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(54) **DISPLAYING INDICATIONS CORRESPONDING TO SETTINGS OF HARDWARE VEHICLE CONTROLS**

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(52) **U.S. Cl.**

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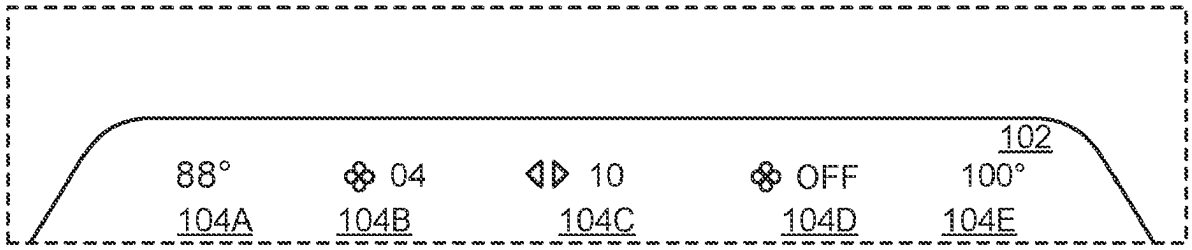
(57) **ABSTRACT**

A computer-based method comprises: receiving, in a computer system of a vehicle, an input generated by user interaction with any of a plurality of hardware controls in the vehicle, the plurality of hardware controls corresponding to respective vehicle systems; and presenting, in response to the input, a container on a display device of the vehicle, the container configured for displaying indications that correspond to and reflect present settings of each of the plurality of hardware controls.



