

DESCRIPTION

Title of Invention

REFRIGERATOR COMMUNICATION SYSTEM

5 Technical Field

[0001]

The present disclosure relates to a refrigerator communication system including a refrigerator and an information terminal that are configured to communicate with each other via an external network.

10 Background Art

[0002]

Some home electric appliance communication systems have been known that each receive an operational instruction transmitted from a remote operation device via an external network and control an operation state of a home electric appliance on the basis of the received operational instruction. Among such systems, a refrigerator communication system has been proposed in which the home electric appliance is a refrigerator and that includes an information terminal configured to communicate with the refrigerator via an external network. Patent Literature 1 discloses a remote control system including a controller that controls a controlled appliance in accordance with an operational instruction from a remote operation device. In Patent Literature 1, as examples, a personal computer and a mobile phone are described as remote operation devices, and an air-conditioning apparatus is described as the controlled appliance. Furthermore, Patent Literature 2 discloses a home electric appliance remote control system including a home electric appliance in which content for remote operation is stored, and a mobile communication terminal. The home electric appliance of Patent Literature 2 receives content for remote operation transmitted from the mobile communication terminal and performs operation corresponding to the received remote operation content.

Citation List

30 Patent Literature

[0003]

Patent Literature 1: Japanese Unexamined Patent Application Publication No.
2008-42262

Patent Literature 2: Japanese Unexamined Patent Application Publication No.
2003-319471

Summary of Invention

Technical Problem

[0004]

However, the remote control system according to Patent Literature 1 can set an
operation state of the air-conditioning apparatus from a remote place but the air-
conditioning apparatus is only applied with the operation state instructed from the
remote place. In this case, the operation state instructed from the remote place
does not necessarily correspond to an operation state suited for a usage condition of
a user using the air-conditioning apparatus. Furthermore, the home electric
appliance remote control system according to Patent Literature 2 needs to use
operation states registered in advance as the content for remote operation. Thus,
when an operation state suited for the usage condition of the user is not included in
the content for remote operation, the operation state suited for the usage condition of
the user cannot be set.

[0005]

The present disclosure has been made to solve the above problems and has
an object to provide a refrigerator communication system in which a refrigerator can
perform an operation suited for a usage condition of a user.

Solution to Problem

[0006]

A refrigerator communication system according to an embodiment of the
present disclosure includes a refrigerator configured to refrigerate an article stored in
a storage compartment formed in the refrigerator and having a refrigerator
communication unit configured to transmit and receive data, an information terminal
having an information communication unit configured to communicate with the

refrigerator communication unit of the refrigerator via an external network, and a controller configured to control the refrigerator and the information terminal. The controller includes determination circuitry configured to determine a suited setting adapted for a usage condition of the refrigerator of a user on the basis of operation information of the refrigerator, and proposition circuitry configured to propose the suited setting determined by the determination circuitry by use of the information terminal.

Advantageous Effects of Invention

[0007]

According to an embodiment of the present disclosure, determined suited setting is proposed by use of the information terminal. Therefore, the user can recognize the suited setting adapted for the usage condition. Thus, the refrigerator can perform an operation suited for the usage condition of the user.

Brief Description of Drawings

[0008]

[Fig. 1] Fig. 1 is a schematic diagram illustrating a refrigerator communication system according to Embodiment 1.

[Fig. 2] Fig. 2 is a perspective view illustrating a refrigerator according to Embodiment 1.

[Fig. 3] Fig. 3 is a front view of the refrigerator according to Embodiment 1.

[Fig. 4] Fig. 4 is one cross-sectional view of the refrigerator according to Embodiment 1.

[Fig. 5] Fig. 5 is another cross-sectional view of the refrigerator according to Embodiment 1.

[Fig. 6] Fig. 6 is a functional block diagram illustrating the refrigerator communication system according to Embodiment 1.

[Fig. 7] Fig. 7 is a flowchart illustrating an operation of the refrigerator communication system according to Embodiment 1.

[Fig. 8] Fig. 8 is a flowchart illustrating an example of operation of the refrigerator communication system according to Embodiment 1.

[Fig. 9] Fig. 9 is a schematic diagram illustrating a refrigerator communication system according to Embodiment 2.

[Fig. 10] Fig. 10 is a functional block diagram illustrating the refrigerator communication system according to Embodiment 2.

[Fig. 11] Fig. 11 is a flowchart illustrating an operation of the refrigerator communication system according to Embodiment 2.

Description of Embodiments

[0009]

Embodiments of a refrigerator communication system of the present disclosure will be described below with reference to the drawings. It should be noted that the present disclosure is not limited by the embodiments described below. Further, in the drawings including Fig. 1, a size relationship of the components may differ from that of actual components. In addition, in the following description, terms indicating directions are used, as appropriate, to facilitate understanding of the present disclosure. The terms are used only for the explanation purpose, and the present disclosure is not limited by these terms. Examples of terms indicating directions include "up", "down", "right", "left", "front", and "rear".

[0010]

Embodiment 1

Fig. 1 is a schematic diagram illustrating a refrigerator communication system according to Embodiment 1. As shown in Fig. 1, the refrigerator communication system 1 includes a refrigerator 2 and an information terminal 4. The refrigerator 2 and the information terminal 4 are configured to be connected to each other via an external network 3. The refrigerator 2 and the external network 3 are configured to be able to communicate with each other. The information terminal 4 and the external network 3 are configured to be able to communicate with each other.

[0011]

(Refrigerator 2)

Fig. 2 is a perspective view illustrating the refrigerator 2 according to Embodiment 1. Fig. 3 is a front view of the refrigerator 2 according to Embodiment

1. The refrigerator 2 refrigerates articles stored in a storage compartment 21 formed in the refrigerator 2. As shown in Figs. 2 and 3, the refrigerator 2 includes a refrigerator body 20, a door 22, a door opening-closing sensor 23, temperature sensors 24, a refrigerator communication unit 25, and a controller 5.

