

DESCRIPTION

MANAGEMENT SYSTEM FOR POWER STORAGE DEVICE

5

TECHNICAL FIELD

[0001]

The present disclosure relates to a management system for a power storage device, and more particularly to a management system for a portable power storage device.

10

BACKGROUND

[0002]

Conventionally, portable power storage devices have been used as power supplies for electric vehicles such as a power-assisted bicycle, an electric motorcycle, and an electric cart, and electric devices such as a computer, a printer, a smartphone, and a tablet terminal. In addition, the portable power storage device is also used as an emergency power supply when a power failure, a disaster, or the like occurs.

15

[0003]

In recent years, there has also been proposed a power storage device including a wireless communication module for transmitting information on a state of the power storage device to an information terminal such as a smartphone (for example, refer to Patent Literature 1). With the power storage device including the wireless communication module, the information on the state of the power storage device, such as a charging rate and a temperature, is transmitted to a smartphone or the like of a user, thereby enabling the user to easily confirm the state of the power storage device.

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CITATION LIST

PATENT LITERATURE

[0004]

SUMMARY

TECHNICAL PROBLEM

5 [0005]

Meanwhile, situations can be envisaged where a portable power storage device is taken out from a predetermined management area and lost, or the portable power storage device may be stolen. Therefore, there is a demand for a system capable of quickly searching for a power storage device when the power storage device is taken out of a
10 management area.

SOLUTION TO PROBLEM

[0006]

A management system for a power storage device according to the present disclosure includes: the power storage device including a communication module; at least one
15 management device disposed in a predetermined management area of the power storage device, the at least one management device being wirelessly communicable with the power storage device; and a management server, in which the at least one management device is capable of detecting that the power storage device has been taken out of the management area, and at least one of the at least one management device and the management server is
20 configured to output taking-out detection information when it is detected that the power storage device is taken out.

ADVANTAGEOUS EFFECTS OF INVENTION

[0007]

With a management system for a power storage device of the present disclosure,
25 when the power storage device is taken out of a management area, the power storage device can be quickly searched for.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

FIG. 1 is a diagram schematically illustrating a management system for a power storage device according to a first embodiment.

FIG. 2 is a block diagram illustrating a configuration of the management system
5 according to the first embodiment.

FIG. 3 is a diagram illustrating a first notification screen displayed on an information terminal.

FIG. 4 is a flowchart illustrating a processing procedure in the management system of the first embodiment.

10 FIG. 5 is a diagram schematically illustrating a management system for a power storage device according to a second embodiment.

FIG. 6 is a diagram illustrating a second notification screen displayed on an information terminal.

15 FIG. 7 is a diagram illustrating a third notification screen displayed on the information terminal.

FIG. 8 is a diagram illustrating a modification of the management system according to the second embodiment.

FIG. 9 is a diagram illustrating a modification of the management system according to the second embodiment.

20 FIG. 10 is a flowchart illustrating a processing procedure in the management system of the second embodiment.

FIG. 11 is a flowchart illustrating a modification of a processing procedure in a management device of the management system of the second embodiment.

25 FIG. 12 is a flowchart illustrating a modification of a processing procedure in a management server of the management system of the second embodiment.

DESCRIPTION OF EMBODIMENTS

[0009]

Hereinafter, an example of an embodiment of a management system for a power storage device according to the present disclosure will be described in detail with reference to the drawings. The embodiments described below are merely examples, and the present disclosure is not limited to the following embodiments. In addition, it is within the scope of the present disclosure to selectively combine respective components of a plurality of embodiments and modifications described below.

[0010]

A main body of a system according to the present disclosure includes a computer. The computer executes a program, thereby implementing a function of the main body of the system of the present disclosure. The computer includes, as a main hardware configuration, a processor that operates according to a program. The type of the processor is not limited as long as the processor can implement the function by executing the program. The processor is formed of one or a plurality of electronic circuits including an integrated circuit (IC) or a large-scale integrated circuit (LSI). The plurality of electronic circuits may be integrated on one chip or may be provided on a plurality of chips. The plurality of chips may be aggregated into one device or may be provided in a plurality of devices. In addition, the program is stored in a computer-readable non-transitory storage medium such as a ROM, an optical disk, or a hard disk drive. The program may be stored in advance in a storage medium, or may be supplied to a storage medium via a wide area communication network including the Internet or the like.

[0011]

Hereinafter, a management system 1 for a power storage device according to a first embodiment will be described with reference to FIGS. 1 to 4. FIG. 1 is a diagram schematically illustrating the management system 1. FIG. 2 is a block diagram illustrating a configuration of the management system 1. In FIG. 1, dot hatching is applied to a power storage device 10 taken out of a predetermined management area.

[0012]

As illustrated in FIGS. 1 and 2, the management system 1 includes the portable

power storage device 10 including a communication module 12, at least one management device disposed in a predetermined management area A of the power storage device 10 and configured to wirelessly communicate with the power storage device 10, and a management server 30. The management server 30 communicates with the at least one management device. As will be described in detail later, the at least one management device can detect that the power storage device 10 is taken out of the management area A. At least one of the at least one management device and the management server 30 is configured to output, when taking-out of the power storage device 10 is detected, taking-out detection information.

