

Battery Test System

Technical Field

[0001] The invention relates to the technical field of batteries, in particular to a battery test system.

Background Art

[0002] In recent years, with the rapid development of new energy vehicles, cascade utilization of power batteries has become a hot topic, because batteries of electric vehicles have to be decommissioned from the vehicle after a certain period or times of use. However, there are many uncertainties in battery replacement due to different use conditions, in some cases, the batteries in the chassis may have only a few damaged cells leading to malfunction of the whole chassis, and in some other cases, one or two cells may differ greatly from others, leading to shortened endurance mileage due to insufficient power of the chassis. Therefore, it is particularly important to analyze the decommissioned power battery comprehensively.

Summary of the Invention

Technical Problem

[0003] The battery management system (BMS) of the existing electric vehicle is self-designed by the battery manufacturer and thus imposes technical barriers. Except for a battery manufacturer's authorization, it is substantially difficult to detect the information of the batteries in the chassis in other ways. The existing cabinet test for battery detection requires a large space and complex wiring, or batteries of the chassis have to be disassembled into cells or battery modules composed of a plurality of cells to be tested, imposing difficulties on the whole chassis test.

[0004] Therefore, it is an urgent technical problem to be solved regarding how to design a test system that can quickly detect chassis battery information.

Solution to the Problem

Technical Solution

[0005] Given the above, it is necessary to provide a battery test system to solve the above problem.

[0006] A battery test system, comprising:

[0007] a data acquisition module, the data acquisition module being electrically connected with a battery of an automobile chassis and used for acquiring state information of each cell in a battery system of an automobile chassis and current information of the battery system; the state information comprising voltage information and temperature information;

[0008] a communication conversion module, the communication conversion module being in

communication connection with the data acquisition module and used for transmitting the state information and the current information of the battery system acquired by the data acquisition module; and

[0009] a main control module, the main control module being in communication connection with the communication conversion module and used for receiving the state information of each cell in the battery system of the automobile chassis and the current information of the battery system transmitted by the communication conversion module, analyzing the state information and the current information of the battery system, and judging a use condition of the battery system of the automobile chassis according to a preset judgment strategy.

[0010] Optionally, in an embodiment, the system further comprises a power supply conversion module, wherein the power supply conversion module is in communication connection with the communication conversion module, the power supply conversion module is electrically connected with the battery of the automobile chassis and a power grid, and the power supply conversion module is used for converting an AC power supply output by the power grid from and to a DC power supply output by the battery;

[0011] the power supply conversion module is also used for receiving a control instruction sent by the main control module through the communication module, and changing an amplitude of conversion power and directions of power supply conversion according to the control instruction.

[0012] Optionally, in an embodiment, the system further comprises a battery control module, wherein the battery control module is electrically connected with the battery of the automobile chassis, the power supply conversion module and the data acquisition module, and the battery control module is used for controlling connection and disconnection between the battery of the automobile chassis and the power supply conversion module and for disconnecting the battery from the outside when an exception of the battery occurs.

[0013] Optionally, in an embodiment, the power supply conversion module comprises an AC/DC converter, and the AC/DC converter is used for rectifying an AC power supply transmitted by the power grid into a DC power supply to keep charging the battery of the automobile chassis until SOC100%; and the DC power supply is also used for inverting the DC power supply transmitted by the battery of the automobile chassis into the AC power supply to keep discharging back into the power grid until SOC0%.

[0014] Optionally, in an embodiment, the data acquisition module comprises a data acquisition master control and a data acquisition slave control, wherein the data acquisition slave control is electrically connected with the battery of the automobile chassis and used for acquiring the state information of each cell in the battery of the automobile chassis and the current information of the battery system;

[0015] the data acquisition master control is electrically connected with the data acquisition slave control and the battery control module, used for sending the state information acquired by the data acquisition slave control to the main control module, and also used for controlling the battery control module to disconnect the battery of the automobile chassis with the power supply conversion module when the exception of the battery is acquired.

[0016] Optionally, in an embodiment, after disconnecting a data acquisition connector with a main power line of a primary battery module, the data acquisition slave control is connected with each cell in the battery of the automobile chassis through a sampling line, and calculates the state information of each cell corresponding to the sampling line and the current information of the battery system by acquiring data of the sampling line.