[0012]

(Refrigerator Body 20)

The refrigerator body 20 includes an outer case 20a and an inner case 20b, which form a box-shape shell of the refrigerator 2. A formed heat insulation material (not shown) is filled in a heat insulation filling space between the outer case 20a and the inner case 20b. When the space between the outer case 20a and the inner case 20b is filled with this formed heat insulation material, the outer case 20a and the inner case 20b are thereby unified. The outer case 20a and the inner case 20b serve as a heat insulating box body.

[0013]

(Storage Compartment 21)

Fig. 4 is one cross-sectional view of the refrigerator 2 according to Embodiment 1 taken along line A-A of Fig. 3. Fig. 5 is another cross-sectional view of the refrigerator 2 according to Embodiment 1 taken along line B-B of Fig. 3. As shown in Figs. 3, 4, and 5, the storage compartment 21 includes, for example, a vegetable compartment 21a, a first freezer compartment 21b, an ice-making compartment 21c, a second freezer compartment 21d, and a refrigerator compartment 21e each having a different temperature zone. The vegetable compartment 21a is a space provided at a position closest to the floor among the compartments and in which vegetables are mainly stored. The first freezer compartment 21b is a space provided above the vegetable compartment 21a and in which frozen articles are mainly stored.

[0014]

The ice-making compartment 21c is a space provided on a part above the first freezer compartment 21b and in which ice is made and stored. The second freezer compartment 21d is a space provided on another part above the first freezer compartment 21b and in which frozen articles are mainly stored. The refrigerator

compartment 21e is a space provided above the ice-making compartment 21c and the second freezer compartment 21d and in which refrigerated articles whose storage temperature is higher than temperatures of frozen articles are mainly stored.

Although Embodiment 1 describes a case where the storage compartment 21 consists of the vegetable compartment 21a, the first freezer compartment 21b, the ice-making compartment 21c, the second freezer compartment 21d, and the refrigerator compartment 21e, the storage compartment 21 may be made up of at least one compartment. The arrangement of the storage compartment 21 can be changed, as appropriate.

[0015]

(Door 22)

As shown in Figs. 2 and 3, the door 22 includes a vegetable compartment door 22a, a first freezer compartment door 22b, an ice-making compartment door 22c, a second freezer compartment door 22d, and a refrigerator compartment door 22e.

The vegetable compartment door 22a is provided at a position closest to the floor among the doors and with which the vegetable compartment 21a is opened and closed. The first freezer compartment door 22b is provided at an upper end of the vegetable compartment door 22a and with which the first freezer compartment 21b is opened and closed.

[0016]

The ice-making compartment door 22c is provided on a part above the first freezer compartment door 22b and with which the ice-making compartment 21c is opened and closed. The second freezer compartment door 22d is provided on another part above the first freezer compartment door 22b and with which the second freezer compartment 21d is opened and closed. The refrigerator compartment door 22e is provided above the ice-making compartment door 22c and the second freezer compartment door 22d and with which the refrigerator compartment 21e is opened and closed. Although Embodiment 1 describes a case where the door 22 consists of the vegetable compartment door 22a, the first freezer compartment door 22b, the ice-making compartment door 22c, the second freezer compartment door 22d, and the

refrigerator compartment door 22e, the door 22 may be made up of at least one door. The arrangement of the door 22 can be changed, as appropriate.

[0017]

(Door Opening-closing Sensor 23)

5 As shown in Figs. 2 and 3, the door opening-closing sensor 23 is configured to detect opening and closing of the door 22, and includes a sensor 23a for vegetable compartment, a sensor 23b for first freezer compartment, and a sensor 23c for three compartments. The sensor 23a for vegetable compartment is provided between the vegetable compartment 21a and the first freezer compartment 21b to detect opening and closing of the vegetable compartment door 22a. The sensor 23b for first freezer compartment is provided between the first freezer compartment 21b and the ice-making compartment 21c to detect opening and closing of the first freezer compartment door 22b. The sensor 23c for three compartments is provided above the ice-making compartment 21c and the second freezer compartment 21d and below the refrigerator compartment 21e to detect opening and closing of each of the ice-making compartment door 22c, the second freezer compartment door 22d, and the refrigerator compartment door 22e.

[0018]

(Temperature Sensors 24)

20 As shown in Fig. 3, the temperature sensors 24 are each provided for the corresponding one of the vegetable compartment 21a, the first freezer compartment 21b, the ice-making compartment 21c, the second freezer compartment 21d, and the refrigerator compartment 21e. Each temperature sensor 24 detects the temperature of the corresponding one of the vegetable compartment 21a, the first freezer compartment 21b, the ice-making compartment 21c, the second freezer compartment 21d, and the refrigerator compartment 21e.

[0019]

(Refrigerator Communication Unit 25)

30 As shown in Fig. 2, the refrigerator communication unit 25 is mounted inside the refrigerator compartment door 22e, for example, to perform transmission and

reception of data. The refrigerator communication unit 25 is configured to communicate with the information terminal 4 via the external network 3.

[0020]

(Controller 5)

5 As shown in Fig. 2, the controller 5 is provided at the top of the refrigerator body 20 on a back face. The controller 5 is dedicated hardware or a central processing unit (CPU, also referred to as central processor, processing unit, arithmetic device, microprocessor, microcomputer, or processor) configured to execute a program stored in a memory. When the controller 5 is dedicated
10 hardware, the controller 5 corresponds to, for example, a single circuit, a composite circuit, an application specific integrated circuit (ASIC), a field-programmable gate array (FPGA), or a combination of these circuits. Functional units to be implemented by the controller 5 may be achieved by respective pieces of hardware or may be achieved by a single piece of hardware.

