

DESCRIPTION

Title of Invention

REFRIGERATOR

5 Technical Field

[0001]

The present disclosure relates to a refrigerator and more particularly to a refrigerator that suggests a storage method to a user when the user stores a food or a food ingredient in the refrigerator.

10 Background Art

[0002]

An existing refrigerator determines whether a food for storage has been placed inside or removed from the refrigerator by capturing, using a camera installed in the refrigerator, an image of the food and generates an inside-of-refrigerator food list (for example, see Patent Literature 1).

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[0003]

Another existing refrigerator specifies the names of food ingredients in the refrigerator and displays food ingredients present in the refrigerator, a recipe received from a server, and information about food ingredients that need to be purchased to make a food in accordance with the recipe (for example, see Patent Literature 2).

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Citation List

Patent Literature

[0004]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2019-070477

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Patent Literature 2: Japanese Unexamined Patent Application Publication No. 2019-095172

Summary of Invention

Technical Problem

[0005]

In Patent Literature 1 described above, a food in a refrigerator is specified and is added to a list; however, which storage compartment the food should be stored in is not suggested.

5 [0006]

In Patent Literature 2 described above, a recipe is suggested on the basis of information regarding food ingredients in the refrigerator; however, how the food should be stored is not suggested in a case where the food is left over or a case where the food is a make-ahead meal prepared to be stored.

10 [0007]

The present disclosure has been made to solve such problems and aims to obtain a refrigerator that can suggest, to a user, a storage environment suited to storing a storage item in a case where the storage item is to be stored.

Solution to Problem

15 [0008]

A refrigerator according to an embodiment of the present disclosure includes a main body, a communication device provided in the main body and configured to communicate with a controller and a mobile terminal, and a first storage device in which function data indicating a function of the refrigerator and setting data indicating a current setting state of the refrigerator are stored. The controller is installed outside or inside the main body. The communication device is configured to transmit the function data and the setting data to the controller. The controller has a second storage device in which a shelf life database is stored in advance in which one or more shelf lives of one or more respective storage items are set separately for each storage environment. The controller is configured to receive the function data and the setting data from the communication device, to extract, from the shelf life database on the basis of the function data and the setting data, a storage environment and a shelf life set for the storage environment, the storage environment being suited to the function of the refrigerator and the current setting state of the

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refrigerator and being extracted as a storage environment in which a storage item to be stored in the refrigerator is to be stored, and to output the extracted storage environment and the extracted shelf life.

Advantageous Effects of Invention

5 [0009]

A refrigerator according to an embodiment of the present disclosure can suggest, to a user, a storage environment suited to a storage item in a case where the storage item is to be stored.

Brief Description of Drawings

10 [0010]

[Fig. 1] Fig. 1 is a front view illustrating the configuration of the entirety of a refrigerator 1 according to Embodiment 1.

[Fig. 2] Fig. 2 is a sectional side view illustrating the configuration of the refrigerator 1 according to Embodiment 1.

15 [Fig. 3] Fig. 3 is a diagram illustrating the relationship between the refrigerator 1 according to Embodiment 1 and individual communication devices.

[Fig. 4] Fig. 4 is a flow chart illustrating the procedure of processing regarding presentation of a storage environment for a storage item in the refrigerator 1 according to Embodiment 1.

20 [Fig. 5] Fig. 5 is a flow chart illustrating the procedure of processing regarding presentation of a storage expiry date of the storage item in the refrigerator 1 according to Embodiment 1.

[Fig. 6] Fig. 6 is a diagram illustrating storage item names 18 registered in an external network 11 according to Embodiment 1.

25 [Fig. 7] Fig. 7 is a diagram illustrating a shelf life database 19, which the external network 11 according to Embodiment 1 has.

[Fig. 8] Fig. 8 is a diagram illustrating an example of function data 20 regarding the refrigerator 1 according to Embodiment 1.

[Fig. 9] Fig. 9 is a diagram illustrating setting data 21 regarding the refrigerator 1 according to Embodiment 1.

[Fig. 10] Fig. 10 is a diagram illustrating an example of storage suggestion information 30 displayed by a mobile terminal 14 according to Embodiment 1.

[Fig. 11] Fig. 11 is a front view illustrating an example of a panel 13 of the refrigerator 1 according to Embodiment 1.

[Fig. 12] Fig. 12 is a diagram illustrating an example of a storage expiry date list 40 stored in the external network 11 according to Embodiment 1.

[Fig. 13] Fig. 13 is a diagram illustrating an example of an approaching expiry notification 41 displayed by the mobile terminal 14 according to Embodiment 1.

[Fig. 14] Fig. 14 is a diagram illustrating an example of a number-of-days-stored notification 42 displayed by the mobile terminal 14 according to Embodiment 1.

[Fig. 15] Fig. 15 is a flow chart illustrating the procedure of processing performed by a refrigerator 1 according to Embodiment 2.

[Fig. 16] Fig. 16 is a diagram illustrating an example of a food list 50 of an external network 11 according to Embodiment 2.

[Fig. 17] Fig. 17 illustrates an example of list data 60 regarding storage items 17 displayed by a mobile terminal 14 according to Embodiment 2.

[Fig. 18] Fig. 18 is a diagram illustrating an example of a recommended recipe displayed by the mobile terminal 14 according to Embodiment 2.

Description of Embodiments

[0011]

In the following, embodiments of a refrigerator according to the present disclosure will be described with reference to the drawings. The present disclosure is not limited to the embodiments below, and various changes can be made without departing from the gist of the present disclosure. Moreover, the present disclosure includes all combinations that can be made from configurations illustrated in each of the embodiments below and their modifications. In the individual drawings, items

denoted by the same reference signs are identical or substantially identical, and this applies to the entire description of the present specification. Note that, in each diagram, the relationship between the relative sizes, shapes, or other properties of individual components may be different from actual ones.