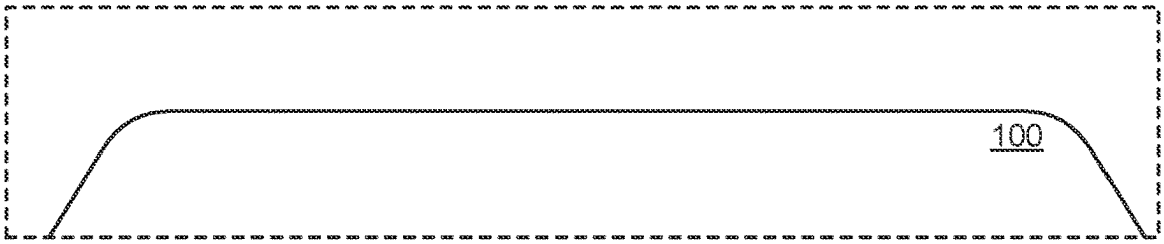


FIG. 1A

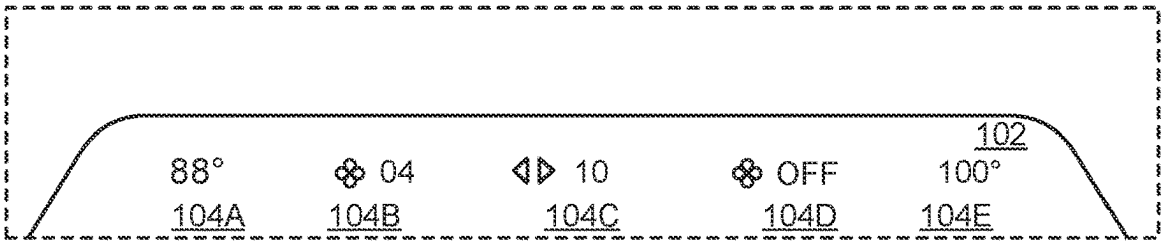


FIG. 1B

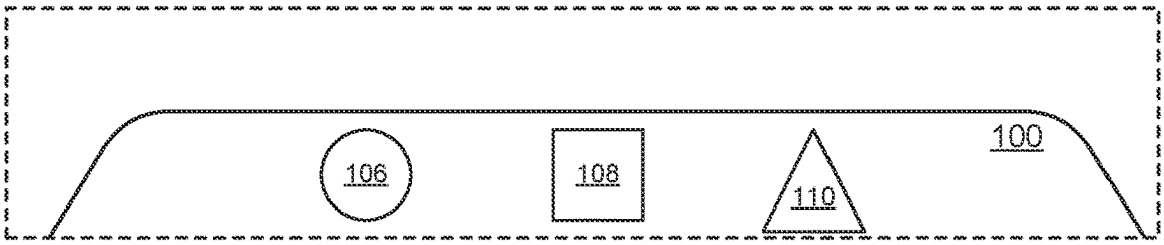


FIG. 1C

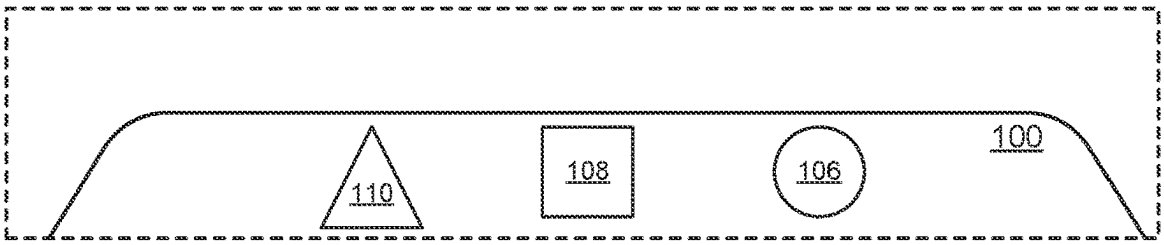


FIG. 1D

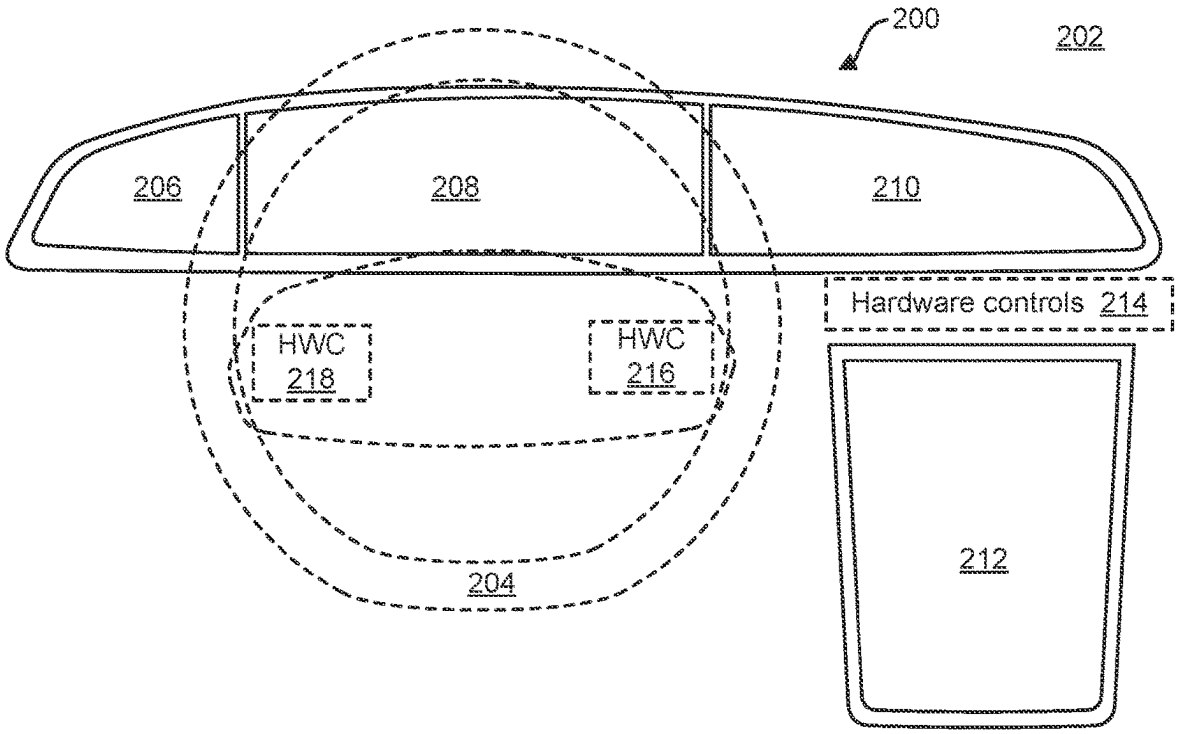

200
202
206
208
210
Hardware controls 214
HWC 218
HWC 216
212
204

FIG. 2

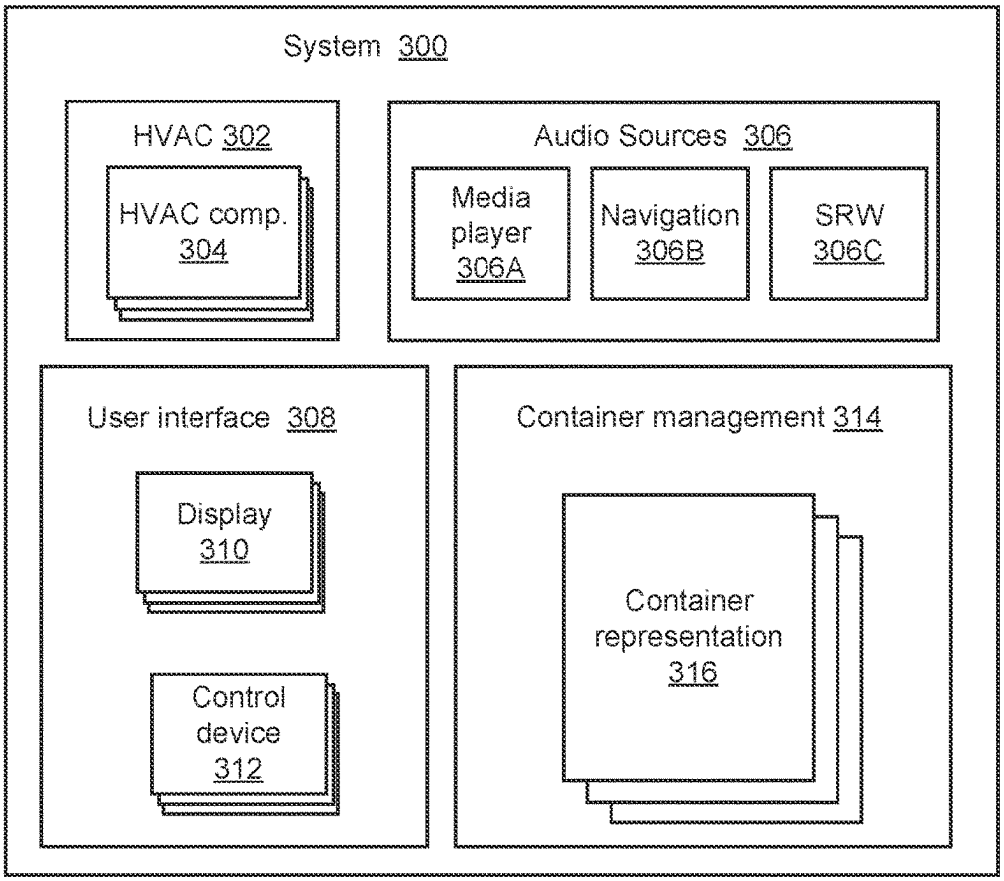


FIG. 3

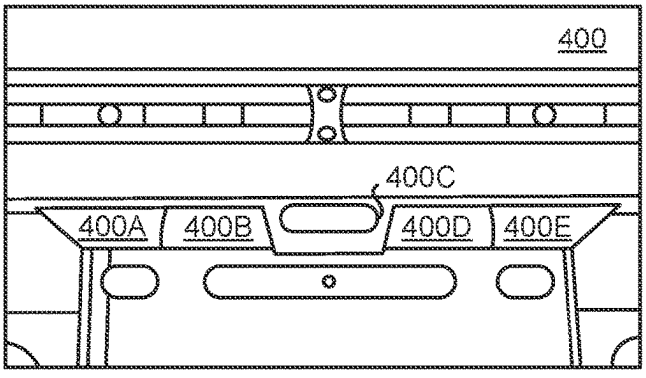


FIG. 4

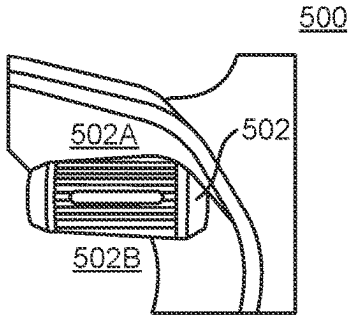


