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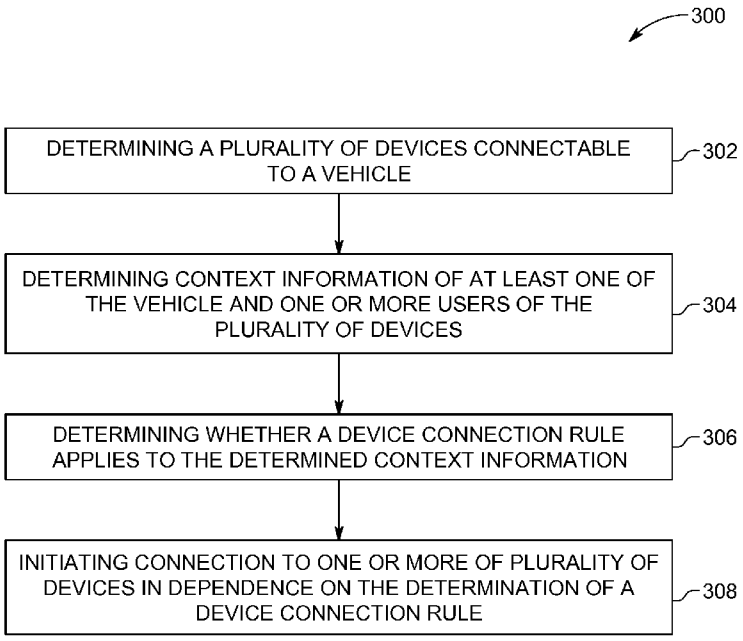


FIG. 3

(57) Abstract: A vehicle system controller (10) comprising means for: determining a plurality of devices (12) connectable to a vehicle (14); determining context information (16) of at least one of the vehicle (14) and one or more users (18) of the plurality of devices (12); determining whether a device connection rule applies to the determined context information (16); and initiating connection to one or more of the plurality of devices (12) in dependence on the determination of a device connection rule.

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SELECTING COMMUNICATION DEVICE FOR IN-VEHICLECOMMUNICATION BASED ON CONEXT INFORMATION

TECHNICAL FIELD

The present disclosure relates to a controller, method and computer program for vehicle connection control. In particular, but not exclusively it relates to a controller, method and computer program for vehicle connection control in controlling connection of a vehicle to one or more devices.

Aspects of the invention relate to a controller, a method, a computer program, a vehicle system and a vehicle.

BACKGROUND

When operating a vehicle, an occupant of the vehicle may wish to connect one or more personal devices to the vehicle to allow sharing of information between the personal device(s) and the vehicle. For example, the occupant of the vehicle may wish to connect a personal device such as a mobile phone to the vehicle to allow the playing of music from the mobile phone through speakers of the vehicle.

In conventional vehicle systems connection is initiated with a default device, which may be the last device connected to the vehicle, without any consideration for the current context of the vehicle and/or a user of a device connectable to the vehicle.

It is an aim of the present invention to address disadvantages associated with the prior art.

SUMMARY OF THE INVENTION

Aspects and embodiments of the invention provide a vehicle system controller, a method, a vehicle system, a vehicle, a computer program and a non-transitory computer readable media as claimed in the appended claims.

According to an aspect of the invention, there is provided a vehicle system controller comprising means for: determining a plurality of devices connectable to a vehicle; determining context information of at least one of the vehicle and one or more users of the plurality of devices; determining whether a device connection rule applies to the determined context information; initiating connection to one or more of the plurality of devices in dependence on the determination of a device connection rule.

According to another aspect of the invention, there is provided a vehicle system controller comprising means for: determining a plurality of devices connectable to a vehicle; determining context information of at least one of the vehicle and one or more users of the plurality of devices; determining whether a device connection rule applies to the determined context information; initiating connection to one or more of the plurality of devices in dependence on the determination of a device connection rule; determining a user changing a device connected to the vehicle; and determining context information of at least one of the vehicle and one or more users of a device when the device change occurs.

This provides the advantage of automatically connecting to an appropriate device without user intervention. Thus appropriate device connection can also be carried out whilst a vehicle is moving without significant user distraction.

The vehicle system controller may comprise means for determining whether at least one trigger event has occurred, wherein the means for determining a plurality of devices connectable to a vehicle may be configured to determine the plurality of devices upon determination that at least one trigger event has occurred.

The at least one trigger event may comprise one or more of: a vehicle start, an engine start, a vehicle driver identification, one or more occupants approaching the vehicle, one or more occupants attempting to enter the vehicle, and one or more occupants entering the vehicle.

The means for determining a plurality of devices connectable to the vehicle may comprise means for retrieving a list of devices previously connected to the vehicle.

The means for determining a plurality of devices connectable to the vehicle may comprise means for detecting devices within a range of the vehicle and connectable to the vehicle.

The means for determining a plurality of devices connectable to the vehicle may comprise means for receiving one or more identifiers from the plurality of devices within the range and connectable to the vehicle.

At least one of the plurality of devices may be connectable to the vehicle by a wired and/or wireless connection.

Context information may comprise at least one of: location information, passenger information, time information, date information, weather information, schedule information, calendar information, and route information.

The vehicle system controller may comprise means for receiving a user input defining one or more device connection rules.

The vehicle system controller may comprise means for updating one or more device connection rules in dependence on the context information when the device change occurs.

The vehicle system controller may comprise means for generating one or more device connection rules in dependence on the change of device and the context information when the device change occurs.

The vehicle system controller may comprise means for generating a device connection rule after a predetermined number of device changes under a particular context.

The vehicle system controller may comprise means for initiating at least one output to a user of the vehicle prior to initiating connection to a device or devices.

The vehicle system controller may comprise means for downloading one or more device connection rules.

The device connection rules may be predefined.

According to another aspect of the invention, there is provided a vehicle system controller as described above, wherein: the means comprises an electronic processor; and an electronic

memory device electrically coupled to the electronic processor and having instructions stored therein.

According to yet another aspect of the invention there is provided a vehicle system controller comprising an electronic processor and an electronic memory device electrically coupled to the electronic processor and having instructions stored therein which, when executed by the electronic processor, cause the vehicle system controller at least to: determine a plurality of devices connectable to a vehicle; determine context information of at least one of the vehicle and one or more users of the plurality of devices; determine whether a device connection rule applies to the determined context information; and initiate connection to one or more of the plurality of devices in dependence on the determination of a device connection rule.

According to a further aspect of the invention, there is provided a vehicle system controller comprising means for: determining a plurality of devices connectable to a vehicle; determining context information; determining whether a device connection rule applies to the determined context information; and initiating at least one action in relation to one or more of the plurality of devices in dependence on the determination of a device connection rule.

According to another aspect of the invention, there is provided a method of controlling a vehicle system, comprising: determining a plurality of devices connectable to a vehicle; determining context information of at least one of the vehicle and one or more users of the plurality of devices; determining whether a device connection rule applies to the determined context information; and initiating connection to one or more of the plurality of devices in dependence on the determination of a device connection rule.

According to another aspect of the invention, there is provided a method of controlling a vehicle system, comprising: determining a plurality of devices connectable to a vehicle; determining context information of at least one of the vehicle and one or more users of the plurality of devices; determining whether a device connection rule applies to the determined context information; and initiating connection to one or more of the plurality of devices in dependence on the determination of a device connection rule ; determining a user changing a device connected to the vehicle; and determining context information of at least one of the vehicle and one or more users of a device when the device change occurs

The method may comprise determining the plurality of devices upon a determination that at least one trigger event has occurred.

The at least one trigger event may comprise one or more of: a vehicle engine start, an engine start, a vehicle driver identification, one or more occupants approaching the vehicle, one or more occupants attempting to enter the vehicle and one or more occupants entering the vehicle.

Determining a plurality of devices connectable to the vehicle may comprise retrieving a list of devices previously connected to the vehicle.

Determining a plurality of devices connectable to the vehicle may comprise detecting devices within a range of the vehicle and connectable to the vehicle.

Determining a plurality of devices connectable to the vehicle may comprise receiving one or more identifiers from the plurality of devices within the range and connectable to the vehicle.

At least one of the plurality of devices may be connectable to the vehicle by a wired and/or wireless connection.

Context information may comprise at least one of: location information, passenger information, time information, date information, weather information, schedule information, calendar information and route information.

The method may comprise receiving a user input defining one or more device connection rules.

The method may comprise determining a user changing the device connected to the vehicle and determining the context information of at least one of the vehicle and/or one or more users of a device when the device change occurs.

The method may comprise initiating at least one output to a user of the vehicle prior to initiating connection to a device.

According to another aspect of the invention, there is provided a vehicle system controller comprising an electronic processor and an electronic memory device electrically coupled to the electronic processor and having instructions stored therein which, when executed by the electronic processor, cause the vehicle system controller at least to perform a method as described in any preceding paragraph.

According to yet another aspect of the invention, there is provided a vehicle system comprising a vehicle system controller as described in any preceding paragraph and at least one transceiver.

According to a further aspect of the invention, there is provided a vehicle comprising a vehicle system controller as described in any preceding paragraph and/or a vehicle system as described in any preceding paragraph.

According to a still further aspect of the invention, there is provided a computer program comprising instructions that, when executed by one or more processors, cause a system to perform, at least the method as described in any preceding paragraph.

