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(54) **DRIVING-ENVIRONMENT SETUP SYSTEM, IN-VEHICLE DEVICE AND PROGRAM THEREOF, PORTABLE DEVICE AND PROGRAM THEREOF, MANAGEMENT DEVICE AND PROGRAM THEREOF**

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Publication Classification

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G05B 13/02 (2006.01)

(52) **U.S. Cl.** **701/36**

(57) **ABSTRACT**

A driving-environment setup system has a plurality of portable devices, each of which transmits a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices and transmits an environment identification information item used for identifying a driving environment for the associated user. An in-vehicle device of the system detects a physical feature of a person sitting in a driver's seat and identifies one of the associated users as a driver when the physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the detected physical feature. The in-vehicle device sets a driving environment for the driver based on the received environment identification information item.

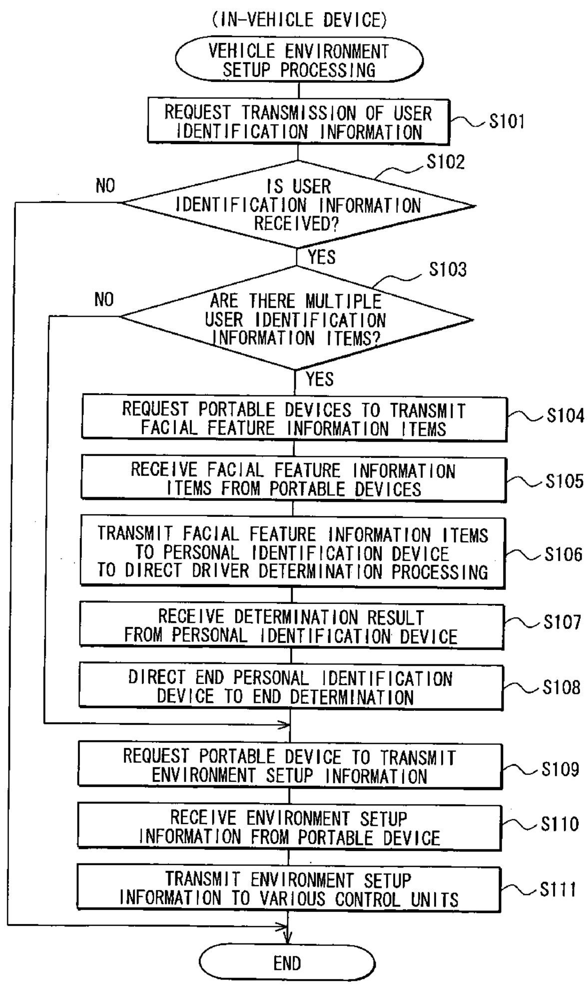


FIG. 1

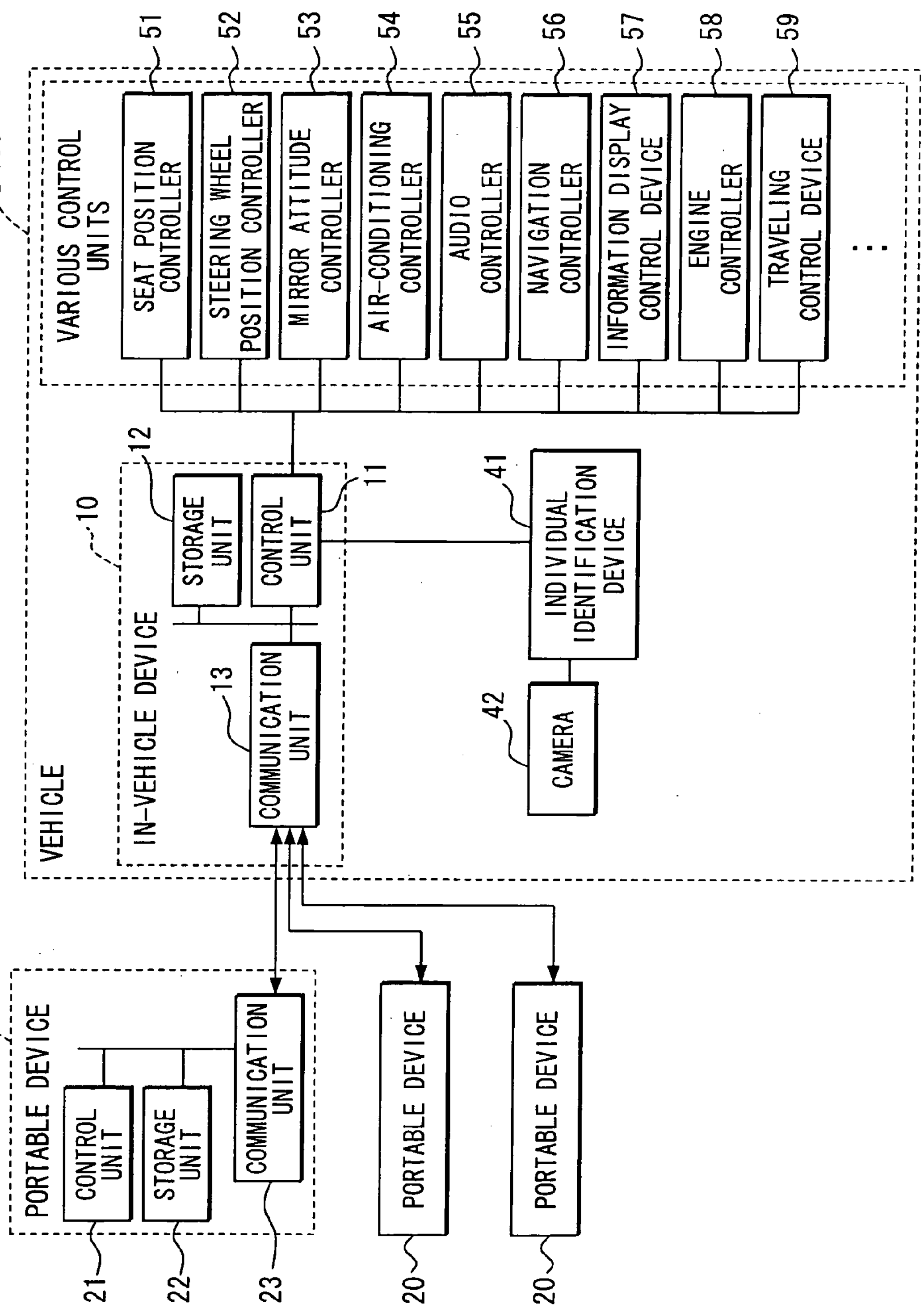

VEHICLE
100
VARIOUS CONTROL UNITS
51
SEAT POSITION CONTROLLER
52
STEERING WHEEL POSITION CONTROLLER
53
MIRROR ATTITUDE CONTROLLER
54
AIR-CONDITIONING CONTROLLER
55
AUDIO CONTROLLER
56
NAVIGATION CONTROLLER
57
INFORMATION DISPLAY CONTROL DEVICE
58
ENGINE CONTROLLER
59
TRAVELING CONTROL DEVICE
...
10
IN-VEHICLE DEVICE
12
STORAGE UNIT
11
CONTROL UNIT
13
COMMUNICATION UNIT
41
INDIVIDUAL IDENTIFICATION DEVICE
42
CAMERA
20
PORTABLE DEVICE
21
CONTROL UNIT
22
STORAGE UNIT
23
COMMUNICATION UNIT
20
PORTABLE DEVICE
20
PORTABLE DEVICE

FIG. 2

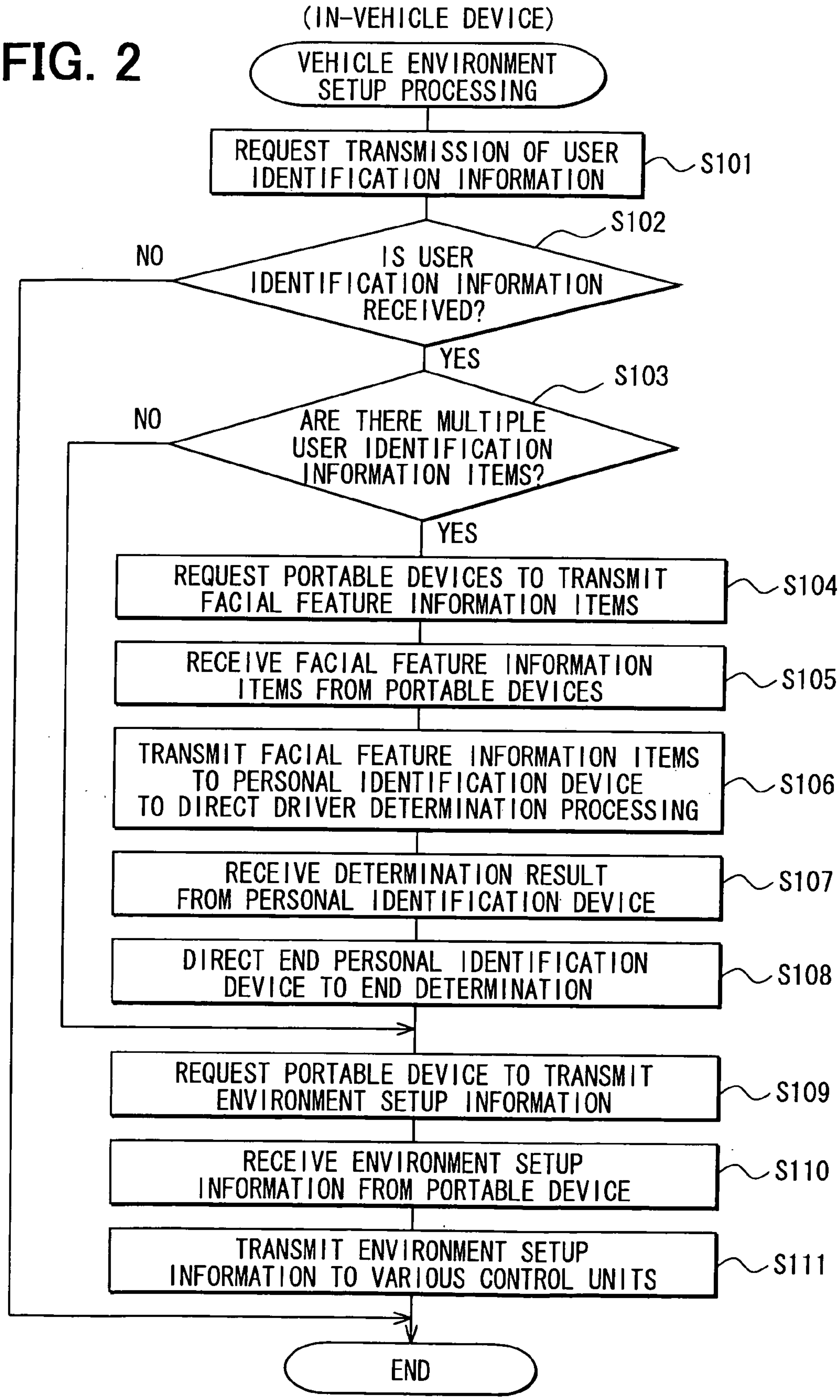

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION
S101
IS USER IDENTIFICATION INFORMATION RECEIVED?
S102
NO
YES
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
S103
NO
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S104
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S105
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S106
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S107
DIRECT END PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S108
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION
S109
RECEIVE ENVIRONMENT SETUP INFORMATION FROM PORTABLE DEVICE
S110
TRANSMIT ENVIRONMENT SETUP INFORMATION TO VARIOUS CONTROL UNITS
S111
END

FIG. 3

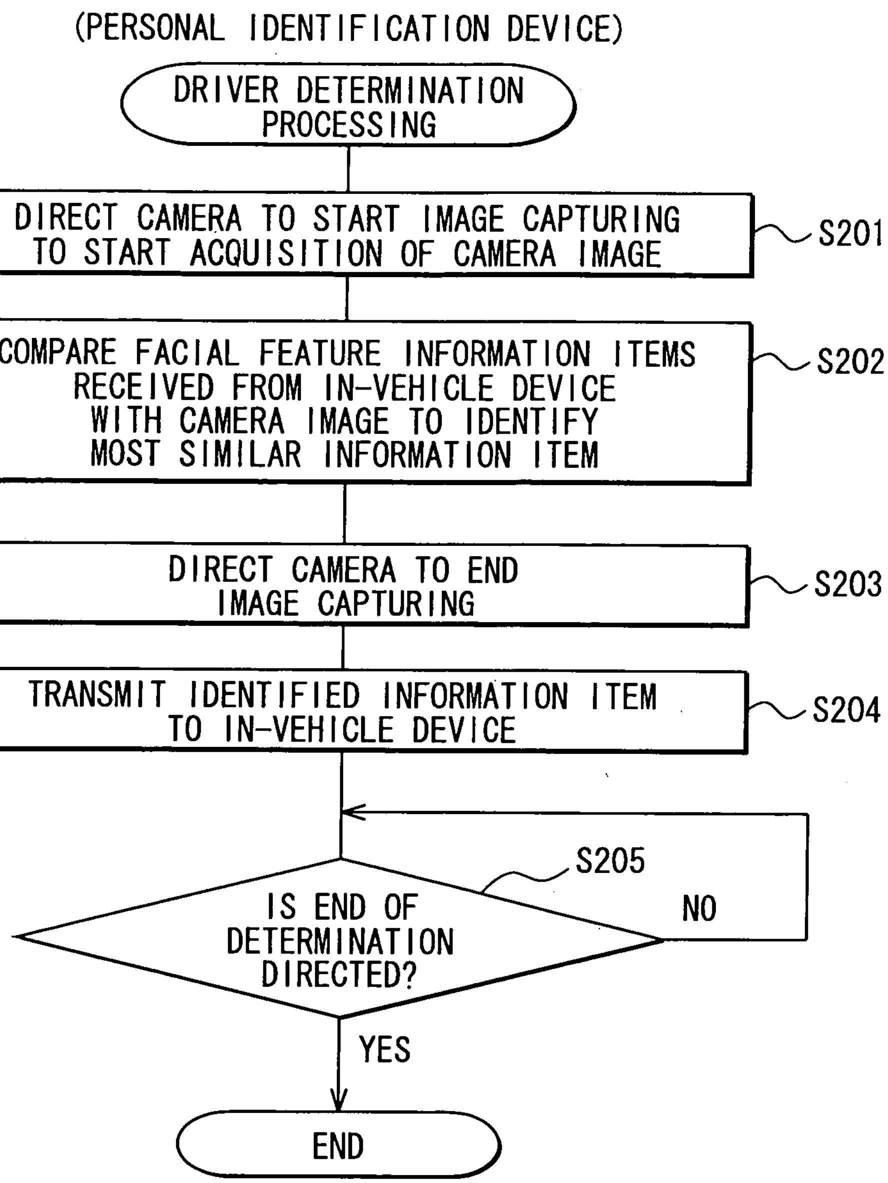

(PERSONAL IDENTIFICATION DEVICE)
DRIVER DETERMINATION PROCESSING
DIRECT CAMERA TO START IMAGE CAPTURING TO START ACQUISITION OF CAMERA IMAGE
S201
COMPARE FACIAL FEATURE INFORMATION ITEMS RECEIVED FROM IN-VEHICLE DEVICE WITH CAMERA IMAGE TO IDENTIFY MOST SIMILAR INFORMATION ITEM
S202
DIRECT CAMERA TO END IMAGE CAPTURING
S203
TRANSMIT IDENTIFIED INFORMATION ITEM TO IN-VEHICLE DEVICE
S204
S205
IS END OF DETERMINATION DIRECTED?
NO
YES
END

FIG. 4

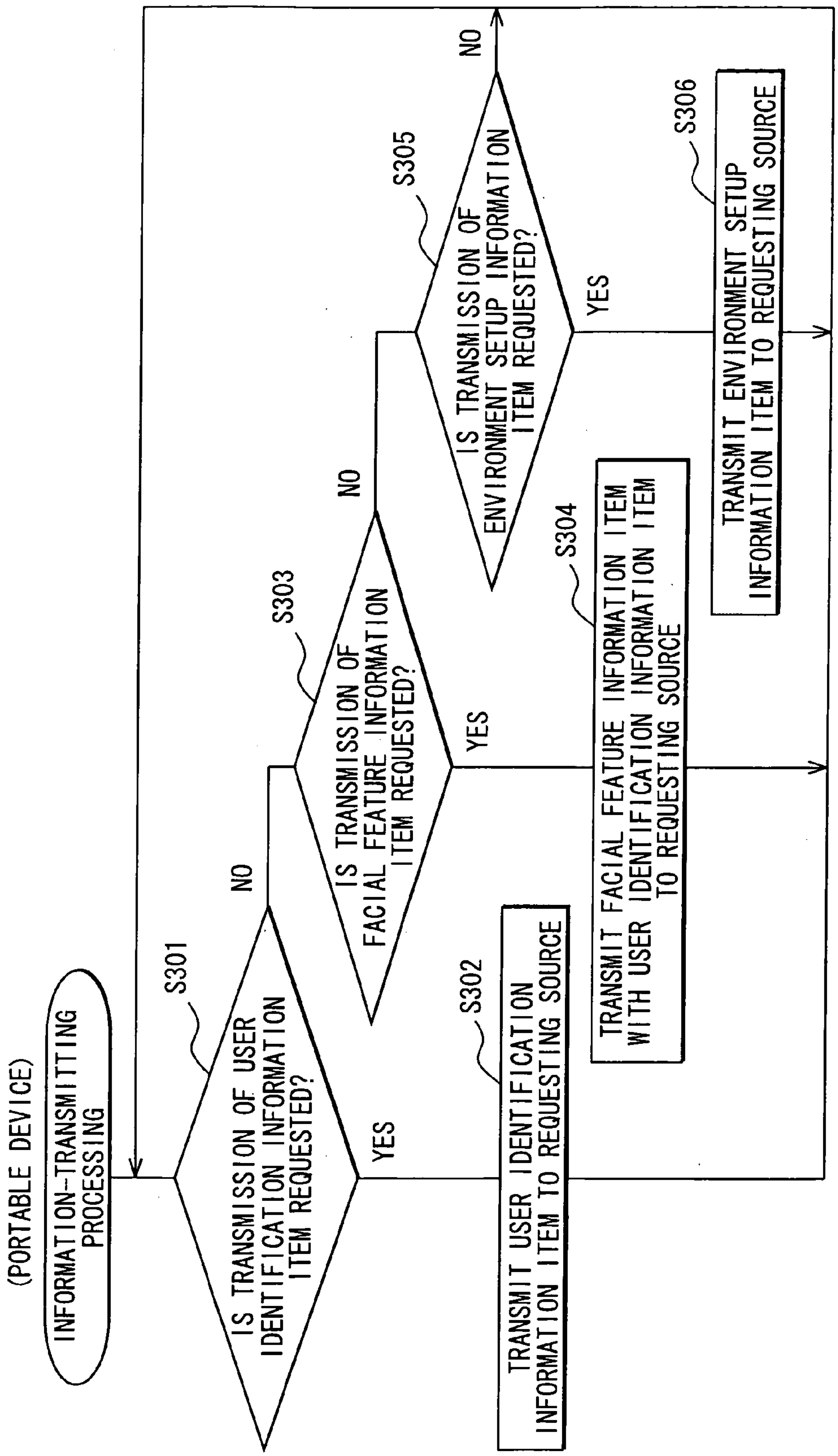

(PORTABLE DEVICE)
INFORMATION-TRANSMITTING PROCESSING
S301
IS TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM REQUESTED?
YES
NO
S302
TRANSMIT USER IDENTIFICATION INFORMATION ITEM TO REQUESTING SOURCE
S303
IS TRANSMISSION OF FACIAL FEATURE INFORMATION ITEM REQUESTED?
YES
NO
S304
TRANSMIT FACIAL FEATURE INFORMATION ITEM WITH USER IDENTIFICATION INFORMATION ITEM TO REQUESTING SOURCE
S305
IS TRANSMISSION OF ENVIRONMENT SETUP INFORMATION ITEM REQUESTED?
YES
NO
S306
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO REQUESTING SOURCE

FIG. 5A

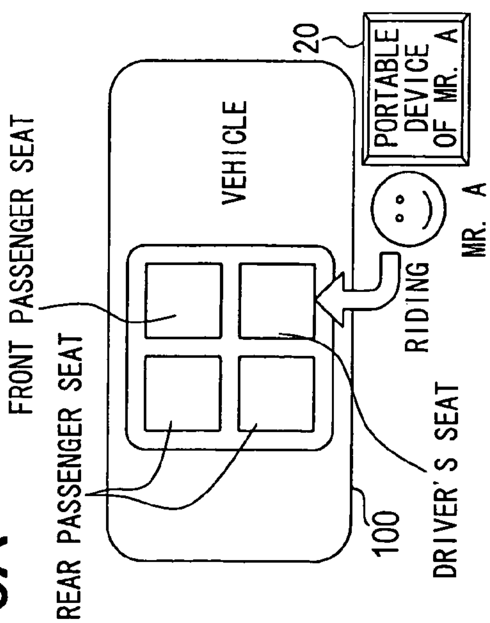


FIG. 5B

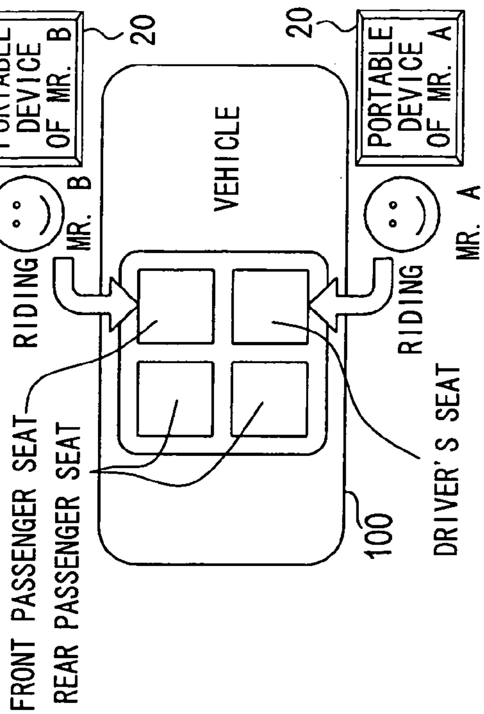


FIG. 5C

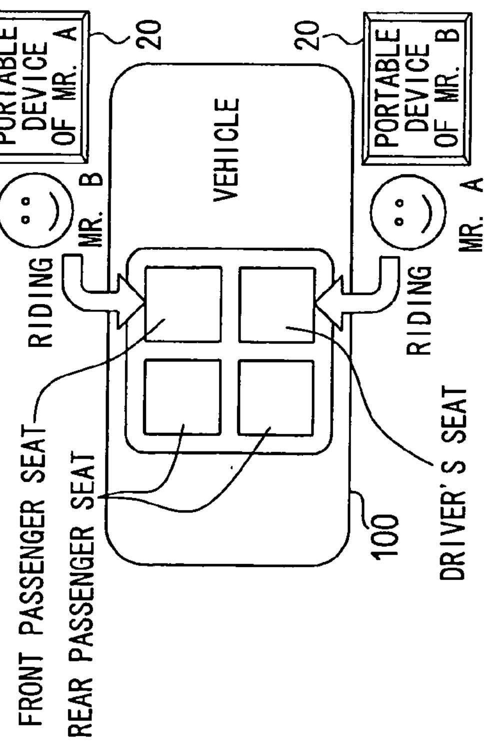


FIG. 5D

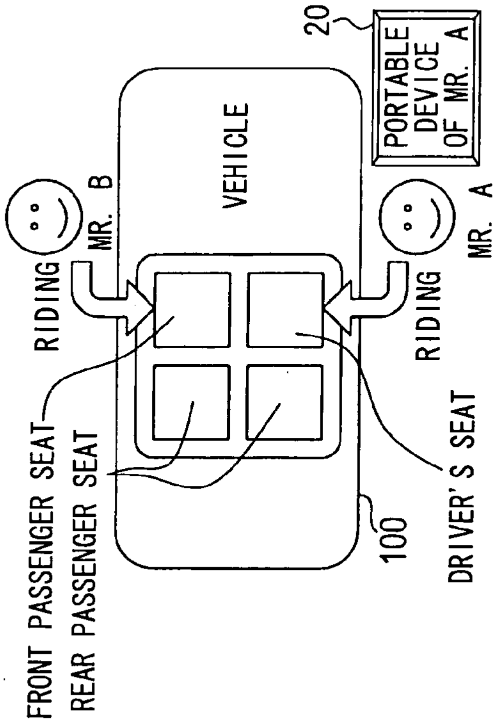


FIG. 6

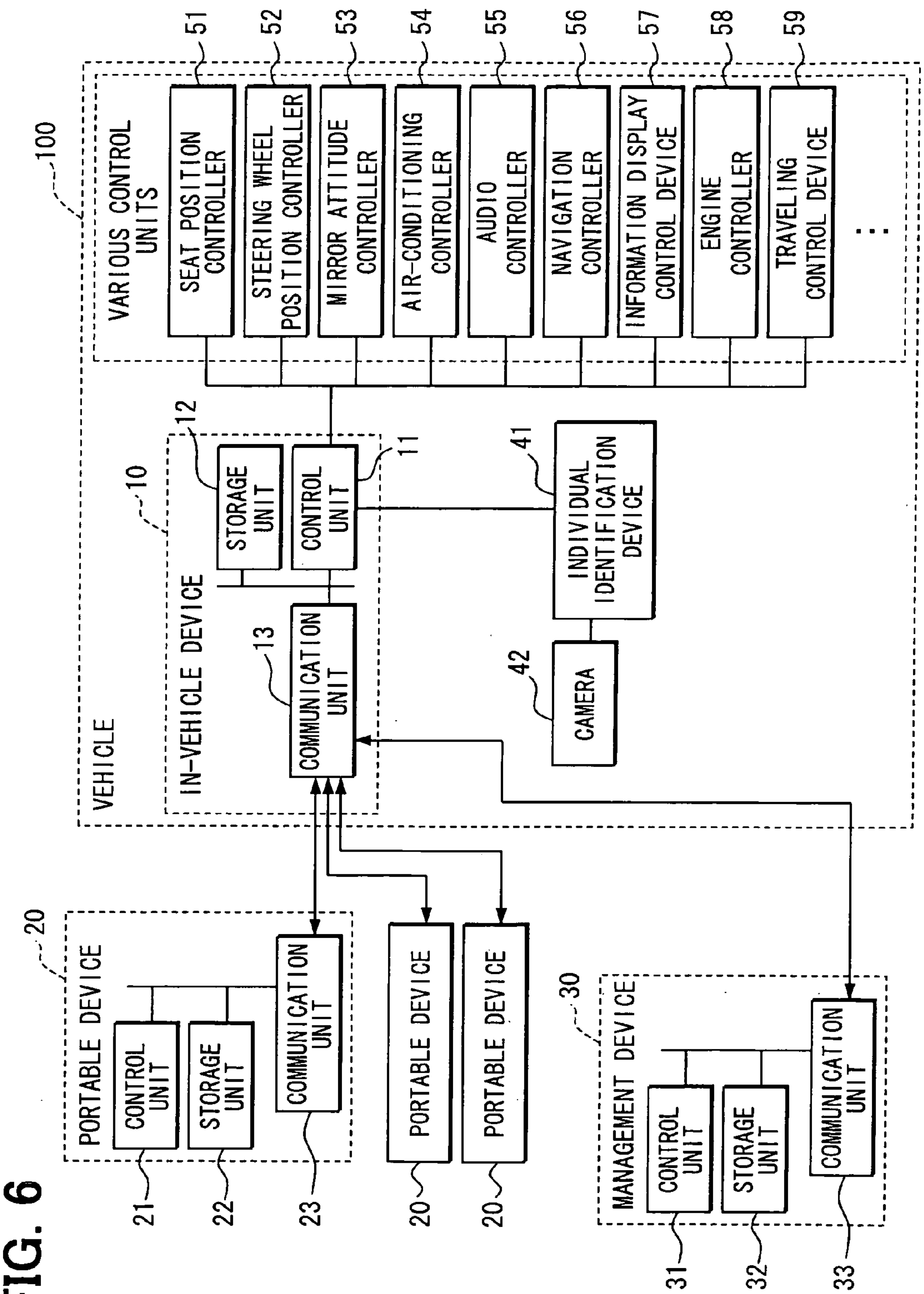

VEHICLE
100
VARIOUS CONTROL UNITS
SEAT POSITION CONTROLLER
51
STEERING WHEEL POSITION CONTROLLER
52
MIRROR ATTITUDE CONTROLLER
53
AIR-CONDITIONING CONTROLLER
54
AUDIO CONTROLLER
55
NAVIGATION CONTROLLER
56
INFORMATION DISPLAY CONTROL DEVICE
57
ENGINE CONTROLLER
58
TRAVELING CONTROL DEVICE
59
IN-VEHICLE DEVICE
10
STORAGE UNIT
12
CONTROL UNIT
11
COMMUNICATION UNIT
13
INDIVIDUAL IDENTIFICATION DEVICE
41
CAMERA
42
PORTABLE DEVICE
20
CONTROL UNIT
21
STORAGE UNIT
22
COMMUNICATION UNIT
23
PORTABLE DEVICE
20
PORTABLE DEVICE
20
MANAGEMENT DEVICE
30
CONTROL UNIT
31
STORAGE UNIT
32
COMMUNICATION UNIT
33

