

DESCRIPTION

Title of Invention

DELIVERY LOCKER

Technical Field

[0001] The present disclosure generally relates to a delivery locker, and more particularly relates to a delivery locker in which a parcel is loaded by a delivery service provider and from which the parcel is unloaded by its recipient.

Background Art

[0002] A delivery locker with communication capabilities has been known in the art (see, for example, Patent Literature 1).

[0003] The delivery locker of Patent Literature 1 includes: a storage box to be loaded with a parcel to deliver; an openable and closable door mounted to the storage box; a door locking mechanism for locking and unlocking the door; and a communications device for transmitting operating status information to an external device and receiving, from the external device, an instruction to lock or unlock the door. The communications device communicates wirelessly with a Wi-Fi® router connected to a communications network such as the Internet.

[0004] In accordance with an operating command entered by the user, his or her mobile communications device transmits an unlocking instruction to the communications device of the delivery locker over the communications network.

[0005] The delivery locker of Patent Literature 1 is supposed to communicate with the mobile communications device over the communications network. Thus, the communications device (communications unit) is provided outside of the delivery locker. Nevertheless, there is a growing demand for establishing direct wireless communication between the mobile communications device and the communications device of the delivery locker. In that case, the communications device needs to be provided inside the delivery locker. The delivery locker is made of a metal from the viewpoint of enhancing security. Thus, providing the communications device inside the delivery locker would cause a decline in communication quality.

Citation List

Patent Literature

[0006] Patent Literature 1: JP 2019-146761 A

Summary of Invention

[0007] In view of the foregoing background, it is therefore an object of the present disclosure to provide a delivery locker with the ability to curb a decline in communication quality.

[0008] A delivery locker according to an aspect of the present disclosure includes: a body case made of a metallic material; a door made of a metallic material; a panel made of a resin; a locking mechanism; a control unit; and a communications unit. The body case has an opening. The door is provided in a readily openable and closable state for the opening of the body case. The locking mechanism locks and unlocks the door. The control unit controls an operation of the locking mechanism. The communications unit includes an antenna and communicates wirelessly with an external device. The door has a window. The panel is fitted into the window. The communications unit is provided behind the panel. The control unit makes the locking mechanism unlock the door in response to a signal received by the communications unit.

Brief Description of Drawings

[0009] FIG. 1 is a front view of a door included in a delivery locker according to an aspect of the present disclosure;

FIG. 2A is a front view of the delivery locker;

FIG. 2B is a perspective view of the delivery locker;

FIG. 3 illustrates how the door is opened and closed;

FIG. 4A is a rear view of the door;

FIG. 4B is a rear view of the door, from which a battery cover is removed;

FIG. 5 is a rear view of the door, from which a battery housing unit is removed;

FIG. 6 illustrates a configuration for a delivery system including a plurality of management systems provided for the delivery locker;

FIG. 7 illustrates a configuration for each of the management systems;

FIG. 8 is a chart showing how the delivery system operates when a parcel is loaded;

FIG. 9 is a chart showing how the delivery system operates when a parcel is unloaded;

and

FIGS. 10A–10C show communication characteristics of a communications unit provided for the management system.

Description of Embodiments

[0010] Note that an embodiment and its variations to be described below are only an exemplary one of various embodiments and its variations of the present disclosure and should not be construed as limiting. Rather, the exemplary embodiment and its variations may be readily modified in various manners depending on a design choice or any other factor without departing from a true spirit and scope of the present disclosure.

[0011] (Embodiment)

A delivery locker according to an exemplary embodiment will now be described with reference to FIGS. 1–10.

[0012] (1) Structure of delivery locker

A delivery locker 100 according to this embodiment includes: a body case 1 with a plurality of (e.g., five in this example) openings 3; a plurality of doors 4 provided one to one for the plurality of openings 3; and a plurality of (e.g., five in this example) storage boxes 2 provided one to one for the plurality of openings 3 (see FIGS. 2A and 2B). The delivery locker 100 further includes a plurality of locking mechanisms 19, a plurality of control boards 18a, and a plurality of communications units 12, all of which are provided one to one for the plurality of doors 4 (see FIGS. 1 and 5). The delivery locker 100 further includes a battery housing 101 and batteries 17 (see FIGS. 4A and 4B).

[0013] The body case 1 is made of a metallic material. The plurality of openings 3 of the body case 1 are arranged in a predetermined arrangement direction D1 (hereinafter also referred to as a “first direction D1”). The plurality of storage boxes 2 are spaces to be loaded with parcels. Each of the plurality of storage boxes 2 is provided to extend, in a depth direction D2 (hereinafter also referred to as a “second direction D2”) perpendicular to the first direction D1, from an associated one of the openings 3. In this case, one end of each storage box 2 in the second direction D2 corresponds to its associated opening 3.

[0014] The delivery locker 100 further includes a plurality of hinge mechanisms 5, each of which is provided at one end of an associated door 4 in a width direction D3 (hereinafter also referred to as a “third direction D3”) perpendicular to both the first direction D1 and the second direction D2 (see FIG. 3). This makes each door 4 openable and closable around a point where the associated hinge mechanism 5 is provided as a fulcrum.

[0015] Each door 4 is made of a metallic material and is provided in a readily openable and closable state. Each door 4 has a window 6 (see FIG. 2A). Each window 6 is a hole provided through an associated door 4. The window 6 is provided at a location adjacent to a different end portion of the associated door 4 in the third direction D3 from the end portion thereof provided with the hinge mechanism 5. In other words, the window 6 is provided closer to the different end

portion than a midpoint of the associated door 4 in the third direction D3.

[0016] A panel 7 made of a resin is fitted into the window 6 (see FIG. 2A).

[0017] The panel 7 forms part of the door 4 and is secured, with a plurality of screws 14, to the rear surface of a window frame 13 that forms the window 6 (see FIGS. 4A, 4B, and 5). The panel 7 includes a door operator 8 and an operating panel 11. The door operator 8 and the operating panel 11 are arranged on a front surface 7a of the panel 7. When the door 4 is viewed from in front of the door 4, the operating panel 11 is arranged between the door operator 8 and the hinge mechanism 5 (see FIG. 3).