According to another aspect of the invention, there is provided a non-transitory computer readable media comprising a computer program as described in any preceding paragraph.

Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 illustrates an example of a vehicle system controller;
Fig. 2 illustrates an example of a vehicle system in a vehicle;
Fig. 3 illustrates an example of a method of controlling a vehicle system;
Figs. 4A and 4B illustrate an example of a method of controlling a vehicle system;
Fig. 5 illustrates an example of a method of controlling a vehicle system; and
Fig. 6 illustrates an example of a vehicle.

DETAILED DESCRIPTION

Examples of the present disclosure relate to controlling connection of one or more devices to a vehicle.

In examples a controller of a vehicle, such as a vehicle system controller, determines a plurality of devices connectable to a vehicle. For example, the vehicle system controller may detect one or more devices within a range of the vehicle and/or may retrieve a list of devices previously connected to the vehicle.

In examples, the vehicle system controller determines context information of at least one of the vehicle and one or more users of the plurality of devices. For example, context information comprises at least one of location information, passenger information, time information, date information, weather information, schedule information, calendar information and route information.

In examples, the vehicle system controller determines whether a device connection rule applies to the determined context information. In examples, the device connection rules may be predefined.

In examples, the vehicle system controller initiates connection to one or more of the plurality of devices in dependence upon the determination of a device connection rule. For example, the vehicle system controller may determine that based on the current context of the vehicle one or more particular device or devices of a user should be connected to the vehicle and will therefore initiate connection to that device or those devices.

That is, in examples a vehicle system controller can initiate connection with a device or devices in dependence upon the current context of the vehicle and/or a user of a device.

A technical effect of at least some examples of the disclosure is that a connection to an appropriate device or devices of a user can be made in an efficient way.

Furthermore, at least some examples of the disclosure provide for an intelligent way to connect to one or more of multiple devices within range of a vehicle which may prevent a user, such as a driver of the vehicle, from having to switch devices connected to a vehicle while the vehicle is moving.

Fig. 1 illustrates an example of a controller 10 in the form of a vehicle system controller 10 that may be a chip or a chipset. The vehicle system controller 10 may form part of one or more vehicle systems 28 comprised in a vehicle 14, such as the one illustrated in the example of Fig. 2.

Implementation of a vehicle system controller 10 may be as controller circuitry. The vehicle system controller 10 may be implemented in hardware alone, have certain aspects in software including firmware alone or can be a combination of hardware and software (including firmware).

As illustrated in Fig. 1 the vehicle system controller 10 may be implemented using instructions that enable hardware functionality, for example, by using executable instructions of a computer program 34 in a general-purpose or special-purpose processor 38 that may be stored on a computer readable storage medium (disk, memory etc.) to be executed by such a processor 38.

The processor 38 is configured to read from and write to the memory 42. The processor 38 may also comprise an output interface via which data and/or commands are output by the processor 38 and an input interface via which data and/or commands are input to the processor 38.

The memory 42 stores a computer program 34 comprising computer program instructions 36 (computer program code) that control the operation of the vehicle system controller 10 when loaded into the processor 38. The computer program instructions, of the computer program

34, provide the logic and routines that enables the apparatus to perform the methods illustrated in Figs. 3, 4A and 4B. The processor 38 by reading the memory 42 is able to load and execute the computer program 34.

The vehicle system controller 10 therefore comprises:
at least one processor 38; and
at least one memory 42 including computer program code;
the at least one memory 42 and the computer program code configured to, with the at least one processor 38, cause the vehicle system controller 10 at least to perform:

determining a plurality of devices 12 connectable to a vehicle 14, determining context information 16 of at least one of the vehicle 14 and one or more users 18 of the plurality of devices 12, determining whether a device connection rule applies to the determined context information 16 and initiating connection to one or more of the plurality of devices 12 in dependence on the determination of a device connection rule.

As illustrated in Fig. 1, the computer program 34 may arrive at the vehicle system controller 10 via any suitable delivery mechanism 40. The delivery mechanism 40 may be, for example, a non-transitory computer-readable storage medium, a computer program product, a memory device, a record medium such as a compact disc read-only memory (CD-ROM) or digital versatile disc (DVD), an article of manufacture that tangibly embodies the computer program 34. The delivery mechanism 40 may be a signal configured to reliably transfer the computer program 34. The vehicle system controller 10 may propagate or transmit the computer program 34 as a computer data signal.

Although the memory 42 is illustrated as a single component/circuitry it may be implemented as one or more separate components/circuitry some or all of which may be integrated/removable and/or may provide permanent/semi-permanent/ dynamic/cached storage.

Although the processor 38 is illustrated as a single component/circuitry it may be implemented as one or more separate components/circuitry some or all of which may be integrated/removable. The processor 38 may be a single core or multi-core processor.

References to 'computer-readable storage medium', 'computer program product', 'tangibly embodied computer program' etc. or a 'controller', 'computer', 'processor' etc. should be understood to encompass not only computers having different architectures such as single /multi- processor architectures and sequential (Von Neumann)/parallel architectures but also specialized circuits such as field-programmable gate arrays (FPGA), application specific circuits (ASIC), signal processing devices and other processing circuitry. References to computer program, instructions, code etc. should be understood to encompass software for a programmable processor or firmware such as, for example, the programmable content of a hardware device whether instructions for a processor, or configuration settings for a fixed-function device, gate array or programmable logic device etc.

The blocks illustrated in the Figs. 3, 4A and 4B may represent steps in a method and/or sections of code in the computer program 34. The illustration of a particular order to the blocks does not necessarily imply that there is a required or preferred order for the blocks and the order and arrangement of the block may be varied. Furthermore, it may be possible for some blocks to be omitted.

In examples, the vehicle system controller 10 of Fig. 1 or the vehicle system 28 of Fig. 2 provide means for performing the methods illustrated in Figs. 3, 4A and 4B and as described herein.

The vehicle system controller 10 may be considered a controller or controllers and/or a system.

Fig. 2 illustrates an example of a vehicle system 28. In the illustrated example the vehicle system 28 is a system for controlling connection of devices to a vehicle 14.

Fig. 2 also illustrates a vehicle 14 comprising a vehicle system controller 10 as described herein and/or a vehicle system 28 as described herein.

In examples, the system 28 may be considered a control system. In some, but not necessarily all, examples the system 28 is comprised in a vehicle 14 as illustrated in the example of Fig. 2.

In the example of Fig. 2, the system 28 comprises one or more sensors 32, one or more transceivers 30, one or more user interfaces 26 and the vehicle system controller 10 illustrated in Fig. 1.

The vehicle system controller 10 provides means for controlling operation of the vehicle system 28.

As illustrated in the example of Fig. 2 the elements 32, 30 and 26 are operationally coupled to the vehicle system controller 10 and any number or combination of intervening elements can exist between them (including no intervening elements).

In some examples, the elements 32, 30 and 26 may be operationally coupled to each other and/or may share one or more components. Additionally or alternatively, the elements 32, 30 and 26 may be operationally coupled to and/or share one or more components with other elements not illustrated in the example of Fig. 2.

The one or more sensors 32 are for obtaining/collecting/gathering information. In examples, the one or more sensors 32 are for obtaining information in relation to one or more trigger events, such as an engine start, and/or obtaining information regarding a current context of the vehicle 14 and/or one or more users 18 of one or more devices 12 (see, for example, Fig. 5).

The one or more sensors 32 comprise any suitable sensor(s)/means for obtaining information. For example, the one or more sensors 32 may comprise one or more cameras, one or more temperature sensors, one or more location sensors such as GPS sensors, one or more biometric sensors, one or more motion sensors, one or more optical sensors, one or more infra-red sensors, one or more ultra-sonic sensors, one or more radar sensors, one or more chemical sensors, one or more proximity sensors, one or more pressure sensors and so on.

In some examples, the one or more transceivers 30 may be considered to be one or more sensors 32 as the one or more transceivers 30 may, for example, be for detecting one or more devices proximate the vehicle 14 and/or receiving context information 16 and so on.

In examples, the vehicle system controller 10 is for controlling operation of the one or more sensors 32. Information may be transmitted between the vehicle system controller 10 and the one or more sensors 32. For example, control information may be transmitted from the vehicle system controller 10 to the one or more sensors 32 and/or information gathered by the one or more sensors 32 transmitted to the vehicle system controller 10.

This is illustrated in the example of Fig. 2 by the double-headed arrow linking the one or more sensors 32 and the vehicle system controller 10.

In examples, the one or more transceivers 30 are for receiving and/or transmitting one or more signals. In some examples, the one or more transceivers 30 are for receiving and/or transmitting one or more signals to/from a vehicle 14. Any suitable transceiver or transceivers may be used and in some examples separate transmitter(s) and/or receiver(s) may be used.

In some, but not necessarily all, examples the one or more transceivers 30 are for transmitting and/or receiving signals of any suitable range. For example, the one or more transceivers 30 may be configured to receive and/or transmit radio frequency signals over any suitable range.

In examples, the one or more transceivers 30 are configured to operate using one or more short range radio communication protocols, such as Bluetooth or WiFi protocols and/or one or more longer range radio protocols such as one or more cellular telephone protocols.

Additionally or alternatively, the one or more transceivers 30 are, in examples, configured to operate using one or more hardwired protocols. For example universal serial bus (USB) protocol, high-definition multimedia interface (HDMI) protocol and so on.

