Title: BATTERY MANAGEMENT METHOD AND SYSTEM

Abstract: A battery management system is provided. The battery management system comprises a plurality of batteries; a plurality of tokens respectively associated with the plurality of batteries; and recording information of the respective batteries; and a plurality of battery swapping stations gathering the information from the plurality of tokens.
BATTERY MANAGEMENT METHOD AND SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates to a battery management method and system, and more particularly to a battery management method and system applied to the Electric Vehicle by using the Internet protocol.

BACKGROUND OF THE INVENTION

[0002] Ever since the issue of environmental protection has been proposed, more and more people start to realize that resources of the Earth are not inexhaustible. The discovery and research about substitution schemes of energy are eagerly and continually conducted around the world. However, there are no efficiently applicable methods at present, and the usage of petroleum still possesses a huge percentage in our life. The idea of Electric Vehicle (EV) has already been proposed a long time ago, and the substantial product has also been manufactured and sold in the market. EV is a kind of vehicle which uses the electric motor as the source of propulsion. By using the electricity for automobile propulsion, EV could provide much more power as well as comfort and ease of operation than the conventional transportation using the Internal Combustion Engine (ICE). Nevertheless, the pure Electric Vehicle has a lot of disadvantages which still remain unsolved, wherein the most significant one is that they cannot afford long-distance traveling.

[0003] In order to overcome this issue, the Hybrid Electric Vehicle (HEV) appears. This kind of vehicle uses the combination of the ICE propulsion system and electric propulsion system, and therefore provides special characteristics that are between the conventional car and EV. However, due
to the complexity and production cost of HEV, it is difficult to promote HEV into the market and popularize among consumers.

[0004] Presently, the concept of building "battery stations" has been proposed. The goal of building "battery stations" is to enable the user of EV to get their battery of EV recharged everywhere instead of at home, just like the model of gasoline stations right now. This could effectively prolong the travel distance of EV. In this system, however, the function of battery stations is to recharge the battery, and this system has to be constructed on the premise that EV is popular in the market. Yet for EV, the most important and expensive component is the battery, which is the core of the entire vehicle and provides the power to propel the vehicle. If the performance of the battery is getting down, it is necessary to buy another battery for the EV, or the vehicle would become a scrap. Therefore, the spread of EV still faces a lot of problems and obstacles.

[0005] In order to overcome the drawbacks in the prior art, a battery management method and system are provided. The particular designs in the present invention not only solve the problems described above, but also are easy to be implemented. Thus, the present invention has the utility for the industry.

SUMMARY OF THE INVENTION

[0006] In accordance with an aspect of the present invention, a battery management method and system are provided, which make the simpler, more environmentally-friendly, economical, less-complicated, and potentially less-costly-to-produce Electric Vehicle a reality.

[0007] In accordance with another aspect of the present invention, a battery management system is provided. The system comprises a plurality of
batteries; a plurality of tokens respectively associated with the plurality of batteries, and recording information of the respective batteries; and a plurality of battery swapping stations gathering the information from the plurality of tokens.

[0008] Preferably, the information of the battery comprises a current condition being at least one selected from a group consisting of a temperature, a voltage, a life cycle and a charging status of the battery.

[0009] Preferably, the plurality of batteries are used to drive vehicles, and the plurality of battery swapping stations read the information recorded in the tokens when the vehicles enter the plurality of battery swapping stations to replace the respective batteries.

[0010] Preferably, each of the plurality of tokens has an Internet protocol address to wirelessly communicate with the plurality of battery swapping stations nearby.

[0011] Preferably, the information recorded in each of the plurality of tokens is transmitted to the plurality of battery swapping stations when communicating.

[0012] Preferably, the system further comprises a vehicle driven by one of the plurality of batteries; a managing center that tracks the plurality of batteries based on the information gathered from the plurality of battery swapping stations; and a plurality of warehouses respectively configured with the plurality of battery swapping stations for storing the plurality of batteries.

[0013] Preferably, the plurality of batteries are used to drive vehicles, and the respective vehicle has a global positioning system to identify the plurality of battery swapping stations nearby.
Preferably, the plurality of battery swapping stations maintain and recharge the plurality of batteries; and each of the plurality of tokens sends an alert to a vehicle driver when the associated battery in the vehicle has one of necessities to be maintained and recharged.

In accordance with a further aspect of the present invention, a method for managing battery used for a vehicle is provided. The method comprises the steps of providing at least a swapping station; providing a first and a second batteries; associating a token with the first and the second batteries; and swapping the first battery with the second battery in one of the battery swapping stations.