[0012]

Embodiment 1

Fig. 1 is a front view illustrating the configuration of the entirety of a refrigerator 1 according to Embodiment 1. Fig. 2 is a sectional side view illustrating the configuration of the refrigerator 1 according to Embodiment 1. Fig. 3 is a diagram illustrating the relationship between the refrigerator 1 according to Embodiment 1 and individual communication devices. Fig. 4 is a flow chart illustrating the procedure of processing regarding presentation of a storage environment for a storage item in the refrigerator 1 according to Embodiment 1. Fig. 5 is a flow chart illustrating the procedure of processing regarding presentation of a storage expiry date of the storage item in the refrigerator 1 according to Embodiment 1.

[0013]

As illustrated in Figs. 1 and 2, a main body 1a of the refrigerator 1 is provided with five compartments as storage compartments classified by purpose, which are a refrigerator compartment 2, a versatile compartment 3, an ice-making compartment 4, a freezer compartment 5, and a vegetable compartment 6.

[0014]

As illustrated in Fig. 2, a main control unit 7 for controlling the operation of the refrigerator 1 is provided at the top of the back of the refrigerator 1. Moreover, a first storage device 7a is connected to the main control unit 7.

[0015]

As illustrated in Fig. 1, the refrigerator compartment 2 has a refrigerator compartment left door 8 and a refrigerator compartment right door 9. A pair of hinges 10 is provided at the top of the refrigerator 1 and serves as a rotating shaft of the refrigerator compartment left door 8 and a rotating shaft of the refrigerator

compartment right door 9. The refrigerator compartment 2 has a plurality of shelves 2a in its inside.

[0016]

The versatile compartment 3, the ice-making compartment 4, the freezer compartment 5, and the vegetable compartment 6 are pull-out drawer type storage compartments. The versatile compartment 3 has a plurality of storage modes and can be switched between the storage modes in accordance with a command from a user. The storage modes include, for example, a normal mode, a supercooling freezing mode, and a subzero mode. The other storage compartments may also have a plurality of storage modes.

[0017]

As illustrated in Fig. 2, one of the hinges 10 is provided with a communication device 12. The communication device 12 may be provided inside the hinge 10 or may also be fixed to the surface of the hinge 10. As illustrated in Fig. 3, the communication device 12 can communicate with an external network 11, which is provided outside. The external network 11 is, for example, a cloud server. The external network 11 has a second storage device 11a for storing, for example, a shelf life database 19 to be described later (see Fig. 7). In Embodiment 1, a description will be made, as an example, by use of the case where the external network 11 operates as a controller that manages the shelf lives of storage items. However, the main control unit 7 of the refrigerator 1 may operate as the controller.

[0018]

The communication device 12 may be directly connected to the external network 11 or may also be configured to communicate with the external network 11 through a gateway 15 provided separately from the refrigerator 1 as illustrated in Fig. 3. In the description above, the communication device 12 is described as being provided in the hinge 10; however, the communication device 12 is not limited to this case. The communication device 12 may be installed at any position of the

refrigerator 1 or at any position inside the room where the refrigerator 1 is installed as long as there is a space where the communication device 12 can be installed.

[0019]

As illustrated in Figs. 2 and 3, the refrigerator compartment left door 8 is provided with a panel 13. Fig. 11 is a front view illustrating an example of the panel 13 of the refrigerator 1 according to Embodiment 1. The panel 13 accepts an operation performed by a user and displays a message for the user on the screen. Specifically, as illustrated in Fig. 11, the panel 13 has buttons that the user operates, and accepts input settings of temperatures of the individual storage compartments and input settings of the storage modes of the individual storage compartments. Moreover, as illustrated in Fig. 11, the panel 13 has a display screen 13b for displaying a message for the user. The panel 13 is electrically connected to the main control unit 7 as illustrated in Fig. 2. Note that the panel 13 is connected through the hinge 10 to the main control unit 7 by a wiring line as illustrated in Fig. 2. Thus, the panel 13 may be directly connected to the main control unit 7 or may also be electrically connected to the main control unit 7 via the communication device 12 in the hinge 10.

[0020]

The main control unit 7 exercises control to adjust the temperature environment of each storage compartment on the basis of information regarding the set temperature of the storage compartment and the storage mode of the storage compartment set through the panel 13.

[0021]

Moreover, as illustrated in Fig. 3, a mobile terminal 14 that the user owns is connected to the external network 11 and the gateway 15 such that communication is possible. Thus, the mobile terminal 14 can be connected to the communication device 12 via the external network 11 or the gateway 15. Thus, the mobile terminal 14 can be connected to the main control unit 7 via the communication device 12. The user can input a temperature setting of each storage compartment and a storage

mode setting of the storage compartment by operating the mobile terminal 14 instead of the panel 13. The mobile terminal 14 has a screen for performing screen display. Note that the mobile terminal 14 is, for example, a smartphone or a tablet terminal.