In examples, one or more transceivers 30 are for transmitting and/or receiving signals comprising information. The signal may be transmitted and/or received using any suitable communication protocol or protocols.

In examples, the vehicle system controller 10 is for controlling the one or more transceivers 30 to transmit and/or receive one or more signals to transmit and/or receive information.

In examples, the vehicle system controller 10 is for controlling operation of the one or more transceivers 30. Information may be transmitted between the vehicle system controller 10 and the one or more transceivers 30. For example, control information may be transmitted from the vehicle system controller 10 to the one or more transceivers 30 and/or data/information received in one or more signals transmitted to the vehicle system controller 10. This is illustrated in the example of Fig. 2 by the double-headed arrow linking the one or more transceivers 30 and the vehicle system controller 10.

Accordingly, Fig. 2 illustrates a vehicle system 28 comprising a vehicle system controller 10 as described in relation to Fig. 1 and at least one transceiver 30.

In examples, the one or more user interfaces 26 are for receiving user input from a user and/or providing output to a user. Any suitable user interface(s) may be used.

In examples, the one or more user interfaces 26 may comprise one or more displays, one or more touch sensitive inputs, one or more buttons, one or more joysticks, one or more haptic outputs, one or more speakers, one or more microphones and so on.

In examples, the one or more user interfaces 26 may comprise any suitable means for receiving user input and/or any suitable means for outputting information to a user.

For example, the one or more user interfaces 26 may comprise one or more displays for presenting a number of options to a user and one or more user controllable inputs, such as one or more buttons and/or one or more touch sensitive inputs, for receiving an input from the user to provide a selection.

In some examples, the one or more transceivers 30 may be considered to be at least part of the one or more user interfaces 26 and the one or more transceivers 30 may be used to receive information from/transmit information to a personal device of a user.

In examples, the vehicle system controller 10 is for controlling operation of the one or more user interfaces 26. Information may be transmitted between the vehicle system controller 10 and the one or more user interfaces 26. For examples, control information may be transmitted from the vehicle system controller 10 to the one or more user interfaces 26

and/or information received via the one or more user interfaces 26 transmitted to the vehicle system controller 10.

This is illustrated in the example of Fig. 2 by the double-headed arrow linking the one or more user interfaces 26 and the vehicle system controller 10.

In examples, the vehicle system controller 10 provides means for controlling the various elements of the system 28. In some examples, the vehicle system controller 10 controls the various elements of the system 28 using one or more wired network systems and/or using one or more wireless network systems such as USB, HDMI, Bluetooth, Wi-Fi and so on.

In the example of Fig. 2, the system 28 is comprised in a vehicle 14. The vehicle 14 may be any suitable vehicle 14 such as a car, van or a truck and so on.

The system 28 may comprise any number of additional elements not illustrated in the example of Fig. 2. Additionally or alternatively, one or more of the elements of the system 28 illustrated in the example of Fig. 2 may be integrated and/or combined. For example, the one or more sensors 32 may be at least partially combined with the one or more transceivers 30.

In some examples, one or more elements illustrated in the example of Fig. 2 may be omitted from the system 28. For example, the one or more user interfaces 26 may be omitted from the system 28.

Fig. 3 illustrates an example of a method 300. For example, the method 300 may be for controlling a vehicle system 28 such as the vehicle system illustrated in the example of Fig. 2.

In examples, the method 300 is performed by the vehicle system controller 10 of Fig. 1 or the vehicle system 28 of Fig. 2.

That is, in examples, the vehicle system controller 10 of Fig. 1 or the vehicle system 28 of Fig. 2 comprises means for performing the method 300.

Some of the elements referred to in the discussion of Fig. 3 are found in Fig. 5 and/or 6.

At block 302 a plurality of devices 12 connectable to a vehicle 14 are determined.

Any suitable method for determining a plurality of devices 12 connectable to a vehicle 14 may be used.

In examples, determining a plurality of devices 12 connectable to a vehicle 14 comprises retrieving a list of devices 12 previously connected to the vehicle 14, for example from a local or remote memory.

For example, the vehicle system controller 10 may store in the memory 42 a list of devices 12 previously connected to the vehicle 14.

In examples, the vehicle system controller 10 may retrieve from the memory 42 the list of devices 12 previously connected to the vehicle 14 to determine the plurality of devices 12 connectable to the vehicle 14.

In some examples, determining a plurality of devices 12 connectable to the vehicle 14 comprises detecting devices 12 within a range of the vehicle 14 and connectable to the vehicle 14.

In examples, the vehicle system controller 10 controls the one or more sensors 32 and/or the one or more transceivers 30 illustrated in the example of Fig. 2 to detect one or more devices 12 within a range of the vehicle 14 and connectable to the vehicle 14.

In examples, the one or more transceivers 30 are used to send signals to and/or receive signals from one or more devices 12 within a range of the vehicle 14.

In some examples, determining a plurality of devices 12 connectable to the vehicle 14 comprises receiving one or more identifiers from the plurality of devices 12 within the range and connectable to the vehicle 14.

The one or more transceivers 30 may be controlled by the vehicle system controller 10 to receive one or more signals comprising the one or more identifiers to allow the determination of the plurality of devices 12 connectable to the vehicle 14.

In examples, the range is any suitable range, for example the range may be of the order of metres, tens of metres, hundreds of metres and so on. In some examples, the range is determined by the physical limitations of the system 28 such as the limitations of the transmission and reception range of the one or more transceivers 30.

In some examples, the range is a predetermined range and distance information regarding how distant the one or more devices 12 are from the vehicle 14 may be included in one or more signals received by the one or more sensors 32 and/or one or more transceivers 30 to allow a determination of whether the device 12 in question is within the range.

In examples, at least one of the plurality of devices 12 is connectable to the vehicle 14 by a wired and/or wireless connection, for example, via the one or more transceivers 30.

In some examples, any suitable device 12 connectable to a vehicle 14 may be determined. For example, one or more mobile phones, tablets, laptops, personal digital assistants (PDA's) and so on.

At block 304, context information 16 of at least one of the vehicle 14 and one or more users 18 of the plurality of devices 12 is determined. In examples, any suitable method for determining context information 16 of at least one of the vehicle 14 and one or more users 18 of the plurality of the devices 12 may be used.

In examples, context information 16 comprises at least one of: location information, passenger information, time information, date information, weather information, schedule information, calendar information, and route information.

In some examples, the context information 16 may be determined using one or more of the one or more sensors 32, one or more transceivers 30 and/or one or more user interfaces 26 of Fig. 2.

For example, the one or more sensors 32 may be used to determine context information 16 such as location information and/or weather information by receiving one or more signals and so on.

Additionally or alternatively, the one or more transceivers 30 may be used to receive one or more signals comprising information to allow determination of context information 16 such as location information, passenger information, time information, date information, weather information, schedule information, calendar information, and/or route information.

Additionally or alternatively, the one or more user interfaces 26 may be used by a user 18 of the plurality of devices 12 or another vehicle occupant to input context information 16.

In some examples, the context information 16 may be stored in a memory or memories such as the memory 42 of the vehicle system controller 10.

Additionally or alternatively the vehicle system controller 10 may be configured to retrieve context information 16 from the memory 42 or one or more other memory/memories. For example, date information, weather information, schedule information, calendar information, route information and so on may be retrieved from the memory 42.

At block 306 it is determined whether a device connection rule applies to the determined context information 16.

In examples, any suitable method for determining whether a device connection rule applies to the determined context information 16 may be used.

As used herein, a device connection rule is intended to mean a link between a certain context of the vehicle 14 and/or one or more users 18 of the plurality of devices 12 and one or more instructions as to which device 12, if any, should be connected to the vehicle 14.

The rule may be positive in nature or negative in nature. A positive rule positively indicates that a device should be connected to the vehicle 14 in certain context conditions. A negative rule indicates that a device (or devices) should not be connected to the vehicle 14 in certain context situations.

Device connection rules may be automatically and/or manually defined.

Any suitable device connection rules may be applied. For example, a device connection rule may specify that on week days a first device or a first set of devices should be automatically

connected to the vehicle 14 and on the weekend a second, different device 12 or set of devices should be automatically connected to the vehicle 14.

Accordingly, context information 16 regarding the day of the week would allow the correct device 12 or devices to be automatically connected to the vehicle 14 following these device connection rules.

In examples, the device connection rules are predefined. The device connection rules may be stored in a data structure in one or more memories, such as the memory 42 and retrieved by the vehicle system controller 10 to allow determination as to whether a device connection rule applies to the determined context information 16.

In examples where no device connection rule can be found that applies to the current context the vehicle system controller 10 may resort to a default behavior. For example, the vehicle system controller 10 may initiate a connection to the last connected device 12 or devices.

At block 308 connection to one or more of the plurality of devices 12 in dependence on the determination of a device connection rule is initiated.

In examples, any suitable method for initiating connection to one or more of the plurality of devices 12 in dependence on the determination of a device connection rule may be used.

In some examples, the one or more transceivers 30 are controlled by the vehicle system controller 10 to initiate, and maintain, a connection with one or more of the plurality of devices 12. In some examples, a short range wireless connection is used to connect the device 12 or devices 12 to the vehicle 14.