[0018] The door operator 8 is provided on the front surface of the panel 7 and is operated by the user who is going to open and close the door 4. The door operator 8 includes an operating lever 8a and a pivotal portion 8b provided at the base of the operating lever 8a (see FIG. 1). The door operator 8 is at least partially made of a resin. In this embodiment, the operating lever 8a and the pivotal portion 8b are made of a resin.

[0019] The operating lever 8a is turned by the user who is going to open and close the door 4. The pivotal portion 8b is pivotally supported by a shaft (not shown) with respect to the panel 7. In this embodiment, the door operator 8 is configured such that when the user pulls the operating lever 8a toward him- or herself, a door bolt 9 shown in FIG. 3 is pulled out of an engagement hole 10 of the body case 1 via a coupling mechanism (not shown), thereby opening and closing the door 4.

[0020] The operating panel 11 includes a plurality of operating keys 11a (see FIG. 1). The plurality of operating keys 11a are arranged at predetermined intervals to accept an operating command of unlocking the door 4 using the locking mechanism 19. The plurality of operating keys 11a are arranged in columns and rows in the first direction D1 and the third direction D3. Each operating key 11a may be, for example, a pressure sensitive sensor. When pressed by the user (with one of his or her fingers), the operating key 11a has its electrical resistance varied by the contact pressure and outputs a value representing the variation to the control board 18a.

[0021] When the user enters an unlock number for unlocking the door 4 by tapping the plurality of operating keys 11a provided for the door 4 that he or she wants to unlock, the door 4 is unlocked by the operation of the locking mechanism 19. After the door 4 has been unlocked, the user pulls the operating lever 8a toward him- or herself to pull the door bolt 9 out of the engagement hole 10 of the body case 1 via the coupling mechanism and thereby open the door 4.

[0022] The locking mechanism 19 locks and unlocks its associated door 4. The locking mechanism 19 includes at least one of the coupling mechanism or the door bolt 9. A detailed configuration of the locking mechanism 19 is already well known in the art and its description will

be omitted herein.

[0023] The communications unit 12, the control board 18a, and the battery housing 101 are provided for the rear surface 7b of the panel 7. Specifically, the communications unit 12, the control board 18a, and the battery housing 101 are provided behind the operating panel 11 of the panel 7. In other words, when the door 4 is viewed from in front of the door 4, at least part of the operating panel 11 overlaps with the communications unit 12, the control board 18a, and the battery housing 101.

[0024] The battery housing 101 has a battery cover 15 and a battery housing case 16. The battery housing case 16 houses a plurality of (e.g., four in this example) batteries 17 (see FIG. 4B) for supplying power to the locking mechanism 19 and the control unit 18 (to be described later). The battery cover 15 is a lid for covering the plurality of batteries 17 housed in the battery housing case 16. In this embodiment, the shell of the batteries 17 is a metallic surface.

[0025] FIG. 4A is a rear view of the panel 7 to which the battery housing 101 is attached. FIG. 4B is a rear view of the panel 7, from which the battery cover 15 of the battery housing 101 is removed.

[0026] FIG. 5 is a rear view of the panel 7, from which the battery housing 101 is removed. As shown in FIG. 5, the control board 18a is provided behind the operating panel 11. The communications unit 12 is mounted on the control board 18a. In this embodiment, the communications unit 12 is provided behind the control board 18a. That is to say, the communications unit 12 is arranged between the battery housing 101 and the panel 7. In other words, the battery housing 101 is provided behind the panel 7 such that the communications unit 12 is arranged between the battery housing 101 and the rear surface of the panel 7. Stated otherwise, the panel 7, the communications unit 12, and the battery housing 101 are arranged in this order from the door 4 toward the storage box 2 in a state where the door 4 is closed.

[0027] The communications unit 12 includes an antenna 12a and a communications module 12b and communicates with communications devices. In this embodiment, the communications devices may be, for example, a delivery service provider terminal 23 owned by a delivery service provider and a user terminal 25 owned by the user who is the recipient of the parcel and uses the delivery locker 100. The delivery service provider terminal 23 may be, for example, a dedicated mobile terminal, a smartphone, or a tablet computer. The user terminal 25 may be, for example, a smartphone or a tablet computer.

[0028] The antenna 12a may be formed as a conductor pattern, for example, on the control board 18a. The communications module 12b has the capability of communicating with an external device such as the communications device described above.

[0029] The control board 18a has the capability of controlling the operation of the locking mechanism 19 (i.e., the capability of controlling locking and unlocking the door 4 by the locking mechanism 19) and corresponds to the control unit 18 to be described later. The control board 18a includes a microcomputer including a processor and a memory. The microcomputer performs the function of the control unit 18 by making the processor execute a program stored in the memory. In this embodiment, the program executed by the processor is stored in advance in the memory of the microcomputer. However, this is only an example and should not be construed as limiting. The program may also be distributed after having been stored in a non-transitory storage medium such as a memory card or downloaded via a telecommunications line such as the Internet.

[0030] The control board 18a includes a board different from a metal base board, e.g., a board made of a resin. In the control board 18a, the microcomputer, electronic devices and other components required for controlling the operation of the locking mechanism 19 are arranged on the resin board. The control unit 18 corresponding to the control board 18a makes the locking mechanism 19 unlock the door 4 in response to the signal received by the communications unit 12.

[0031] In this embodiment, the communications unit 12 is provided behind the operating panel 11. Behind the communications unit 12, a plurality of batteries 17, each of which has a metallic shell, are arranged. That is to say, the operating panel 11, the control board 18a, the communications unit 12, and the batteries 17 (battery housing 101) are arranged in this order backward from the door 4 of the delivery locker 100. In other words, the battery housing 101 is provided for the rear surface 7b of (the operating panel 11 of) the panel 7 and is arranged to sandwich the communications unit 12 and the control board 18a between the rear surface of the operating panel 11 of the panel 7 and the battery housing 101 itself.

