

Design and Application of Power Lithium Ion Battery Management System

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Abstract: In recent years, the environmental protection policy issued by the state requires more and more stringent emission standards for enterprises. The state vigorously promotes new energy vehicles and gradually reduces the number of traditional energy vehicles. The core component of electric enterprises is power battery system, and the main component of such batteries is lithium ion. Lithium-ion batteries have minimal environmental pollution, and the installation of such lithium-ion batteries in automobiles can produce zero pollution and zero emission to the external environment.

1. Introduction

With the gradual decrease of the earth's fossil fuel resources and the intensification of global environmental pollution. Many countries in the world have introduced new energy electric vehicles as a driving tool in the future. The core component of electric vehicle is power battery, which determines the performance, speed and mileage of the whole vehicle. Nowadays, power lithium-ion batteries have become the bottleneck of the development of electric vehicles. At present, the performance and quality of power batteries can not meet people's requirements for automotive power. The existing power lithium-ion batteries have long charging time, high battery cost and short battery life. There is a clear gap between electric vehicle and traditional fuel vehicle. The future development direction of power lithium battery is to improve the battery charging efficiency, battery storage capacity, battery life and economy. The cost of using lithium-ion batteries in automobiles is much lower than that of consuming gasoline. Therefore, due to the excellent characteristics and low cost of lithium-ion batteries, they are widely used in various industries in China, and their application scope is more and more extensive.

2. Overview of Power Lithium Ion Batteries

Lithium-ion batteries have been used in people's life and industrial production for nearly 50 years, but up to now, the technology of lithium-ion batteries can not fully meet the requirements of the market. Because of its special structure, long-term use of lithium-ion batteries will damage the quality of batteries, and the longer the charging times, the shorter the service life of batteries. And at high temperature, it may lead to battery explosion. In recent years, researchers have embedded graphite into lithium batteries to enhance their durability, life and overall internal stability. By adding graphite, lithium-ion batteries have been fully applied in all walks of life. People now commonly use mobile phones, computers, flashlights, electric bicycles and other items, which are all lithium-ion batteries. Now people's life has been inseparable from lithium-ion batteries, which is also of great significance to the production of enterprises.

3. Design of Battery Management System

3.1 Functional and structural design

The main components of lithium-ion battery system are control chips, and other components of the battery are also included. The function of the chip is mainly to manage the whole battery system, as well as the battery protection, power display and battery communication functions. The main

function of the battery management system is to control the voltage and current data and the temperature inside the battery when it is running. The system can also scientifically calculate the charge status inside the battery, and then keep the system running smoothly. The system has a strong protective effect, which can prevent the damage of battery caused by large external current, the damage of battery caused by long charging time and the influence of high temperature and low temperature on battery. The communication function of management system is mainly realized by serial communication of batteries. The display function of the management system is to output the operation parameters of the battery to the LED display screen in the form of digital symbols, images, English or Chinese characters. Lithium-ion battery management system, as shown in Figure 1.

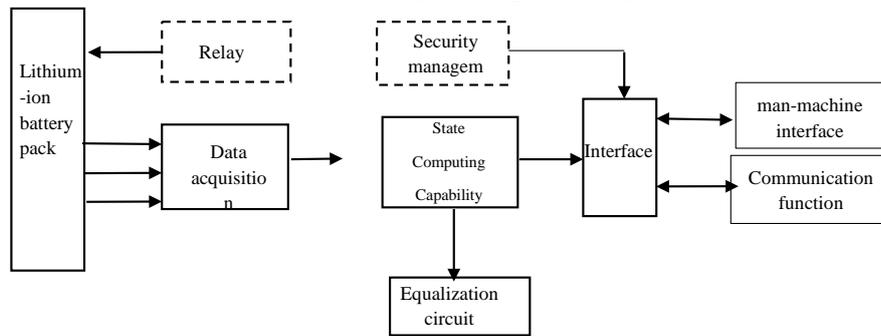


Fig. 1 Lithium-ion battery management system

In the whole lithium-ion battery management system, it can be seen that the data acquisition module mainly collects the voltage, current and temperature inside the battery. The current and voltage inside the battery and the average temperature inside the battery are measured by the electronic components inside the battery. The system can judge whether the battery is in normal condition. If it is in an abnormal state, it will send an alarm or automatically cut off the power supply to protect the battery.

3.2 Software Design of Management System

It is impossible to realize the function of the whole battery management system only depending on the hardware of the battery. It is also necessary to support certain software programs in order to ensure the better function of the whole system. Excellent software program design can effectively improve the operation efficiency of the whole battery system, reduce the endless loss in the system, reduce the overall hardware cost, and also simplify the hardware system of lithium ion batteries. Therefore, the specific software design must include the data acquisition program of voltage, current and the temperature inside the battery. The software system also needs to incorporate the communication module program and the display part program in the battery, so as to form a complete battery management software system.