This is advantageous as it allows an intelligent determination of the correct device or devices 12 to be automatically connected to a vehicle 14 in dependence on a context of the vehicle 14 and/or a context of a user 18 of the device 12.

For example, a user of the vehicle 14 may have a plurality of devices 12 each of which are connectable to the vehicle 14.

However, the user 18 may wish a first device 12 or a first set of devices to be connected to the vehicle on the way to work in the morning and a second, different device 12 or set of devices to be connected to the vehicle 14 on the way home from work and at the weekends.

Accordingly, device connection rules may be automatically or manually defined and stored linking weekday morning times with connection to the first device 12 or set of devices and weekday evening times and weekends with the second, different device 12 or set of devices.

This provides the technical benefit of automatically and intelligently connecting to an appropriate device 12 or devices without causing a user 18 to have to cancel and manually connect to a different device 12 or devices.

For example, this allows a vehicle 14 to be intelligently connected to a device 12 or devices without requiring a user 18 of the vehicle 14, such as the driver, to have to manually switch devices while the vehicle 14 is in motion.

Figs. 4A and 4B illustrate an example of a method 400. For example, the method 400 may be for controlling a vehicle system 28 such as the vehicle system illustrated in the example of Fig. 2.

In examples, the method 400 is performed by the vehicle system controller 10 of Fig. 1 or the vehicle system 28 of Fig. 2.

That is, in some examples, the vehicle system controller 10 of Fig. 1 or the vehicle system 28 of Fig. 2 comprise means for performing the method 400.

At block 402 one or more device connection rules are downloaded. That is, in examples the vehicle system controller 10 comprises means for downloading one or more device connection rules.

In examples, any suitable method for downloading one or more device connection rules may be used.

In some examples, the one or more transceivers 30 of Fig. 2 may be used to receive one or more signals comprising information to download one or more device connection rules to be stored in a memory or memories such as the memory 42 of the vehicle system controller 10.

For example, if a device user 18 is a driver of or a passenger in a new or previously unused vehicle 14, upon first connection of the device 12 of the user 18 to the vehicle 14 one or more device connection rules may be downloaded to the vehicle 14.

In some examples, a user 18 may use the one or more user interfaces 26 of the vehicle 14 to log into a profile to allow the vehicle 14 to download one or more device connection rules from a remote storage location.

In this way a new or previously unused vehicle 14 can be readily configured with a user's previously defined or learned device connection rules (see blocks 404 and 420).

At block 404 the method 400 comprises receiving user input defining one or more device connection rules.

In examples, any suitable method of receiving user input defining one or more device connection rules may be used. In some examples, the user may input one or more device connection rules using the one or more user interfaces 26 of Fig. 2.

In some examples, a user may input definitions of one or more device connection rules using a device connected to the vehicle 14.

For example, a user may use the one or more user interfaces 26 of a vehicle 14 to input rules into a calendar type application of the vehicle 14 to indicate which devices 12 should be automatically connected to the vehicle 14 at certain times on certain days/dates and so on.

At block 406 the method comprises determining whether at least one trigger event has occurred.

Any suitable method for determining whether at last one trigger event has occurred may be used. For example, the one or more sensors 32 and/or one or more transceivers 30 may be used to determine whether at least one trigger event has occurred.

As used herein, trigger event is intended to mean an event which triggers the vehicle system controller 10 to determine a plurality of devices connectable to a vehicle (see block 302 of Fig. 3 and block 408 of Fig. 4).

That is, in examples, the method comprises determining the plurality of devices 12 upon a determination that at least one trigger event has occurred.

In examples, the at least one trigger event comprises one or more of: a vehicle engine start, an engine start, a vehicle driver identification, one or more occupants approaching the vehicle 14, one or more occupants attempting to enter the vehicle 14, and one or more occupants entering the vehicle 14.

In examples, the determination of the occurrence of a trigger event comprises the one or more sensors 32 obtaining information and providing the information to the vehicle system controller 10. For example, the one or more sensors 32 may detect a vehicle engine start, an engine start and/or provide information allowing an indication of a vehicle driver and so on.

Additionally or alternatively, the one or more transceivers 30 may be used to determine whether at least one trigger event has occurred. For example, the one or more transceivers 30 may be used to receive one or more signals comprising information to allow vehicle driver identification or detection of one or more occupants approaching the vehicle 14 or one or more occupants entering the vehicle 14 either alone or in combination with the one or more sensors 32.

Blocks 408, 410 and 412 are the same as blocks 302, 304 and 306 described in relation to Fig. 3. Accordingly, blocks 408, 410 and 412 may be as described in relation to Fig. 3.

However, in Fig. 4A block 408 occurs upon determination that at least one trigger event has occurred.

Accordingly, the method 400 comprises determining the plurality of devices 12 upon a determination that at least one trigger event has occurred.

At block 414 the method comprises initiating at least one output to a user 18 of the vehicle 14 prior to initiating connection to a device 12. In examples, any suitable method for initiating at least one output to a user 18 of the vehicle 14 prior to initiating connection to a device 12 may used.

In some examples, the vehicle system controller 10 controls the at least one user interface 26 to provide at least one output to a user 18 of a vehicle 14 prior to initiating connection to a device or devices 12.

In some examples, the at least one output may comprise a notification that connection to a particular device 12 or devices is to be initiated. This allows a user 18 to become involved if the user wishes to do so, otherwise connection to the device or devices 12 will be initiated at block 416.

In some examples, such as the example illustrated in Fig. 4A, the at least one output to a user 18 comprises a check that requires user input. See, for example, Fig. 5.

If the user provides an input, for example to the one or more user interfaces 26, authorising the connection to the device 12 the method moves to block 416 which is the same as block 308 of Fig. 3 and therefore may be as described in relation to Fig. 3.

If the user rejects connections to the suggested device 12, the method 400 proceeds to block 418.

At block 418 the method 400 may end or the method 400 may resort to default behaviour regarding connection of a device 12 or devices to the vehicle 14.

Additionally or alternatively, at block 418 a further user output may be provided requesting an indication as to which device 12 or devices should be connected to the vehicle 14.

At block 420 the method comprises determining a user 18 changing a device 12 connected to the vehicle 14 and determining context information of at least one of the vehicle 14 and one or more users 18 of a device 12 when the device change occurs.

In examples, any suitable method for determining a user changing a device 12 connected to the vehicle 14 may be used. For example, the vehicle system controller 10 may receive user input via the one or more user interfaces 26 to control the vehicle system controller 10 to connect to a particular device 12 that is different to a device 12 currently connected or to be connected.

In examples, when it is determined that a user 18 is changing and/or has changed a device 12 connected to the vehicle 14 the context of the vehicle 14 and/or one or more users of a device 12 may be obtained. Determination of the context information 16 may be as described in relation to block 304 of Fig. 3.

The vehicle system controller 10 may keep a record in a data structure in at least one memory 42 recording the context and the identification of a device 12 that was selected. The vehicle system controller 10 may then automatically generate one or more device connection rules and/ or update one or more device connection rules in dependence upon the change of device 12 and the context information 16.

In some examples, a device connection rule may be created after a predetermined number of device changes under a particular context.

For example, if a user 18 repeatedly changes connection to a different device 12 at a certain time of day the vehicle system controller 10 may create a device connection rule linking the different device 12 to the time of day for subsequent automatic connection under that context.

In some examples, a device connection rule may be created by the vehicle system controller 10 upon a single change of device.

This is advantageous as it allows the vehicle system controller 10 to automatically determine device connection rules in dependence on the user's behavior under certain context situations.

Fig. 5 illustrates an example of a method 300, 400. For example, the method 300, 400 is for controlling a vehicle system 28 and may be as described in relation to Fig. 3 and/or Figs. 4A and 4B.

In part A of Fig. 5 a vehicle 14 is schematically illustrated.

The vehicle 14 comprises a vehicle system controller 10 as described in relation to Fig. 1 and a vehicle system 28 described in relation to Fig. 2 (not explicitly illustrated in Fig. 5).

The vehicle 14 comprises an engine 44. Two users 18 are present in the vehicle 14, user A and user B. User A is, in the illustrated example, the driver of the vehicle 14.

User A and user B are both carrying devices 12 which, in Fig. 5, are mobile telephones. User A is carrying device A and user B is carrying device B.

The vehicle 14 is used by user A during the week and therefore the device of user A is the last device 12 connected to the vehicle 14.

In part A of Fig. 5 a trigger event 20 has occurred. In the example of Fig. 5 the trigger event is the engine 44 starting.

In part A of the example of Fig. 5 the vehicle system controller 10, using the one or more sensors 32, has determined that the trigger event has occurred.

In part B of the example of Fig. 5 the vehicle system controller 10 is determining a plurality of devices 12 connectable to the vehicle 14.

In part B of the example of Fig. 5 the vehicle system controller 10 is using the one or more transceivers 30 to exchange one or more signals 22 with the devices 12 of user A and user B. This is illustrated in part B of Fig. 5 by the wavy line between the vehicle system controller 10 and device A, and by the wavy line between the vehicle system controller 10 and device B.

In the example of Fig. 5 the devices 12 have provided identifiers 20 in one or more signals 22 sent to the vehicle system controller 10 via the one or more transceivers 30.

