FIG. 9
SMART REFRIGERATOR, REFRIGERATOR SYSTEM
INCLUDING THE SMART REFRIGERATOR, AND CONTROL
METHOD THEREOF

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a refrigerator, and in particular, to a smart refrigerator, a refrigerator system including the smart refrigerator and a control method thereof.

Related Art

The basic function of an existing refrigerator is to provide a low-temperature storage environment. For such a refrigerator, a user usually needs to open the refrigerator to check an object storage situation therein before purchasing, so as to plan objects to be supplemented. However, with the accelerated pace of everyday life, the user increasingly needs a smart refrigerator, a storage situation of which can be remotely obtained, so as to make arrangement for a purchasing demand.

On such basis, the present invention provides a smart refrigerator, a refrigerator system including the smart refrigerator, and a control method thereof, so as to meet the above demands.

SUMMARY OF THE INVENTION

An objective of the present invention is to provide a smart refrigerator, a refrigerator system including the smart refrigerator, and a control method thereof, so as to meet the user's demand of a smart refrigerator, a storage situation of which can be remotely obtained to arrange purchasing.

To solve the above problem, the present invention provides a smart refrigerator, which includes:
an image capture device, disposed inside the refrigerator and used for capturing an image of an object stored in the refrigerator; and

a control device, used for receiving an instruction to control the image capture device to capture an image, receiving the captured image, and sending the received image to a remote terminal.

Optionally, the instruction received by the control device is from the remote terminal.

Optionally, a weight sensor is disposed below a storage device inside the refrigerator, and the instruction received by the control device is from the weight sensor.

Optionally, the smart refrigerator includes a timer, and the instruction received by the control device is from the timer.

Optionally, the control device includes:

an image input port, used for receiving the image captured by the image capture device and transmitting the captured image to an image processor;

the image processor, used for processing the image captured by the image capture device into an image capable of being displayed by the remote terminal, and transmitting the processed image to an image output port; and

the image output port, used for receiving the image transmitted by the image processor and sending the image to the remote terminal.

Optionally, the control device includes:

an instruction input port, used for receiving an image capture instruction sent by the remote terminal and transmitting the image capture instruction to an instruction processor;

the instruction processor, used for processing the image capture instruction sent by the remote terminal into an instruction capable of being identified by the image capture
device, and transmitting the processed instruction to an instruction output port; and

the instruction output port, used for receiving the instruction transmitted by the instruction processor (122) and sending the instruction to the image capture device.

Optionally, the control device includes:

an instruction input port, used for receiving an image capture instruction sent by the remote terminal and/or the weight sensor, and transmitting the image capture instruction to an instruction processor;

the instruction processor, used for processing the image capture instruction sent by the remote terminal and/or the weight sensor into an instruction capable of being identified by the image capture device, and transmitting the processed instruction to an instruction output port; and

the instruction output port, used for receiving the instruction transmitted by the instruction processor and sending the instruction to the image capture device.

Optionally, the control device includes:

an instruction input port, used for receiving an image capture instruction sent by the remote terminal and/or the timer, and transmitting the image capture instruction to an instruction processor;

the instruction processor, used for processing the image capture instruction sent by the remote terminal and/or the timer into an instruction capable of being identified by the image capture device, and transmitting the processed instruction to an instruction output port; and

the instruction output port, used for receiving the instruction transmitted by the instruction processor and sending the instruction to the image capture device.

Optionally, the image processor further includes an image information enhancement module for enhancing information of the captured image.
Optionally, the image information enhancement includes enhancement of an outline.

Optionally, the image processor further includes:

an information prestoring module, used for prestoring an image of an object; and

a comparison module, connected to the information prestoring module and used for comparing the image captured by the image capture device with the prestored image of the object, generating a list of images of the objects to be purchased, processing the images into images capable of being displayed by the remote terminal, and transmitting the processed images to the image output port.

Optionally, the image of the object is a picture or a video.

Optionally, the image capture device includes a camera and an illuminator.

Optionally, the illuminator is integrated on the camera.

Optionally, the image capture device is disposed on a side wall, a rear wall or an upper wall of a storage compartment.

Optionally, the storage compartment has at least one shelf and is partitioned by the shelf into multiple storage spaces; the image capture device is fit for moving from one storage space to another storage space along the side wall.

Optionally, multiple bottle supports are disposed on an inner side of the door of the storage compartment; when the door is closed, the image capture device is located between the bottle supports and the shelf and is fit for moving between the bottle supports and the shelf.

Optionally, the control device further includes an infrared apparatus, a Bluetooth apparatus, a Wireless Fidelity (WIFI) apparatus or an Internet apparatus.

Optionally, the control device is integrated to a control panel of the refrigerator.

Based on the above smart refrigerator, the present invention further provides a
refrigerator system, which includes:

the above smart refrigerator; and

a remote user operation device, used for sending an image capture instruction to the control device and receiving an image sent by the control device.