10 [0013]

In the present embodiment, an information terminal 20 and a beacon 40 are provided as the management device. The beacon 40 is a monitoring device configured to detect that the power storage device 10 is taken out of the management area A and to output taking-out detection information. The information terminal 20 is a terminal device including a monitor 23 capable of displaying the taking-out detection information, and examples thereof include a smartphone, a tablet terminal, and a laptop computer owned by a user. The management system 1 is configured so as to allow a user, particularly an equipment manager, to confirm the state of the power storage device 10 using the information terminal 20. The information terminal 20 may have a function as a monitoring device detecting that the power storage device 10 is taken out.

[0014]

The management system 1 is a system capable of quickly searching for the power storage device 10 when the power storage device 10 is taken out of the predetermined management area A. It is assumed that the power storage device 10 managed by the management system 1 is to be used in the management area A. In the management area A, for example, information is displayed to indicate that the power storage device 10 is prohibited from being taken out of the management area A, and the beacon 40 is installed at the entrance and exit. Accordingly, the power storage device 10 is prevented from

being taken out. However, in a case where the power storage device 10 is taken out by any chance, it is necessary to promptly notify a manager of occurrence of the taking out.

[0015]

When it has been detected, by the beacon 40 or the information terminal 20, that the power storage device 10 has been taken out of the management area A, the management system 1 displays taking-out detection information on the monitor 23 of the information terminal 20. As a result, the manager can know that the power storage device 10 has been taken out, and can search for the power storage device 10 that has been taken out. An example of the management area A includes an office, a factory, a public facility (a public office, a community hall, a school, a hospital, or the like), a commercial facility (a store, a shopping mall, or the like), or the like. An example of the management area A is one floor or an area in one facility. A plurality of management areas may be set in one facility.

[0016]

The management server 30 forming the management system 1 is a device that stores information on the power storage device 10 and comprehensively manages the power storage device 10. An example of the management server 30 is a server of a manufacturer, a management business operator, or the like of the power storage device 10. The information terminal 20 and the management server 30 are configured to be communicable via a wide area communication network such as an Internet line or a mobile communication system. The beacon 40 is preferably communicable with the information terminal 20, and may be configured to be communicable with the management server 30 via the wide area communication network. It is noted that the management server 30 may be a server managed by a user.

[0017]

The management area A generally includes a plurality of power storage devices 10. The management device and the management server 30 store identification numbers of the power storage devices 10 and manage information for each power storage device 10.

Therefore, when the power storage device 10 is taken out of the management area A, a manager can grasp which power storage device 10 is taken out. For example, the power storage device 10 is registered in the management server 30 using the information terminal 20. When a user owns a large number of power storage devices 10, the information terminal 20 used for management may be divided for each group of a predetermined number of power storage devices 10.

[0018]

FIGS. 1 and 2 illustrate a plurality of power storage devices 10, one information terminal 20 that manages each power storage device 10, and the management server 30 that can communicate with the information terminal 20. Each power storage device 10 provides information to the information terminal 20 by short-range wireless communication such as Bluetooth (registered trademark), Wi-Fi (registered trademark), or NFC. Hereinafter, a configuration unit of the system illustrated in FIGS. 1 and 2 will be described in detail, but the management server 30 may manage information of a large number of power storage devices 10 owned by other users. It is assumed that information terminals 20 of other users are connected to the management server 30 of the present embodiment, and pieces of information on other power storage devices 10 are registered therein.

[0019]

Hereinafter, a description will be given in detail as to the power storage device 10, the management device (the information terminal 20 and the beacon 40), and the management server 30 that form the management system 1.

[0020]

[Power storage device 10]

The power storage device 10 includes a battery module 11 and a case 14 that houses the battery module 11. The power storage device 10 is a portable power storage device, and is also generally referred to as a battery pack. The power storage device 10 includes the communication module 12 and a controller 13. The communication module 12 and

the controller 13, as well as the battery module 11, are housed in the case 14. The battery module 11 is charged using, for example, a predetermined charger/discharger. The charger/discharger has an outlet to which electric equipment is connected, and the power storage device 10 can be discharged in a state where the power storage device 10 is
5 installed in the charger/discharger.

[0021]

The battery module 11 may be configured as a single battery, but is preferably configured as an assembled battery including a plurality of batteries. The shape of the battery forming the assembled battery is not particularly limited, and may be, for example,
10 any one of a cylindrical battery, a pouch type battery, and a rectangular battery. The type of battery is not particularly limited, and a preferred example thereof is a high capacity lithium ion battery. The power storage device 10 may be provided with a connector for extracting power from the battery module 11.

[0022]

15 The power storage device 10 is provided with measurement devices such as a voltmeter for measuring a voltage of the battery module 11, an ammeter for measuring a current thereof, and a temperature sensor for measuring a temperature thereof. The controller 13 calculates a value indicating the state of the battery module 11, such as a charging rate of the battery module 11 based on these measurement values. The charging
20 rate can be calculated based on the voltage of the battery module 11 measured by the voltmeter. In addition, the controller 13 may calculate a degradation degree of the battery module 11 based on these measurement values.