Accordingly, in the example of Fig. 5 the determination of the plurality of devices 12 connectable to a vehicle 14 comprises determining the plurality of devices 12 within a range of the vehicle 14 and connectable to the vehicle 14.

At part C of the example of Fig. 5 the vehicle system controller 10 is determining context information 16 of the vehicle 14 and users A and B in the vehicle 14.

In the example of Fig. 5, the vehicle system controller 10 is using the one or more sensors 32 and one or more transceivers 30 to determine the context information 16.

In part C of Fig. 5 the vehicle system controller 10 determines from one or more received signals that it is Saturday morning.

At part C of the example of Fig. 5 the vehicle system controller 10 also determines whether a device connection rule applies to the determined context information 16.

In the illustrated example the vehicle system controller 10 retrieves the predefined device connection rules from a memory 42. In the example of Fig. 5 a device connection rule exists specifying that at the weekend the device 12 of user B should be automatically connected to the vehicle 14.

In part D of the example of Fig. 5 the vehicle system controller 10 initiates an output prior to initiating connection to device B. As can be seen in part D of the example of Fig. 5 the output queries whether a connection to device B should be made.

In the example of Fig. 5 user A responds by indicating positively that device B should be connected to. In other examples the output illustrated at part D of Fig. 5 may be for informing the users that device B will be connected to.

In some examples part D of the example of Fig. 5 may be omitted and device B automatically connected to without any output to the users 18 and/or input required from the users 18.

In part E of the example of Fig. 5, the vehicle system controller 10 initiates connection to device B using a wireless connection 24.

Accordingly, in this way the vehicle system controller 10 has intelligently connected to device B in dependence upon determined context information 16 instead of simply connecting to the previously connected device A.

This is advantageous and provides technical benefits as it allows for an improved and efficient connection of user devices 12 to a vehicle 14.

Fig. 6 illustrates an example of a vehicle 14. In the illustrated example, the vehicle 14 comprises a vehicle system controller 10 as described in relation to Fig. 1 and/or a vehicle system 28 as described in relation to Fig. 2.

As used herein “for” should be considered to also include “configured or arranged to”. For example, a “vehicle system controller for” should be considered to also include “a vehicle system controller configured or arranged to”.

For purposes of this disclosure, it is to be understood that the controller(s) described herein can each comprise a control unit or computational device having one or more electronic processors. A vehicle and/or a system thereof may comprise a single control unit or electronic controller or alternatively different functions of the controller(s) may be embodied in, or hosted in, different control units or controllers. A set of instructions could be provided which, when executed, cause said controller(s) or control unit(s) to implement the control techniques described herein (including the described method(s)). The set of instructions may be embedded in one or more electronic processors, or alternatively, the set of instructions could be provided as software to be executed by one or more electronic processor(s). For example, a first controller may be implemented in software run on one or more electronic processors, and one or more other controllers may also be implemented in software run on or more electronic processors, optionally the same one or more processors as the first controller. It will be appreciated, however, that other arrangements are also useful, and therefore, the present disclosure is not intended to be limited to any particular arrangement. In any event, the set of instructions described above may be embedded in a computer-readable storage medium (e.g., a non-transitory storage medium) that may comprise any

mechanism for storing information in a form readable by a machine or electronic processors/computational device, including, without limitation: a magnetic storage medium (e.g., floppy diskette); optical storage medium (e.g., CD-ROM); magneto optical storage medium; read only memory (ROM); random access memory (RAM); erasable programmable memory (e.g., EPROM ad EEPROM); flash memory; or electrical or other types of medium for storing such information/instructions.

As used here 'module' refers to a unit or apparatus that excludes certain parts/components that would be added by an end manufacturer or a user.

The blocks illustrated in Figs. 3, 4A and 4B may represent steps in a method and/or sections of code in the computer program 34. The illustration of a particular order to the blocks does not necessarily imply that there is a required or preferred order for the blocks and the order and arrangement of the block may be varied. Furthermore, it may be possible for some steps to be omitted. For example, block 402 and/or 404 of Fig. 4A may be omitted.

Where a structural feature has been described, it may be replaced by means for performing one or more of the functions of the structural feature whether that function or those functions are explicitly or implicitly described.

The term "comprised" is used in this document with an inclusive not an exclusive meaning. That is any reference to X comprising Y indicates that X may comprise only one Y or may comprise more than one Y. If it is intended to use "comprise" with an exclusive meaning than it will be made clear in the context by referring to "comprising only one ..." or by using " consisting".

Although embodiments of the present invention have been described in the preceding paragraphs with reference to various examples, it should be appreciated that modifications to the examples given can be made without departing from the scope of the invention as claimed.

Features described in the preceding description may be used in combinations other than the combinations explicitly described.

Although functions have been described with reference to certain features, those functions may be performable by other features whether described or not.

Although features have been described with reference to certain embodiments, those features may also be present in other embodiments whether described or not.

Whilst endeavoring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

CLAIMS

1. A vehicle system controller comprising means for:

determining a plurality of devices connectable to a vehicle;

determining context information of at least one of the vehicle and one or more users of the plurality of devices;

determining whether a device connection rule applies to the determined context information;

initiating connection to one or more of the plurality of devices in dependence on the determination of a device connection rule;

determining a user changing a device connected to the vehicle; and

determining context information of at least one of the vehicle and one or more users of a device when the device change occurs.

2. A vehicle system controller as claimed in claim 1, comprising means for determining whether at least one trigger event has occurred, wherein the means for determining a plurality of devices connectable to a vehicle is configured to determine the plurality of devices upon determination that at least one trigger event has occurred.

3. A vehicle system controller as claimed in claim 2, wherein the at least one trigger event comprises one or more of: a vehicle start, an engine start, a vehicle driver identification, one or more occupants approaching the vehicle, one or more occupants attempting to enter the vehicle, and one or more occupants entering the vehicle.

4. A vehicle system controller as claimed in any preceding claim, wherein the means for determining a plurality of devices connectable to the vehicle comprises means for retrieving a list of devices previously connected to the vehicle.

5. A vehicle system controller as claimed in any of claims 1 to 3, wherein the means for determining a plurality of devices connectable to the vehicle comprises means for detecting devices within a range of the vehicle and connectable to the vehicle .

6. A vehicle system controller as claimed in claim 5, wherein the means for determining a plurality of devices connectable to the vehicle comprises means for receiving one or more identifiers from the plurality of devices within the range and connectable to the vehicle.

7. A vehicle system controller as claimed in any preceding claim, wherein at least one of the plurality of devices is connectable to the vehicle by a wired and/or wireless connection.

8. A vehicle system controller as claimed in any preceding claim, wherein context information comprises at least one of: location information, passenger information, time information, date information, weather information, schedule information, calendar information, and route information.

9. A vehicle system controller as claimed in any preceding claim, comprising means for receiving a user input defining one or more device connection rules.

10. A vehicle system controller as claimed in any preceding claim, comprising means for updating one or more device connection rules in dependence on the context information when the device change occurs.

11. A vehicle system controller as claimed in any preceding claim, comprising means for generating one or more device connection rules in dependence on the change of device and the context information when the device change occurs.

12. A vehicle system controller as claimed in claim 11, comprising means for generating a device connection rule after a predetermined number of device changes under a particular context.

13. A vehicle system controller as claimed in any preceding claim, comprising means for initiating at least one output to a user of the vehicle prior to initiating connection to a device or devices.

14. A vehicle system controller as claimed in any preceding claim, comprising means for downloading one or more device connection rules.

15. A vehicle system controller as claimed in any preceding claim, wherein the device connection rules are predefined.

16. A method of controlling a vehicle system, comprising:

determining a plurality of devices connectable to a vehicle;

determining context information of at least one of the vehicle and one or more users of the plurality of devices;

determining whether a device connection rule applies to the determined context information;

initiating connection to one or more of the plurality of devices in dependence on the determination of a device connection rule

determining a user changing a device connected to the vehicle; and

determining context information of at least one of the vehicle and one or more users of a device when the device change occurs.

17. A method as claimed in claim 16, comprising determining the plurality of devices upon a determination that at least one trigger event has occurred.

18. A method as claimed in claim 17, wherein the at least one trigger event comprises one or more of: a vehicle engine start, an engine start, a vehicle driver identification, one or more occupants approaching the vehicle, one or more occupants attempting to enter the vehicle and one or more occupants entering the vehicle.

19. A method as claimed in any of claims 16 to 18, wherein determining a plurality of devices connectable to the vehicle comprises retrieving a list of devices previously connected to the vehicle.

20. A method as claimed in any of claims 16 to 18, wherein determining a plurality of devices connectable to the vehicle comprises detecting devices within a range of the vehicle and connectable to the vehicle.

21. A method as claimed in claim 20, wherein determining a plurality of devices connectable to the vehicle comprises receiving one or more identifiers from the plurality of devices within the range and connectable to the vehicle.

22. A method as claimed in any of claims 16 to 21, wherein at least one of the plurality of devices is connectable to the vehicle by a wired and/or wireless connection.

23. A method as claimed in any of claims 16 to 22, wherein context information comprises at least one of: location information, passenger information, time information, date information, weather information, schedule information, calendar information and route information.

24. A method as claimed in any of claims 16 to 23, comprising receiving a user input defining one or more device connection rules.

25. A method as claimed in any of claims 16 to 24, comprising updating one or more device connection rules in dependence on the context information when the device change occurs.

