

(54) Title of the Invention: **Power-assisted bicycle, and power management system and management method thereof**

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Drawings

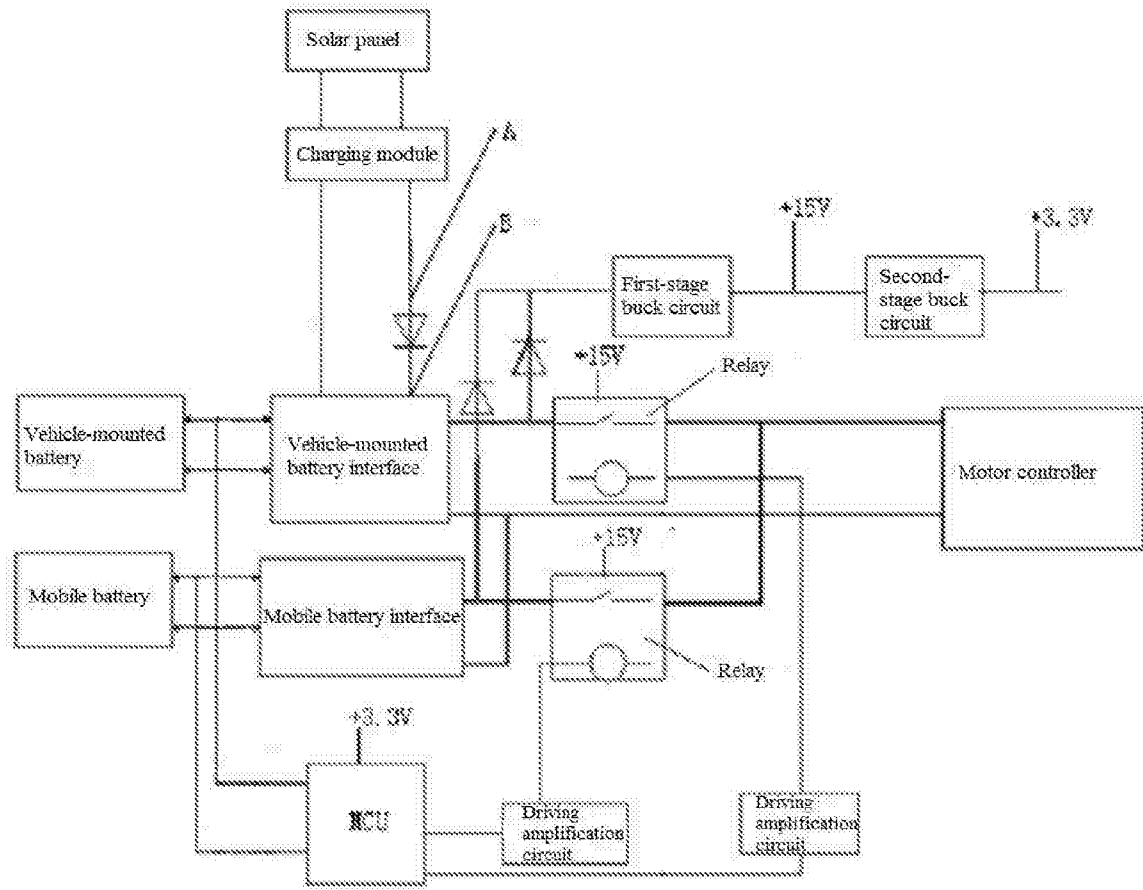


Fig. 1

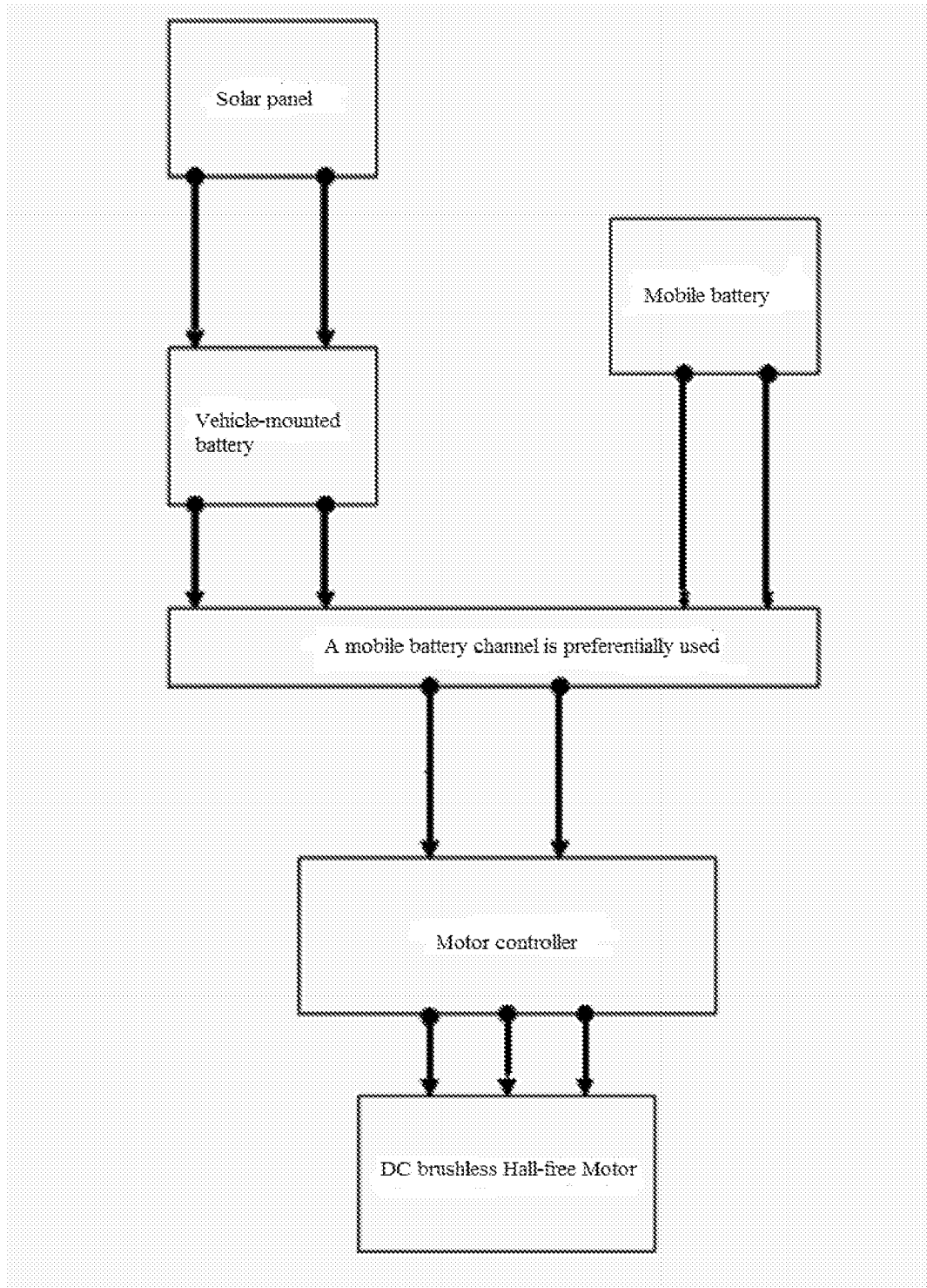


Fig. 2

Power-assisted bicycle, and Power Management System and Management Method Thereof

Technical Field

The present invention relates to a power-assisted bicycle, and a power management system and a management method thereof.

Background Art

A power-assisted bicycle has been developed rapidly due to energy saving and labor saving, and the advent of sharing economy enables the power-assisted bicycle to be developed more rapidly. However, there are some inherent problems in the power-assisted bicycle. Firstly, a cruising ability is limited, and user experience is poor in the case of power failure. Secondly, a battery is bulky, so that it is inconvenient for a user to take the battery home for charging, while there are great risks when charging outside (electricity safety and theft prevention).