FIG. 7

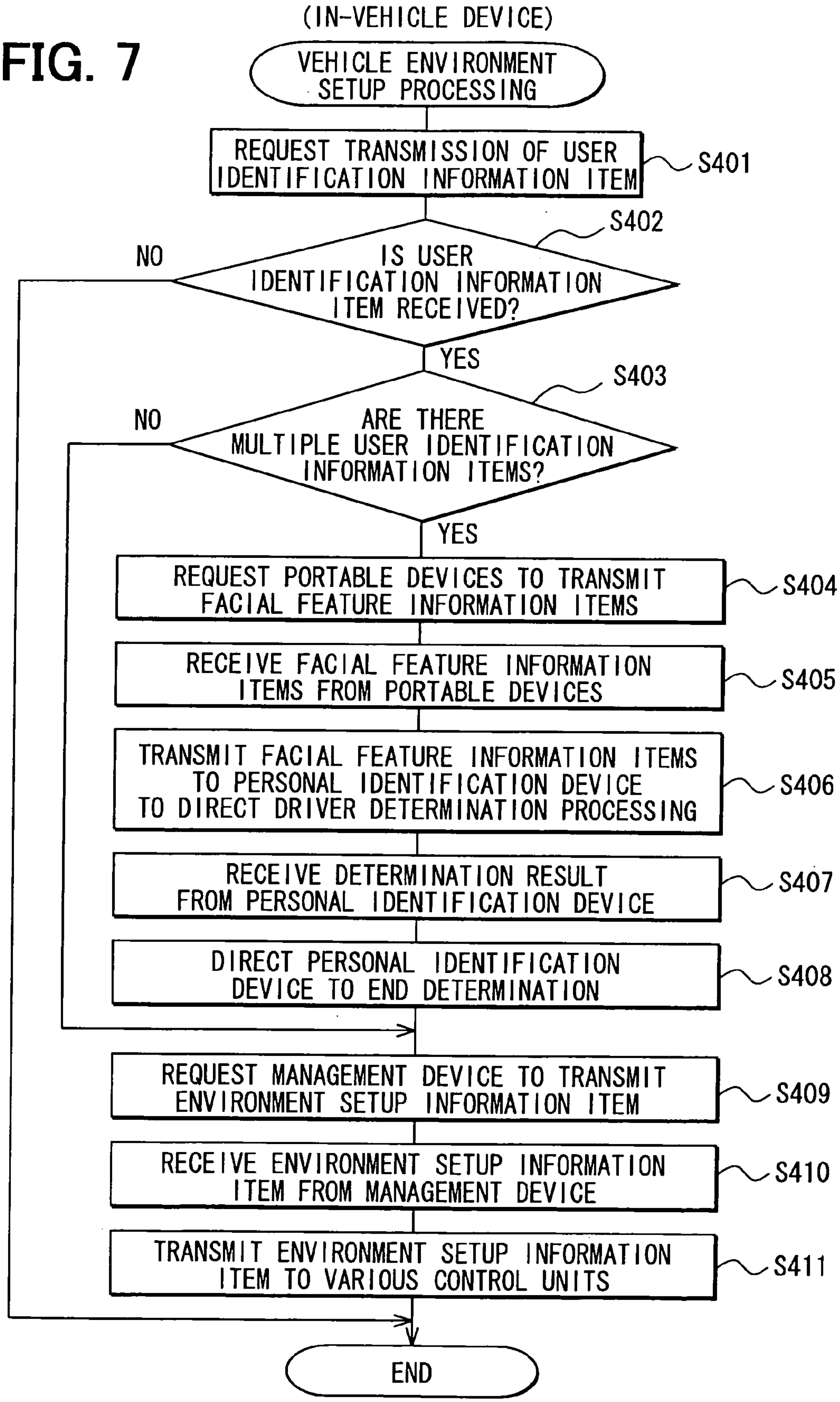

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S401
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
S402
NO
YES
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
S403
NO
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S404
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S405
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S406
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S407
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S408
REQUEST MANAGEMENT DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S409
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM MANAGEMENT DEVICE
S410
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S411
END

FIG. 8

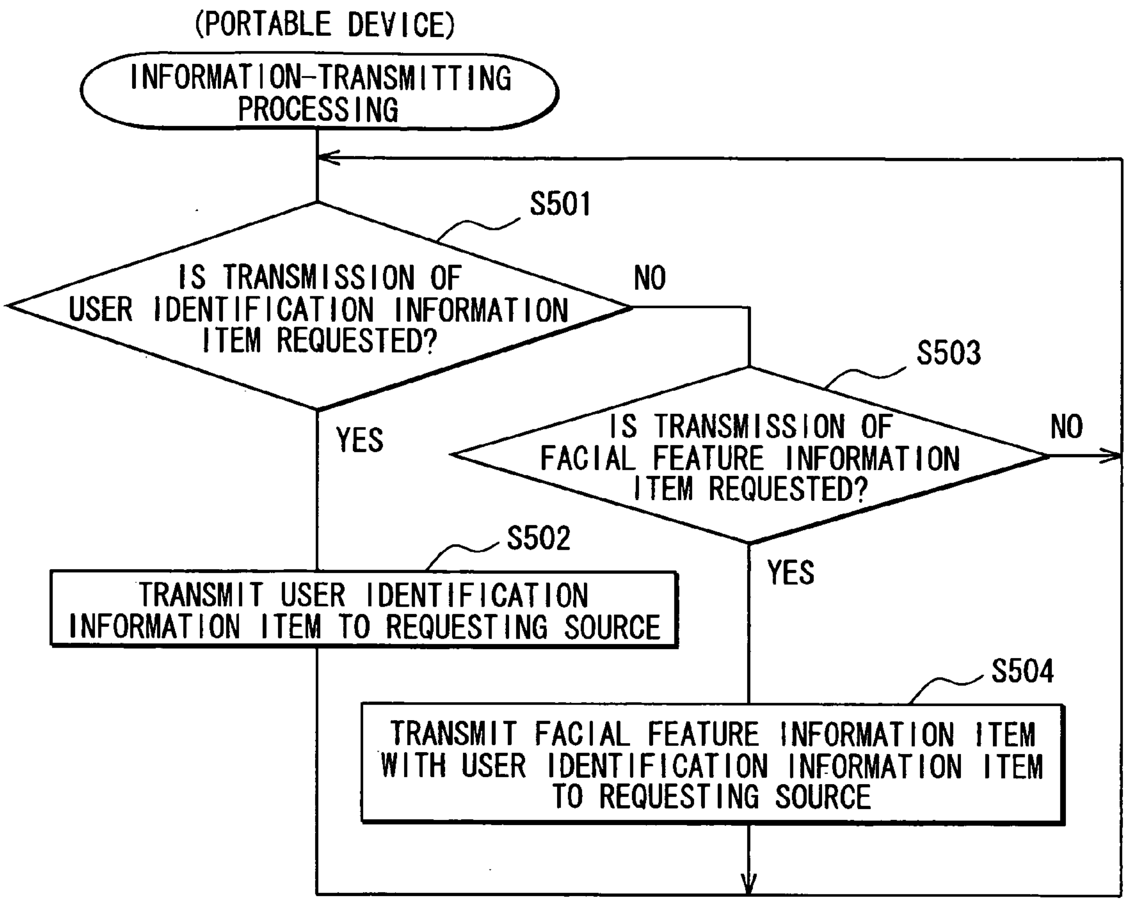

(PORTABLE DEVICE)
INFORMATION-TRANSMITTING PROCESSING
S501
IS TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM REQUESTED?
NO
YES
S503
IS TRANSMISSION OF FACIAL FEATURE INFORMATION ITEM REQUESTED?
NO
YES
S502
TRANSMIT USER IDENTIFICATION INFORMATION ITEM TO REQUESTING SOURCE
S504
TRANSMIT FACIAL FEATURE INFORMATION ITEM WITH USER IDENTIFICATION INFORMATION ITEM TO REQUESTING SOURCE

FIG. 9

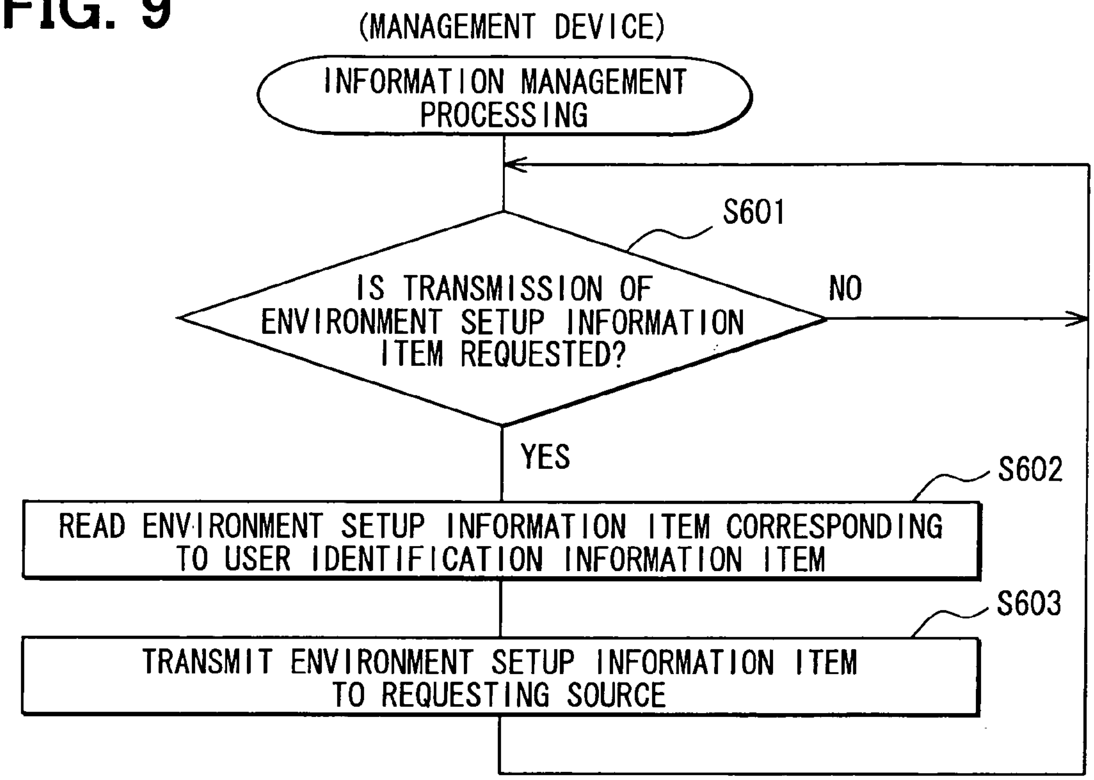

(MANAGEMENT DEVICE)
INFORMATION MANAGEMENT PROCESSING
S601
IS TRANSMISSION OF ENVIRONMENT SETUP INFORMATION ITEM REQUESTED?
NO
YES
S602
READ ENVIRONMENT SETUP INFORMATION ITEM CORRESPONDING TO USER IDENTIFICATION INFORMATION ITEM
S603
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO REQUESTING SOURCE

FIG. 11

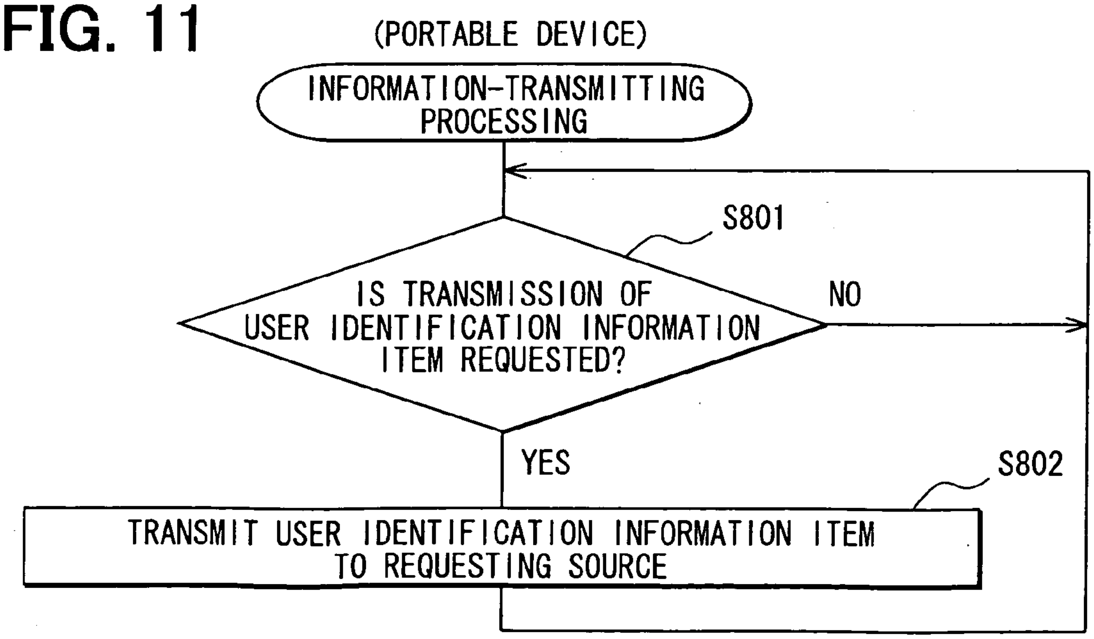

(PORTABLE DEVICE)
INFORMATION-TRANSMITTING PROCESSING
S801
IS TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM REQUESTED?
NO
YES
S802
TRANSMIT USER IDENTIFICATION INFORMATION ITEM TO REQUESTING SOURCE

FIG. 10

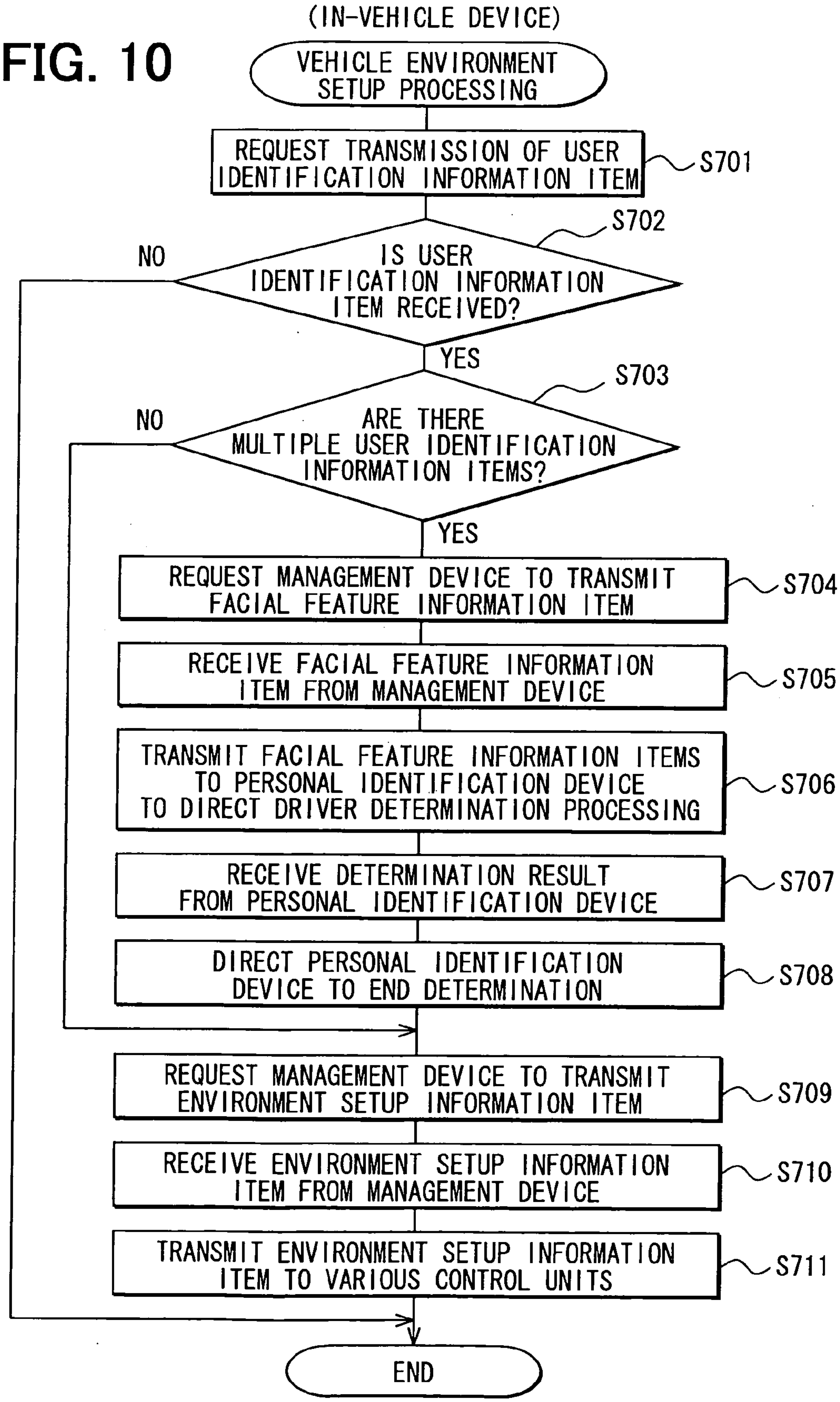

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S701
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
S702
NO
YES
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
S703
NO
YES
REQUEST MANAGEMENT DEVICE TO TRANSMIT FACIAL FEATURE INFORMATION ITEM
S704
RECEIVE FACIAL FEATURE INFORMATION ITEM FROM MANAGEMENT DEVICE
S705
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S706
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S707
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S708
REQUEST MANAGEMENT DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S709
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM MANAGEMENT DEVICE
S710
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S711
END

FIG. 12

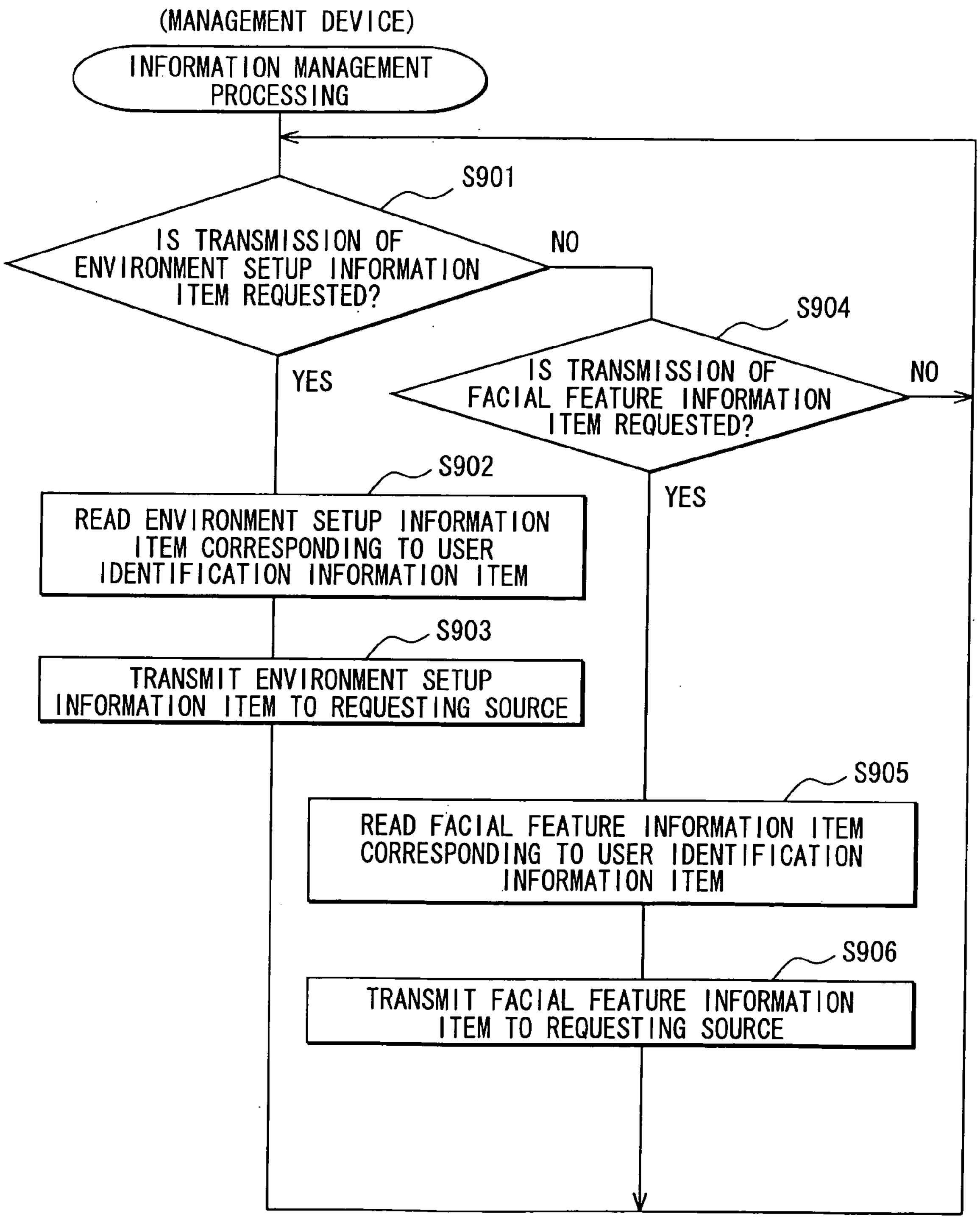

(MANAGEMENT DEVICE)
INFORMATION MANAGEMENT PROCESSING
S901
IS TRANSMISSION OF ENVIRONMENT SETUP INFORMATION ITEM REQUESTED?
NO
YES
S904
IS TRANSMISSION OF FACIAL FEATURE INFORMATION ITEM REQUESTED?
NO
YES
S902
READ ENVIRONMENT SETUP INFORMATION ITEM CORRESPONDING TO USER IDENTIFICATION INFORMATION ITEM
S903
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO REQUESTING SOURCE
S905
READ FACIAL FEATURE INFORMATION ITEM CORRESPONDING TO USER IDENTIFICATION INFORMATION ITEM
S906
TRANSMIT FACIAL FEATURE INFORMATION ITEM TO REQUESTING SOURCE

FIG. 13

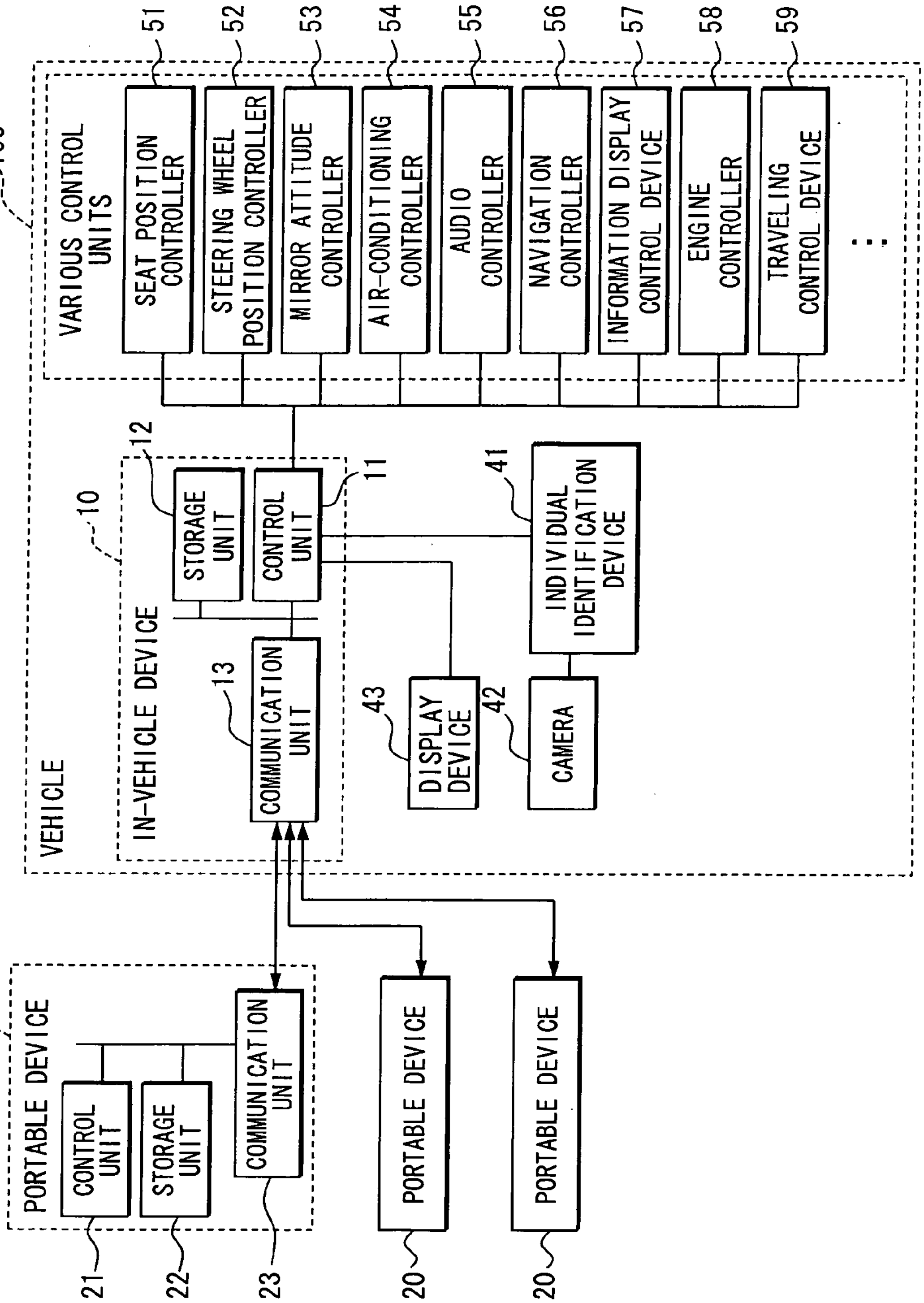

100
VEHICLE
VARIOUS CONTROL UNITS
SEAT POSITION CONTROLLER
STEERING WHEEL POSITION CONTROLLER
MIRROR ATTITUDE CONTROLLER
AIR-CONDITIONING CONTROLLER
AUDIO CONTROLLER
NAVIGATION CONTROLLER
INFORMATION DISPLAY CONTROL DEVICE
ENGINE CONTROLLER
TRAVELING CONTROL DEVICE
51
52
53
54
55
56
57
58
59
10
IN-VEHICLE DEVICE
STORAGE UNIT
CONTROL UNIT
COMMUNICATION UNIT
12
11
13
41
INDIVIDUAL IDENTIFICATION DEVICE
42
CAMERA
43
DISPLAY DEVICE
20
PORTABLE DEVICE
CONTROL UNIT
STORAGE UNIT
COMMUNICATION UNIT
21
22
23
PORTABLE DEVICE
20
PORTABLE DEVICE
20

FIG. 14

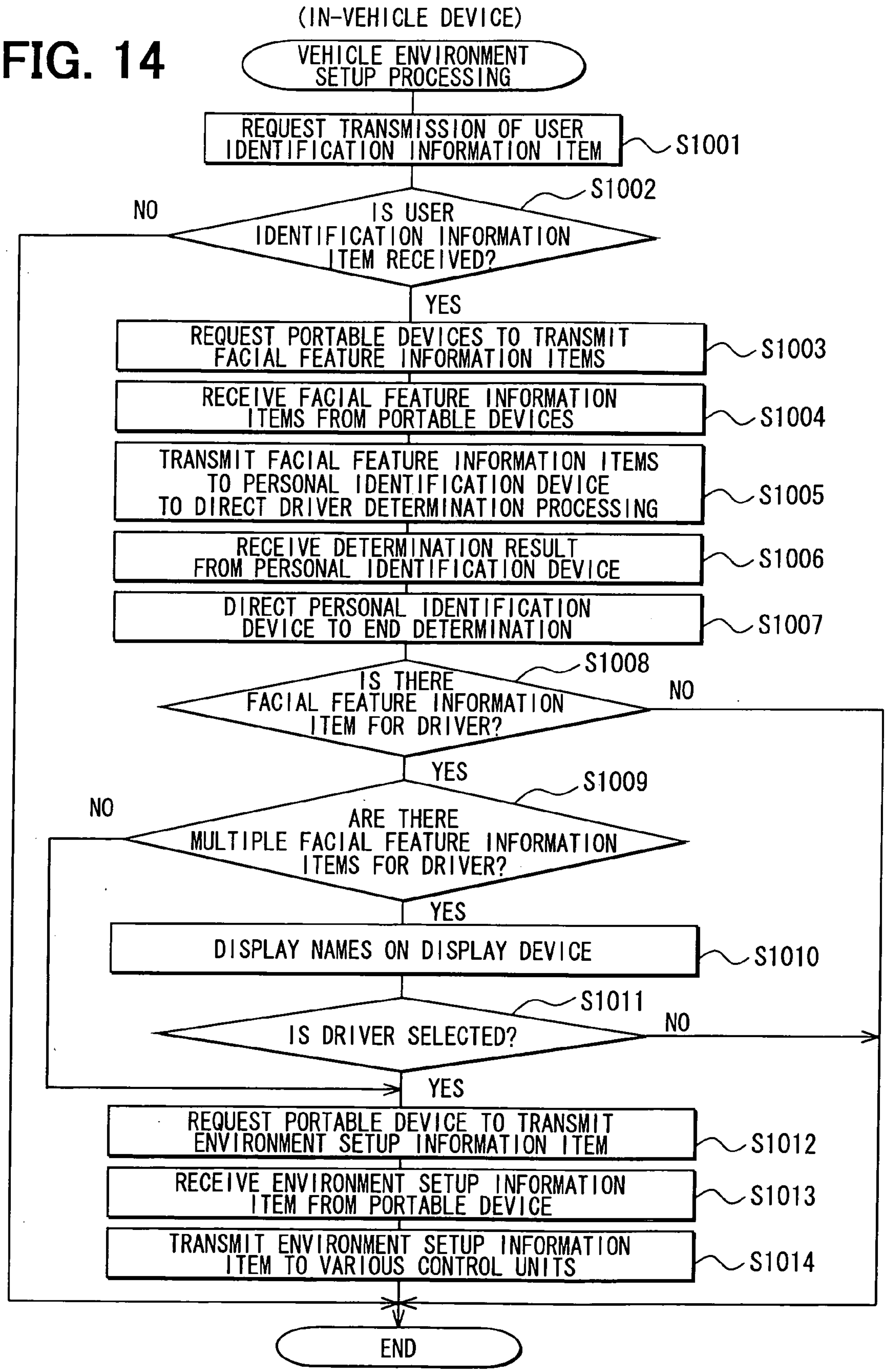

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1001
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
S1002
NO
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S1003
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S1004
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1005
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1006
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1007
IS THERE FACIAL FEATURE INFORMATION ITEM FOR DRIVER?
S1008
NO
YES
ARE THERE MULTIPLE FACIAL FEATURE INFORMATION ITEMS FOR DRIVER?
S1009
NO
YES
DISPLAY NAMES ON DISPLAY DEVICE
S1010
IS DRIVER SELECTED?
S1011
NO
YES
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S1012
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1013
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1014
END