15 [0021]

When the controller 5 is a CPU, functions to be executed by the controller 5 are each achieved by software, firmware, or a combination of software and firmware. The software and the firmware are each described as a program. The CPU is configured to read out and execute the program, to thereby achieve each of the
20 functions. Note that, some of the functions of the controller 5 may be achieved by dedicated hardware and other functions may be achieved by software or firmware.

[0022]

Fig. 6 is a functional block diagram illustrating the refrigerator communication system 1 according to Embodiment 1. As shown in Fig. 6, the controller 5 includes
25 door opening-closing detection circuitry 51, use frequency prediction circuitry 52, temperature detection circuitry 53, determination circuitry 54, proposition circuitry 55, and operation control circuitry 56.

[0023]

(Door Opening-closing Detection Circuitry 51)

The door opening-closing detection circuitry 51 is configured to detect opening and closing of the door 22 of the storage compartment 21. More specifically, when the door opening-closing sensor 23 detects opening and closing of the door 22, the door opening-closing detection circuitry 51 receives a signal from the door opening-closing sensor 23. The door opening-closing detection circuitry 51 thus detects the opening and closing of the door 22.

[0024]

(Use Frequency Prediction Circuitry 52)

The use frequency prediction circuitry 52 is configured to predict a use frequency of the refrigerator 2 for each time zone. The use frequency prediction circuitry 52 predicts a use frequency of the refrigerator 2 for each time zone on the basis of the number of times of opening and closing of the door 22 detected by the door opening-closing detection circuitry 51. More specifically, when the number of times of opening and closing of the door 22 is large in a certain time zone, the use frequency prediction circuitry 52 predicts that the use frequency of the refrigerator 2 will be high in this time zone. When the number of times of opening and closing of the door 22 is small in another time zone, the use frequency prediction circuitry 52 predicts that the use frequency of the refrigerator 2 will be low in this time zone.

[0025]

(Temperature Detection Circuitry 53)

The temperature detection circuitry 53 is configured to detect the temperature of the storage compartment 21. More specifically, the temperature detection circuitry 53 receives a signal relating to the temperature detected by one of the temperature sensors 24. The temperature detection circuitry 53 thus detects the temperature of the storage compartment 21.

[0026]

(Determination Circuitry 54)

The determination circuitry 54 is configured to determine a suited setting adapted for a usage condition of the refrigerator 2 by the user on the basis of operation information of the refrigerator 2. The operation information of the

refrigerator 2 in this case is, for example, an operation state of the refrigerator 2 when the user who owns the refrigerator 2 uses the refrigerator 2 in a normal manner. The determination circuitry 54 determines a suited setting, which is the most appropriate usage condition for the user, on the basis of how the refrigerator 2 is normally used by the user. In this case, the operation information includes the use frequency of each time zone predicted by the use frequency prediction circuitry 52. The operation information includes also the temperature detected by the temperature detection circuitry 53. In addition, the suited setting includes a setting that suites the usage condition indicating how the user normally uses the refrigerator.

[0027]

(Proposition Circuitry 55)

The proposition circuitry 55 is configured to propose the suited setting determined by the determination circuitry 54 by use of the information terminal 4. The refrigerator communication unit 25 transmits the suited setting proposed by the proposition circuitry 55 to the information terminal 4 via the external network 3. The proposed content is, for example, a display message stating "would you like to change the operation state of the refrigerator 2 to the one suited for the user?"

[0028]

(Operation Control Circuitry 56)

The operation control circuitry 56 is configured to apply the suited setting proposed by the proposition circuitry 55 to the refrigerator 2 when the user accepts the suited setting. The operation control circuitry 56 causes the refrigerator 2 to operate after the suited setting is applied to the refrigerator 2. The refrigerator communication unit 25 transmits a notification that the suited setting has been applied by the operation control circuitry 56, to the information terminal 4 via the external network 3.

[0029]

In addition, the operation control circuitry 56 is configured to determine whether the suited setting is applicable to the refrigerator 2. More specifically, the operation control circuitry 56 determines whether it is the time when the suited setting is

applicable on the basis of a current operation state of the refrigerator 2. When determining that the suited setting is applicable to the refrigerator 2, the operation control circuitry 56 applies the suited setting to the refrigerator 2. Meanwhile, when determining that the suited setting is not applicable to the refrigerator 2, the operation control circuitry 56 does not apply the suited setting to the refrigerator 2. Then, the refrigerator communication unit 25 transmits a notification that application of the suited setting has been failed to the information terminal 4 via the external network 3.

[0030]

Note that although Embodiment 1 describes a case where the controller 5 is provided at the refrigerator 2, the configuration is not limited to this case. The controller 5 may be provided at the information terminal 4, a server installed separately, or a cloud server or a similar device existing on the external network 3. In addition, the controller 5 may be installed at more than one of these devices. Furthermore, some of the functions of the controller 5 may be provided in a device other than the refrigerator 2.

[0031]

(Information Terminal 4)

The information terminal 4 is owned by the user, and is a mobile information terminal or a personal computer, for example. As shown in Fig. 6, the information terminal 4 includes an information communication unit 41, a display device 42, and a control unit 43.

[0032]

(Information Communication Unit 41)

The information communication unit 41 is configured to communicate with the refrigerator communication unit 25 of the refrigerator 2 via the external network 3. When the refrigerator communication unit 25 of the refrigerator 2 transmits the suited setting proposed by the proposition circuitry 55 via the external network 3, the information communication unit 41 receives the suited setting. In addition, when the user accepts the suited setting, the information communication unit 41 transmits notification of this acceptance to the refrigerator communication unit 25 of the

refrigerator 2 via the external network 3. Furthermore, when the refrigerator communication unit 25 of the refrigerator 2 transmits a notification that the suited setting has been applied by the operation control circuitry 56 via the external network 3, the information communication unit 41 receives this notification. Moreover, when the refrigerator communication unit 25 of the refrigerator 2 transmits a notification that application of the suited setting has been failed via the external network 3, the information communication unit 41 receives this notification.

