



(11)

**EP 1 953 468 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**06.08.2008 Bulletin 2008/32**

(51) Int Cl.:  
**F24F 11/00 (2006.01)**

(21) Application number: **07110541.5**

(22) Date of filing: **19.06.2007**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR**  
Designated Extension States:  
**AL BA HR MK RS**

(30) Priority: **02.02.2007 KR 20070011113**

(71) Applicant: **Samsung Electronics Co., Ltd.**  
**Suwon-si, Gyeonggi-Do (KR)**

(72) Inventors:  
• **Jo, Su-ho,**  
**Cheongsol Maeul Jugong 9-danji Apt.**  
**Gyeonggi-do (KR)**

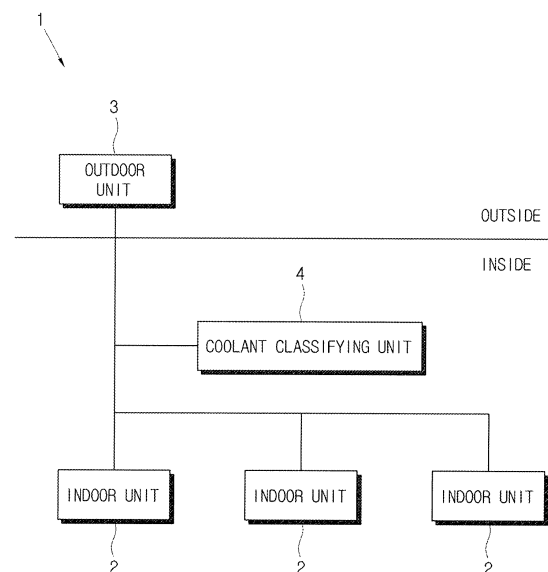
- **Kim, Hyo-suk,**  
**Sinyeongtong Hyundai Apt. No.111-701**  
**Gyeonggi-do (KR)**
- **Han, Jeong-su,**  
**Hwanggol Maeul 2-danji Hankook Apt.**  
**Gyeonggi-do (KR)**
- **Choi, Hyen-young,**  
**Jeong Town No.103**  
**Gyeonggi-do (KR)**
- **Ryu, O-do,**  
**Huiseong Opian No.608**  
**Gyeonggi-do (KR)**

(74) Representative: **Grünecker, Kinkeldey,**  
**Stockmair & Schwanhäusser**  
**Anwaltssozietät**  
**Leopoldstrasse 4**  
**80802 München (DE)**

(54) **AIR CONDITIONING SYSTEM AND PROGRAM UPDATING METHOD THEREOF**

(57) An air conditioning system includes: an outdoor unit; at least one indoor unit connected to the outdoor unit; a storage unit which stores a control program for controlling at least one of the outdoor unit and the indoor unit; a communication unit which communicates with an external host device; and a controller which receives an updating program for updating the control program through the communication unit and updates the control program when receiving a request for updating the control program from the external host device during execution of the control program.

FIG. 1



## Description

### CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application claims priority from Korean Patent Application No. 2007-0011113, filed on February 02, 2007 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

### BACKGROUND OF THE INVENTION

#### Field of the Invention

**[0002]** Apparatuses and methods consistent with the present invention relate to an air conditioning system and a program updating method thereof, and more particularly, to an air conditioning system that updates a control program, and a method thereof.

#### Description of the Related Art

**[0003]** As shown in FIG. 1, a conventional air conditioning system includes a plurality of indoor units 2, respectively provided in each room, and an outdoor unit 3 shared with the plurality of indoor units 2 and controlling flow of a coolant distributed to each indoor unit 2. In addition, the air conditioning system may further include a coolant classifying device 4 for controlling a coolant flowing to each indoor unit 2.

**[0004]** Herein, the air conditioning system 1 is separately placed within a building, and therefore, it is connected to the respective indoor units 2 through a communication line and determines a state of the outdoor unit 3, and stores a control program for operation of each unit. Such a control program needs to be updated to supplement functions of the respective indoor units 2, the outdoor unit 3, and the coolant classifying device 4.

**[0005]** However, in order to update a control program, the conventional air conditioning system 1 must stop operations of the respective indoor units 2, the outdoor unit 3, and the coolant classifying unit 4 and replace a micro-computer (MICOM) that stores the control program. In this case, since the air conditioning system 1 is separately placed within a building and a user cannot easily access the air conditioning system 1, a lot of time and effort are required for updating the control program.