Optionally, the control device exchanges information with the remote user operation device through an infrared protocol, a Bluetooth protocol, a WIFI protocol or an Internet protocol.

Optionally, the remote user operation device is a computer or a mobile phone.

Based on the above refrigerator system, the present invention further provides a control method thereof, which includes:

sending, by the remote user operation device, an instruction to the control device; and

controlling, by the control device, the image capture device to capture an image and sending the image of an object stored in the refrigerator to the remote user operation device.

Optionally, the image capture device includes a camera and an illuminator; the control method further includes: when the control device controls the image capture device to captures the image, turning on the camera and the illuminator, and after the capture is completed, turning off the camera and the illuminator.

Compared with the prior art, the present invention has the following advantages:

1) Different from the existing solution of arranging purchasing by opening the refrigerator to acquire an object storage situation, the present invention adopts a manner in which the control device receives an instruction to control the image capture device disposed inside the refrigerator to capture an image of a stored object and sends the captured image to a remote terminal, which meets the users' demand of remotely obtaining information about a storage situation in the refrigerator and accordingly
arranging purchasing.

2) In an optional solution, three manners of sending the instruction are provided. In the first manner, the instruction is from the remote terminal, that is, a user sends the instruction according to a demand to obtain an existing situation of objects stored in the refrigerator. In the second manner, the instruction is from a weight sensor disposed below a storage device inside the refrigerator, where the sensor sends the instruction to prompt the user to supplement the supply when detecting that the weight of the storage device is lower than a weight set by the user or lower than the weight of necessities for daily life. In the third manner, the instruction is from a timer, for example, at off-duty time every Friday, the instruction is sent, so that the existing situation of objects stored in the refrigerator is sent to the user, and then the user determines whether it is necessary to supplement the supply.

3) In an optional solution, the three manners of sending the instruction coexist.

4) In an optional solution, the control device includes an image processor used for processing the image captured by the image capture device into an image capable of being displayed by the remote terminal, and the image processor includes an image information enhancement module used for enhancing information of the captured image, so that the clarity of the image received by the terminal can be improved, thereby preventing false purchase.

5) In an optional solution, in addition to the image information enhancement module, the image processing module further includes: an information prestoring module used for prestoring an image of an object; and a comparison module used for comparing the image captured by the image capture device with the prestored image of the object, generating a list of images of the objects to be purchased, and processing the images into images capable of being displayed by the remote terminal. In this way, the list of images of the objects to be purchased by the user is provided together with the existing situation of objects stored in the refrigerator, making it more convenient for the user to determine the supply to be supplemented.

6) In an optional solution, the control device further includes an infrared apparatus,
a Bluetooth apparatus, a WIFI apparatus or an Internet apparatus, and the remote terminal of the user implements wireless communication with the control device through the above apparatuses.

7) In an optional solution, the image capture device includes an illuminator and a camera. The illuminator may be an illuminator of the refrigerator or an additionally disposed illuminator. In addition, the illuminator may be separated from the camera and may also be integrated on the camera; the latter arrangement not only improves the integration, but also provides a better illumination condition.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a schematic structural view of a smart refrigerator provided in Embodiment 1 of the present invention;

FIG. 2 is a control circuit diagram of an illuminator of an existing refrigerator;

FIG. 3 is a control circuit diagram of a camera and an illuminator in Embodiment 1;

FIG. 4 is another control circuit diagram of the camera and the illuminator in Embodiment 1;

FIG. 5 is a schematic view of a control device of an image capture device moving along a rail;

FIG. 6 is a module structure diagram of a control device in Embodiment 1;

FIG. 7 is a module structure diagram of an image processor in Embodiment 1;

FIG. 8 is another module structure diagram of the image processor in Embodiment 1;

FIG. 9 is a schematic structural view of a refrigerator system provided in Embodiment 1;

FIG. 10 is a schematic structural view of a smart refrigerator provided in Embodiment 2 of the present invention; and
FIG. 11 is a schematic structural view of a smart refrigerator provided in Embodiment 3 of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

To make the objectives, features and advantages of the present invention more comprehensible, specific embodiments of the present invention are further described in detail below with reference to the accompanying drawings, and the drawings are not drawn to scale since emphasis is placed on the principles of the present invention.

To facilitate understanding of the technical solutions of the present invention, reference numerals appearing in the present invention are listed below.