Preferably, the method further comprises a step of detecting and recording information of the first and the second batteries by the tokens thereof, wherein the information comprise a current condition being at least one selected from a group consisting of a temperature, a voltage, a life cycle and a charging status.

Preferably, the step of swapping further comprises reading the information recorded in the tokens by the battery swapping station.

Preferably, the method further comprises a step of managing the information received from the battery swapping station in a managing center.

Preferably, each of the tokens has an Internet protocol address to wirelessly communicate with one of the plurality of battery swapping stations nearby so as to transmit the information recorded in the each token to the battery swapping stations nearby.

Preferably, the method further comprises a step of managing the information received from the battery swapping station in a managing center.
Preferably, the method further comprises the steps of storing the first and the second batteries in a plurality of warehouses respectively configured with the battery swapping stations; maintaining and recharging the first and the second batteries by the plurality of battery swapping stations; identifying any one of the plurality of battery swapping stations nearby by a global positioning system configured in the vehicle; and sending an alert to a driver of the vehicle when one of the first and the second batteries in the vehicle has one of necessities to be maintained and recharged.

In accordance with further another aspect of the present invention, a token used for a battery is provided. The token comprises a detection element detecting a condition of the battery to generate an information; and a communication element transmitting the information.

Preferably, the battery is a rechargeable battery for a vehicle, and the information comprises at least one selected from a group consisting of a temperature, a voltage, a life cycle and a charging status of the rechargeable battery.

Preferably, the token further comprises a storage element storing the information; and an Internet protocol address in a network, with which the token wirelessly communicates by using the communication element.

Preferably, the token sends an alert to a vehicle driver when the token detects that the battery in the vehicle has one of necessities to be maintained and recharged.

In accordance with further another aspect of the present invention, a token used for a battery having an information of a condition is provided. The token comprises a providing element providing the information.
Preferably, the providing element is a communication element transmitting the information; the battery is a rechargeable battery for a vehicle, and the information comprises at least one selected from a group consisting of a temperature, a voltage, a life cycle and a charging status of the rechargeable battery; and the token sends an alert to a vehicle driver when the token detects that the battery in the vehicle has one of necessities to be maintained and recharged, and the token further comprises: a detection element detecting the condition of the battery to generate the information; a storage element storing the information; and an Internet protocol address in a network, with which the token wirelessly communicates by using the communication element.

The above objects and advantages of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed descriptions and accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram of the battery management system in the present invention.

Fig. 2 is a schematic diagram of the token structure in the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for the purposes of illustration and description only; it is not intended to be exhaustive or to be limited to the precise form disclosed.
In the present invention, it is assumed that all the EVs sold to the user do not include batteries, and thus the price of the EV and the cost afforded by the user can be effectively decreased. Batteries are owned and provided by other companies, and the users may have to drive their EVs to the battery swapping stations to swap out the "empty" battery for a fully-recharged one.

Please refer to Fig. 1, which is a schematic diagram of the battery management system in the present invention. The battery management system comprises a plurality of batteries 10, a plurality of tokens 11 respectively embedded in the plurality of batteries 10 for recording information of the respective batteries 10, a plurality of battery swapping stations 12 for gathering the information from the plurality of tokens 11, a plurality of warehouses 13 respectively constructed beside the plurality of battery swapping stations 12 for storing the plurality of batteries 10, and a managing center 14 collecting all the information from the plurality of battery swapping stations 12.

Each token 11 comprises a detection element 101 detecting a current condition of the battery so as to generate the information, a communication element 102 for transmitting the information, a storage element 103 for storing the information, and an Internet protocol (IP) address, wherein the token 11 has the capability to wirelessly communicate and is identified in a network.

As a user drives an EV 15 out of a battery swapping station 12, the EV 15 carries a fully-recharged battery 10 provided by the battery swapping station 12. When the user drives the EV 15 on the road, the condition and performance of the battery 10, such as the temperature, voltage or charging status thereof, would constantly change. In addition, all the
batteries 10 have specific lifecycles, and each time the battery 10 is charged, the lifecycle thereof would be decreased. Therefore, the token 11, which is embedded in the battery 10, could detect all the abovementioned characteristics of the battery 10 varying at every moment and store them as information, and then wirelessly transmit the information back to the battery swapping station 12 through the network. Then, the managing center 14 would collect all the information transmitted from the battery swapping station 12 so as to manage and track every battery 10 outside. As a result, the real-time monitoring and managing for the battery 10 can be achieved. 