[0033]

(Display Device 42)

The display device 42 is, for example, a liquid crystal display, and displays an image. When the information communication unit 41 receives the suited setting proposed by the proposition circuitry 55, the display device 42 displays a message such as "would you like to change the operation state of the refrigerator 2 to the one suited for the user?" In addition, when the information communication unit 41 receives a notification that the suited setting has been applied by the operation control circuitry 56, the display device 42 displays this notification. Furthermore, when the information communication unit 41 receives a notification that application of the suited setting by the operation control circuitry 56 has been failed, the display device 42 displays this notification.

[0034]

(Control Unit 43)

The control unit 43 is configured to control operation of the information terminal 4. When the information communication unit 41 receives the suited setting proposed by the proposition circuitry 55, the control unit 43 measures time. When the user does not respond to the message "would you like to change the operation state of the refrigerator 2 to the one suited for the user?" displayed on the display device 42 and a predetermined period of time has elapsed, the control unit 43 causes the information communication unit 41 to transmit a notification that the suited setting has been rejected by the user to the external network 3. In this case, the predetermined period of time is three minutes, for example.

[0035]

Fig. 7 is a flowchart illustrating an operation of the refrigerator communication system 1 according to Embodiment 1. Next, operation of the refrigerator

communication system 1 will be described. As shown in Fig. 7, first in the

5 refrigerator 2, the use frequency prediction circuitry 52 predicts a use frequency of the refrigerator 2 for each time zone on the basis of the number of times of opening and closing of the door 22 detected by the door opening-closing detection circuitry 51. In addition, the temperature detection circuitry 53 receives a signal relating to the temperature detected by one of the temperature sensors 24 to detect the temperature
10 of the storage compartment 21 (step S1).

[0036]

Next, on the basis of the operation information such as the use frequency for each time zone and the temperature, the determination circuitry 54 determines a

suited setting adapted for the usage condition of the refrigerator 2 by the user (step

15 S2). Then, the proposition circuitry 55 proposes the suited setting determined by the determination circuitry 54 by use of the information terminal 4 (step S3). More specifically, the refrigerator communication unit 25 transmits the suited setting

proposed by the proposition circuitry 55 to the external network 3. The external

network 3 transmits the suited setting transmitted from the refrigerator communication
20 unit 25 to the information communication unit 41 of the information terminal 4 (step S4).

[0037]

In the information terminal 4, when the information communication unit 41

receives the suited setting proposed by the proposition circuitry 55, the display device

25 42 displays a message such as "would you like to change the operation state of the refrigerator 2 to the one suited for the user?" (step S5). At this time, the control unit

43 measures time (step S6). When the predetermined period of time has elapsed

(YES in step S6), the control unit 43 causes the information communication unit 41 to transmit a notification that the user has rejected the suited setting to the external

30 network 3 (step S10). Thus, the processing is ended.

[0038]

Meanwhile, when the user rejects the suited setting (NO in step S7) even before the predetermined period of time has elapsed (NO in step S6), the control unit 43 causes the information communication unit 41 to transmit a notification that the user has rejected the suited setting to the external network 3 (step S10). On the other hand, when the user accepts the suited setting (YES in step S7) before the predetermined period of time has elapsed (NO in step S6), the information communication unit 41 transmits a notification that the user has accepted the suited setting to the external network 3 (step S8). The external network 3 transmits the notification that the user has accepted the suited setting and that is transmitted from the information communication unit 41, to the refrigerator communication unit 25 of the refrigerator 2 (step S9).

[0039]

In the refrigerator 2, the operation control circuitry 56 determines whether the suited setting is applicable to the refrigerator 2 (step S11). When determining that the suited setting is not applicable to the refrigerator 2, the operation control circuitry 56 does not apply the suited setting to the refrigerator 2 (NO in step S11). Then, the refrigerator communication unit 25 transmits a notification that application of the suited setting has been failed to the external network 3 (step S16). The external network 3 transmits the notification that application of the suited setting has been failed and that is transmitted from the refrigerator communication unit 25, to the information communication unit 41 of the information terminal 4 (step S17). In the information terminal 4, when the information communication unit 41 receives the notification that application of the suited setting has been failed, the display device 42 displays the notification that application of the suited setting has been failed (step S18). In this manner, the information terminal 4 informs the user that the application of the suited setting has been failed.

[0040]

Meanwhile, when determining that the suited setting is applicable to the refrigerator 2 (YES in step S11), the operation control circuitry 56 applies the suited

setting to the refrigerator 2 (step S12). Then, the refrigerator communication unit 25 transmits a notification that the suited setting has been applied by the operation control circuitry 56 to the external network 3 (step S13). The external network 3 transmits the notification that the suited setting has been applied and that is transmitted from the refrigerator communication unit 25, to the information communication unit 41 of the information terminal 4 (step S14). In the information terminal 4, when the information communication unit 41 receives the notification that suited setting has been applied, the display device 42 displays the notification that the suited setting has been applied (step S15). In this manner, the information terminal 4 informs the user that the suited setting has been applied.

[0041]

According to Embodiment 1, a determined suited setting is proposed by use of the information terminal 4. Thus, the user can recognize the suited setting adapted for the usage condition. As a result, the refrigerator 2 can perform a flexible operation suited for the usage condition of the user. This allows the user to use the refrigerator 2 and the articles stored in the refrigerator 2 in a more comfortable manner in daily life.

[0042]

Although, as the suited setting in Embodiment 1, a setting condition suited for the user is described as an example, the suited setting may be usage of the refrigerator 2 suited for the user. For example, when the user usually takes 10 seconds each time to open and close the door 22, the proposition circuitry 55 can suggest to the user that energy saving performance can be improved by shortening the time of opening and closing the door 22 into 5 seconds or less during summer because the temperature is high. In addition, because the ice-making compartment 21c is thought to be used frequently during summer, the proposition circuitry 55 can suggest to the user that the user clean a water suction course before summer, for example, in March.