Smart refrigerator 1  
Control device 12  
Illuminator 112  
Printed circuit board (PCB) 14  
Instruction input port 121  
Instruction output port 123  
Image processor 125  
Image information enhancement module 1251  
Comparison module 1253  
Mobile phone 2  
Timer 17  
power line 114  

Image capture device 11  
Camera 111  
Door switch 13  
PCB board 14'  
Instruction processor 122  
Image input port 124  
Image output port 126  
Information prestoring module 1252  
Control panel 15  
Weight sensor 16  
Wheel 113  
Data line 115

Embodiment 1

As described above, the present invention adopts a manner in which a control device receives an instruction to control an image capture device disposed inside a
refrigerator to capture an image of a stored object and sends the captured image to a remote terminal, which meets the users' demand of remotely obtaining information about a storage situation in the refrigerator and accordingly arranging purchasing. The instruction received by the control device may be from multiple sources. In Embodiment 1, that the instruction received by the control device is from a remote terminal is taken as an example to introduce the technical solutions of the present invention in detail.

FIG. 1 shows a smart refrigerator 1 provided in Embodiment 1, which includes:

an image capture device 11, disposed inside the refrigerator and used for capturing an image of an object stored in the refrigerator; and

a control device 12, used for receiving an instruction to control the image capture device 11 to capture an image, receiving the captured image, and sending the received image to a remote terminal, where the instruction received by the control device 12 is from the remote terminal.

In Embodiment 1, the image of the object is a picture or a video, and correspondingly, the image capture device 11 includes a camera 111, and illumination is preferably provided in shooting to achieve a high-quality image. The illumination may be provided by an illuminator 112 of the existing refrigerator or by an additionally disposed illuminator 112, and no matter which illuminator 112 is adopted, it needs to be implemented by a control circuit of the illuminator 112 that the illuminator 112 is in an on state when the camera 111 captures an image and the illuminator 112 is turned off after the shooting.

To prevent heating of the illuminator 112 from affecting the refrigeration or freezing temperature of the refrigerator, the illuminator 112 is preferably an LED, and in addition, it is preferred that the control circuit of the illuminator 112 and the control circuit of the camera 111 can simultaneously turn on and turn off the illuminator 112 and the camera 111. Taking as an example that the illuminator 112 is the illuminator of the existing refrigerator, a control circuit enabling the illuminator 112 and the camera 111 to be simultaneously turned on and turned off is described below.
The control circuit of the illuminator 112 of the existing refrigerator is first introduced. Referring to FIG. 2, a working process of the control circuit is as follows: when the door of the refrigerator is opened, a door switch 13 is turned off, and the illuminator 112 is powered on; when the door of the refrigerator is closed, the door switch 13 is turned on, and the illuminator 112 is powered off. In Embodiment 1, the camera 111 is provided, and correspondingly, regarding a control circuit of the camera 111 and the illuminator 112, as shown in FIG. 3, it can be seen that a PCB board 14 is added to the circuit, and the PCB board 14 is controlled by the image capture device 11. A working process of the control circuit is as follows: the control device 12 controls the image capture device 11 to capture an image after receiving an instruction, and at this time, after obtaining an image capture signal, the PCB board 14 controls the camera 111 and the illuminator 112 to be simultaneously powered on; after the capture is completed, the PCB board 14 obtains an image capture complete signal, and then controls the camera 111 and the illuminator 112 to be simultaneously powered off and to stay in the off state. In the above process, the illuminator 112 is additionally controlled by the door switch 13, that is, when the door of the refrigerator is opened, the illuminator 112 is powered on; when the door of the refrigerator is closed, the illuminator 112 is powered off. In other words, the illuminator 112 is separately controlled by the door switch 13 and the PCB board 14, with no interference to each other.

In addition to the above manner shown in FIG. 3 that the illuminator 112 is separately and directly controlled by the door switch 13 and the PCB board 14, as shown in FIG. 4, the door switch 13 may also be integrated into the PCB board 14' for uniform management. A working process of the control circuit is as follows: the control device 12 controls the image capture device 11 to capture an image after receiving an instruction, and at this time, after obtaining an image capture signal, the PCB board 14' controls the camera 111 and the illuminator 112 to be simultaneously powered on; after the capture is completed, the PCB board 14' obtains an image capture complete signal, and then controls the camera 111 and the illuminator 112 to be simultaneously powered off. In the process, the illuminator 112 is additionally controlled by the door switch 13 integrated into the PCB board 14', that is, when the door of the refrigerator is opened, the illuminator 112 is powered on; when the door of the refrigerator is closed, the
illuminator 112 is powered off. In other words, the illuminator 112 is separately controlled by the door switch 13 and the PCB board 14, with no interference to each other.

During the specific implementation, the illuminator 112 may be provided separately from the camera 111, and the illuminator 112 may also be integrated on the camera 111, so as to improve the integration and provide a better illumination condition.

The image capture device 11 is disposed inside the refrigerator, and the refrigerator is an existing refrigerator. Specifically, an existing refrigerator generally includes a refrigerating chamber and a freezing chamber according to different storage conditions. Generally, objects in the refrigerating chamber are used frequently; therefore, in Embodiment 1, the image capture device 11 is preferably disposed in the refrigerating chamber. Definitely, in another embodiment, the image capture device 11 may also be disposed in the freezing chamber as required, or the refrigerating chamber and the freezing chamber are each provided with an image capture device 11.