[0036] Since the token 11 of the present invention has an IP address, it provides the battery 10 with the ability to access in the network and transmit the information therethrough. The token 11 would transmit the information every specific period, which could be determined in advance, to the battery swapping station 12 through the network, or the battery swapping station 12 could actively request a connection with the token 11 to acquire the information stored in the token 11 also through the network. In the present embodiment, the battery swapping station 12 is a base station of the wireless network, but is not limited thereto. That is, any other ways which are available in the present embodiment can be adopted. Additionally, this IP address provides a specific identification to each battery 10, and therefore the management of massive quantities for the battery 10 could be realized. 

[0037] However, the transmission of the information is not limited to the above-mentioned methods. When the EV 15 is driven into the battery swapping station 12 for replacing the battery 10, the information of the battery 10 stored in the token 11 could also be read and gathered by the battery swapping station 12 through a short-range wireless transmission method, such
as the Radio Frequency Identification (RFID), Infrared Ray, Microwave communication or any other methods which are available in the present embodiment. To be more specific, when the EV 15 is running on the road, the information of the battery 10 will keep transmitting to the battery swapping station 12, and when the user drives the EV 15 to the battery swapping station 12 for replacing the battery, a latest update of the condition of the battery 10 will be performed by the battery swapping station 12 through the token 11. The information of the swap-out battery would also be transmitted to the managing center 14 for overall management. Consequently, the managing center 14 would immediately update instant conditions of all the batteries 10, and discover whether there is any broken battery 10 in the warehouses 13 or being used in any EV 15 currently, and the notification could be sent to the battery swapping station 12 or the user accordingly.

[0038] Through the configuration of the IP address, each battery swapping station 12 could identify whether the battery 10 is qualified, which means that the battery 10 is accepted by the battery swapping station 12. If the EV 15 with an unqualified battery is driven into the battery swapping station 12 to request for battery replacing, the battery swapping station 12 would recognize and deny such request.

[0039] Besides, the present invention could also combine the technology of Global Positioning System (GPS), which is configured in each EV 15 for helping the user to locate and identify the battery swapping stations 12 nearby. In addition to the function of providing swapping of the battery 10, the battery swapping stations 12 may also provide the services of maintenance, repair and reporting back to the managing center 14. Since the token 11 could detect the current conditions of the battery 10, when the status of the battery 10 appears
to require maintenance or recharge, the token 11 would send an alert actively to the user, and thus the user would have enough time to search for the available battery swapping stations 12 according to the information on the GPS.

[0040] Because the managing center 14 would also track and update the immediate statuses of all the batteries 12, it can also discover which battery 12 needs to be replaced, maintained or recharged, and send an notification directly or indirectly to the token 11 embedded therewith so as to remind the user. In this way, the status of each battery 10 would be double-checked, and the efficacy of monitoring and administration will be considerably enhanced.

[0041] To sum up, the present invention provides an integrated battery management system, which may bring a revolution into the current transportation structure, tremendously decrease the exhaustion of the Earth's resources, and realize a comfortable, convenient and promising future. The idea of the present invention practically solves the difficulties that putting the population of EV into force would face, and conserve the Earth at the same time. Therefore, the present invention effectively solves the problems and drawbacks in the prior art, and thus it fits the demand of the industry and is industrially valuable.

[0042] While the invention has been described in terms of what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention needs not be limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims which are to be accorded with the broadest interpretation so as to encompass all such modifications and similar structures.
WHAT IS CLAIMED IS:

1. A battery management system, comprising:
   a plurality of batteries;
   a plurality of tokens respectively associated with the plurality of batteries, and recording information of the respective batteries; and
   a plurality of battery swapping stations gathering the information from the plurality of tokens.

2. The battery management system according to Claim 1, wherein the information of the battery comprises a current condition being at least one selected from a group consisting of a temperature, a voltage, a life cycle and a charging status of the battery.

3. The battery management system according to Claim 1, wherein the plurality of batteries are used to drive vehicles, and the plurality of battery swapping stations read the information recorded in the tokens when the vehicles enter the plurality of battery swapping stations to replace the respective batteries.

4. The battery management system according to Claim 1, wherein each of the plurality of tokens has an Internet protocol address to wirelessly communicate with the plurality of battery swapping stations nearby.

5. The battery management system according to Claim 4, wherein the information recorded in each of the plurality of tokens is transmitted to the plurality of battery swapping stations when communicating.

6. The battery management system according to Claim 1, further comprising:
   a vehicle driven by one of the plurality of batteries;
   a managing center that tracks the plurality of batteries based on the information gathered from the plurality of battery swapping stations; and
a plurality of warehouses respectively configured with the plurality of battery swapping stations for storing the plurality of batteries.