[0032] When the door 4 is viewed from in front of the door 4, the operating panel 11 is arranged between the door operator 8 and the hinge mechanism 5 and the communications unit 12 is provided behind the operating panel 11. Thus, when the door 4 is viewed from in front of the door 4, the hinge mechanism 5, the communications unit 12, and the door operator 8 are arranged in this order in the third direction D3 as the predetermined direction.

[0033] (2) System configuration

Next, a delivery system 1000 including management systems 200, each of which is provided for an associated one of the doors 4, will be described.

[0034] As shown in FIG. 6, the delivery system 1000 includes the plurality of management systems 200, a delivery service provider terminal 23 owned by a service person of the delivery service provider, a user terminal 25 owned by the user (i.e., the recipient of a parcel), and a server

24 for managing the status of use of the delivery locker 100. Each of the plurality of management systems 200 is provided for an associated one of the plurality of doors 4 of the delivery locker 100. Each management system 200 is configured to be ready to communicate with the delivery service provider terminal 23 and the user terminal 25. The delivery service provider terminal 23 and the user terminal 25 are configured to be ready to communicate with the server 24.

[0035] (2-1) Management system

As shown in FIG. 6, the management system 200 includes the communications unit 12, the plurality of batteries 17, the control unit 18, the locking mechanism 19, a door sensor 20, and a storage unit 21.

[0036] The communications unit 12 includes the antenna 12a and the communications module 12b as described above. The communications module 12b has the capability of communicating wirelessly with the delivery service provider terminal 23 and the user terminal 25 via the antenna 12a. The communication between the communications unit 12 and the delivery service provider terminal 23 and the user terminal 25 may be established in compliance with a communications protocol such as the Bluetooth® or ZigBee® standard, for example.

[0037] The plurality of batteries 17 are housed in the battery housing 101. The plurality of batteries 17 supply power to the control unit 18, the locking mechanism 19, and the door sensor 20.

[0038] The door sensor 20 senses the associated door 4 be opened and closed. The door sensor 20 outputs the result of sensing to the control unit 18.

[0039] The control unit 18 controls the operation of the locking mechanism 19, controls the communication established by the communications unit 12, and makes management of the presence or absence of any parcel in/from its associated storage box 2. The respective functions of the control unit 18 may be performed by, for example, a microcomputer built in the control board 18a.

[0040] The control unit 18 communicates with the delivery service provider terminal 23 and the user terminal 25 via the communications unit 12, thereby controlling the locking mechanism 19 to either lock or unlock the door 4.

[0041] The control unit 18 controls the locking mechanism 19 to either lock or unlock the door in accordance with an operating command entered via at least one operating key 11a out of the plurality of operating keys 11a of the operating panel 11.

[0042] The control unit 18 determines, based on the result of sensing made by the door sensor 20, whether or not there is any parcel in the associated storage box 2. For example, if the door sensor 20 senses the door be opened and closed in a situation where communication has been

established with the delivery service provider terminal 23, then the control unit 18 decides that a parcel should have been loaded into, and should be now present in, the associated storage box 2. On the other hand, if the door sensor 20 senses the door be opened and closed in a situation where communication has been established with the user terminal 25, then the control unit 18 decides that the parcel should have been unloaded from, and should now be absent from, the associated storage box 2.

[0043] The locking mechanism 19 locks and unlocks the associated door 4. The locking mechanism 19 includes at least one of the coupling mechanism or the door bolt 9 described above. The locking mechanism 19 includes a motor for locking and unlocking the door 4. Rotating the motor under the control of the control unit 18 allows the locking mechanism 19 to lock and unlock the door 4. Specifically, the motor of the locking mechanism 19 receives power supplied from the plurality of batteries 17 and rotates in either a direction in which the door 4 is locked or in a direction in which the door 4 is unlocked under the control.

[0044] The storage unit 21 is implemented as a readable and writable memory. The storage unit 21 memorizes an identifier assigned to its associated storage box 2. The storage unit 21 stores the history of receipt of parcels that have been loaded into the storage box 2. For example, the storage unit 21 may store data about the date and time when a parcel was loaded into the storage box 2 (i.e., the date and time when the delivery service provider delivered the parcel) and data about the date and time when the parcel loaded was unloaded (i.e., the date and time when the user received the parcel) in association with each other.

[0045] The storage unit 21 also stores a flag, indicating whether or not information to be transmitted to the server 24 has been transmitted to the server 24 yet, in association with the information to be transmitted.

[0046] The storage unit 21 further stores an authentication code for use to authenticate the user who is going to receive the parcel. Note that the authentication code is discarded once the parcel has been received by the user.

[0047] (2-2) Delivery service provider terminal

The delivery service provider terminal 23 includes, for example, a microcomputer including a processor and a memory. The microcomputer performs the function of the delivery service provider terminal 23 by making the processor execute a program stored in the memory. In this embodiment, the program executed by the processor is stored in advance in the memory of the microcomputer. However, this is only an example and should not be construed as limiting. The program may also be distributed after having been stored in a non-transitory storage medium such as a memory card or downloaded via a telecommunications line such as the Internet.

[0048] The delivery service provider terminal 23 is configured to communicate with the respective management systems 200 and the server 24.

[0049] The delivery service provider terminal 23 communicates with the server 24 to acquire information about the presence or absence of a parcel in/from each storage box 2. The delivery service provider terminal 23 displays, on a storage box 2 basis, information about the presence or absence of a parcel on a display unit provided for the delivery service provider terminal 23.

[0050] The delivery service provider terminal 23 transmits a request to unlock the door 4 to the management system 200 associated with one storage box 2, in which the parcel should be loaded, out of the plurality of storage boxes 2.

[0051] The delivery service provider terminal 23 generates an authentication code. The delivery service provider terminal 23 transmits the authentication code to the management system 200 associated with one storage box 2, in which the parcel should be loaded, out of the plurality of storage boxes 2. Specifically, the delivery service provider terminal 23 transmits authentication information, including the delivery slip number of the parcel, the authentication code, and the identifier of the storage box 2 to be loaded with the parcel, to the user terminal 25 of the target user via the server 24.