26. A method as claimed in any of claims 16 to 25, comprising initiating at least one output to a user of the vehicle prior to initiating connection to a device.

27. A vehicle system comprising a vehicle system controller as claimed in at least one of claims 1 to 15 and at least one transceiver.

28. A vehicle comprising a vehicle system controller as claimed in at least one of claims 1 to 15 and/or a vehicle system as claimed in claim 27.

29. A computer program comprising instructions that, when executed by one or more processors, cause a system to perform, at least the method as claimed in at least one of claims 16 to 26.

30. A non-transitory computer readable media comprising a computer program as claimed in claim 29.

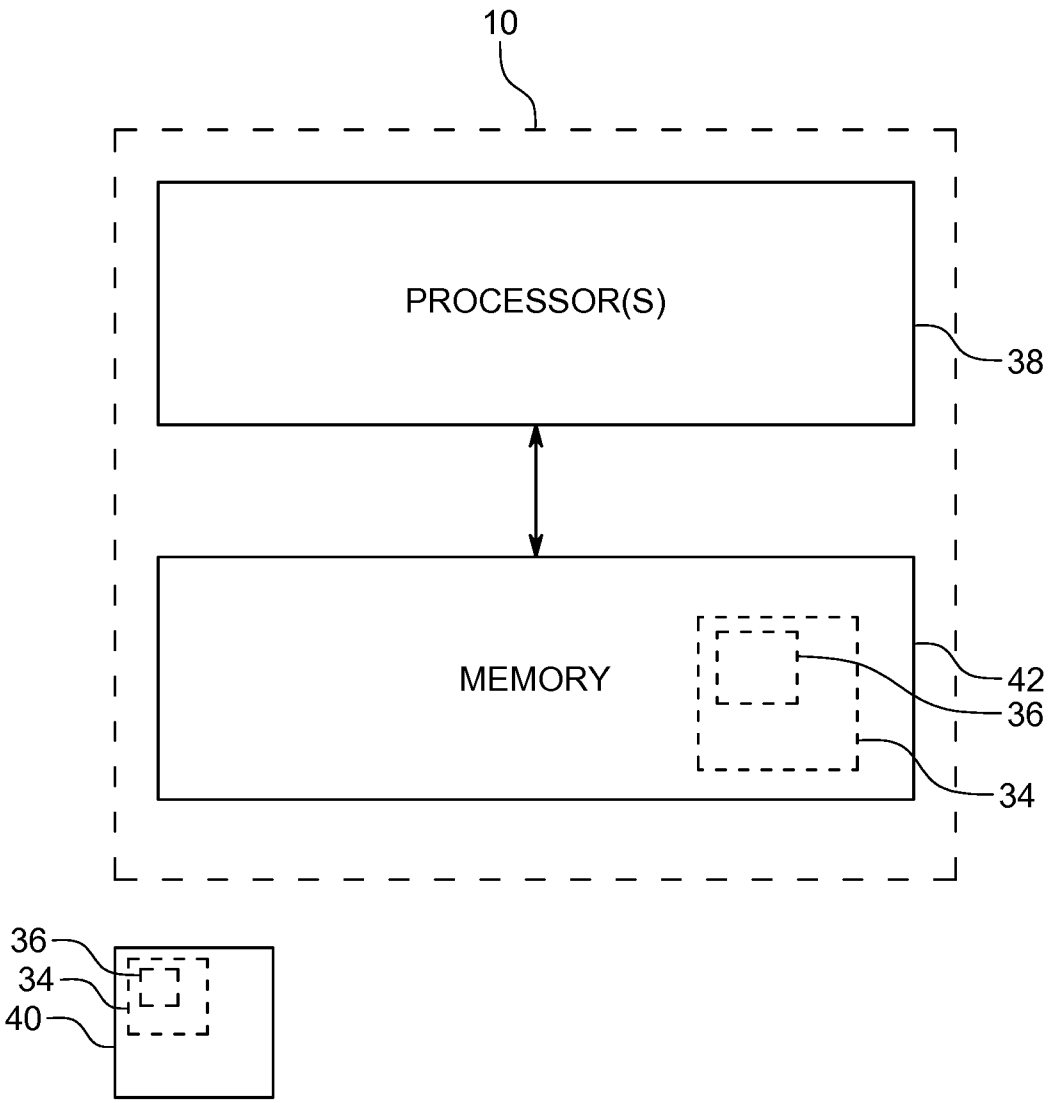


FIG. 1

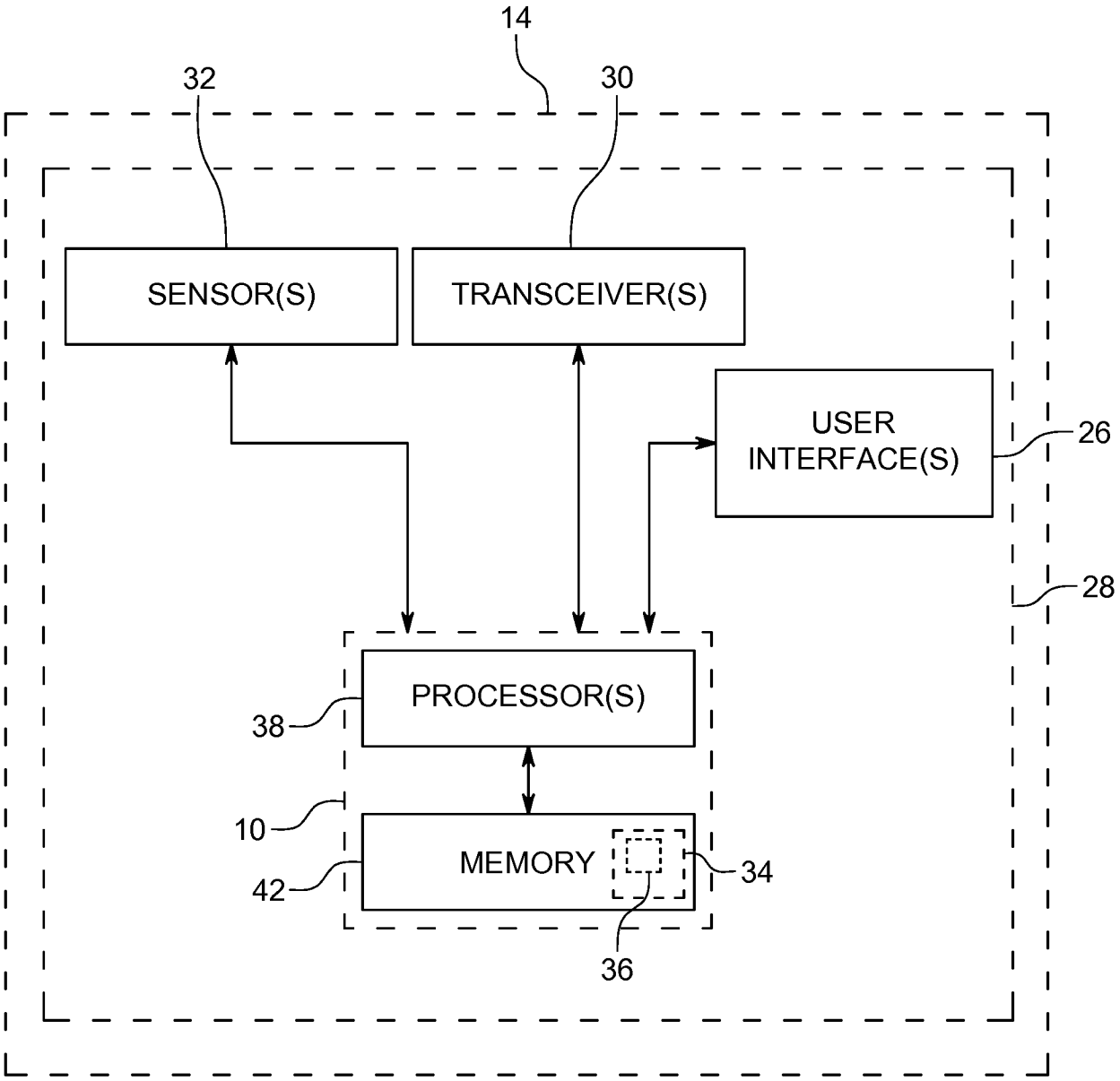

14
32
30
SENSOR(S)
TRANSCEIVER(S)
USER INTERFACE(S)
26
28
PROCESSOR(S)
38
10
MEMORY
34
42
36

FIG. 2

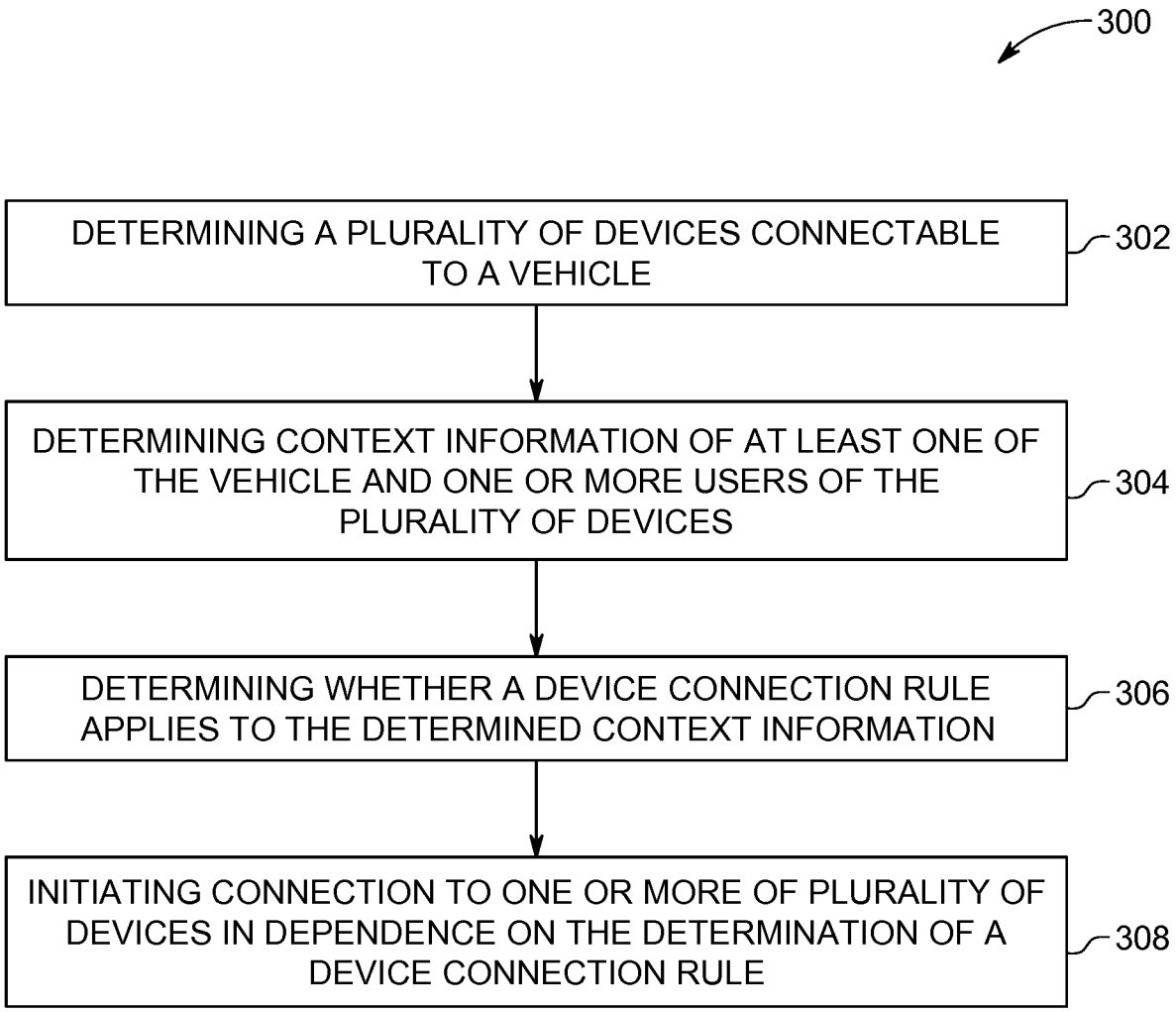

300
DETERMINING A PLURALITY OF DEVICES CONNECTABLE TO A VEHICLE
302