Summary of the Invention

The present invention is intended to provide a power-assisted bicycle power management system making a cruising range of a whole power-assisted bicycle more competitive, a power-assisted bicycle using the power management system, and a management method.

The technical solutions used for achieving the objectives of the present invention are as follows: a power-assisted bicycle power management system is provided first, which includes a motor controller, driving circuits, batteries, a MCU and a charging power supply assembly, wherein:

the motor controller is used for driving a motor arranged on the power-assisted bicycle;

the driving circuits are used for driving the motor controller;

the batteries are used for supplying power to the driving circuits and the MCU, and include a vehicle-mounted battery and a mobile battery;

the MCU is used for deciding to supply power to the driving circuits by the vehicle-mounted battery/the mobile battery according to voltage sampling of the vehicle-mounted battery and the mobile battery; and

the charging power supply assembly is used for charging the vehicle-mounted battery, and when an electric quantity in the vehicle-mounted battery is less than or equal to a preset threshold, the MCU controls the mobile battery to supply power to the driving circuits; wherein the power-assisted bicycle power management system further includes two-stage buck circuits, wherein a first-stage buck circuit of the two-stage buck circuits is used for reducing and supplying output voltages of the vehicle-mounted battery and the mobile battery to the driving circuits, and a second-stage buck circuit of the two-stage buck circuits is used for reducing and supplying an output voltage of the first-stage buck circuit to the MCU.

The charging power supply assembly includes a solar panel and a charging module.

The driving circuits refer to two relays, and the two relays are respectively controlled by signals of the MCU and powered by the vehicle-mounted battery/mobile battery to control the motor controller to drive the motor of the power-assisted bicycle.

Driving amplification circuits are respectively arranged among the two relays of the driving circuits and the MCU.

The vehicle-mounted battery includes a solar panel and a storage battery;

the solar panel is flatly laid on at least one side surface and a bottom surface on a basket of the power-assisted bicycle;

the storage battery is arranged below the bottom surface and on a side opposite to the solar panel; and

the solar panel is electrically connected with the storage battery, converts solar radiation energy received into electric energy, and saves the electric energy into the storage battery.

Secondly, a power-assisted bicycle includes a motor, a smart lock, a body and the above power-assisted bicycle power management system, and the power-assisted bicycle power management system configures power for the motor; and the MCU of the power-assisted bicycle power management system is communicated with the smart lock and starts power output according to a signal of the smart lock.

Finally, a power management method of the above power-assisted bicycle is used, and a condition for charging the vehicle-mounted battery by the solar panel is that: the solar panel is electrified, and an output voltage of the solar panel through the charging module is higher

than that of the vehicle-mounted battery; wherein a first-stage buck circuit of the two-stage buck circuits of the power-assisted bicycle power management system is used for reducing and supplying output voltages of the vehicle-mounted battery and the mobile battery to the driving circuits, and a second-stage buck circuit of the two-stage buck circuits is used for reducing and supplying an output voltage of the first-stage buck circuit to the MCU.

The MCU periodically scans an unlocking instruction of the smart lock of the power-assisted bicycle, and if the unlocking instruction is scanned, electric energy of the power-assisted bicycle power management system is turned on and outputted to the motor of the power-assisted bicycle; and an electric quantity required by the MCU to periodically scan the unlocking instruction of the smart lock of the power-assisted bicycle is provided by the vehicle-mounted battery.

Voltage protection values are set for the vehicle-mounted battery and the mobile battery; the MCU continuously samples the vehicle-mounted battery and the mobile battery to obtain two real-time voltage values; if a voltage sampling value of the vehicle-mounted battery is less than the protection value of the vehicle-mounted battery, a relay of the driving circuit connected with the vehicle-mounted battery is turned off; and if a voltage sampling value of the mobile battery is no less than the protection value of the mobile battery, the mobile battery outputs by full power.