[0052] In addition, upon receiving the information to be transmitted from at least one of the plurality of management systems 200, the delivery service provider terminal 23 transmits the information to be transmitted that has been received to the server 24.

[0053] (2-3) User terminal

The user terminal 25 includes, for example, a microcomputer including a processor and a memory. The microcomputer performs the function of the user terminal 25 by making the processor execute a program stored in the memory. In this embodiment, the program executed by the processor is stored in advance in the memory of the microcomputer. However, this is only an example and should not be construed as limiting. The program may also be distributed after having been stored in a non-transitory storage medium such as a memory card or downloaded via a telecommunications line such as the Internet.

[0054] The user terminal 25 is configured to communicate with the respective management systems 200 and the server 24.

[0055] The user terminal 25 receives the authentication code and the identifier of the storage box 2 from one of the management systems 200 via the server 24. The user terminal 25 stores the authentication code and the identifier of the storage box 2 thus received.

[0056] When receiving the parcel, the user terminal 25 transmits the authentication code to the management system 200 of the storage box 2 associated with the identifier thus received.

[0057] Upon receiving the information to be transmitted from at least one of the plurality of management systems 200, the user terminal 25, as well as the delivery service provider terminal 23, also transmits the information to be transmitted that has been received to the server 24.

[0058] (2-4) Server

The server 24 includes, for example, a microcomputer including a processor and a memory. The microcomputer performs the function of the server 24 by making the processor execute a program stored in the memory. In this embodiment, the program executed by the processor is stored in advance in the memory of the microcomputer. However, this is only an example and should not be construed as limiting. The program may also be distributed after having been stored in a non-transitory storage medium such as a memory card or downloaded via a telecommunications line such as the Internet.

[0059] The server 24 is configured to communicate with the delivery service provider terminal 23 and the user terminal 25.

[0060] The server 24 manages the presence or absence of parcels in/from the respective storage boxes 2. The server 24 store information about the association between the delivery slip numbers and the user terminals of the recipients (users) of the parcels corresponding to the delivery slip numbers.

[0061] Upon receiving the authentication information from the delivery service provider terminal 23, the server 24 transmits the authentication code and identifier of the storage box 2, which are included in the authentication information received, to the user terminal 25 associated with the delivery slip number included in the authentication information.

[0062] (3) Operation

(3-1) Operation when loading parcel

Next, it will be described with reference to FIG. 8 how the delivery system 1000 operates when loading a parcel. The management system 200 shown in FIG. 8 is the management system 200 associated with the target storage box 2 into which the parcel should be loaded.

[0063] When a service person of a delivery service provider enters a wireless communication range of the management system 200, the delivery service provider terminal 23 acquires transmission information transmitted from the communications unit 12 of the management system 200 (in Step S1). At this time, the delivery service provider terminal 23 also acquires transmission information transmitted from the communications unit 12 of another management system 200 of the delivery locker 100. In this case, if the communications protocol is Bluetooth®, then the transmission information is an advertise packet.

[0064] The delivery service provider terminal 23 acquires storage information from the server

24 (in Step S2). In this case, the storage information is information indicating whether or not each storage box 2 is used, i.e., whether or not a parcel is present there.

[0065] The delivery service provider terminal 23 performs display processing (in Step S3). Specifically, the delivery service provider terminal 23 displays, based on the storage information acquired, information indicating whether or not each storage box 2 is used.

[0066] The delivery service provider terminal 23 performs selection processing (in Step S4). Specifically, in accordance with a user's operating command entered through a display screen indicating whether or not each storage box 2 is used, the delivery service provider terminal 23 selects a storage box 2 to be loaded with the parcel, out of a plurality of storage boxes 2.

[0067] The delivery service provider terminal 23 transmits a connection request for establishing a communications link to the communications unit 12 of the management system 200 associated with the storage box 2 selected (in Step S5).

[0068] Upon receiving the connection request, the communications unit 12 of the management system 200 performs processing to establish a communications link with the delivery service provider terminal 23. When completing the processing, the communications unit 12 of the management system 200 transmits a connection established notification, indicating that connection has been established, to the delivery service provider terminal 23 (in Step S6).

[0069] Upon receiving the connection established notification from the communications unit 12, the delivery service provider terminal 23 transmits an unlocking request for unlocking the door 4 to the communications unit 12 of the management system 200 (in Step S7).

[0070] When the communications unit 12 receives the unlocking request, the control unit 18 of the management system 200 performs unlocking processing (in Step S8). Specifically, the control unit 18 drives the motor of the locking mechanism 19 to unlock the door 4.

[0071] When the control unit 18 completes the unlocking processing, the communications unit 12 of the management system 200 transmits an unlocking completed notification, indicating that the door 4 has been unlocked, to the delivery service provider terminal 23 (in Step S9).

[0072] If the door sensor 20 senses the door 4 be opened and then closed, the control unit 18 of the management system 200 performs locking processing (in Step S10). Specifically, the control unit 18 drives the motor of the locking mechanism 19 to lock the door 4.

[0073] When the control unit 18 completes the locking processing, the communications unit 12 of the management system 200 transmits parcel loaded information, indicating that the door 4 has been locked and a parcel has been loaded, to the delivery service provider terminal 23 (in Step S9). In this case, the parcel loaded information includes information indicating that the parcel has been loaded, the identifier of the storage box 2, the date and time when the parcel is loaded (the time

when the locking processing is completed), and information indicating that the storage box 2 is now used.

[0074] Upon receiving the parcel loaded information from the communications unit 12 of the management system 200, the delivery service provider terminal 23 transmits the parcel loaded information thus received to the server 24 (in Step S12).

[0075] Upon receiving the parcel loaded information, the server 24 performs update processing (in Step S13). Specifically, the server 24 stores, in the storage unit 21, data about the date and time when the parcel is loaded into the storage box 2 (i.e., the date and time when the delivery service provider delivered the parcel). This allows the server 24 to manage the presence of the parcel in the storage box 2.

