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Inventor(s)	MATSUMOTO; Kohei

CHARGING CONTROL SYSTEM AND CHARGING CONTROL DEVICE

Abstract

A charging control system is provided. A first apparatus includes a first battery, a first power supply manager, a first switch for connecting/disconnecting between a first terminal and the first battery, in accordance with a command from the first power supply manager, and a first resistor provided between the first battery and the first terminal. A second apparatus includes a second battery, a second power supply manager, a second switch for connecting/disconnecting between a second terminal and the second battery, in accordance with a command from the second power supply manager, and a second resistor provided between the second battery and the second terminal. When the first apparatus and the second apparatus are coupled to each other, the first battery and the second battery are electrically connected to each other with the first resistor, the first switch, the second switch, and the second resistor connected in series being interposed.

Inventors: **MATSUMOTO; Kohei (Kyoto-shi, JP)**

Applicant: **NINTENDO CO., LTD.** (Kyoto-shi, JP)

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Background/Summary

[0001] This non-provisional application claims priority on and is a continuation of International Patent Application PCT/J P2022/040466 filed with the Japan Patent Office on Oct. 28, 2022, the entire contents of which are hereby incorporated by reference.

FIELD

[0002] The present disclosure relates to a charging control system and a charging control device.

BACKGROUND AND SUMMARY

[0003] A charging control device that causes charging, with electric power in a first battery included in a first apparatus, of a second battery included in a second apparatus has been known. This charging control device includes a control unit provided in the first apparatus, the control unit controlling an amount of charging electricity to be supplied from the first battery to the second apparatus based on information on a remaining battery level of the second battery and information on power consumption in the second apparatus which have been supplied from the second apparatus.

[0004] In transfer of electric power between batteries, electric power and a current are generally adjusted by a charging control circuit such as a charging control integrated circuit (IC). Overall power feed performance, on the other hand, may lower because there may be conversion loss in the charging control IC. In the prior art, only charging in one direction is assumed and mutual power feed is not assumed.

[0005] An exemplary embodiment provides a charging control system that includes a first apparatus and a second apparatus separable from each other. The first apparatus includes a first battery, a first power supply manager, a first switch for connecting or disconnecting between a first terminal for electrical connection to the second apparatus and the first battery, in accordance with a command from the first power supply manager, and a first resistor provided between the first battery and the first terminal. The second apparatus includes a second battery, a second power supply manager, a second switch for connecting or disconnecting between a second terminal for electrical connection to the first apparatus and the second battery, in accordance with a command from the second power supply manager, and a second resistor provided between the second battery and the second terminal. When the first apparatus and the second apparatus are coupled to each other, the first battery and the second battery are electrically connected to each other with the first resistor, the first switch, the second switch, and the second resistor connected in series being interposed.

[0006] According to this configuration, the first battery and the second battery are electrically connected to each other with the switch and the resistor being interposed. Therefore, mutual charging can be performed in accordance with states of the first battery and the second battery, and overall efficiency of power feed can be enhanced.

[0007] Power feed from the first battery to the second battery or power feed from the second battery to the first battery may occur in accordance with at least one of (i) a voltage of the first battery and a voltage of the second battery or (ii) a remaining battery level of the first battery and a remaining battery level of the second battery. According to this configuration, a direction of power feed is determined by voltages or remaining battery levels of the first battery and the second battery, and hence a charging control circuit or the like is not required.

[0008] At least one of when the voltage of the first battery is higher than the voltage of the second

battery or when the remaining battery level of the first battery is higher than the remaining battery level of the second battery, power feed from the first battery to the second battery may occur. At least one of when the voltage of the second battery is higher than the voltage of the first battery or when the remaining battery level of the second battery is higher than the remaining battery level of the first battery, power feed from the second battery to the first battery may occur. According to this configuration, power feed occurs from a battery higher in voltage or remaining battery level to a battery lower in voltage or remaining battery level. Therefore, the first apparatus and the second apparatus can continue processing while they interchange electric power.

[0009] When the first apparatus and the second apparatus are coupled to each other, in a path through which the first battery and the second battery are electrically connected to each other, a charging control circuit for power feed from the first battery to the second battery and a charging control circuit for power feed from the second battery to the first battery do not have to be provided. According to this configuration, there is no electric power loss in the charging control circuit.

[0010] The first power supply manager may cause the first switch to connect or disconnect based on at least one of a voltage or a temperature of the first battery. The second power supply manager may cause the second switch to connect or disconnect based on at least one of a voltage or a temperature of the second battery. According to this configuration, each of the first power supply manager and the second power supply manager can perform mutual power feed while it manages the voltage and/or the temperature of the battery.

[0011] At least one of the first power supply manager or the second power supply manager may transmit at least one of a voltage or a temperature of the battery of the apparatus to which the first power supply manager or the second power supply manager belongs, to another one of the first power supply manager and the second power supply manager. At least one of the first power supply manager or the second power supply manager may cause the switch of the apparatus to which the first power supply manager or the second power supply manager belongs, to connect or disconnect based on at least one of the voltage or the temperature of the battery obtained from the another one of the first power supply manager and the second power supply manager. According to this configuration, the first power supply manager and/or the second power supply manager can determine whether or not to perform mutual power feed between batteries of the apparatuses to which they belong, based on information on the other of the power supply managers.

[0012] The first power supply manager may command the first switch to connect when a voltage of the first battery is within a predetermined voltage range. The second power supply manager may command the second switch to connect when a voltage of the second battery is within a predetermined voltage range. According to this configuration, mutual power feed can be performed only when the voltage of the battery is within the predetermined voltage range, and hence the battery is not damaged.

[0013] The charging control system may further include a third apparatus configured to be coupled to at least one of the first apparatus or the second apparatus. The third apparatus may include a third battery, a third power supply manager, a third switch for connecting or disconnecting between a third terminal for electrical connection to at least one of the first apparatus or the second apparatus and the third battery, in accordance with a command from the third power supply manager, and a third resistor provided between the third battery and the first terminal. When the first apparatus, the second apparatus, and the third apparatus are coupled to one another, the third battery may be connected between the first switch and the second switch, with the third switch and the third resistor being interposed. According to this configuration, mutual power feed can be performed among three apparatuses.

[0014] Power feed may occur among the first battery, the second battery, and the third battery in accordance with at least one of (i) voltages of the first battery, the second battery, and the third battery or (ii) remaining battery levels of the first battery, the second battery, and the third battery.

According to this configuration, the direction of power feed is determined by the voltages or the remaining battery levels of the first battery, the second battery, and the third battery, and hence a charging control circuit or the like is not required.

