Design of a Taxi Meter Based on Single Chip Computer

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Abstract

As a convenient means of transportation, taxis greatly facilitate people's daily travel. Based on such a background, this article designed a simple taxi meter based on STC89C52 microcontroller. This taximeter uses a single-chip microcomputer as the core, combines display module, clock module, storage module, key module, and combines software and hardware to build the required taxi meter model. The taxi meter introduced in this article has the functions of displaying time, starting price, and real-time display of the cost according to vehicle mileage. Theoretically, the meter has higher accuracy and has a wider practical value in daily life.

Keywords: Taxi meter, single chip microcomputer, STC89C52

1. Introduction

With the continuous progress of society and the rapid development of science and technology, people's living standards are developing rapidly. As one of the modes of transportation, taxi develops rapidly. People have become more and more dependent on the convenient, fast and comfortable services provided by taxis. Taxis have gradually penetrated into our lives and gradually developed into an indispensable part of our social services. More and more people prefer taxis to travel.

The taximeter is one of the most important parts of taxis, which plays an important role. The most important feature of taxi meter is to record the mileage calculation cost. Only by ensuring that its core function is recognized by passengers, can the industry operate well. At the same time, the taximeter serves the taxi, and constantly improving its function to better serve passengers will be the constant pursuit of the whole taxi industry. This paper will use STC89C52 MCU to design a simple and accurate taximeter.

2. Overall Design Ideas

The taximeter designed in this paper is composed of STC89C52 single chip microcomputer, AT24C02 memory chip and LCD1602 LCD display, including the main program module, power module, data display part, clock part, storage unit design, key module, etc. The meter can control the charging status of taxis by pressing buttons.

Firstly, different mileage corresponds to different charging modes. Secondly, it has different charging prices for day and night. At the same time, it also adds a charging standard of waiting state during driving. LCD1602 also displays real-time data such as time, distance and price. In addition, the taximeter designed in this paper not only meets the charging function, but also increases the practical function of carpool and special car, so that the taximeter can meet more needs of consumers and has better practicability.

3. Hardware Design

3.1. STC89C52

STC89C52 is the core part of this taximeter. This microcontroller has a wide range of applications, such as a design of intelligent led lighting systems[1], and a design of laboratory fire alarm system[2]. And it can be also used in a gain controllable system in RF receiver[3]. STC89C52 is an 8-bit microcontroller with low power consumption

and high performance produced by STC company. STC89C52 uses the classic MCS-51 core, on this basis, the chip has done a lot of improvement. In this paper, STC89C52 MCU is used to solve the mileage recording, billing calculation and other functions.

The main features are as follows:

- Working voltage: 3.4V-5.5V.
- Working frequency: 0-40MHz.
- The instruction code of traditional C51 MCU is completely compatible.
- 512BS data memory can be integrated.
- The chip contains E2PROM function.
- There are three 16 bits timers / counters compatible with MCS-51 single chip microcomputer timers.

3.2. LCD1602

In many electronic devices, LCD1602 will be used as a display module[4]. For example, the display interface of multimeter, calculator and so on uses liquid crystal display, which will present the required digital data through the LCD module. As shown in the Fig.1, it is the LCD display module in this paper.

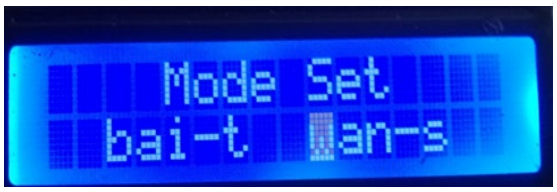

Fig.1 LCD module

In this paper, LCD1602 display module is used to display the mileage, price, time and other data in the process of driving. It is the display module of this design and undertakes the important function of displaying data.

As shown in the Fig.2, the circuit diagram of LCD display module.

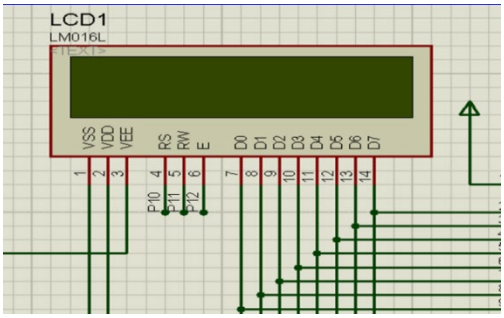

Fig.2 LCD circuit diagram

The main performance of LCD1602:

- The working voltage of the chip: 4.5-5.5V
- Capacity: 16 × 2 characters
- The best working voltage: 5.0V
- Working current: 2.0mA

3.3. DS1302

In this paper, DS1302 chip is used to realize the function of real-time display time. It has the characteristics of low power consumption and high performance. It is a kind of real-time clock circuit, which can display the date, time, minute and second accurately. In the daytime and at night, the charging standard of Taximeter is different, and time is the most basic way to distinguish day and night. It is very important to display the time in real time through DS1302 chip for the charging link in the process of driving. As shown in the Fig.3, it is DS1302 chip.

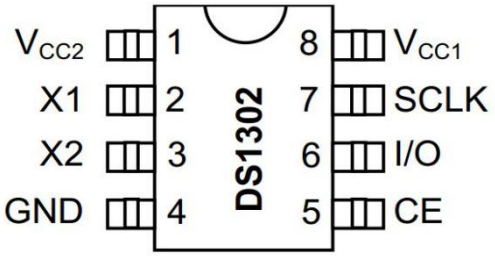

Fig.3 DS1302 pin diagram

Pins and functions of DS1302:

- Pin 1: VCC2 is the power supply pin.
- Pin 2: X1 is a 32.768KHz crystal oscillator pin.
- Pin 3: X2 is also a 32.768KHz crystal oscillator pin.
- Pin 4: GND.
- Pin 5: RST is the reset pin.
- Pin 6: I / O is the input / output pin of data.
- Pin 7: SCLK is the serial clock pin.
- Pin 8: VCC1 is the power supply pin.