The present invention has the following positive effects after using the above technical solutions: (1) the vehicle-mounted battery, the mobile battery and the solar panel are arranged for the power-assisted bicycle in the present invention, since the vehicle-mounted battery and the mobile battery may both supply power, a volume and a weight of the mobile battery can be reduced, so that the mobile battery is lighter, and the solar panel may continuously charges the vehicle-mounted battery, so that a cruising ability of the power-assisted bicycle is further enhanced.

(2) According to the present invention, when the mobile battery and the vehicle-mounted battery coexist on the power-assisted bicycle, the power supply is optimally managed, the mobile battery is preferentially used, and the vehicle-mounted battery provides the electric quantity for scanning the obtained unlocking instruction of the lock, so that division of labor is clear, management is reasonable, and the cruising ability is greatly enhanced.

(3) According to the present invention, the protection values are set for the vehicle-mounted battery and the mobile battery, so that the management method is more

scientific and reasonable, and service lives of the batteries are prolonged.

Brief Description of the Drawings

In order to make the contents of the present invention easier to be understood, the present invention is further described in detail hereinafter with reference to the specific embodiments and the accompanying drawings.

Fig. 1 is a functional block diagram of the present invention.

Fig. 2 is a flow block diagram of the present invention.

Detailed Description of the Preferred Embodiments

(Embodiment 1)

A power-assisted bicycle in the embodiment includes a motor, a smart lock, a body and a power-assisted bicycle power management system, and the power-assisted bicycle power management system configures power for the motor. A MCU of the power-assisted bicycle power management system is communicated with the smart lock and starts power output according to a signal of the smart lock. A Bluetooth lock with Bluetooth communication is used as the smart lock.

With reference to Fig. 1, the power-assisted bicycle power management system in the embodiment includes a motor controller, driving circuits, batteries, the MCU, a charging power supply assembly, and two-stage buck circuits. In the embodiment, the charging power supply assembly includes a solar panel and a charging module, but other charging power supplies, such as wind energy, may also be used. The charging module herein is mainly an inverter that converts solar energy into electric energy.

The motor controller is used for driving a motor arranged on the power-assisted bicycle to convert the electric energy into kinetic energy outputted by the motor.

The driving circuits are used for driving the motor controller. Specifically, the driving circuits refer to two relays, and the two relays are respectively controlled by signals of the MCU and powered by a vehicle-mounted battery/mobile battery to control the motor controller to drive the motor of the power-assisted bicycle.

The batteries are used for supplying power to the driving circuits and the MCU, and include the vehicle-mounted battery and the mobile battery. The vehicle-mounted battery is used as a normal power supply battery, is convenient for a user to save the electric energy converted by the solar panel at any time, and outputs the electric energy to the motor

controller when needed. The mobile battery is used as a detachable battery, is kept by the user and charged by itself, and is a main energy source of the motor controller. In the embodiment, the mobile battery only outputs power. The two batteries are set. The mobile battery is preferentially used, and may be almost completely used up. In order to protect the service life of the battery, a protection value is set in the embodiment, such as 5% of an electric quantity, and if the electric quantity is lower than 5%, the user is reminded to charge the battery. If the power-assisted bicycle is still needed to use, the vehicle-mounted battery may be used for short-term power supply. Certainly, the protection value may also be set lower or even set as 0. Moreover, in order to prolong the service life of the vehicle-mounted battery (the vehicle-mounted battery is inconvenient to replace, and if the vehicle-mounted battery is overused, the service life of the vehicle-mounted battery can be shortened), a protection value is also set for the vehicle-mounted battery, such as 80% of an electric quantity, and if the electric quantity is lower than 80%, power output of the vehicle-mounted battery is turned off.

The MCU is used for deciding to supply power to the driving circuits by the vehicle-mounted battery/the mobile battery according to voltage sampling of the vehicle-mounted battery and the mobile battery. In the embodiment, the MCU is a Bluetooth control chip with a model number of 51822, and is used for matching with the Bluetooth lock and outputting the electric quantity along with an unlocking instruction.