[0076] After having transmitted the parcel loaded information to the server 24, the delivery service provider terminal 23 generates an authentication code (in Step S14). Then, the delivery service provider terminal 23 transmits the authentication code to the communications unit 12 of the management system 200 associated with the target storage box 2 (in Step S15). The delivery service provider terminal 23 further transmits authentication information, including authentication data, the delivery slip number, and the identifier of the storage box 2 in which the parcel is loaded, to the server 24 (in Step S16).

[0077] When the communications unit 12 receives the authentication code, the control unit 18 of the management system 200 performs update processing (in Step S17). Specifically, the control unit 18 stores the authentication code in the storage unit 21. In addition, the control unit 18 also stores the parcel loaded information, which has been transmitted to the delivery service provider terminal 23, as a history of use in association with a flag indicating that the parcel loaded information has been transmitted.

[0078] Upon receiving the authentication information, the server 24 performs transmission processing (in Step S18). Specifically, the server 24 transmits the authentication code and the identifier of the storage box 2, which are included in the authentication information, to the user terminal 25 associated with the delivery slip number included in the authentication information.

[0079] (3-2) Operation when loading parcel

Next, it will be described with reference to FIG. 9 how the delivery system 1000 operates when allowing the user to receive the parcel. The management system 200 shown in FIG. 9 is a management system 200 associated with a storage box 2 loaded with a parcel.

[0080] When the recipient of the parcel (user) enters a wireless communication range of the management system 200, the user terminal 25 acquires transmission information transmitted from the communications unit 12 of the management system 200 (in Step S101). At this time, the user

terminal 25 also acquires transmission information transmitted from the communications unit 12 of another management system 200 of the delivery locker 100. In this case, if the communications protocol is Bluetooth®, then the transmission information is an advertise packet.

[0081] The user terminal 25 performs receipt request processing concerning the receipt of the parcel (in Step S102). Specifically, the user terminal 25 starts a dedicated application in accordance with the user's operating command and accepts a receipt instruction about the receipt of the parcel. When accepting the receipt instruction, the user terminal 25 acquires the authentication code stored and the identifier of the storage box 2 loaded with the parcel.

[0082] The user terminal 25 transmits a connection request for establishing a communications link to the communications unit 12 of the management system 200 for the storage box 2 associated with the identifier acquired (in Step S103).

[0083] Upon receiving the connection request, the communications unit 12 of the management system 200 performs processing to establish a communications link with the user terminal 25. When completing the processing, the communications unit 12 of the management system 200 transmits a connection established notification, indicating that connection has been established, to the user terminal 25 (in Step S104).

[0084] Upon receiving the connection established notification from the communications unit 12, the user terminal 25 transmits an unlocking request for unlocking the door 4 and the authentication code to the communications unit 12 of the management system 200 (in Step S105).

[0085] When the communications unit 12 receives the unlocking request and the authentication code, the control unit 18 of the management system 200 performs authentication processing (in Step S106). Specifically, the control unit 18b determines whether or not the authentication code stored matches the authentication code acquired from the user terminal 25. When finding these authentication codes matching with each other, the control unit 18 decides that the authentication has succeeded. On the other hand, when finding these authentication codes not matching with each other, the control unit 18 decides that the authentication has failed. When deciding that the authentication has failed, the control unit 18 will not perform the rest of the processing.

[0086] When deciding that the authentication has succeeded, the control unit 18 of the management system 200 performs unlocking processing (in Step S107). Specifically, the control unit 18 drives the motor of the locking mechanism 19 to unlock the door 4.

[0087] When the control unit 18 completes the unlocking processing, the communications unit 12 of the management system 200 transmits an unlocking completed notification, indicating that the door 4 has been unlocked, to the user terminal 25 (in Step S108).

[0088] If the door sensor 20 senses the door 4 be opened and then closed, the control unit 18 of

the management system 200 performs locking processing (in Step S109). Specifically, the control unit 18 drives the motor of the locking mechanism 19 to lock the door 4.

[0089] When the control unit 18 completes the locking processing, the communications unit 12 of the management system 200 transmits parcel received information, indicating that the door 4 has been locked and a parcel has been unloaded (i.e., the parcel has been received), to the user terminal 25 (in Step S110). In this case, the parcel received information includes information indicating that the parcel has been received, the identifier of the storage box 2, the date and time when the parcel is unloaded from the storage box 2 (the date and time when the user receives the parcel), and information indicating that the storage box 2 is now unused.

[0090] Upon receiving the parcel received information from the communications unit 12 of the management system 200, the user terminal 25 transmits the parcel received information thus received to the server 24 (in Step S111).

[0091] Upon receiving the parcel received information, the server 24 performs update processing (in Step S112). Specifically, the server 24 stores, in the storage unit 21, data about the date and time when the parcel is unloaded from the storage box 2 (i.e., the date and time when the user receives the parcel). This allows the server 24 to manage the absence of the parcel from the storage box 2.

[0092] After having transmitted the parcel received information, the control unit 18 of the management system 200 performs update processing (in Step S113). Specifically, the control unit 18 also stores the parcel received information, which has been transmitted to the user terminal 25, as a history of use in association with a flag indicating that the parcel received information has been transmitted.

[0093] (3-3) Other operations #1

Next, it will be described how the delivery system 1000 operates when a parcel is loaded using the operation keys 11a. In this case, the communications unit 12 does not communicate with the delivery service provider terminal 23.

[0094] A service person of the delivery service provider performs, by tapping the operation keys 11a, the operation of unlocking the door 4 of the target storage box 2 in which the parcel should be loaded.

[0095] Upon receiving an unlocking instruction given by the unlocking operation, the control unit 18 of the management system 200 for the target storage box 2 makes the locking mechanism 19 unlock the door 4. At this time, the control unit 18 determines, by reference to the latest history information stored, the status of use of the storage box 2. When finding that the latest history information is parcel received information, the control unit 18 decides that there should be

no parcel loaded in the storage box 2 (i.e., that the storage box 2 should be unused).