**[0006]** The above information disclosed in this Background section is only for enhancement of understanding of the background of the invention and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

### SUMMARY OF THE INVENTION

**[0007]** Accordingly, it is an aspect of the present invention to provide an air conditioning system and a program updating method thereof automatically updating a

control program, thereby automatically updating the control program during operation of the air conditioning system.

**[0008]** Another aspect of the present invention is to provide an air conditioning system and a program updating method of easily updating a control program without directly accessing the air conditioning system by a user.

**[0009]** Additional features of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention.

**[0010]** The foregoing and/or other aspects of the present invention can be achieved by providing an air conditioning system comprising: an outdoor unit; at least one indoor unit connected to the outdoor unit; a storage unit which stores a control program for controlling at least one of the outdoor unit and the indoor unit; a communication unit which communicates with an external host device; and a controller which receives an updating program for updating the control program through the communication unit and updates the control program when receiving a request for updating the control program from the external host device during execution of the control program.

**[0011]** According to an aspect of the invention, the controller receives the updating program and the updated control program through the communication unit, deletes the control program stored in the storage unit, and stores the updated control program in the storage unit,

**[0012]** According to an aspect of the invention, the controller assigns the external host device an authority for accessing the storage unit when receiving the request.

**[0013]** According to an aspect of the invention, the air conditioning system further comprises a coolant classifying device which controls a coolant flowing to the indoor unit, wherein the control program controls the coolant classifying device.

**[0014]** According to an aspect of the invention, the storage unit and the controller are provided in at least one of the outdoor unit, the indoor unit, and the coolant classifying device.

**[0015]** According to an aspect of the invention, the controller stops operation of one among the outdoor unit, the indoor unit, and the coolant classifying device, as a control target of the control program, when the control program is being updated.

**[0016]** According to an aspect of the invention, the communication unit further comprises a converter which converts the updating program received through an RS-232 interface into an appropriate format for an RS-485 interface.

**[0017]** The foregoing and/or other aspects of the present invention can be achieved by providing a program updating method of an air conditioning system having an outdoor unit, at least one indoor unit connected to the outdoor unit, and a storage unit which stores a control program that controls at least one of the outdoor unit and the indoor unit, the program updating method comprising:

executing a control program for controlling at least one of the outdoor unit and the indoor unit; determining whether a request for updating the control program is received from an external host device during execution of the control program; receiving an updating program for updating the control program from the external host device, when receiving the request; and updating the control program by using the received updating program.

**[0018]** According to an aspect of the invention, the receiving the updating program comprises receiving the updating program and the updated control program, and the updating the control program comprises deleting the control program stored in the storage unit and storing the updated program in the storage.

**[0019]** According to an aspect of the invention, the updating the control program further comprises assigning the external host device an authority for accessing the storage unit when receiving the request.

**[0020]** According to an aspect of the invention, the air conditioning system further comprises a coolant classifying device which controls a coolant flowing to the indoor unit, wherein the control program controls the coolant classifying device.

**[0021]** According to an aspect of the invention, the updating the control program further comprises pausing operation of one among the outdoor unit, the indoor unit, and the coolant classifying device as a control target of the control program.

**[0022]** According to an aspect of the invention, the receiving the updating program further comprises receiving the updating program through an RS-232 interface and converting the updating program into an appropriate format for an RS-485 interface.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0023]** The above and/or other aspects of the present invention will become apparent and more readily appreciated from the following description of the exemplary embodiments, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a block diagram of a conventional air conditioning system;

FIG. 2 is a block diagram of an air conditioning system according to an exemplary embodiment of the present invention;

FIG. 3A to FIG. 3C show a control program updating process in the air conditioning system according to the exemplary embodiment of the present invention; and

FIG. 4 is a flowchart of a program updating method of the air conditioning system according to the exemplary embodiment of the present invention.

#### DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS OF THE INVENTION

**[0024]** Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below so as to explain the present invention by referring to the figures.

**[0025]** FIG. 2 is a block diagram of an air conditioning system 100 according to an exemplary embodiment of the present invention. As shown in FIG. 2, the air conditioning system 100 includes an outdoor unit 10, an indoor unit 20, a coolant classifying device 30, a storage unit 40, a communication unit 50, and a controller 60.