When the electric quantity in the vehicle-mounted battery is less than or equal to a preset threshold, such as being lower than 10%, the MCU controls the mobile battery to supply power to the power-assisted bicycle instead of the vehicle-mounted battery. It can be understood that the preset threshold may be a default value of the system, or may be set by the user according to an actual demand.

In a preferred embodiment, two solar panels and a storage battery are arranged in the vehicle-mounted battery. The two solar panels are flatly laid on a front side surface and a bottom surface on a basket of the power-assisted bicycle respectively, so that the solar panels are able to absorb solar rays more comprehensively. It can be understood that in order to obtain more solar radiation energy, the solar panels may be flatly laid on four side surfaces and the bottom surface on the basket. The storage battery is arranged below the bottom surface on the basket, which is namely the other side opposite to the solar panel, and is electrically connected with the solar panel. Therefore, the solar panel is able to convert solar radiation energy absorbed into electric energy, and saves the electric energy into the storage

battery. It can be understood that, in order to further avoid overcharge of the storage battery by the solar panel 0, a charge and discharge control element may be further arranged between the solar panel the storage battery. The solar panel and the charging module are used for charging the vehicle-mounted battery. Large voltage and power input are used in the solar panel, and a rated voltage is higher than a battery voltage of the system. In order to protect the vehicle-mounted battery, an anti-reverse connection protection circuit may be provided herein, and an alarm is given if reverse connection occurs. A number of the solar panels is selected according to an actual need, and the solar panels may be arranged on the bottom surface and the side surface on the basket, or on a frame body. Certainly, a plurality of solar panels may be provided at the same time.

A first-stage buck circuit of the two-stage buck circuits is used for reducing output voltages of the vehicle-mounted battery and the mobile battery to 15 V and supplying the output voltages of the vehicle-mounted battery and the mobile battery to the driving circuits, and a second-stage buck circuit of the two-stage buck circuits is used for reducing an output voltage of the first-stage buck circuit to 3.3V and supplying the output voltage of the first-stage buck circuit to the MCU. A linear voltage stabilizing chip may be used in both the two-stage buck circuits to stabilize and reduce the voltage.

In order to obtain a more stable driving signal, driving amplification circuits are respectively arranged among the two relays of the driving circuits and the MCU. A simple and reliable triode may be used in the driving amplification circuits for amplification.

With reference to Fig. 1 and Fig. 2, a power-assisted bicycle power management method includes the following key points.

I. A condition for charging the vehicle-mounted battery by the solar panel is that: the solar panel is electrified, and an output voltage (point A in Fig. 1) of the solar panel through the charging module is higher than an output voltage (point B in Fig. 1) of the vehicle-mounted battery.

II. The MCU scans the unlocking instruction of the smart lock of the power-assisted bicycle once per minute under a stand-by state, and if the unlocking instruction is scanned, electric energy of the power-assisted bicycle power management system is turned on and outputted to the motor of the power-assisted bicycle. An electric quantity required by the MCU to periodically scan the unlocking instruction of the smart lock of the power-assisted bicycle is provided by the vehicle-mounted battery. A scanning time interval is appropriately one minute. If the time interval is too long, user experience is affected, and if the time

interval is too short, too much electricity is consumed.

III. Voltage protection values are set for the vehicle-mounted battery and the mobile battery. The MCU continuously samples the vehicle-mounted battery and the mobile battery to obtain two real-time voltage values. If a voltage sampling value of the vehicle-mounted battery is less than the protection value of the vehicle-mounted battery, a relay of the driving circuit connected with the vehicle-mounted battery is turned off. If a voltage sampling value of the mobile battery is no less than the protection value of the mobile battery, the mobile battery outputs by full power.

The above specific embodiments further illustrate the objectives, technical solutions and beneficial effects of the present invention. It should be understood that the above embodiments are only specific embodiments of the present invention and are not used to limit the present invention. Any modifications, equivalent substitutions and improvements made within the spirit and principle of the present invention should be included in the scope of protection of the present invention.