[0096] If the door sensor 20 senses the door 4 be opened and then closed, the control unit 18 of the management system 200 for the target storage box 2 performs locking processing. When the control unit 18 completes the locking processing, the communications unit 12 of the management system 200 generates and stores parcel loaded information. At this time, the control unit 18 stores the parcel loaded information as a history of use in association with a flag indicating that the parcel loaded information has not been transmitted yet.

[0097] From this point in time on, if the control unit 18 of the management system 200 stores the parcel loaded information in association with a flag indicating that the parcel loaded information has not been transmitted yet, the control unit 18 of the management system 200 transmits the parcel loaded information along with regular information. Upon receiving the parcel loaded information along with the regular information, a communications device transmits the parcel loaded information to the server 24. In addition, the communications device that has received the parcel loaded information along with the regular information transmits transmission completed information, indicating that the parcel loaded information has been transmitted to the server 24, to the management system 200. When the communications unit 12 receives the transmission completed information, the control unit 18 of the management system 200 updates the value of the flag, corresponding to the parcel loaded information transmitted, into a value indicating that the parcel loaded information has been transmitted. As used herein, the “communications device” is a terminal which may communicate with the server 24, e.g., the delivery service provider terminal 23 or the user terminal 25.

[0098] (3–4) Other operations #2

Next, it will be described how the delivery system 1000 operates when a parcel is received using the operation keys 11a. In this case, the communications unit 12 does not communicate with the user terminal 25.

[0099] The recipient of the parcel (i.e., the user) performs, by tapping the operation keys 11a, the operation of unlocking the door 4 of the target storage box 2 in which the parcel to receive is loaded.

[0100] Upon receiving an unlocking instruction given by the unlocking operation, the control unit 18 of the management system 200 for the target storage box 2 makes the locking mechanism 19 unlock the door 4. At this time, the control unit 18 determines, by reference to the latest history information stored, the status of use of the storage box 2. When finding that the latest history information is parcel loaded information, the control unit 18 decides that there should be a parcel loaded in the storage box 2 (i.e., that the storage box 2 should be used).

[0101] If the door sensor 20 senses the door 4 be opened and then closed, the control unit 18 of the management system 200 for the target storage box 2 performs locking processing. When the control unit 18 completes the locking processing, the communications unit 12 of the management system 200 generates and stores parcel received information. At this time, the control unit 18 stores the parcel received information as a history of use in association with a flag indicating that the parcel received information has not been transmitted yet.

[0102] From this point in time on, if the control unit 18 of the management system 200 stores the parcel received information in association with a flag indicating that the parcel received information has not been transmitted yet, the control unit 18 of the management system 200 transmits the parcel received information along with regular information. Upon receiving the parcel received information along with the regular information, a communications device transmits the parcel received information to the server 24. In addition, the communications device that has received the parcel received information along with the regular information transmits transmission completed information, indicating that the parcel received information has been transmitted to the server 24, to the management system 200. When the communications unit 12 receives the transmission completed information, the control unit 18 of the management system 200 updates the value of the flag, corresponding to the parcel received information transmitted, into a value indicating that the parcel received information has been transmitted. As used herein, the “communications device” is a terminal which may communicate with the server 24, e.g., the delivery service provider terminal 23 or the user terminal 25.

[0103] (4) Advantages

As can be seen from the foregoing description, a delivery locker 100 according to this embodiment includes: a body case 1 made of a metallic material and having an opening 3; a door 4 made of a metallic material; a locking mechanism 19; a control unit 18; and a communications unit 12. The door 4 is provided in a readily openable and closable state for the opening 3. The locking mechanism 19 locks and unlocks the door 4. The control unit 18 controls an operation of the locking mechanism 19. The communications unit 12 has an antenna 12a and communicates with an external device. The door 4 has a window 6. A panel 7 made of a resin is fitted into the window 6. The communications unit 12 is provided behind the panel 7. The control unit 18 makes the locking mechanism 19 unlock the door 4 in response to a signal received by the communications unit 12.

[0104] Suppose three axis directions are herein defined with the antenna 12a of the communications unit 12 (e.g., the tip of the antenna 12a) set as the origin. In this example, the second direction D2, the third direction D3, and the first direction D1 are defined to be the X-axis,

the Y-axis, and the Z-axis, respectively. As for the X-axis, the direction pointing from the depth of the storage box 2 toward the door 4 in a state where the door 4 is closed will be hereinafter referred to as a “+X direction” and the direction opposite from the +X direction will be hereinafter referred to as a “-X direction.” As for the Y-axis, the direction pointing from the door operator 8 toward the operating panel 11 will be hereinafter referred to as a “+Y direction” and the direction opposite from the +Y direction will be hereinafter referred to as a “-Y direction.” As for the Z-axis, the upward direction in a state where the delivery locker 100 is installed will be hereinafter referred to as a “+Z direction” and the direction opposite from the +Z direction will be hereinafter referred to as a “-Z direction.” Also, a plane defined by the X-axis and the Y-axis will be hereinafter referred to as an “XY plane,” a plane defined by the Y-axis and the Z-axis will be hereinafter referred to as a “YZ plane,” and a plane defined by the X-axis and the Z-axis will be hereinafter referred to as an “XZ plane.” The XY plane is a plane intersecting at right angles with the door 4 and parallel to the horizontal plane in a state where the delivery locker 100 is installed. The YZ plane is a plane parallel to the door 4 in the closed state. The XZ plane is a plane intersecting at right angles with not only the door 4 but also the horizontal plane in the state where the delivery locker 100 is installed.

[0105] FIGS. 10A–10C show communication characteristics on the respective planes in a situation where the communications unit 12 is built in the delivery locker 100. FIG. 10A shows horizontal polarization characteristics and vertical polarization characteristics on the XY plane. FIG. 10B shows horizontal polarization characteristics and vertical polarization characteristics on the XZ plane. FIG. 10C shows horizontal polarization characteristics and vertical polarization characteristics on the YZ plane.

[0106] As can be seen from FIGS. 10A and 10B, communication is established much more smoothly in the +X direction rather than in the -X direction, i.e., in front of the door 4 rather than behind the door 4.