**[0026]** The outdoor unit 10 is shared with a plurality of indoor units 20 respectively provided in rooms and controls flow of a coolant to each indoor unit 20. The coolant classifying device 30 controls a coolant flowing to the indoor unit 20. The coolant classifying device 30 according to the exemplary embodiment of the present invention is connected to the indoor unit 20 through a communication line, and transmits/receives information based on a predetermined protocol.

**[0027]** The storage unit 40 stores a control program for controlling at least one of the outdoor unit 10, the indoor unit 20, and the coolant classifying device 30. Herein, the control program can control the air conditioning system 100 to manage power and to control the degree of heating and cooling, and may be provided as software that can process information received from the external host device 200. In addition, the control program may have different performance and functions according to its version number, and can be updated.

**[0028]** The storage unit 40 according to the exemplary embodiment of the present invention is preferably but not necessarily provided as a non-volatile memory such as a flash memory. In addition, the storage unit 40 may be included in the controller 60.

**[0029]** Further, the storage unit 40 may be provided in at least one of the outdoor unit 10, the indoor unit 20, and the coolant classifying device 30, and store the control programs for the respective members. Alternatively, the storage unit 40 may be provided in each of the outdoor unit 10, the indoor unit 20, and the coolant classifying device 30, and store additional control programs for the respective members.

**[0030]** The communication unit 50 communicates with the external host device 200. The communication unit 50 according to the exemplary embodiment of the present invention preferably but not necessarily performs communication through a wired interface such as an RS-232 interface and an RS-485 interface, and other interface, which can be used as long as it can connect multiple devices, such as a wireless local area network (WLAN) and a Bluetooth interface. Herein, the external host device 200 is provided as a computer that stores an updating program for updating the control program, and can

be connected with the air conditioning system 100 through an Internet or Ethernet.

**[0031]** In addition, it is preferred that the communication unit 50 further include a converter 50a for converting an updating program received from the external host device 200 through the RS-232 interface into an appropriate format for the RS-485 interface. Herein, when the RS-485 interface is used, the external host device 200 can perform one-to-one communication with at least one of the outdoor unit 10, the indoor unit 20, and the coolant classifying device 30.

**[0032]** When receiving a request for updating the control program from the external host device 200 during operation of the control program stored in the storage unit 40, the controller 60 receives an updating program for updating through the communication unit 50 and updates the control program.

**[0033]** The controller 60 according to the exemplary embodiment of the present invention may be provided as a microcontroller unit (MCU). Also, like the storage unit 40, the controller 60 may be provided in at least one of the outdoor unit 10, the indoor unit 20, and the coolant classifying device 30 or may be provided in the respective members, thereby controlling an operation of a control target based on the control program. In addition, the controller 60 may be included in the external host device 200.

**[0034]** Hereafter, assume that the controller 60 is included in the outdoor unit 10 in the present embodiment, and an operation of the controller 60 will be described in further detail.

**[0035]** When receiving a request for updating a control program from the external host device 200 through the communication unit 50 during operation of the outdoor unit 10, the indoor unit 20, and the coolant classifying device 30, the controller 60 allocates a communication time for receiving an updating program from the external host device 200. Herein, the controller 60 can assign the external host device 200 an authority for accessing the storage unit 40 during the allocated communication time. When the controller 60 assigns the authority to the external host device 200, the external host device 200 operates as a master, and the outdoor unit 10, the indoor unit 20, and the coolant classifying device 30 operate as a slave.

**[0036]** In addition, the controller 60 transmits information on the control programs, which are stored in the storage unit 40, for controlling at least one of the outdoor unit 10, the indoor unit 20, and the coolant classifying device 30 to the external host device 200. Herein, the information on the control programs may include version information and a model name of each device.

**[0037]** When a user requests an update of the control program according to the transmitted information on the control program, the controller 60 receives an updating program from the external host device 200 through the communication unit 50 and updates the control program stored in the storage unit 40. Herein, the controller 60 preferably stops operation of the outdoor unit 10, the in-

door unit 20, and the coolant classifying device 30 when receiving the request for updating.

**[0038]** As described above, the controller 60 may be provided in the outdoor unit 10, or provided in at least one of the indoor unit 20 and the coolant classifying device 30.

**[0039]** Hereinafter, a control program updating process in the air conditioning system 100 according to the exemplary embodiment of the present invention will be described in further detail with reference to FIG. 3A to FIG. 3C.