Claims

1. A power-assisted bicycle power management system, comprising a motor controller, driving circuits, batteries, a MCU and a charging power supply assembly, wherein:

the motor controller is used for driving a motor arranged on the power-assisted bicycle;

the driving circuits are used for driving the motor controller;

the batteries are used for supplying power to the driving circuits and the MCU, and comprise a vehicle-mounted battery and a mobile battery;

the MCU is used for deciding to supply power to the driving circuits by the vehicle-mounted battery/the mobile battery according to voltage sampling of the vehicle-mounted battery and the mobile battery; and

the charging power supply assembly is used for charging the vehicle-mounted battery, and when an electric quantity in the vehicle-mounted battery is less than or equal to a preset threshold, the MCU controls the mobile battery to supply power to the driving circuits;

the power-assisted bicycle power management system further comprising two-stage buck circuits, wherein a first-stage buck circuit of the two-stage buck circuits is used for reducing and supplying output voltages of the vehicle-mounted battery and the mobile battery to the driving circuits, and a second-stage buck circuit of the two-stage buck circuits is used for reducing and supplying an output voltage of the first-stage buck circuit to the MCU.

2. The power-assisted bicycle power management system according to claim 1, wherein the charging power supply assembly comprises a solar panel and a charging module.

3. The power-assisted bicycle power management system according to claim 2, wherein the driving circuits refer to two relays, and the two relays are respectively controlled by signals of the MCU and powered by the vehicle-mounted battery/mobile battery to control the motor controller to drive the motor of the power-assisted bicycle.

4. The power-assisted bicycle power management system according to claim 3, wherein driving amplification circuits are respectively arranged among the two relays of the driving circuits and the MCU.

5. The power-assisted bicycle power management system according to claim 1,

wherein:

the vehicle-mounted battery comprises a solar panel and a storage battery;

the solar panel is flatly laid on at least one side surface and a bottom surface on a basket of the power-assisted bicycle;

the storage battery is arranged below the bottom surface and on a side opposite to the solar panel; and

the solar panel is electrically connected with the storage battery, converts solar radiation energy received into electric energy, and saves the electric energy into the storage battery.

6. A power-assisted bicycle, comprising a motor, a smart lock and a body, wherein the power-assisted bicycle further comprises the power-assisted bicycle power management system according to one of claims 1 to 5, the power-assisted bicycle power management system configures power for the motor; and the MCU of the power-assisted bicycle power management system is communicated with the smart lock and starts power output according to a signal of the smart lock.

7. A power-assisted bicycle power management method, wherein the power-assisted bicycle power management system according to claim 4 is used, and a condition for charging the vehicle-mounted battery by the solar panel is that: the solar panel is electrified, and an output voltage of the solar panel through the charging module is higher than that of the vehicle-mounted battery,

wherein a first-stage buck circuit of the two-stage buck circuits of the power-assisted bicycle power management system is used for reducing and supplying output voltages of the vehicle-mounted battery and the mobile battery to the driving circuits, and a second-stage buck circuit of the two-stage buck circuits is used for reducing and supplying an output voltage of the first-stage buck circuit to the MCU.

8. The power-assisted bicycle power management method according to claim 7, wherein the MCU periodically scans an unlocking instruction of the smart lock of the power-assisted bicycle, and if the unlocking instruction is scanned, electric energy of the power-assisted bicycle power management system is turned on and outputted to the motor of the power-assisted bicycle; and an electric quantity required by the MCU to periodically scan the unlocking instruction of the smart lock of the power-assisted bicycle is provided by the vehicle-mounted battery.

9. The power-assisted bicycle power management method according to claim 8, wherein voltage protection values are set for the vehicle-mounted battery and the mobile

battery; the MCU continuously samples the vehicle-mounted battery and the mobile battery to obtain two real-time voltage values; if a voltage sampling value of the vehicle-mounted battery is less than the protection value of the vehicle-mounted battery, a relay of the driving circuit connected with the vehicle-mounted battery is turned off; and if a voltage sampling value of the mobile battery is no less than the protection value of the mobile battery, the mobile battery outputs by full power.