Software systems need to include the following main functions:

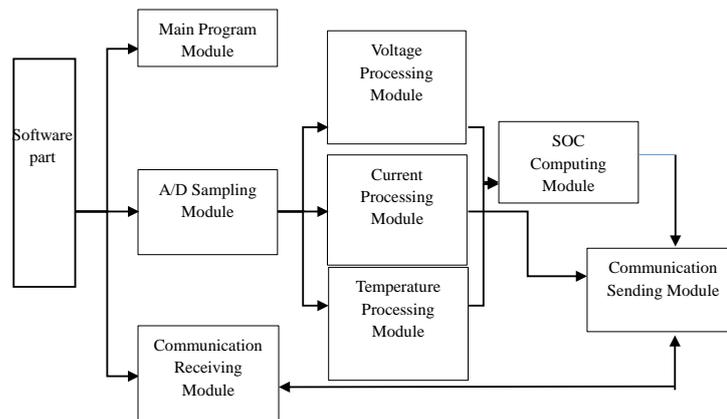


Figure 2 Software design diagram

1) Initialization. In the early stage of the operation of the battery management system, it is necessary to mobilize the initialization program in the software, to initialize the functions of the system, to initialize the timer modules in the software system, to initialize the conversion module in the chip, and to initialize all registers and electronic components in the chip. Chemicals [3].

2) System parameters. The parameters in the software management system are chips, the configuration of each component and the clock setting parameters in the system, as well as the setting parameters of interrupt mode and data storage values.

3) Data acquisition. With the controller module in software system as the main part, the collected data are transferred from the output module of the controller to the converter port, and the data collected from each module of the battery are transferred to the input port of the controller.

4) Battery status. An application program is set up in the battery system to judge the battery status, and the battery status can be displayed to show whether the battery is discharged or charged according to the operation status of the battery. Then the relevant information of the battery is transmitted to the display screen, and the program can effectively judge whether the battery is in abnormal working state, and automatically adjust the battery in time.

5) Communication and display of software system. The data information generated by the software system must be transmitted to the external display screen through the communication function of the system. It is convenient for the staff to view the operation status of the battery in time by displaying information.

4. Application

The development of lithium-ion battery industry strongly supported by the state has formed a lithium-ion battery industry in China, which has relatively excellent enterprises in battery production industry, such as BYD, Tianjin Lishen and other battery manufacturers. The application of batteries has covered all aspects of people's lives.

4.1 Aerospace field

For example, in the field of aerospace, satellite manufacturers apply lithium-ion batteries to satellites. Lithium-ion batteries have the characteristics of small size, light weight and large storage capacity. In this way, the efficiency of satellite is greatly improved, and the cost of satellite launching is also reduced. Compared with traditional batteries, lithium-ion batteries have higher life. Batteries used in high-orbit satellites have a life of about 15 years, and low-orbit satellites have a life of more than 5 years.

The capacity of lithium-ion batteries is required by space equipment. Especially in satellite equipment, because satellites stay in space for decades, the life of batteries must also meet this standard, and the capacity of batteries must be large enough. This type of battery technology is immature in China, especially the key components of the battery must also rely on foreign imports, which will restrict China's aerospace industry to a certain extent. At the same time, lithium-ion batteries in the space field must also be suitable for the vacuum environment in space and the impact of high radiation in space, which requires very strict quality of batteries.

4.2 Automobile field

In the automotive field, electric vehicles have been recognized, in which lithium-ion batteries are the core components of electric vehicles. In today's China, power lithium-ion battery technology is not comparable to that of the United States, but there are many excellent enterprises in China. These battery companies have been working in the battery industry for many years, and have formed a certain scale and strong brand. At the same time, in Shanghai, a Shanghai Institute of Space Power has also developed lithium-ion batteries, which has formed a large number of patents and has a small influence in the industry. At present, power lithium-ion batteries have been applied to major automobile manufacturers, especially domestic automobiles have accelerated the layout of new energy vehicles, bringing huge demand to the lithium-ion battery industry, and promoting the rapid development of the industry.

4.3 Electricity field

In the power industry, lithium-ion batteries have been successfully applied to power storage. In March 2011, China Southern Grid Corporation developed a 5MW lithium-ion battery storage equipment, which has been successfully put into production and operation. The storage station can store 10MW of power. In 2011, the storage station has become the world's memory storage power. The largest and most advanced lithium-ion battery storage power station.

Domestic lithium-ion battery technology has been improved to a certain extent. Domestic enterprises can not produce the core components of batteries independently. They need to rely on imports from the United States and Japan. This bottleneck seriously hinders the development of battery industry in China. With the increasing trade frictions between China and the United States, the Chinese people are aware of the need to solve the core technical problems of batteries and provide an important guarantee for the overall development of batteries and energy security in China. Push the lithium ion battery industry to the top of the world, promote the rapid development of domestic industry chain upstream and downstream enterprises, and form a complete lithium ion battery industry chain.

Lithium-ion battery technology has brought changes to various industries in China and promoted high-quality development of the whole industry. The development of power lithium ion batteries directly promotes the rapid development of electric vehicles and bicycles in China, as well as the rapid development of unmanned aerial vehicles and electronic communication equipment in China. Batteries are the basis of the development of these industries, and the development of these industries also drives the development of lithium-ion battery industry. In order to meet the needs of batteries in China, various industrial policies have been introduced. The government has given certain financial subsidies to lithium-ion battery manufacturers, and set up relevant industrial funds to provide adequate funding for the development of battery manufacturers.

4.4 Concluding remarks

With the development of lithium-ion batteries, the technology level of batteries has been rapidly improved, and has attracted widespread attention. Enterprises have invested a lot of research and development funds to develop new technologies and accelerate the application of lithium-ion batteries. Lithium-ion batteries have profoundly changed people's lives and the production and operation of enterprises. In this paper, the design of hardware system and software system of lithium ion batteries is studied, and the application of lithium ion batteries is discussed and analyzed in depth.

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