**[0040]** As shown in FIG. 3A to FIG. 3C, the storage unit 40 includes a random access memory (RAM) region occupied by the control program and a read only memory (ROM) region in which the control program is stored.

**[0041]** As shown in FIG. 3A, the controller 60 receives an updating program for updating the control program from the external host device 200, stores the received updating program in the RAM region, executes the updating program.

**[0042]** Next, the controller 60 deletes a control program stored in the ROM region by using the received updating program as shown in FIG. 3B. In addition, when the control program stored in the storage unit 40 is deleted, the controller 60 receives an updated control program from the external host device 200 through the communication unit 50 and stores the received updated control program in the ROM region. Accordingly, the control program can be updated without difficulty.

**[0043]** Hereinafter, a program updating method of the air conditioning system 100 according to the exemplary embodiment of the present invention will be described in detail with reference to FIG. 4.

**[0044]** During execution of a control program for controlling at least one of the outdoor unit 10 and the indoor unit 20 at operation of S10, the controller 60 determines a request for updating the control program is received from the external host device 200 at operation of S20. At the operation of S10, a control program for controlling the coolant classifying device 30 also can be executed.

**[0045]** When the request for updating is received at the operation of S20, the controller 60 receives an updating program from the external host device 200 at operation of S30. In addition, the controller 60 updates a control program stored in the storage unit 40 by using the received updating program, at operation of S40.

**[0046]** At the operation of S30, the controller 60 may receive an updating program and an updated control program, and at the operation of S40, the controller 60 may delete the control program stored in the storage unit 40 and store the updated control program in the storage unit 40.

**[0047]** In addition, the updating program can be received through the RS-232 interface and converted into an appropriate format for the RS-485 interface.

**[0048]** As described above, an air conditioning system and a program updating method thereof automatically updating a control program by using an updating program

received from an external host device during operation of the air conditioning system, can be provided.

**[0049]** In addition, a user can easily update a control program without directly accessing the air conditioning system.

**[0050]** Although a few exemplary embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.

## Claims

### 1. An air conditioning system comprising:

an outdoor unit;  
at least one indoor unit connected to the outdoor unit;  
a storage unit which stores a control program for controlling at least one of the outdoor unit and the indoor unit;  
a communication unit which communicates with an external host device; and  
a controller which receives an updating program for updating the control program through the communication unit and updates the control program when receiving a request for updating the control program from the external host device during execution of the control program.

2. The air conditioning system of claim 1, wherein the controller receives the updating program and the updated control program through the communication unit, deletes the control program stored in the storage unit, and stores the updated control program in the storage unit,

3. The air conditioning system of claim 1, wherein the controller assigns the external host device an authority for accessing the storage unit when receiving the request.

4. The air conditioning system of any one of claims 1 through 3, further comprising a coolant classifying device which controls a coolant flowing to the indoor unit, wherein the control program controls the coolant classifying device.

5. The air conditioning system of claim 4, wherein the storage unit and the controller are provided in at least one of the outdoor unit, the indoor unit, and the coolant classifying device.

6. The air conditioning system of claim 4, wherein the

controller stops operation of one among the outdoor unit, the indoor unit, and the coolant classifying device, as a control target of the control program, when the control program is being updated.

7. The air conditioning system of claim 1, wherein the communication unit further comprises a converter which converts the updating program received through an RS-232 interface into an appropriate format for an RS-485 interface.

8. A program updating method of an air conditioning system having an outdoor unit, at least one indoor unit connected to the outdoor unit, and a storage unit which stores a control program that controls at least one of the outdoor unit and the indoor unit, the program updating method comprising:

executing a control program for controlling at least one of the outdoor unit and the indoor unit;  
determining whether a request for updating the control program is received from an external host device during execution of the control program;  
receiving an updating program for updating the control program from the external host device, when receiving the request; and  
updating the control program by using the received updating program.

9. The program updating method of claim 8, wherein the receiving the updating program comprises receiving the updating program and the updated control program, and the updating the control program comprises deleting the control program stored in the storage unit and storing the updated program in the storage.

10. The program updating method of claim 8, wherein the updating the control program further comprises assigning the external host device an authority for accessing the storage unit when receiving the request.

11. The program updating method of any one of claims 8 through 10, wherein the air conditioning system further comprises a coolant classifying device which controls a coolant flowing to the indoor unit, wherein the control program controls the coolant classifying device.

