Design of Lithium Battery Charger Test System Based on STM32

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ABSTRACT

Aiming at the phenomenon of hot or even explosion when using unqualified charger to charge lithium battery at present, a charger test system based on STM32 is proposed. This design makes full use of STM32's excellent control ability to monitor and control the charging process of the charger in real time, and then judge whether it conforms to the lithium battery charging requirements in "GB/T 18287-2000 general specification for lithium ion battery for cellular phone". The test system designed in this paper has the advantages of high accuracy, good reliability, fast test speed, convenient operation and easy large-scale production and promotion.[1]

INTRODUCTION

With the further popularization of wearable devices, it is a common thing in daily life to use chargers for charging. A good charger actually has a very complicated internal structure. Of course, here are short circuit protection, filter design, voltage stability design, power compensation, even in the wire will do a lot of shielding design [1]. These designs not only ensure that the charger can continuously and stably charge the wearable device, but also automatically cut off power in case of accidents to ensure that there is no damage to the machine and the user. But for now, apart from the original chargers offered by major wearables manufacturers, the market is relatively chaotic [2].

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The most important part of the charger is the transformer and various filter capacitors. The chargers with good quality usually use enclosed transformer or even digital transformer in transformer part to ensure the stability of transformer and the accuracy of voltage. But poor charger performance indicators will be much worse, not only will harm the device, but also will pose a threat to the user's health and even life. Therefore, a charger tester with high test accuracy and good reliability has become an urgent demand of various production units and testing departments [3-5].

DESIGN OF HARDWARE

Structure of Hardware

In this paper, the 32-bit microprocessor STM32F103 is used as the main control unit. In terms of structure, the system includes STM32 minimum system circuit, charger test circuit, liquid crystal display circuit, keyboard scanning circuit, et al. The block diagram of hardware is shown in Figure 1.

Design of Charger Test Circuit

In this section, a simulated battery is designed by electrolytic capacitor, which can store energy, than the charger can output rated current and voltage without a real battery. The circuit principle is shown in figure 2. During the test, STM32 controls the on-off and off-off of Q1 through Control IO. When the Control IO terminal output high level, Q1 conduction, Q2 also conduction. After Q2 conduction, the actual output current of the charger can be measured by sampling resistors R4 and R5. As C1 keeps storing energy, Q2 base level voltage keeps rising, Q2 gradually enters the cut-off state, and the current flowing through the sampling resistance gradually decreases. At this point, detects the charger output voltage is constant or not. If the charger meets the function, it is qualified; otherwise, it is unqualified.
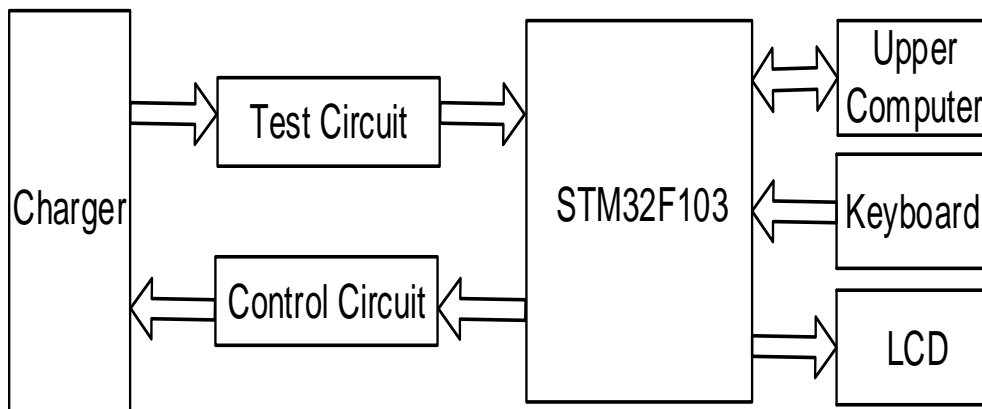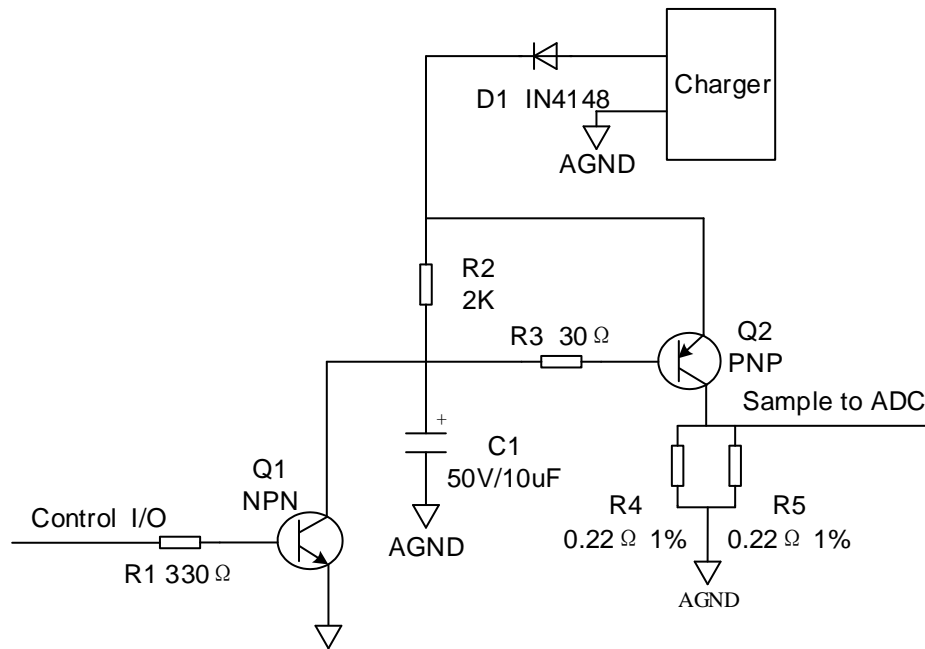

Figure 1. Block diagram of hardware.