To realize that the image captured by the image capture device 11 includes information about all the stored objects, the camera 111 of the image capture device 11 is disposed in a non-blind angle shooting region, for example, as show in FIG. 1, disposed at a position on a side wall close to the door. Definitely, the camera 111 may also be disposed on a rear wall or an upper wall, and a rotatable camera may also be selected according to a demand, so as to shoot from multiple angles. The refrigerating chamber and/or the freezing chamber of the existing refrigerator have/has multiple storage compartments (not shown), and in order not to miss any information about the stored objects, a rail (not shown) may be disposed between the multiple storage compartments. The rail is used for the image capture device 11, especially the camera 111, to slide thereon, so that the image capture device 11 shoots once for a certain sliding distance or shoots a continuous video in the sliding.

During the specific implementation, the multiple storage compartments are generally spaced by a shelf (not shown), the rail is disposed on a side wall inside the refrigerator, and a through hole is disposed at a position where the shelf and the side
wall are connected, and is used for passing the rail and the image capture device 11 there-through. As shown in FIG. 1, in Embodiment 1, the rail not only is disposed on a liner sidewall of the refrigerating chamber but also is located in a gap between the door in the closed state and the shelf. In this way, it is enabled that the image capture device 11 can move from one storage space to another storage space, and the space is also saved, thereby avoiding providing a through hole on the shelf.

In another embodiment, for the refrigerator, multiple bottle supports are generally disposed at an inner side of the door of the storage compartment. When the door is closed, a spacing is kept between the bottle supports and the front end of the shelf, and at this time, the rail not only is disposed on a liner sidewall of the storage compartment, but also is located in a gap between the bottle supports and the front end of the shelf. In this way, it is enabled that the image capture device 11 can move between the bottle supports and the shelf along the side wall of the storage compartment, and the space is also saved, thereby avoiding providing a through hole on the shelf.

The refrigerator in Embodiment 1 is not limited to a refrigerator only provided with a refrigerating chamber and a freezing chamber, and may also be a refrigerator only provided with a refrigerating chamber, or a single-door, double-door or three-door refrigerator.

The movement of the image capture device 11 along the rail may be driven by a servo motor. To prevent a lead (for example, a power line) of the image capture device 11 from being tied in a knot in the process that the image capture device 11 slides around the rail, preferably, the lead is disposed in the rail, and further preferably, a wheel that retracts and releases the lead with the movement of the image capture device 11 is disposed in the rail. During the specific implementation, the lead includes a data line and a power line, and preferably, the two lines are twisted together to form a lead. In addition, another line or lead may also be disposed at the other end, opposite to the disposed lead, of the image capture device 11 (for example, the camera 111), where the line and the lead or the two leads are wound on a wheel 113 in opposite directions with free ends thereof fixed on the wheel 113. The image capture device 11 can be driven up and down by controlling the rotation direction and the speed of the wheel 113, and
during the movement, a sum of the lengths of the two leads wound on the wheel 113 and located at the two ends of the image capture device 11 or a sum of the lengths of the lead and another line located at the two ends of the image capture device 11 is not changed, the lead is a lead formed with a data line and a power line twisted together, the another line is an ordinary line, or the data line 115 and the power line 114 are separated, and are respectively located on two ends of the image capture device 11, as shown in FIG. 5. The wheel 113 can be located at a side of the rail or in a side wall of the refrigerator.

The control device 12 is introduced below, and as shown in FIG. 6, the control device 12 includes:

an instruction input port 121, used for receiving an image capture instruction sent by the remote terminal and transmitting the image capture instruction to an instruction processor 122;

the instruction processor 122, used for processing the image capture instruction sent by the remote terminal into an instruction capable of being identified by the image capture device 11 and transmitting the processed instruction to an instruction output port 123;

the instruction output port 123, used for receiving the instruction transmitted by the instruction processor 122 and sending the instruction to the image capture device 11;

an image input port 124, used for receiving the image captured by the image capture device 11 and transmitting the captured image to an image processor 125;

the image processor 125, used for processing the image captured by the image capture device 11 into an image capable of being displayed by the remote terminal, and transmitting the processed image to an image output port 126; and

the image output port 126, used for receiving the image transmitted by the image processor 125 and sending the image to the remote terminal.

It can be seen that both the instruction input port 121 and the image output port 126
remotely communicate with the remote terminal. To achieve the remote communication, the control device 12 further includes a wireless communication apparatus, such as an infrared apparatus, a Bluetooth apparatus, a WIFI apparatus or an Internet apparatus. Correspondingly, the remote terminal is an apparatus matching the wireless communication apparatus and capable of infrared communication, Bluetooth communication, or accessing the network via WIFI or the Internet, for example, a mobile phone or computer having the infrared or Bluetooth function, capable of receiving WIFI or Internet network signals or having a software module with the above functions.