[0022]

5 The refrigerator compartment 2 is provided with an interior camera 16 as illustrated in Fig. 2. The interior camera 16 captures images of the internal space of the refrigerator compartment 2. The interior camera 16 is attached to, for example, the refrigerator compartment left door 8 or the refrigerator compartment right door 9. Specifically, the interior camera 16 is fixed to the face of the refrigerator compartment
10 left door 8 that faces the storage compartments or the face of the refrigerator compartment right door 9 that faces the storage compartments. The refrigerator compartment 2 may be provided with one interior camera 16, or each shelf 2a may be provided with one interior camera 16. Alternatively, in a case where one interior camera 16 is provided, the interior camera 16 may be moved from one shelf 2a to
15 another shelf 2a. In this case, the refrigerator compartment left door 8 or the refrigerator compartment right door 9 is provided with a guide rail for guiding movement of the interior camera 16. The guide rail is installed to extend in a vertical direction. The interior camera 16 is moved along the guide rail in the up-down directions by a driving device such as a motor. As a result, one interior
20 camera 16 can capture images of the internal spaces defined by the individual shelves 2a of the refrigerator compartment 2. In a state where the refrigerator compartment left door 8 or the refrigerator compartment right door 9 of the refrigerator 1 is closed, the interior camera 16 is present in the refrigerator compartment 2. Thus, when the refrigerator compartment left door 8 or the
25 refrigerator compartment right door 9 of the refrigerator 1 is opened, water condensation may occur on the lens of the interior camera 16. Thus, the interior camera 16 may be provided with a lens heater as needed.

[0023]

The versatile compartment 3, the ice-making compartment 4, the freezer compartment 5, and the vegetable compartment 6 may also be each provided with an interior camera 16.

[0024]

Moreover, as illustrated in Fig. 2, the refrigerator compartment 2 is provided with a best before date detection sensor 25 as needed. The best before date detection sensor 25 is, for example, a gas sensor, a temperature sensor, or a weight sensor. The best before date detection sensor 25 estimates the best before dates of storage items 17 stored in the refrigerator compartment 2. The refrigerator compartment 2 may be provided with one best before date detection sensor 25, or each shelf 2a may be provided with one best before date detection sensor 25.

[0025]

The versatile compartment 3 and the vegetable compartment 6 may also be each provided with a best before date detection sensor 25.

[0026]

The following describes processing in a method for presenting, to a user, a storage environment for a storage item. Fig. 4 illustrates a flow chart indicating the procedure of processing in the method. Fig. 4 illustrates the procedure of processing from when an image of a storage item 17 is captured to when the image is presented to a user.

[0027]

As illustrated in Fig. 4, in step S101, the user captures, using the mobile terminal 14, an image of a storage item 17 to be stored in the refrigerator 1 and transmits the captured image to the external network 11. The storage item 17 is, for example, a food ingredient purchased by the user or a food prepared by the user. By receiving the captured image of the storage item 17 from the mobile terminal 14, the external network 11 recognizes that the storage item 17 is a storage item designated by the user.

[0028]

An image of the storage item 17 may be captured in step S102 by the interior camera 16 installed in the refrigerator 1. Step S102 is performed as needed. In a case where step S102 is performed, processing in step S101 may or may not be performed. Step S102 is performed, for example, at the timing at which the user stores the storage item 17 into the refrigerator 1. The communication device 12 of the refrigerator 1 transmits the image captured by the interior camera 16 to the external network 11. By receiving the captured image of the storage item 17 from the communication device 12 of the refrigerator 1, the external network 11 recognizes that the storage item 17 is a storage item designated by the user. An image may be automatically captured by the interior camera 16 when the refrigerator compartment left door 8 or the refrigerator compartment right door 9 is opened and closed, or an image may also be captured by the user operating the interior camera 16.

[0029]

In this manner, an image of the storage item 17 may be captured by the interior camera 16 serving as a first camera or by a built-in camera included in the mobile terminal 14 and serving as a second camera.

[0030]

Next, in step S103, the external network 11 receives the captured image and automatically recognizes a storage item name 18 from the captured image. The storage item name 18 is a food name or a food ingredient name of the storage item 17. The recognition is performed through, for example, pattern recognition processing. In step S104, the recognized storage item name 18 is stored in the second storage device 11a of the external network 11 and is thus registered in the external network 11. Fig. 6 is a diagram illustrating storage item names 18 registered in the external network 11 according to Embodiment 1.

[0031]

Note that just in case where the storage item name 18 of the storage item 17 cannot be automatically recognized by the external network 11, the user is allowed to manually input the storage item name 18 in step S105. In step S105, the user

inputs the storage item name 18 of the storage item 17 into the mobile terminal 14 and transmits it to the external network 11. As a result, the storage item name 18 is registered in the external network 11. Step S105 is performed as needed.

Alternatively, to prompt the user to perform step S105, the external network 11 may transmit a message saying "the name of the storage item could not be recognized" to the mobile terminal 14.

[0032]

The shelf life database 19 is stored in the second storage device 11a of the external network 11. Fig. 7 is a diagram illustrating the shelf life database 19, which the external network 11 according to Embodiment 1 has. In the shelf life database 19, for example, storage recommendation data such as a recommended storage environment and a shelf life is stored for each storage item name 18. As illustrated in Fig. 7, the shelf life database 19 stores, for each storage item name 18, a plurality of storage environments suited to storing the storage item 17 and furthermore stores, for each storage environment, the shelf life of the storage item 17. For example, in a case where the storage item name 18 is "pork belly", the stored shelf life is "2 days" when the storage environment is the "refrigerator compartment" and is "30 days" when the storage environment is the "freezer compartment". These shelf lives are not best before dates written on the product and are, for example, use-by dates or expiration dates usually recommended by government and municipal offices.

[0033]

The description returns to Fig. 4. In step S106, the external network 11 acquires storage recommendation data regarding the storage item name 18 registered in step S104 from the shelf life database 19.

[0034]

In step S107, the external network 11 acquires function data 20 indicating the functions of the refrigerator 1 from the main control unit 7 of the refrigerator 1 via the communication device 12. Fig. 8 is a diagram illustrating an example of the function data 20 regarding the refrigerator 1 according to Embodiment 1. The function data

20 is stored in the first storage device 7a of the main control unit 7. In the function data 20, as illustrated in Fig. 8, the types of storage compartments of the refrigerator 1 and the storage modes of the refrigerator 1 are stored. In step S107, the external network 11 acquires, as the function data 20, for example, data indicating the presence or absence of the supercooling freezing mode of the versatile compartment 3.