[0015] The first apparatus may be an electronic device including a display. The second apparatus may be a controller to be coupled to one side of the first apparatus and configured to transmit a signal in accordance with an operation by a user to the first apparatus. The third apparatus may be a controller to be coupled to the other side of the first apparatus and configured to transmit a signal in accordance with an operation by the user to the first apparatus. At least one of when a voltage of the first battery is higher than a voltage of the second battery and a voltage of the third battery or when a remaining battery level of the first battery is higher than a remaining battery level of the second battery and a remaining battery level of the third battery, power feed from the first battery to the second battery and the third battery may occur. At least one of when the voltage of the second battery and the voltage of the third battery are higher than the voltage of the first battery or when the remaining battery level of the second battery and the remaining battery level of the third battery are higher than the remaining battery level of the first battery, power feed from the second battery and the third battery to the first battery may occur. According to this configuration, power feed occurs from a battery higher in voltage or remaining battery level to a battery lower in voltage or remaining battery level, and hence the first apparatus, the second apparatus, and the third apparatus can continue processing while they interchange electric power.

[0016] When the second apparatus and the third apparatus are coupled to the first apparatus, in a path through which the first battery and the second battery are electrically connected to each other, a charging control circuit for power feed from the first battery to the second battery and a charging control circuit for power feed from the second battery to the first battery are not provided, and in a path through which the first battery and the third battery are electrically connected to each other, a charging control circuit for power feed from the first battery to the third battery and a charging control circuit for power feed from the third battery to the first battery are not provided. According to this configuration, there is no electric power loss in the charging control circuit.

[0017] At least one of the first power supply manager, the second power supply manager, or the third power supply manager may transmit at least one of a voltage or a temperature of the battery of the apparatus to which the first power supply manager, the second power supply manager, or the third power supply manager belongs, to at least another one of power supply managers. At least one of the first power supply manager, the second power supply manager, or the third power supply manager may cause the switch of the apparatus to which the first power supply manager, the second power supply manager, or the third power supply manager belongs, to connect or disconnect based on at least one of the voltage or the temperature of the battery obtained from one or more other power supply managers. According to this configuration, the first power supply manager, the second power supply manager, and/or the third power supply manager can determine whether or not to perform mutual power feed among batteries of the apparatuses to which they belong, based on information from other power supply manager(s).

[0018] In a first state in which the first apparatus and the second apparatus are coupled to each other, the first apparatus and the second apparatus may exchange information in a wired signal. In a second state in which the first apparatus and the second apparatus are separate from each other, the first apparatus and the second apparatus may exchange information in a wireless signal. According to this configuration, whether the first apparatus and the second apparatus are coupled to each other or separate from each other, they can perform processing while exchanging information therebetween.

[0019] Another exemplary embodiment provides a charging control device separable from another charging control device. The charging control device includes a battery, a power supply manager, a switch for connecting or disconnecting between a terminal for electrical connection to the another charging control device and the battery, in accordance with a command from the power supply

manager, and a resistor provided between the battery and the terminal. When the charging control device is coupled to the another charging control device, the battery and a battery of the another charging control device are electrically connected to each other with the resistor, the switch, a switch of the another charging control device, and a resistor of the another charging control device connected in series being interposed.
[0020] The power supply manager may cause the switch to connect or disconnect based on at least one of a voltage or a temperature of the battery.
[0021] The power supply manager may transmit at least one of a voltage or a temperature of the battery to the another charging control device. The power supply manager may cause the switch to connect or disconnect based on at least one of a voltage or a temperature of the battery obtained from a power supply manager of the another charging control device.
[0022] The power supply manager may command the switch to connect when a voltage of the battery is within a predetermined voltage range.
[0023] When the charging control device is coupled to the another charging control device and second another charging control device, a battery of the second another charging control device may be connected between the switch and a switch of the another charging control device with a switch and a resistor of the second another charging control device being interposed.
[0024] In a first state in which the charging control device is coupled to the another charging control device, the charging control device and the another charging control device may exchange information with each other in a wired signal, and in a second state in which the charging control device and the another charging control device are separate, the charging control device and the another charging control device may exchange information in a wireless signal.
[0025] The foregoing and other objects, features, aspects, and advantages of the present disclosure will become more apparent from the following detailed description of the present disclosure when taken in conjunction with the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0026] FIG. **1** shows an exemplary illustrative non-limiting drawing illustrating an exemplary overall configuration of a game system according to the present embodiment.
[0027] FIG. **2** shows an exemplary illustrative non-limiting drawing illustrating an exemplary form of use of a processing apparatus including a power supply circuit according to the present embodiment.
[0028] FIG. **3** shows an exemplary illustrative non-limiting drawing illustrating an exemplary form of use of the processing apparatus including the power supply circuit according to the present embodiment.
[0029] FIG. **4** shows an exemplary illustrative non-limiting drawing illustrating an exemplary internal configuration of the game system according to the present embodiment.
[0030] FIGS. **5**A to **5**C and **6**A to **6**C show exemplary illustrative non-limiting drawings for illustrating mutual power feed in the game system according to the present embodiment.
[0031] FIG. **7** shows an exemplary illustrative non-limiting drawing illustrating an exemplary configuration associated with mutual power feed in the game system according to the present embodiment.
[0032] FIGS. **8**A and **8**B show exemplary illustrative non-limiting drawings illustrating exemplary power feed that occurs in the exemplary configuration shown in FIG. **7**.
[0033] FIG. **9** shows an exemplary illustrative non-limiting flowchart illustrating a processing procedure associated with mutual power feed in the exemplary configuration shown in FIG. **7**.
[0034] FIG. **10** shows an exemplary illustrative non-limiting drawing illustrating another

exemplary configuration associated with mutual power feed in the game system according to the present embodiment.
[0035] FIG. **11** shows an exemplary illustrative non-limiting flowchart illustrating a processing procedure associated with mutual power feed in the exemplary configuration shown in FIG. **10**.
[0036] FIG. **12** shows an exemplary illustrative non-limiting drawing illustrating yet another exemplary configuration associated with mutual power feed in the game system according to the present embodiment.

DETAILED DESCRIPTION OF NON-LIMITING EXAMPLE EMBODIMENTS

[0037] The present embodiment will be described in detail with reference to the drawings. The same or corresponding elements in the drawings have the same reference characters allotted and description thereof will not be repeated.