12. The program updating method of claim 11, wherein the updating the control program further comprises pausing operation of one among the outdoor unit, the indoor unit, and the coolant classifying device as a control target of the control program.

13. The program updating method of claim 8, wherein

the receiving the updating program further comprises receiving the updating program through an RS-232 interface and converting the updating program into an appropriate format for an RS-485 interface.

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

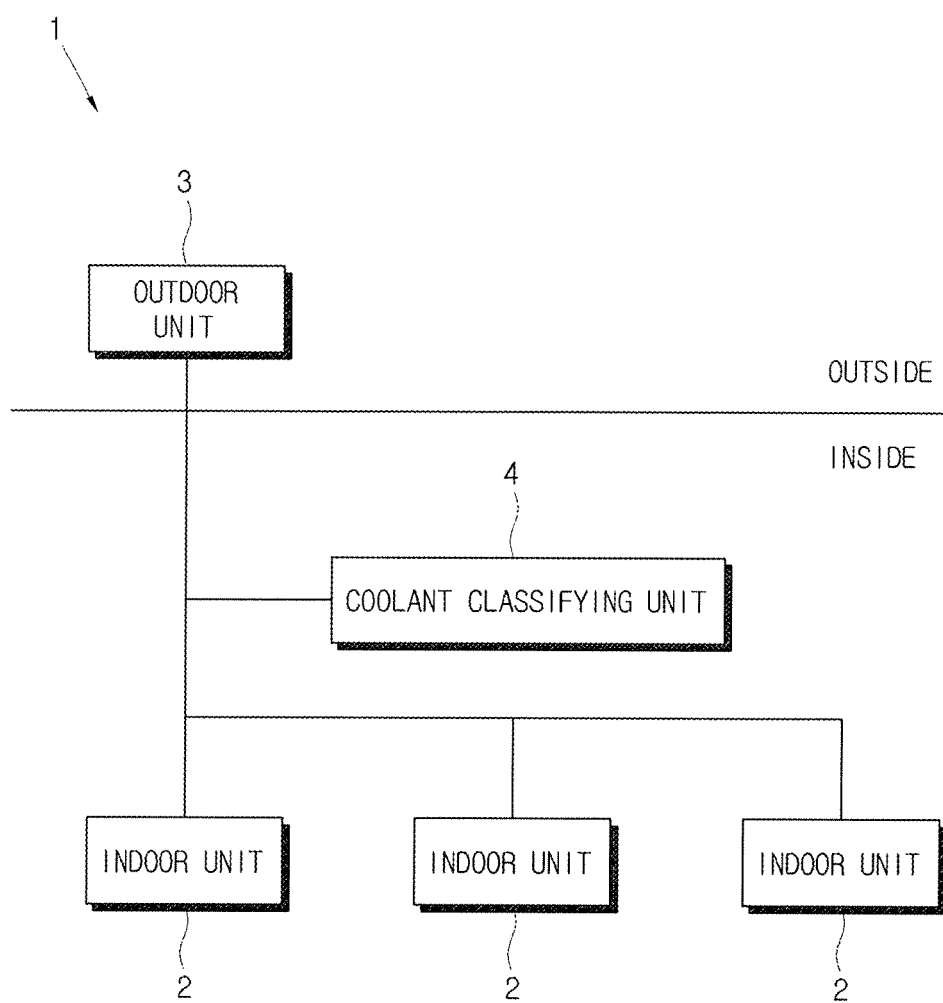


FIG. 2

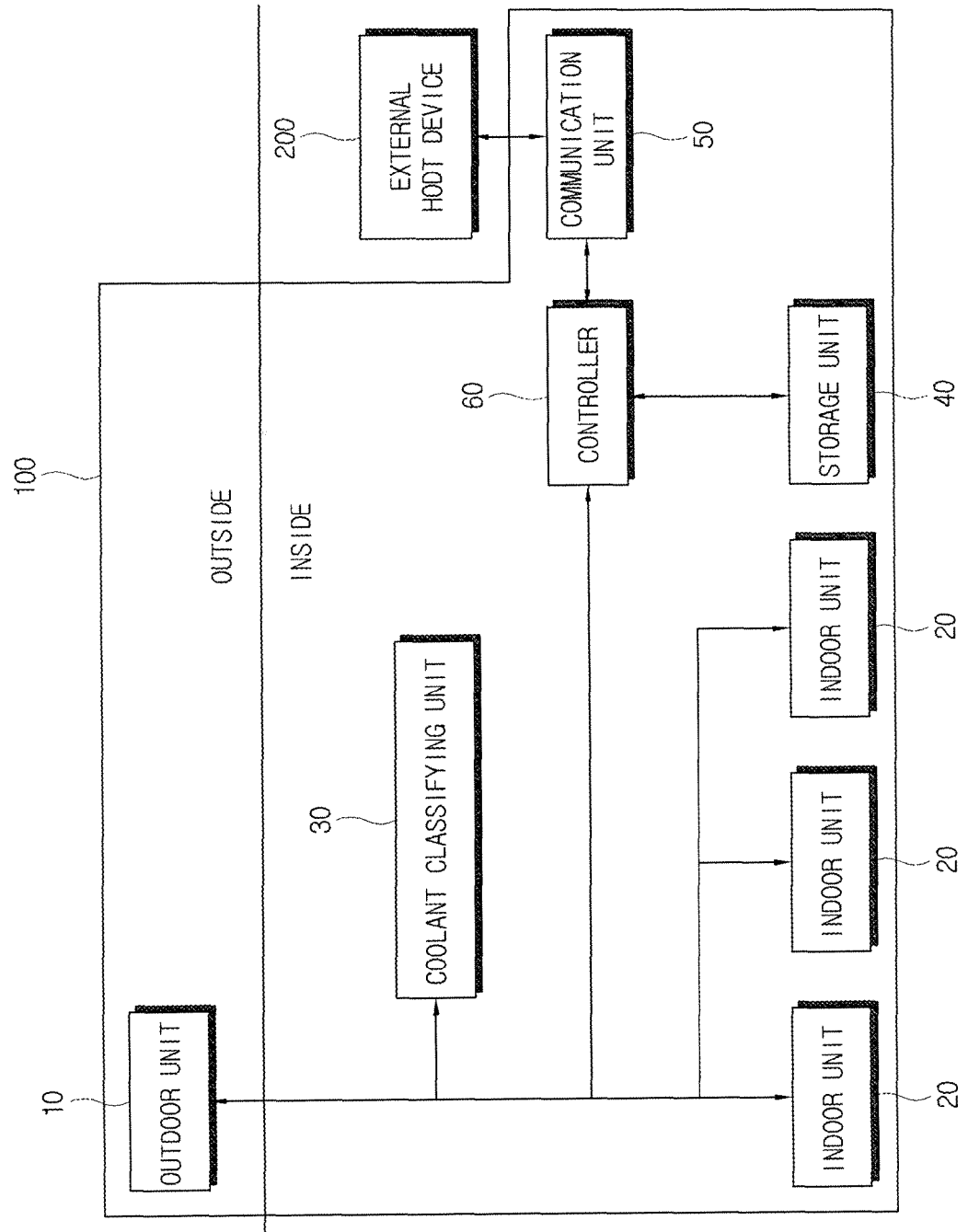


FIG. 3A

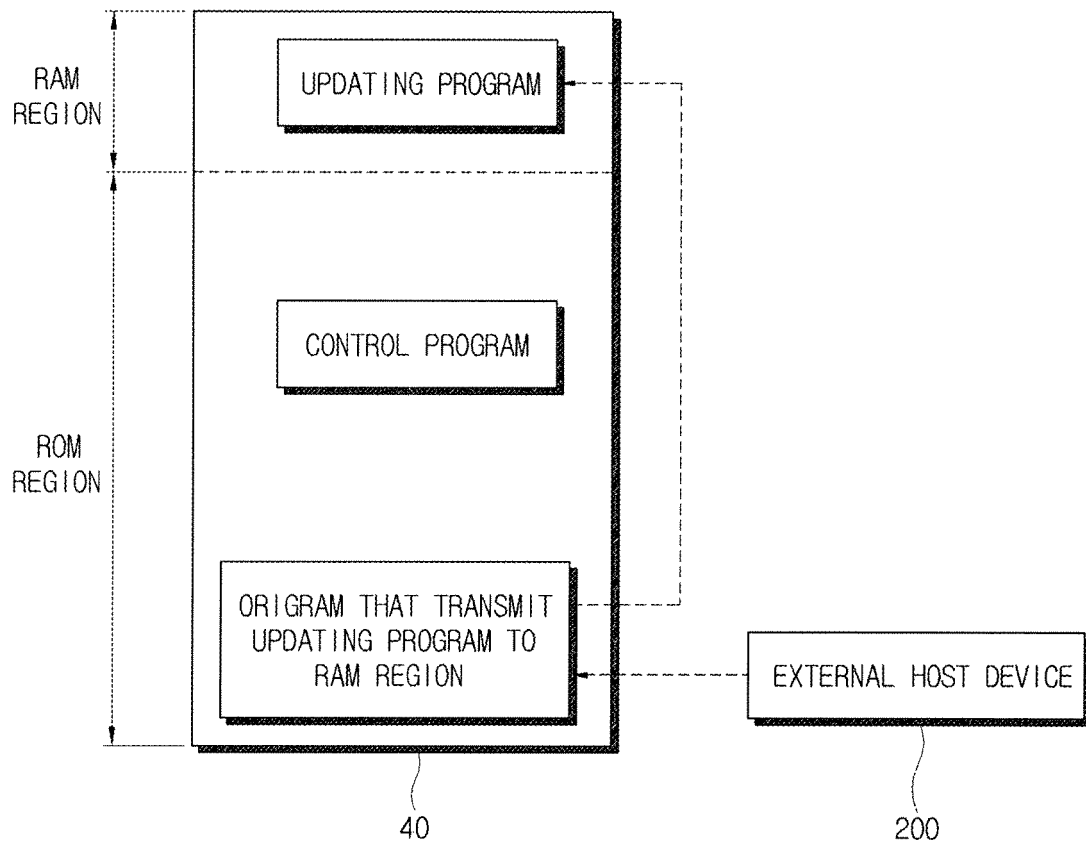