[0043]

As described above, even in a case where a suited setting is usage of the refrigerator 2 suited for the user, the proposition circuitry 55 proposes the suited setting by use of the information terminal 4 owned by the user, as with the case where a suited setting is a setting condition suited for the user. At this time, regardless of whether the user accepts a proposal or not, when the user has checked the proposal or when a predetermined period of time has elapsed, the display device 42 of the information terminal 4 hides the content of the proposal. Note that, regardless of whether the user has checked a proposal or not, the content of the proposal is recorded by the control unit 43. Therefore, the user can check back the content of each proposal that has been proposed in the past.

[0044]

(Normal Ice-making Mode and Ice-making Stop Mode)

Next, a normal ice-making mode and an ice-making stop mode will be described as examples of the suited operation state. A case is described where the user has set the ice-making compartment 21c to a normal ice-making mode, in which an ice-making operation is performed. In this example, the ice-making compartment door 22c of the ice-making compartment 21c has not been opened for seven days. In this case, the determination circuitry 54 determines that the user will not use an ice-making function for a while. Then, the determination circuitry 54 determines that changing the setting from the normal ice-making mode, which performs the ice-making operation, to an ice-making stop mode, which does not perform the ice-making operation, is suited for the user's usage.

[0045]

Fig. 8 is a flowchart illustrating an example of operation of the refrigerator communication system 1 according to Embodiment 1. Next, an example of operation of the refrigerator communication system 1 according to Embodiment 1 will be described. As shown in Fig. 8, first in refrigerator 2, when the normal ice-making mode has been set, the use frequency prediction circuitry 52 predicts a use frequency of the ice-making compartment 21c on the basis of the number of times of opening and closing of the ice-making compartment door 22c detected by the door opening-

closing detection circuitry 51. The number of times of opening and closing of the ice-making compartment door 22c is zero for the last seven days (step S101).

[0046]

5 Next, the determination circuitry 54 determines that it is appropriate to set the mode to the ice-making stop mode because the ice-making compartment 21c has not been used for seven days (step S102). Then, the proposition circuitry 55 proposes the suited setting determined by the determination circuitry 54 by use of the information terminal 4 (step S103). More specifically, the refrigerator communication unit 25 transmits the suited setting proposed by the proposition circuitry 55 to the external network 3. The external network 3 transmits the suited setting transmitted from the refrigerator communication unit 25, to the information communication unit 41 of the information terminal 4 (step S104).

[0047]

15 In the information terminal 4, when the information communication unit 41 receives the suited setting proposed by the proposition circuitry 55, the display device 42 displays a message such as "would you like to change the mode to the ice-making stop mode?" (step S105). At this time, the control unit 43 measures time (step S106). When the predetermined period of time has elapsed (YES in step S106), the control unit 43 causes the information communication unit 41 to transmit a notification that the user has rejected the suited setting to the external network 3 (step S110). Thus, the processing is ended.

[0048]

25 Meanwhile, when the user rejects the suited setting (NO in step S107) even before the predetermined period of time has elapsed (NO in step S106), the control unit 43 causes the information communication unit 41 to transmit a notification that the user has rejected the suited setting to the external network 3 (step S110). On the other hand, when the user accepts the suited setting (YES in step S107) before the predetermined period of time has elapsed (NO in step S106), the information communication unit 41 transmits a notification that the user has accepted the suited setting to the external network 3 (step S108). The external network 3 transmits the

notification that the user has accepted the suited setting and that is transmitted from the information communication unit 41, to the refrigerator communication unit 25 of the refrigerator 2 (step S109).

[0049]

5 In the refrigerator 2, the operation control circuitry 56 determines whether the suited setting is applicable to the refrigerator 2 (step S111). When determining that the suited setting is not applicable to the refrigerator 2, the operation control circuitry 56 does not apply the suited setting to the refrigerator 2 (NO in step S111). Then, the refrigerator communication unit 25 transmits a notification that application of the suited setting has been failed to the external network 3 (step S116). The external network 3 transmits the notification that application of the suited setting has been failed and that is transmitted from the refrigerator communication unit 25, to the information communication unit 41 of the information terminal 4 (step S117). In the information terminal 4, when the information communication unit 41 receives the notification that application of the suited setting has been failed, the display device 42 displays the notification that application of the suited setting has been failed (step S118). In this manner, the information terminal 4 informs the user that the application of the suited setting has been failed.

[0050]

20 Meanwhile, when determining that the suited setting is applicable to the refrigerator 2 (YES in step S111), the operation control circuitry 56 applies the suited setting to the refrigerator 2 (step S112). That is, the operation control circuitry 56 changes the mode of the refrigerator 2 to the ice-making stop mode. Then, the refrigerator communication unit 25 transmits a notification that the suited setting has been applied by the operation control circuitry 56 to the external network 3 (step S113). The external network 3 transmits the notification that the suited setting has been applied and that is transmitted from the refrigerator communication unit 25, to the information communication unit 41 of the information terminal 4 (step S114). In the information terminal 4, when the information communication unit 41 receives the notification that suited setting has been applied, the display device 42 displays the

notification that the suited setting has been applied (step S115). In this manner, the information terminal 4 informs the user that the suited setting has been applied.

[0051]

As described above, Embodiment 1 describes a case where it is determined that the user will not use the ice-making function for a while when the number of times of opening and closing of the ice-making compartment door 22c of the ice-making compartment 21c is zero for the last seven days. Note that the number of times of opening and closing of the ice-making compartment door 22c and the period of time required for determining that the ice-making compartment 21c is not used can be changed, as appropriate, on the basis of analysis of user's normal usage conditions of the ice-making compartment 21c. In addition, the determination circuitry 54 may determine that the user will not use the ice-making function for a while on the basis of the number of consecutive days in which the ice-making function has not been used. The determination circuitry 54 may determine that the user will not use the ice-making function for a while on the basis of the amount of water in a water supply tank (not shown) provided for ice-making operation.