DETERMINING CONTEXT INFORMATION OF AT LEAST ONE OF THE VEHICLE AND ONE OR MORE USERS OF THE PLURALITY OF DEVICES
304
DETERMINING WHETHER A DEVICE CONNECTION RULE APPLIES TO THE DETERMINED CONTEXT INFORMATION
306
INITIATING CONNECTION TO ONE OR MORE OF PLURALITY OF DEVICES IN DEPENDENCE ON THE DETERMINATION OF A DEVICE CONNECTION RULE
308

FIG. 3

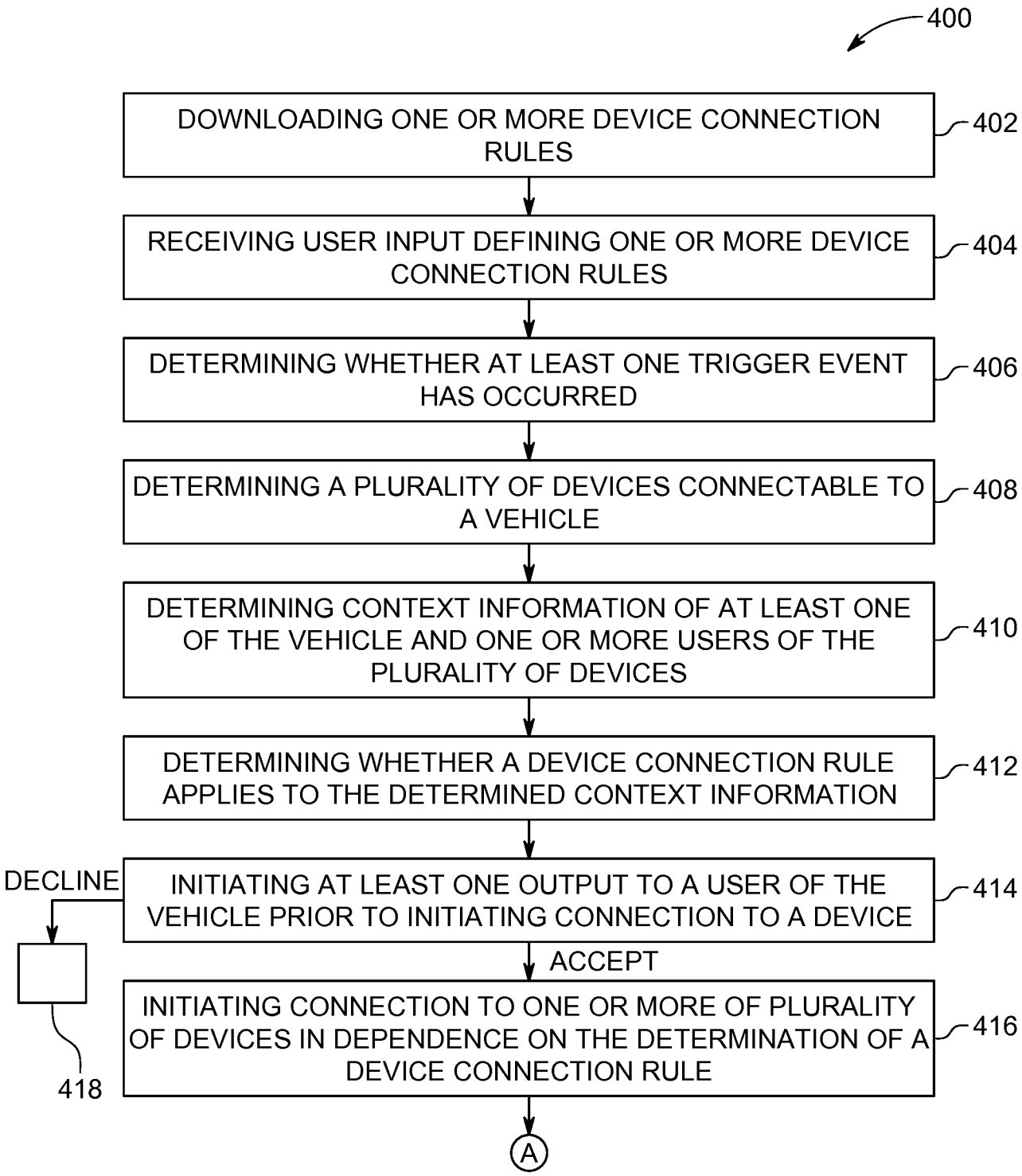

400
DOWNLOADING ONE OR MORE DEVICE CONNECTION RULES
402
RECEIVING USER INPUT DEFINING ONE OR MORE DEVICE CONNECTION RULES
404
DETERMINING WHETHER AT LEAST ONE TRIGGER EVENT HAS OCCURRED
406
DETERMINING A PLURALITY OF DEVICES CONNECTABLE TO A VEHICLE
408
DETERMINING CONTEXT INFORMATION OF AT LEAST ONE OF THE VEHICLE AND ONE OR MORE USERS OF THE PLURALITY OF DEVICES
410
DETERMINING WHETHER A DEVICE CONNECTION RULE APPLIES TO THE DETERMINED CONTEXT INFORMATION
412
DECLINE
INITIATING AT LEAST ONE OUTPUT TO A USER OF THE VEHICLE PRIOR TO INITIATING CONNECTION TO A DEVICE
414
ACCEPT
INITIATING CONNECTION TO ONE OR MORE OF PLURALITY OF DEVICES IN DEPENDENCE ON THE DETERMINATION OF A DEVICE CONNECTION RULE
416
418
A