The processing result of the image processor 125 affects the quality of the image received by the remote terminal, and concerns the identification of information about the existing stored objects by the remote terminal, so that the image processor 125 is a core component of the control device 12 and is introduced in detail below. To enhance the clarity of the captured image, as shown in FIG. 7, the image processor 125 may include an image information enhancement module 1251 for enhancing information of the captured image, that is, the image processor 125 receives the image captured by the image capture device 11 and transmitted by the image input port 124, and the image is first enhanced by the image information enhancement module 1251 and is then processed into an image capable of being displayed by the remote terminal and transmitted to the image output port 126. The image information enhancement module 1251 can enhance the information about the entire captured image, but the process may reduce the image processing speed, and thus, preferably, the image information enhancement only includes enhancement of an outline, so as to facilitate identification of the object.

By introducing the working processes of the image capture device 11 and the control device 12, the remote terminal can acquire an image of an object stored in the refrigerator. However, in certain situations, while acquiring a situation of the existing object stored in the refrigerator, the user of the remote terminal also expects to acquire a list of images of objects to be purchased, so as to determine objects to be supplemented in a more targeted manner.
On such basis, as shown in FIG. 8, the image processor 125 in Embodiment 1 further includes:

an information prestoring module 1252, used for prestoring an image of an object; and

a comparison module 1253, connected to the information prestoring module 1252 and used for comparing the image captured by the image capture device 11 with the prestored image of the object, generating a list of images of the objects to be purchased, processing the images into images capable of being displayed by the remote terminal, and transmitting the processed images to the image output port 126.

It should be noted that, for some objects, the number of which can be distinguished, such as cans and beverage bottles, the information prestoring module 1252 may also store the number, and correspondingly, the list of images of the objects to be purchased generated by the comparison module 1253 includes information about the number.

It should be understood that the picture with the entire image information or only the outline enhanced by the image information enhancement module 1251 can reduce the error rate when being compared with the prestored image of the object.

It can be seen from the above description that the control device 12 includes multiple modules, and to improve the integration, the multiple modules can be integrated to a control panel 15 of the refrigerator.

Based on the above smart refrigerator 1, Embodiment 1 further provides a refrigerator system, and as shown in FIG. 9, the refrigerator system includes:

the above smart refrigerator 1; and

a mobile phone 2, used for sending an image capture instruction to the control device 12 and receiving an image sent by the control device 12.

In other embodiments, the mobile phone 2 may also be other remote user operation devices, such as a computer. The remote user operation device exchanges information
with the control device 12 through an infrared protocol, a Bluetooth protocol, a WIFI protocol or an Internet protocol.

Based on the above refrigerator system, Embodiment 1 further provides a control method thereof, which includes:

sending, by the remote user operation device, an instruction to the control device 12; and

controlling, by the control device 12, the image capture device 11 to capture an image and sending the image of an object stored in the refrigerator to the remote user operation device.

In an optional solution, the image capture device 11 includes a camera 111 and an illuminator 112. To avoid affecting the temperature in the storage chamber or freezing chamber, the control method further includes: when the control device 12 controls the image capture device 11 to capture an image, turning on the camera 111 and the illuminator 112, and after the capture is completed, turning off the camera 111 and the illuminator 112.

Embodiment 2

The smart refrigerator, the refrigerator system including the smart refrigerator, and the control method of the system provided in Embodiment 2 are approximately the same as those in Embodiment 1, and the difference lies in that: as shown in FIG. 10, a weight sensor 16 is disposed below a storage device (such as a shelf, a tray, or a drawer) inside the refrigerator, the instruction received by the control device 12 is from the weight sensor 16 or the remote terminal, and definitely, the instruction may also be from both the weight sensor 16 and the remote terminal.

Based on that the instruction received by the control device 12 is from the weight sensor 16 and/or the remote terminal, correspondingly, the functions of the modules in the control device 12 are as follows:

an instruction input port 121, used for receiving an image capture instruction sent
by the remote terminal and/or the weight sensor 16 and transmitting the image capture instruction to an instruction processor 122;

the instruction processor 122, used for processing the image capture instruction sent by the remote terminal and/or the weight sensor 16 into an instruction capable of being identified by the image capture device 11, and transmitting the processed instruction to an instruction output port 123; and

the instruction output port 123, used for receiving the instruction transmitted by the instruction processor 122 and sending the instruction to the image capture device 11.

The weight sensor 16 is provided to achieve the advantage that: the sensor 16 sends an instruction to the control device 12 to prompt the user to supplement the supply when detecting that the weight of the storage device is lower than a weight set by the user or the weight of necessities for daily life.

Based on the smart refrigerator with the weight sensor 16 disposed below the storage device inside the refrigerator, the refrigerator system provided in Embodiment 2 further includes, in addition to the smart refrigerator, a remote user operation device, used for sending an image capture instruction to the control device 12 and receiving an image sent by the control device 12.