[0052]

The determination circuitry 54 may determine that the user will not use the ice-making function for a while on the basis of the information on season or weather obtainable via the external network 3. For example, when consecutive low-temperature days are forecasted, the determination circuitry 54 may determine that it is unlikely that the user will need cold drinks, and the proposition circuitry 55 may propose that the mode of the ice-making compartment 21c is changed from the normal ice-making mode to the ice-making stop mode. Furthermore, during winter, the determination circuitry 54 may determine that the ice-making compartment 21c will not be used for a long time, and the proposition circuitry 55 may propose that the mode of the ice-making compartment 21c is changed from the normal ice-making mode to the ice-making stop mode.

[0053]

As described above, the determination circuitry 54 can determine a suited setting state by extracting a reasonable causal relation by use of any arbitrary data among the data obtainable from the refrigerator 2, the data obtainable via the external network 3, the data obtainable from the information terminal 4, and other data.

5 [0054]

(Rapid Cooling Mode)

Next, a rapid cooling mode will be described as an example of the suited operation state. On the basis of the number of times of opening and closing of the door 22, the determination circuitry 54 determines a usage pattern of the refrigerator 2 of the user. For example, when the door 22 is opened and closed very often at 18 o'clock every day, the determination circuitry 54 determines that the temperature in the storage compartment 21 will be raised by the frequent opening and closing of the door 22. For this reason, the proposition circuitry 55 can propose, as a suited operation state, that the operation mode is changed to a rapid cooling mode, which 10 cools the storage compartment 21 rapidly, before 18 o'clock, for example, at 17 o'clock.

15 [0055]

(Excess State and Deficiency State of Cooling Capacity)

Next, an excess and deficiency state of a cooling capacity will be described as an example of the suited operation state. For example, a case is described where the user has set the setting of the refrigerator compartment 21e to a powerful cooling setting to make the refrigerator compartment 21e cooler, and where data on the temperature transition of the refrigerator compartment 21e indicates that the refrigerator compartment 21e has been kept cold for 10 days. When the refrigerator compartment door 22e of the refrigerator compartment 21e has been opened and closed only three times in the 10 days, the determination circuitry 54 determines that the setting of the temperature for the refrigerator compartment 21e is too low. Then, the proposition circuitry 55 can propose, as a suited operation state, that the setting of the refrigerator compartment 21e is changed from the powerful cooling setting to a 20 25

weak cooling setting. As a result, excess cooling can be prevented, and thereby energy saving performance can be improved.

[0056]

Furthermore, in this example, the user has set the setting of the first freezer compartment 21b to the weak cooling setting not to make the first freezer compartment 21b too cold. When the first freezer compartment door 22b of the first freezer compartment 21b has been opened and closed 40 times in two days, the determination circuitry 54 determines that the setting temperature of the first freezer compartment 21b is too high and the cooling capacity is insufficient. Then, the proposition circuitry 55 can propose, as a suited operation state, that the setting of the first freezer compartment 21b is changed from the weak cooling setting to the powerful cooling setting. As a result, insufficient cooling can be eliminated. Note that the powerful cooling setting or the weak cooling setting, the number of times of opening and closing of the door 22 in a predetermined period described in Embodiment 1, and other property can be changed, as appropriate. In addition, the excess state and the deficiency state of the cooling capacity may be determined for any compartment of the storage compartment 21 other than the refrigerator compartment 21e and the first freezer compartment 21b.

[0057]

The determination circuitry 54 can determine a suited setting state by use of a combination of any arbitrary data among the data obtainable from the refrigerator 2, the data obtainable via the external network 3, the data obtainable from the information terminal 4, and other data.

[0058]

Embodiment 2

Fig. 9 is a schematic diagram illustrating a refrigerator communication system 101 according to Embodiment 2. Embodiment 2 differs from Embodiment 1 in that refrigerators 102 owned by other users are connected to the external network 3. In Embodiment 2, features that are the same as or similar to those of Embodiment 1 will

be denoted by the same reference signs, and their descriptions will be omitted.
Differences from Embodiment 1 will be mainly described below.

[0059]

As shown in Fig. 9, the refrigerator 2 and the information terminal 4 are
5 configured to communicate with refrigerators 102, which are owned by users other
than the user of the refrigerator 2, via the external network 3. The refrigerators 102
of other users have the same functions as the refrigerator 2 owned by the user.
Note that Embodiment 2 describes a case where several refrigerators 102 owned by
other users are present; however, the refrigerator communication system 101 may
10 include only one refrigerator 102 owned by another user.

[0060]

Fig. 10 is a functional block diagram illustrating the refrigerator communication
system 101 according to Embodiment 2. As shown in Fig. 10, a controller 105
includes the door opening-closing detection circuitry 51, the use frequency prediction
15 circuitry 52, the temperature detection circuitry 53, comparison circuitry 157,
determination circuitry 154, the proposition circuitry 55, and the operation control
circuitry 56. Among these pieces of circuitry, the door opening-closing detection
circuitry 51, the use frequency prediction circuitry 52, the temperature detection
circuitry 53, and the operation control circuitry 56 are the same as those pieces of
20 circuitry of Embodiment 1.

[0061]

(Comparison Circuitry 157)

The comparison circuitry 157 is configured to compare the operation
information of the refrigerator 2 with the operation information of the refrigerators 102
25 owned by other users and determine whether or not there is a difference between
them.

[0062]

(Determination Circuitry 154)

When the comparison circuitry 157 determines, through the comparison, that
30 the operation information of the refrigerator 2 is different from that of the refrigerators

102, the determination circuitry 154 is configured to determine a suited setting adapted for a usage condition of the refrigerators 102 of other users on the basis of the operation information of the refrigerators 102.

[0063]

5 (Proposition Circuitry 55)

The proposition circuitry 55 is configured to propose the suited setting determined by the determination circuitry 154 by use of the information terminal 4.