A. Exemplary Overall Configuration

[0038] An exemplary overall configuration of a charging control system including a charging control device according to the present embodiment will initially be described. Though the charging control system according to the present embodiment is applicable to any electronic devices and systems, a game system will be described below by way of example of the charging control system. The term “game system” in the description below encompasses the “charging control system.”
[0039] Referring to FIG. **1**, a game system **1** includes a processing apparatus **100**, a right controller **200**, and a left controller **300**. Each of processing apparatus **100**, right controller **200**, and left controller **300** is an exemplary “charging control device.” In the description below, processing apparatus **100**, right controller **200**, and left controller **300** may simply collectively be referred to as an “apparatus”.
[0040] Processing apparatus **100**, right controller **200**, and left controller **300** are separable from one another. Processing apparatus **100**, right controller **200**, and left controller **300** can directly or indirectly be coupled to one another.
[0041] Processing apparatus **100** is an electronic device that executes an application such as a game in accordance with data indicating an operation by a user from each of right controller **200** and left controller **300**. Processing apparatus **100** includes a built-in display **130** that outputs an image.
[0042] Each of right controller **200** and left controller **300** receives the operation by the user. Processing apparatus **100** and right controller **200** are removably attachable to each other. Similarly, processing apparatus **100** and left controller **300** are removably attachable to each other.
[0043] Each of right controller **200** and left controller **300** exchanges data through wireless communication with processing apparatus **100** while it is separate from processing apparatus **100**. Each of right controller **200** and left controller **300** exchanges data through wired communication and/or wireless communication with processing apparatus **100** while it is attached to processing apparatus **100**.
[0044] Right controller **200** is thus coupled to one side of processing apparatus **100** and can transmit a signal in accordance with the operation by the user to processing apparatus **100**. Left controller **300** is coupled to the other side of processing apparatus **100** and can transmit a signal in accordance with the operation by the user to processing apparatus **100**.
[0045] An exemplary form of use of processing apparatus **100** including a power supply circuit according to the present embodiment will now be described with reference to FIGS. **2** and **3**.
[0046] Referring to FIG. **2**, when right controller **200** and left controller **300** are coupled to processing apparatus **100**, the user can hold and operate right controller **200** and left controller **300** integrated with processing apparatus **100**.
[0047] Referring to FIG. **3**, when processing apparatus **100** is placed in a dock **450**, one or more users operate right controller **200** and/or left controller **300** while watching images outputted to an external monitor **400**.
[0048] As shown in FIG. **2**, when processing apparatus **100** is coupled to right controller **200** and

left controller **300**, information is exchanged in a wired signal between processing apparatus **100** and right controller **200** and between processing apparatus **100** and left controller **300**. While processing apparatus **100** is separate from right controller **200** and left controller **300**, on the other hand, information is exchanged in a wireless signal between processing apparatus **100** and right controller **200** and between processing apparatus **100** and left controller **300**.

[0049] Information may be exchanged in a wireless signal between processing apparatus **100** and right controller **200** and/or between processing apparatus **100** and left controller **300** also in the state shown in FIG. **2**.

B. Exemplary Internal Configuration of Game System **1**

[0050] An exemplary internal configuration of game system **1** according to the present embodiment will now be described.

[0051] An exemplary internal configuration of processing apparatus **100**, right controller **200**, and left controller **300** included in game system **1** will be described with reference to FIG. **4**.

[0052] Processing apparatus **100** includes a battery **102**, a power supply circuit **110** electrically connected to battery **102** through a line **104**, and a load circuit **120** supplied with electric power from power supply circuit **110**. Right controller **200** includes a battery **202**, a power supply circuit **210** electrically connected to battery **202** through a line **204**, and a load circuit **220** supplied with electric power from power supply circuit **210**. Left controller **300** includes a battery **302**, a power supply circuit **310** electrically connected to battery **302** through a line **304**, and a load circuit **320** supplied with electric power from power supply circuit **310**.

[0053] Power supply circuits **110**, **210**, and **310** adjust voltages of electric power supplied from batteries **102**, **202**, and **302** to voltages suitable for operation of load circuits **120**, **220**, and **320**, respectively.

[0054] Batteries **102**, **202**, and **302** are each a chargeable and dischargeable secondary battery. Any secondary battery such as a lithium ion battery, a nickel metal hydride battery, or a nickel-cadmium battery can be adopted as batteries **102**, **202**, and **302**. Since a capacity, a rated current, a rated voltage, or the like is designed appropriately for each battery, batteries **102**, **202**, and **302** do not have to be identical in specifications.

[0055] Batteries **102**, **202**, and **302** may each be provided with a not-shown circuit for storage of electric power supplied from an external power supply (for example, a power supply adapter).

[0056] In game system **1**, processing apparatus **100** (battery **102**), right controller **200** (battery **202**), and left controller **300** (battery **302**) can mutually feed power between at least two of them or among all of them.

[0057] Load circuit **120** of processing apparatus **100** includes a processor **122**, a memory **124**, a storage **126**, an operation portion **128**, display **130**, a wireless communication module **132**, a wired communication module **134**, and a power supply manager **136**.

[0058] Processor **122** is a processing entity for performing processing provided by processing apparatus **100**.

[0059] Memory **124** is a storage device accessible by processor **122**, and it is implemented, for example, by a volatile storage device such as a dynamic random access memory (DRAM) or a static random access memory (SRAM).

[0060] Storage **126** is implemented, for example, by a non-volatile storage device such as a flash memory. For example, a system program **1260** and an application program **1262** are stored in storage **126**.

[0061] Processor **122** performs processing as will be described later by reading a program stored in storage **126**, developing the program on memory **124**, and executing the program. The term "processor" herein encompasses, in addition to ordinary meaning of processing circuitry that performs processing in accordance with instruction code described in a program, such as a central processing unit (CPU), a micro processing unit (MPU), or a graphics processing unit (GPU), hard-wired circuitry such as an application specific integrated circuit (ASIC) or a field programmable