[0035]

In step S108, the external network 11 acquires setting data 21 indicating a current setting state of the refrigerator 1 from the main control unit 7 of the refrigerator 1 via the communication device 12. Fig. 9 is a diagram illustrating the setting data 21 regarding the refrigerator 1 according to Embodiment 1. The setting data 21 is stored in the first storage device 7a of the main control unit 7. In the setting data 21, setting information and other information are stored as illustrated in Fig. 9. The setting information includes set temperatures for the individual storage compartments of the refrigerator 1 and the storage modes for the individual storage compartments. In step S108, the external network 11 acquires, as the setting data 21, for example, setting information that the temperature setting of the freezer compartment 5 is "low" and other information.

[0036]

In step S110, the external network 11 checks the storage recommendation data, the function data 20, and the setting data 21 acquired in steps S106 to S108 against each other. That is, the external network 11 extracts, from the storage recommendation data acquired from the shelf life database 19, a storage environment for the storage item 17 suited to the functions of the refrigerator 1 and the current setting state of the refrigerator 1. Moreover, the external network 11 extracts a shelf life set for the extracted storage environment from the shelf life database 19.

[0037]

In step S111, the external network 11 presents, as the storage environment extracted in step S110, a storage compartment of the refrigerator 1 suited to storing the storage item 17. Moreover, the external network 11 may present, as the storage environment, the set temperature of the storage compartment suited to storing the storage item 17. Furthermore, the external network 11 may present, as the storage environment, the storage mode of the storage compartment suited to storing the storage item 17. In the following, these pieces of presented information will be referred to as storage suggestion information 30 (see Fig. 10). The storage suggestion information 30 includes at least one out of the storage compartment, the set temperature, and the storage mode.

[0038]

As a method for presenting the storage suggestion information 30 to the user in step S111, for example, the storage suggestion information 30 is displayed on the display screen of the mobile terminal 14 communicating with the external network 11 or on the panel 13 of the refrigerator 1 via the main control unit 7.

[0039]

Fig. 10 is a diagram illustrating an example of the storage suggestion information 30 displayed by the mobile terminal 14 according to Embodiment 1. As illustrated in Fig. 10, the storage item name 18 and the storage suggestion information 30 are displayed on the display screen of the mobile terminal 14.

[0040]

In this manner, by registering purchased food ingredients or prepared foods in the external network 11, the user can create and manage a list of the food ingredients or the foods. Moreover, as illustrated in Fig. 10, the user can check the storage item name 18 and the storage suggestion information 30 on the display screen of the mobile terminal 14. Thus, the user can be informed of storage methods suited to the food ingredients and foods and the refrigerator 1 of the user.

[0041]

Fig. 11 illustrates an example of the storage suggestion information 30 displayed on the panel 13 of the refrigerator 1. As illustrated in Fig. 11, the storage item name 18 and the storage suggestion information 30 are displayed on the display screen 13b of the panel 13. Note that the display screen 13b does not always have to be displayed on the panel 13 and may be displayed on the panel 13 when the user touches a main switch 13a.

[0042]

Regarding the process in Fig. 4, a description will be made by use of a specific example. For example, the user captures an image of some pork belly purchased at a supermarket as a storage item 17 using the mobile terminal 14 and registers a storage item name 18 in the external network 11. The external network 11 acquires storage recommendation data regarding the registered storage item name 18 from the shelf life database 19. That is, as illustrated in Fig. 7, pieces of data indicating that pork belly can be stored for 2 days in the refrigerator compartment, 6 days in a chilling compartment, 14 days in the versatile compartment 3 with the supercooling freezing mode, and 30 days in the freezer compartment is stored in the shelf life database 19. Thus, the external network 11 acquires these pieces of data as storage recommendation data. The external network 11 checks the acquired storage recommendation data against the function data 20 and the setting data 21 regarding the refrigerator 1. Specifically, the external network 11 comprehends, on the basis of the function data 20 regarding the refrigerator 1, that the refrigerator 1 used by the user is provided with the versatile compartment 3, the versatile compartment 3 can be set to the supercooling freezing mode, and a chilling compartment is not provided. Moreover, the external network 11 comprehends, on the basis of the setting data 21 regarding the refrigerator 1, that the versatile compartment 3 of the refrigerator 1 used by the user is currently set to the supercooling freezing mode. The external network 11 first excludes, on the basis of these pieces of comprehended information, information regarding the chilling compartment from the storage recommendation data acquired in advance.

Moreover, the external network 11 compares the freezer compartment 5 with the versatile compartment 3 set to the supercooling freezing mode and prioritizes and chooses the versatile compartment 3, which can keep storage items fresher than can the freezer compartment 5. Here, the external network 11 is defined to prestore priority levels of the individual storage compartments in the second storage device 11a. In this manner, the external network 11 transmits, to the mobile terminal 14 of the user, storage suggestion information 30 (see Fig. 10) indicating that pork belly can be stored for 2 days in the refrigerator compartment 2 but can be stored for 14 days in the versatile compartment 3 set to the supercooling freezing mode.

Moreover, without using the priority levels, the external network 11 may transmit, as the storage suggestion information 30, all the candidates that the user can select from, that is, all of the refrigerator compartment 2, the versatile compartment 3, and the freezer compartment 5.

[0043]

Through the storage suggestion information 30, the user can easily know which storage compartment, which set temperature, and which storage mode are suited to storing the storage item 17. Moreover, in recent years, the refrigerator 1 has the supercooling freezing mode, the subzero mode, and other mode, and the functions of the refrigerator 1 have been more and more complicated each year.