[0064]

10 Fig. 11 is a flowchart illustrating an operation of the refrigerator communication system 101 according to Embodiment 2. Next, operation of the refrigerator communication system 101 will be described. As shown in Fig. 11, first in the refrigerators 102 of other users, operation information of the refrigerators 102 is obtained (step S220). Then, operation information of the refrigerators 102 is transmitted from the refrigerators 102 of other users to the refrigerator communication unit 25 of the refrigerator 2 of the user via the external network 3 (step S221).

15 [0065]

Meanwhile, in the refrigerator 2 of the user, the use frequency prediction circuitry 52 predicts a use frequency of the refrigerator 2 for each time zone on the basis of the number of times of opening and closing of the door 22 detected by the door opening-closing detection circuitry 51. In addition, the temperature detection circuitry 53 receives a signal relating to the temperature detected by one of the temperature sensors 24 to detect the temperature of the storage compartment 21 (step S201).

20 [0066]

25 Next, the comparison circuitry 157 compares the operation information of the refrigerator 2 such as the use frequency for each time zone and the temperature with the operation information of the refrigerators 102 and determines whether or not there is a difference between them (step S222). When the operation information of the refrigerator 2 is the same as the operation information of the refrigerators 102 (NO in step S222), the determination circuitry 154 determines a suited setting adapted for

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the usage condition of the refrigerator 2 of the user on the basis of the operation information of the refrigerator 2 (step S202). Meanwhile, when the operation information of the refrigerator 2 is not the same as the operation information of the refrigerators 102 (YES in step S222), the determination circuitry 154 determines a suited setting adapted for the usage condition of the refrigerator 2 of the user on the basis of the operation information of the refrigerators 102 (step S223).

[0067]

Then, the proposition circuitry 55 proposes the suited setting determined by the determination circuitry 154 by use of the information terminal 4 (step S203). More specifically, the refrigerator communication unit 25 transmits the suited setting proposed by the proposition circuitry 55 to the external network 3. The external network 3 transmits the suited setting transmitted from the refrigerator communication unit 25, to the information communication unit 41 of the information terminal 4 (step S204).

[0068]

In the information terminal 4, when the information communication unit 41 receives the suited setting proposed by the proposition circuitry 55, the display device 42 displays a message such as "would you like to change the operation state of the refrigerator 2 to the one suited for the user?" (step S205). At this time, the control unit 43 measures time (step S206). When the predetermined period of time has elapsed (YES in step S206), the control unit 43 causes the information communication unit 41 to transmit a notification that the user has rejected the suited setting to the external network 3 (step S210). Thus, the processing is ended.

[0069]

Meanwhile, when the user rejects the suited setting (NO in step S207) even before the predetermined period of time has elapsed (NO in step S206), the control unit 43 causes the information communication unit 41 to transmit a notification that the user has rejected the suited setting to the external network 3 (step S210). On the other hand, when the user accepts the suited setting (YES in step S207) before the predetermined period of time has elapsed (NO in step S206), the information

communication unit 41 transmits a notification that the user has accepted the suited setting to the external network 3 (step S208). The external network 3 transmits the notification that the user has accepted the suited setting and that is transmitted from the information communication unit 41, to the refrigerator communication unit 25 of the refrigerator 2 (step S209).

[0070]

In the refrigerator 2, the operation control circuitry 56 determines whether the suited setting is applicable to the refrigerator 2 (step S211). When determining that the suited setting is not applicable to the refrigerator 2, the operation control circuitry 56 does not apply the suited setting to the refrigerator 2 (NO in step S211). Then, the refrigerator communication unit 25 transmits a notification that application of the suited setting has been failed to the external network 3 (step S216). The external network 3 transmits the notification that application of the suited setting has been failed and that is transmitted from the refrigerator communication unit 25, to the information communication unit 41 of the information terminal 4 (step S217). In the information terminal 4, when the information communication unit 41 receives the notification that application of the suited setting has been failed, the display device 42 displays the notification that application of the suited setting has been failed (step S218). In this manner, the information terminal 4 informs the user that the application of the suited setting has been failed.

[0071]

Meanwhile, when determining that the suited setting is applicable to the refrigerator 2 (YES in step S211), the operation control circuitry 56 applies the suited setting to the refrigerator 2 (step S212). Then, the refrigerator communication unit 25 transmits a notification that the suited setting has been applied by the operation control circuitry 56 to the external network 3 (step S213). The external network 3 transmits the notification that the suited setting has been applied and that is transmitted from the refrigerator communication unit 25, to the information communication unit 41 of the information terminal 4 (step S214). In the information terminal 4, when the information communication unit 41 receives the notification that

suited setting has been applied, the display device 42 displays the notification that the suited setting has been applied (step S215). In this manner, the information terminal 4 informs the user that the suited setting has been applied.

[0072]

5 According to Embodiment 2, in addition to obtaining the same effect as Embodiment 1, it is capable of applying the operation information of the refrigerators 102 of other users, which is not ordinarily available to the user of the refrigerator 2, to the operation of the own refrigerator 2. The user can further improve the operation state of the refrigerator 2 while recognizing usage conditions of the refrigerators 102 of other users.

[0073]

Note that the controller 105 stores the operation information of the refrigerators 102 and also stores a user history of acceptances and rejections of the suited setting. When the suited setting to be proposed is the one that has been proposed before and 15 rejected by the user within a predetermined time, the proposition circuitry 55 may be configured to terminate the processing without offering the proposal. The predetermined time is, for example, two days but may be changed, as appropriate.