gate array (FPGA). In the hard-wired circuitry such as an ASIC or an FPGA, a circuit corresponding to processing to be performed is formed in advance. Furthermore, the “processor” herein also encompasses circuitry in which a plurality of functions are integrated, such as a system on chip (SoC) and combination of the processor in a narrow sense and the hard-wired circuitry.
[0062] Operation portion **128** includes a key or a button to be operated by the user. Operation portion **128** outputs a signal in accordance with the operation by the user to processor **122**.
[0063] Display **130** shows an image based on a result of processing by processor **122**.
[0064] Wireless communication module **132** transmits and receives a wireless signal to or from right controller **200** and left controller **300**. For example, any wireless scheme such as Bluetooth®, ZigBee®, wireless LAN (IEEE 802.11), or infrared communication can be adopted for wireless communication module **132**.
[0065] Wired communication module **134** transmits and receives an electrical signal (wired signal) to and from right controller **200** and left controller **300**, through a communication terminal **143** and a communication terminal **144**.
[0066] Power supply manager **136** manages exchange of electric power with right controller **200** and/or left controller **300**. More specifically, power supply manager **136** obtains state information such as a voltage and a temperature of battery **102** and provides a command to a switch **108**. A sensor **112** for obtaining the state information of battery **102** is provided for battery **102**.
[0067] Switch **108** activates/deactivates electrical connection to right controller **200** through a power terminal **141** and electrical connection to left controller **300** through a power terminal **142**. In other words, switch **108** connects or disconnects battery **102** to or from power terminal **141** and power terminal **142** for electrical connection to right controller **200** and left controller **300**, respectively, in accordance with a command from power supply manager **136**. Switch **108** (and switches **208** and **308** which will be described later) may include a mechanical opening and closing mechanism or may switch a conducting state of a semiconductor or the like.
[0068] A resistor **106** is provided between battery **102** and switch **108**. A resistance value of resistor **106** is determined in accordance with a value of an allowable current suppliable from battery **102** to right controller **200** and/or left controller **300** (for example, approximately 1 Ω).
[0069] Load circuit **220** of right controller **200** includes a processor **222**, a memory **224**, a storage **226**, an operation portion **228**, a wireless communication module **232**, a wired communication module **234**, and a power supply manager **236**.
[0070] Processor **222** is a processing entity for performing processing provided by right controller **200**. Processor **222** performs processing necessary for right controller **200** by reading a program stored in storage **226**, developing the program on memory **224**, and executing the program.
[0071] Operation portion **228** outputs a signal in accordance with the operation by the user to processor **222**. Details of the operation by the user are transmitted to processing apparatus **100** as a wireless signal or a wired signal.
[0072] Wireless communication module **232** transmits and receives a wireless signal to and from processing apparatus **100**. Wired communication module **234** transmits and receives an electrical signal (wired signal) to and from processing apparatus **100** through a communication terminal **243**.
[0073] Power supply manager **236** manages exchange of electric power with processing apparatus **100** and/or left controller **300**. M ore specifically, power supply manager **236** obtains state information such as a voltage and a temperature of battery **202** and provides a command to a switch **208**. A sensor **212** for obtaining the state information of battery **202** is provided for battery **202**.
[0074] Switch **208** activates/deactivates electrical connection to processing apparatus **100** (and left controller **300**) through a power terminal **241**. In other words, switch **208** connects or disconnects battery **202** to or from power terminal **241** for electrical connection to processing apparatus **100** (and left controller **300**), in accordance with a command from power supply manager **236**.
[0075] A resistor **206** is provided between battery **202** and switch **208**. A resistance value of resistor **206** is determined in accordance with a value of an allowable current suppliable from battery **202** to

processing apparatus **100** and/or left controller **300**.
[0076] Load circuit **320** of left controller **300** includes a processor **322**, a memory **324**, a storage **326**, an operation portion **328**, a wireless communication module **332**, a wired communication module **334**, and a power supply manager **336**. Wired communication module **334** transmits and receives a wired signal to and from processing apparatus **100** through a communication terminal **344**. Since a configuration and a function of each component are similar to those in load circuit **220** of right controller **200**, detailed description will not be repeated.
[0077] A switch **308** activates/deactivates electrical connection to processing apparatus **100** (and right controller **200**) through a power terminal **342**. In other words, switch **308** connects or disconnects battery **302** to or from power terminal **342** for electrical connection to processing apparatus **100** (and right controller **200**), in accordance with a command from power supply manager **336**.
[0078] A resistor **306** is provided between battery **302** and switch **308**. A resistance value of resistor **306** is determined in accordance with a value of an allowable current suppliable from battery **302** to processing apparatus **100** and/or right controller **200**.
[0079] A sensor **312** for obtaining state information such as a voltage and a temperature of battery **302** is provided for battery **302**.
C. Mutual Power Feed
[0080] Mutual power feed in game system **1** according to the present embodiment will now be described.
[0081] Mutual power feed in game system **1** according to the present embodiment will be described with reference to FIGS. **5**A to **5**C and **6**A to **6**C. It is assumed that electric power from an external power supply is not supplied.
[0082] Referring to FIG. **5**A, it is assumed, for example, that a remaining battery level of processing apparatus **100** is 30%, a remaining battery level of right controller **200** is 80%, and a remaining battery level of left controller **300** is 80%. The remaining battery level herein mainly means a state of charge (SOC) which is an indicator indicating a rate of charging or a charged state. In other words, the remaining battery level represents how much electric power is stored with respect to a full charge capacity of each battery.
[0083] When each apparatus operates only with electric power from its own battery, the remaining battery level of processing apparatus **100** reaches a lower limit value (for example, 20%) first, and game system **1** becomes unable to operate. When the remaining battery level of right controller **200** and/or left controller **300** has not reached the lower limit value, however, processing apparatus **100** can operate by using electric power stored in the batteries of these controllers.
[0084] In game system **1** according to the present embodiment, processing apparatus **100**, right controller **200**, and left controller **300** can mutually feed power.
[0085] FIG. **5**B shows a state in which right controller **200** and left controller **300** feed power to processing apparatus **100** by way of example. When electric power supplied to processing apparatus **100** is higher than electric power used in processing apparatus **100**, the remaining battery level of processing apparatus **100** increases. As a result of such mutual power feed, the remaining battery level of game system **1** as a whole can be leveled. In other words, a plurality of batteries of game system **1** can be used in a unified manner so to speak.
[0086] Consequently, as shown in FIG. **5**C, substantially all electric power stored in the batteries can be used, so that game system **1** can operate for a longer time period.
[0087] FIG. **5**B shows the state in which right controller **200** and left controller **300** feed power to processing apparatus **100** by way of example. In this state, the remaining battery levels of battery **202** of right controller **200** and battery **302** of left controller **300** are higher than the remaining battery level of battery **102** of processing apparatus **100**. At this time, the voltages of battery **202** and battery **302** are higher than the voltage of battery **102**. Depending on such relative relation of the voltage or the remaining battery level, power feed from battery **202** and battery **302** to battery