FIG. 4A

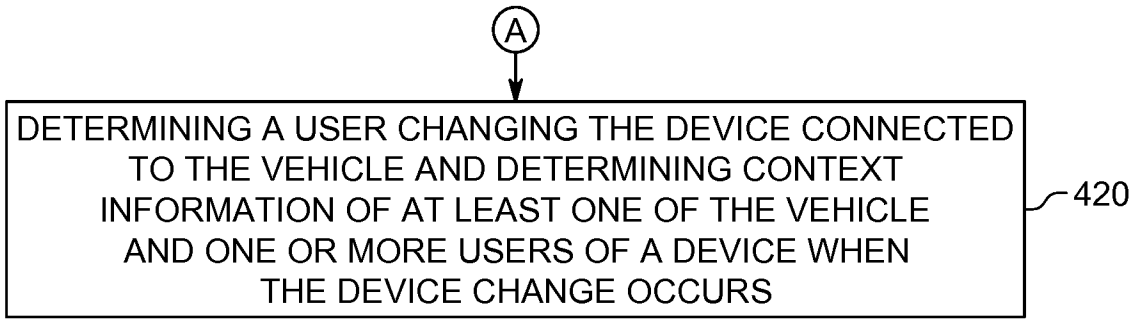

A
DETERMINING A USER CHANGING THE DEVICE CONNECTED TO THE VEHICLE AND DETERMINING CONTEXT INFORMATION OF AT LEAST ONE OF THE VEHICLE AND ONE OR MORE USERS OF A DEVICE WHEN THE DEVICE CHANGE OCCURS
420

FIG. 4B

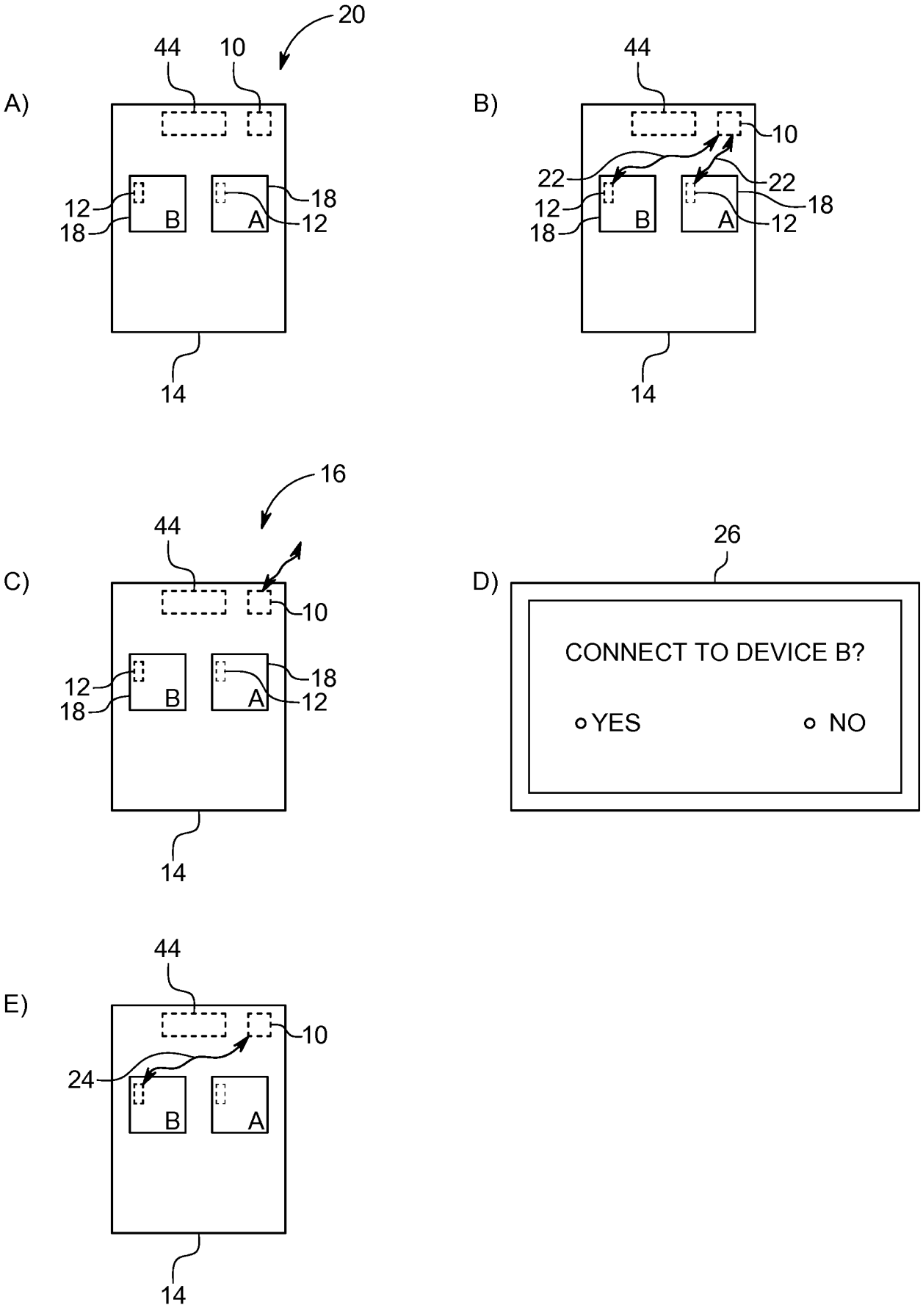

A)
20
44
10
12
18
B
A
18
12
14
B)
44
10
22
22
12
18
B
A
18
12
14
C)
16
44
10
12
18
B
A
18
12
14
D)
26
CONNECT TO DEVICE B?
YES
NO
E)
44
10
24
B
A
14

FIG. 5

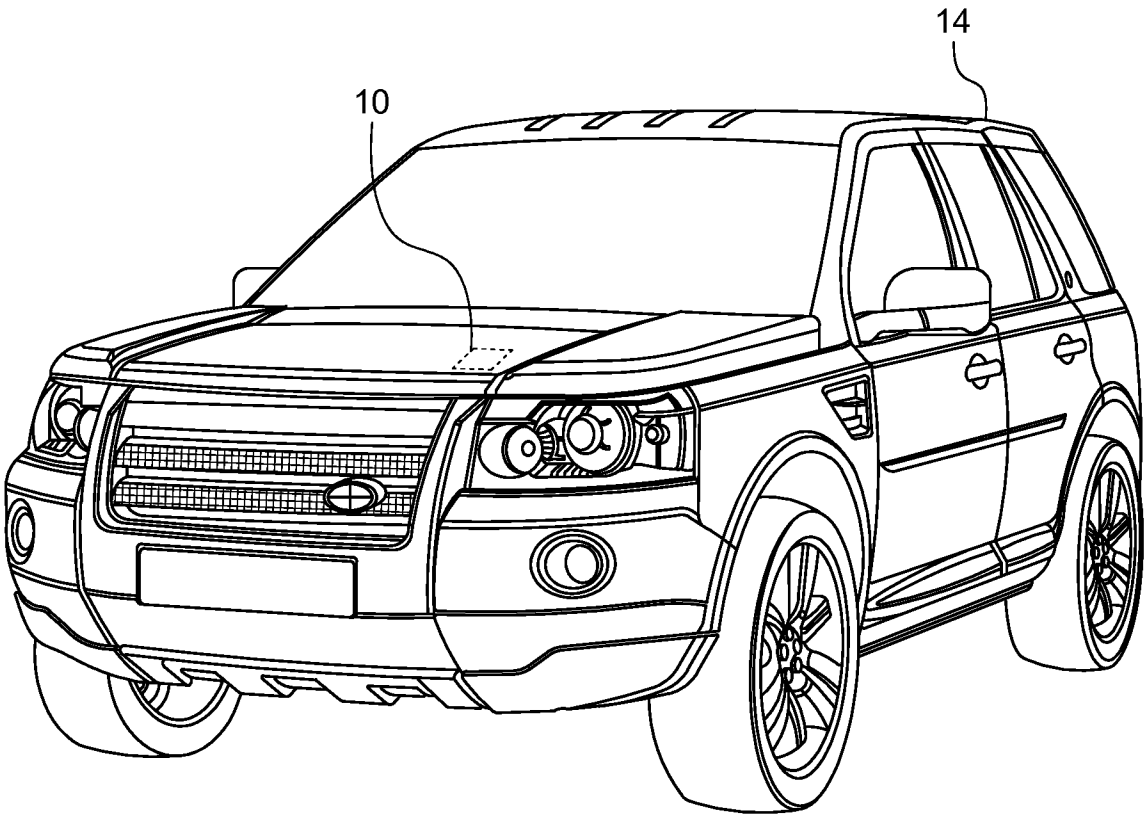


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/063682

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04M1/60 H04M1/725
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04M

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/018000 A1 (SEYMOUR SHAFER [US] ET AL) 16 January 2014 (2014-01-16) abstract figures 2-4 paragraph [0002] paragraph [0009] paragraph [0011] - paragraph [0015] paragraph [0017] - paragraph [0026] paragraph [0028] - paragraph [0033] ----- -/--	1-30

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 June 2018	26/06/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Kim-Mayser, Michael

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/063682

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2011/109344 A1 (JOHNSON CONTROLS TECH CO [US]; ANDERSON ELISABET A [US]; ZEINSTRA MARK) 9 September 2011 (2011-09-09) abstract figures 2,3 paragraph [0002] paragraph [0007] - paragraph [0008] paragraph [0011] - paragraph [0016] paragraph [0021] paragraph [0031] - paragraph [0033] -----	1-30
A	US 2012/161927 A1 (PIERFELICE JEFFREY EDWARD [US] ET AL) 28 June 2012 (2012-06-28) the whole document -----	1-30

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2018/063682

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014018000 A1	16-01-2014	CN 103546941 A	29-01-2014
		DE 102013212941 A1	16-01-2014
		GB 2506920 A	16-04-2014
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