FIG. 15

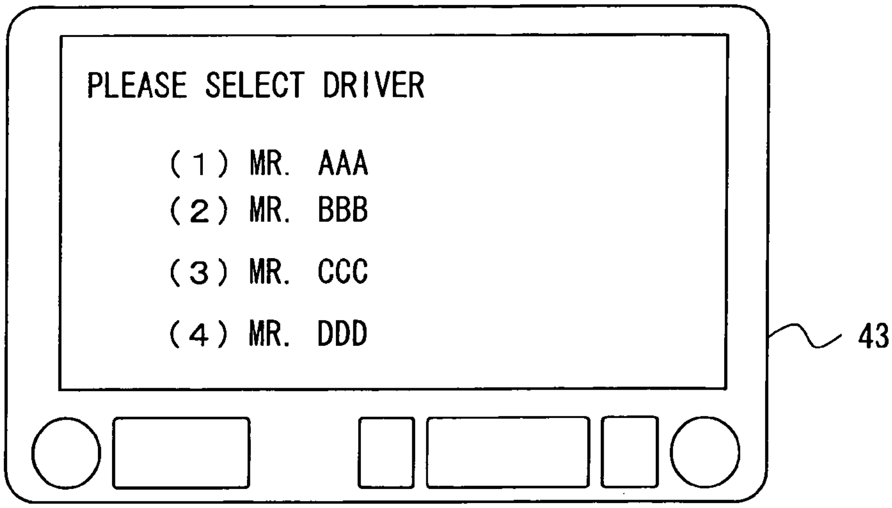

PLEASE SELECT DRIVER
(1) MR. AAA
(2) MR. BBB
(3) MR. CCC
(4) MR. DDD
43

FIG. 16

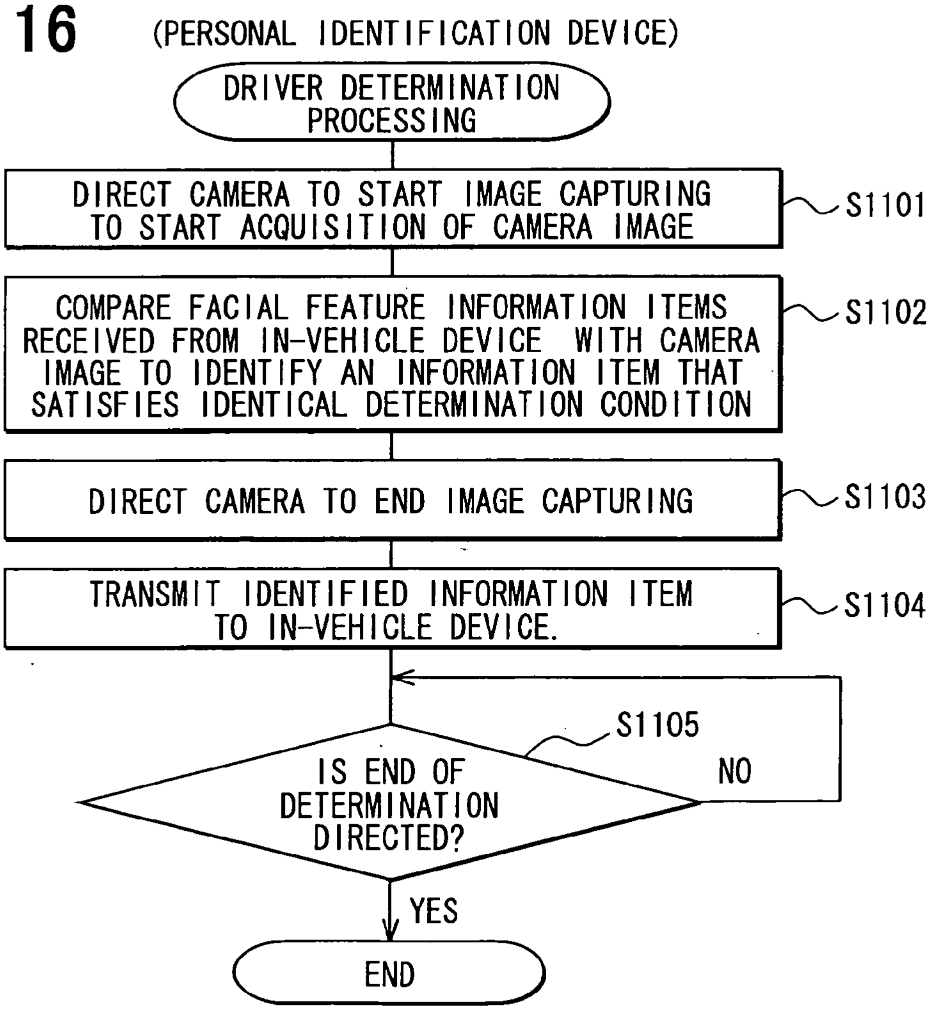

(PERSONAL IDENTIFICATION DEVICE)
DRIVER DETERMINATION PROCESSING
DIRECT CAMERA TO START IMAGE CAPTURING TO START ACQUISITION OF CAMERA IMAGE
S1101
COMPARE FACIAL FEATURE INFORMATION ITEMS RECEIVED FROM IN-VEHICLE DEVICE WITH CAMERA IMAGE TO IDENTIFY AN INFORMATION ITEM THAT SATISFIES IDENTICAL DETERMINATION CONDITION
S1102
DIRECT CAMERA TO END IMAGE CAPTURING
S1103
TRANSMIT IDENTIFIED INFORMATION ITEM TO IN-VEHICLE DEVICE.
S1104
S1105
IS END OF DETERMINATION DIRECTED?
NO
YES
END

FIG. 17

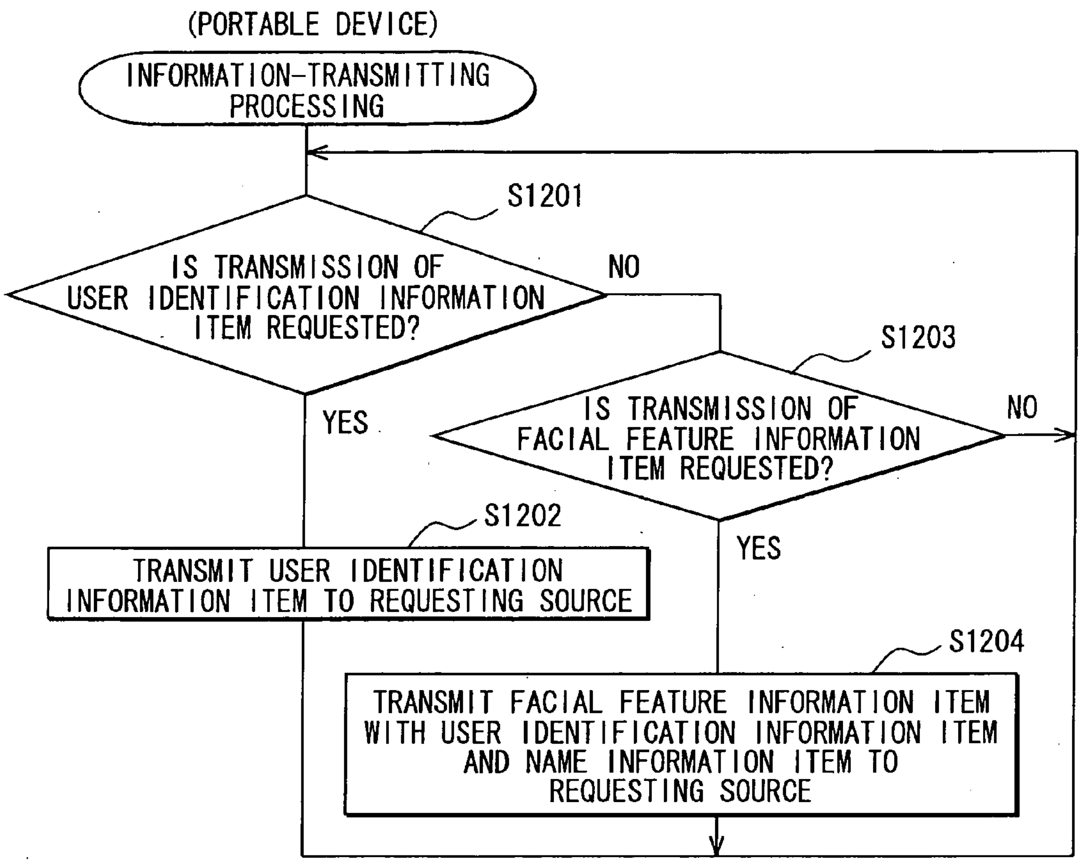

(PORTABLE DEVICE)
INFORMATION-TRANSMITTING PROCESSING
S1201
IS TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM REQUESTED?
NO
YES
S1203
IS TRANSMISSION OF FACIAL FEATURE INFORMATION ITEM REQUESTED?
NO
YES
S1202
TRANSMIT USER IDENTIFICATION INFORMATION ITEM TO REQUESTING SOURCE
S1204
TRANSMIT FACIAL FEATURE INFORMATION ITEM WITH USER IDENTIFICATION INFORMATION ITEM AND NAME INFORMATION ITEM TO REQUESTING SOURCE

FIG. 18A

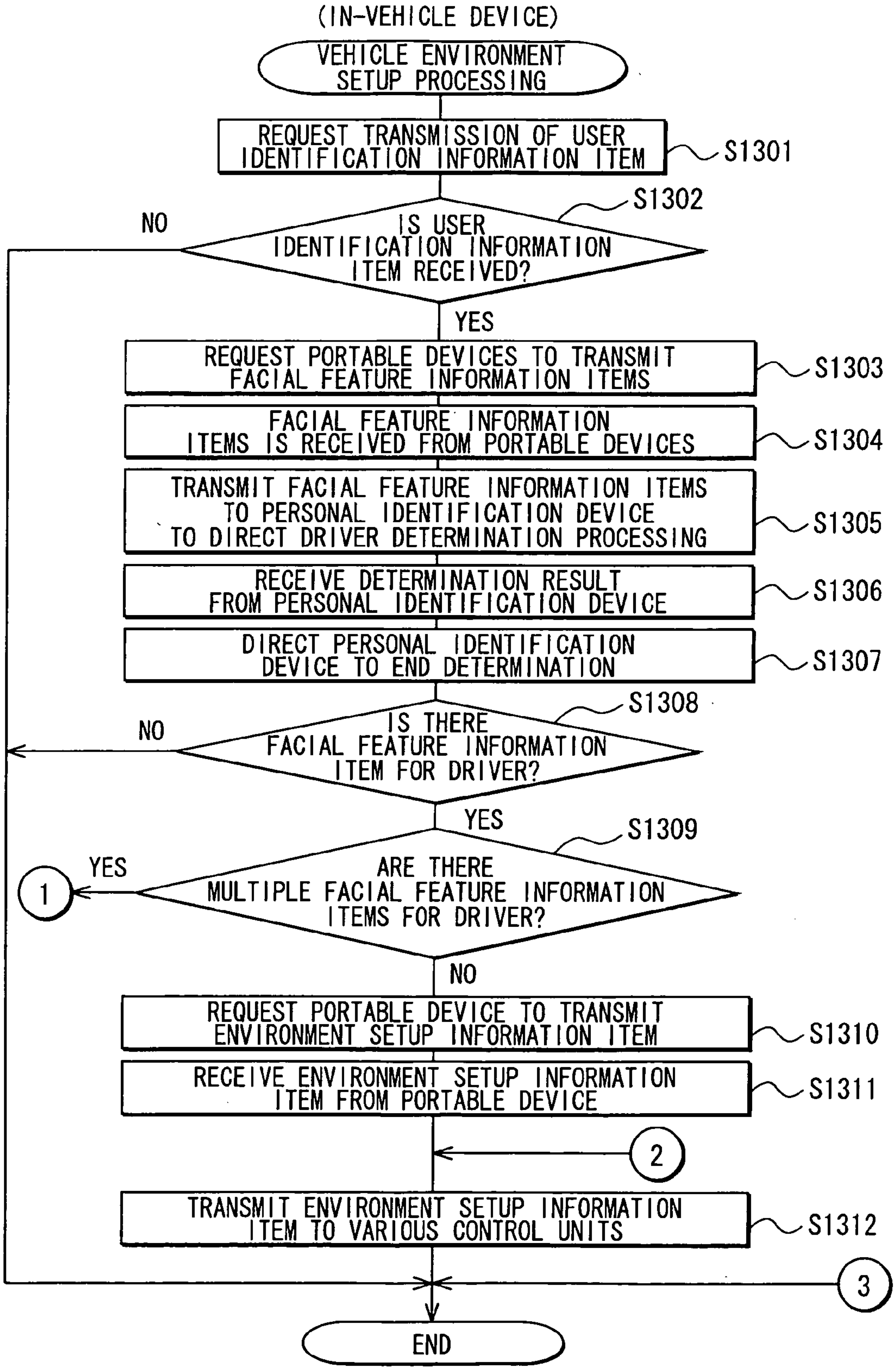

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1301
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
S1302
NO
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S1303
FACIAL FEATURE INFORMATION ITEMS IS RECEIVED FROM PORTABLE DEVICES
S1304
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1305
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1306
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1307
IS THERE FACIAL FEATURE INFORMATION ITEM FOR DRIVER?
S1308
NO
YES
ARE THERE MULTIPLE FACIAL FEATURE INFORMATION ITEMS FOR DRIVER?
S1309
YES
1
NO
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S1310
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1311
2
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1312
3
END

FIG. 18B

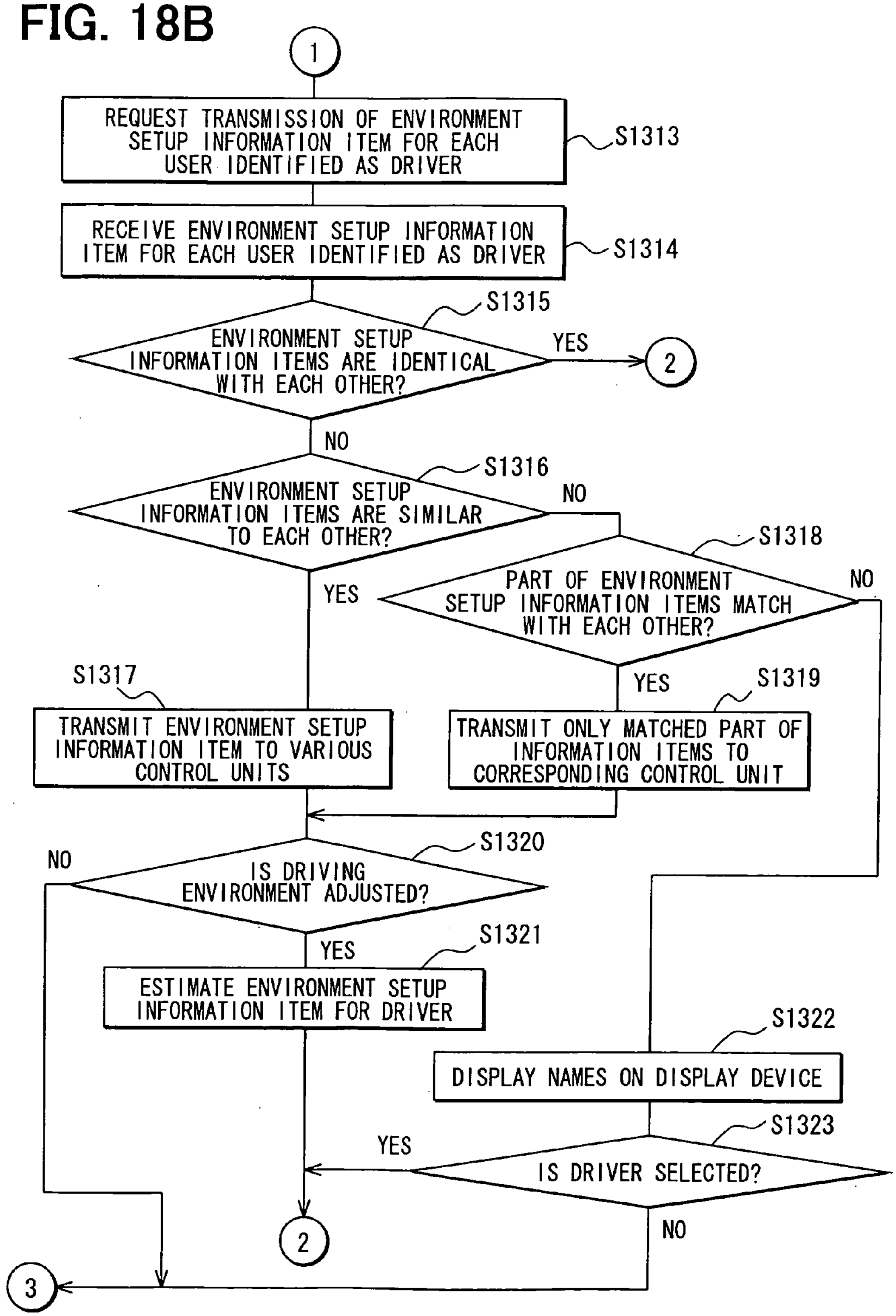

1
REQUEST TRANSMISSION OF ENVIRONMENT SETUP INFORMATION ITEM FOR EACH USER IDENTIFIED AS DRIVER
S1313
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FOR EACH USER IDENTIFIED AS DRIVER
S1314
S1315
ENVIRONMENT SETUP INFORMATION ITEMS ARE IDENTICAL WITH EACH OTHER?
YES
2
NO
S1316
ENVIRONMENT SETUP INFORMATION ITEMS ARE SIMILAR TO EACH OTHER?
NO
S1318
PART OF ENVIRONMENT SETUP INFORMATION ITEMS MATCH WITH EACH OTHER?
NO
YES
YES
S1317
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1319
TRANSMIT ONLY MATCHED PART OF INFORMATION ITEMS TO CORRESPONDING CONTROL UNIT
NO
S1320
IS DRIVING ENVIRONMENT ADJUSTED?
YES
S1321
ESTIMATE ENVIRONMENT SETUP INFORMATION ITEM FOR DRIVER
S1322
DISPLAY NAMES ON DISPLAY DEVICE
S1323
YES
IS DRIVER SELECTED?
NO
2
3

FIG. 19

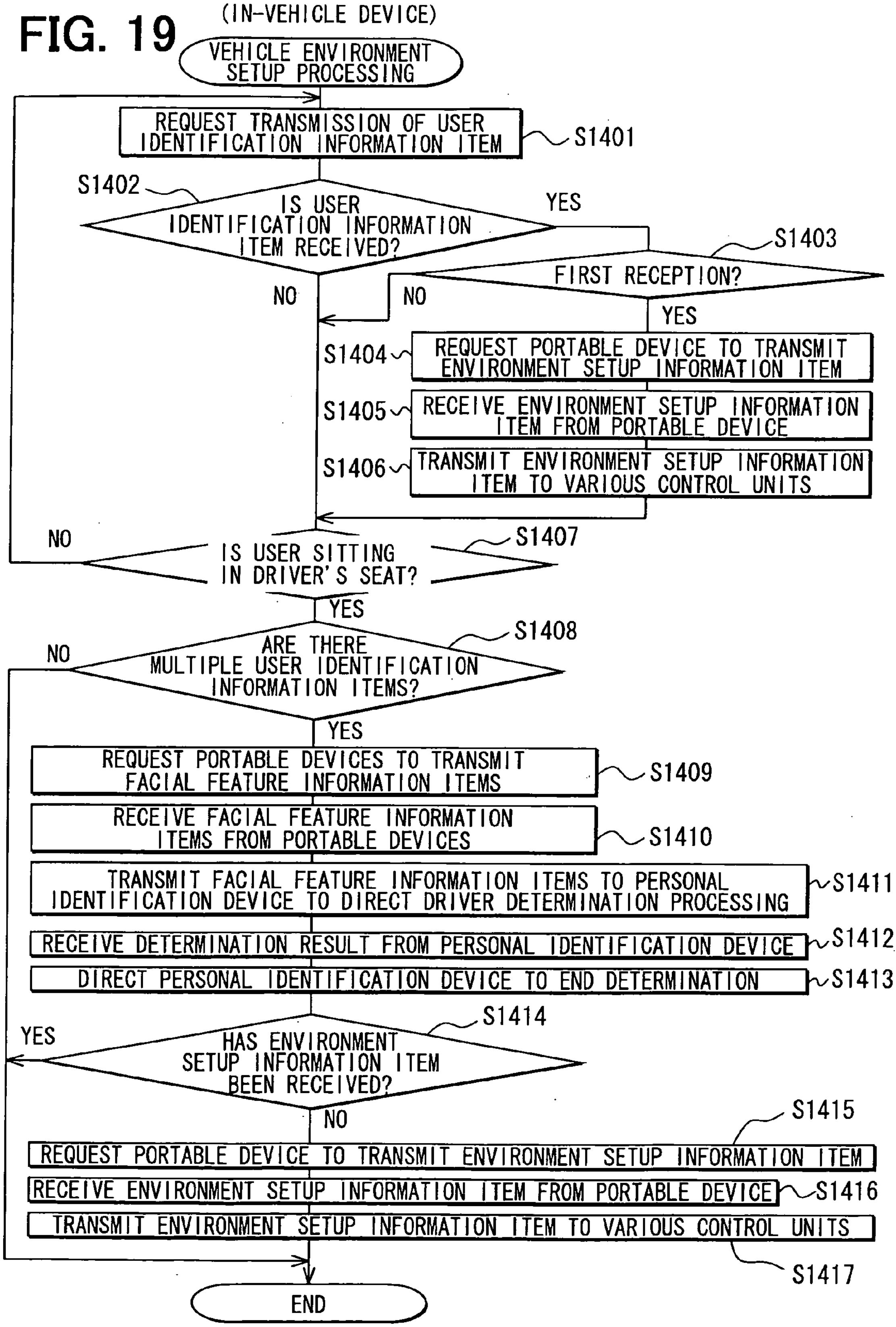

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1401
S1402
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
YES
NO
S1403
FIRST RECEPTION?
NO
YES
S1404
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S1405
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1406
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
NO
IS USER SITTING IN DRIVER'S SEAT?
S1407
YES
S1408
NO
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S1409
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S1410
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1411
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1412
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1413
S1414
YES
HAS ENVIRONMENT SETUP INFORMATION ITEM BEEN RECEIVED?
NO
S1415
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1416
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1417
END

FIG. 20

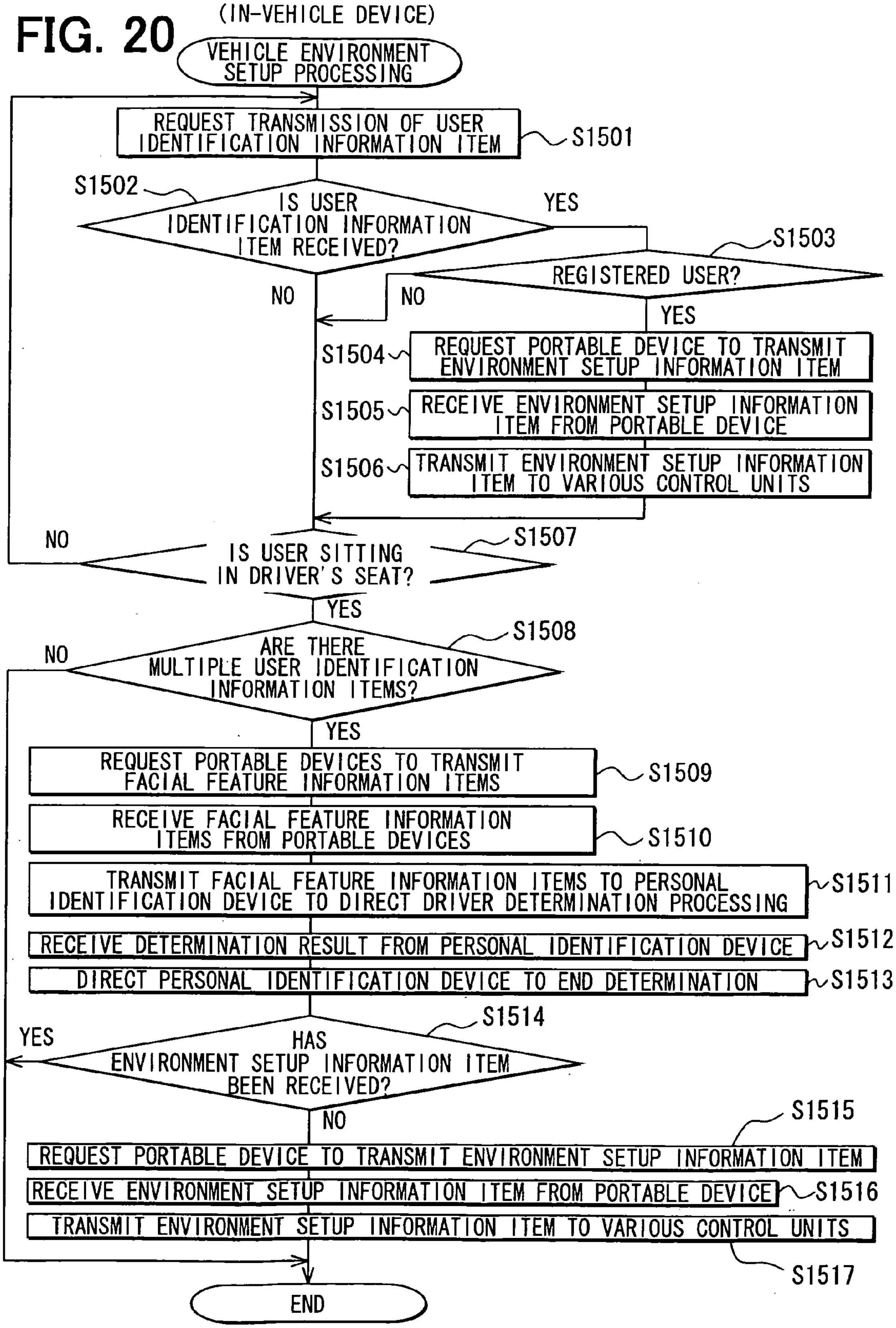

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1501
S1502
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
YES
NO
S1503
REGISTERED USER?
NO
YES
S1504
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S1505
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1506
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
NO
IS USER SITTING IN DRIVER'S SEAT?
S1507
YES
S1508
NO
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S1509
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S1510
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1511
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1512
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1513
S1514
YES
HAS ENVIRONMENT SETUP INFORMATION ITEM BEEN RECEIVED?
NO
S1515
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1516
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1517
END

FIG. 21

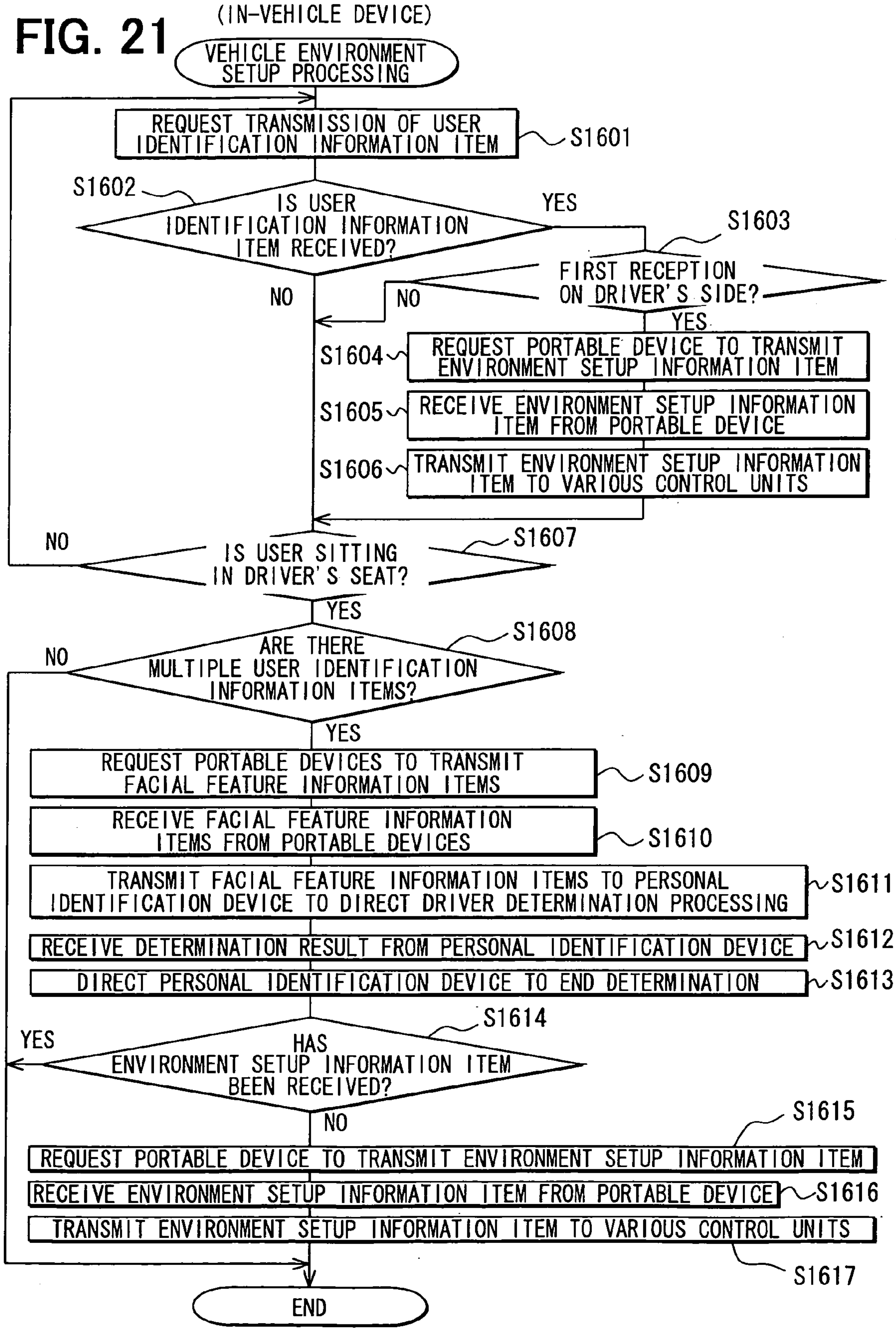

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1601
S1602
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
YES
NO
S1603
FIRST RECEPTION ON DRIVER'S SIDE?
NO
YES
S1604
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S1605
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1606
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
NO
IS USER SITTING IN DRIVER'S SEAT?
S1607
YES
NO
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
S1608
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S1609
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S1610
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1611
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1612
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1613
YES
HAS ENVIRONMENT SETUP INFORMATION ITEM BEEN RECEIVED?
S1614
NO
S1615
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1616
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1617
END