[0107] In addition, as can be seen from FIG. 10C, communication is established very smoothly in both the +Y direction and the -Y direction, i.e., in the third direction D3. Furthermore, it can also be seen that communication is established very smoothly in both the +Z direction and the -Z direction, i.e., in the first direction D1.

[0108] Consequently, according to this embodiment, in front of the (door 4 of the) body case 1, communication may be established very smoothly in a broad area in the upward/downward direction (first direction D1) and the rightward/leftward direction (third direction D3), thus improving the handiness of the delivery locker 100 significantly.

[0109] As can be seen, this embodiment allows communication to be established very smoothly

in front of the door 4 and in a broad area in the upward/downward direction and the rightward/leftward direction. This result is accomplished by making the panel 7 to be fitted into the window 6 of a resin and making the operating lever 8a and the pivotal portion 8b, which are members provided on the front surface of the panel 7 to form the door operator 8, of a resin. This configuration enables the communications unit 12 provided behind the panel 7 to establish communication very smoothly with a communications device present in front of the (door 4 of the) body case 1 without being disturbed by a metallic member.

[0110] In addition, on the front surface of the panel 7, the operating panel 11 is arranged between the door operator 8 and the hinge mechanism 5. The communications unit 12 is provided behind the operating panel 11, and therefore, is allowed a sufficiently broad communication range in the third direction D3.

[0111] Furthermore, the communications unit 12 is provided behind the operating panel 11. The operating panel 11 also has a plurality of operation keys 11a which are arranged at regular intervals. This allows the communications unit 12 to establish communication very smoothly, through the gaps between the operating keys 11a, with a communications device present in front of the body case 1.

[0112] Furthermore, behind the communications unit 12, the plurality of batteries 17 are arranged to be housed in the battery housing case 16. That is to say, the radio waves emitted from the communications unit 12 are reflected forward by the plurality of batteries 17. This enables establishing communication very smoothly between the communications unit 12 and the communications device in front of the body case 1.

[0113] (5) Variations

Next, variations of the exemplary embodiment described above will be enumerated one after another. Note that the variations to be described below may be adopted as appropriate in combination with the exemplary embodiment described above.

[0114] In the exemplary embodiment described above, the communications unit 12 is provided behind the control board 18a. However, this configuration is only an example and should not be construed as limiting. Alternatively, the communications unit 12 may also be arranged between the operating panel 11 and the control board 18a.

[0115] In the exemplary embodiment described above, the communications unit 12 is provided behind the operating panel 11. However, this configuration is only an example and should not be construed as limiting. Rather, the communications unit 12 has only to be provided behind the panel 7. In particular, the communications unit 12 is suitably provided behind a resin portion of the panel 7.

[0116] In the exemplary embodiment described above, the delivery locker 100 is configured to include a plurality of storage boxes 2. However, this configuration is only an example and should not be construed as limiting. Alternatively, the delivery locker 100 may include only one storage box 2. In that case, the delivery locker 100 is provided with a single management system 200.

[0117] In the exemplary embodiment described above, the delivery locker 100 is configured to be provided with the hinge mechanism 5 at one of the two ends of the door 4 in the third direction D3. However, this configuration is only an example and should not be construed as limiting. Alternatively, the delivery locker 100 may be provided with the hinge mechanism 5 at one of the two ends of the door 4 in the first direction D1. In that case, when the door 4 is viewed from in front of the door 4, the hinge mechanism 5, the communications unit 12, and the door operator 8 are arranged in this order in the first direction D1 as a predetermined direction.

[0118] In the exemplary embodiment described above, the delivery locker 100 is configured to include a plurality of storage boxes 2 arranged in the first direction D1. However, this configuration is only an example and should not be construed as limiting. Alternatively, the delivery locker 100 may also be provided with the storage boxes 2 arranged in the third direction D3. Still alternatively, the delivery locker 100 may also be provided with the storage boxes 2 arranged in the first direction D1 and the third direction D3.

[0119] In the exemplary embodiment described above, the delivery service provider terminal 23 is configured to generate the authentication code. However, this configuration is only an example and should not be construed as limiting. Alternatively, the management system 200 may generate the authentication code. Still alternatively, the server 24 may generate the authentication code.

[0120] The agent that performs the functions of the management system 200 according to the present disclosure includes a computer system. The computer system includes, as hardware components, a processor and a memory. The agent performs the functions of the management system 200 according to the present disclosure by making the processor execute a program stored in the memory of the computer system. The program may be stored in advance in the memory of the computer system. Alternatively, the program may also be downloaded through a telecommunications line. Still alternatively, the program may also be distributed after having been recorded in some non-transitory storage medium such as a memory card, an optical disc, or a hard disk drive, any of which is readable for the computer system. The processor of the computer system may be made up of a single or a plurality of electronic circuits including a semiconductor integrated circuit (IC) or a large-scale integrated circuit (LSI). As used herein, the “integrated circuit” such as an IC or an LSI is called by a different name depending on the degree of integration thereof. Examples of the integrated circuits include a system LSI, a very-

large-scale integrated circuit (VLSI), and an ultra-large-scale integrated circuit (ULSI). Optionally, a field-programmable gate array (FPGA) to be programmed after an LSI has been fabricated or a reconfigurable logic device allowing the connections or circuit sections inside of an LSI to be reconfigured may also be adopted as the processor. Those electronic circuits may be either integrated together on a single chip or distributed on multiple chips, whichever is appropriate. Those multiple chips may be integrated together in a single device or distributed in multiple devices without limitation.

[0121] Also, in the embodiment described above, the plurality of functions of the management system 200 are integrated together in a single housing. However, this configuration for the management system 200 is only an example and should not be construed as limiting. Alternatively, those constituent elements of the management system 200 may be distributed in multiple different housings. Still alternatively, at least some functions of the management system 200 may be implemented as a cloud computing system as well.