[0023]

The case 14 may be a metal case, but is preferably a resin case from the viewpoint of
25 communication performance, weight reduction, and the like. The case 14 is generally opaque and conceals the battery module 11 and the like housed therein. The case 14 illustrated in FIG. 1 is formed in a substantially rectangular parallelepiped shape, and the case 14 has a handle 15 provided at an upper end portion thereof and used when the power

storage device 10 is carried. In addition, the case 14 has a connection portion 16 provided at a lower portion thereof and inserted into a battery installation portion of a charger or a discharger. The connection portion 16 has a terminal 16A electrically connected to the battery module 11.

5 [0024]

The case 14 is provided with a remaining amount display button 17 and an indicator 18. The remaining amount display button 17 is an operation unit configured to display a charging rate of the battery module 11 on the indicator 18. The indicator 18 includes, for example, a plurality of lamps, and displays the charging rate by changing the number of
10 lamps to be turned on depending on the charging rate. The indicator 18 may be a display unit capable of displaying the charging rate as a numerical value, or may be capable of displaying the state of the power storage device 10 other than the charging rate.

[0025]

The remaining amount display button 17 may also be used as an operation unit
15 configured to shut down the power storage device 10 and to start a long-term storage mode. For example, the charging rate is displayed on the indicator 18 by performing a normal first operation of short-pressing the remaining amount display button 17, and the power storage device 10 is shut down by performing a second operation of long-pressing the remaining amount display button 17. In the long-term storage mode, all device
20 components to which power is supplied from the battery module 11 are shut down.

[0026]

The communication module 12 is a device for wirelessly communicating with the management device. The function of the communication module 12 allows information of the power storage device 10 to be transmitted to the management device. In the
25 present embodiment, it is sufficient that the communication module 12 has a function of wirelessly communicating with the information terminal 20 existing a short distance from the power storage device 10. The configuration of the communication module 12 is not particularly limited, but is preferably a short-range wireless communication module from

the viewpoint of reducing power consumption and the like.

[0027]

A specific example of the communication module 12 includes a module that performs Bluetooth (registered trademark) low energy (BLE) communication. BLE corresponds to version 4 of Bluetooth (registered trademark) which is a short-range wireless communication standard. Since power consumption for the BLE communication is relatively small, internal power consumption of the power storage device 10 can be suppressed by using a BLE module. It is noted that Bluetooth (registered trademark) is compliant with the IEEE 802.15.1 standard, which is an international standard for short-range wireless communication.

[0028]

The controller 13 has a function of controlling the operation of the power storage device 10, such as functions of charging and discharging the battery module 11, calculating information indicating the state of the power storage device 10, transmitting information via the communication module 12, and the like. The information of the power storage device 10 is transmitted to the information terminal 20 by the function of the communication module 12 under the control of the controller 13. For example, the controller 13 outputs information prompting charging when the charging rate is less than a predetermined threshold value, and outputs information indicating abnormality when abnormality occurs. In addition, the controller 13 may output information indicating the state of the power storage device 10 based on a request from the information terminal 20.

[0029]

The controller 13 includes a microcomputer including a processor and a memory. The memory includes, for example, a non-volatile memory such as a RAM, a ROM, and a hard disk. The processor reads and executes a program installed in the memory to implement a function as the power storage device 10. In addition, the controller 13 may have a protective substrate referred to as a BMS substrate, and monitors the state of the battery module 11 to execute optimum charging/discharging.

[0030]

[Management device]

As described above, the management device of the management system 1 includes the information terminal 20 having the monitor 23 capable of displaying taking-out

5 detection information thereon. The management device further includes the beacon 40 serving as a monitoring device configured to detect that the power storage device 10 has been taken out of the management area A and to output taking-out detection information. The beacon 40 outputs the taking-out detection information to at least one of the information terminal 20 and the management server 30. The taking-out detection
10 information may be transmitted from the beacon 40 to the information terminal 20 via the management server 30, or may be directly transmitted from the beacon 40 to the information terminal 20. The information terminal 20 may have a function of detecting that the power storage device 10 has been taken out.

[0031]

15 The information terminal 20 is used to acquire information from the power storage device 10 and to confirm the state of the power storage device 10. The information terminal 20 may be a dedicated terminal of the management system 1, and an example thereof includes a smartphone owned by a user. For example, by installing application software (hereinafter, simply referred to as an "application") of the management system 1,
20 the user's smartphone can be used as the information terminal 20 of the management system 1. Among the information terminals, only information terminals in which the application is installed may function as the information terminal 20 that acquires the taking-out detection information.

[0032]

25 The application of the management system 1 includes, for example, two types of user registration methods. One method is registration as a general user simply for using the power storage device 10. The other method is registration as a manager who manages the power storage device 10 (hereinafter, manager registration). When the manager

registration is performed, it is necessary to provide contact information for receiving the taking-out detection information. Examples of the contact information include an e-mail address, an SNS ID, and an application ID. The application ID may be automatically transmitted to the management server 30. Alternatively, the application of the management system 1 may include an application for a general user and an application for a manager.

[0033]

Similarly to the controller 13 of the power storage device 10, the information terminal 20 includes a processor 21 and a memory 22. The processor 21 reads and executes a program (the application of the management system 1) installed in the memory 22, thereby implementing a function as the information terminal 20. Further, the processor 21 acquires information of the power storage device 10, stores the information in the memory 22, and transmits necessary information to the management server 30. In the present embodiment, short-range wireless communication such as BLE is used to perform communication between the information terminal 20 and the power storage device 10, and a wide area communication network such as the Internet or a mobile communication system is used to perform communication between the information terminal 20 and the management server 30.