FIG. 22

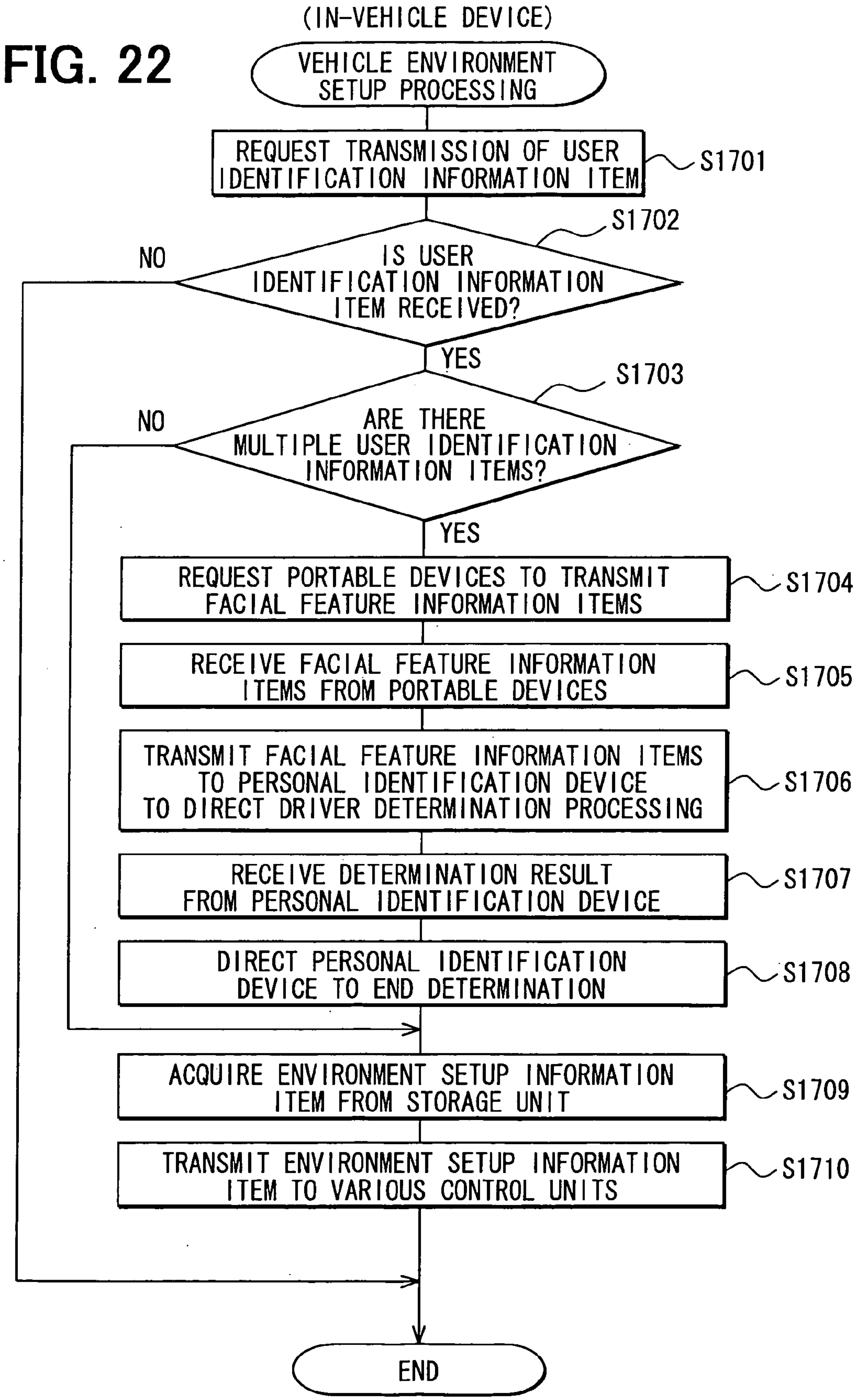

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1701
S1702
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
NO
YES
S1703
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
NO
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S1704
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S1705
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1706
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1707
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1708
ACQUIRE ENVIRONMENT SETUP INFORMATION ITEM FROM STORAGE UNIT
S1709
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1710
END

FIG. 23

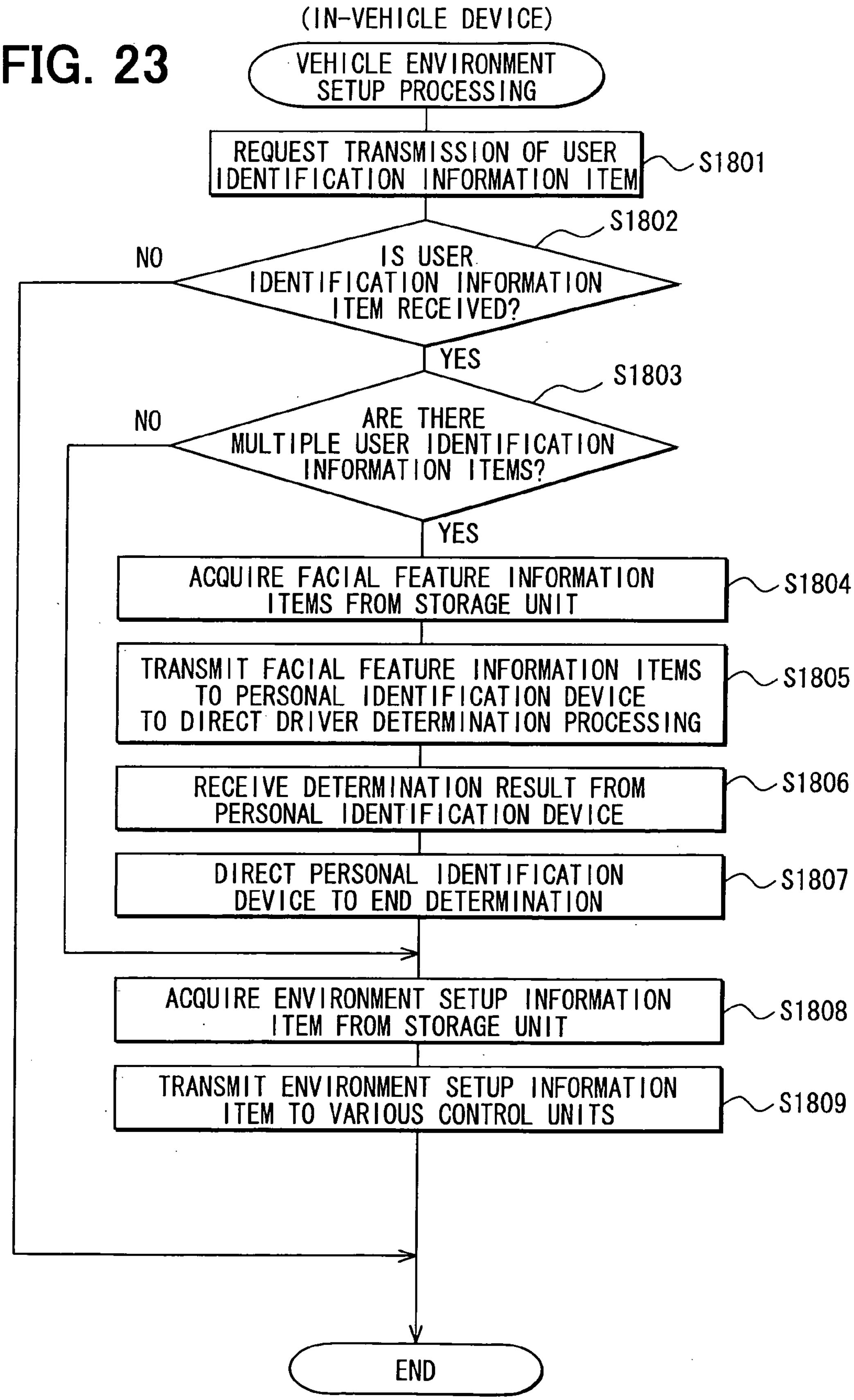

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1801
S1802
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
NO
YES
S1803
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
NO
YES
ACQUIRE FACIAL FEATURE INFORMATION ITEMS FROM STORAGE UNIT
S1804
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1805
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1806
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1807
ACQUIRE ENVIRONMENT SETUP INFORMATION ITEM FROM STORAGE UNIT
S1808
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1809
END

FIG. 24

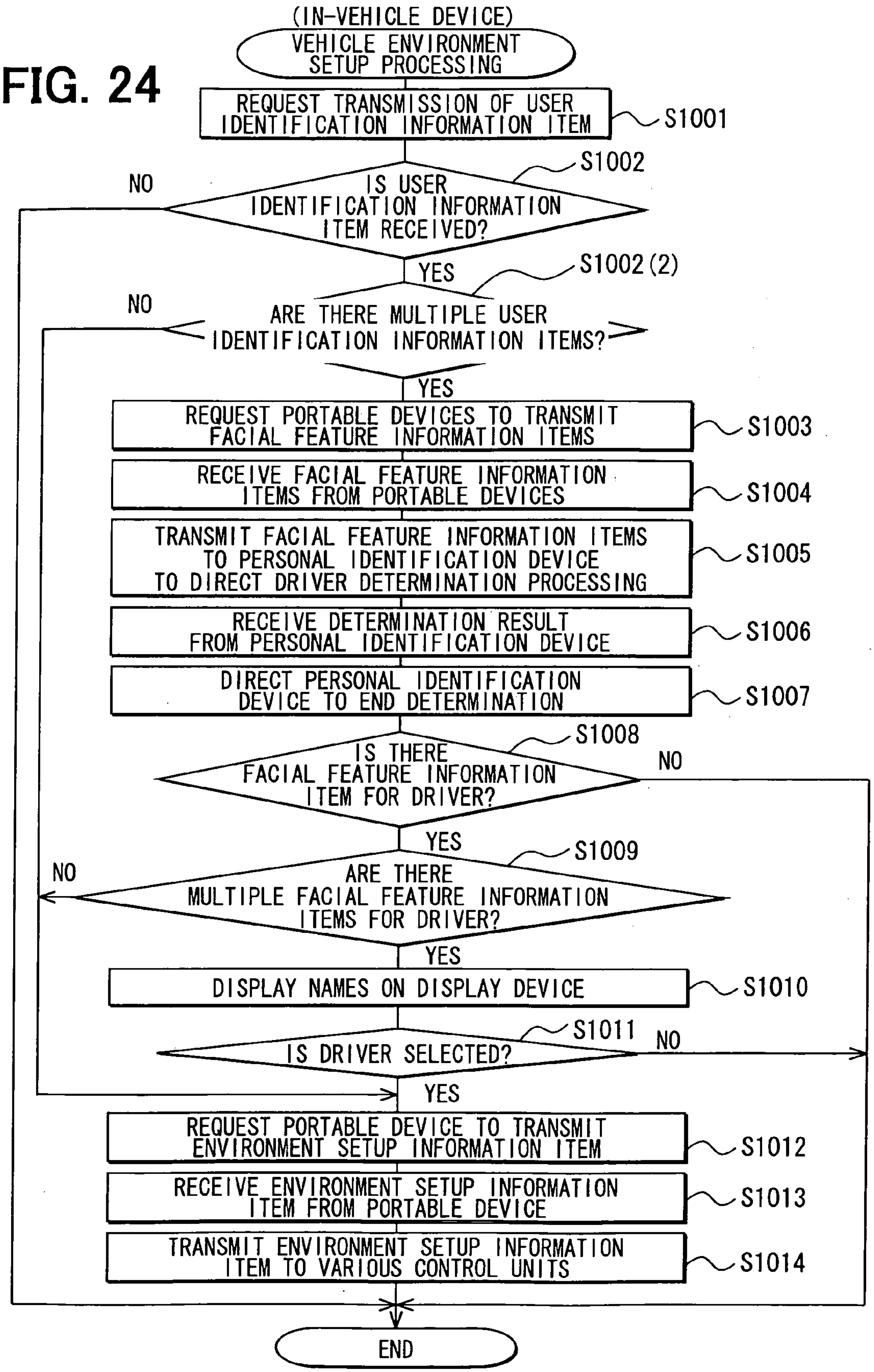

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1001
S1002
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
NO
YES
S1002(2)
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
NO
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S1003
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S1004
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1005
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1006
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1007
S1008
IS THERE FACIAL FEATURE INFORMATION ITEM FOR DRIVER?
NO
YES
S1009
ARE THERE MULTIPLE FACIAL FEATURE INFORMATION ITEMS FOR DRIVER?
NO
YES
DISPLAY NAMES ON DISPLAY DEVICE
S1010
S1011
IS DRIVER SELECTED?
NO
YES
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S1012
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1013
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1014
END

FIG. 25A

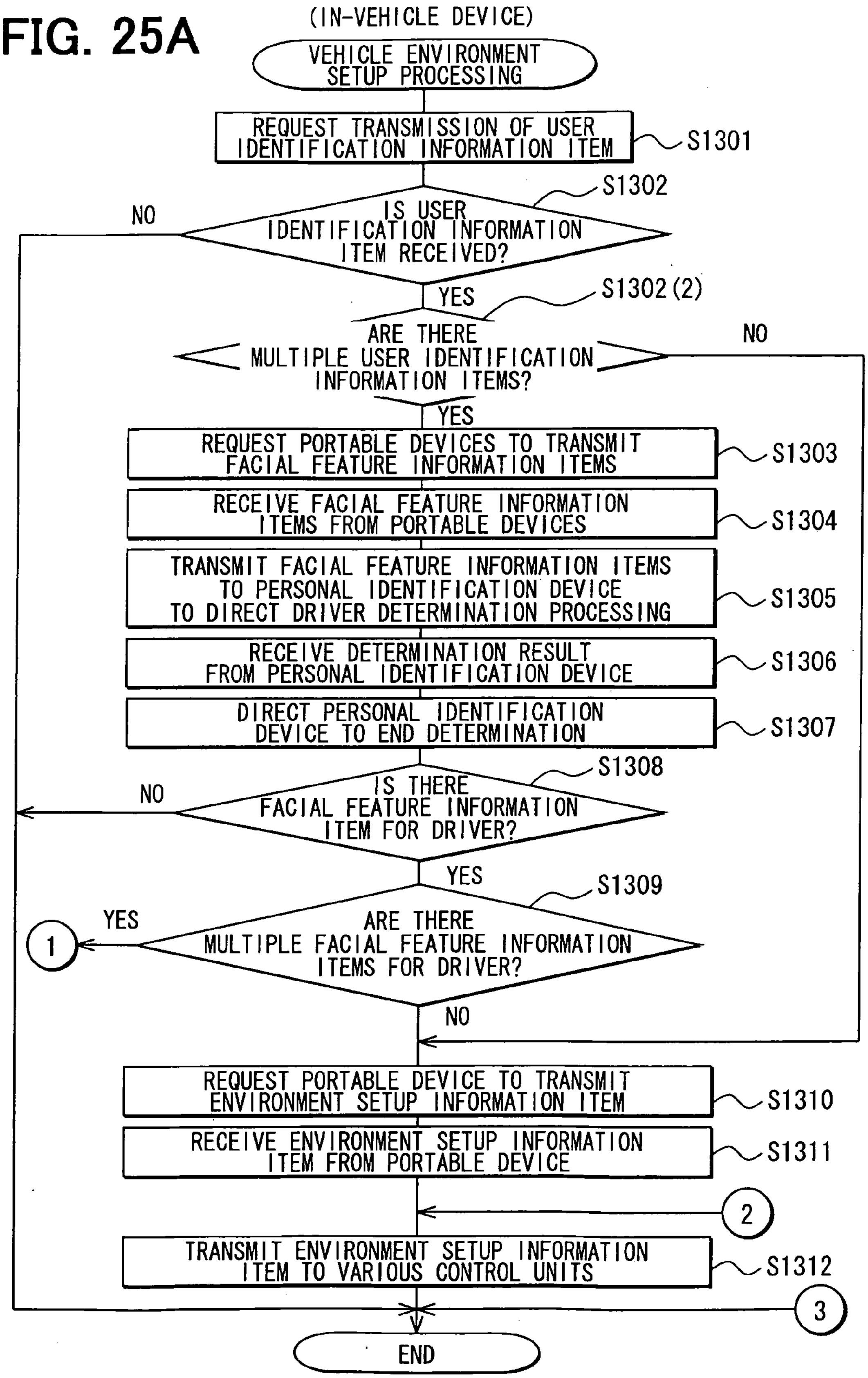
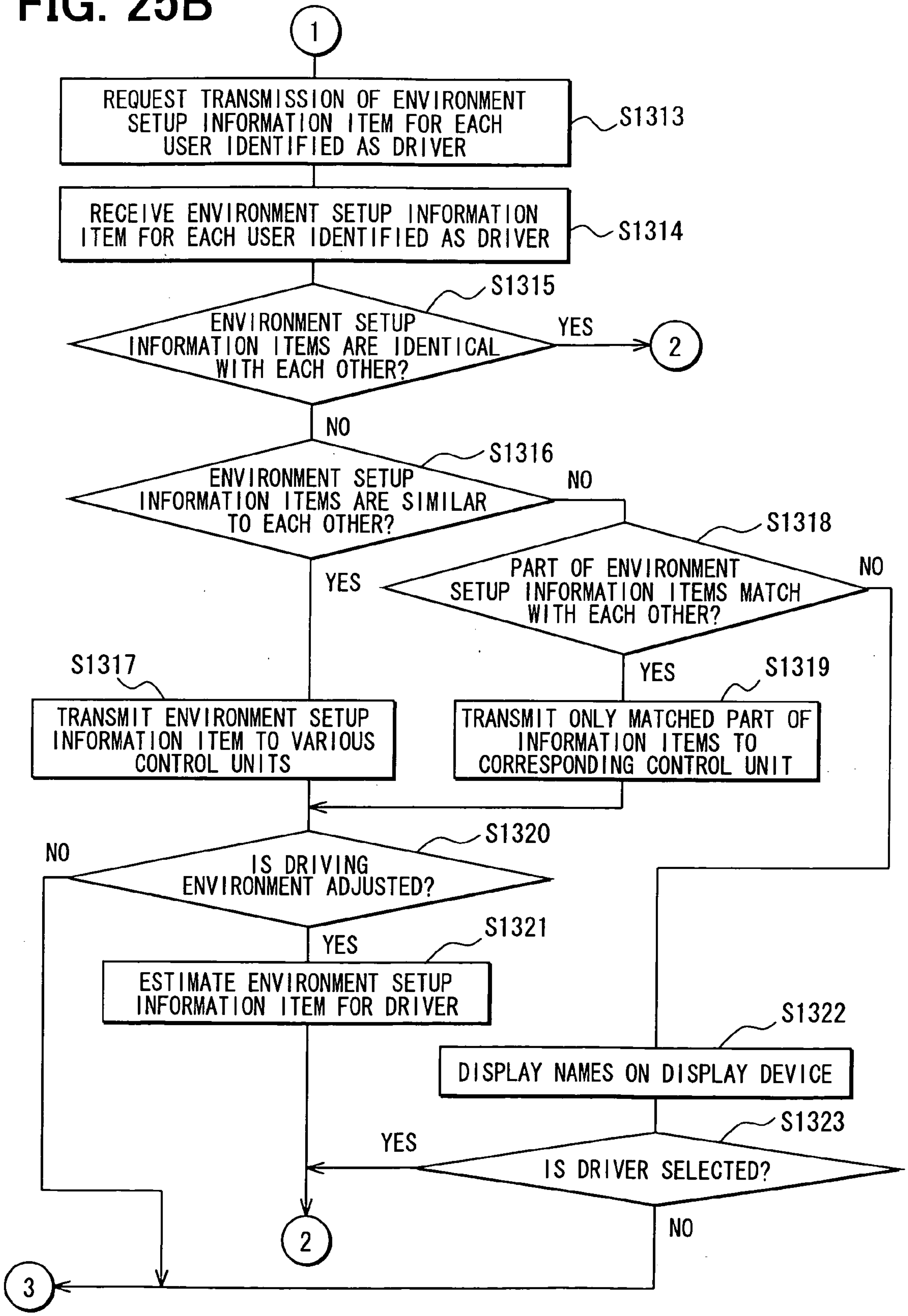

(IN-VEHICLE DEVICE)
VEHICLE ENVIRONMENT SETUP PROCESSING
REQUEST TRANSMISSION OF USER IDENTIFICATION INFORMATION ITEM
S1301
IS USER IDENTIFICATION INFORMATION ITEM RECEIVED?
S1302
NO
YES
ARE THERE MULTIPLE USER IDENTIFICATION INFORMATION ITEMS?
S1302(2)
NO
YES
REQUEST PORTABLE DEVICES TO TRANSMIT FACIAL FEATURE INFORMATION ITEMS
S1303
RECEIVE FACIAL FEATURE INFORMATION ITEMS FROM PORTABLE DEVICES
S1304
TRANSMIT FACIAL FEATURE INFORMATION ITEMS TO PERSONAL IDENTIFICATION DEVICE TO DIRECT DRIVER DETERMINATION PROCESSING
S1305
RECEIVE DETERMINATION RESULT FROM PERSONAL IDENTIFICATION DEVICE
S1306
DIRECT PERSONAL IDENTIFICATION DEVICE TO END DETERMINATION
S1307
IS THERE FACIAL FEATURE INFORMATION ITEM FOR DRIVER?
S1308
NO
YES
ARE THERE MULTIPLE FACIAL FEATURE INFORMATION ITEMS FOR DRIVER?
S1309
YES
1
NO
REQUEST PORTABLE DEVICE TO TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM
S1310
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FROM PORTABLE DEVICE
S1311
2
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1312
3
END

FIG. 25B


1
REQUEST TRANSMISSION OF ENVIRONMENT SETUP INFORMATION ITEM FOR EACH USER IDENTIFIED AS DRIVER
S1313
RECEIVE ENVIRONMENT SETUP INFORMATION ITEM FOR EACH USER IDENTIFIED AS DRIVER
S1314
S1315
ENVIRONMENT SETUP INFORMATION ITEMS ARE IDENTICAL WITH EACH OTHER?
YES
2
NO
S1316
ENVIRONMENT SETUP INFORMATION ITEMS ARE SIMILAR TO EACH OTHER?
NO
S1318
PART OF ENVIRONMENT SETUP INFORMATION ITEMS MATCH WITH EACH OTHER?
NO
YES
YES
S1317
TRANSMIT ENVIRONMENT SETUP INFORMATION ITEM TO VARIOUS CONTROL UNITS
S1319
TRANSMIT ONLY MATCHED PART OF INFORMATION ITEMS TO CORRESPONDING CONTROL UNIT
S1320
NO
IS DRIVING ENVIRONMENT ADJUSTED?
YES
S1321
ESTIMATE ENVIRONMENT SETUP INFORMATION ITEM FOR DRIVER
S1322
DISPLAY NAMES ON DISPLAY DEVICE
S1323
YES
IS DRIVER SELECTED?
NO
2
3

DRIVING-ENVIRONMENT SETUP SYSTEM, IN-VEHICLE DEVICE AND PROGRAM THEREOF, PORTABLE DEVICE AND PROGRAM THEREOF, MANAGEMENT DEVICE AND PROGRAM THEREOF

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is based on and incorporates herein by reference Japanese Patent Application No. 2007-52941 filed on Mar. 2, 2007.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relate to a driving-environment setup system which sets up a driving environment of a vehicle.

[0004] 2. Description of Related Art

[0005] Conventionally, in a vehicle, various setups are possible, such as a seat position, a steering wheel position, angles of various mirrors, an air-conditioning setup, an audio system setup, and a navigation system setup. The driving environment of the vehicle can be changed according to a driver's liking. However, when two or more users share the same vehicle to drive, a driving environment must be set up whenever a driver changes,.

[0006] Accordingly, JP-A-2003-237504 proposes a system which recognizes a driver who rides a vehicle and sets the driving environment of the vehicle as a driving environment for the recognized driver. In this system, a scanner for taking an image of the picture of a driver's license is installed in the vehicle, and a user who rides the vehicle operates the scanner to take his or her image of the driver's license. By the above operation, the driving environment of the vehicle is set as the driving environment for the driver recognized through the scanner.

[0007] In the above-described construction, a user who rides a vehicle does not need to perform the operation itself to set up the driving environment of the vehicle, but needs to operate a scanner to take an image of a driver's license. Therefore, the user is made conscious of the setting operation of the driving environment. In order to set up a driving environment of a vehicle, without making a user conscious of the setting operation of the driving environment, there may be provided a construction, in which a user is made to carry a portable device that stores information regarding a driving environment for the user, for example, and the vehicle automatically acquires the information from the portable device of the user when the user rides the vehicle.

[0008] Such construction will work satisfactorily if there is only one user who rides the vehicle. However, when two or more users, each possessing a portable device, ride the vehicle, it is easy to imagine that the driving environment of the vehicle will be set as a driving environment for an occupant other than the driver (a fellow passenger).

SUMMARY OF THE INVENTION

[0009] The present invention has been made in view of the above disadvantages, and it is an object of the present invention to provide a driving-environment setup system which can set the driving environment of a vehicle as a driving environment for a driver, even when two or more users ride or get in the vehicle.

[0010] According to a first aspect of the disclosure, a driving-environment setup system includes an in-vehicle device mounted on a vehicle and a plurality of portable devices capable of being carried in the vehicle. Each of the plurality of portable devices includes feature information transmitting means and environmental information transmitting means. The feature information transmitting means transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices. The environmental information transmitting means transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user. The in-vehicle device includes feature detection means, driver identifying means, and driving-environment setup means. The feature detection means detects a physical feature of a person sitting in a driver's seat of the vehicle. The driver identifying means identifies one of the associated users as a driver of the vehicle when the physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the physical feature detected by the feature detection means. The driving-environment setup means sets a driving environment of the vehicle for the driver based on the received environment identification information item of the one of the associated users.

[0011] According to a second aspect of the disclosure, an in-vehicle device includes driver identifying means and driving-environment setup means. The in-vehicle device is mounted on a vehicle for being capable of communicating with a plurality of portable devices. The plurality of portable devices are capable of being carried in the vehicle. Each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices. The each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user. The driver identifying means identifies one of the associated users as a driver of the vehicle when the physical feature identified based on the feature identification information item of the one of the associated users corresponds to a physical feature detected from a person sitting in a driver's seat of the vehicle. The driving-environment setup means sets a driving environment of the vehicle for the driver based on the received environment identification information item of the one of the associated users.

[0012] According to a third aspect of the disclosure, a portable device for an associated user includes feature information transmitting means and environmental information transmitting means. The portable device is capable of communicating with an in-vehicle device mounted in a vehicle. The portable device is capable of being carried in the vehicle. The in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle. The in-vehicle device identifies the associated user as a driver of the vehicle when a physical feature identified based on a received feature identification information item of the associated user corresponds to a physical feature detected by the in-vehicle device. The in-vehicle device sets a driving environment of the vehicle for the driver based on a received environment identification information item of the associated user. The feature information transmitting means transmits, to the in-vehicle device, the feature identification information item used for identifying the physical feature of the associated user of the portable device. The environmental information transmitting means transmits, to the in-vehicle device, the environment identification information item used for identifying the driving environment for the associated user.

[0013] According to a fourth aspect of the disclosure, a management device capable of communicating with a plurality of portable devices and an in-vehicle device mounted in a vehicle includes storing means and setup information replying means. The plurality of portable devices are capable of being carried in the vehicle. Each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices. The each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying an environment setup information item indicative of a driving environment of the associated user of the each of the plurality of portable devices among environment setup information items stored in the management device. The in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle. The in-vehicle device identifies one of the associated users as a driver of the vehicle when a physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the physical feature detected by the in-vehicle device. The in-vehicle device acquires the environment setup information item of the one of the associated users by transmitting the received environment identification information item of the one of the associated users to the management device. The in-vehicle device sets the driving environment of the vehicle for the driver as the driving environment indicated by the acquired environment setup information item. The storing means stores the environment setup information item indicative of the driving environment of the associated user of the each of the plurality of portable devices. The setup information replying means transmits, to the in-vehicle device, the environment setup information item identified based on the environment identification information item, when the environment identification information item is received from the in-vehicle device.

[0014] According to a fifth aspect of the disclosure, a management device capable of communicating with a plurality of portable devices and an in-vehicle device mounted in a vehicle includes storing means and feature information replying means. The plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a feature information item indicative of a physical feature of an associated user of the each of the plurality of portable devices among feature information items stored in the management device, wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device acquires the feature information item of the associated user of the each of the plurality of portable devices by transmitting the received feature identification information item of the associated user to the management device, wherein the in-vehicle device identifies one of the associated users as a driver of the vehicle when a physical feature indicated by the acquired feature information item of the one of the associated users corresponds to the physical feature detected by the in-vehicle device, and wherein the in-vehicle device sets a driving environment of the vehicle for the driver based on the received environment setup information item of the one of the associated users. The storing means stores the feature information item indicative of the physical feature of the associated user of the each of the plurality of portable devices. The feature information replying means transmits, to the in-vehicle device, the feature information item identified based on the feature identification information item, when the feature identification information item is received from the in-vehicle device.

[0015] According to a sixth aspect of the disclosure, an article manufacture for an in-vehicle device mounted on a vehicle includes a computer readable medium and program instructions. The in-vehicle device is capable of communicating with a plurality of portable devices, wherein the plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices, and wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user. The computer readable medium is readable by a computer. The program instructions are carried by the computer readable medium for causing the computer to serve as driver identifying means and driving-environment setup means. The driver identifying means identifies one of the associated users as a driver of the vehicle when the physical feature identified based on the feature identification information item of the one of the associated users corresponds to a physical feature detected from a person sitting in a driver's seat of the vehicle. The driving-environment setup means sets a driving environment of the vehicle for the driver based on the received environment identification information item of the one of the associated users.