[0017] Optionally, in an embodiment, the main control module is further used for calculating a capacity, charging and discharging temperatures, charging and discharging efficiency of the battery system and internal resistance of each cell of the automobile chassis according to the state information of each cell in the automobile chassis and the current information of the battery system;

[0018] calculating a state of health of each cell according to the state information, the current information of the battery system and the capacity, the charging and discharging temperatures, the charging and discharging efficiency of the battery system and the internal resistance of each cell of the automobile chassis; and

[0019] judging the use condition of the battery of the automobile chassis according to the state of health of each cell.

[0020] Optionally, in an embodiment, the main control module judges the use condition of the battery of the automobile chassis according to the state of health of each cell, comprising:

[0021] judging that the battery of the automobile chassis is in a normal use state when the state of health of each cell is greater than or equal to a first threshold value;

[0022] judging that a corresponding cell is in want of repair when the state of health of the cell is smaller than a second threshold value; and

[0023] judging that the battery of the automobile chassis is in want of replacement when more than a preset number of cells have the state of health smaller than a first threshold value.

[0024] Optionally, in an embodiment, the system further comprises a display module, the display module being electrically connected with the main control module and used for displaying the state information of each cell in the automobile chassis, the current information of the battery system and the use condition of the battery of the automobile chassis.

[0025] Optionally, in an embodiment, the communication conversion module comprises a communication converter for connection with the main control module through network wiring,

for connection with the data acquisition module through a CAN bus or a 485 bus, and for connection with the power supply conversion module through the 485 bus.

Advantageous Effects of the Invention

Advantageous Effects

[0026] The embodiment of the invention has the following advantageous effects:

[0027] According to the battery test system, the data acquisition module is electrically connected with the battery of the automobile chassis for acquiring the state information of each cell in the battery of the automobile chassis; the state information acquired by the data acquisition module is transmitted by the communication conversion module; the state information of each cell in the automobile chassis and the current information of the battery system transmitted by the communication conversion module are received by the main control module; through all the above, the state information and the current information of the battery system are analyzed, and the use condition of the battery of the automobile chassis is judged according to a preset judgment strategy. Through the system, a direct connection with the battery of the automobile chassis can be provided to render analyses of the capacity, the pressure difference, the running consistency of the cells and the like of the battery, the degree of modularization design and integration of the system is improved, the costs are saved, the space occupation is reduced, and the operation is facilitated.

Brief Description of the Drawings

[0028] In order to more clearly explain the embodiments of the present application or the technical solutions in the prior art, the drawings required for the description of the embodiments or the prior art will be briefly described below. Obviously, the drawings described below are only some embodiments of the present application. A person of ordinary skill in the art, without paying any inventive efforts, can also obtain other drawings from these drawings.

[0029] In the drawings:

[0030] FIG. 1 is a block diagram of a structure of a battery test system according to an embodiment of the present application;

[0031] FIG. 2 is a block diagram of the structure of the battery test system according to another embodiment of the present application;

[0032] FIG. 3 is a block diagram of the structure of the battery test system according to another embodiment of the present application.

Detailed Description of the Invention

[0033] The technical solution in the embodiments of the present application will be described clearly and completely with reference to the drawings in the embodiments of the present

application. Obviously, the described embodiments are only a part of the embodiments of the present application, but not all of them. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments in the present application without inventive efforts shall fall within the scope of the present application.

[0034] In order to make the object, technical solution and advantages of the present application clearer, the following describes the present application in further detail with reference to the drawings and embodiments. It should be understood that the specific embodiments described herein are only used to explain the present application, but not intended to limit the present application.