FIG. 5

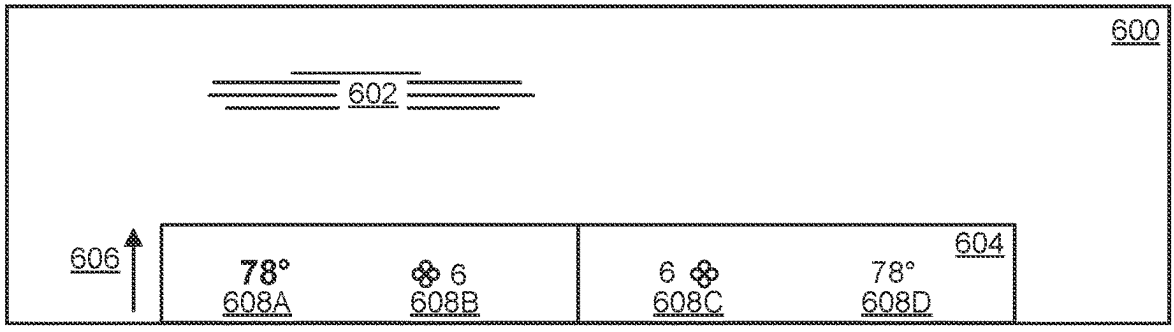


FIG. 6A

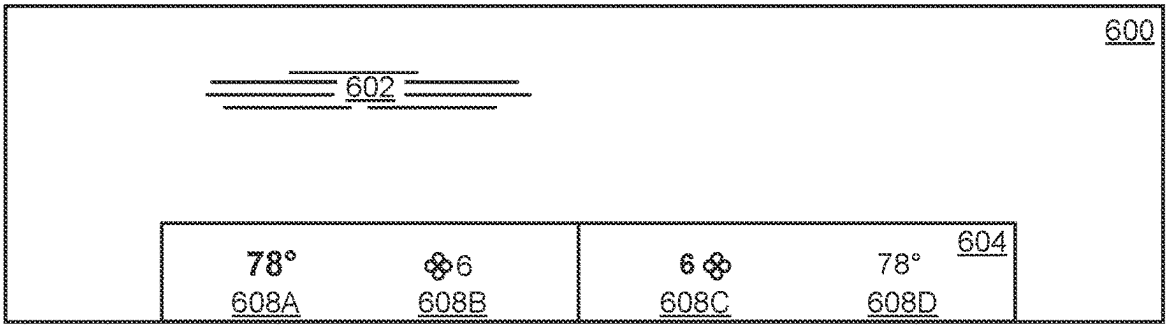


FIG. 6B

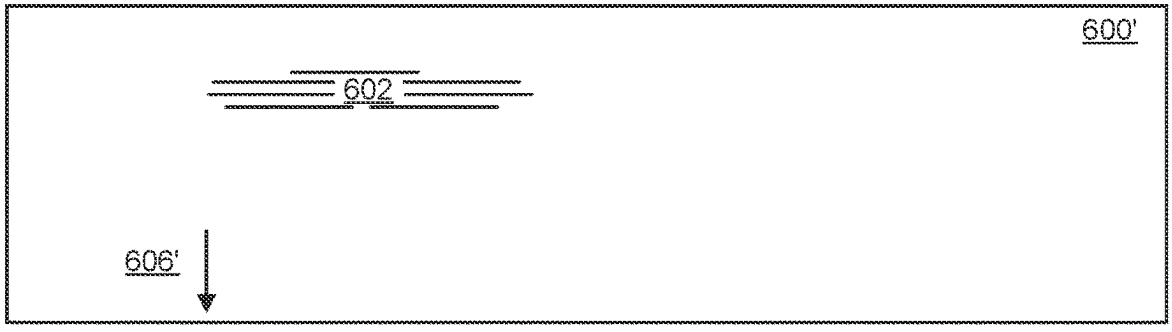


FIG. 6C

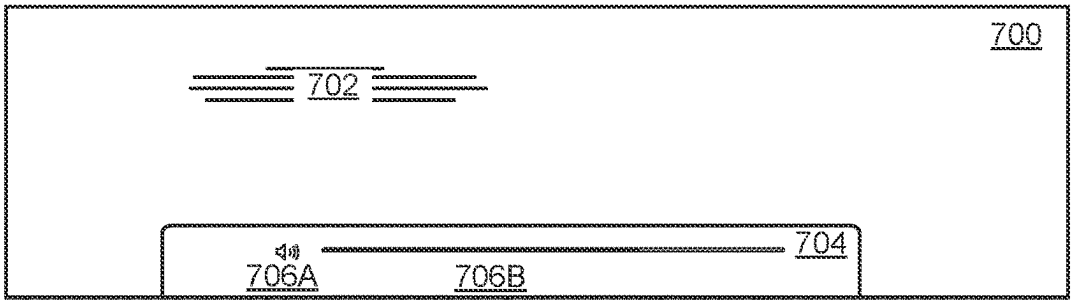


FIG. 7A

FIG. 7B

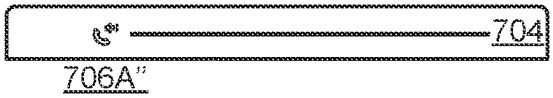


FIG. 7C

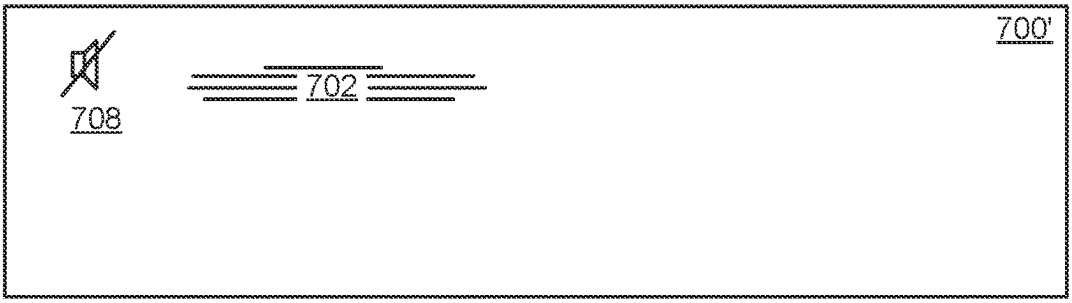


FIG. 7D

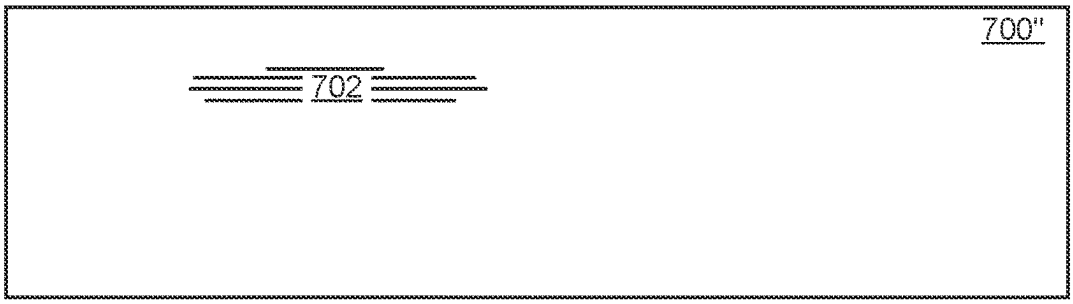


FIG. 7E

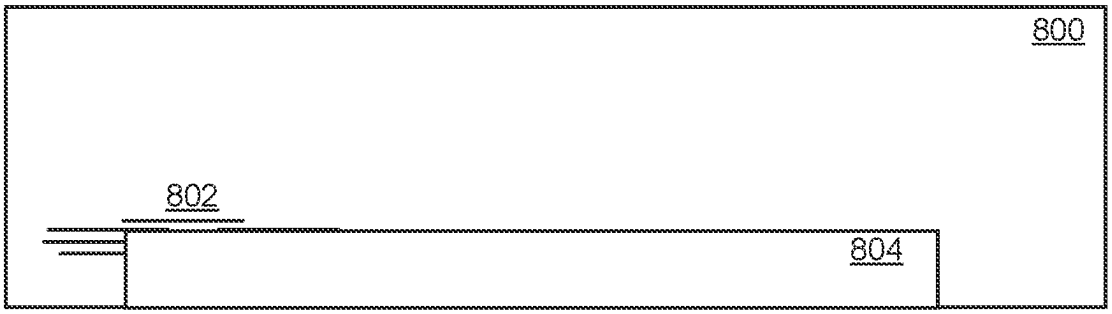


FIG. 8A