The user can easily know, from the storage suggestion information 30, the functions of the refrigerator 1 that have been more and more complicated as above without referring to its manual while actually using the refrigerator 1, that is, while storing the storage item 17 into the refrigerator 1.

[0044]

Next, Fig. 5 illustrates a flow chart indicating the procedure of processing in a method for presenting, to a user, a storage expiry date of a storage item in the refrigerator 1 according to Embodiment 1. Fig. 5 illustrates the procedure of processing from when a storage item 17 is stored to when the number of days of the shelf life of the storage item 17 is presented to the user. Moreover, Fig. 12 is a

diagram illustrating an example of a storage expiry date list 40 stored in the external network 11 according to Embodiment 1.

[0045]

As illustrated in Fig. 5, in step S201, the user stores the storage item 17 into the refrigerator 1.

[0046]

In step S202, the refrigerator 1 specifies a storage location of the storage item 17 in the refrigerator 1 by causing the interior camera 16 to capture an image of the storage item 17. The refrigerator 1 transmits the specified storage location of the storage item 17 to the external network 11.

[0047]

In step S203, the external network 11 registers the specified storage location, which is denoted by 22, of the storage item 17 in the storage expiry date list 40 illustrated in Fig. 12. As a result, which storage compartment of the refrigerator 1 the storage item 17 has been stored in can be automatically registered. The storage expiry date list 40 is stored in the second storage device 11a.

[0048]

Just in case where the storage location 22 of the storage item 17 cannot be specified using the interior camera 16, the user is allowed to manually input the storage location 22 of the storage item 17 in step S204. Note that step S204 is performed as needed. Alternatively, to prompt the user to perform step S204, the refrigerator 1 may transmit a message saying "storage location could not be specified" to the mobile terminal 14. In step S204, the user inputs the storage location 22 of the storage item 17 into the mobile terminal 14 and transmits it to the external network 11. As a result, the storage location 22 of the storage item 17 is registered in the storage expiry date list 40 of the external network 11.

[0049]

In step S205, the external network 11 determines whether the storage item name 18 of the storage item 17 has already been registered in the storage expiry

date list 40. In a case where the storage item name 18 has already been registered, the process proceeds to step S206. In a case where the storage item name 18 has not yet been registered, processing in steps S103 to S105 will be performed. Steps S103 to S105 have already been described using Fig. 4, and thus their description will be omitted here.

[0050]

In step S206, the external network 11 registers the date at which the storage item 17 is stored into the refrigerator 1 as a storage date 23 in the storage expiry date list 40.

[0051]

In step S207, the external network 11 counts the number of elapsed days 24 for the storage item 17 stored in the refrigerator 1 and registers the number of elapsed days 24 in the storage expiry date list 40. The number of elapsed days 24 is updated every day at the same time of day, for example, at midnight. Note that the amount of time elapsed may be registered instead of the number of elapsed days 24.

[0052]

In step S208, the external network 11 acquires a shelf life regarding the registered storage item name 18 from the shelf life database 19.

[0053]

In step S209, the external network 11 determines whether a storage expiry date 26 of the storage item 17 is within a short time by comparing the shelf life acquired in step S208 with the number of elapsed days 24 in the storage expiry date list 40. For example, a case will be discussed where some pork belly is stored in the versatile compartment 3, and the number of elapsed days indicates 4 days. In this case, for the pork belly stored in the versatile compartment, a shelf life of 14 days is stored in the shelf life database 19. Thus, the external network 11 compares the number of elapsed days of 4 days with the shelf life of 14 days and determines that the storage expiry date 26 is not within a short time. In contrast, in a case where the

number of elapsed days indicates 13 days, the external network 11 compares the number of elapsed days of 13 days with the shelf life of 14 days and determines that the storage expiry date 26 is within a short time. That is, the external network 11 determines that the storage expiry date 26 is within a short time in a case where the difference between the number of elapsed days and the shelf life is less than or equal to a preset threshold, and the process proceeds to step S210. Otherwise, the external network 11 determines that the storage expiry date 26 is not within a short time, and the process proceeds to step S211.

[0054]

Note that, as illustrated in Fig. 12, the storage expiry date 26 may be calculated on the basis of the number of elapsed days 24 and the shelf life database 19 and registered in the storage expiry date list 40 by the external network 11; however, the storage expiry date 26 does not have to be registered in particular. In a case where the storage expiry date 26 is not registered, the external network 11 calculates the storage expiry date 26 on an as-needed basis.

[0055]

In step S210, the external network 11 transmits an approaching expiry notification 41 to the mobile terminal 14 to report that the storage expiry date 26 of the storage item 17 is approaching. Fig. 13 is a diagram illustrating an example of the approaching expiry notification 41 displayed by the mobile terminal 14 according to Embodiment 1. As illustrated in Fig. 13, the storage item name 18 and the approaching expiry notification 41 are displayed on the display screen of the mobile terminal 14.

[0056]

In step S211, the external network 11 regularly presents, at predetermined intervals, a number-of-days-stored notification 42 to the user. The number-of-days-stored notification 42 reports the numbers of elapsed days 24 included in the storage expiry date list 40. To present the number-of-days-stored notification 42, the number-of-days-stored notification 42 is displayed on the display screen of the

mobile terminal 14 or on the display screen 13b of the panel 13 of the refrigerator 1. Intervals at which the number-of-days-stored notification 42 is presented can be set by the user. Fig. 14 is a diagram illustrating an example of the number-of-days-stored notification 42 displayed by the mobile terminal 14 according to Embodiment 1. As illustrated in Fig. 14, the storage item names 18 and the number-of-days-stored notification 42 are displayed on the display screen of the mobile terminal 14. A method for displaying the number-of-days-stored notification 42 on the panel 13 is only required to be performed as in the case of the approaching expiry notification 41 illustrated in Fig. 13 is displayed, and thus its description will be omitted here.