[0035] As shown in FIG. 1, in an embodiment, a battery test system is provided, which can be used for testing a battery of an automobile chassis, and particularly, the automobile can be an electric automobile or a hybrid automobile; the battery can be a storage battery or a fuel battery, wherein the storage battery is suitable for pure electric vehicles and includes lead-acid storage batteries, nickel-hydrogen batteries, sodium-sulfur batteries, secondary lithium batteries, air batteries and the like; the fuel battery is special for fuel battery electric vehicles and includes alkaline fuel batteries, phosphoric acid fuel batteries, molten carbonate fuel batteries, solid oxide fuel batteries, proton exchange membrane fuel batteries, direct methanol fuel batteries and the like. The battery can serve as a power supply of an automobile driving system. The battery test system provided by the embodiment of the invention can quickly detect the battery of the automobile chassis, the integration degree of the system is improved, the costs can be saved, the space occupation can be reduced, and the operation is facilitated. FIG. 1 is a block diagram of a structure of a battery test system according to an embodiment of the present application, the system includes a data acquisition module 110, a communication conversion module 120 and a main control module 130, wherein the data acquisition module 110 is electrically connected with the battery of the automobile chassis, the communication conversion module 120 is in communication connection with the data acquisition module 110, and the main control module 130 is in communication connection with the communication conversion module 120.

[0036] The data acquisition module 110 is used for acquiring state information of each cell in a battery system of the automobile chassis and current information of the battery system; the state information comprising voltage information and temperature information. Specifically, the data acquisition module 110 can be connected, for example, through a sampling line, with each cell in the battery of the automobile chassis, thereby acquiring the state information of each cell, such as voltage, temperature and other data of each cell. Further, the data acquisition module 110 transmits the acquired data to the main control module 130 through the communication conversion module 120 so that the main control module 130 can analyze the acquired data.

[0037] The communication conversion module 120 is in communication connection with the data acquisition module 110 and is used for transmitting the state information of the battery of the automobile chassis and the current information of the battery system acquired by the data acquisition module 120. Specifically, the communication conversion module 120 cooperates with data transmission between the data acquisition module 110 and the main control module 130, so that the state information of the battery of the automobile chassis acquired by the data acquisition module 120 can be sent to the main control module 130 so that the main control module 130 can analyze the acquired data, and a control instruction sent by the main control module 130 can also be transmitted to the data acquisition module 110 to control the work of the data acquisition module 110. For example, the communication conversion module 120 may be a communication interface converter capable of performing data conversion between different communication interfaces, such as a communication converter, a serial port converter, etc.

[0038] The main control module 130 is used for receiving the state information of each cell in the battery system of the automobile chassis and the current information of the battery system transmitted by the communication conversion module 120, analyzing the state information and the current information of the battery system, and judging the use condition of the battery of the automobile chassis according to a preset judgment strategy. Specifically, the main control module 130 can receive data such as voltage and temperature of each cell in the automobile chassis, calculate the state of health (SOH) of each cell according to the acquired data, and judge the use condition of the battery of the automobile chassis according to the SOH of each cell so as to realize the rapid test of the battery of the automobile chassis.

[0039] The battery test system can be directly connected with the battery of the automobile chassis to render analyses of the capacity, the pressure difference, the running consistency of the cells and the like of the battery, the degree of modularization design and integration of the system is improved, the costs are saved, the space occupation is reduced, and the operation is facilitated.

[0040] In an embodiment, as shown FIG. 2 which is a block diagram of the structure of the battery test system according to another embodiment of the present application, the battery test system further includes a power supply conversion module 230, the power supply conversion module 230 is in communication connection with the communication conversion module 220, the power supply conversion module 230 is electrically connected with the battery of the automobile chassis and a power grid, and the power supply conversion module 230 is used for converting an AC power supply output by the power grid from and to a DC power supply output by the battery. The power supply conversion module 230 is also used for receiving a control instruction sent by the main control module 240 through the communication module 220, and changing an amplitude of conversion power and directions of power conversion according to the control instruction.

Wherein the power supply conversion module 230 can perform the conversion between the AC power supply and the DC power supply, for example, by rectifying the AC power supply into the DC power supply, or by inverting the DC power supply into the AC power supply. A power grid is to be understood as a whole of substations and transmission and distribution lines of various voltages in a power system, for example, a 380 V AC mains supply provided by a national power grid through an industrial park.