[0122] (Recapitulation)

As can be seen from the foregoing description, a delivery locker (100) according to a first aspect includes: a body case (1) made of a metallic material; a door (4) made of a metallic material; a panel (7) made of a resin; a locking mechanism (19); a control unit (18); and a communications unit (12). The body case (1) has an opening (3). The door (4) is provided in a readily openable and closable state for the opening (3) of the body case (1). The locking mechanism (19) locks and unlocks the door (4). The control unit (18) controls an operation of the locking mechanism (19). The communications unit (12) includes an antenna (12a) and communicates wirelessly with an external device (such as a delivery service provider terminal 23 and a user terminal 25). The door (4) has a window (6). The panel (7) is fitted into the window (6). The communications unit (12) is provided behind the panel (7). The control unit (18) makes the locking mechanism (19) unlock the door (4) in response to a signal received by the communications unit (12).

[0123] According to this configuration, the delivery locker (100) includes a panel (7) made of a resin and a communications unit (12) is provided behind the panel (7), thus allowing the communications unit (12) to establish wireless communication without being disturbed by the metallic member. Therefore, the delivery locker (100) may curb a decline in communication quality when wireless communication needs to be established.

[0124] In a delivery locker (100) according to a second aspect, which may be implemented in conjunction with the first aspect, the panel (7) includes an operating panel (11). The operating panel (11) has a plurality of operating keys (11a) which are arranged at predetermined intervals and operated to make the locking mechanism (19) unlock the door (4). The communications unit

(12) is provided behind the operating panel (11).

[0125] This configuration allows the communications unit (12) to establish communication through the gaps between the operating keys (11a). This allows the delivery locker (100) to curb a decline in communication quality when wireless communication needs to be established.

[0126] A delivery locker (100) according to a third aspect, which may be implemented in conjunction with the first or second aspect, further includes a battery housing (101). The battery housing (101) houses a battery (17) to supply power to the locking mechanism (19) and the control unit (18). The battery housing (101) is provided behind the panel (7) such that the communications unit (12) is arranged between the battery housing (101) and a rear surface of the panel (7).

[0127] This configuration causes the radio waves emitted from the communications unit (12) to be reflected forward by the plurality of batteries (17). This allows the delivery locker (100) to curb a decline in communication quality when wireless communication needs to be established.

[0128] A delivery locker (100) according to a fourth aspect, which may be implemented in conjunction with any one of the first to third aspects, further includes a hinge mechanism (5) to open and close the door (4); and a door operator (8). The door operator (8) is provided on a front surface of the panel (7) and operated by a user who is going to open and close the door (4). The hinge mechanism (5), the communications unit (12), and the door operator (8) are arranged in this order in a predetermined direction (third direction D3) when the door (4) is viewed from in front of the door (4).

[0129] This configuration ensures a sufficiently broad communication range in the direction in which the hinge mechanism (5), the communications unit (12), and the door operator (8) are arranged side by side.

[0130] In a delivery locker (100) according to a fifth aspect, which may be implemented in conjunction with the fourth aspect, the door operator (8) is at least partially made of a resin.

[0131] This configuration allows the communications unit (12) to establish wireless communication without being disturbed by the metallic member. Therefore, the delivery locker (100) may curb a decline in communication quality when wireless communication needs to be established.

[0132] In a delivery locker (100) according to a sixth aspect, which may be implemented in conjunction with any one of the first to fifth aspects, the body case (1) has a plurality of openings (3), one of which is the opening (3). The plurality of openings (3) are arranged in a predetermined arrangement direction (such as a first direction D1). A plurality of doors (4), one of which is the door (4), are provided one to one for the plurality of openings (3). Each of the plurality of doors

(4) is provided with the panel (7), the locking mechanism (19), the control unit (18), and the communications unit (12).

[0133] This configuration may curb a decline in communication quality when wireless communication needs to be established by each communications unit (12).

Reference Signs List

[0134]	1	Body Case
	3	Opening
	4	Door
	5	Hinge Mechanism
	6	Window
	7	Panel
	8	Door Operator
	11	Operating Panel
	11a	Operating Key
	12	Communications Unit
	12a	Antenna
	12b	Communications Module
	17	Battery
	18	Control Unit
	18a	Control Board
	19	Locking Mechanism
	23	Delivery Service Provider Terminal
	24	Server
	25	User Terminal
	100	Delivery Locker
	101	Battery Housing
	200	Management System
	1000	Delivery System
	D1	Arrangement Direction (First Direction)
	D2	Depth Direction (Second Direction)
	D3	Width Direction (Third Direction)

CLAIMS

1. A delivery locker comprising:
 - a body case made of a metallic material and having an opening;
 - a door made of a metallic material and provided in a readily openable and closable state for the opening of the body case;
 - a panel made of a resin;
 - a locking mechanism configured to lock and unlock the door;
 - a control unit configured to control an operation of the locking mechanism; and
 - a communications unit including an antenna and configured to communicate wirelessly with an external device,
 - the door having a window,
 - the panel being fitted into the window,
 - the communications unit being provided behind the panel,
 - the control unit being configured to make the locking mechanism unlock the door in response to a signal received by the communications unit.
2. The delivery locker of claim 1, wherein
 - the panel includes an operating panel having a plurality of operating keys which are arranged at predetermined intervals and configured to be operated to make the locking mechanism unlock the door, and
 - the communications unit is provided behind the operating panel.
3. The delivery locker of claim 1 or 2, further comprising a battery housing configured to house a battery to supply power to the locking mechanism and the control unit, wherein
 - the battery housing is provided behind the panel such that the communications unit is arranged between the battery housing and a rear surface of the panel.

4. The delivery locker of any one of claims 1 to 3, further comprising:
a hinge mechanism configured to open and close the door; and
a door operator provided on a front surface of the panel and configured to be operated by a user who is going to open or close the door, wherein
the hinge mechanism, the communications unit, and the door operator are arranged in this order in a predetermined direction when the door is viewed from in front of the door.
5. The delivery locker of claim 4, wherein
the door operator is at least partially made of a resin.
6. The delivery locker of any one of claims 1 to 5, wherein
the body case has a plurality of openings, one of which is the opening,
the plurality of openings are arranged in a predetermined arrangement direction,
a plurality of doors, one of which is the door, are provided one to one for the plurality of openings, and
each of the plurality of doors is provided with the panel, the locking mechanism, the control unit, and the communications unit.