[0034]

For example, the information terminal 20 detects the presence of the power storage device 10 by receiving a radio wave transmitted from the power storage device 10 in the management area A. For this reason, when the information terminal 20 cannot receive the radio wave of the power storage device 10 in the management area A, it is assumed that the power storage device 10 has been taken out of the management area A, and taking-out detection information may be displayed on the monitor 23 of the information terminal 20. In this case, the information terminal 20 detects that the power storage device 10 has been taken out of the management area A, and outputs taking-out detection information to its own monitor 23.

[0035]

FIG. 3 is an example of the taking-out detection information displayed on the monitor 23 of the information terminal 20. The taking-out detection information may be displayed as a screen of the application of the management system 1, or may be notified by e-mail, SNS, or the like. The taking-out detection information is output to notify a manager of a possibility that the power storage device 10 has been taken out of the management area A. The taking-out detection information includes information (for example, an identification number allocated to the power storage device 10) for specifying the power storage device 10 which may have been taken out, a place where power storage device 10 was last detected, and a date and time when the power storage device 10 was last detected. The manager can know that the power storage device 10 has been taken out from the taking-out detection information, and can, for example, search for the power storage device 10 in the management area A or around the area.

[0036]

The beacon 40 is installed, for example, at the entrance and exit in the management area A and emits a predetermined radio wave. When the power storage device 10 receiving the radio wave passes through the entrance and exit in the management area A, the beacon 40 detects the presence of the power storage device 10 and outputs taking-out detection information. The taking-out detection information may be directly transmitted from the beacon 40 to the information terminal 20, or may be transmitted to the information terminal 20 via the management server 30. The beacon 40 may be a device that detects a radio wave transmitted from the power storage device 10.

[0037]

The beacon 40 may output a predetermined detection signal as the taking-out detection information. Then, the information terminal 20 or the management server 30 receiving the detection signal from the beacon 40 may generate a notification screen, as illustrated in FIG. 3, as the taking-out detection information. The beacon 40 may be configured to output a warning sound when the power storage device 10 is detected.

[0038]

[Management server 30]

As described above, the management server 30 stores the information of the power storage device 10. In addition, in the management server 30, information on the management device in each management area including the management area A is registered. In the management server 30, information on a plurality of power storage devices 10 and a plurality of management devices is stored for each power storage device 10 in a state of being associated with the management device. Initial registration of the power storage device 10 and the information terminal 20 in the management server 30, a change of a registered content, and the like can be performed by operating the information terminal 20. At least a part of the registered information on the power storage device 10 is automatically transmitted to the management server 30 via the information terminal 20.

[0039]

The management server 30 includes a processor 31 and a memory 32, similarly to each controller of the power storage device 10 and the information terminal 20. The management server 30 may include one computer or a plurality of computers. The processor 31 implements a function as the management server 30 by reading and executing a program installed in the memory 32. Further, the processor 31 acquires information on the power storage device 10 and the management device and stores the information in the memory 32.

[0040]

The memory 32 of the management server 30 stores product information on the power storage device 10 (a product number, a date of manufacture, and the like), storage information on the power storage device 10 to be described later, information on the information terminal 20 (an e-mail address, a telephone number, an SNS ID, an application ID of the management system 1 installed in the information terminal 20, and the like), information on the beacon 40 (a MAC address, an IP address, and the like), information on a user of the power storage device 10, and the like. The information on the management

device is used when the information is transmitted from the management server 30. The management server 30 may store, as the information on the power storage device 10, the same information as the information stored in the information terminal 20, or may store different information.

5 [0041]

Hereinafter, an example of a processing procedure in the management system 1 will be described with reference to a flowchart in FIG. 4.

[0042]

FIG. 4 illustrates a case in which the beacon 40 detects that the power storage device
10 10 has been taken out. When the beacon 40 detects the power storage device 10 at the entrance and exit in the management area A (S1), the beacon 40 determines that the power storage device 10 has been taken out and transmits a detection signal to the management server 30 (S2). Upon receiving the detection signal, the management server 30 generates taking-out detection information, as illustrated in FIG. 3, and transmits the information to
15 the information terminal 20 in the management area A (S3). A method of transmitting the taking-out detection information from the management server 30 to the information terminal 20 is not particularly limited, but in any case, the taking-out detection information is displayed on the monitor 23 of the information terminal 20.

[0043]

20 Since the taking-out detection information includes information for specifying the power storage device 10 that may have been taken out, and the place where and the time when the power storage device 10 was last detected, a manager can search for the power storage device 10 based on the information (S4). When the power storage device 10 cannot be found even if the power storage device 10 is searched for, a report of loss, to be
25 described later, can be transmitted to the management server 30. Alternatively, when a predetermined condition is satisfied, a report of loss may be automatically transmitted. It is noted that, in the example illustrated in FIG. 4, the detection signal is transmitted from the beacon 40 to the management server 30, but the detection signal may be directly

transmitted from the beacon 40 to the information terminal 20. In addition, the taking-out detection information illustrated in FIG. 3 may be generated by the beacon 40.