[0016] According to a seventh aspect of the disclosure, an article manufacture for a portable device for an associated user includes a computer readable medium and program instructions. The portable device is capable of communicating with an in-vehicle device mounted in a vehicle, wherein the portable device is capable of being carried in the vehicle, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device identifies the associated user as a driver of the vehicle when a physical feature identified based on a received feature identification information item of the associated user corresponds to a physical feature detected by the in-vehicle device, and wherein the in-vehicle device sets a driving environment of the vehicle for the driver based on a received environment identification information item of the associated user. The computer readable medium is readable by a computer. The program instructions are carried by the computer readable medium for causing the computer to serve as feature information transmitting means and environmental information transmitting means. The feature information transmitting means transmits, to the in-vehicle device, the feature identification information item used for identifying the physical feature of the associated user of the portable device. The environmental information transmitting means transmits, to the in-vehicle device, the environment identification information item used for identifying the driving environment for the associated user.

[0017] According to an eighth aspect of the disclosure, an article manufacture for a management device capable of communicating with a plurality of portable devices and an in-vehicle device mounted in a vehicle includes a computer readable medium and program instructions. The plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices, wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying an environment setup information item indicative of a driving environment of the associated user of the each of the plurality of portable devices among environment setup information items stored in the management device, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device identifies one of the associated users as a driver of the vehicle when a physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the physical feature detected by the in-vehicle device, wherein the in-vehicle device acquires the environment setup information item of the one of the associated users by transmitting the received environment identification information item of the one of the associated users to the management device, and wherein the in-vehicle device sets the driving environment of the vehicle for the driver as the driving environment indicated by the acquired environment setup information item. The computer readable medium is readable by a computer. The program instructions are carried by the computer readable medium for causing the computer to serve as storing means and setup information replying means. The storing means stores the environment setup information item indicative of the driving environment of the associated user of the each of the plurality of portable devices. The setup information replying means transmits, to the in-vehicle device, the environment setup information item identified based on the environment identification information item, when the environment identification information item is received from the in-vehicle device.

[0018] According to a ninth aspect of the disclosure, an article manufacture for-a management device capable of communicating with a plurality of portable devices and an in-vehicle device mounted in a vehicle includes a computer readable medium and program instructions. The plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a feature information item indicative of a physical feature of an associated user of the each of the plurality of portable devices among feature information items stored in the management device, wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device acquires the feature information item of the associated user of the each of the plurality of portable devices by transmitting the received feature identification information item of the associated user to the management device, wherein the in-vehicle device identifies one of the associated users as a driver of the vehicle when a physical feature indicated by the acquired feature information item of the one of the associated users corresponds to the physical feature detected by the in-vehicle device, and wherein the in-vehicle device sets a driving environment of the vehicle for the driver based on the received environment setup information item of the one of the associated users. The computer readable medium is readable by a computer. The program instructions are carried by the computer readable medium for causing the computer to serve as storing means and feature information replying means. The storing means stores the feature information item indicative of the physical feature of the associated user of the each of the plurality of portable devices. The feature information replying means transmits, to the in-vehicle device, the feature information item identified based on the feature identification information item, when the feature identification information item is received from the in-vehicle device.

[0019] According to a tenth aspect of the disclosure, an in-vehicle device mounted on a vehicle includes feature detection means, driver identifying means, and driving-environment setup means. The in-vehicle device is capable of communicating with a plurality of portable devices, each of which transmits identification information unique to the each of the plurality of portable devices. The feature detection means detects a physical feature of a person sitting in a driver's seat of the vehicle. The driver identifying means determines whether the physical feature detected by the feature detection means corresponds to a predetermined physical feature identified based on the identification information received from one of the plurality of portable devices. The driving-environment setup means sets a driving environment of the vehicle as a predetermined driving environment identified based on the identification information received from the one of the plurality of the portable devices when the driver identifying means determines that the detected physical feature corresponds to the predetermined physical feature of the one of the plurality of the portable devices.

[0020] According to an eleventh aspect of the disclosure, a driving-environment setup system includes an in-vehicle device mounted on a vehicle and a portable device capable of being carried in the vehicle. The portable device includes feature information transmitting means and environmental information transmitting means. The feature information transmitting means transmits, to the in-vehicle device, feature identification information item used for identifying a physical feature of an associated user of the portable device. The environmental information transmitting means transmits, to the in-vehicle device, environment identification information item used for identifying a driving environment for the associated user of the portable device. The in-vehicle device includes feature detection means, driver identifying means, and driving-environment setup means. The feature detection means detects a physical feature of a person sitting in a driver's seat of the vehicle. The driver identifying means determines whether the physical feature detected by the feature detection means corresponds to the physical feature identified based on the received feature identification information item of the associated user of the portable device. The driving-environment setup means sets a driving environment of the vehicle as the driving environment identified based on the received environment identification information item of the associated user when the driver identifying means determines that the detected physical feature corresponds to the identified physical feature of the associated user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Embodiments of the present invention will be described in detail based on the following figures, wherein:

[0022] FIG. **1** is a block diagram illustrating an outline structure of a driving-environment setup system according to a first embodiment of the present invention;

[0023] FIG. **2** is a flow chart illustrating a vehicle environment setup processing according to the first embodiment;

[0024] FIG. **3** is a flow chart illustrating a driver determination processing according to the first embodiment;

[0025] FIG. **4** is a flow chart illustrating an information-transmitting processing according to the first embodiment;

[0026] FIG. **5**A is a schematic diagram for explaining the effect of the driving-environment setup system;

[0027] FIG. **5**B is another schematic diagram for explaining the effect of the driving-environment setup system;

[0028] FIG. **5**C is still another schematic diagram for explaining the effect of the driving-environment setup system;

[0029] FIG. **5**D is further another schematic diagram for explaining the effect of the driving-environment setup system;

[0030] FIG. **6** is a block diagram illustrating an outline structure of a driving-environment setup system according to a second embodiment of the present invention;

[0031] FIG. **7** is a flow chart illustrating a vehicle environment setup processing according to the second embodiment;

[0032] FIG. **8** is a flow chart illustrating an information-transmitting processing according to the second embodiment;

[0033] FIG. **9** is a flow chart illustrating an information management processing according to the second embodiment;

[0034] FIG. **10** is a flow chart illustrating a vehicle environment setup processing according to a third embodiment of the present invention;

[0035] FIG. **11** is a flow chart illustrating an information-transmitting processing according to the third embodiment;

[0036] FIG. **12** is a flow chart illustrating an information management processing according to the third embodiment;

[0037] FIG. **13** is a block diagram illustrating an outline structure of a driving-environment setup system according to a fourth embodiment of the present invention;

[0038] FIG. **14** is a flow chart illustrating a vehicle environment setup processing according to the fourth embodiment;

[0039] FIG. **15** is an explanatory drawing of a display device displaying names of the users;

[0040] FIG. **16** is a flow chart illustrating a driver determination processing according to the fourth embodiment;

[0041] FIG. **17** is a flow chart illustrating an information-transmitting processing according to the fourth embodiment;

[0042] FIG. **18**A is a flow chart illustrating a vehicle environment setup processing according to a fifth embodiment of the present invention;

[0043] FIG. **18**B is another flow chart in connection with the flow chart in FIG. **18**A for illustrating the vehicle environment setup processing according to the fifth embodiment;

[0044] FIG. **19** is a flow chart illustrating a vehicle environment setup processing according to a sixth embodiment of the present invention;

[0045] FIG. **20** is a flow chart illustrating a vehicle environment setup processing according to a seventh embodiment of the present invention;

[0046] FIG. **21** is a flow chart illustrating a vehicle environment setup processing according to an eighth embodiment of the present invention;

[0047] FIG. **22** is a flow chart illustrating a vehicle environment setup processing according to a ninth embodiment of the present invention;

[0048] FIG. **23** is a flow chart illustrating a vehicle environment setup processing according to a tenth embodiment of the present invention;

[0049] FIG. **24** is a flow chart illustrating a vehicle environment setup processing of a modified example of the fourth embodiment;

[0050] FIG. **25**A is a flow chart illustrating a vehicle environment setup processing of a modified example of the fifth embodiment; and

[0051] FIG. **25**B is another flow chart in connection with the flow chart in FIG. **25**A for illustrating the vehicle environment setup processing of the modified example of the fifth embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0052] Hereinafter, with reference to the accompanying drawings, the embodiments of the present invention are explained in detail.

1 First Embodiment

[0053] First, a driving-environment setup system according to a first embodiment of the present invention is explained.

[0054] [1-1 Entire Configuration]

[0055] FIG. **1** is a block diagram illustrating an outline structure of a driving-environment setup system according to the first embodiment.

[0056] The present driving-environment setup system is for automatically setting a driving environment of a vehicle **100** as a driving environment for a user, when the user who serves as the driver rides or gets in the vehicle **100**. The present driving-environment setup system includes an in-vehicle device **10** and a portable device **20**.

[0057] Here, the concrete construction of the devices **10** and **20** of the driving-environment setup system is explained.

[0058] [1-1-1 Construction of an In-Vehicle Device]

[0059] The in-vehicle device **10** is used in the state where it is mounted in the vehicle **100**. When there exist two or more vehicles **100** which use the driving-environment setup system, each of the two or more vehicles **100** is mounted with one driving-environment setup system.

[0060] The in-vehicle device **10** possesses or includes a control unit **11**, a storage unit **12**, and a communication unit **13**.

[0061] The control unit **11** includes as a main element a microcomputer having a CPU, a ROM, a RAM, and executes various processing. The control unit **11** is coupled for capable of communicating with a personal identification device **41** and various control units **51-59** which are mounted in the vehicle **100**.

[0062] Here, the personal identification device **41** is for authenticating a user sitting in the driver's seat based on his or her physical feature. To be specific, a camera **42** is installed ahead of the driver's seat inside the vehicle **100**, and can take an image of a face of a user sitting in the driver's seat. The personal identification device **41** performs authentication by detecting a facial feature point from the taken image of the camera **42** as the driver's physical feature. Other devices for other in-vehicle systems, such as an inattentive driving prevention device, may be used as the personal identification device **41** and the camera **42**.

[0063] Various control units **51-59** enable a setup (change) of the driving environment according to a driver's liking. In the present embodiment, a seat position controller **51**, a steering wheel position controller **52**, a mirror attitude controller **53**, an air-conditioning controller **54**, an audio controller **55**, a navigation controller **56**, an information display control device **57**, an engine controller **58**, and a traveling control device **59** are mounted.

[0064] These control units **51-59** are operable to set or change the driving environment, according to the external operation by the user who rides the vehicle **100**. For example, the seat position controller **51** adjusts the position of the driver's electric seat (the height of the seat surface, the position in the back-and-forth direction, etc.), according to the external operation. Here, the driving environment (the height of the seat surface, the position in the back-and-forth direction, etc.) realizable with the seat position controller **51** is indicated as the environment setup information item (for example, numerical data). The seat position controller **51** is operable to reproduce the driving environment indicated by the environment setup information item, when the environment setup information item is directly inputted from the exterior. That is, if the environment setup information item is inputted, the driving environment can be reproduced correctly, without performing fine tuning by the external operation, etc.

[0065] In the above, the seat position controller **51** is explained as an example. The other control units **52-59** are similarly operable to reproduce the driving environment indicated by the environment setup information item, when the environment setup information item is inputted.

[0066] The storage unit **12** is operable to store a variety of information. The vehicles identification information which is identification information unique to the in-vehicle device **10** concerned is stored in the storage unit **12** in advance.

[0067] The communication unit **13** is for performing a short distance radio communication with the portable device **20**, and enables radio communication with the portable device **20** which exists in a communications area or in an area, in which the short distance radio communication is enabled, covering at least the entire of the inside of the vehicle **100** in which the in-vehicle device **10** concerned is mounted. Examples of the short distance radio communication include Bluetooth (registered trademark), DSRC (Dedicated Short Range Communication), wireless LAN, ZIGBEE (registered trademark), etc.

[0068] [1-1-2 Construction of a Portable Device]

[0069] The portable device **20** is a portable terminal which the user who rides the vehicle **100** can carry, and is possessed by a user who uses the present driving-environment setup system (a user who can drive the vehicle **100**). When there are two or more users who use the present driving-environment setup system, each user possesses one portable device **20**.

[0070] The portable device **20** includes a control unit **21**, a storage unit **22**, and a communication unit **23**.

[0071] The control unit **21** includes as a main element a microcomputer having a CPU, a ROM, a RAM, etc., and executes various processing.

[0072] The storage unit **22** is operable to store a variety of information or various information items. The storage unit **22** prestores user identification information, which is identification information unique to a user or an associated user who possesses the portable device **20**, facial feature information, which is indicative of the user's facial feature point, and environment setup information, which is indicative of the driving environment for the user.

[0073] The environment setup information item is stored in the storage unit **22** of the portable device **20** with a predetermined procedure. In the present embodiment, when registration operation of the environment setup information item is performed in the portable device **20** after the driving environment for the user is set up by the user's external operation in the vehicle **100**, the portable device **20** transmits the registration directions of the environment setup information item to the in-vehicle device **10**. Then, the in-vehicle device **10** which has received the registration directions transmits the environment setup information item indicative of the current driving environment of the vehicle **100** to the portable device **20** as a transmitting source, and the portable device **20** stores the received environment setup information item in the storage unit **22**. Here, the current driving environment a driving environment, which the user has set up through the external operation by the time of registration procedure.

[0074] The communication unit **23** is for performing a short distance radio communication with the in-vehicle device **10**, and able to perform radio communication with the in-vehicle device **10** in a communications area which covers the entire of the cabin or the occupant compartment of the vehicle **100**.

[0075] In the driving-environment setup system of the present embodiment, a portable telephone terminal is employed as the portable device **20**.

[0076] [1-2 Processing Performed by a Driving-Environment Setup System]

[0077] Next, the processing performed by the devices **10** and **20** which are included in the driving-environment setup system of the first embodiment is explained.

[0078] [1-2-1 Processing Performed by an In-Vehicle Device]

[0079] First, the vehicle environment setup processing performed by the control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **2**. This vehicle environment setup processing is started at the time when a driver is detected to ride in the vehicle **100**. Detection of the driver to ride in the vehicle **100** can be performed by, for example, detecting a user's seating with a sitting sensor provided in the driver's seat.

[0080] When the vehicle environment setup processing is started, first, in Step **S101**, the control unit **11** transmits an identification information-sending request which is a request to the portable device **20** for the transmission of the user identification information, using a short distance radio communication in order to detect that the user is in a state of riding the vehicle **100**. Consequently, when the portable device **20** exists in the communications area (when a user who possesses the portable device **20** has ridden the vehicle **100**), the user identification information stored in the portable device **20** is transmitted to the in-vehicle device **10** concerned (Step

S**302** in the information-transmitting processing (FIG. **4**) described later). That is, it is so designed that the portable device **20** (user) which exists in the communications area is detected by receiving the user identification information transmitted by the portable device **20** in response to the identification information-sending request.

[0081] Then, in Step S**102**, it is determined whether the user identification information is received.

[0082] When it is determined in Step S**102** that no user identification information is received (for instance, when the user who rides the vehicle **100** does not possess the portable device **20**), the present vehicle environment setup processing is terminated without further execution.

[0083] On the other hand, when it is determined in Step S**102** that the user identification information is received, flow or execution proceeds to Step S**103** to determine whether two or more pieces of the user identification information are received. That is, it is determined whether two or more users possessing the portable device **20** are in the vehicle **100**.

[0084] When it is determined in Step S**103** that two or more pieces of the user identification information are received or that two or more users possessing the portable device **20** ride in the vehicle **100**, the flow proceeds to Step S**104**.

[0085] In Step S**104**, the feature information-sending request is sent to the portable device **20**, which is the transmitting source of the user identification information. The feature information-sending request is sent to request the portable device **20** to send facial feature information. Consequently, the facial feature information (the facial feature information of the user who rides in the vehicle **100**) stored in the portable device **20** is transmitted to the in-vehicle device **10** concerned, together with the user identification information (Step S**304** in the information-transmitting processing (FIG. **4**) to be described later).

[0086] In Step S**105**, the multiple facial feature information items or two or more pieces of facial feature information transmitted by the portable devices **20** are received.

[0087] In Step S**106**, the in-vehicle device **10** transmits the facial feature information items received in Step S**105** to the personal identification device **41** such that the personal identification device **41** is directed to perform the driver determination processing in order to identify or select a facial feature information item of the driver among the transmitted facial feature information items. Consequently, the personal identification device **41** identifies the facial feature information belonging to the driver (the facial feature information of the user who rides the vehicle **100**), among the facial feature information items which are received from the in-vehicle device **10**. Concrete explanation of the driver determination processing will be described later (FIG. **3**).

[0088] In Step S**107**, the identified facial feature information of the driver identified as the determination result of the driver determination processing is received from the personal identification device **41**. That is, the in-vehicle device **10** has identified or selected the facial feature information item that corresponds to the detected facial feature point detected by the camera **42** among the facial feature information items which are received from the multiple portable devices **20**.

[0089] In Step S**108**, the end of the driver determination processing is directed to the personal identification device **41**, and the flow proceeds to Step S**109**. Consequently, the personal identification device **41** ends the driver determination processing.

[0090] On the other hand, when it is determined in Step S**103** described above that not two or more pieces but a single piece of user identification information is received, the facial feature information which is receivable from the portable device **20** is highly possible to correspond to the facial feature point detected with the camera **42**. Therefore, in this case, the received user identification information is considered to belong to the driver and the flow proceeds to Step S**109**, without processing Steps S**104**-S**108**.

[0091] In Step S**109**, in order to identify the driving environment for the driver, the setup information-sending request is transmitted to the portable device **20** of the driver. Here, the portable device **20** is the transmitting source of the facial feature information and user identification information of the driver, and the setup information-sending request requests the portable device **20** of the driver to send the environment setup information item. Consequently, the environment setup information item stored in the portable device **20** of the driver or the environment setup information item indicative of the driving environment for the driver is transmitted from the portable device **20** to the in-vehicle device **10** (see Step S**306** in the information-transmitting processing (FIG. **4**) to be described later.

[0092] In Step S**110**, the environment setup information item transmitted by the portable device **20** is received.

[0093] In Step S**111**, the environment setup information item received in Step S**110** is transmitted to various control units **51**-**59**, and the present vehicle environment setup processing is ended. Consequently, the driving environment of the vehicle **100** is set as the driving environment for the driver.

[0094] [1-2-2 Processing Performed by a Personal Identification Device]

[0095] Next, the driver determination processing performed by the personal identification device **41** is explained using a flow chart of FIG. **3**. The driver determination processing is started at the time of reception of the directions for driver determination processing which is effected by transmission of the facial feature information from the in-vehicle device **10** (the directions in Step S**106** in the vehicle environment setup processing (FIG. **2**) described above).

[0096] When the driver determination processing is started, first in Step S**201**, the personal identification device **41** directs the camera **42** to start capturing an image of the driver and starts acquisition of the image taken or captured with the camera **42**

[0097] Then, in Step S**202**, the personal identification device **41** identifies the driver's facial feature information item out of the facial feature information items received from the in-vehicle device **10**, by template matching of the facial feature information items received from the in-vehicle device **10** with the image taken with the camera **42**. In the present embodiment, one of the facial feature information items that has a facial feature point most similar to the facial feature point shown by the image taken with the camera **42** is identified to correspond to the facial feature information item of the driver. Accordingly, the facial feature information item that belongs to the driver is certainly identified or selected among the multiple facial feature information items received from the in-vehicle device **10**.

[0098] In Step S**203**, the end of capturing the image is directed to the camera **42**. Then, in Step S**204**, the facial feature information identified as belonging to the driver is transmitted to the in-vehicle device **10**.

[0099] In Step S205, the personal identification device 41 stands by until it receives the directions of the end of the driver determination processing from the in-vehicle device 10, and terminates the present person determination processing at the time of reception of the directions. Above directions of ending the driver determination processing corresponds to the directions in Step S108 in the vehicle environment setup processing shown in FIG. 2.

[0100] [1-2-3 Processing Performed by a Portable Device]

[0101] Next, the information-transmitting processing performed by a control unit 21 of the portable device 20 is explained using a flow chart of FIG. 4. The information-transmitting processing begins with starting (power ON) of the portable device 20, and continues until end of the operation of the portable device 20 (power OFF).

[0102] When the information-transmitting processing is started, in Step S301, the control unit 21 firstly determines whether the identification information-sending request is received. The identification information-sending request is transmitted by the in-vehicle device 10 in Step S101 in the vehicle environment setup processing (FIG. 2) described above.

[0103] In Step S301, when it is determined that the identification information-sending request is received, the flow proceeds to Step S302 to transmit the user identification information of the user who possesses the portable device 20 concerned to the in-vehicle device 10 as the requesting source, and the flow returns to Step S301.

[0104] On the other hand, in Step S301, when it is determined that the identification information-sending request is not received, the flow proceeds to Step S303 to determine whether the feature information-sending request is received. The feature information-sending request is transmitted by the in-vehicle device 10 in Step S104 in the vehicle environment setup processing (FIG. 2) described above.

[0105] In Step S303, when it is determined that the feature information-sending request is received, the flow proceeds to Step S304 to transmit the facial feature information of the user who possesses the portable device 20 concerned to the in-vehicle device 10 as the requesting source, together with the user identification information, and then the flow returns to Step S301.

[0106] On the other hand, in Step S303, when it is determined that the feature information-sending request is not received, the flow proceeds to Step S305 to determine whether the setup information-sending request is received. The setup information-sending request is transmitted by the in-vehicle device 10 in Step S109 in the vehicle environment setup processing (FIG. 2) described above.

[0107] In Step S305, when it is determined that the setup information-sending request is received, the flow proceeds to Step S306 to transmit the environment setup information item for the user who possesses the portable device 20 concerned to the in-vehicle device 10 as the requesting source, and the flow returns to Step S301.

[0108] On the other hand, in Step S305, when it is determined that the setup information-sending request is not received, the flow returns to Step S301 without performing anything.

[0109] [1-3 Effect]

[0110] As explained in the above, according to the driving-environment setup system of the first embodiment, the following effects or advantages are obtained.

[0111] (1A) The in-vehicle device 10 is operable to perform a radio communication with the portable device 20 which exists in the communications area covering the entire of the inside of the vehicle 100 acquires automatically the environment setup information item from the portable device 20 operable to perform a radio communication, and sets up the driving environment. As a result, the user using the vehicle 100 only has to possess the portable device 20 and ride the vehicle 100. Even if a special operation for setting the driving environment is not performed, the driving environment of the vehicle 100 is automatically set as the driving environment for the user.

[0112] Moreover, even when two or more users, each possessing the portable device 20, ride in the vehicle 100, the in-vehicle device 10 can set the driving environment of the vehicle 100 as the driving environment for the driver by identifying the driver based on the facial feature point.

[0113] Specifically, it is possible to set the driving environment of the vehicle 100 as the driving environment for the driver, for example, in the following cases.

[0114] As illustrated in FIG. 5A, there may be a case where a certain user A (Mr. A) possesses own portable device 20 and rides in the driver's seat of the vehicle 100. In this case, the driving environment of the vehicle 100 is set as the driving environment for user A which rides in the driver's seat.

[0115] As illustrated in FIG. 5B, there may be a case where, while a certain user A (Mr. A) possesses own portable device 20 and rides in the driver's seat of the vehicle 100, another user B (Mr. B) possesses own portable device 20 and seats in any seat except the driver's seat of the vehicle 100. That is, the present case is a modified case of FIG. 5A where user B rides in the vehicle 100 as a fellow passenger or an occupant. Also in the present case, the driving environment of the vehicle 100 is set as the driving environment for user A who rides in the driver's seat, regardless of the order of the user of getting in the vehicle or regardless of the fact that which user A or user B gets in the vehicle earlier.

[0116] Furthermore, as illustrated in FIG. 5C, there may be a case where, while a certain user A (Mr. A) possesses the portable device 20 of user B and rides in the driver's seat of the vehicle 100, another user B (Mr. B) possesses the portable device 20 of user A and seats in any seat except the driver's seat of the vehicle 100. That is, the present case is a modified case of FIG. 5B where user A and user B ride in the vehicle 100, each possessing the portable device 20 of the other user. Also in this case, the driving environment of the vehicle 100 is set as the driving environment for user A which rides in the driver's seat, regardless of the order of the user of getting in the vehicle.

[0117] As illustrated in FIG. 5D on the other hand, there may be a case where, while a certain user A (Mr. A) possesses own portable device 20 and rides in the driver's seat of the vehicle 100, and another user B (Mr. B) does not possess the portable device 20 and seats in any seat except the driver's seat of the vehicle 100. That is, the present case is another modified case of FIG. 5B where user B does not possess own portable device 20. Also in this case, the driving environment of the vehicle 100 is set as the driving environment for user A which rides in the driver's seat, regardless of the order of the user of getting in or riding the vehicle.

[0118] Because the portable device 20 should just be in the area where communication with the in-vehicle device 10 is possible, the same effect will be obtained even if the portable device 20 is put in a bag and placed in a rear passenger seat, a trunk, etc., for example. That is, the driver can be identified correctly, regardless of the position where the portable device **20** is placed in the indoor of the vehicle **100**.

[0119] (1B) Because the in-vehicle device **10** is designed so as to authenticate the driver based on the facial feature point, the in-vehicle device **10** can employ the construction of other in-vehicle systems, such as an inattentive driving prevention device.

[0120] (1C) Because the portable device **20** transmits information according to the request from the in-vehicle device **10** only at the time of necessity, the present system can reduce transmission of unnecessary information, compared with the construction which transmits information regardless of the request from the in-vehicle device **10**.

[0121] (1D) The in-vehicle device **10** performs the search of the portable device **20** (the detection of the user who rides the vehicle **100**) at the time when the driver is detected to have gotten in the vehicle **100**. Accordingly, compared with the construction which always searches for the portable device **20**, the portable device **20** can be efficiently detected. Moreover, erroneous determination of the driver can be avoided, because a user who gets in the vehicle **100** after the driver is not detected.

[0122] (1E) The in-vehicle device **10** identifies as the driver a user having a facial feature point, which is indicated by the facial feature information received from the portable device **20**, and which is most similar to a facial feature point of the image of the driver taken with the camera **42**. Accordingly, the in-vehicle device **10** can identify as the driver one user with highest possibility of being the driver, based on the facial feature point.

[0123] (1F) When a single piece of the user identification information is received from the portable device **20**, the in-vehicle device **10** sets the driving environment as the driving environment for the user identified based on the received user identification information, without requesting transmission of the facial feature information to the portable device **20**. Accordingly, it is possible to simplify the processing in case where two or more users who possess the portable device **20** do not ride in the vehicle **100**.

[0124] (1G) The in-vehicle device **10** acquires the facial feature information and the environment setup information item from the portable device **20**. Therefore, because the in-vehicle device does not need to prestore the environment setup information item for each of the users who may use the vehicle **100**, it becomes possible to set up the driving environment for a user who rides the vehicle for the first time.

[0125] [1-4 Correspondence with Claims]

[0126] In the driving-environment setup system according to the first embodiment, the camera **42** corresponds to feature detection means.

[0127] The control unit **11** of the in-vehicle device **10** which performs processing of Steps **S103**-**S107** in the vehicle environment setup processing (FIG. **2**) corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps **S109**-**S111** corresponds to driving-environment setup means.

[0128] The control unit **21** of the portable device **20** which performs processing of Steps S**303** and S**304** in the information-transmitting processing (FIG. **4**) corresponds to feature information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps **S305** and S**306** corresponds to environmental information transmitting means.

2 Second Embodiment

[0129] Next, a driving-environment setup system according to a second embodiment is explained.

[0130] [2-1 Entire Configuration]

[0131] FIG. **6** is a block diagram illustrating an outline structure of a driving-environment setup system according to the second embodiment.

[0132] In comparison with the driving-environment setup system (FIG. **1**) of the first embodiment, the driving-environment setup system of the second embodiment differs in that it includes a management device **30**. Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the first embodiment, and further explanation on the identical or similar portion is omitted by using the same symbols and numerals to the same elements.

[0133] [2-1-1 Construction of an In-Vehicle Device]

[0134] In the driving-environment setup system of the second embodiment, the communication unit **13** of the in-vehicle device **10** is constructed such that radio communication may be performed between the portable device **20** and the management device **30**.

[0135] Specifically, the communication unit **13** is operable to perform a short distance radio communication with the portable device **20**, as in the driving-environment setup system of the first embodiment.

[0136] On the other hand, the communication unit **13** is operable to perform data communication by radio through a mobile phone network (communication network of mobile phones) with the management device **30**. For this reason, the in-vehicle device **10** is operable to perform data communication with the management device **30**, in a communications area covered by a mobile phone base station arranged in various places (it is markedly wider than the communications area with the portable device **20**).

[0137] [2-1-2 Construction of a Portable Device]

[0138] In the driving-environment setup system of the second embodiment, the environment setup information item indicative of the driving environment for a user possessing the portable device **20** concerned is not stored in the storage unit **22** of the portable device **20**. The above structure is different from the first embodiment. That is, user identification information which is identification information unique to a user possessing the portable device **20** concerned, and facial feature information indicative of a facial feature point of the user are prestored in the storage unit **22**.

[0139] [2-1-3 Construction of a Management Device]

[0140] The management device **30** is for performing overall management of the information about two or more users, and is installed in a control center etc. One set of management device **30** is shared by two or more sets of the in-vehicle device **10**.

[0141] The management device **30** includes a control unit **31**, a storage unit **32**, and a communication unit **33**.

[0142] The control unit **31** includes as a main element a microcomputer having a CPU, a ROM, a RAM, etc., and performs various processing.

[0143] The storage unit **32** is operable to store a variety of information. The setting information database which registers the environment setup information item indicative of the driving environment for each of the users is stored in the storage unit **32**. In the setting information database, the environment setup information item for each user is registered in association with user identification information of each user;

thereby, the environment setup information item can be identified based on the user identification information.