7. The battery management system according to Claim 1, wherein the plurality of batteries are used to drive vehicles, and the respective vehicle has a global positioning system to identify the plurality of battery swapping stations nearby.

8. The battery management system according to Claim 1, wherein the plurality of battery swapping stations maintain and recharge the plurality of batteries; and each of the plurality of tokens sends an alert to a vehicle driver when the associated battery in the vehicle has one of necessities to be maintained and recharged.

9. A method for managing battery used for a vehicle, comprising the steps of:
   providing at least a swapping station;
   providing a first and a second batteries;
   associating a token with the first and the second batteries; and
   swapping the first battery with the second battery in one of the battery swapping stations.

10. The method according to Claim 9, further comprising a step of:
    detecting and recording information of the first and the second batteries by the tokens thereof, wherein the information comprise a current condition being at least one selected from a group consisting of a temperature, a voltage, a life cycle and a charging status.

11. The method according to Claim 10, wherein the step of swapping further comprises reading the information recorded in the tokens by the battery swapping station.

12. The method according to Claim 11, further comprising a step of:
managing the information received from the battery swapping station in a managing center.

13. The method according to Claim 10, wherein each of the tokens has an Internet protocol address to wirelessly communicate with one of the plurality of battery swapping stations nearby so as to transmit the information recorded in the each token to the battery swapping stations nearby.

14. The method according to Claim 13, further comprising the step of:

managing the information received from the battery swapping station in a managing center.

15. The method according to Claim 9, further comprising the steps of:

storing the first and the second batteries in a plurality of warehouses respectively configured with the battery swapping stations;

maintaining and recharging the first and the second batteries by the plurality of battery swapping stations;

identifying any one of the plurality of battery swapping stations nearby by a global positioning system configured in the vehicle; and

sending an alert to a driver of the vehicle when one of the first and the second batteries in the vehicle has one of necessities to be maintained and recharged.

16. A token used for a battery, comprising:

a detection element detecting a condition of the battery to generate an information; and

a communication element transmitting the information.

17. The token according to Claim 16, wherein the battery is a rechargeable battery for a vehicle, and the information comprises at least one selected from a group consisting of a temperature, a voltage, a life cycle and a charging
status of the rechargeable battery.

18. The token according to Claim 16, further comprising:
   a storage element storing the information; and
   an Internet protocol address in a network, with which the token wirelessly
   communicates by using the communication element.

19. The token according to Claim 16, wherein the token sends an alert to a
    vehicle driver when the token detects that the battery in the vehicle has one of
    necessities to be maintained and recharged.

20. A token used for a battery having an information of a condition,
    comprising a providing element providing the information.

21. The token according to Claim 20, wherein the providing element is a
    communication element transmitting the information; the battery is a
    rechargeable battery for a vehicle, and the information comprises at least one
    selected from a group consisting of a temperature, a voltage, a life cycle and a
    charging status of the rechargeable battery; and the token sends an alert to a
    vehicle driver when the token detects that the battery in the vehicle has one of
    necessities to be maintained and recharged, and the token further comprises:
       a detection element detecting the condition of the battery to generate the
       information;
       a storage element storing the information; and
       an Internet protocol address in a network, with which the token wirelessly
       communicates by using the communication element.
International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H02J 7/00 (2009.01)
USPC - 320/1 50

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - H02J 7/00 (2009.01)
USPC - 320/1 50

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8) - H02J 7/00 (2009.01), USPC - 320/150, 152; 324/426, 602, 609: keyword search, as below

Electronic data base searched during the international search (name of data base and, where practicable, search terms used)
USPTO PubWest (databases: PGIB,USPT,USOC,EPAB,JPAB), DialogWeb, databases: 989, 996, 995, 992, 990, 995, 997, 993, 991, 6, 63, 65 - Search Terms - battery, exchange, interchange, swap, supply, purchase, provide, rent, station, location, store, facility, information, data, condition, state, temperature, voltage, state, charge, life, internet, wire

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>X</td>
<td>US 2007/0108946 A1 (YAMAUCHI et al.) 17 May 2007 (17.05.2007) abstract, para [0061], [0062], [0063], [0002], [0014], [0034], [0066], [0090]</td>
<td>16-21, 1-15</td>
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<td>Y</td>
<td>US 2009/0058355 A1 (MEYER) 5 March 2009 (05.03.2009) abstract, para [0101], [0011], [0012], [0031]</td>
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<td>US 2006/0123053 A1 (SCANNELL) 8 June 2006 (08.06.2006) para [0073]</td>
<td>7, 15</td>
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<td>A</td>
<td>US 2008/0053716 A1 (SCHUECHER) 6 March 2008 (06.03.2008)</td>
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