[0044]

Hereinafter, a management system 2 according to a second embodiment will be described with reference to FIGS. 5 to 12. FIG. 5 is a diagram schematically illustrating the management system 2. Hereinafter, redundant description of contents common to the first embodiment will be omitted, and differences from the first embodiment will be described in detail.

[0045]

As illustrated in FIG. 5, the management system 2 is common to the management system 1 in that the power storage device 10, the management device (the information terminal 20 and the beacon 40) disposed in the management area A, and the management server 30 are provided. As described above, the information terminal 20 and the beacon 40 can detect that the power storage device 10 has been taken out of the management area A. When it is detected that the power storage device 10 has been taken out, taking-out detection information is displayed on the monitor 23 of the information terminal 20. In the second embodiment, for convenience of description, the power storage device 10 that belongs to the management area A and has been taken out of the management area A is referred to as a "power storage device 10T".

[0046]

Meanwhile, the management system 2 is different from the management system 1 in that the management device in the management area A and a second management device disposed in a second management area other than the management area A transmit, to the management server 30, storage information of the power storage device 10 existing in each area. As will be described in detail later, an example of the storage information is list information of the power storage device 10 existing in each management area. For example, the storage information is transmitted to the management server 30 every predetermined time. The management server 30 transmits, based on the storage

information, information on a location of the power storage device 10T related to the taking-out detection information to the management device in the management area A.

[0047]

The management device in the management area A may generate search request
5 information of the power storage device 10T based on the taking-out detection information of the power storage device 10T and transmit the search request information to the management server 30. In this case, the management server 30 searches for the power storage device 10T based on the list information of the power storage devices 10 and the search request information received from the management device in each management
10 area, and transmits the result (information on the location of the power storage device 10T) to the management device in the management area A. The management server 30 may generate search request information of the power storage device 10T and transmit the information to the management device in the second management area.

[0048]

15 Although management areas B and C are illustrated as the second management areas in FIG. 5, the number of management areas to be managed by the management system 2 is not particularly limited. Although the same kinds of power storage devices 10 are illustrated in FIG. 5, different kinds of power storage devices may exist in each area, or two or more kinds of power storage devices may exist in the same area. Examples of the
20 management areas A, B, and C are different buildings, floors, or areas in the same facility. In this case, it is assumed that the power storage device 10 belonging to the management area A is brought into the management areas B and C. However, the management areas A, B, and C may be different facilities or areas of different users. The management area A corresponds to the second management area when viewed from the management areas B
25 and C.

[0049]

In the management system 2, as described above, the management device in each of the management areas A, B, and C transmits the storage information of the power storage

device 10 in each area to the management server 30 every predetermined time. The predetermined time can be set to any time such as every five minutes, every one hour, and once a day (every 24 hours). The storage information includes identification information of all the power storage devices 10 detected by the management device in each management area. In other words, in the power storage device 10 under the management of the management system 2, pieces of information on the locations of all the power storage devices 10 detected by the management device are collected in the management server 30.

[0050]

The storage information of the power storage device 10 may be transmitted from the beacon 40 to the management server 30, but the same is transmitted from the information terminal 20 in the example illustrated in FIG. 5. When the power storage device 10T in the management area A is brought into the management area B, for example, the power storage device 10T is detected by the beacon 40 in the management area B, and a detection signal is output to the information terminal 20 in the management area B. In this case, the storage information transmitted from the management area B includes information on the power storage device 10T. That is, the management server 30 can acquire location information indicating that the power storage device 10T is located in the management area B.

[0051]

The management server 30 transmits information on the location of the power storage device 10T to the management device in the management area A based on the storage information received from the management area B. Since the information on the location of the power storage device 10T includes information on a discovery location of the power storage device 10T, a manager in the management area A can collect the power storage device 10T. The information on the location of the power storage device 10T is transmitted to the information terminal 20 in the management area A.

[0052]

When the storage information transmitted from any of the management areas does not include the information on the power storage device 10T, the management server 30 may transmit, to the information terminal 20 in the management area A, information indicating that the location of the power storage device 10T is unknown at the present time as the information on the location of the power storage device 10T. Hereinafter, among the pieces of information on the location of the power storage device 10T, information transmitted to the information terminal 20 in the management area A when the power storage device 10T is found is referred to as "discovery information".

[0053]

FIG. 6 is an example of the discovery information displayed on the monitor 23 of the information terminal 20. Similarly to the taking-out detection information, the discovery information may be displayed as a screen of an application of the management system 1, or may be notified by e-mail, SNS, or the like. The discovery information includes information specifying the lost power storage device 10T, and information such as a place where the power storage device 10T is discovered, a discovery date and time, and a contact address of a discovery location. By transmitting the discovery information as illustrated in FIG. 6 to a manager in the management area A, the manager in the management area A can go to the discovery location or contact a manager of the discovery location to collect the power storage device 10T.

