric conversion efficiency constraints and high cost constraints, thermoelectric power generation technology is mainly used for high-end technology. In recent years, with the emergence of high-performance thermoelectric materials, the application in the industrial and civilian applications has become possible[3-5]. Plug in the wings of science and technology, which will be a new way to save energy and environmental protection.

The whole system is divided into two parts[6], one is the thermoelectric power generation device, the other is the monitoring device, the overall block diagram of the system shown in Figure 1:

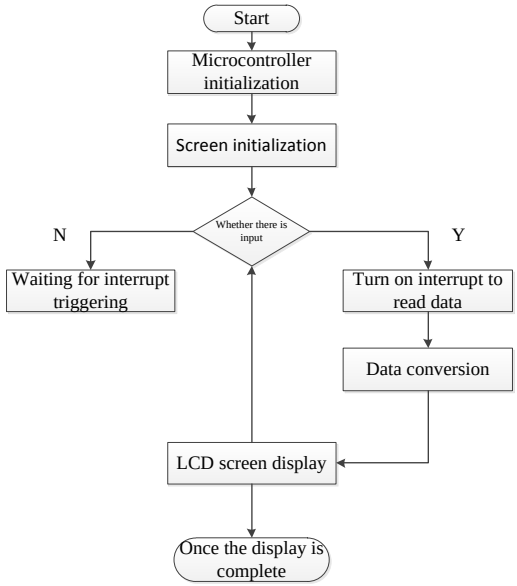

Fig. 1 The overall block diagram of the system

After the temperature difference between the two ends of the power generation module reaches a certain value, the power generation chip will produce electromotive force, and then output to the boost circuit, the main booster circuit is the step-up booster chip CE8301, after the step-up circuit Output to the charging module, the charging module is through the chip voltage into pulse into the form of lithium batteries; measurement module is measured using the sensor through the MCU after processing to the LCD 1602 display measurement data.

III. SYSTEM HARDWARE CIRCUIT DESIGN

Test control module is the two sensors in the constant detection of external temperature and humidity and pressure values[7-9], and then the level of the clock level in the transmission of data sent to the microcontroller through the data

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bus, if the microcontroller received the data after the transmission It will trigger the serial interrupt, the data will be stored in the SBUF buffer register, then enter the interrupt by the software interrupt control bit will be closed[10], so as to produce the next interrupt, the cache register data read. Trigger the external interrupt into the interrupt function after the implementation of the interruption of the program, the interrupt time is set reasonable, so that the microcontroller constantly detects whether the interrupt trigger, once the signal is incoming, the data in the clock so that the detection of data into the microcontroller , And then continue to deal with the 1602 liquid crystal display.

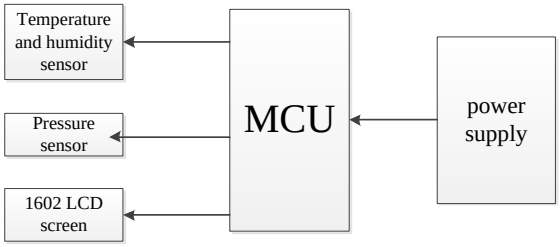

Fig. 2 Test module block diagram

IV. EBOOST CIRCUIT DESIGN

The boost circuit is the key circuit of the charging module, and the voltage sent directly from the power generation chip is only about 1.0V. If the charging module directly receives the charging of the charging module, it is necessary to carry out the boosting process. Circuit is used to rise to 5V boost circuit, the chip is CE8301 boost control chip, is a reference voltage source, oscillation circuit, comparator[11-13], PFM control circuit composed of CMOS step-up DC / CD controller. Input 0.9V-5.0V any DC voltage, can be stable output 5V DC voltage.

The circuit diagram of the boost module is shown in Figure 3:

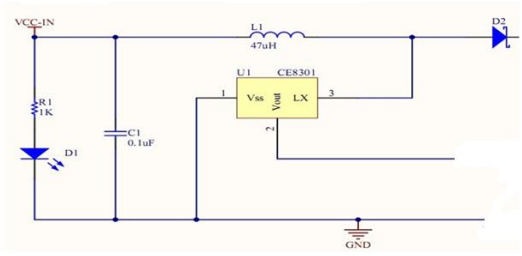

Fig. 3 Test module block diagram

Figure 2 pin of the chip is connected to the output voltage, 1 pin is connected to the ground, the input through an inductor access chip 3-pin, the input voltage in the inductor, capacitor, resistor and diode Under the control of the voltage will increase, the inductance of the size of 47uH, capacitance size 0.1uF, the resistance of the size of 1k, as well as light-emitting diode for the light, the voltage input after the light will be bright.