The remote user operation device is a mobile phone or a computer, and exchanges information with the control device 12 through an infrared protocol, a Bluetooth protocol, a WIFI protocol or an Internet protocol.

It should be noted that the control device 12 not only receives the instruction of the remote user operation device but also receives the instruction sent by the weight sensor 16.

Based on the above refrigerator system, Embodiment 2 provides a control method thereof, which includes:

sending, by the remote user operation device, an instruction to the control device 12; and
controlling, by the control device 12, the image capture device 11 to capture an image and sending the image of an object stored in the refrigerator to the remote user operation device.

It should be noted that since the control device 12 not only receives the instruction from the remote user operation device but also receives the instruction sent by the weight sensor 16, specifically, the weight sensor 16 sends an instruction when detecting that the weight of the storage device is lower than a weight set by the user or the weight of necessities for daily life, and after receiving the instruction, the control device 12 controls the image capture device 11 to capture an image, receives the captured image, and sends the received image to the remote user operation device, and according to the received image reflecting the situation of the existing object stored in the refrigerator, the user determines whether it is necessary to supplement the supply.

Embodiment 3

The smart refrigerator, the refrigerator system including the smart refrigerator, and the control method of the system provided in Embodiment 3 are approximately the same as those in Embodiment 1, and the difference lies in that: as shown in FIG. 11, the smart refrigerator includes a timer 17, the instruction received by the control device 12 is from the timer 17 or the remote terminal, and definitely, the instruction may also be from both the timer 17 and the remote terminal.

The location of the timer 17 is not limited, and since the timer 17 is a circuit module, the timer 17 is preferably integrated to the control panel 15 of the refrigerator.

Based on that the instruction received by the control device 12 is from the timer 17 and/or the remote terminal in Embodiment 3, correspondingly, the functions of the modules in the control device 12 are as follows:

an instruction input port 121, used for receiving an image capture instruction sent by the remote terminal and/or the timer 17 and transmitting the image capture instruction to an instruction processor 122;

the instruction processor 122, used for processing the image capture instruction sent
by the remote terminal and/or the timer 17 into an instruction capable of being identified by the image capture device 11, and transmitting the processed instruction to an instruction output port 123; and

the instruction output port 123, used for receiving the instruction transmitted by the instruction processor 122 and sending the instruction to the image capture device 11.

The timer 17 is provided to achieve the advantage that: the timer 17 sends an instruction to the control device 12 at a particular time, for example, at off-duty time every Friday, the control device 12 sends the situation of the existing object stored in the refrigerator to the user, and then the user determines whether it is necessary to supplement the supply.

Based on the smart refrigerator provided with the timer 17, the refrigerator system according to Embodiment 3 further includes, in addition to the smart refrigerator, a remote user operation device, used for sending an image capture instruction to the control device 12 and receiving an image sent by the control device 12.

Similar to Embodiments 1 and 2, the remote user operation device is a mobile phone 2 or a computer, and exchanges information with the control device 12 through an infrared protocol, a Bluetooth protocol, a WIFI protocol or an Internet protocol.

It should be noted that the control device 12 not only receives the instruction from the remote user operation device but also receives the instruction sent by the timer 17.

Based on the above refrigerator system, Embodiment 3 provides a control method thereof, which includes:

sending, by the remote user operation device, an instruction to the control device 12; and

controlling, by the control device 12, the image capture device 11 to capture an image and sending the image of an object stored in the refrigerator to the remote user operation device.
It should be noted that since the control device 12 not only receives the instruction from the remote user operation device but also receives the instruction sent by the timer 17, specifically, the timer 17 sends an instruction according to the purchase time set by the user, for example, at off-duty time every Friday, and after receiving the instruction, the control device 12 controls the image capture device 11 to capture an image, receives the captured image, and sends the received image to the remote user operation device, and according to the received image reflecting the existing object stored in the refrigerator, the user determines whether it is necessary to supplement the supply.

Embodiment 4

For the smart refrigerator provided in Embodiment 4, the instruction received by the control device thereof is from the remote terminal and/or the weight sensor and/or the timer, that is, an instruction sending method with three coexisting manners is adopted.

Based on the smart refrigerator provided with the timer 17 and the weight sensor 16 disposed below a storage device in the refrigerator, the refrigerator system provided in Embodiment 4 further includes, in addition to the smart refrigerator, a remote user operation device, used for sending an image capture instruction to the control device 12 and receiving an image sent by the control device 12.

Similar to Embodiments 1, 2, and 3, the remote user operation device is a mobile phone 2 or a computer, and exchanges information with the control device 12 through an infrared protocol, a Bluetooth protocol, a WIFI protocol or an Internet protocol.