102 occurs.
[0088] In addition to power feed shown in FIG. **5**B, at least power feed shown below can be performed.
[0089] (1) Power feed from processing apparatus **100** to right controller **200** and left controller **300**
[0090] (2) Power feed from processing apparatus **100** to right controller **200**
[0091] (3) Power feed from processing apparatus **100** to left controller **300**
[0092] (4) Power feed from right controller **200** to processing apparatus **100** and left controller **300**
[0093] (5) Power feed from right controller **200** to processing apparatus **100**
[0094] (6) Power feed from right controller **200** to left controller **300**
[0095] (7) Power feed from left controller **300** to processing apparatus **100** and right controller **200**
[0096] (8) Power feed from left controller **300** to processing apparatus **100**
[0097] (9) Power feed from left controller **300** to right controller **200**
[0098] For example, power feed shown in (1) may occur when the remaining battery level of battery **102** is higher than the remaining battery levels of battery **202** and battery **302**. At this time, the voltage of battery **102** is higher than the voltages of battery **202** and battery **302**. Depending on such relative relation of the voltage or the remaining battery level, power feed from battery **102** to battery **202** and battery **302** occurs.
[0099] As shown in FIG. **6**A, when right controller **200** is higher (for example, 80%) in remaining battery level than processing apparatus **100** and left controller **300**, each apparatus performs processing while right controller **200** feeds power to processing apparatus **100** and left controller **300**.
[0100] Thereafter, when right controller **200** and left controller **300** are substantially equal in remaining battery level to each other (that is, a voltage difference between right controller **200** and left controller **300** becomes substantially zero), as shown in FIG. **6**B, right controller **200** and left controller **300** feed power to processing apparatus **100**.
[0101] As such power feed is naturally performed, as shown in FIG. **6**C, substantially all electric power stored in the batteries can fully be used.
D. Processing Procedure
[0102] A processing procedure in mutual power feed in game system **1** according to the present embodiment will now be described.
(d1: Mutual Power Feed Between Two Apparatuses)
[0103] For simplification of description, exemplary mutual power feed between two apparatuses (processing apparatus **100** and right controller **200**) is initially shown. Description below is applicable to combination of any two of processing apparatus **100**, right controller **200**, and left controller **300**.
[0104] An exemplary configuration associated with mutual power feed in game system **1** according to the present embodiment will be described with reference to FIG. **7**. FIG. **7** shows a state in which processing apparatus **100** and right controller **200** are coupled to each other.
[0105] A power supply path **50** between switch **108** of processing apparatus **100** and switch **208** of right controller **200** includes power terminal **141** of processing apparatus **100** and power terminal **241** of right controller **200**.
[0106] As processing apparatus **100** and right controller **200** are thus coupled to each other, battery **102** and battery **202** are electrically connected to each other with resistor **106**, switch **108**, switch **208**, and resistor **206** connected in series being interposed. As shown in FIG. **7**, when processing apparatus **100** and right controller **200** are coupled to each other, in the path through which battery **102** and battery **202** are electrically connected to each other, a charging control circuit for power feed from battery **102** to battery **202** and a charging control circuit for power feed from battery **202** to battery **102** are not provided.
[0107] Consequently, when switch **108** and switch **208** are closed, a current in accordance with a voltage difference between battery **102** and battery **202** and resistance values of resistor **106** and

resistor **206** flows between battery **102** and battery **202**.
[0108] Power supply manager **136** of processing apparatus **100** and power supply manager **236** of right controller **200** can communicate with each other. A communication path **52** includes communication terminal **143** of processing apparatus **100** and communication terminal **243** of right controller **200**. Communication processing may be performed through wired communication module **134** and wired communication module **234** (FIG. **4**).
[0109] Power supply manager **136** determines whether or not mutual power feed can be performed based on the state information (the voltage, the temperature, etc.) of battery **102** and information obtained from power supply manager **236**. When power supply manager **136** determines that mutual power feed can be performed, it has switch **108** closed. As switch **108** is closed, power feed from battery **102** to another apparatus and/or power reception from another apparatus to battery **102** can be performed.
[0110] Similarly, power supply manager **236** determines whether or not mutual power feed can be performed based on the state information (the voltage, the temperature, etc.) of battery **202** and information obtained from power supply manager **136**. When power supply manager **236** determines that mutual power feed can be performed, it has switch **208** closed. As switch **208** is closed, power feed from battery **202** to another apparatus and/or power reception from another apparatus to battery **202** can be performed.
[0111] Power supply manager **136** thus causes switch **108** to connect or disconnect based on at least one of the voltage or the temperature of battery **102**. Similarly, power supply manager **236** causes switch **208** to connect or disconnect based on at least one of the voltage or the temperature of battery **202**.
[0112] Furthermore, when power supply manager **136** and/or power supply manager **236** is/are able to transmit at least one of the voltage or the temperature of the battery of the apparatus to which it belongs to the other of the power supply managers as shown in FIG. **7**, the power supply manager as a destination may cause the switch of the apparatus to which it belongs to connect or disconnect based on at least one of the obtained voltage or temperature of the battery. Both of power supply manager **136** and power supply manager **236** do not have to be able to transmit the state information (the voltage, the temperature, etc.) of the battery to the other of the power supply managers. In other words, only one of the power supply managers may be able to transmit the state information of the battery.
[0113] In game system **1** according to the present embodiment, power feed (naturally) occurs in accordance with a difference in voltage or remaining battery level of the battery. In other words, power feed from the first battery to the second battery or power feed from the second battery to the first battery occurs in accordance with the state of the voltage or the remaining battery level of each battery.
[0114] Exemplary power feed that occurs in the exemplary configuration shown in FIG. **7** will now be described.
[0115] As shown in FIG. **8**A, when a voltage V**1** of battery **102** is higher than a voltage V**2** of battery **202**, power feed from battery **102** to battery **202** occurs. Alternatively, as shown in FIG. **8**B, when voltage V**2** of battery **202** is higher than voltage V**1** of battery **102**, power feed from battery **202** to battery **102** occurs. Similar power feed may occur also depending on relation of magnitude of the remaining battery level.
[0116] When battery **102** is higher in voltage or remaining battery level than battery **202**, power feed from battery **102** to battery **202** occurs. When battery **202** is higher in voltage or remaining battery level than battery **102**, power feed from battery **202** to battery **102** occurs.
[0117] In mutual power feed between battery **102** and battery **202**, a current flows through resistor **106** and resistor **206** connected in series. By designing resistance values of resistors **106** and **206** to appropriate values, an excessively large current can be prevented from flowing between batteries while a simplified circuit configuration is maintained.