[0054]

For example, when receiving search request information of the power storage device 10T from the management device in the management area A, the management server 30 transmits the information on the location of the power storage device 10T to the management device in the management area A. The management server 30 collates each storage list with the search request information of the power storage device 10T, and confirms whether the information of the power storage device 10T is included in the storage list. When the storage list includes the information on the power storage device 10T, the location information (the discovery information) on the power storage device 10T

including the information on the discovery location is transmitted to the information terminal 20 in the management area A. The management server 30 may acquire the storage information from each management area on condition that the search request information is received.

5 [0055]

The search request information of the power storage device 10T may be transmitted from the beacon 40 to the management server 30 when the beacon 40 in the management area A detects that the power storage device 10T has been taken out, but the search request information is transmitted from the information terminal 20 in the example illustrated in

10 FIG. 5. The transmission of the search request information may be executed by an operation of a manager. The search request information can be generated by an application function of the management system 2, and may be automatically generated based on information acquired from the management device. A transmission button of the search request information is displayed on the monitor 23 of the information terminal
15 20, and a manager can transmit the generated search request information to the management server 30 by pressing the button.

[0056]

The transmission of the search request information may be performed automatically. For example, the search request information may be automatically transmitted after a lapse
20 of a predetermined time from the output of the taking-out detection information of the power storage device 10T. In addition, the management server 30 may transmit the search request information to the management devices in the management areas B and C. For example, the search request information is transmitted to the information terminals 20 in the management areas B and C. In this case, the search request information can be
25 transmitted to managers in the management areas B and C, and cooperation of other managers can be obtained to search for the power storage device 10T.

[0057]

FIG. 7 is an example of the search request information displayed on the monitor 23

of the information terminal 20. Similarly to the taking-out detection information and the discovery information, the search request information may be displayed as a screen of an application of the management system 1, or may be notified by e-mail, SNS, or the like. The search request information includes information specifying the lost power storage device 10T, information on a date and time when the power storage device 10T was last confirmed and a contact address of a manager in the management area A, and the like. The screen in FIG. 7 is, for example, an input screen input by the manager in the management area A or a screen displayed on the monitor 23 of the information terminal 20 in the management areas B and C.

10 [0058]

FIGS. 8 and 9 are diagrams illustrating management systems 2X and 2Y, which are modifications of the management system 2, respectively. As illustrated in FIG. 8, the management system 2X is different from the management system 2 in that the management system 2X includes a gateway 41 in addition to the beacon 40 as a monitoring device configured to detect that the power storage device 10 has been taken out of a management area and to output taking-out detection information. The gateway 41 is configured to detect the presence of the power storage device 10 in each management area and to be able to detect the power storage device 10 in a wider range than the beacon 40. The management system 2X including the gateway 41 is suitable when there are a large number of entrances and exits in the management area.

[0059]

For example, the gateway 41 receives a radio wave transmitted from the power storage device 10 in the management area A, and outputs taking-out detection information assuming that the power storage device 10 has been taken out of the management area A when the radio wave cannot be received. The taking-out detection information may be directly transmitted from the gateway 41 to the information terminal 20, or may be transmitted to the information terminal 20 via the management server 30. The gateway 41 may output a predetermined detection signal as the taking-out detection information,

and the information terminal 20 or the management server 30 that has received the detection signal may generate a notification screen, as illustrated in FIG. 3, as the taking-out detection information.

[0060]

5 As illustrated in FIG. 9, the management system 2Y is common to the management system 2X in that the beacon 40 and the gateway 41 are respectively provided as monitoring devices. Meanwhile, the management system 2Y is different from the management system 2X in that a management server 30A in the management area A and a management server 30B in the management area B are separately provided. The
10 management servers 30A and 30B may be different servers managed by the same business operator, or may be servers managed by different users or servers of different management business operators. The management system 2Y is constructed by cooperation of a plurality of management servers 30A and 30B.

[0061]

15 In the management system 2Y, transmission and reception of information between the management devices in the respective management areas are performed via communication between the management servers 30A and 30B. However, when a management device belonging to the second management area other than the management area A is registered in the management server 30A, the management server 30A may
20 transmit and receive information to and from the management device in the second management area without going through the management server 30B. As illustrated in FIG. 9, the management server 30A can transmit search request information to the information terminal 20 outside each management area, and the information terminal 20 can detect the power storage device 10T outside each management area.

25 [0062]

Hereinafter, an example of a processing procedure in the management systems 2, 2X, and 2Y will be described with reference to a flowchart of FIG. 10. FIG. 10 illustrates processing mainly performed by the management server 30, but steps S5 and S6 are steps

executed in the management area A where the loss of the power storage device 10 has occurred.

[0063]

When receiving search request information corresponding to a search request from a
5 management device in the management area A where the power storage device 10 is lost
(YES in S1), the management server 30 acquires, from the management device in each
management area, list information of the power storage devices 10 existing in each area as
storage information of the power storage devices 10 (S2). The transmission of the search
request information from the management area A may be executed by an operation of a
10 manager or may be automatically executed. In the example illustrated in FIG. 10, on
condition that the search request information is received, the management server 30
acquires a list of the power storage devices 10 from the management device in each
management area.

[0064]

15 The management server 30 confirms whether information on the power storage
device 10T as a search target is included in the list based on the list information of the
power storage devices 10 and the search request information (S3). When it is confirmed
that the information on the power storage device 10T is included in the list, the
management server 30 makes predetermined contact with the management device in the
20 management area A (S4). In step S4, for example, discovery information is transmitted to
the information terminal 20 in the management area A as information on a location of the
power storage device 10T. On the other hand, when the information on the power storage
device 10T is not included in the list, the management server 30 subsequently acquires the
list information from the management device in each management area every
25 predetermined time.