[0041] In an embodiment, the power supply conversion module includes an AC/DC converter, and the AC/DC converter can be used for rectifying the AC power supply transmitted by the power grid into the DC power supply to keep charging the battery of the automobile chassis until SOC100%; the AC/DC converter can also be used for inverting the DC power supply transmitted by the battery of the automobile chassis into the AC power supply to keep discharging back into the power grid until SOC0%. Specifically, during charging, the AC power supply is rectified into the DC power supply of more than 0.5C, during discharging, the output DC power supply is inverted into the AC power supply of 0.75C, and the AC/DC converter can perform AC/DC conversion through thermoelectric conversion, an electric system, an electrostatic system, an electronic system and the like.

[0042] Through the power grid, the battery system is kept being charged with a current of more than 0.5C until SOC100%, and then kept being discharged with a current of 0.75C until SOC0%; a complete charge and discharge cycle was performed. Since a complete cycle is done, the data are all really acquired without estimation, and thus the data accuracy is high.

[0043] In an embodiment, as shown in FIG. 3, which is a block diagram of the structure of the battery test system according to another embodiment of the present application, the battery test system further includes a battery control module 320 electrically connected with the battery of the automobile chassis, the power supply conversion module 340 and the data acquisition module 310, and the battery control module 320 is used for controlling connection and disconnection between the battery of the automobile chassis and the power supply conversion module 340 and for disconnecting the battery with the outside when an exception of the battery occurs. Specifically, the battery control module 320 includes a battery control component, and connection and disconnection between the battery and the outside can be controlled to protect the battery by controlling on and off of the battery control component. For example, the battery control module 320 may be a battery connector and may be other components having a switch-on and switch-off function, and this embodiment is not limited thereto.

[0044] In an embodiment, with continued reference to FIG. 3, the data acquisition module 310 includes a data acquisition master control 314 and a data acquisition slave control 312. The data acquisition slave control 312 is electrically connected with the battery of the automobile chassis

and used for acquiring the state information of each cell in the battery of the automobile chassis and the current information of the battery system. The data acquisition master control 314 is electrically connected with the data acquisition slave control 312 and the battery control module 320 for sending the state information acquired by the data acquisition slave control 312 to the main control module 350 and for controlling the battery control module 320 to disconnect the battery of the automobile chassis with the power supply conversion module 340 when the exception of the battery is acquired.

[0045] Specifically, a data acquisition general control 312 receives data acquired by the data acquisition slave control 312 and transmits the data to the main control module 350, and the data acquisition general control 312 is also used for controlling a battery control unit 320 according to the acquired exception, so that the battery of the automobile chassis and the power supply conversion module 340 are disconnected, and the battery of the automobile chassis is protected. The data acquisition slave control 312 may collect voltage information and temperature information for all the cells in the vehicle chassis.

[0046] In an embodiment, the communication conversion module includes a communication converter for connection with the main control module through network wiring, for connection with the data acquisition module through a CAN bus or a 485 bus, and for connection with the power supply conversion module through the 485 bus.

[0047] In an embodiment, after disconnecting a data acquisition connector with a main power line of a primary battery module, the data acquisition slave control is connected with each cell in the battery of the automobile chassis through a sampling line, and calculates the state information of each cell corresponding to the sampling line and the current information of the battery system by acquiring data of the sampling line. As an example, a battery in an automobile chassis includes 95 cells connected in series, a data acquisition slave control 312 is connected with each cell through a sampling line, and data such as voltage and temperature of each cell corresponding to each sampling line are calculated by acquiring data of the sampling line, for example, the voltage of a first cell is U1, the negative pole of the first cell is connected with a sampling line B0, the positive pole of the first cell is connected with a sampling line B1, and then the pressure difference between the sampling line B0 and the sampling line B1 is U1. The data acquisition slave control can also acquire the temperature of each cell corresponding to each sampling line through the temperature sampling line.

[0048] A signal acquisition connector of the battery system package is connected with the signal acquisition connector of the present system, and information is acquired bypassing the BMS of the original factory setting; data acquisition is carried out by utilizing the self-contained data acquisition control of the system, getting rid of the original control box of the electric automobile

battery system, without the necessity to analyze the CAN protocol of the original factory setting.