[0118] An exemplary processing procedure associated with mutual power feed in the exemplary configuration shown in FIG. **7** will be described with reference to FIG. **9** Each step shown in FIG. **9** is performed by the power supply manager of each apparatus. The power supply manager does not have to perform all processing but the processor may perform some processing.
[0119] The power supply manager of each apparatus determines whether or not a condition for performing processing associated with mutual power feed has been satisfied (step S**100**). The condition for performing the processing associated with mutual power feed may include, for example, electrical connection of an apparatus to which a power supply manager belongs to another apparatus and lapse of a predetermined time period since previous determination processing.
[0120] When the condition for performing the processing associated with mutual power feed has been satisfied (YES in step S**100**), the power supply manager obtains the state information (the voltage, the temperature, etc.) of the battery of the apparatus to which it belongs (step S**102**) and obtains from another connected apparatus, the state information (the voltage, the temperature, etc.) of the battery of that another apparatus (step S**104**).
[0121] The power supply manager determines whether or not mutual power feed can be performed based on the state information of the battery of the apparatus to which it belongs and the state information of the battery of another apparatus (step S**106**). When mutual power feed can be performed (YES in step S**106**), the power supply manager maintains the switch in the closed state (step S**108**). When mutual power feed cannot be performed (NO in step S**106**), the power supply manager maintains the switch in the open state (step S**110**).
[0122] When the condition for performing the processing associated with mutual power feed has not been satisfied (NO in step S**100**), processing in steps S**102** to S**110** is skipped.
[0123] In succession, the power supply manager determines whether or not the power supply manager of another apparatus has issued a request for the state information of the battery (step S**112**). When the power supply manager of another apparatus has issued the request for the state information of the battery (YES in step S**112**), the power supply manager transmits the state information of the battery of the apparatus to which it belongs to the power supply manager from which the request was issued (step S**114**).
[0124] When the power supply manager of another apparatus has not issued the request for the state information of the battery (NO in step S**112**), processing in step S**114** is skipped.
[0125] Thereafter, processing in step S**100** or later is repeated.
[0126] The condition that enables mutual power feed described above (step S**106**) can be set, for example, by combining one or more of conditions below as appropriate. [0127] The voltage of the battery of a certain apparatus being within a predetermined voltage range (or the voltage of the battery of the certain apparatus being not larger than the predetermined upper limit value) [0128] The voltage of the battery of another apparatus being within a predetermined voltage range (or the voltage of the battery of another apparatus being not larger than the predetermined upper limit value) [0129] A difference between the voltage of the battery of a certain apparatus and the voltage of the battery of another apparatus being within a predetermined range [0130] The temperature of the battery of a certain apparatus being within a predetermined temperature range (for example, a room temperature) [0131] The temperature of the battery of another apparatus being within a predetermined temperature range (for example, a room temperature)
[0132] Furthermore, the remaining battery level, power consumption in the load circuit, whether or not there is supply from an external power supply, or the like may be included in the condition that enables mutual power feed.
[0133] When the remaining battery level is lowering, it may be determined that the condition that enables mutual power feed is no longer satisfied before the remaining battery level reaches a predetermined lower limit value. In other words, before electric power stored in the battery is fully used, the switch may be opened to electrically disconnect the battery from another battery.

(d2: Mutual Power Feed Between Two Apparatuses: Without Communication)
[0134] In the exemplary configuration for mutual power feed described above, whether or not mutual power feed can be performed is determined by communication by the power supply manager with another power supply manager. In game system **1** according to the present embodiment, each apparatus may determine whether or not mutual power feed can be performed without communication by the power supply manager with another power supply manager.
[0135] FIG. **10** is a schematic diagram showing another exemplary configuration associated with mutual power feed in game system **1** according to the present embodiment. In the exemplary configuration shown in FIG. **10**, as compared with the exemplary configuration shown in FIG. **7**, communication path **52** between power supply manager **136** of processing apparatus **100** and power supply manager **236** of right controller **200** has been removed.
[0136] Each of power supply manager **136** of processing apparatus **100** and power supply manager **236** of right controller **200** determines whether or not mutual power feed can be performed based on the information obtained from the apparatus to which it belongs. When mutual power feed can be performed, the switch is maintained in the closed state.
[0137] When mutual power feed can be performed in one of the apparatuses and mutual power feed cannot be performed in the other of the apparatuses, the batteries are not electrically connected to each other and hence mutual power feed is substantially not started. In other words, mutual power feed is started only when it is determined that mutual power feed can be performed in both of the two apparatuses.
[0138] Therefore, appropriate control can be achieved even when the power supply manager of each apparatus determines whether or not mutual power feed can be performed based only on information obtained from each apparatus to which it belongs.
[0139] An exemplary processing procedure associated with mutual power feed in the exemplary configuration shown in FIG. **10** will be described with reference to FIG. **11**. Each step shown in FIG. **11** is performed by the power supply manager of each apparatus. The power supply manager does not have to perform all processing but the processor may perform some processing. Processing in FIG. **11** substantially identical to that in the steps shown in FIG. **9** has the same step number allotted.
[0140] The power supply manager of each apparatus determines whether or not the condition for performing processing associated with mutual power feed has been satisfied (step S**100**). The condition for performing the processing associated with mutual power feed may include, for example, electrical connection of an apparatus to which a power supply manager belongs to another apparatus and lapse of a predetermined time period since previous determination processing.
[0141] When the condition for performing the processing associated with mutual power feed has been satisfied (YES in step S**100**), the power supply manager obtains the state information (the voltage, the temperature, etc.) of the battery of the apparatus to which it belongs (step S**102**).
[0142] The power supply manager determines whether or not mutual power feed can be performed based on the state information of the battery of the apparatus to which it belongs (step S**107**). When mutual power feed can be performed (YES in step S**107**), the power supply manager maintains the switch in the closed state (step S**108**). When mutual power feed cannot be performed (NO in step S**107**), the power supply manager maintains the switch in the open state (step S**110**).
[0143] When the condition for performing the processing associated with mutual power feed has not been satisfied (NO in step S**100**), the processing in steps S**102** to S**110** is skipped.
[0144] Thereafter, processing in step S**100** or later is repeated.
[0145] In the exemplary configuration shown in FIG. **10**, the condition that enables mutual power feed (step S**107**) can be set, for example, by combining one or more of conditions below as appropriate. [0146] The voltage of the battery of a certain apparatus being within a predetermined voltage range [0147] The temperature of the battery of a certain apparatus being within a