Figure 2. Hardware circuit of charger test.

DESIGN OF SOFTWARE

In order to realize the accurate test of the expected parameters of the system, a good system needs not only a stable and reliable hardware platform, but also an optimized and reasonable software design.

The flow chart of software is shown in figure 3.

In the software design, firstly, the rated parameters of charger are set to initiate the system. Secondly, start the test. During the test, monitor the rated current and voltage output of the charger and record it. Then, test other functions, such as over charge, over current, short circuit protection, et al. Finally, give the test result.

TEST OF SYSTEM

This paper selects the charger of a well-known brand for testing, and the test curve is shown in figure 4.

As can be seen from the figure, the charger maintains constant current output until the charging voltage reaches the rated voltage, when the rated voltage is reached, trickle charging is carried out. This test process is in accordance with the provisions of the national standard for lithium battery charging process, and also verified the rationality and effectiveness of the system.
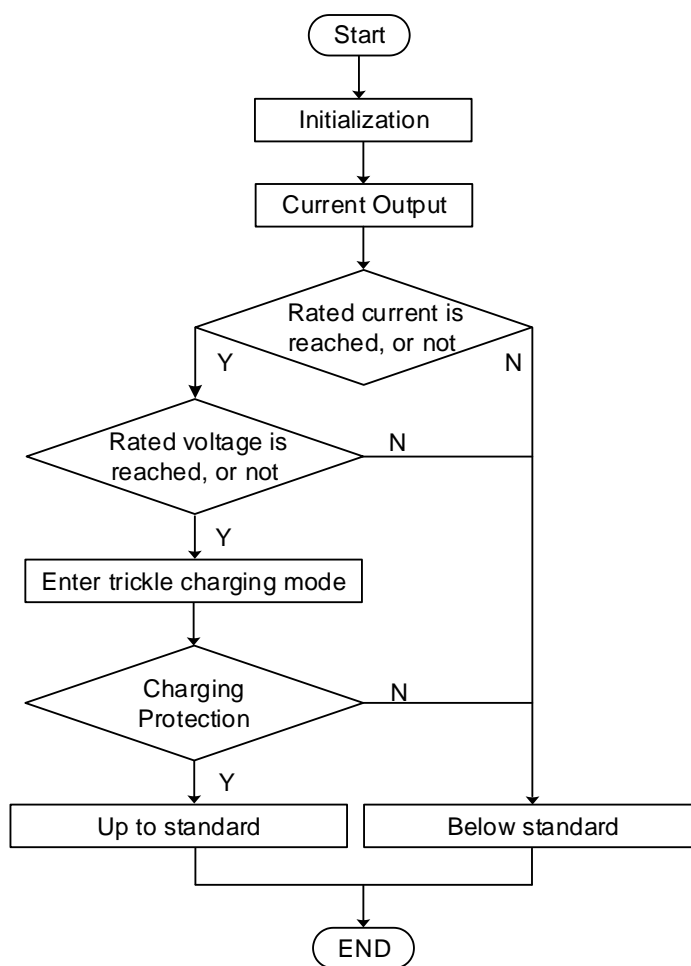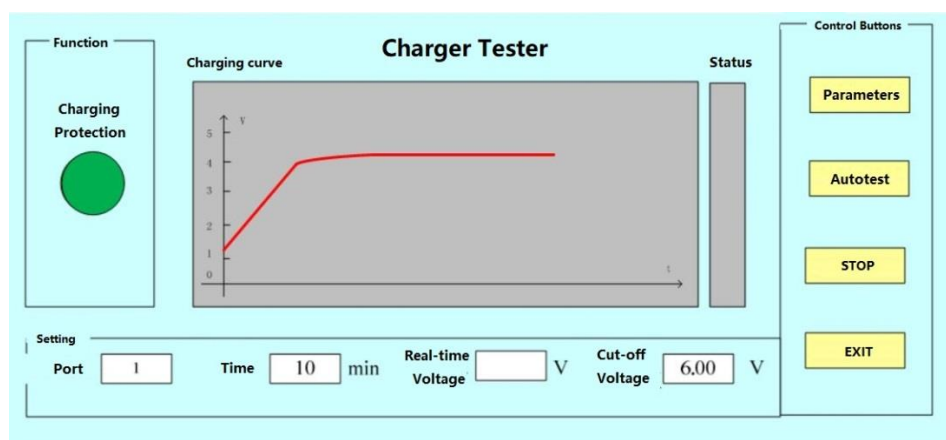
Figure 3. Flow chart of software.

Figure 4. Test software of system.

CONCLUSIONS

This paper designs a lithium battery charger test system with STM32 processor as the core, and realizes the accurate detection of charger. The practical application shows that the test method in the system conforms to the national standard, the test system has high accuracy, good reliability, fast test speed, reliable test data, convenient operation, easy to scale production and promotion, and has certain effectiveness for the detection of lithium battery charger.

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