[0049] in an embodiment, the main control module is further used for analyzing the acquired data of the battery of the vehicle chassis. The main control module is further used for calculating a capacity, charging and discharging temperatures, charging and discharging efficiency of the battery system and internal resistance of each cell of the automobile chassis according to the state information of each cell in the automobile chassis and the current information of the battery system;

[0050] calculating a state of health of each cell according to the state information, the current information of the battery system and the capacity, the charging and discharging temperatures, the charging and discharging efficiency of the battery system and the internal resistance of each cell of the automobile chassis; and

[0051] judging the use condition of the battery of the automobile chassis according to the state of health of each cell.

[0052] Wherein the SOH can be used to indicate the battery capacity, health, and performance status of the battery, i.e., the ratio of the full-charge capacity of the battery to the rated capacity, typically 100% for newly produced batteries and 0% for completely unserviceable batteries. The use condition of the battery of the automobile chassis is judged according to the SOH of each cell, the test result of the battery can be directly and automatically analyzed, an analysis result of the use condition is obtained visually, without operation and analysis to be provided by professional personnel; the costs are saved, operation is convenient, and management of the battery by maintenance personnel is facilitated.

[0053] In an embodiment, the main control module can automatically analyze and judge whether the battery of the battery chassis is functioning well or not according to the tested cell voltage information, the tested cell temperature information and the tested battery system current information, and judge the consistency of all the cells in the battery of the chassis. Furthermore, the main control module judges the use condition of the battery of the automobile chassis according to the state of health of each cell, including: judging that the battery of the automobile chassis is in a normal use state when the state of health of each cell is greater than or equal to a first threshold value; judging that a corresponding cell is in want of repair when the state of health of the cell is smaller than a second threshold value; and judging that the battery of the automobile chassis is in want of replacement when more than a preset number of cells have the state of health smaller than a first threshold value.

[0054] Specifically, for example, the curve of operation of a new cell can be compared with the curves of operation of all the cells of the test chassis to judge whether the cells are functioning well or not, and the SOH of each cell can be estimated by comparing with the operation voltage

data of the new cell. The new cell refers to the cell newly produced, the voltage operation curve of the new cell can be obtained, and the voltage operation curves of the cells are drawn according to the acquired voltage data of the cells. Furthermore, when the SOH of the cells are all higher than 85%, the cells can be recycled for use in vehicles; when a few cells do not meet the requirements, the cells can be determined correspondingly and repaired or replaced; when the SOH of most cells is less than 85%, cascade utilization can be considered, cells with the SOH in the range of 70-85% can be used in the field of energy storage, and cells with the SOH in the range of 50-70% can be used in the field of standby power. When the SOH of one cell is different from that of other cells greatly, even if not having reached a critical value of the SOH, the cell is obviously attenuated too quickly, in want of corresponding treatment. Through the judgment strategy above, the functioning status of the cells of the battery of chassis and the consistency of all the cells in the battery of the chassis can be judged.

[0055] in an embodiment, with continuing reference to FIG. 3, the battery test system further includes a display module 360, the display module 360 is electrically connected with the main control module 350 and used for displaying the state information of each cell in the automobile chassis and the use condition of the battery of the automobile chassis.

[0056] According to the battery test system above, the data acquisition module is electrically connected with the battery of the automobile chassis for acquiring the state information of each cell in the battery of the automobile chassis; the state information acquired by the data acquisition module is transmitted by the communication conversion module; the state information of each cell in the automobile chassis and the current information of the battery system transmitted by the communication conversion module are received by the main control module; by means of all the above, the state information and the current information of the battery system are analyzed, and the use condition of the battery of the automobile chassis is judged according to a preset judgment strategy. By means of the system, a direct connection with the battery of the automobile chassis can be provided to render analyses of the capacity, the pressure difference, the running consistency of the cells and the like of the battery, the degree of modularization design and integration of the system is improved, the costs are saved, the space occupation is reduced, and the operation is facilitated.

[0057] The above-mentioned embodiments only show several implementations of the present application described specifically and in detail, but they should not be construed as limiting the scope of the present application. It should be noted that those of ordinary skill in the art, without departing from the concept of the present application, can make modifications and improvements, which all fall within the protection scope of the present application. Therefore, the protection scope of this application shall be subject to the appended claims.