predetermined temperature range
[0148] Furthermore, the remaining battery level, power consumption in the load circuit, whether or not there is supply from an external power supply, or the like may be included in the condition that enables mutual power feed.
(d3: Mutual Power Feed Among Three Apparatuses)
[0149] Three apparatuses (processing apparatus **100**, right controller **200**, and left controller **300**) included in game system **1** according to the present embodiment can also mutually feed power.
[0150] Yet another exemplary configuration associated with mutual power feed in game system **1** according to the present embodiment will be described with reference to FIG. **12**. FIG. **12** shows a state in which processing apparatus **100**, right controller **200**, and left controller **300** are coupled to one another.
[0151] Switch **108** of processing apparatus **100**, switch **208** of right controller **200**, and switch **308** of left controller **300** are electrically connected to one another through a power supply path **54**. Power supply path **54** includes power terminal **141** of processing apparatus **100**, power terminal **241** of right controller **200**, and power terminal **342** of left controller **300**.
[0152] Power feed among battery **102**, battery **202**, and battery **302** occurs in accordance with the voltages or the remaining battery levels of battery **102**, battery **202**, and battery **302**.
[0153] A s processing apparatus **100**, right controller **200**, and left controller **300** are thus coupled to one another, battery **302** is connected between switch **108** and switch **208** with switch **308** and resistor **306** being interposed. As shown in FIG. **12**, in a state in which processing apparatus **100** is coupled to right controller **200** and left controller **300**, in a path through which battery **102** and battery **202** are electrically connected to each other, a charging control circuit for power feed from battery **102** to battery **202** and a charging control circuit for power feed from battery **202** to battery **102** are not provided. Similarly, in a path through which battery **102** and battery **302** are electrically connected to each other, a charging control circuit for power feed from battery **102** to battery **302** and a charging control circuit for power feed from battery **302** to battery **102** are not provided.
[0154] Power supply manager **136** of processing apparatus **100** and power supply manager **236** of right controller **200** can communicate with each other, and power supply manager **136** of processing apparatus **100** and power supply manager **336** of left controller **300** can communicate with each other. Communication path **52** includes communication terminal **143** of processing apparatus **100** and communication terminal **243** of right controller **200**. A communication path **56** includes communication terminal **143** of processing apparatus **100** and communication terminal **344** of left controller **300**.
[0155] Power supply manager **136** determines whether or not mutual power feed can be performed based on the state information (the voltage, the temperature, etc.) of battery **102**, the information obtained from power supply manager **236**, and the information obtained from power supply manager **336**. Similarly, power supply manager **236** determines whether or not mutual power feed can be performed based on the state information (the voltage, the temperature, etc.) of battery **202**, the information obtained from power supply manager **136**, and the information obtained from power supply manager **336**. Similarly, power supply manager **336** determines whether or not mutual power feed can be performed based on the state information (the voltage, the temperature, etc.) of battery **302**, the information obtained from power supply manager **136**, and the information obtained from power supply manager **236**.
[0156] When power supply managers **136**, **236**, and **336** determine that mutual power feed can be performed, they have switches **108**, **208**, and **308** closed, respectively. When at least two switches are closed, mutual power feed is performed.
[0157] As shown in FIG. **12**, when at least one of power supply manager **136**, power supply manager **236**, or power supply manager **336** can transmit at least one of the voltage or the temperature of the battery of the apparatus to which it belongs to other power supply manager(s), the power supply manager(s) as the destination may cause the switch(es) of the apparatus(es) to

which it (they) belong(s) to connect or disconnect based on at least one of the obtained voltage or temperature of the battery. All of power supply manager **136**, power supply manager **236**, and power supply manager **336** do not have to be able to transmit the state information (the voltage, the temperature, etc.) of the battery to other power supply managers. In other words, only at least one power supply manager may be able to transmit the state information of the battery.

[0158] In game system **1** according to the present embodiment, power feed in accordance with the difference in voltage or remaining battery level of the battery occurs. In other words, power feed from one or more batteries relatively high in voltage among electrically connected batteries to one or more batteries relatively low in voltage occurs.

(d4: Mutual Power Feed Among Three Apparatuses: Without Communication)

[0159] A communication path among the power supply managers may be removed also from the exemplary configuration shown in FIG. **12**, as in the exemplary configuration shown in FIG. **10**. When it is determined that mutual power feed can be performed in at least two apparatuses as described above, mutual power feed is started.

(d5: Mutual Power Feed Among More Than Three Apparatuses)

[0160] Though mutual power feed between two apparatuses or among three apparatuses is described in the exemplary configurations above, more apparatuses may electrically be connected to one another to perform mutual power feed.

[0161] In the game system according to the present embodiment, power feed in accordance with the voltage or the remaining battery level of the battery of each apparatus occurs, and hence complicated control is not required. Therefore, the number of apparatuses to electrically be connected is not particularly restricted.

E. Modification

[0162] Even when at least one electrically connected battery is being charged with electric power from an external power supply, mutual power feed with another battery can be performed. In this case, at least one of electric power stored in the battery or electric power supplied from the external power supply is supplied to another battery.

[0163] Though right controller **200** and left controller **300** can be coupled to processing apparatus **100** in the exemplary configurations described above, without being limited as such, right controller **200** and left controller **300** may be configured to be coupled to each other. In this case, mutual power feed between right controller **200** and left controller **300** can be performed.

F. Advantage

[0164] According to the present embodiment, when the condition that enables mutual power feed is satisfied when a plurality of physically separable apparatuses are physically coupled to each other, batteries are electrically connected to each other. Since power feed in accordance with the voltage or the remaining battery level occurs between/among the batteries, electric power stored in the batteries is fully used in the system as a whole and the system can operate for a longer time period.

[0165] According to the present embodiment, electric power and the current do not have to be adjusted with the charging control circuit such as the charging control IC and hence there is no conversion loss. Therefore, efficiency in power feed can be enhanced. Since power feed occurs in accordance with the difference in voltage or remaining battery level of the battery, necessity for processing for determining a power feed side and a power reception side, processing for determining a voltage for power feed, or the like can be obviated. Furthermore, according to the present embodiment, since the number of electrically connectable batteries is not restricted, a plurality of apparatuses can also feed power to a single apparatus.

[0166] Mutual power feed according to the present embodiment aims at operation of the system for a longer time period by fully using electric power stored in a plurality of batteries, and a rate of power feed (wattage) does not have to excessively be increased.

[0167] Although the present disclosure has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way

of illustration, the scope of the present disclosure being interpreted by the terms of the appended claims.