It should be noted that the control device 12 not only receives the instruction from the remote user operation device but also receives the instruction sent by the weight sensor 16 and/or the timer 17.

Based on the above refrigerator system, Embodiment 4 provides a control method thereof, which includes:

sending, by the remote user operation device, an instruction to the control device 12; and
controlling, by the control device 12, the image capture device 11 to capture an image and sending the image of an object stored in the refrigerator to the remote user operation device.

It should be noted that since the control device 12 not only receives the instruction from the remote user operation device but also receives the instruction sent by the timer 17 and/or the weight sensor 16, specifically, 1) the weight sensor 16 sends an instruction when detecting that the weight of the storage device is lower than a weight set by the user or the weight of necessities for daily life, and after receiving the instruction, the control device 12 controls the image capture device 11 to capture an image, receives the captured image, and sends the received image to the remote user operation device, and according to the received image reflecting the situation of the existing object stored in the refrigerator, the user determines whether it is necessary to supplement the supply; 2) the timer 17 sends an instruction according to the purchase time set by the user, for example, at off-duty time every Friday, and after receiving the instruction, the control device 12 controls the image capture device 11 to capture an image, receives the captured image, and sends the received image to the remote user operation device, and according to the received image reflecting the situation of the existing object stored in the refrigerator, the user determines whether it is necessary to supplement the supply. Either of the two sending manners can be selected or the two manners coexist.

The present invention has been disclosed above through exemplary embodiments, but is not intended to be limited thereto. Persons skilled in the art can make possible variations and modifications to the technical solutions of the present invention by using the above-disclosed method and the technical content without departing from the spirit and scope of the present invention. Therefore, any simple modification, equivalent variation and modification made to the above embodiments according to the technical essence of the present invention without departing from the content of the technical solutions of the present invention shall fall within the protection scope of the technical solutions of the present invention.
CLAIMS

What is claimed is:

1. A smart refrigerator, comprising:

   an image capture device (11), disposed inside the refrigerator and used for capturing an image of an object stored in the refrigerator; and

   a control device (12), used for receiving an instruction to control the image capture device (11) to capture an image, receiving the captured image, and sending the received image to a remote terminal.

2. The smart refrigerator according to claim 1, characterized in that the instruction received by the control device (12) is from the remote terminal.

3. The smart refrigerator according to claim 1, characterized in that a weight sensor (16) is disposed below a storage device inside the refrigerator, and the instruction received by the control device (12) is from the weight sensor (16).

4. The smart refrigerator according to claim 1, characterized in that the smart refrigerator comprises a timer (17), and the instruction received by the control device (12) is from the timer (17).

5. The smart refrigerator according to claim 1, characterized in that the control device (12) comprises:

   an image input port (124), used for receiving the image captured by the image capture device (11) and transmitting the captured image to an image processor (125);

   the image processor (125), used for processing the image captured by the image capture device (11) into an image capable of being displayed by the remote terminal, and transmitting the processed image to an image output port (126); and

   the image output port (126), used for receiving the image transmitted by the image processor (125) and sending the image to the remote terminal.
6. The smart refrigerator according to claim 2, characterized in that the control device (12) comprises:

   an instruction input port (121), used for receiving an image capture instruction sent by the remote terminal and transmitting the image capture instruction to an instruction processor (122);

   the instruction processor (122), used for processing the image capture instruction sent by the remote terminal into an instruction capable of being identified by the image capture device (11), and transmitting the processed instruction to an instruction output port (123); and

   the instruction output port (123), used for receiving the instruction transmitted by the instruction processor (122) and sending the instruction to the image capture device (11).

7. The smart refrigerator according to claim 3, characterized in that the control device (12) comprises:

   an instruction input port (121), used for receiving an image capture instruction sent by the remote terminal and/or the weight sensor (16), and transmitting the image capture instruction to an instruction processor (122);

   the instruction processor (122), used for processing the image capture instruction sent by the remote terminal and/or the weight sensor (16) into an instruction capable of being identified by the image capture device (11), and transmitting the processed instruction to an instruction output port (123); and

   the instruction output port (123), used for receiving the instruction transmitted by the instruction processor (122) and sending the instruction to the image capture device (11).

8. The smart refrigerator according to claim 4, characterized in that the control device (12) comprises:
an instruction input port (121), used for receiving an image capture instruction sent by the remote terminal and/or the timer (17) and transmitting the image capture instruction to an instruction processor (122);

the instruction processor (122), used for processing the image capture instruction sent by the remote terminal and/or the timer (17) into an instruction capable of being identified by the image capture device (11), and transmitting the processed instruction to an instruction output port (123); and

the instruction output port (123), used for receiving the instruction transmitted by the instruction processor (122) and sending the instruction to the image capture device (11).

9. The smart refrigerator according to claim 5, characterized in that the image processor (125) further comprises an image information enhancement module (1251) for enhancing information of the captured image.