[0065]

The manager in the management area A who has received the discovery information
from the management server 30 can collect the power storage device 10T based on this

information (YES in S5). On the other hand, when the power storage device 10T cannot be found even if the power storage device 10T is searched for based on the discovery information (NO in S5), the manager in the management area A transmits the search request information to the management server 30 again, and can continue the search for the power storage device 10T by the management system (S6). The retransmission of the search request information is preferably executed by an operation of the manager.

[0066]

In the example illustrated in FIG. 10, step S2 is executed on condition that the search request information is received, but step S2 may be periodically executed regardless of the presence or absence of the search request information. In this case, collation of the list information in step S3, that is, confirmation processing as to whether the information of the power storage device 10T is included in the list ,may be executed on condition that the search request information is received.

[0067]

In the management system 2, as described above, the search request information of the power storage device 10T may be transmitted to the management devices in the management areas B and C. In this case, when the management devices in the management areas B and C detect the power storage device 10T, detection information is transmitted to the management server 30. Upon receiving the detection information of the power storage device 10T from the management areas B and C, the management server 30 generates discovery information as the information on the location of the power storage device 10T and transmits the discovery information to the information terminal 20 in the management area A. When the beacon 40 or the gateway 41 in the management areas B and C detects the power storage device 10T, the detection information of the power storage device 10T may be directly transmitted from the beacon 40 or the gateway 41 to the management server 30, or may be transmitted thereto via the information terminal 20.

[0068]

In addition, when it is detected that the power storage device 10T is taken out of the

management area A, loss information of the power storage device 10T may be transmitted from the management device in the management area A to the management server 30. In this case, the management server 30 that has received the loss information generates search request information. The loss information is a so-called report of loss, and includes
5 information specifying the power storage device 10T, information on a date and time when the power storage device 10T was last confirmed and a contact address of a manager of the power storage device 10T, and the like. For example, the loss information is transmitted from the information terminal 20 in the management area A, but may be directly transmitted to the management server 30 from the beacon 40 or the gateway 41 that has
10 detected that the power storage device 10T is taken out.

[0069]

Hereinafter, a modification of the processing procedure in the management systems 2, 2X, and 2Y will be described with reference to the flowcharts in FIGS. 11 and 12.

Steps S12, S13, and S16 in FIG. 11 are steps executed by the manager in the management
15 area A.

[0070]

FIG. 11 is a flowchart illustrating a processing procedure in the information terminal 20. When the beacon 40 or the gateway 41 detects that the power storage device 10T has been taken out of the management area A and a detection signal is received by the
20 information terminal 20 (S10), taking-out detection information is displayed on the monitor 23 (S11). Then, the manager in the management area A starts a search for the power storage device 10T according to the taking-out detection information (S12). When the power storage device 10T is not found even if the power storage device 10T is searched for (NO in S13), loss information is transmitted to the management server 30 (S14).

25 [0071]

The transmission of the loss information is executed by, for example, an operation of a manager. The loss information can be generated by an application function of the management systems 2, 2X, and 2Y, and may be automatically generated based on the

information acquired from the management device. A transmission button of the loss information is displayed on the monitor 23 of the information terminal 20, and the manager can transmit the generated loss information to the management server 30 by pressing the button. In addition, the taking-out detection information may include guidance of the loss information, a transmission button of the loss information, and the like.

[0072]

The transmission of the loss information may be executed automatically. For example, the loss information may be automatically transmitted after a predetermined time has elapsed since the taking-out detection information was output in step S11. In this case, the loss information may be directly transmitted to the management server 30 from the beacon 40 or the gateway 41 detecting that the power storage device 10T has been taken out. In addition, the beacon 40 or the gateway 41 may transmit the loss information to the management server 30 when communication with the information terminal 20 cannot be performed or when there is no response from the information terminal 20.

[0073]

When the loss information is transmitted in step S14 and as such the power storage device 10T is discovered in another management area or the like, the manager in the management area A can acquire discovery information as information on the location of the power storage device 10T (S15). The discovery information is displayed on the monitor 23 of the information terminal 20. Since the discovery information includes a contact address of a manager of a discovery location, a manager in the management area A can visit the discovery location or contact the manager of the discovery location to collect the power storage device 10T (S16). After the transmission of the loss information is performed, it is assumed that the manager in the management area A finds the power storage device 10T. Therefore, it is preferable that information for withdrawing the loss information can be transmitted to the management server 30.

[0074]

FIG. 12 is a flowchart illustrating a processing procedure in the management server

30. When receiving the loss information from the information terminal 20 in the management area A (S20), the management server 30 generates search request information based on the loss information and transmits the search request information to the management device in the second management area (S21). It is preferable that the search request information is transmitted as the information illustrated in FIG. 7 in a mode where the search request information can be confirmed by at least a manager in the second management area.