3.4. Key design

For the taximeter, setting the charging standard is a very important link. This paper sets the charging standard by pressing the button. In the system designed in this paper, a total of six buttons are designed.

The first is the confirm key. By pressing this key, you can enter the menu to set the parameters. No matter which setting you want to change, you must press this

key before entering the page to make corresponding changes.

The second is the add key, which can be used to add variables when setting parameters. For example, it can be used to accurately adjust the time and unit price. When the time is slow or the unit price is set low, you can use this key to speed up the time or increase the unit price.

The third key has two functions. It can be used as a minus key and as a start or pause key for managing waiting time. Waiting time refers to the time that passengers spend when they want to get off and do something in the process of driving. There is a charging standard for waiting time. The minus key can be used to adjust the time and unit price.

The fourth is exit key: Exit menu setting key. After each setting, you can press this key to realize an exit function.The fifth is the reset key, which is to reset it after the end of the previous trip, so as to start a new mileage charging.

The sixth key is used to simulate the increase of mileage, that is, to simulate and record the driving process of a taxi. Pressing this key is equivalent to a taxi driving 0.1km.

As shown in the Fig.4, it is the circuit diagram of the key part.

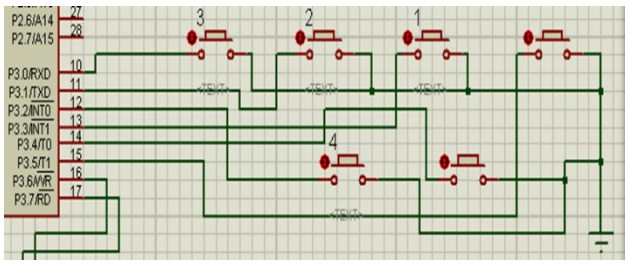

Fig.4 Key module circuit diagram

3.5. AT24C02 memory chip

The memory chip AT24C02 of ATMEL firm was chose as the memory cell for losing electricity[5]. AT24C02 memory chip is responsible for the realization of power-off protection in this design. It is an electrically erasable memory chip E2PROM with I^{2}C bus interface. This kind of chip can save data when power is off.

The I^{2}C bus can be used to communicate with single chip microcomputer and save the working data. In the process of driving, if there is power failure, there is no need to be nervous, because AT24C02 memory chip has saved the data of the previous section, once powered on, it can be recovered, which has great practical significance for the taximeter.

Pins and functions of AT24C02 are shown below:

- Pins 1-3: A0 -A2 are device address selection pins.
- Pin 4: GND, ground.
- Pin 5: SDA, serial data input and output port.
- Pin 6: SCL, serial shift clock control terminal.
- Pin 7: WP, hardware write protect control pin.
- Pin 8: VCC, connected to + 5V voltage.

As shown in the Fig.5, it is AT24C02.

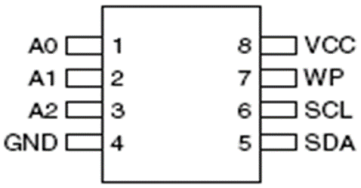

Fig.5 AT24C02 pin diagram

4. Simulation

In this paper, software Proteus is used for theoretical simulation. Proteus has a rich library of components, and can easily create components. When searching for components, we can accurately select the required devices according to little information. It has powerful function of schematic drawing. The MCU simulation and spice circuit simulation are combined. It supports the simulation of mainstream SCM system. It provides software debugging function. As shown in the Fig.6, it is a circuit diagram simulated by Proteus.

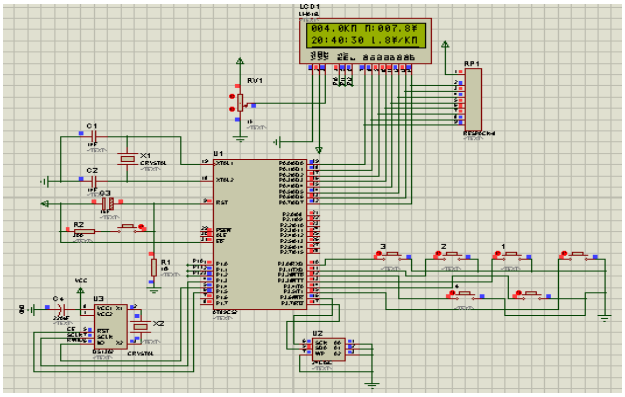

Fig.6 Simulation diagram

5. Software Design

In this paper, the design of software can be divided into several steps: main program design, timing interrupt service program, mileage counting interrupt service program, midway waiting interrupt service program, display subroutine service program, etc. these programs are combined with MCU, key circuit, LCD1602 display circuit and DS1302 clock circuit involved in hardware circuit. This paper uses the program to drive the circuit to achieve the design function of the taxi meter, and finally presents a simple but accurate taxi meter.

6. Conclusion

After the actual test, the function of the taximeter designed in this paper can be realized and the expected effect can be achieved. The simple taximeter designed in this paper can meet various scenes of daily life after actual test. In theory, the meter has high precision and wide application value.

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