[0144] The environment setup information item is registered into the setting information database by a predetermined procedure. In the present embodiment, the driving environment for a user is set up by an external operation by the user in the vehicle **100**, and then the register operation of the environment setup information item is performed in the portable device **20**. Subsequently, the portable device **20** transmits the registration directions of the environment setup information item to the in-vehicle device **10**, together with the user identification information stored in the storage unit **22**. Then, the in-vehicle device **10**, upon receiving the registration directions, transmits the environment setup information item indicative of the current driving environment of the vehicle **100** to the management device **30**, together with the user identification information received from the portable device **20**. Here, the current driving environment is a driving environment which the user has set up through the external operation by the time of executing the above procedure. The management device **30**, upon receiving the user identification information and the environment setup information item, registers the user identification information in association with the environment setup information item in the setting information database of the storage unit **32**.

[0145] The communication unit **33** performs data communication by radio through a mobile phone network with two or more in-vehicle devices **10**.

[0146] [2-2 Processing Performed by a Driving-Environment Setup System]

[0147] Next, the processing performed by the devices **10**, **20**, and **30** which are included in the driving-environment setup system of the second embodiment is explained.

[0148] [2-2-1 Processing Performed by an In-Vehicle Device]

[0149] First, the vehicle environment setup processing performed by a control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **7**. Compared with the vehicle environment setup processing (FIG. **2**) of the first embodiment, the vehicle environment setup processing of the second embodiment differs in performing processing in Steps S**409** and S**410** instead of the processing in Steps S**109** and S**110**. In addition, contents of each processing in Steps S**401**-S**408**, and Step S**411** are respectively the same as those in Steps S**101**-S**108**, and Step S**111**; therefore, the explanation about the contents of the processing thereof is omitted.

[0150] In Step S**409**, in order to identify the driving environment for a driver, the setup information-sending request is transmitted to the management device **30**, together with the user identification information of the driver and the vehicles identification information of the in-vehicle device **10**. Here, the setup information-sending request is transmitted to request the management device **30** to send the environment setup information. Consequently, the environment setup information item corresponding to the transmitted user identification information (the environment setup information item indicative of the driving environment for the driver) is transmitted from the management device **30** to the in-vehicle device **10** concerned (Step S**603** in the information management processing (FIG. **9**) to be described later).

[0151] Then, in Step S**410**, the environment setup information item transmitted by the management device **30** is received.

[0152] [2-2-2 Processing Performed by a Personal Identification Device]

[0153] The driver determination processing performed by a personal identification device **41** is the same as the driver determination processing (FIG. **3**) of the first embodiment; therefore, the explanation thereof is omitted.

[0154] [2-2-3 Processing Performed by a Portable Device]

[0155] Next, the information-transmitting processing performed by a control unit **21** of the portable device **20** is explained using a flow chart of FIG. **8**. Compared with the information-transmitting processing (FIG. **4**) of the first embodiment, the information-transmitting processing of the second embodiment differs in not performing the processing of Steps S**305** and S**306**. In addition, contents of each processing of Steps S**501**-S**504** are respectively the same as contents of each processing of Steps S**301**-S**304**; therefore, the explanation about the concrete contents of the processing thereof is omitted.

[0156] [2-2-4 Processing Performed by a Management Device]

[0157] Next, the information management processing performed by the control unit **31** of the management device **30** is explained using a flow chart of FIG. **9**. The information management processing begins with starting (power ON) of the management device **30**, and continues until end of the operation of the management device **30** (power OFF).

[0158] When the information management processing is started, in Step S**601**, the control unit **31** determines first whether the setup information-sending request is received. When it is determined that the setup information-sending request is received, control proceeds to Step S**602**. The setup information-sending request is transmitted by the in-vehicle device **10** in Step S**409** in the vehicle environment setup processing (FIG. **7**) described above, together with the user identification information and the vehicles identification information.

[0159] In Step S**602**, the control unit **31** reads the environment setup information item stored in the storage unit **32** in association with the user identification information received. That is, the control unit **31** reads the environment setup information item indicative of the driving environment for a driver.

[0160] Then, in Step S**603**, the environment setup information item read in Step S**602** is transmitted to the in-vehicle device **10** which is the transmitting source of the user identification information, and execution returns to Step S**601**. Here, the in-vehicle device **10** is identified based on the vehicles identification information, which has been received with the user identification information. Consequently, the driving environment of the vehicle **100** is set as the driving environment for the driver.

[0161] [2-3 Effect]

[0162] As explained above, according to the driving-environment setup system of the second embodiment, the following effects or advantages are achieved in addition to the same effects as in (1A)-(1F) of the first embodiment.

[0163] (2G) The in-vehicle device **10** acquires the facial feature information from the portable device **20**, and acquires the environment setup information item from the management device **30**. For this reason, the in-vehicle device **10** does not need to store the information about the user using the vehicle **100** beforehand, and can provide the driving environment for a user who rides the vehicle **100** for the first time.

[0164] (2H) Because the management device **30** performs the overall management of the environment setup information item about two or more users in the present construction, the environment setup information item is efficiently manageable. Because the portable device **20** only has to store and transmit to the in-vehicle device **10** the user identification information instead of the environment setup information item, it is possible to reduce the amount of information to be stored to the storage unit **22** as well as the amount of information to be transmitted to the in-vehicle device **10**.

[0165] [2-4 Correspondence with Claims]

[0166] In the driving-environment setup system of the second embodiment, the camera **42** corresponds to feature detection means.

[0167] The control unit **11** of the in-vehicle device **10** which performs processing of Steps S**403**-S**407** in the vehicle environment setup processing (FIG. **7**) corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps **S409**-**S411** corresponds to driving-environment setup means.

[0168] The control unit **21** of the portable device **20** which performs processing of Steps S**501** and S**502** in the information-transmitting processing (FIG. **8**) corresponds to environmental information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps S**503** and S**504** corresponds to feature information transmitting means.

[0169] The management device **30** corresponds to a setup information management device, and the control unit **31** of the management device **30** which performs processing of Steps S**601**-S**603** in the information management processing (FIG. **9**) corresponds to setup information reply means.

3 Third Embodiment

[0170] Next, a driving-environment setup system according to a third embodiment is explained. The entire structure of the driving-environment setup system of the third embodiment will be explained, referring to FIG. **6** which illustrates the outline structure of the driving-environment setup system of the second embodiment.

[0171] [3-1 Entire Structure]

[0172] In comparison with the driving-environment setup system of the second embodiment, the driving-environment setup system of the third embodiment differs in that the management device **30** is operable to manage not only the environment setup information item about two or more users but also the facial feature information for each user.

[0173] That is, the facial feature information indicative of the facial feature point of a user possessing the portable device **20** concerned is not stored in the storage unit **22** of the portable device **20**.

[0174] On the other hand, the setting information database which registers, for two or more users, the environment setup information item indicative of the driving environment for each user and the facial feature information indicative of the facial feature point of each user are stored in the storage unit **32** of the management device **30**. In the setting information database, the environment setup information item and the facial feature information for each user are registered in association with the user identification information for each user, and it is possible to identify the environment setup information item and the facial feature information based on the user identification information.

[0175] Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the second embodiment, and further explanation on the similar or identical portion to the second embodiment is omitted by using the same symbols and numerals to the same elements.

[0176] [3-2 Processing Performed by a Driving-Environment Setup System]

[0177] Next, the processing performed by each of devices **10**, **20**, and **30** included in the driving-environment setup system of the third embodiment is explained.

[0178] [3-2-1 Processing Performed by an In-Vehicle Device]

[0179] First, the vehicle environment setup processing performed by the control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **10**. Compared with the vehicle environment setup processing (FIG. **7**) of the second embodiment, the vehicle environment setup processing of the third embodiment differs in performing processing of Steps S**704** and S**705** instead of processing of Steps S**404** and S**405**. In addition, contents of each processing of Steps S**701**-S**703**, and Steps S**706**-S**711** are respectively the same as contents of each processing of Steps S**401**-S**403**, and Steps S**406**-S**411**; therefore, the explanation about the contents of the processing thereof is omitted.

[0180] In Step S**704**, in order to acquire the facial feature information items of the users corresponding to the user identification information received from the portable devices **20**, the feature information-sending request is transmitted to the management device **30**, together with the user identification information and the vehicles identification information of the in-vehicle device **10** concerned. Here, the feature information-sending request is transmitted to request the management device **30** to send the facial feature information items. Consequently, the facial feature information items corresponding to the transmitted user identification information items are transmitted to the in-vehicle device **10** concerned from the management device **30** (Step S**906** in the information management processing (FIG. **12**) to be described later). The above facial feature information items corresponding to the transmitted user identification information items indicate the facial feature points of the users in the vehicle **100**.

[0181] Then, in Step S**705**, the facial feature information items transmitted by the management device **30** are received.

[0182] [3-2-2 Processing Performed by a Personal Identification Device]

[0183] The driver determination processing performed by a personal identification device **41** is the same as the driver determination processing (FIG. **3**) of the second embodiment; therefore, the explanation thereof is omitted.

[0184] [3-2-3 Processing Performed by a Portable Device]

[0185] Next, the information-transmitting processing performed by a control unit **21** of the portable device **20** is explained using a flow chart of FIG. **11**. Compared with the information-transmitting processing (FIG. **8**) of the second embodiment, the information-transmitting processing of the third embodiment differs in not performing processing of Step S**503** and Step S**504**. In addition, contents of each processing of Steps S**801** and S**802** are respectively the same as contents of each processing of Steps S**501** and S**502**; therefore, the explanation about the concrete contents of processing is omitted.

[0186] [3-2-4 Processing Performed by a Management Device]

[0187] Next, the information management processing performed by a control unit **31** of the management device **30** is explained using a flow chart of FIG. **12**. Compared with the information management processing (FIG. **9**) of the second embodiment, the present information management processing differs in performing processing of Steps S**904**-S**906**. In addition, contents of each processing of Steps S**901**-S**903** are respectively the same as contents of each processing of Steps S**601**-S**603**; therefore, the explanation about the contents of the processing thereof is omitted.

[0188] When it is determined that the setup information-sending request is not received in Step S**901**, the flow proceeds to Step S**904** to determine whether the feature information-sending request is received. The feature information-sending request is transmitted by the in-vehicle device **10**, together with the user identification information and the vehicles identification information, in Step S**704** in the vehicle environment setup processing (FIG. **10**) described above.

[0189] When it is determined in Step S**904** that the feature information-sending request is not received, the flow returns to Step S**901**.

[0190] When it is determined, on the other hand, that the feature information-sending request is received in Step S**904**, the flow proceeds to Step S**905**. Then, the control unit **31** reads the facial feature information, which is stored in the storage unit **32** in association with the received user identification information. Here, the facial feature information indicates the facial feature point of the user who rides the vehicle **100**.

[0191] Then, in Step S**906**, the facial feature information read in Step S**905** is transmitted to the in-vehicle device **10** which is the transmitting source of the user identification information, and control returns to Step S**901**. Here, the in-vehicle device **10** is identified based on the vehicles identification information received by the user identification information.

[0192] [3-3 Effect]

[0193] As explained above, according to the driving-environment setup system of the third embodiment, the following effects or advantages are achieved in addition to the same effects as in (1A)-(1F) of the first embodiment.

[0194] (3G) The in-vehicle device **10** acquires the facial feature information and the environment setup information item from the management device **30**. For this reason, the in-vehicle device **10** does not need to store the information about the user using the vehicle **100** beforehand, and can set up the driving environment for a user who rides the vehicle for the first time.

[0195] (3H) Because the management device **30** performs the overall management of the facial feature information and the environment setup information item about two or more users in the present construction, the facial feature information and the environment setup information item can be efficiently managed. Because the portable device **20** should just store and transmit to the in-vehicle device **10** the user identification information instead of the facial feature information and the environment setup information item, it is possible to reduce the amount of information to be stored to the storage unit **22** as well as the amount of information to be transmitted to the in-vehicle device **10**.

[0196] [3-4 Correspondence with Claims]

[0197] In the driving-environment setup system of the third embodiment, the camera **42** corresponds to feature detection means.

[0198] The control unit **11** of the in-vehicle device **10** which performs processing of Steps S**703**-S**707** in the vehicle environment setup processing (FIG. **10**) corresponds to driver identifying means. The control unit **11** of the in-vehicle device **10** which performs processing of Steps S**709**-S**711** corresponds to driving-environment setup means.

[0199] The control unit **21** of the portable device **20** which performs processing of Steps S**801** and S**802** in the information-transmitting processing (FIG. **11**) corresponds to environmental information transmitting means and feature information transmitting means.

[0200] The management device **30** corresponds to a setup information management device and a feature information management device. The control unit **31** of the management device **30** which performs processing of Steps S**901**-S**903** in the information management processing (FIG. **12**) corresponds to setup information reply means, and the control unit **31** of the management device **30** which performs processing of Steps S**904**-S**906** corresponds to feature information replying means.

4 Fourth Embodiment

[0201] Next, a driving-environment setup system of a fourth embodiment of the present invention is explained.

[0202] [4-1 Entire Structure]

[0203] FIG. **13** is a block diagram illustrating an outline structure of a driving-environment setup system according to the fourth embodiment.

[0204] In comparison with the driving-environment setup system (FIG. **1**) of the first embodiment, the driving-environment setup system of the fourth embodiment differs in that a display device **43** is mounted on a vehicle **100**. Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the first embodiment, and further explanation on the similar or identical portion to the first embodiment is omitted by using the same symbols and numerals to the same elements.

[0205] [4-1-1 Construction of an In-Vehicle Device]

[0206] In the driving-environment setup system of the fourth embodiment, a control unit **11** of the in-vehicle device **10** is coupled for capable of communicating with the display device **43** mounted in the vehicle **100**.

[0207] Here, the display device **43** is for displaying a variety of information items as images which a user who sits in the driver's seat of the vehicle **100** can recognize visually. In the present embodiment, a touch-sensitive liquid crystal display used for a navigation system etc. is employed to provide not only the display of an image but a function which enables the input of instruction by the external operation by the user.

[0208] [4-1-2 Construction of the Portable Device]

[0209] In comparison with the first embodiment, the driving-environment setup system of the fourth embodiment differs in that name information indicative of the name of a user possessing the portable device **20** concerned is stored in a storage unit **22** of the portable device **20**. That is, the storage unit **22** prestores user identification information, which is identification information unique to the user who possesses the portable device **20** concerned, facial feature information, which is indicative of a facial feature point of the user, environment setup information item, which is indicative of a driving environment for the user, and name information indicative of the user's name.

[0210] [4-2 Processing Performed by a Driving-Environment Setup System]

[0211] Next, the processing performed by the devices **10** and **20** which are included in the driving-environment setup system of the fourth embodiment is explained.

[0212] [4-2-1 Processing Performed by an In-Vehicle Device]

[0213] First, the vehicle environment setup processing performed by a control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **14**. Compared with the vehicle environment setup processing (FIG. **2**) of the first embodiment, the vehicle environment setup processing of the fourth embodiment differs in that processing of Step S**103** is not performed and processing of Steps S**1008**-S**1011** is performed instead. In addition, contents of each processing of Steps S**1001**-S**1007**, and Steps S**1012**-S**1014** are respectively the same as contents of each processing of Steps S**101** and S**102**, and Steps S**104**-S**111**; therefore, the explanation about the contents of the processing thereof is omitted.

[0214] When it is determined that the user identification information is received in Step S**1002**, the flow proceeds to Step S**1003**, regardless of whether a single piece or two or more pieces of the user identification information is received. That is, even when a single piece of the user identification information is received, a personal identification device **41** is made to perform the driver determination processing.

[0215] In Step S**1008**, it is determined whether there exists the facial feature information which is identified as belonging to the driver based on the determination result received in Step S**1006**. Namely, in the driving-environment setup system of the fourth embodiment, the personal identification device **41** sets up the identical determination condition used as a criterion in deciding or determining a facial feature point to be same as the driver's facial feature point indicated by the image taken with the camera **42**. The personal identification device **41** identifies one of the facial feature information items received from the in-vehicle device **10** as belonging to the driver when the one of the facial feature information items satisfies the above identical determination condition. Consequently, in such a case where the driver does not possess the portable device **20** but a passenger other than the driver possesses the portable device **20**, it may be determined that the facial feature information to be identified as belonging to the driver does not exist. On the contrary, when a user (for example, a twin brother) having a face that resembles with a face of the driver rides the vehicle **100**, plural pieces of the facial feature information or multiple facial feature information items may be identified as belonging to the driver. Thus, because the facial feature information identified as belonging to the driver is not necessarily a single piece, unlike the first embodiment, determination processing such as in Step S**1008** and in Step S**1009** to be described later is performed.

[0216] When it is determined that there exists no facial feature information which is identified as belonging to the driver in Step S**1008**, the present vehicle environment setup processing is terminated without further execution.

[0217] When it is determined, on the other hand, that there exists the facial feature information which is identified as belonging to the driver in Step S**1008**, the flow proceeds to Step S**1009** to determine whether there exist two or more pieces of the facial feature information identified as belonging to the driver. In other words, it is determined at step S**1009** whether there are multiple facial feature information items for the driver.

[0218] When it is determined that there exist two or more pieces of the facial feature information in Step S**1009**, the flow proceeds to Step S**1010**, and the names indicated by the name information corresponding to the identified facial feature information (users' names, each identified as the possible driver) are displayed on the display device **43**. Specifically, as illustrated in FIG. **15**, while displaying a list of the users' names, a message ("please select the driver") requesting the user of the vehicle **100** of the selection operation to select a driver's name out of the names in the displayed list. The name information corresponding to the facial feature information is received together with the facial feature information in Step S**1004**.

[0219] Then, in Step S**1011**, it is determined whether the selection operation (touch panel operation) to select the driver's name out of the names in the displayed list on the display device **43** is performed by the user.

[0220] When it is determined that the selection operation to select the driver's name is not performed by the user in Step S**1011**, the present vehicle environment setup processing is terminated without further execution. In the present embodiment, if the selection operation is not performed within a fixed time (for example, for one minute) after displaying the users' names on the display device **43**, it is determined that the selection operation is not performed by the user. Determination that the selection operation is not performed by the user is not limited to the lapse of fixed time. For example, the determination may be made when a parking brake is released, when the position of a shift lever is changed into D-range from P-range, or when the vehicle **100** begins to run etc.

[0221] On the other hand, when it is determined that the selection operation to select the driver's name is performed by the user in Step S**1011**, the user identification information which is received in Step S**1004** together with the facial feature information corresponding to the selected name is considered to belong to the driver. Then, the flow proceeds to Step S**1012**.

[0222] Also when it is determined that there exists not plural pieces of but a single piece of the facial feature information identified as belonging to the driver in Step S**1009**, the user identification information received in Step S**1004** together with the facial feature information is considered to belong to the driver. Then, the flow proceeds to Step S**1012** without performing processing of Steps S**1010** and S**1011**,

[0223] [4-2-2 Processing Performed by a Personal Identification Device]

[0224] Next, the driver determination processing performed by a personal identification device **41** is explained using a flow chart of FIG. **16**. Compared with the driver determination processing (FIG. **3**) of the first embodiment, the driver determination processing of the fourth embodiment differs in that processing of Step S**1102** is performed instead of processing Step S**202**. In addition, contents of each processing of Step S**1101**, Steps S**1103**-S**1105** are respectively the same as contents of each processing of Step S**201**, Steps S**203**-S**205**; therefore, the explanation about the contents of the processing thereof is omitted.

[0225] In Step S**1102**, by performing template matching for the facial feature information received from the in-vehicle device **10** with the image taken with the camera **42**, the facial feature information for the driver is identified among the received facial feature information item(s). In the present embodiment, as described above, the identical determination condition is set up so as to be used as a criterion in deciding a facial feature point to be same as the driver's facial feature point indicated by an image taken with the camera **42**. Then, one facial feature information item is identified or selected to correspond to the driver among the facial feature information items received from the in-vehicle device **10** when the one facial feature information item satisfies the identical determination condition. Consequently, as described above, there is a possibility that no facial feature information may exist which is identified as belonging to the driver, or two or more pieces of facial feature information may exist which is identified as belonging to the driver.

[0226] [4-2-3 Processing Performed by a Portable Device]

[0227] Next, the information-transmitting processing performed by a control unit **21** of the portable device **20** is explained using a flow chart of FIG. **17**. Compared with the information-transmitting processing (FIG. **4**) of the first embodiment, the information-transmitting processing of the fourth embodiment differs in that processing of Steps S**305** and S**306** is not performed, and that processing of Step S**1204** is performed instead of processing of Step S**304**. In addition, contents of each processing of Steps S**1201**-S**1203** are respectively the same as contents of each processing of Steps S**301**-S**303**; therefore, the explanation about the contents of the processing thereof is omitted.

[0228] In Step S**1204**, the facial feature information of the user possessing the portable device **20** concerned is transmitted to the in-vehicle device **10** as the requesting source, together with the user identification information and the name information, then the flow returns to Step S**1201**. That is, compared with Step S**304** in the information-transmitting processing of the first embodiment, Step S**1204** differs in that the name information is transmitted.

[0229] [4-3 Effect]

[0230] As explained above, according to the driving-environment setup system of the fourth embodiment, the following effects or advantages are achieved in addition to the same effect as in (1A)-(1D) and (1G) of the first embodiment.

[0231] (4E) The in-vehicle device **10** identifies as a driver a user possessing the facial feature point which is indicated by the facial feature information received from the portable device **20** and satisfies the identical determination condition set up based on the facial feature of the image of the driver taken with the camera **42**. For this reason, the in-vehicle device **10** identifies a user with a high possibility of being the driver based on the facial feature point, thereby preventing to identify as a driver a user whose facial feature point is greatly different.

[0232] (4F) Even when a single piece of the user identification information is received from the portable device **20**, the in-vehicle device **10** requests the portable device **20** of transmission of the facial feature information, and performs authentication based on the facial feature point. For this reason, when the driver does not possess the portable device **20** but a passenger other than the driver possesses the portable device **20** for example, it is possible to prevent to bring about a case where the driving environment is wrongly set for the passenger.

[0233] (4H) When there exist two or more users who satisfy the identical determination condition, the in-vehicle device **10** displays each user's name, and requests the user to select one. For this reason, even when determining by the facial feature point is difficult, it is possible to surely set the driving environment of vehicle **100** as the driving environment for the driver, at a cost of very easy selection operation.

[0234] [4-4 Correspondence with Claims]

[0235] In the driving-environment setup system of the fourth embodiment, the camera **42** corresponds to feature detection means.

[0236] The control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1003**-S**1006** and Steps S**1008**-S**1011** in the vehicle environment setup processing (FIG. **14**) corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1012**-S**1014** corresponds to driving-environment setup means.

[0237] The control unit **21** of the portable device **20** which performs processing of Steps S**1201** and S**1202** in the information-transmitting processing (FIG. **17**) corresponds to environmental information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps S**1203** and S**1204** corresponds to feature information transmitting means.

5 Fifth Embodiment

[0238] Next, a driving-environment setup system according to a fifth embodiment is explained. The entire structure of the driving-environment setup system of the fifth embodiment will be explained, referring to FIG. **13** which illustrates the outline structure of the driving-environment setup system of the fourth embodiment.

[0239] [5-1 Entire Structure]

[0240] In comparison with the driving-environment setup system of the fourth embodiment, the driving-environment setup system of the fifth embodiment differs in the processing performed when there exist two or more pieces of the facial feature information identified as belonging to the driver by the personal identification device **41**. Specifically, before performing processing to display each name of the users identified as the driver, determination is performed whether the environment setup information item for each of the two or more users identified as the driver is the same, or similar to each other, or shares an identical part in common to each other, and the subsequent processing is performed according to the determination result. Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the fourth embodiment, and further explanation on the similar or identical portion to the fourth embodiment is omitted by using the same symbols and numerals to the same elements.

[0241] [5-2 Processing Performed by a Driving-Environment Setup System]

[0242] Next, the processing performed by each of devices **10** and **20** which are included in the driving-environment setup system according to the fifth embodiment is explained.

[0243] [5-2-1 Processing Performed by an In-Vehicle Device]

[0244] First, a vehicle environment setup processing performed by the control unit **11** of the in-vehicle device **10** is explained using a flow chart in FIGS. **18**A and **18**B. Compared with the vehicle environment setup processing (FIG. **14**) of the fourth embodiment, in the vehicle environment setup processing of the fifth embodiment, contents of each processing of Steps S**1301**-S**1312** are respectively the same as contents of each processing of Steps S**1001**-S**1009** and Steps S**1012**-S**1014**, but processing is different if it is determined at S**1309** that there exist two or more pieces of facial feature information identified as belonging to the driver.

[0245] In Step S**1309**, when it is determined that there exist two or more pieces of facial feature information identified as belonging to the driver, the flow proceeds to Step S**1313**.

[0246] In Step S**1313**, in order to acquire, from the portable device **20**, the environment setup information item corresponding to the identified facial feature information, the setup information-sending request is transmitted to the portable device **20** which is a transmitting source of the each identified facial feature information. In other words, at S**1313**, the control unit **11** requests each of the portable devices **20** of the possible driver to transmit the environment setup information for each associated user identified as the possible driver. Consequently, the environment setup information items stored in the portable device **20** (environment setup information item for each user identified as the driver) are transmitted to the in-vehicle device **10**.

[0247] In Step S**1314**, the environment setup information items transmitted by the portable device **20** are received.

[0248] In Step S**1315**, it is determined whether the contents of the environment setup information items received in Step S**1314** are identical with each other. That is, it is determined whether the driving environment for each of users identified as the driver has the same conditions with each other.

[0249] In Step S**1315**, when it is determined that the contents of the environment setup information items are the same, it is considered that any one of the environment setup information items corresponds to the driver, and the flow proceeds to Step S**1312**. As a result, the driving environment of the vehicle **100** is set as the driving environment indicated by the environment setup information item (the driving environment for the driver).

[0250] On the other hand, in Step S**1315**, when it is determined that the contents of the environment setup information items are not the same with each other, the flow proceeds to Step S**1316** to determine whether the contents of the environment setup information items (driving environment) are similar to each other. Specifically, the similarity range is set up for use as a criterion in deciding the similar driving environment, then, it is determined that the environment setup information items are similar to each other when the environment setup information items fall in the similarity range.

[0251] When it is determined, in Step S**1316**, that the contents of the environment setup information items are similar, the flow proceeds to Step S**1317**. After one of the multiple environment setup information items determined to be similar to each other is transmitted to the various control units **51**-**59**, the flow proceeds to Step S**1320**. As a result, the driving environment of the vehicle **100** is set as the driving environment for one of the users among the multiple users identified as the driver.

[0252] When it is determined, on the other hand, in Step S**1316**, that the contents of the environment setup information items are not similar, the flow proceeds to Step S**1318** to determine whether the contents of the environment setup information items are partially matching with each other. In other words, it is determined at S**1318** whether the environment setup information items for the driver mutually have an identical part with each other. For example, when only the driving environment (seat position), which is set by the seat position controller **51** among the various control units **51**-**59**, is the identical part shared by the environment setup information items, it is determined that the contents of the environment setup information item are partially matching with each other.

[0253] In Step S**1318**, when it is determined that the contents of the environment setup information item are partially matching with each other, the flow proceeds to Step S**1319**. After transmitting, to the various control units **51**-**59**, only the identical portion shared among the environment setup information item, the flow proceeds to Step S**1320**. As a result, only the identical portion which is common among the driving environment for each of users identified as the driver is set up.

[0254] In Step S**1320**, it is determined whether the driving environment is adjusted by the external operation of the driver who rides the vehicle **100**.

[0255] When it is determined that the driving environment has been adjusted in Step S**1320**, the flow proceeds to Step S**1321**. Based on the adjusted driving environment, the environment setup information item for the driver is estimated out of the environment setup information item of each of the users identified as the driver in Step S**1321**. Then, the flow proceeds to Step S**1312**. Namely, because adjustment of the driving environment by the user is operation for correcting the driving environment of the vehicle **100** to the driving environment for the user, it becomes possible to estimate the environment setup information item for the driver with the help of the adjusted driving environment as a clue. Consequently, the driving environment of the vehicle **100** is set (corrected) as the driving environment for the driver by processing in Step S**1312**.

[0256] On the other hand, when it is determined that the driving environment is not adjusted in Step S**1320**, the present vehicle environment setup processing is terminated without further execution. In the present embodiment, when no external operation to adjust the driving environment is performed within a fixed time (for example, for one minute), it is determined that the driving environment is not adjusted.

[0257] When it is determined in Step S**1318** that the contents of the environment setup information items are not matching with each other even partially, the flow proceeds to Step S**1322**, and the name indicated by the name information corresponding to the identified facial feature information (name of each user identified as the driver) is displayed on the display device **43**.

[0258] Then, in Step S**1323**, it is determined whether the user has performed operation (touch panel operation) to select the driver's name from the names listed on the display device **43**.

[0259] When it is determined that the user has not performed operation to select the driver's name in Step S**1323**, the present vehicle environment setup processing is terminated without further execution. In the present embodiment, when selection operation is not performed within a fixed time (for example, for one minute) after displaying the user's name on the display device **43**, it is determined that the selection operation has not been performed by the user.

[0260] On the other hand, in Step S**1323**, when it is determined that the user has performed operation to select the driver's name, it is considered that the environment setup information item corresponding to the selected name belongs to the driver, and the flow proceeds to Step S**1312**. As a result, the driving environment of the vehicle **100** is set as the driving environment indicated by the environment setup information item (the driving environment for the driver).

[0261] [5-2-2 Processing Performed by a Personal Identification Device]

[0262] Because the driver determination processing performed by the personal identification device **41** is the same as the driver determination processing (FIG. **16**) of the fourth embodiment, the explanation thereof is omitted.

[0263] [5-2-3 Processing Performed by a Portable Device]

[0264] Because the information-transmitting processing performed by the control unit **21** of the portable device **20** is also the same as the information-transmitting processing (FIG. **17**) of the fourth embodiment, the explanation thereof is omitted.

[0265] [5-3 Effect]

[0266] As explained above, according to the driving-environment setup system of the fifth embodiment, the following effects or advantages are obtained in addition to the same effect as in the fourth embodiment.

[0267] (5I) Even when there exist two or more users who satisfy the identical determination condition, if the driving environment for each user is identical or similar, the in-vehicle device **10** identifies one of the users as the driver, and sets the driving environment of the vehicle **100** as the driving environment for the identified user. For this reason, the driving environment of the vehicle **100** can be set as, or similar to, the driving environment for the driver, without requesting the user to perform the selection operation.