Claims

1. A charging control system comprising: a first apparatus and a second apparatus separable from each other, wherein the first apparatus comprises a first battery, a first power supply manager, a first switch for connecting or disconnecting between a first terminal for electrical connection to the second apparatus and the first battery, in accordance with a command from the first power supply manager, and a first resistor provided between the first battery and the first terminal, the second apparatus comprises a second battery, a second power supply manager, a second switch for connecting or disconnecting between a second terminal for electrical connection to the first apparatus and the second battery, in accordance with a command from the second power supply manager, and a second resistor provided between the second battery and the second terminal, and when the first apparatus and the second apparatus are coupled to each other, the first battery and the second battery are electrically connected to each other with the first resistor, the first switch, the second switch, and the second resistor connected in series being interposed.
2. The charging control system according to claim 1, wherein power feed from the first battery to the second battery or power feed from the second battery to the first battery occurs in accordance with at least one of (i) a voltage of the first battery and a voltage of the second battery or (ii) a remaining battery level of the first battery and a remaining battery level of the second battery.
3. The charging control system according to claim 2, wherein at least one of when the voltage of the first battery is higher than the voltage of the second battery or when the remaining battery level of the first battery is higher than the remaining battery level of the second battery, power feed from the first battery to the second battery occurs, and at least one of when the voltage of the second battery is higher than the voltage of the first battery or when the remaining battery level of the second battery is higher than the remaining battery level of the first battery, power feed from the second battery to the first battery occurs.
4. The charging control system according to claim 2, wherein when the first apparatus and the second apparatus are coupled to each other, in a path through which the first battery and the second battery are electrically connected to each other, a charging control circuit for power feed from the first battery to the second battery and a charging control circuit for power feed from the second battery to the first battery are not provided.
5. The charging control system according to claim 1, wherein the first power supply manager is configured to cause the first switch to connect or disconnect based on at least one of a voltage or a temperature of the first battery, and the second power supply manager is configured to cause the second switch to connect or disconnect based on at least one of a voltage or a temperature of the second battery.
6. The charging control system according to claim 1, wherein at least one of the first power supply manager or the second power supply manager is configured to transmit at least one of a voltage or a temperature of the battery of the apparatus to which the first power supply manager or the second power supply manager belongs to another one of the first power supply manager and the second power supply manager, and at least one of the first power supply manager or the second power supply manager is configured to cause the switch of the apparatus to which the first power supply manager or the second power supply manager belongs to connect or disconnect based on at least one of the voltage or the temperature of the battery obtained from the another one of the first power supply manager and the second power supply manager.
7. The charging control system according to claim 1, wherein the first power supply manager is configured to command the first switch to connect when a voltage of the first battery is within a predetermined voltage range, and the second power supply manager is configured to command the

second switch to connect when a voltage of the second battery is within a predetermined voltage range.

8. The charging control system according to claim 1, further comprising a third apparatus configured to be coupled to at least one of the first apparatus or the second apparatus, wherein the third apparatus comprises a third battery, a third power supply manager, a third switch for connecting or disconnecting between a third terminal for electrical connection to at least one of the first apparatus or the second apparatus and the third battery, in accordance with a command from the third power supply manager, and a third resistor provided between the third battery and the first terminal, and when the first apparatus, the second apparatus, and the third apparatus are coupled to one another, the third battery is connected between the first switch and the second switch, with the third switch and the third resistor being interposed.

9. The charging control system according to claim 8, wherein power feed occurs among the first battery, the second battery, and the third battery in accordance with at least one of (i) a voltage of the first battery, a voltage of the second battery, and a voltage of the third battery or (ii) a remaining battery level of the first battery, a remaining battery level of the second battery, and a remaining battery level of the third battery.

10. The charging control system according to claim 8, wherein the first apparatus is an electronic device comprising a display, the second apparatus is a controller to be coupled to one side of the first apparatus and configured to transmit a signal in accordance with an operation by a user to the first apparatus, the third apparatus is a controller to be coupled to the other side of the first apparatus and configured to transmit a signal in accordance with an operation by the user to the first apparatus, at least one of when a voltage of the first battery is higher than a voltage of the second battery and a voltage of the third battery or when a remaining battery level of the first battery is higher than a remaining battery level of the second battery and a remaining battery level of the third battery, power feed from the first battery to the second battery and the third battery occurs, and at least one of when the voltage of the second battery and the voltage of the third battery are higher than the voltage of the first battery or when the remaining battery level of the second battery and the remaining battery level of the third battery are higher than the remaining battery level of the first battery, power feed from the second battery and the third battery to the first battery occurs.

11. The charging control system according to claim 10, wherein when the second apparatus and the third apparatus are coupled to the first apparatus, in a path through which the first battery and the second battery are electrically connected to each other, a charging control circuit for power feed from the first battery to the second battery and a charging control circuit for power feed from the second battery to the first battery are not provided, and in a path through which the first battery and the third battery are electrically connected to each other, a charging control circuit for power feed from the first battery to the third battery and a charging control circuit for power feed from the third battery to the first battery are not provided.

12. The charging control system according to claim 8, wherein at least one of the first power supply manager, the second power supply manager, or the third power supply manager is configured to transmit at least one of a voltage or a temperature of the battery of the apparatus to which the first power supply manager, the second power supply manager, or the third power supply manager belongs to at least another one of power supply managers, and at least one of the first power supply manager, the second power supply manager, or the third power supply manager is configured to cause the switch of the apparatus to which the first power supply manager, the second power supply manager, or the third power supply manager belongs to connect or disconnect based on at least one of the voltage or the temperature of the battery obtained from one or more other power supply managers.

13. The charging control system according to claim 1, wherein the first apparatus and the second apparatus are configured to exchange information in a wired signal in a first state in which the first

apparatus and the second apparatus are coupled to each other, and the first apparatus and the second apparatus are configured to exchange information in a wireless signal in a second state in which the first apparatus and the second apparatus are separate from each other.

14. A charging control device separable from another charging control device, the charging control device comprising: a battery; a power supply manager; a switch for connecting or disconnecting between a terminal for electrical connection to the another charging control device and the battery, in accordance with a command from the power supply manager; and a resistor provided between the battery and the terminal, wherein when the charging control device is coupled to the another charging control device, the battery and a battery of the another charging control device are electrically connected to each other with the resistor, the switch, a switch of the another charging control device, and a resistor of the another charging control device connected in series being interposed.

15. The charging control device according to claim 14, wherein the power supply manager is configured to cause the switch to connect or disconnect based on at least one of a voltage or a temperature of the battery.

16. The charging control device according to claim 14, wherein the power supply manager is configured to transmit at least one of a voltage or a temperature of the battery to the another charging control device, and the power supply manager is configured to cause the switch to connect or disconnect based on at least one of a voltage or a temperature of the battery obtained from a power supply manager of the another charging control device.

17. The charging control device according to claim 14, wherein the power supply manager is configured to command the switch to connect when a voltage of the battery is within a predetermined voltage range.

18. The charging control device according to claim 14, wherein when the charging control device is coupled to the another charging control device and second another charging control device, a battery of the second another charging control device is connected between the switch and a switch of the another charging control device with a switch and a resistor of the second another charging control device being interposed.

19. The charging control device according to claim 14, wherein the charging control device and the another charging control device are configured to exchange information with each other in a wired signal in a first state in which the charging control device is coupled to the another charging control device, and the charging control device and the another charging control device are configured to exchange information in a wireless signal in a second state in which the charging control device and the another charging control device are separate.