[0057]

Note that, in step S209, the external network 11 presents the approaching expiry notification 41 to the user in a case where the storage expiry date 26 of the storage item 17 is approaching; however, what is presented is not limited to this. For example, in a case where the storage expiry date 26 of the storage item 17 is over, the external network 11 may present an expiry notification to the user as in the case of the approaching expiry notification 41. Note that a method for presenting an expiry notification to the user is substantially the same as the above-described method. Moreover, the content of the expiry notification is, for example, "Storage item name: pork belly Storage expiry date is over". Both of or one out of the approaching expiry notification 41 and the expiry notification may be presented to the user.

[0058]

In a case where the refrigerator 1 is provided with the best before date detection sensor 25, processing in step S212 of Fig. 5 may be performed. The best before date detection sensor 25 is, for example, a gas sensor, a temperature sensor, or a weight sensor. The best before date detection sensor 25 estimates the storage expiry date of the storage item 17 from a detection result. In step S212, in a case where the storage expiry date of the storage item 17 is estimated from a detection result, the best before date detection sensor 25 transmits the estimated storage

expiry date to the main control unit 7. The main control unit 7 transmits the estimated storage expiry date to the external network 11 via the communication device 12. The external network 11 determines, in step S209, whether the storage expiry date 26 of the storage item 17 is approaching on the basis of the received
5 estimated storage expiry date and the number of elapsed days 24. Processing in steps S210 and S211 has already been described above, and thus their description will be omitted here.

[0059]

In this manner, the user can be regularly informed of the use-by date or the
10 expiration date of the stored storage item 17 through the presented approaching expiry notification 41, and thus the risk of forgetting the stored storage item and letting the stored storage item spoil can be reduced.

[0060]

As described above, in Embodiment 1, the user can be informed of a method
15 suited to storing a food ingredient or a food through the process in Fig. 4. Moreover, the risk of wasting the food ingredient or the food can be reduced through the process in Fig. 5, and thus the user can relieve their stress and resolve their dissatisfaction regarding storage of food in the refrigerator.

[0061]

In the following, the hardware configurations of the external network 11 and the
20 main control unit 7 and the hardware configurations of the first storage device 7a and the second storage device 11a will be described. The external network 11 and the main control unit 7 include controllers. Functions of the external network 11 and the main control unit 7 are implemented by processing circuits. The processing circuits
25 include dedicated hardware devices or processors. Examples of the dedicated hardware devices include an application specific integrated circuit (ASIC) or a field programmable gate array (FPGA). The processors execute programs stored in a memory or memories. Both of the first storage device 7a and the second storage device 11a include memories. Examples of the memories include a nonvolatile or

volatile semiconductor memory such as a random access memory (RAM), a read only memory (ROM), a flash memory, or an erasable programmable ROM (EPROM) or a disk or disc such as a magnetic disk, a flexible disk, or an optical disc.

[0062]

5 Note that, as described above, processing performed by the external network 11 described in Embodiment 1 may be performed by the main control unit 7 of the refrigerator 1. In this case, all the data stored in the second storage device 11a is stored in the first storage device 7a.

[0063]

10 Embodiment 2

In Embodiment 2, the user can register a photograph, a rating, and a recipe of a food prepared by the user in the external network 11. Fig. 15 is a flow chart illustrating the procedure of processing performed by a refrigerator 1 according to Embodiment 2.

15 [0064]

As illustrated in Fig. 15, in step S101, the user captures, using the mobile terminal 14, an image of a food prepared by the user as a storage item 17 to be stored in the refrigerator 1, and transmits a photograph of the food to the external network 11.

20 [0065]

Processing in steps S102, S103, and S105 is the same as that in steps S102, S103, and S105 in Fig. 4 described in Embodiment 1, and thus its description will be omitted here.

[0066]

25 In Embodiment 2, in step S301, the external network 11 stores a storage item name 18 indicating the name of the food and a captured image 51 of the food into a food list 50. Fig. 16 is a diagram illustrating an example of the food list 50 of the external network 11 according to Embodiment 2. In the food list 50, as illustrated in Fig. 16, captured images 51 of storage items 17, image capturing date data 52

indicating the image capturing dates of the storage items 17, rating data 53, and recipe data 54 are registered for the respective storage item names 18. The food list 50 is stored in the second storage device 11a of the external network 11. In this case, the user further stores recipe data 54 into the food list 50 via the mobile terminal 14. Note that in a case where the recipe data 54 has already been stored in the second storage device 11a of the external network 11, the user does not have to perform registration in step S301, in particular.

[0067]

In step S302, the user inputs a rating of the storage item 17 into the mobile terminal 14. The mobile terminal 14 transmits input rating data 53 to the external network 11. In step S303, the external network 11 registers the rating data 53 in the food list 50. The rating data 53 includes, for example, rank information. In this case, for example, when ranking is performed on a scale of five levels, five stars is the highest rank as illustrated in Fig. 18, the rated rank is reduced by one as the number of stars is reduced by one, and one star is the lowest rank. Note that the rating data 53 is not limited to rank information and may be input as a text message such as a review.

[0068]

In step S304, the user inputs, into the mobile terminal 14, a request to browse the storage items 17 registered in the food list 50. The mobile terminal 14 transmits the input request to the external network 11. In step S305, in response to the request, the external network 11 transmits the list data 60 regarding the storage items 17 registered in the food list 50 to the mobile terminal 14. In step S312, the mobile terminal 14 displays the list data 60 regarding the storage items 17 on the screen. Fig. 17 illustrates an example of the list data 60 regarding the storage items 17 displayed by the mobile terminal 14 according to Embodiment 2. In this manner, the mobile terminal 14 displays the captured images of the foods displayed separately for each image capturing date in a calendar format on the basis of the list data 60

regarding the storage items 17. Note that the list data 60 is stored in the second storage device 11a of the external network 11.