[0268] (5J) Even when there exist two or more users who satisfy the identical determination condition, if there is a portion which is mutually common in the driving environment for each user, the in-vehicle device **10** sets up the driving environment of the vehicle **100** for the common portion, regardless of the external operation. For this reason, a part of the driving environment of the vehicle **100** can be set as the driving environment for the driver, without requesting the user to perform the selection operation.

[0269] (5K) When the driving environment is adjusted through the external operation by the driver who rides the vehicle **100**, the in-vehicle device **10** estimates, based on the adjusted driving environment, the driving environment for the driver out of the driving environments of the users, each identified as the driver. For this reason, the driving environment can be set up, without requesting the driver to make all the adjustments.

[0270] [5-4 Correspondence with Claims]

[0271] In the driving-environment setup system of the fifth embodiment, the camera **42** corresponds to feature detection means.

[0272] The control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1303**-S**1306**, Steps S**1308** and S**1309**, and Steps S**1313**-S**1323** in the vehicle environment setup processing (FIGS. **18**A and **18**B) corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1310**-S**1312** corresponds to driving-environment setup means.

[0273] The control unit **21** of the portable device **20** which performs processing of Steps S**1201** and S**1202** in the information-transmitting processing (FIG. **17**) corresponds to environmental information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps S**1203** and S**1204** corresponds to feature information transmitting means.

6 Sixth Embodiment

[0274] Next, a driving-environment setup system according to a sixth embodiment is explained. The entire structure of the driving-environment setup system of the sixth embodiment will be explained, referring to FIG. **1** which illustrates the outline structure of the driving-environment setup system of the first embodiment.

[0275] [6-1 Entire Structure]

[0276] In comparison with the driving-environment setup system of the first embodiment, a driving-environment setup system of the sixth embodiment differs in that an in-vehicle device **10** sets a driving environment of a vehicle **100** as a driving environment for a user predicted to be a driver before the driver rides the vehicle **100**. Specifically, a communication unit **13** of an in-vehicle device **10** is operable to perform a short distance radio communication between a portable device **20** existing in the communications area which includes the interior of a room of the vehicle **100** in which the in-vehicle device **10** concerned is mounted, and the exterior of the vehicle **100** (the circumference of the vehicle **100**). Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the first embodiment, and further explanation on the similar or identical portion to the first embodiment is omitted by using the same symbols and numerals to the same elements.

[0277] [6-2 Processing Performed by a Driving-Environment Setup System]

[0278] Next, the processing performed by each of devices **10** and **20** which are included in the driving-environment setup system of the sixth embodiment is explained.

[0279] [6-2-1 Processing Performed by an In-Vehicle Device]

[0280] First, the vehicle environment setup processing performed by the control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **19**. Compared with the vehicle environment setup processing (FIG. **2**) of the first embodiment, the vehicle environment setup processing of the sixth embodiment differs in that processing of Steps S**1401**-S**1408** and processing of Step S**1414** are performed instead of processing of Steps S**101**-S**103**. In addition, contents of each processing of Steps S**1409**-S**1413**, and Steps S**1415**-S**1417** are respectively the same as contents of each processing of Steps S**104**-S**111**; therefore, the explanation of the contents of the processing thereof is omitted.

[0281] The vehicle environment setup processing of the sixth embodiment is started in the state where the user is not riding the vehicle **100**. Specifically, for example, it is started when the engine of the vehicle **100** is stopped and when the portable device **20** has not been detected in the communications area for a predetermined time.

[0282] When the vehicle environment setup processing is started, first in Step S**1401**, the control unit **11** transmits the identification information-sending request to the portable device **20** by the short distance radio communication, in order to detect a user who is about to ride the vehicle **100** or a user who exists in the exterior of (in the areas surrounding) the vehicle **100**. Consequently, when the portable device **20** exists in the areas surrounding the vehicle **100** or when the user is about to get in the vehicle **100** exists, the user identification information stored in the portable device **20** is transmitted to the in-vehicle device **10**. This corresponds to Step S**302** in the information-transmitting processing (FIG. **4**) described above. That is, by receiving the user identification information transmitted by the portable device **20** in response to the identification information-sending request, the portable device **20** which exists in the communications area can be detected. In other words, the user in the communications area can be detected. The transmission of the identification information-sending request in Step S**1401** is performed at an interval longer than a fixed time (for example, several seconds) from the last transmission. That is, the identification information-sending request is made to be transmitted periodically.

[0283] Then, in Step S**1402**, it is determined whether the user identification information is received.

[0284] When it is determined that the user identification information is received in Step S**1402** (that is, when the portable device **20** is detected in the areas surrounding the vehicle **100**, or when the user is about to ride the vehicle **100** is detected), the flow proceeds to Step S**1403**. After the start of the present vehicle environment setup processing, if the user identification information received is the same as the user identification information which has already been received, it is determined in Step S**1402** that the user identification information is not received. That is, in Step S**1402**, it is designed so as to determine whether a new portable device **20** (a new user) is detected.

[0285] In Step S**1403**, it is determined whether the reception of the user identification information in Step S**1402** is the first reception after the start of the present vehicle environment setup processing. In other words, it is determined at S**1403** whether the user identification information received at S**1402** corresponds to a first user who is about to ride the vehicle **100**.

[0286] When it is determined that the reception is the first reception in Step S**1403**, the flow proceeds to Step S**1404**.

[0287] In Step S**1404**, in order to identify the driving environment for the user of the user identification information received or for the first user who is going to ride the vehicle **100**, the setup information-sending request is transmitted to the portable device **20** which is a transmitting source of the above user identification information. Consequently, the environment setup information item stored in the portable device **20** is transmitted to the in-vehicle device **10** from the portable device **20**. This corresponds to Step S**306** in the information-transmitting processing (FIG. **4**) described above.

[0288] In Step S**1405**, the environment setup information item transmitted by the portable device **20** is received.

[0289] In Step S**1406**, the environment setup information item received in Step S**1405** is transmitted to various control units **51**-**59**, and the flow proceeds to Step S**1407**. Consequently, the driving environment of the vehicle **100** is set as the driving environment for the user who is going to ride the vehicle **10** first.

[0290] On the other hand, also when it is determined in Step S**1402** that the user identification information is not received in response to the transmission of the identification information-sending request in Step S**1401** (that is, when the portable device **20** does not exist in the communications area), the flow proceeds to Step S**1407**.

[0291] Also when it is determined in Step S**1403** that the reception is not the first reception, the flow proceeds to Step S**1407**.

[0292] In Step S**1407**, it is determined whether the user has sat or seated in the driver's seat of the vehicle **100** (that is, whether the driver has been seated or not). It is possible to perform the determination of whether the driver has sat down, for example, based on a detection value of a seat sensor provided in the driver's seat.

[0293] When it is determined in Step S**1407** that the driver has not sat down, the flow returns to Step S**1401**. That is, processing of Steps S**1401**-S**1406** is repeated until the driver sits down.

[0294] On the other hand, when it is determined in Step S**1407** that the driver has sat down, the flow proceeds to Step S**1408**.

[0295] In Step S**1408**, it is determined whether two or more pieces of the user identification information are received after the start of the present vehicle environment setup processing. That is, it is determined whether multiple users, each of whom possesses the portable device **20**, have ridden in the vehicle **100**.

[0296] When it is determined that the multiple user identification information items are not received in Step S**1408**, the present vehicle environment setup processing is terminated without further execution. That is, when the single user identification information item is received, the driving environment is already set as the driving environment based on the above single user identification information item and it is not necessary to change the driving environment, then, the processing is terminated without further execution. Also when the user identification information is not received (when the user who rides in the vehicle **100** does not possess the portable device **20**), the present vehicle environment setup processing is terminated.

[0297] On the other hand, when it is determined in Step S**1408** that the multiple user identification information items are received (two or more users have ridden in the vehicle **100**, each possessing the portable device **20**), the flow proceeds to Step S**1409**.

[0298] In Step S**1414**, it is determined whether the environment setup information item has already been received from the portable device **20** in Step S**1405**. In this case, the portable device **20** is the transmitting source of the facial feature information which is identified as belonging to the driver, as the determination result of the driver determination processing directed to the personal identification device **41** in Step S**1411**. That is, it is intended to determine whether the driving environment, which has been set up before the driver rides the vehicle **100**, belongs to the driver or not.

[0299] When it is determined that the environment setup information item is already received in Step S**1414**, the present vehicle environment setup processing is terminated without further execution, because the driving environment is already set as the driving environment for the driver.

[0300] On the other hand, when it is determined that the environment setup information item is not received yet in Step S**1414**, (when the driving environment for a passenger other than the driver is set up), the processing of Steps S**1415**-S**1417** is performed in order to reset the current driving environment to the driving environment for the driver, then the present vehicle environment setup processing is terminated.

[0301] [6-2-2 Processing Performed by a Personal Identification Device]

[0302] Because the driver determination processing performed by the personal identification device **41** is the same as the driver determination processing (FIG. **3**) of the first embodiment, the explanation thereof is omitted.

[0303] [6-2-3 Processing Performed by a Portable Device]

[0304] Because the information-transmitting processing performed by portable device **20** is also the same as the information-transmitting processing (FIG. **4**) of the first embodiment, the explanation thereof is omitted.

[0305] [6-3 Effect]

[0306] As explained above, according to the driving-environment setup system of the sixth embodiment, the following effects or advantages are obtained in addition to the same effect as in (1A)-(1C) and (1E)-(1G) of the first embodiment.

[0307] (6L) The in-vehicle device **10** sets the driving environment of the vehicle **100** as the driving environment for the user, before the driver rides the vehicle **100**, based on the environment setup information item acquired from the portable device **20** which is possessed by the user before riding the vehicle **100**. In this way, by performing temporary setting of the driving environment before the driver rides the vehicle **100**, if the driving environment temporarily set is for the driver, it is possible to set the driving environment as the driving environment for the driver before the driver rides the vehicle **100**.

[0308] (6M) The in-vehicle device **10** sets the driving environment as the driving environment for user who is going to ride the vehicle **100** first as temporary setting of the driving environment. For this reason, the driving environment can be set up in the earliest stage. Because the user who is going to ride the vehicle **100** first has a high possibility of being the driver, it is possible to increase the possibility that the driving environment which is set temporarily is for the driver.

[0309] [6-4 Correspondence with Claims]

[0310] In the driving-environment setup system of the sixth embodiment, the camera **42** corresponds to feature detection means.

[0311] The control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1401**-S**1407** in the vehicle environment setup processing (FIG. **19**) corresponds to driving-environment temporary setup means, the control unit **11** of the in-vehicle device **10** which performs processing of Steps **S1408**-**S1412** corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1415**-S**1417** corresponds to driving-environment setup means.

[0312] The control unit **21** of the portable device **20** which performs processing of Steps S**303** and S**304** in the information-transmitting processing (FIG. **4**) corresponds to feature information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps S**305** and S**306** corresponds to environmental information transmitting means.

7 Seventh Embodiment

[0313] Next, a driving-environment setup system of a seventh embodiment is explained. The entire structure of the driving-environment setup system of the seventh embodiment will be explained, referring to FIG. **1** which illustrates the outline structure of the driving-environment setup system of the first embodiment.

[0314] [7-1 Entire Structure]

[0315] In comparison with the driving-environment setup system of the sixth embodiment, the driving-environment setup system of the seventh embodiment differs in the conditions to predict that a user who is detected around a vehicle **100** before a driver rides the vehicle **100** is supposed to be the driver. Specifically, compared with the sixth embodiment in which a first user who is going to ride in the vehicle **100** is predicted to be the driver, in the seventh embodiment, a user who is registered beforehand or in advance is predicted to be the driver. Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the sixth embodiment, and further explanation on the similar or identical portion to the sixth embodiment is omitted by using the same symbols and numerals to the same elements.

[0316] [7-2 Processing Performed by a Driving-Environment Setup System]

[0317] Next, the processing performed by each of devices **10** and **20** which are included in the driving-environment setup system of the seventh embodiment is explained.

[0318] [7-2-1 Processing Performed by an In-Vehicle Device]

[0319] First, a vehicle environment setup processing performed by a control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **20**. Compared with the vehicle environment setup processing (FIG. **19**) of the sixth embodiment, the vehicle environment setup processing of the seventh embodiment differs only in that the processing of Step S**1503** is performed instead of the processing of Step S**1403**. In addition, contents of each processing of Steps S**1501** and S**1502**, and Steps S**1504**-S**1517** are respectively the same as contents of each processing of Steps S**1401** and S**1402** and Steps S**1404**-S**1417**; therefore, the explanation about the contents of the processing thereof is omitted.

[0320] In Step S**1503**, it is determined whether the user identification information received in Step S**1502** is user identification information registered in advance in the in-vehicle device **10**. For example, the user who has the registered user identification information is an owner of the vehicle **100** in the present embodiment.

[0321] When it is determined that the received user identification information is the user identification information registered in advance, the flow proceeds to Step S**1504**, and when it is determined that the received user identification information is not the user identification information registered in advance, the flow proceeds to Step S**1507**.

[0322] In this way, when a user who is the owner of the vehicle **100** is detected before the driver rides the vehicle **100**, the driving environment of the vehicle **100** is set up as the driving environment for the user.

[0323] [7-2-2 Processing Performed by a Personal Identification Device]

[0324] Because the driver determination processing performed by a personal identification device **41** is the same as the driver determination processing (FIG. **3**) of the sixth embodiment, the explanation thereof is omitted.

[0325] [7-2-3 Processing Performed by a Portable Device]

[0326] Because the information-transmitting processing performed by the portable device **20** is also the same as the information-transmitting processing (FIG. **4**) of the sixth embodiment, the explanation thereof is omitted.

[0327] [7-3 Effect]

[0328] As explained above, according to the driving-environment setup system of the seventh embodiment, the following effects or advantages are obtained in addition to the same effect as in the sixth embodiment (except (6M)).

[0329] (7M) The in-vehicle device **10** sets the driving environment as the driving environment for a user registered in advance, as temporary setting of the driving environment. For this reason, by registering in advance a user who has a high possibility of driving the vehicle **100** (for example, the owner of the vehicle **100**), it is possible to increase possibility that the driving environment is set temporarily to the driving environment for the driver.

[0330] [7-4 Correspondence with Claims]

[0331] In the driving-environment setup system of the seventh embodiment, the camera **42** corresponds to feature detection means.

[0332] The control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1501**-S**1507** in the vehicle environment setup processing (FIG. **20**) corresponds to driving-environment temporary setup means, the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1508**-S**1512** corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1515**-S**1517** corresponds to driving-environment setup means.

[0333] The control unit **21** of the portable device **20** which performs processing of Steps S**303** and S**304** in the information-transmitting processing (FIG. **4**) corresponds to feature information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps S**305** and S**306** corresponds to environmental information transmitting means.

8 Eighth Embodiment

[0334] Next, a driving-environment setup system according to an eighth embodiment is explained. The entire structure of the driving-environment setup system of the eighth embodiment will be explained, referring to FIG. **1** which illustrates the outline structure of the driving-environment setup system of the first embodiment.

[0335] [8-1 Entire Structure]

[0336] In comparison with the driving-environment setup system of the sixth embodiment, the driving-environment setup system of the eighth embodiment differs in conditions for predicting that a user who is detected around a vehicle **100** before a driver rides the vehicle **100** is supposed to be the driver. Specifically, compared with the sixth embodiment in which a user who is going to ride in the vehicle **100** first is predicted to be the driver, in the eighth embodiment, a user who is detected first by the side of the driver's seat is predicted to be the driver. That is, in the driving-environment setup system of the eighth embodiment, a communication unit **13** of the in-vehicle device **10** is operable to detect a portable device **20** which exists in the exterior of the vehicle **100**, by distinguishing the exterior on the driver's side from the exterior on the passenger's side. Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the sixth embodiment, and further explanation on the similar or identical portion to the sixth embodiment is omitted by using the same symbols and numerals to the same elements.

[0337] [8-2 Processing Performed by a Driving-Environment Setup System]

[0338] Next, the processing performed by each of devices **10** and **20** which are included in the driving-environment setup system of the eighth embodiment is explained.

[0339] [8-2-1 Processing Performed by an In-Vehicle Device]

[0340] First, a vehicle environment setup processing performed by a control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **21**. Compared with the vehicle environment setup processing (FIG. **19**) of the sixth embodiment, the vehicle environment setup processing of the eighth embodiment differs only in that the processing of Step S**1603** is performed instead of the processing of Step S**1403**. In addition, contents of each processing of Steps S**1601** and S**1602**, and Steps S**1604**-S**1617** are respectively the same as contents of each processing of Steps S**1401** and S**1402** and Steps S**1404**-S**1417**; therefore, the explanation about the contents of the processing thereof is omitted.

[0341] In Step S**1603**, it is determined whether reception of the user identification information in Step S**1602** is the first reception on the driver's side after the start of the present vehicle environment setup processing. In other words, it is determined whether the reception of the user identification information in Step S**1602** corresponds to the first user who is going to ride in the vehicle **100** through the door on the side the vehicle for the driver's seat.

[0342] When it is determined that the reception is the first reception by the driver's side in Step S**1603**, the flow proceeds to Step S**1604**, and when it is determined that the reception is not the first reception by the driver's side, the flow proceeds to Step S**1607**.

[0343] In this way, the driving environment of the vehicle **100** is set as the driving environment for user first detected by the driver's side before the driver rides the vehicle **100**.

[0344] [8-2-2 Processing Performed by a Personal Identification Device]

[0345] Because the driver determination processing performed by a personal identification device **41** is the same as the driver determination processing (FIG. **3**) of the sixth embodiment, the explanation thereof is omitted.

[0346] [8-2-3 Processing Performed by a Portable Device]

[0347] Because the information-transmitting processing performed by the portable device **20** is also the same as the information-transmitting processing (FIG. **4**) of the sixth embodiment, the explanation thereof is omitted.

[0348] [8-3 Effect]

[0349] As explained above, according to the driving-environment setup system of the eighth embodiment, the following effects or advantages are obtained in addition to the same effect as in the sixth embodiment (except (6M)).

[0350] (8M) The in-vehicle device **10** sets the driving environment as the driving environment for a user first detected by the driver's side, as temporary setting of the driving environment. For this reason, it is possible to further increase the possibility that the driving environment is temporarily set as the driving environment for the driver.

[0351] [8-4 Correspondence with Claims]

[0352] In the driving-environment setup system of the eighth embodiment, the camera **42** corresponds to feature detection means.

[0353] The control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1601**-S**1607** in the vehicle environment setup processing (FIG. **21**) corresponds to driving-environment temporary setup means, the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1608**-S**1612** corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1615**-S**1617** corresponds to driving-environment setup means.

[0354] The control unit **21** of the portable device **20** which performs processing of Steps S**303** and S**304** in the information-transmitting processing (FIG. **4**) corresponds to feature information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps S**305** and S**306** corresponds to environmental information transmitting means.

9 Ninth Embodiment

[0355] Next, a driving-environment setup system of a ninth embodiment is explained. The entire structure of the driving-environment setup system of the ninth embodiment will be explained, referring to FIG. **1** which illustrates the outline structure of the driving-environment setup system of the first embodiment.

[0356] [9-1 Entire Structure]

[0357] In comparison with the driving-environment setup system of the first embodiment, the driving-environment setup system of ninth embodiment differs in that a storage unit **22** of a portable device **20** does not store the environment setup information item indicative of the driving environment for the associated user who possesses the portable device **20**. However, the storage unit **12** of the in-vehicle device **10** stores the environment setup information items for two or more associated users of the multiple portable devices **20**.

[0358] That is, the setup information database which registers the environment setup information item indicative of the driving environment for each of two or more users is stored in the storage unit **12** of the in-vehicle device **10**. In the setup information database, the environment setup information item for each user is registered in association with the user identification information of the user, and it is possible to identify the environment setup information item based on the user identification information.

[0359] The environment setup information item is registered in the setup information database by a predetermined procedure. In the present embodiment, in the vehicle **100**, the driving environment for the user is set up by the external operation by the user, and registration operation of the environment setup information item is subsequently performed in the portable device **20**, and the portable device **20** transmits the registration directions of the environment setup information item to the in-vehicle device **10** together with the user identification information stored in the storage unit **22**. Then, upon receiving the registration directions, the in-vehicle device **10** registers, in the setup information database of the storage unit **12**, the environment setup information item indicative of the current driving environment of the vehicle **100** and the user identification information received from the portable device **20**. Here, the current driving environment has been set up by the user through the external operation by the time of the above procedure. The in-vehicle device **10** registers the environment setup information item and the user identification information in association with each other.

[0360] Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the first embodiment, and further explanation on the similar or identical portion to the first embodiment is omitted by using the same symbols and numerals to the same elements.

[0361] [9-2 Processing Performed by a Driving-Environment Setup System]

[0362] Next, the processing performed by each of devices **10** and **20** which are included in the driving-environment setup system of the ninth embodiment is explained.

[0363] [9-2-1 Processing Performed by an In-Vehicle Device]

[0364] First, a vehicle environment setup processing performed by a control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **22**. Compared with the vehicle environment setup processing (FIG. **2**) of the first embodiment, the vehicle environment setup processing of the ninth embodiment differs in that the processing of Step S**1709** is performed instead of the processing of Steps S**109** and S**110**. In addition, contents of each processing of Steps S**1701**-S**1708** and Step S**1710** are respectively the same as contents of each processing of Steps S**101**-S**108** and Step S**111**; therefore, the explanation about the contents of the processing thereof is omitted.

[0365] In Step S**1709**, in order to identify the driving environment for the driver, the environment setup information item corresponding to the user identification information of the driver is acquired from the storage unit **12**. Here, the environment setup information item indicates the driving environment for the driver. That is, the present embodiment differs from the first embodiment in that the environment setup information item is acquired not from the portable device **20**, but from own storage unit **12**.

[0366] [9-2-2 Processing Performed by a Personal Identification Device]

[0367] Because the driver determination processing performed by a personal identification device **41** is the same as the driver determination processing (FIG. **3**) of the first embodiment, the explanation thereof is omitted.

[0368] [9-2-3 Processing Performed by a Portable Device]

[0369] The information-transmitting processing performed by the control unit **21** of the portable device **20** is different from the information-transmitting processing (FIG. **4**) of the first embodiment, but the same as the information-transmitting processing (FIG. **8**) of the second embodiment; therefore, the explanation thereof is omitted.

[0370] [9-3 Effect]

[0371] As explained above, according to the driving-environment setup system of the ninth embodiment, the following effects or advantages are obtained in addition to the same effect as in (1A)-(1F) of the first embodiment.

[0372] (9H) Because the portable device **20** only has to store and transmit to the in-vehicle device **10** the user identification information instead of the environment setup information item, it is possible to reduce the amount of information to be stored in the storage unit **22** and the amount of information to be transmitted to the in-vehicle device **10**.

[0373] [9-4 Correspondence with Claims]

[0374] In the driving-environment setup system of the ninth embodiment, the camera **42** corresponds to feature detection means.

[0375] The storage unit **12** of the in-vehicle device **10** corresponds to a setup information storage means, the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1703**-S**1707** in the vehicle environment setup processing (FIG. **22**) corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1709** and S**1710** corresponds to driving-environment setup means.

[0376] The control unit **21** of the portable device **20** which performs processing of Steps S**303** and S**304** in the information-transmitting processing (FIG. **4**) corresponds to feature information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps S**305** and S**306** corresponds to environmental information transmitting means.

10 Tenth Embodiment

[0377] Next, a driving-environment setup system of a tenth embodiment of the present invention is explained. The entire structure of the driving-environment setup system of the tenth embodiment will be explained, referring to FIG. **1** which illustrates the outline structure of the driving-environment setup system of the first embodiment.

[0378] [10-1 Entire Structure]

[0379] In comparison with the driving-environment setup system of the ninth embodiment, the driving-environment setup system of the tenth embodiment differs in that the storage unit **12** of the in-vehicle device **10** stores not only the environment setup information items for two or more users but also the facial feature information items for the users.

[0380] That is, the storage unit **22** of the portable device **20** doe not store the facial feature information indicative of the facial feature point of the associated user who possesses the portable device **20**.

[0381] On the other hand, the storage unit **12** of the in-vehicle device **10** stores the setup information database for two or more users is stored, which registers the environment setup information item indicative of the driving environment for each user and the facial feature information indicative of the facial feature point of each user. In the present setup information database, the environment setup information item and the facial feature information for each user are registered in association with the user identification information for the user, and it is possible to identify the environment setup information item and the facial feature information based on the user identification information.

[0382] Hereinafter, explanation is given focusing on the portion which is different from the driving-environment setup system of the ninth embodiment, and further explanation on the similar or identical portion is omitted by using the same symbols and numerals to the same elements.

[0383] [10-2 Processing Performed by a Driving-Environment Setup System]

[0384] Next, the processing performed by each of devices **10** and **20** which are included in the driving-environment setup system of the tenth embodiment is explained.

[0385] [10-2-1 Processing Performed by an In-Vehicle Device]

[0386] First, a vehicle environment setup processing performed by a control unit **11** of the in-vehicle device **10** is explained using a flow chart of FIG. **23**. Compared with the vehicle environment setup processing (FIG. **22**) of the ninth embodiment, the vehicle environment setup processing of the tenth embodiment differs in that the processing of Step S**1804** is performed instead of the processing of Steps S**1704** and S**1705**. In addition, contents of each processing of Steps S**1801**-S**1803** and Steps S**1805**-S**1809** are respectively the same as contents of each processing of Steps S**1701**-S**1703** and Steps S**1706**-S**1710**; therefore, the explanation about the contents of the processing thereof is omitted.

[0387] In Step S**1804**, the facial feature information corresponding to the user identification information received from the portable device **20** (the facial feature information of the user who rides in the vehicle **100**) is acquired from the storage unit **12**. That is, the present embodiment differs from the ninth embodiment in that the facial feature information is acquired not from the portable device **20**, but from own storage unit **12**.

[0388] [10-2-2 Processing Performed by a Personal Identification Device]

[0389] Because the driver determination processing performed by a personal identification device **41** is the same as the driver determination processing (FIG. **3**) of the ninth embodiment, the explanation thereof is omitted.

[0390] [10-2-3 Processing Performed by a Portable Device]

[0391] The information-transmitting processing performed by the control unit **21** of the portable device **20** is different from the information-transmitting processing (FIG. **8**) of the ninth embodiment, but the same as the information-transmitting processing (FIG. **11**) of the third embodiment; therefore, the explanation thereof is omitted.

[0392] [10-3 Effect]

[0393] As explained above, according to the driving-environment setup system of the tenth embodiment, in addition to the same effects as in (1A)-(1F) of the first embodiment, the following effects or advantages are obtained.

[0394] (10H) Because the portable device **20** should just store and transmit to the in-vehicle device **10** the user identification information instead of the facial feature information and the environment setup information item, it is possible to reduce the amount of information to be stored to the storage unit **22** and the amount of information to be transmitted to the in-vehicle device **10**.

[0395] [10-4 Correspondence with Claims]

[0396] In the driving-environment setup system of the tenth embodiment, the camera **42** corresponds to feature detection means.

[0397] The storage unit **12** of the in-vehicle device **10** corresponds to a setup information storage means and feature information storage means, the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1803**-S**1806** in the vehicle environment setup processing (FIG. **23**) corresponds to driver identifying means, and the control unit **11** of the in-vehicle device **10** which performs processing of Steps S**1808** and S**1809** corresponds to driving-environment setup means.

[0398] The control unit **21** of the portable device **20** which performs processing of Steps S**303** and S**304** in the information-transmitting processing (FIG. **4**) corresponds to feature information transmitting means, and the control unit **21** of the portable device **20** which performs processing of Steps S**305** and S**306** corresponds to environmental information transmitting means.

[0399] [11 Modification]

[0400] In the above, one embodiment of the present invention has been described. It is needless to say that the present invention can be practiced in various embodiments.

[0401] [11-1 Processing in Case Where a Single Piece of User Identification Information is Received]

[0402] In the fourth and fifth embodiments described above, even when the in-vehicle device **10** receives a single piece of the user identification information from the portable device **20** or when only one set of portable device **20** exists, the personal identification device **41** is made to perform the driver determination processing. However, the present invention is not limited to the case.

[0403] For example, like other embodiments (the first to third embodiments, the sixth to tenth embodiments), when a single piece of the user identification information is received, the driving environment may be set up, based on the environment setup information item corresponding to the received user identification information, without requesting the personal identification device **41** to perform the driver determination processing.

[0404] Specifically, the vehicle environment setup processing (FIG. **14**) of the fourth embodiment can be accomplished by adding processing of Step S**1002** (**2**), as illustrated in FIG.

24. That is, when it is determined that the user identification information is received in Step S**1002**, the flow proceeds to Step S**1002** (**2**), and it is determined whether the multiple user identification information items are received or not. In Step S**1002** (**2**), when it is determined that the multiple user identification information items are received, the flow proceeds to Step S**1003**. On the contrary, when it is determined that the multiple user identification information items are not received, the flow proceeds to Step S**1012**, without performing processing of Steps S**1003**-S**1011**.

[0405] The vehicle environment setup processing (FIGS. **18**A and **18**B) of the fifth embodiment can be accomplished by adding processing of Step S**1302** (**2**), as illustrated in FIGS. **25**A and **25**B. That is, when it is determined that the user identification information is received in Step S**1302**, the flow proceeds to Step S**1302** (**2**), and it is determined whether the multiple user identification information items are received or not. In Step S**1302** (**2**), when it is determined that the multiple user identification information items are received, the flow proceeds to Step S**1303**; on the contrary, when it is determined that the multiple user identification information items are not received, the flow proceeds to Step S**1310**, without performing processing of Steps S**1303**-S**1309** and Steps S**1313**-S**1323**.

[0406] On the other hand, in the first to third embodiments and the sixth to tenth embodiments, when the in-vehicle device **10** receives a single piece of the user identification information from the portable device **20**, the driving environment is set up, based on the environment setup information item corresponding to the user identification information, without requesting the personal identification device **41** to perform the driver determination processing. However, the present invention is not limited to the case.