[0074]

(Normal Ice-making Mode and Ice-making Stop Mode)

20 Next, the normal ice-making mode and the ice-making stop mode will be described as examples of the suited operation state. A case is described where, during winter, many other users use the ice-making stop mode as the setting of the ice-making compartment 21c, rather than the normal ice-making mode. The many other users account for, for example, 30% or higher of all users. In this case, the determination circuitry 154 determines that changing the mode into the ice-making stop mode may be actually beneficial. Then, the proposition circuitry 55 proposes to the user the ice-making stop mode as the suited setting by use of the information terminal 4. Note that, in addition to season information, when a certain tendency is observed in the settings of the refrigerators 102 of other users and it is determined 25 that the tendency is suited for the usage condition of the refrigerator 2 of the user, the 30

proposition circuitry 55 may be configured to arbitrarily propose the tendency as a suited setting.

[0075]

(Opening-closing Time of Door 22)

5 Next, the number of times of opening and closing of the door 22 will be described as an example of the suited operation state. In this example, a time in which the door 22 is kept opened by the user each time is 30 seconds on average. Meanwhile, in the refrigerators 102 of other users connected to the external network 3, a time in which the door 22 is kept opened by each of the other users each time is 10 seconds on average. The shorter the time in which the door 22 of the storage compartment 21 is kept opened, the more a temperature rise can be reduced in the storage compartment 21, and thus the more an operation factor of a compressor can be reduced. Therefore, the determination circuitry 154 determines that the time in which each of the other users opens the door 22 is a suited setting. Then, the proposition circuitry 55 proposes the suited setting to the user of the refrigerator 2 through the information terminal 4.

[0076]

20 The proposition circuitry 55 offers a proposal and an advice indicating, for example, "the door 22 of the refrigerator 2 is closed within 10 seconds on average in many households. Let's try to close the door 22 as quickly as possible." With such a proposal, the user can further improve the operation state of the refrigerator 2. Note that, although Embodiment 2 describes a case where the proposal regarding the opening-closing time of the door 22 each time is made, when a probable tendency is observed in the usage conditions of the refrigerators 102 of other uses, the proposition circuitry 55 may be configured to arbitrarily propose the tendency as a suited setting.

Reference Signs List

[0077]

30 1: refrigerator communication system, 2: refrigerator, 3: external network, 4: information terminal, 5: controller, 20: refrigerator body, 20a: outer case, 20b: inner

case, 21: storage compartment, 21a: vegetable compartment, 21b: first freezer
compartment, 21c: ice-making compartment, 21d: second freezer compartment, 21e:
refrigerator compartment, 22: door, 22a: vegetable compartment door, 22b: first
freezer compartment door, 22c: ice-making compartment door, 22d: second freezer
5 compartment door, 22e: refrigerator compartment door, 23: door opening-closing
sensor, 23a: sensor for vegetable compartment, 23b: sensor for first freezer
compartment, 23c: sensor for three compartments, 24: temperature sensor, 25:
refrigerator communication unit, 41: information communication unit, 42: display
device, 43: control unit, 51: door opening-closing detection circuitry, 52: use frequency
10 prediction circuitry, 53: temperature detection circuitry, 54: determination circuitry, 55:
proposition circuitry, 56: operation control circuitry, 101: refrigerator communication
system, 102: refrigerator, 105: controller, 154: determination circuitry, 157:
comparison circuitry

CLAIMS

[Claim 1]

A refrigerator communication system comprising:

a refrigerator configured to refrigerate an article stored in a storage

5 compartment formed in the refrigerator and having a refrigerator communication unit configured to transmit and receive data;

an information terminal having an information communication unit configured to communicate with the refrigerator communication unit of the refrigerator via an external network; and

10 a controller configured to control the refrigerator and the information terminal, the controller including

determination circuitry configured to determine a suited setting adapted for a usage condition of the refrigerator of a user on the basis of operation information of the refrigerator, and

15 proposition circuitry configured to propose the suited setting determined by the determination circuitry by use of the information terminal.

[Claim 2]

The refrigerator communication system of claim 1, wherein

20 the controller further includes operation control circuitry configured to apply the suited setting proposed by the proposition circuitry to the refrigerator when the user accepts the suited setting.

[Claim 3]

The refrigerator communication system of claim 2, wherein

25 the operation control circuitry is configured to determine whether the suited setting is applicable to the refrigerator.

[Claim 4]

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

the controller further includes use frequency prediction circuitry configured to predict a use frequency of the refrigerator for each time zone, and

the operation information includes the use frequency of the refrigerator for each time zone predicted by the use frequency prediction circuitry.

[Claim 5]

The refrigerator communication system of claim 4, wherein

the controller further includes door opening-closing detection circuitry configured to detect opening and closing of a door of the storage compartment, and the use frequency prediction circuitry is configured to predict a use frequency of the refrigerator for each time zone on the basis of the number of times of opening and closing of the door detected by the door opening-closing detection circuitry.

[Claim 6]

The refrigerator communication system of any one of claims 1 to 5, wherein the controller further includes temperature detection circuitry configured to detect a temperature of the storage compartment, and

the operation information includes the temperature detected by the temperature detection circuitry.

[Claim 7]

The refrigerator communication system of any one of claims 1 to 6, wherein the refrigerator and the information terminal are each configured to communicate with an other refrigerator owned by an other user different from the user of the refrigerator via the external network.

[Claim 8]

The refrigerator communication system of claim 7, wherein

the controller further includes comparison circuitry configured to compare the operation information of the refrigerator with operation information of the other refrigerator owned by the other user and determine whether or not there is a difference between the operation information of the refrigerator and the operation information of the other refrigerator,

the determination circuitry is configured to determine a suited setting adapted for a usage condition of the other refrigerator of the other user on the basis of the operation information of the other refrigerator when the comparison circuitry

determines, through comparison, that the operation information of the refrigerator and the operation information of the other refrigerator are different from each other, and the proposition circuitry is configured to propose the suited setting determined by the determination circuitry by use of the information terminal.

5 [Claim 9]

The refrigerator communication system of any one of claims 1 to 8, wherein the suited setting includes a setting that suits a usual usage condition of the refrigerator of the user.