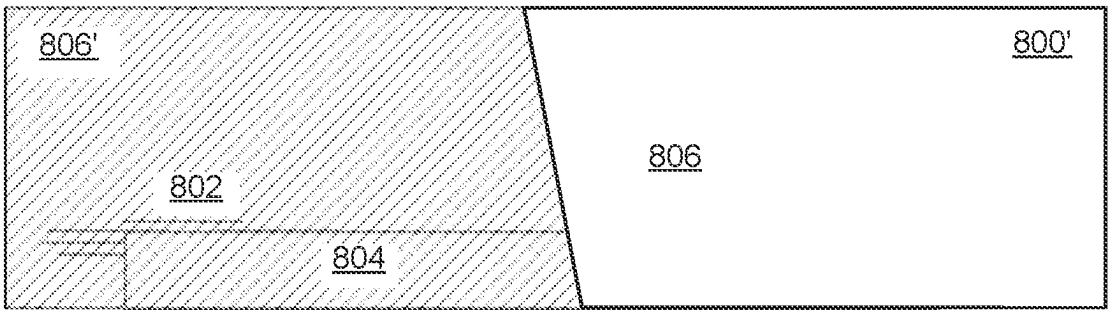


FIG. 8B

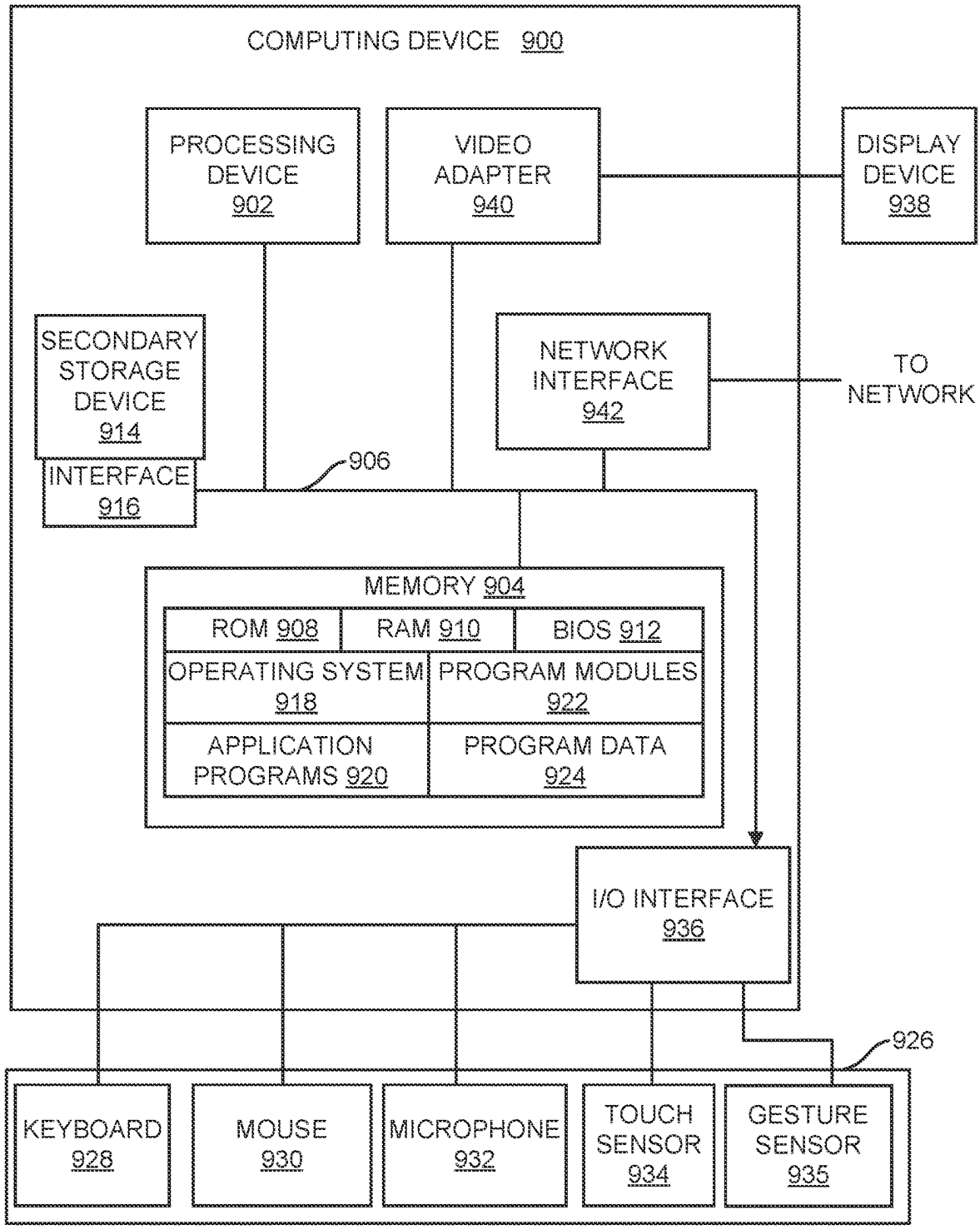

COMPUTING DEVICE 900
PROCESSING DEVICE 902
VIDEO ADAPTER 940
DISPLAY DEVICE 938
SECONDARY STORAGE DEVICE 914
INTERFACE 916
906
NETWORK INTERFACE 942
TO NETWORK
MEMORY 904
ROM 908
RAM 910
BIOS 912
OPERATING SYSTEM 918
PROGRAM MODULES 922
APPLICATION PROGRAMS 920
PROGRAM DATA 924
I/O INTERFACE 936
926
KEYBOARD 928
MOUSE 930
MICROPHONE 932
TOUCH SENSOR 934
GESTURE SENSOR 935

FIG. 9

DISPLAYING INDICATIONS CORRESPONDING TO SETTINGS OF HARDWARE VEHICLE CONTROLS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Patent Application No. 63/263,142, filed on Oct. 27, 2021, and entitled "DISPLAYING INDICATIONS CORRESPONDING TO SETTINGS OF HARDWARE VEHICLE CONTROLS," the disclosure of which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] This document relates to displaying indications corresponding to settings of hardware vehicle controls.

BACKGROUND

[0003] As new models and types of vehicles are developed, they are provided with progressively newer features and functions. One feature that has gained popularity is to have a display device that supports user interaction. However, the usability features may be somewhat unintuitive and as a result the user experience may be negatively impacted.

SUMMARY

[0004] In an aspect, a computer-based method comprises: receiving, in a computer system of a vehicle, an input generated by user interaction with any of a plurality of hardware controls in the vehicle, the plurality of hardware controls corresponding to respective vehicle systems; and presenting, in response to the input, a container on a display device of the vehicle, the container configured for displaying indications that correspond to and reflect present settings of each of the plurality of hardware controls.