[0407] That is, in these embodiments, the personal identification device **41** performs the driver determination processing for identifying one of the facial feature information items received from the in-vehicle device **10** as the facial feature information item for the driver, the one being most similar to the facial feature point indicated by the taken image to belong to the driver. Therefore, the one facial feature information item which belongs to the driver is certainly identified. However, when the driver does not possess the portable device **20** but a passenger other than the driver possesses the portable device **20**, it is likely that the driving environment of the vehicle **100** will be wrongly set as the driving environment for the passenger by such processing. Accordingly, even for the facial feature information item, which is one of the information items received from the in-vehicle device **10**, and which is most similar to the facial feature point indicated by the taken image among the received information items, it is preferable to perform a driver determination processing, in which the facial feature information shall not be identified as belonging to the driver unless the facial feature information satisfies the identical determination condition, as in the fourth and fifth embodiments described above. Even when the in-vehicle device **10** receives a single piece of user identification information from the portable device **20**, it is possible to prevent the driving environment of the vehicle **100** from being wrongly set as the driving environment for the fellow passenger, as long as the personal identification device **41** is made to perform the driver determination processing.

[0408] [11-2 A Driver's Riding Detection]

[0409] According to each embodiment described above, the in-vehicle device **10** detects the fact that the driver rides the vehicle **100** with the aid of the seat sensor provided in the driver's seat. However, the present invention is not limited to the case. For example, it may be possible-.to detect the fact that the driver rides the vehicle **100**, through the detection of opening, closing, and unlocking of the door of the driver's seat side, or in use of the taken image of the camera **42**, etc.

[0410] In the first to fifth embodiments and the ninth and tenth embodiments, the in-vehicle device **10** performs processing to acquire the user identification information (to detect a user who rides in the vehicle **100**), at the time when it is detected that the driver rides in the vehicle **100**. However, the present invention is not limited to the case. For example, the in-vehicle device **10** may perform processing in which the user identification information is periodically acquired, prior to the time when the driver rides in the vehicle **100**.

[0411] [11-3 Acquisition of Information from a Portable Device by an In-Vehicle Device]

[0412] In the first and second embodiments, and the fourth to ninth embodiments described above, the in-vehicle device **10** detects the portable device **20** which exists in the communications area by acquiring the user identification information from the portable device **20**, and acquires the facial feature information by transmitting a feature information-sending request to the detected portable device **20**. However, the timing when the in-vehicle device **10** acquires the facial feature information from the portable device **20** is not limited to the case.

[0413] For example, when the in-vehicle device **10** detects the portable device **20** which exists in the communications area, the in-vehicle device **10** may acquire the facial feature information instead of, or together with, the user identification information. In this way, the in-vehicle device **10** does not need to transmit a feature information-sending request to the portable device **20**, after detecting the portable device **20** which exists in the communications area. Therefore, it is possible to simplify the processing.

[0414] In the construction in which the in-vehicle device **10** acquires the environment setup information item from the portable device **20**, the environment setup information item may be acquired when detecting the portable device **20** which exists in the communications area. In this way, the in-vehicle device **10** does not need to transmit a setup information-sending request to the portable device **20**, thereby simplifying the processing.

[0415] Acquisition of the information from the portable device **20** by the in-vehicle device **10** is not limited to the method performed in response to the request from the in-vehicle device **10**. For example, it may be possible to provide construction in which the portable device **20** transmits information to the in-vehicle device **10** periodically.

[0416] [11-4 Acquisition of Information from a Management Device by an In-Vehicle Device]

[0417] In the second and third embodiments described above, the in-vehicle device **10** receives the environment setup information item corresponding to the user identification information from the management device **30**, by transmitting a setup information-sending request to the management device **30** together with the user identification information. However, the method in which the in-vehicle device **10** acquires the environment setup information item from the management device **30** is not limited to the case.

[0418] For example, when the portable device **20** is operable to perform communication with the management device **30**, the following construction may be also possible.

[0419] That is, the driving-environment setup system may be constructed such that the portable device **20** transmits a setup information-sending request to the management device **30** together with the user identification information, and receives the environment setup information item corresponding to the user identification information from the management device **30**, then the portable device **20** transmits the environment setup information item received to the in-vehicle device **10**.

[0420] Alternatively, the driving-environment setup system may be constructed such that the portable device **20** transmits a setup information-sending request to the management device **30**, together with the user identification information and the vehicles identification information, then the management device **30** transmits the environment setup information item corresponding to the received user identification information to the in-vehicle device **10** identified based on the received vehicles identification information.

[0421] In the third embodiment described above, the in-vehicle device **10** receives the facial feature information corresponding to the user identification information from the management device **30**, by transmitting a feature information-sending request to the management device **30** together with the user identification information. It is also possible to provide a similar construction for the case.

[0422] [11-5 Selection Operation by a User]

[0423] In the fourth and fifth embodiments described above, when there exist the multiple facial feature information items identified as belonging to the driver by the personal identification device **41**, name of each user identified as the driver is displayed on the display device **43**, and the user is requested to select the name. However, the present invention is not limited to the case.

[0424] For example, the name of each user identified as the driver may be displayed on display means other than the display device **43** (for example, on an in-meter-panel indicator of the vehicle **100**, or a display area provided in the portable device **20** of each user). Alternatively, it may be preferable to let the user know the name of each user by other modes than a display (for example, by voice). Further, the selection operation by a user may be possible to use other operation than a touch panel operation (for example, operation of a steering wheel-mounted switch, operation of a switch on an instrument panel, voice-activated operation based on speech recognition). In addition, it is also preferable to let the user know other information than the name of the user.

[0425] [11-6 Construction of a Portable Device]

[0426] In each of the embodiments described above, examples are explained in which a portable telephone terminal is employed to construct the portable device **20**. However, the portable device **20** is not limited to the case. For example, a storage device possessing a scheme operable to perform radio communication, such as a portable information device such as PDA, an electronic key (smart key) of the vehicle **100**, may be employed to construct the portable device **20**. A storage device which performs a non-contact-type or contact-type data transfer, such as an IC card, an Edy Card, a USB memory, and an SD card, may be employed. A special-purpose device may be preferably employed instead of employing other devices.

[0427] In each of the embodiments described above, cases where each user possesses one portable device **20** are exemplified. However, the present invention is not limited to the cases, and two or more users may share one portable device **20**, for example. In this case, the portable device **20** stores the information about each of the two or more users who share the portable device **20**. The information may include the user identification information, the facial feature information, the environment setup information item, as required, in association with each other. Even in such construction, the same effects as in each of the embodiments described above will be obtained.

[0428] [11-7 Physical Feature Detected from a Driver]

[0429] In each of the embodiments described above, the construction in which the authentication of the driver is performed by detecting a facial feature point as a user's physical feature is exemplified. However, the present invention is not limited to the case. Alternatively, the user's physical feature may include other features (e.g., biological feature), which is unique to the individual body, such as a fingerprint, a vein, an iris, a voiceprint, a retina, etc.

[0430] Feature identification information and environment identification information, which are adopted in the present driving-environment setup system, do not necessarily need to be such information that possesses mutually different contents. For example, they may be common information which can identify both a user's physical feature and a driving environment for the user. In this case, environmental information transmitting means and feature information transmitting means, which are adopted in the present driving-environment setup system, can be constructed as one common means.

[0431] In the above embodiments, information is directly transmitted from a portable device to an in-vehicle device. However, the information may be transmitted from the portable device indirectly to the in-vehicle device via an intermediate device. In the above case, the intermediate device transmits the received information as it is, or alternatively, may transmit differently-formatted information different from the received information. For example, the portable device may transmit, to an intermediate device, information which indirectly indicates a physical feature of the associated user of the portable device. Then, the intermediate device converts the information received from the portable device into another information directly indicative of the physical feature of the associated user of the portable device and transmits the converted information to the in-vehicle device. In such construction, feature identification information which can identify a user's physical feature will be transmitted from the portable device to the in-vehicle device as a result.

[0432] When the in-vehicle device is capable of communicating with the portable device in at least one of the situations where a user who possesses the portable device is going to ride or has ridden a vehicle, for example, it can be considered that the portable device of the user can communicate with the in-vehicle device.

[0433] Additional advantages and modifications will readily occur to those skilled in the art. The invention in its broader terms is therefore not limited to the specific details, representative apparatus, and illustrative examples shown and described.

What is claimed is:

1. A driving-environment setup system comprising:

an in-vehicle device mounted on a vehicle; and

a plurality of portable devices capable of being carried in the vehicle, wherein:

each of the plurality of portable devices includes:

feature information transmitting means for transmitting, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices; and

environmental information transmitting means for transmitting, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user; and

the in-vehicle device includes:

feature detection means for detecting a physical feature of a person sitting in a driver's seat of the vehicle;

driver identifying means for identifying one of the associated users as a driver of the vehicle when the physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the physical feature detected by the feature detection means; and

driving-environment setup means for setting a driving environment of the vehicle for the driver based on the received environment identification information item of the one of the associated users.

2. The driving-environment setup system of claim **1**, wherein:

the feature information transmitting means is operable to transmit the feature identification information item to the in-vehicle device when the in-vehicle device requests the feature information transmitting means to transmit the feature identification information item; and

the driver identifying means requests the portable device of the associated user, which gets in the vehicle, to transmit the feature identification information item such that the driver identifying means receives the feature identification information item.

3. The driving-environment setup system of claim **2**, wherein the driver identifying means requests the portable device, which is capable of communicating with the in-vehicle device, to transmit the feature identification information item.

4. The driving-environment setup system of claim **1**, wherein:

the environmental information transmitting means is operable to transmit the environment identification information item to the in-vehicle device when the in-vehicle device requests the environmental information transmitting means to transmit the environment identification information item; and

the driving-environment setup means requests the portable device of the one of the associated users to transmit the environment identification information item such that the driving-environment setup means receives the environment identification information item.

5. The driving-environment setup system of claim **1**, wherein:

when single feature identification information item is receivable from one of the plurality of portable devices, the driver identifying means identifies the associated user of the one of the plurality of portable devices as the driver of the vehicle.

6. The driving-environment setup system of claim **1**, further comprising:

a setup information management device operable to store an environment setup information item indicative of the driving environment of the associated user of the each of the plurality of portable devices, wherein:

the environmental information transmitting means of the each of the plurality of portable devices is operable to transmit, as the environment identification information item, an information item that is used for identifying the environment setup information item of the associated user of the each of the plurality of portable devices among the environment setup information items stored in the setup information management device; and

the driving-environment setup means acquires, from the setup information management device, the environment setup information item identified based on the environment identification information item and sets the driving environment of the vehicle for the driver as the driving environment indicated by the environment setup information item acquired from the setup information management device.

7. The driving-environment setup system of claim **6**,

wherein the setup information management device includes setup information replying means for transmitting, to the in-vehicle device, the environment setup information item identified based on the environment identification information item, when the environment identification information item is received from the in-vehicle device, and

wherein the driving-environment setup means acquires the environment setup information item by transmitting the environment identification information item to the setup information management device.

8. The driving-environment setup system of claim **1**,

wherein the in-vehicle device includes setup information storage means for storing an environment setup information item indicative of the driving environment of the associated user of the each of the plurality of portable devices,

wherein the environmental information transmitting means of the each of the plurality of portable devices is operable to transmit, as the environment setup information item, an information item that is used for identifying the environment setup information item of the associated user of the each of the plurality of portable devices among the environment setup information items stored in the setup information storage means, and

wherein the driving-environment setup means acquires, from the setup information storage means, the environment setup information item identified based on the environment identification information item and sets the driving environment of the vehicle for the driver as the driving environment indicated by the environment setup information item acquired from the setup information storage means.

9. The driving-environment setup system of claim **1**,

wherein the environmental information transmitting means of the each of the plurality of portable devices is operable to transmit, as the environment identification information item, an information item indicative of the driving environment for the associated user of the each of the plurality of portable devices, and

wherein the driving-environment setup means sets the driving environment of the vehicle as the driving environment indicated by the environment identification information item.

10. The driving-environment setup system of claim **1**, wherein the driver identifying means identifies the one of the associated users as the driver of the vehicle when the physical feature identified based on the received feature identification information item of the one of the associated users is most similar to the physical feature detected by the feature detection means.

11. The driving-environment setup system of claim **1**, wherein the driver identifying means identifies the one of the associated users as the driver of the vehicle when the physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the physical feature detected by the feature detection means to satisfy an identical determination condition.

12. The driving-environment setup system of claim **11**, wherein when the physical feature identified based on the received feature identification information item of another one of the associated users satisfies the identical determination condition, the driver identifying means identifies, as the driver of the vehicle, one of the one and the another one of the associated users based on an external operation.

13. The driving-environment setup system of claim **12**, wherein, even in a case, where the physical feature identified based on the received feature identification information item of the another one of the associated users satisfies the identical determination condition, if the driving environments identified based on the environment identification information items of the one and the another one of the associated users are similar to each other to satisfy a similarity criterion condition, the driver identifying means identifies as the driver of the vehicle one of the one and the another one of the associated users regardless of the external operation.

14. The driving-environment setup system of claim **12**, wherein, even in a case, where the physical feature indicated by the received feature identification information item of the another one of the associated users satisfies the identical determination condition, if the driving environments identified based on the environment identification information items of the one and the another one of the associated users mutually have an identical part with each other, the driving-environment setup means sets the identical part of the driving environment of the vehicle regardless of the external operation.

15. The driving-environment setup system of claim **13**, wherein the driver identifying means identifies the one of the one and the another one of the associated users as the driver of the vehicle based on the external operation for adjusting the driving environment of the vehicle.

16. The driving-environment setup system of claim **1**, wherein the in-vehicle device includes driving-environment temporary setup means for setting the driving environment of the vehicle as the driving environment for the associated user of the portable device before the driver gets in the vehicle, based on the environment identification information item received from the portable device located outside the vehicle.

17. The driving-environment setup system of claim **16**, wherein the driving-environment temporary setup means sets the driving environment of the vehicle, based on the environment identification information item firstly received from the portable device located outside the vehicle.

18. The driving-environment setup system of claim **16**, wherein the driving-environment temporary setup means sets the driving environment of the vehicle, based on the environment identification information item received from the portable device, which is located outside the vehicle, and the associated user of which is registered in advance.

19. The driving-environment setup system of claim **16**, wherein the driving-environment temporary setup means sets the driving environment of the vehicle, based on the environment identification information item which is received from the portable device located outside on a driver's seat side of the vehicle.

20. The driving-environment setup system of claim **1**, further comprising:

a feature information management device operable to store a feature information item indicative of the physical feature of the associated user of the each of the plurality of portable devices,

wherein the feature information transmitting means of the each of the plurality of portable devices is operable to transmit, as the feature identification information item, an information item used for identifying the feature information item of the associated user of the each of the plurality of portable devices among the feature information items stored in the feature information management device, and

wherein the driver identifying means acquires, from the feature information management device, the feature information item identified based on the feature identification information item and identifies the one of the associated users as the driver of the vehicle when the physical feature indicated by the feature information item acquired from the feature information management device corresponds to the physical feature detected by the feature detection means.

21. The driving-environment setup system of claim **20**,

wherein the feature information management device includes feature information replying means for transmitting, to the in-vehicle device, the feature information item identified based on the feature identification information item, when the feature identification information item is received from the in-vehicle device, and

wherein the driver identifying means acquires the feature information item by transmitting the feature identification information item to the feature information management device.

22. The driving-environment setup system of claim **1**,

wherein the in-vehicle device includes feature information storage means for storing a feature information item indicative of the physical feature of the associated user of the each of the plurality of portable devices,

wherein the feature information transmitting means of the portable device is operable to transmit, as the feature identification information item, an information item used for identifying the feature information item of the associated user of the each of the plurality of the portable devices among the feature information items stored in the feature information storage means, and

wherein the driver identifying means acquires, from the feature information storage means, the feature information item identified based on the feature identification information item and identifies the one of the associated users as the driver of the vehicle when the physical feature indicated by the feature information item acquired from the feature information storage means corresponds to the physical feature detected by the feature detection means.

23. The driving-environment setup system of claim **1**,

wherein the feature information transmitting means of the each of the plurality of portable devices is operable to transmit, as the feature identification information item, an information item indicative of the physical feature of the associated user of the each of the plurality of portable devices, and

wherein the driver identifying means identifies the one of the associated users as the driver of the vehicle when the physical feature indicated by the feature identification information item of the one of the associated users corresponds to the physical feature detected by the feature detection means.

24. The driving-environment setup system of claim **1**, wherein the physical feature is a facial feature point of the associated user.

25. An in-vehicle device mounted on a vehicle for being capable of communicating with a plurality of portable devices, wherein the plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices, and wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user, the in-vehicle device comprising:

driver identifying means for identifying one of the associated users as a driver of the vehicle when the physical feature identified based on the feature identification information item of the one of the associated users corresponds to a physical feature detected from a person sitting in a driver's seat of the vehicle, and

driving-environment setup means for setting a driving environment of the vehicle for the driver based on the received environment identification information item of the one of the associated users.

26. The in-vehicle device of claim **25**, wherein when single feature identification information item is receivable from one of the plurality of portable devices, the driver identifying means identifies the associated user of the one of the plurality of portable devices as the driver of the vehicle.

27. The in-vehicle device of claim **25**, further comprising:

a setup information management device operable to store an environment setup information item indicative of the driving environment of the associated user of the each of the plurality of portable devices, wherein:

the environmental information transmitting means of the each of the plurality of portable devices is operable to transmit, as the environment identification information item, an information item that is used for identifying the environment setup information item of the associated user of the each of the plurality of portable devices among the environment setup information items stored in the setup information management device; and

the driving-environment setup means acquires, from the setup information management device, the environment setup information item identified based on the environment identification information item and sets the driving environment of the vehicle for the driver as the driving environment indicated by the environment setup information item acquired from the setup information management device.

28. The in-vehicle device of claim **25**, further comprising:

wherein the in-vehicle device includes setup information storage means for storing an environment setup information item indicative of the driving environment of the associated user of the each of the plurality of portable devices,

wherein the environmental information transmitting means of the each of the plurality of portable devices is operable to transmit, as the environment setup information item, an information item that is used for identifying the environment setup information item of the associated user of the each of the plurality of portable devices among the environment setup information items stored in the setup information storage means, and

wherein the driving-environment setup means acquires, from the setup information storage means, the environment setup information item identified based on the environment identification information item and sets the driving environment of the vehicle for the driver as the driving environment indicated by the environment setup information item acquired from the setup information storage means.

29. The in-vehicle device of claim **25**,

wherein the environmental information transmitting means of the each of the plurality of portable devices is operable to transmit, as the environment identification information item, an information item indicative of the driving environment for the associated user of the each of the plurality of portable devices, and

wherein the driving-environment setup means sets the driving environment of the vehicle as the driving environment indicated by the environment identification information item.

30. The in-vehicle device of claim **25**, wherein the driver identifying means identifies the one of the associated users as the driver of the vehicle when the physical feature identified based on the received feature identification information item of the one of the associated users is most similar to the physical feature detected by the feature detection means.

31. The in-vehicle device of claim **25**, wherein the driver identifying means identifies the one of the associated users as the driver of the vehicle when the physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the physical feature detected by the feature detection means to satisfy an identical determination condition.

32. The in-vehicle device of claim **31**, wherein when the physical feature identified based on the received feature identification information item of another one of the associated users satisfies the identical determination condition, the driver identifying means identifies, as the driver of the vehicle, one of the one and the another one of the associated users based on an external operation.

33. The in-vehicle device of claim **32**, wherein, even in a case, where the physical feature identified based on the received feature identification information item of the another one of the associated users satisfies the identical determination condition, if the driving environments identified based on the environment identification information items of the one and the another one of the associated users are similar to each other to satisfy a similarity criterion condition, the driver identifying means identifies as the driver of the vehicle one of the one and the another one of the associated users regardless of the external operation.

34. The in-vehicle device of claim **32**, wherein, even in a case, where the physical feature indicated by the received feature identification information item of the another one of the associated users satisfies the identical determination condition, if the driving environments identified based on the environment identification information items of the one and the another one of the associated users mutually have an identical part with each other, the driving-environment setup means sets the identical part of the driving environment of the vehicle regardless of the external operation.

35. The in-vehicle device of claim **33**, wherein the driver identifying means identifies the one of the one and the another one of the associated users as the driver of the vehicle based on the external operation for adjusting the driving environment of the vehicle.

36. The in-vehicle device of claim **25**, wherein the in-vehicle device includes driving-environment temporary setup means for setting the driving environment of the vehicle as the driving environment for the associated user of the portable device before the driver gets in the vehicle, based on the environment identification information item received from the portable device located outside the vehicle.

37. The in-vehicle device of claim **25**, further comprising:

a feature information management device operable to store a feature information item indicative of the physical feature of the associated user of the each of the plurality of portable devices,

wherein the feature information transmitting means of the each of the plurality of portable devices is operable to transmit, as the feature identification information item, an information item used for identifying the feature information item of the associated user of the each of the plurality of portable devices among the feature information items stored in the feature information management device, and wherein the driver identifying means acquires, from the feature information management device, the feature information item identified based on the feature identification information item and identifies the one of the associated users as the driver of the vehicle when the physical feature indicated by the feature information item acquired from the feature information management device corresponds to the physical feature detected by the feature detection means.

38. The in-vehicle device of claim **25**,

wherein the in-vehicle device includes feature information storage means for storing a feature information item indicative of the physical feature of the associated user of the each of the plurality of portable devices,

wherein the feature information transmitting means of the portable device is operable to transmit, as the feature identification information item, an information item used for identifying the feature information item of the associated user of the each of the plurality of the portable devices among the feature information items stored in the feature information storage means, and

wherein the driver identifying means acquires, from the feature information storage means, the feature information item identified based on the feature identification information item and identifies the one of the associated users as the driver of the vehicle when the physical feature indicated by the feature information item acquired from the feature information storage means corresponds to the physical feature detected by the feature detection means.

39. The in-vehicle device of claim **25**,

wherein the feature information transmitting means of the each of the plurality of portable devices is operable to transmit, as the feature identification information item, an information item indicative of the physical feature of the associated user of the each of the plurality of portable devices, and

wherein the driver identifying means identifies the one of the associated users as the driver of the vehicle when the physical feature indicated by the feature identification information item of the one of the associated users corresponds to the physical feature detected by the feature detection means.

40. A portable device for an associated user for being capable of communicating with an in-vehicle device mounted in a vehicle, wherein the portable device is capable of being carried in the vehicle, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device identifies the associated user as a driver of the vehicle when a physical feature identified based on a received feature identification information item of the associated user corresponds to a physical feature detected by the in-vehicle device, and wherein the in-vehicle device sets a driving environment of the vehicle for the driver based on a received environment identification information item of the associated user, the portable device comprising:

feature information transmitting means for transmitting, to the in-vehicle device, the feature identification information item used for identifying the physical feature of the associated user of the portable device; and

environmental information transmitting means for transmitting, to the in-vehicle device, the environment identification information item used for identifying the driving environment for the associated user.

41. A management device capable of communicating with a plurality of portable devices and an in-vehicle device mounted in a vehicle, wherein the plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices, wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying an environment setup information item indicative of a driving environment of the associated user of the each of the plurality of portable devices among environment setup information items stored in the management device, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device identifies one of the associated users as a driver of the vehicle when a physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the physical feature detected by the in-vehicle device, wherein the in-vehicle device acquires the environment setup information item of the one of the associated users by transmitting the received environment identification information item of the one of the associated users to the management device, and wherein the in-vehicle device sets the driving environment of the vehicle for the driver as the driving environment indicated by the acquired environment setup information item, the management device comprising:

storing means for storing the environment setup information item indicative of the driving environment of the associated user of the each of the plurality of portable devices, and

setup information replying means for transmitting, to the in-vehicle device, the environment setup information item identified based on the environment identification information item, when the environment identification information item is received from the in-vehicle device.

42. A management device capable of communicating with a plurality of portable devices and an in-vehicle device mounted in a vehicle, wherein the plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a feature information item indicative of a physical feature of an associated user of the each of the plurality of portable devices among feature information items stored in the management device, wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device acquires the feature information item of the associated user of the each of the plurality of portable devices by transmitting the received feature identification information item of the associated user to the management device, wherein the in-vehicle device identifies one of the associated users as a driver of the vehicle when a physical feature indicated by the acquired feature information item of the one of the associated users corresponds to the physical feature detected by the in-vehicle device, and wherein the in-vehicle device sets a driving environment of the vehicle for the driver based on the received environment setup information item of the one of the associated users, the management device comprising:

storing means for storing the feature information item indicative of the physical feature of the associated user of the each of the plurality of portable devices; and

feature information replying means for transmitting, to the in-vehicle device, the feature information item identified based on the feature identification information item, when the feature identification information item is received from the in-vehicle device.

43. An article manufacture for an in-vehicle device mounted on a vehicle, wherein the in-vehicle device is capable of communicating with a plurality of portable devices, wherein the plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices, and wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user, the article manufacture comprising:

a computer readable medium readable by a computer; and

program instructions carried by the computer readable medium for causing the computer to serve as:

driver identifying means for identifying one of the associated users as a driver of the vehicle when the physical feature identified based on the feature identification information item of the one of the associated users corresponds to a physical feature detected from a person sitting in a driver's seat of the vehicle; and

driving-environment setup means for setting a driving environment of the vehicle for the driver based on the received environment identification information item of the one of the associated users.

44. An article manufacture for a portable device for an associated user, wherein the portable device is capable of communicating with an in-vehicle device mounted in a vehicle, wherein the portable device is capable of being carried in the vehicle, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device identifies the associated user as a driver of the vehicle when a physical feature identified based on a received feature identification information item of the associated user corresponds to a physical feature detected by the in-vehicle device, and wherein the in-vehicle device sets a driving environment of the vehicle for the driver based on a received environment identification information item of the associated user, the article manufacture comprising:

a computer readable medium readable by a computer; and

program instructions carried by the computer readable medium for causing the computer to serve as:

feature information transmitting means for transmitting, to the in-vehicle device, the feature identification information item used for identifying the physical feature of the associated user of the portable device; and

environmental information transmitting means for transmitting, to the in-vehicle device, the environment identification information item used for identifying the driving environment for the associated user.

45. An article manufacture for a management device capable of communicating with a plurality of portable devices and an in-vehicle device mounted in a vehicle, wherein the plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a physical feature of an associated user of the each of the plurality of portable devices, wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying an environment setup information item indicative of a driving environment of the associated user of the each of the plurality of portable devices among environment setup information items stored in the management device, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device identifies one of the associated users as a driver of the vehicle when a physical feature identified based on the received feature identification information item of the one of the associated users corresponds to the physical feature detected by the in-vehicle device, wherein the in-vehicle device acquires the environment setup information item of the one of the associated users by transmitting the received environment identification information item of the one of the associated users to the management device, and wherein the in-vehicle device sets the driving environment of the vehicle for the driver as the driving environment indicated by the acquired environment setup information item, the article manufacture comprising:

a computer readable medium readable by a computer; and program instructions carried by the computer readable medium for causing the computer to serve as:

storing means for storing the environment setup information item indicative of the driving environment of the associated user of the each of the plurality of portable devices, and

setup information replying means for transmitting, to the in-vehicle device, the environment setup information item identified based on the environment identification information item, when the environment identification information item is received from the in-vehicle device.

46. An article manufacture for a management device capable of communicating with a plurality of portable devices and an in-vehicle device mounted in a vehicle, wherein the plurality of portable devices are capable of being carried in the vehicle, wherein each of the plurality of portable devices transmits, to the in-vehicle device, a feature identification information item used for identifying a feature information item indicative of a physical feature of an associated user of the each of the plurality of portable devices among feature information items stored in the management device, wherein the each of the plurality of portable devices transmits, to the in-vehicle device, an environment identification information item used for identifying a driving environment for the associated user, wherein the in-vehicle device detects a physical feature of a person sitting in a driver's seat of the vehicle, wherein the in-vehicle device acquires the feature information item of the associated user of the each of the plurality of portable devices by transmitting the received feature identification information item of the associated user to the management device, wherein the in-vehicle device identifies one of the associated users as a driver of the vehicle when a physical feature indicated by the acquired feature information item of the one of the associated users corresponds to the physical feature detected by the in-vehicle device, and wherein the in-vehicle device sets a driving environment of the vehicle for the driver based on the received environment setup information item of the one of the associated users, the article manufacture comprising:

a computer readable medium readable by a computer; and

program instructions carried by the computer readable medium for causing the computer to serve as:

storing means for storing the feature information item indicative of the physical feature of the associated user of the each of the plurality of portable devices; and

feature information replying means for transmitting, to the in-vehicle device, the feature information item identified based on the feature identification information item, when the feature identification information item is received from the in-vehicle device.

47. An in-vehicle device mounted on a vehicle, wherein the in-vehicle device is capable of communicating with a plurality of portable devices, each of which transmits identification information unique to the each of the plurality of portable devices, the in-vehicle device comprising:

feature detection means for detecting a physical feature of a person sitting in a driver's seat of the vehicle;

driver identifying means for determining whether the physical feature detected by the feature detection means corresponds to a predetermined physical feature identified based on the identification information received from one of the plurality of portable devices; and

driving-environment setup means for setting a driving environment of the vehicle as a predetermined driving environment identified based on the identification information received from the one of the plurality of the portable devices when the driver identifying means determines that the detected physical feature corresponds to the predetermined physical feature of the one of the plurality of the portable devices.

48. A driving-environment setup system comprising:

an in-vehicle device mounted on a vehicle; and

a portable device capable of being carried in the vehicle, wherein:

the portable device comprising:

feature information transmitting means for transmitting, to the in-vehicle device, feature identification information item used for identifying a physical feature of an associated user of the portable device; and

environmental information transmitting means for transmitting, to the in-vehicle device, environment identification information item used for identifying a driving environment for the associated user of the portable device; and

the in-vehicle device includes:

feature detection means for detecting a physical feature of a person sitting in a driver's seat of the vehicle;

driver identifying means for determining whether the physical feature detected by the feature detection means corresponds to the physical feature identified based on the received feature identification information item of the associated user of the portable device; and

driving-environment setup means for setting a driving environment of the vehicle as the driving environment identified based on the received environment identification information item of the associated user when the driver identifying means determines that the detected physical feature corresponds to the identified physical feature of the associated user.

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