FIG. 3B

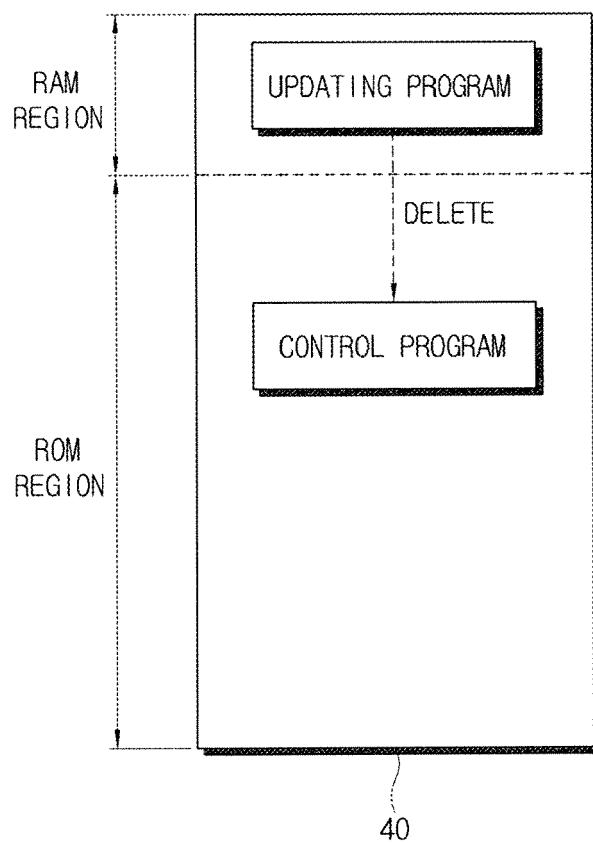


FIG. 3C

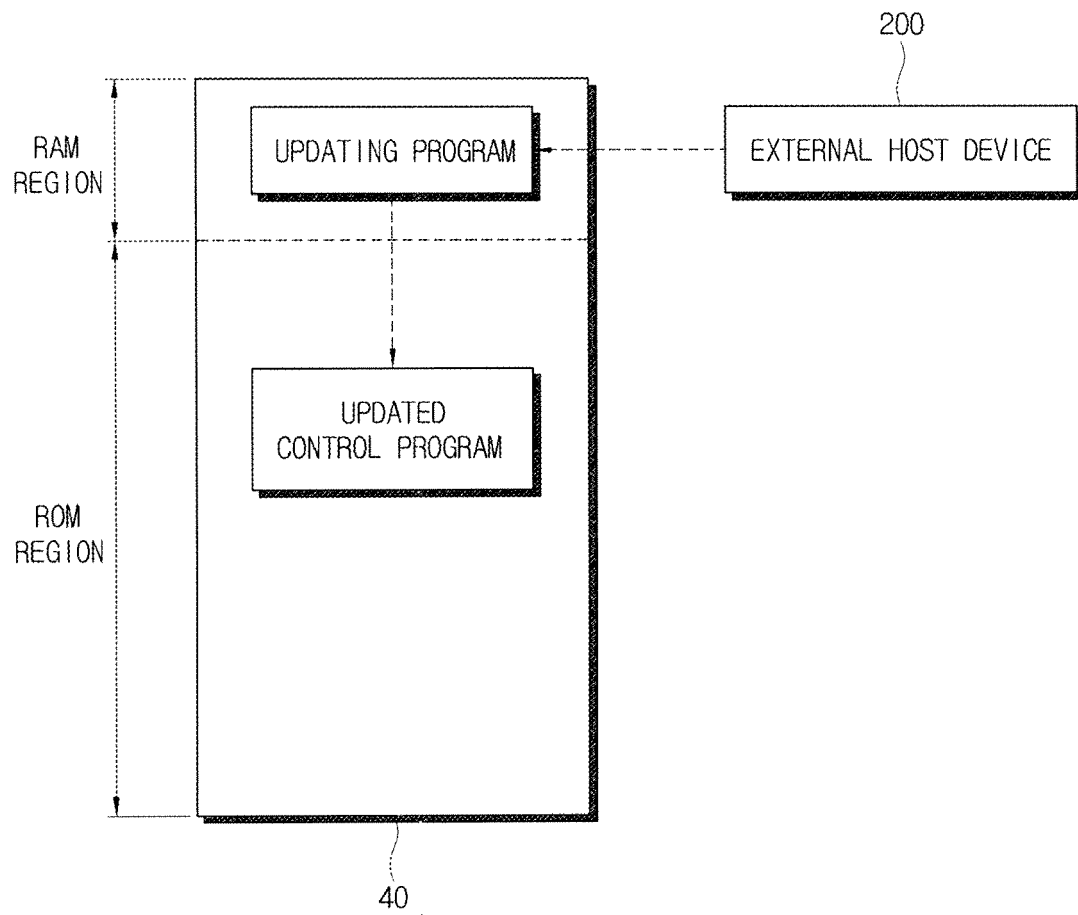
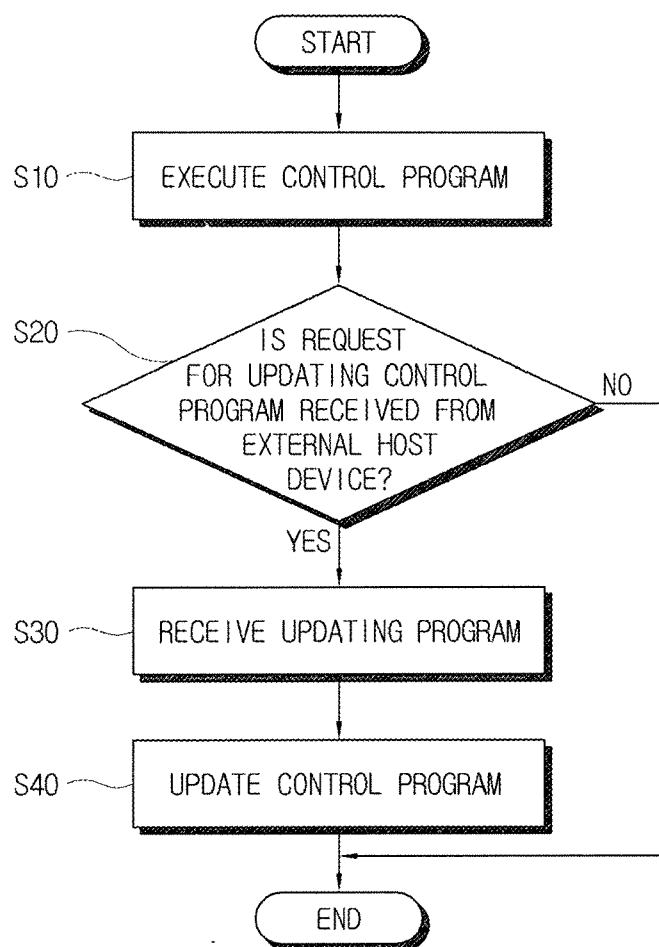


FIG. 4



**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- KR 20070011113 [0001]