10. The smart refrigerator according to claim 9, characterized in that the image information enhancement comprises enhancement of an outline.

11. The smart refrigerator according to claim 5 or 9, characterized in that the image processor (125) further comprises:

an information prestoring module (1252), used for prestoring an image of an object; and

a comparison module (1253), connected to the information prestoring module (1252) and used for comparing the image captured by the image capture device (11) with the prestored image of the object, generating a list of images of the objects to be purchased, processing the images into images capable of being displayed by the remote terminal, and transmitting the processed images to the image output port (126).

12. The smart refrigerator according to claim 1, characterized in that the image of the object is a picture or a video.
13. The smart refrigerator according to claim 1, characterized in that the image capture device (11) comprises a camera (111) and an illuminator (112).

14. The smart refrigerator according to claim 13, characterized in that the illuminator (112) is integrated on the camera (111).

15. The smart refrigerator according to claim 1, characterized in that the image capture device (11) is disposed on a side wall, a rear wall or an upper wall of a storage compartment.

16. The smart refrigerator according to claim 15, characterized in that the storage compartment has at least one shelf and is partitioned by the shelf into multiple storage spaces, and the image capture device (11) is fit for moving from one storage space to another storage space along the side wall.

17. The smart refrigerator according to claim 16, characterized in that multiple bottle supports are disposed on an inner side of a door of the storage compartment, and when the door is closed, the image capture device (11) is located between the bottle supports and the shelf and is fit for moving between the bottle supports and the shelf.

18. The smart refrigerator according to claim 1, characterized in that the control device (12) further comprises an infrared apparatus, a Bluetooth apparatus, a Wireless Fidelity (WIFI) apparatus or an Internet apparatus.

19. The smart refrigerator according to claim 18, characterized in that the control device (12) is integrated to a control panel of the refrigerator.

20. A refrigerator system, comprising:

the smart refrigerator according to any one of claims 1 to 19; and

a remote user operation device, used for sending an image capture instruction to the control device (12) and receiving an image sent by the control device (12).

21. The refrigerator system according to claim 20, characterized in that the control device (12) exchanges information with the remote user operation device through an
infrared protocol, a Bluetooth protocol, a Wireless Fidelity (WIFI) protocol or an Internet protocol.

22. The refrigerator system according to claim 20, characterized in that the remote user operation device is a computer or a mobile phone (2).

23. A control method of the refrigerator system according to claim 20, comprising:

sending, by the remote user operation device, an instruction to the control device (12); and

controlling, by the control device (12), the image capture device (11) to capture an image and sending the image of an object stored in the refrigerator to the remote user operation device.

24. The control method according to claim 23, characterized in that the image capture device (11) comprises a camera (111) and an illuminator (112); the control method further comprises: when the control device (12) controls the image capture device (11) to capture an image, turning on the camera (111) and the illuminator (112), and after the capture is completed, turning off the camera (111) and the illuminator (112).
## A. Classification of Subject Matter

**INV. F25D29/00**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. Fields Searched

Minimum documentation searched (classification system followed by classification symbols)

F25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

- EPO-Internal
- WPI Data

## C. Documents Considered To Be Relevant

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

<table>
<thead>
<tr>
<th>*</th>
<th>Special categories of cited documents:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>document defining the general state of the art which is not considered to be of particular relevance</td>
</tr>
<tr>
<td>E</td>
<td>earlier application or patent but published on or after the international filing date</td>
</tr>
<tr>
<td>L</td>
<td>documents which, although not preceding the claimed invention, may throw doubts on priority claim(s) or which are cited to establish the publication date of another citation or other special reason (as specified)</td>
</tr>
<tr>
<td>O</td>
<td>document referring to an oral disclosure, use, exhibition or other means</td>
</tr>
<tr>
<td>P</td>
<td>document published prior to the international filing date but later than the priority date claimed</td>
</tr>
</tbody>
</table>

| * | Further document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |

| * | Document of particular relevance; the claimed invention cannot be considered new or cannot be considered to involve an inventive step when the document is taken alone |

| * | Document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |

| * | Document member of the same patent family |

**Date of the actual completion of the international search**

26 November 2013

**Date of mailing of the international search report**

09/12/2013

**Name and mailing address of the ISA**

European Patent Office, P.B. 5818 Patentlaan 2 NL- 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

**Authorized officer**

Bi det, Sebasti en
### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>the whole document</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the whole document</td>
<td></td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2002066279 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wo 0215073 A</td>
<td>21-02-2002</td>
<td>AU 8037401 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2421050 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1317721 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE 0002939 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2003164754 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wo 0215073 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wo 2009138359 A</td>
<td>19-11-2009</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2013010208 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DE 102007048834 A</td>
<td>24-04-2008</td>
<td>NONE</td>
</tr>
</tbody>
</table>

Form PCT/ISA/210 (patent family annex) (April 2005)