[0075]

The search request information may be transmitted only to the second management area located within a predetermined threshold value range from the management area A. The threshold value range may be set by the manager in the management area A or may be automatically set on the management server 30 side. The number of second management areas to which the search request information is transmitted may be increased as time elapses after the loss information is output. For example, the management server 30 may transmit search request information to the second management area in a first threshold value range when receiving the loss information, and may transmit the search request information to the second management area in a second threshold value range when a predetermined time has elapsed since the loss information was output.

[0076]

When the power storage device 10T is detected by the management device in the second management area, detection information is transmitted from the second management area to the management server 30 (S22). The transmission of the detection information may be executed by an operation of a manager after the manager in the second management area confirms the power storage device 10T. Alternatively, the management device that has detected the power storage device 10T may automatically transmit the detection information to the management server 30 directly or via the information terminal 20. Upon receiving the detection information of the power storage device 10T, the management server 30 generates discovery information and transmits the discovery

information to the information terminal 20 in the management area A (S23).

[0077]

In the example illustrated in FIGS. 11 and 12, the loss information is transmitted from the information terminal 20 in the management area A to the management server 30, and the search request information is generated in the management server 30. However, the search request information may be generated in the information terminal 20 in the management area A. In addition, the discovery information may be generated by the management device in the second management area that has detected the power storage device 10T.

[0078]

As described above, with the management systems 1, 2, 2X, and 2Y having the above-described configurations, at least one management device detects that the power storage device 10 has been taken out of the management area A, and taking-out detection information is output to the information terminal 20 of a manager. Therefore, the manager can easily grasp that the power storage device 10 has been taken out, and can quickly start searching for the power storage device 10.

[0079]

Further, if storage information on the power storage devices 10 existing in each management area is transmitted to the management server 30, for example, when the power storage device 10T in the management area A is brought into the management area B and detected in the management area B, the management server 30 can transmit discovery information indicating the location of the power storage device 10T to the management device in the management area A. As a result, the manager in the management area A can easily grasp the location of the power storage device 10T, and can quickly collect the power storage device 10T. The management server 30 preferably executes processing based on the search request information transmitted from the management area A.

[0080]

In addition, if the search request information of the power storage device 10 is transmitted from the management server 30 to a management device in another management area, it is possible to obtain cooperation of another manager for searching for the power storage device 10. Since it is assumed that the power storage device 10 that has been taken out is brought into another management area, it is possible to quickly find the power storage device 10 by obtaining cooperation of another manager.

[0081]

It is noted that the above-described embodiments can be appropriately modified in design without impairing the object of the present disclosure. For example, in the above-described embodiments, the same type of management devices are illustrated as the management devices belonging to respective management areas, but different types of management devices may be included in respective management areas. That is, the application of the management system according to the present disclosure is not limited to the management area using the same type of management device.

REFERENCE SIGNS LIST

[0082]

- 1 MANAGEMENT SYSTEM
- 10 POWER STORAGE DEVICE
- 11 BATTERY MODULE
- 12 COMMUNICATION MODULE
- 13 CONTROLLER
- 14 CASE
- 15 HANDLE
- 16 CONNECTION PORTION
- 16A TERMINAL
- 17 REMAINING AMOUNT DISPLAY BUTTON
- 18 INDICATOR

	20	INFORMATION TERMINAL
	21, 31	PROCESSOR
	22, 32	MEMORY
	23	MONITOR
5	30	MANAGEMENT SERVER
	40	BEACON
	41	GATEWAY

Claims

[Claim 1]

A management system for a power storage device, the management system comprising:

- 5 the power storage device including a communication module;
- at least one management device disposed in a predetermined management area of the power storage device, the at least one management device being wirelessly communicable with the power storage device; and
- a management server configured to communicate with the at least one management
- 10 device, wherein:
- the at least one management device is capable of detecting that the power storage device has been taken out of the management area; and
- at least one of the at least one management device and the management server is configured to output taking-out detection information when it is detected that the power
- 15 storage device is taken out.

[Claim 2]

The management system for a power storage device according to claim 1, wherein:

- the at least one management device and at least one second management device disposed in a second management area other than the management area transmit, to the
- 20 management server, storage information on each of the power storage devices respectively existing in the management area and the second management area; and
- the management server transmits, based on the storage information, information on a location of the power storage device related to the taking-out detection information to the at least one management device.

25 [Claim 3]

The management system for a power storage device according to claim 2, wherein the storage information is transmitted to the management server every predetermined time.

[Claim 4]

The management system for a power storage device according to any one of claims 1 to 3, wherein the at least one management device or the management server generates, based on the taking-out detection information, search request information of the power storage device.

5 [Claim 5]

The management system for a power storage device according to claim 4, wherein the management server transmits the search request information to at least one second management device disposed in a second management area other than the management area.

10 [Claim 6]

The management system for a power storage device according to any one of claims 1 to 5, wherein the at least one management device includes an information terminal having a monitor capable of displaying the taking-out detection information thereon.

[Claim 7]

15 The management system for a power storage device according to any one of claims 1 to 6, wherein the at least one management device includes: a monitoring device configured to detect that the power storage device has been taken out, and to output the taking-out detection information; and an information terminal having the monitor capable of displaying the taking-out detection information thereon.

20 [Claim 8]

The management system for a power storage device according to claim 7, wherein the monitoring device is at least one selected from a beacon and a gateway.