[0069]

In step S306, the user selects, using the mobile terminal 14, one food from the list data 60. The mobile terminal 14 transmits information of the selected food to the external network 11. In step S307, the external network 11 acquires the storage expiry date list 40 illustrated in Fig. 12. In step S308, the external network 11 checks the storage expiry date list 40 and the recipe data 54 against each other, determines food ingredients that need to be purchased for the recipe of the selected food, and transmits information of the food ingredients to the mobile terminal 14. In step S313, the mobile terminal 14 displays, on the screen, the food ingredients that need to be purchased.

[0070]

In step S309, the user inputs a request for a recommended recipe into the mobile terminal 14. The mobile terminal 14 transmits the request to the external network 11. In step S310, the external network 11 acquires the storage expiry date list 40 illustrated in Fig. 12. In step S311, the external network 11 refers to the storage expiry date list 40 and searches for a recommended recipe using the stored storage items 17. The recipe data 54 of the food list 50 or the recipes prestored in the second storage device 11a of the external network 11 are searched for the recommended recipe. In a case where the recipe data 54 of the food list 50 is searched for the recommended recipe, the external network 11 refers to the rating data 53 and extracts a highly rated recipe. Note that the number of recipes obtained through the search may be one or two or more. The external network 11 transmits the recommended recipe obtained through the search to the mobile terminal 14. In step S314, the mobile terminal 14 displays the recommended recipe on the screen. Fig. 18 is a diagram illustrating an example of the recommended recipe displayed by the mobile terminal 14 according to Embodiment 2. As illustrated in Fig. 18, in the recommended recipe, for example, the storage item name 18 as the name of the

food, the captured image 51 of the food, the recipe data 54 regarding the food, and the rating data 53 regarding the food are displayed.

[0071]

The other configurations and operations are the same as those of Embodiment 1, and thus their description will be omitted here.

[0072]

As described above, since the configurations in Embodiment 2 are substantially the same as those in Embodiment 1, substantially the same effects as those for Embodiment 1 are obtained.

[0073]

Moreover, in Embodiment 2, photographs of foods prepared by the user, ratings, recipes, and other information can be registered in the external network 11. Thus, the user can receive the list data 60 regarding registered foods from the external network 11 and cause the mobile terminal 14 to display the list data 60.

Moreover, the user can freely select a food from among the foods prepared in the past by browsing the list data 60 regarding the foods displayed by the mobile terminal 14. Moreover, since the external network 11 determines food ingredients that need to be purchased for preparing the food and informs the user of the food ingredients, the user can easily know what to purchase.

[0074]

Moreover, by browsing the list data 60 regarding the foods, the user can easily recall leftovers stored in the refrigerator 1. Moreover, through the process in Fig. 5, the user can easily check the storage expiry dates of the leftovers. Moreover, even in a case where the user stores a leftover into the refrigerator 1, the user can easily know which storage compartment and which storage mode are suited to storing the leftover through the process in Fig. 4.

Reference Signs List

[0075]

1: refrigerator, 1a: main body, 2: refrigerator compartment, 2a: shelf, 3: versatile compartment, 4: ice-making compartment, 5: freezer compartment, 6: vegetable compartment, 7: main control unit, 7a: first storage device, 8: refrigerator compartment left door, 9: refrigerator compartment right door, 10: hinge, 11: external network, 11a: second storage device, 12: communication device, 13: panel, 13a: main switch, 13b: display screen, 14: mobile terminal, 15: gateway, 16: interior camera, 17: storage item, 18: storage item name, 19: shelf life database, 20: function data, 21: setting data, 22: storage location, 23: storage date, 24: number of elapsed days, 25: best before date detection sensor, 26: storage expiry date, 30: storage suggestion information, 40: storage expiry date list, 41: approaching expiry notification, 42: number-of-days-stored notification, 50: food list, 51: captured image, 53: rating data, 54: recipe data, 60: list data

CLAIMS

[Claim 1]

A refrigerator comprising:

a main body;

5 a communication device provided in the main body and configured to communicate with a controller and a mobile terminal; and

a first storage device in which function data indicating a function of the refrigerator and setting data indicating a current setting state of the refrigerator are stored,

10 the controller being installed outside or inside the main body,

the communication device being configured to transmit the function data and the setting data to the controller,

the controller having a second storage device in which a shelf life database is stored in advance in which one or more shelf lives of one or more respective storage items are set separately for each storage environment,

15 the controller being configured

to receive the function data and the setting data from the communication device,

20 to extract, from the shelf life database on the basis of the function data and the setting data, a storage environment and a shelf life set for the storage environment, the storage environment being suited to the function of the refrigerator and the current setting state of the refrigerator and being extracted as a storage environment in which a storage item to be stored in the refrigerator is to be stored, and

to output the extracted storage environment and the extracted shelf life.

25 [Claim 2]

The refrigerator of claim 1, wherein

the controller is configured to communicate with the mobile terminal,

the controller is configured to transmit the extracted storage environment and the extracted shelf life to the mobile terminal, and

the mobile terminal is configured to receive the storage environment and the shelf life and to display the storage environment and the shelf life on a screen of the mobile terminal.

[Claim 3]

5 The refrigerator of claim 1 or 2, comprising:

 a storage compartment that is provided inside the main body and that is for storing the storage item;

 a door that is attached to the main body and that is for opening and closing the storage compartment; and

10 a first camera that is installed at a face of the door that faces the storage compartment and that is configured to capture an image of the storage item, wherein

 the communication device is configured to transmit a captured image of the storage item captured by the first camera to the controller, and

 the controller is configured to recognize, by receiving the captured image of the storage item captured by the first camera, the storage item included in the captured image as the storage item to be stored in the refrigerator.