V. THE DESIGN OF THE CHARGING MODULE

Charging module is mainly used to charge the lithium battery, lithium battery limit voltage of 3.8V or so, which I have to do is to boost the voltage after the first 5V processing, through a resistor after the output voltage control in 3.8 V around, where the design of the circuit is the reference to the universal charger charging circuit, using the chip charge. The circuit diagram of the charging module is shown in Figure 4:

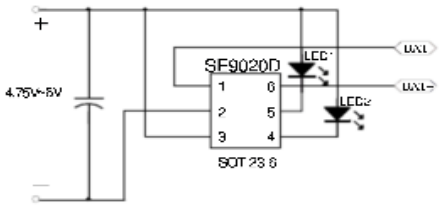

Fig. 4 Charge module circuit diagram

The charging module chip is CT3581, which is a lithium battery charger control chip, integrated by 21 discrete components, a total of 8 pins, which input and output of a pin, connect the charge indicator light, when charging will flash. There are voltage regulator circuit, voltage divider circuit and op amp, charging, the regulator circuit and the voltage divider circuit and the op amp constitute the comparison and amplification of the output signal, driving the transistor output charge current, charging the circuit will automatically stop charging[14].

VI. CONTROL PROGRAM DESIGN

System software design methods and hardware design corresponds to the same modular design, a total of the system can be divided into two modules, temperature measurement and control module program and temperature and humidity, pressure measurement control module program[15-17].

Temperature control module to complete the work are: Temperature sensor DS18B20 according to the communication protocol to send measurement instructions to the microcontroller, the microcontroller to receive data to determine whether the data is a response signal or measured data, if it is measured signal will send its data to the LCD display, and then Continue to wait for the temperature sensor signal transmission and data collection.

Temperature and humidity, barometric module measurement and control procedures to complete the work are: As the sensor is used in the I2C bus transmission protocol, BMP085 sensor in the collection of data will be in the high and low level of the clock line through the data line to the microcontroller Send a command, the microcontroller receives the command will be prepared to receive the sensor to collect the data[18], and stored in the EEPROM, the display time and then remove the measurement data from the EEPROM sent to the 1602 display function for processing, in the 1602 the appropriate location to show. DHT11 sensor in the processing of the output data is transmitted through the serial port, the first need to send a request to the microcontroller instructions, the microcontroller receives the command will be executed after the interrupt function of the program, the data received and Processing, and then sent to the liquid crystal display function to display.

Since modular programming is also used for each module, each function is treated as a function or as a module[19]. The main function program only needs to combine the modules and invoke them when the interrupt occurs. Write is conducive to

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the program debugging and modification, enhanced program portability.

Temperature control module control program flow chart shown in Figure 5:

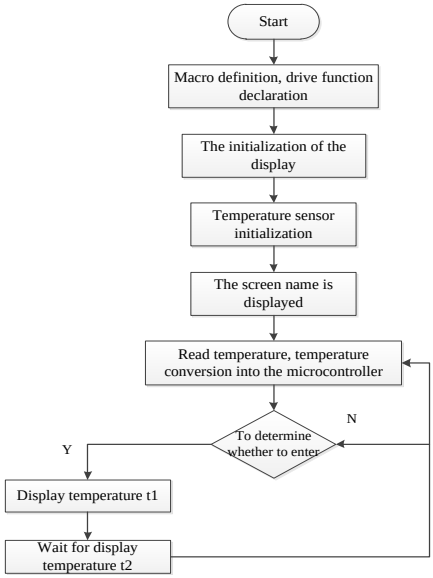

Fig. 5 Temperature difference measurement control program flow chart

Temperature and humidity measurement module control program flow chart shown in Figure 6:

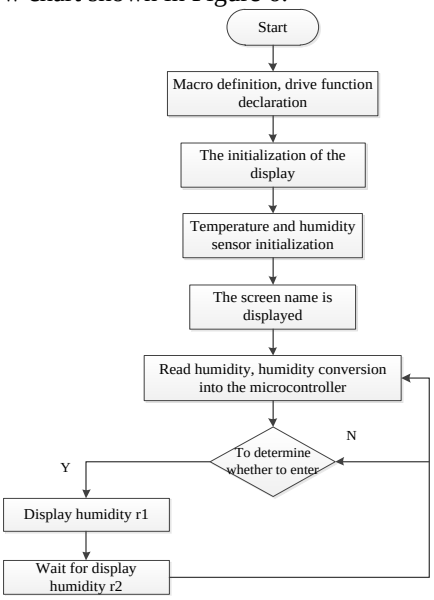

Fig. 6 Temperature and humidity measurement module control program flow chart

VII. CONCLUSION

This paper is based on the principle of temperature difference generation of Bessec phenomenon to achieve the effect of temperature and power generation. Based on the design of the gas parameter measuring device of temperature difference generation, it is effective to realize the effect of power generation and reuse. Device, and designed the corresponding boost circuit to increase the load required voltage, the use of LCD to display the laboratory temperature and humidity, laboratory pressure, the final complete realization of the device design.

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