Claims

1. A battery test system, characterized by comprising:

a data acquisition module, the data acquisition module being electrically connected with a battery of an automobile chassis and used for acquiring state information of cells in a battery system of an automobile chassis and current information of the battery system; the state information comprising voltage information and temperature information;

a communication conversion module, the communication conversion module being in communication connection with the data acquisition module and used for transmitting the state information and the current information of the battery system acquired by the data acquisition module; and

a main control module, the main control module being in communication connection with the communication conversion module and used for receiving the state information of each cell in the battery system of the automobile chassis and the current information of the battery system transmitted by the communication conversion module, analyzing the state information and the current information of the battery system, and judging a use condition of the battery system of the automobile chassis according to a preset judgment strategy.

2. The system according to claim 1, characterized by further comprising a power supply conversion module, wherein the power supply conversion module is in communication connection with the communication conversion module, the power supply conversion module is electrically connected with the battery of the automobile chassis and a power grid, and the power supply conversion module is used for converting an AC power supply output by the power grid from and to a DC power supply output by the battery;

the power supply conversion module is also used for receiving a control instruction sent by the main control module through the communication module, and changing an amplitude of conversion power and directions of power supply conversion according to the control instruction.

3. The system according to claim 2, characterized by further comprising a battery control module, wherein the battery control module is electrically connected with the battery of the automobile chassis, the power supply conversion module and the data acquisition module, and the battery control module is used for controlling connection and disconnection between the battery of the automobile chassis and the power supply conversion module and for disconnecting the battery from the outside when an exception of the battery occurs.

4. The system according to claim 2 or 3, characterized in that the power supply conversion module comprises an AC/DC converter, and the AC/DC converter is used for rectifying an AC power supply transmitted by the power grid into a DC power supply to keep charging the battery of the automobile chassis until SOC100%; and the DC power supply is also used for inverting the DC power supply transmitted by the battery of the automobile chassis into the AC power supply to keep discharging back into the power grid until SOC0%.

5. The system according to claim 3, characterized in that the data acquisition module comprises a data acquisition master control and a data acquisition slave control, wherein the data acquisition slave control is electrically connected with the battery of the automobile chassis and used for acquiring the state information of each cell in the battery of the automobile chassis;
the data acquisition master control is electrically connected with the data acquisition slave control and the battery control module, used for sending the state information acquired by the data acquisition slave control to the main control module, and also used for controlling the battery control module to disconnect the battery of the automobile chassis with the power supply conversion module when the exception of the battery is acquired.

6. The system according to claim 5, characterized in that after disconnecting a data acquisition connector with a main power line of a primary battery module, the data acquisition slave control is connected with each cell in the battery of the automobile chassis through a sampling line, and calculates the state information of each cell corresponding to the sampling line and the current information of the battery system by acquiring data of the sampling line.

7. The system according to claim 1, characterized in that the main control module is further used for calculating a capacity, charging and discharging temperatures, charging and discharging efficiency of the battery system and internal resistance of each cell of the automobile chassis according to the state information of each cell in the automobile chassis and the current information of the battery system;
calculating a state of health of each cell according to the state information, the current information of the battery system and the capacity, the charging and discharging temperatures, the charging and discharging efficiency of the battery system and the internal resistance of each cell of the automobile chassis; and
judging the use condition of the battery of the automobile chassis according to the state of health of each cell.

8. The system according to claim 7, characterized in that the main control module judges the use condition of the battery of the automobile chassis according to the state of health of each cell, comprising:

judging that the battery of the automobile chassis is in a normal use state when the state of health of each cell is greater than or equal to a first threshold value;

judging that a corresponding cell is in want of repair when the state of health of the cell is smaller than a second threshold value; and

judging that the battery of the automobile chassis is in want of replacement when more than a preset number of cells have the state of health smaller than a first threshold value.

9. The system according to claim 7 or 8, characterized in that the system further comprises a display module, the display module being electrically connected with the main control module and used for displaying the state information of each cell in the automobile chassis, the current information of the battery system and the use condition of the battery of the automobile chassis.

10. The system according to claim 2, characterized in that the communication conversion module comprises a communication converter for connection with the main control module through network wiring, for connection with the data acquisition module through a CAN bus or a 485 bus, and for connection with the power supply conversion module through the 485 bus.