[Claim 4]

 The refrigerator of any one of claims 1 to 3, wherein

20 the mobile terminal has a second camera configured to capture an image of the storage item, and

 the controller is configured to recognize, by receiving a captured image of the storage item captured by the second camera from the mobile terminal, the storage item included in the captured image as the storage item to be stored in the refrigerator.

25 [Claim 5]

 The refrigerator of any one of claims 1 to 4, wherein

 the controller is configured

 to store a storage date of the storage item,

to count the number of elapsed days or an amount of elapsed time from the storage date, and

to regularly transmit the number of elapsed days or the amount of elapsed time to the mobile terminal, and

5 the mobile terminal is configured to receive the number of elapsed days or the amount of elapsed time and to display the number of elapsed days or the amount of elapsed time on a screen of the mobile terminal.

[Claim 6]

The refrigerator of claim 5, wherein

10 the controller is configured

to store, in the second storage device, a storage location of the storage item in the refrigerator,

to extract, from the shelf life database, a shelf life set for a storage environment of the storage location,

15 to determine, on the basis of the number of elapsed days or the amount of elapsed time and the shelf life, whether a difference between the number of elapsed days or the amount of elapsed time and the shelf life is less than or equal to a preset threshold, and

20 to transmit an approaching expiry notification to the mobile terminal in a case where the difference is less than or equal to the preset threshold, and

the mobile terminal is configured to receive the approaching expiry notification and to display the approaching expiry notification on the screen of the mobile terminal.

[Claim 7]

25 The refrigerator of claim 5 or 6, wherein

the controller is configured

to store, in the second storage device, a storage location of the storage item in the refrigerator,

to extract, from the shelf life database, a shelf life set for a storage environment of the storage location,

to determine, on the basis of the number of elapsed days or the amount of elapsed time and the shelf life, whether a storage expiry date of the storage item is over, and

to transmit an expiry notification to the mobile terminal in a case where the storage expiry date of the storage item is over, and

the mobile terminal is configured to receive the expiry notification and to display the expiry notification on the screen of the mobile terminal.

[Claim 8]

The refrigerator of any one of claims 1 to 7, comprising:

a storage compartment that is provided inside the main body and that is for storing the storage item;

a door that is attached to the main body and that is for opening and closing the storage compartment; and

a panel that is installed in the door or the main body and that is configured to perform screen display, wherein

the controller is configured to transmit the extracted storage environment and the extracted shelf life to the communication device of the refrigerator,

the communication device of the refrigerator is configured to receive the storage environment and the shelf life, and

the panel of the refrigerator is configured to display, on a screen of the panel, the storage environment and the shelf life received by the communication device.

[Claim 9]

The refrigerator of claim 8, wherein

the controller is configured

to store a storage date of the storage item,

to count the number of elapsed days or an amount of elapsed time from the storage date, and

to regularly transmit the number of elapsed days or the amount of elapsed time to the communication device of the refrigerator,

the communication device of the refrigerator is configured to receive the number of elapsed days or the amount of elapsed time, and

5 the panel of the refrigerator is configured to display, on the screen of the panel, the number of elapsed days or the amount of elapsed time received by the communication device.

[Claim 10]

The refrigerator of claim 9, wherein

10 the controller is configured

to store, in the second storage device, a storage location of the storage item in the refrigerator,

to extract, from the shelf life database, a shelf life set for a storage environment of the storage location,

15 to determine, on the basis of the number of elapsed days or the amount of elapsed time and the shelf life, whether a difference between the number of elapsed days or the amount of elapsed time and the shelf life is less than or equal to a preset threshold, and

20 to transmit an approaching expiry notification to the communication device of the refrigerator in a case where the difference is less than or equal to the preset threshold,

the communication device of the refrigerator is configured to receive the approaching expiry notification, and

25 the panel of the refrigerator is configured to display, on the screen of the panel, the approaching expiry notification received by the communication device.

[Claim 11]

The refrigerator of claim 9 or 10, wherein

the controller is configured

to store, in the second storage device, a storage location of the storage item in the refrigerator,

to extract, from the shelf life database, a shelf life set for a storage environment of the storage location,

5 to determine, on the basis of the number of elapsed days or the amount of elapsed time and the shelf life, whether a storage expiry date of the storage item is over, and

to transmit an expiry notification to the communication device of the refrigerator in a case where the storage expiry date of the storage item is over,

10 the communication device of the refrigerator is configured to receive the expiry notification, and

the panel of the refrigerator is configured to display, on the screen of the panel, the expiry notification received by the communication device.

[Claim 12]

15 The refrigerator of any one of claims 1 to 11, wherein the one or more storage items are foods, and the controller is configured

to store captured images of the foods and image capturing dates of the foods, and

20 to output list data regarding the foods when a browsing request is received, the list data displaying the captured images of the foods displayed separately for each image capturing date.

[Claim 13]

The refrigerator of claim 12, wherein

25 the controller is configured to transmit the list data regarding the foods to the mobile terminal when receiving the browsing request from the mobile terminal, the list data displaying the captured images of the foods displayed separately for each image capturing date, and

the mobile terminal is configured to receive the list data regarding the foods and to display, on a screen of the mobile terminal, the captured images of the foods displayed separately for each image capturing date in a calendar format.

[Claim 14]

- 5 The refrigerator of any one of claims 1 to 13, wherein the controller comprises an external network provided outside the refrigerator.

[Claim 15]

 The refrigerator of claim 14, wherein the external network comprises a cloud server.

- 10 [Claim 16]

 The refrigerator of any one of claims 1 to 13, wherein the controller comprises a main control unit provided inside the refrigerator.