[0005] Implementations can include any or all of the following features. The vehicle has multiple containers for presentation on the display device, the method further comprising selecting the container from among the multiple containers for presentation, the container selected based on the received input. The container selected from among the multiple containers is a volume control container. The plurality of hardware controls includes multiple hardware volume controls, wherein each of the multiple hardware volume controls is configured for increasing and decreasing volume of audio in the vehicle, and wherein the volume control container is presented in response to the user interaction occurring with any of the multiple hardware volume controls. At least one of the multiple hardware volume controls is a roller control, and wherein at least another one of the multiple hardware volume controls is a toggle control. At least one of the multiple hardware volume controls is positioned on a steering wheel of the vehicle, and wherein at least another one of the multiple hardware volume controls is positioned on an instrument panel of the vehicle. The volume control container is presented in response to user interaction with a hardware volume control, and wherein the hardware volume control is configured for controlling whichever one of multiple sound sources in the vehicle that is presently in focus. The volume control container is presented with a respective icon corresponding to a corresponding one of the multiple sound sources. The volume control container has a different numbers of volume control stops for at least some of the multiple sound sources. The multiple sound sources include at least master audio, navigation audio, and short-range wireless audio. The master audio comprises an overall sound of the vehicle. The navigation audio comprises sound that a navigation component is outputting to a sound mixer of the vehicle. The short-range wireless audio comprises sound that a portable electronic device is outputting to a sound mixer of the vehicle by short-range wireless communication. The indication in the volume control container is a slider reflecting a present volume setting. Volume is muted in the vehicle before the input is received, wherein the input corresponds to an increase volume command, and wherein the volume control container when presented indicates that the volume is unmuted. The container selected from among the multiple containers is a heating, ventilation, and air conditioning (HVAC) control container. The plurality of hardware controls includes multiple hardware HVAC controls, wherein the indications in the HVAC control container include multiple HVAC values corresponding to present settings of the multiple hardware HVAC controls, and wherein the HVAC control container is presented in response to the user interaction occurring with any of the multiple hardware HVAC controls. At least one of the multiple hardware HVAC controls is a toggle control. At least one of the multiple hardware HVAC controls is positioned on an instrument panel of the vehicle. A first control of the multiple hardware HVAC controls is dedicated to a left-side passenger of the vehicle, wherein a second control of the multiple hardware HVAC controls is dedicated to a right-side passenger of the vehicle, and wherein the first and second controls are independent of each other. The computer-based method further comprises highlighting in the HVAC control container one of the multiple HVAC values corresponding to the one of the multiple hardware HVAC controls with which the user interaction occurs. The HVAC control container supports simultaneous user interaction using more than one of the multiple hardware HVAC controls. The computer-based method further comprises highlighting those of the multiple HVAC values corresponding to the more than one of the multiple hardware HVAC controls. While the container selected based on the received input is presented, the method further comprises receiving another input generated by another user interaction with another of the plurality of hardware controls, and in response to the other input, replacing content of the container to correspond to the other of the plurality of hardware controls. The content is replaced without ceasing to present the container. Replacing the content comprises ceasing to present the container, and thereafter again presenting the container to include the replaced content. The display device comprises a touchscreen input control. The touchscreen input control is configured for controlling a setting of at least one of the vehicle systems, and wherein the container is not presented upon controlling the setting of the vehicle system using the touchscreen input control. The computer-based method further comprises ceasing to present the container in response to a gesture detected by the touchscreen input control. The computer system presents content on the display device, and wherein the container is presented on top of at least some of the content. The content includes modal content, and wherein the container is presented below the modal content. Presenting the container comprises presenting an animation wherein the container performs a move out onto the display

device from an edge of the display device, and wherein the move takes a predefined time. A signal from the one of the plurality of hardware controls with which the user interaction occurs is active during the move. The computer-based method further comprises ceasing to present the container in response to a predefined time elapsing after a most recent user interaction with any of the plurality of hardware controls.

BRIEF DESCRIPTION OF DRAWINGS

[0006] FIGS. **1**A-**1**D show examples of containers that can be used for displaying indications corresponding to settings of hardware vehicle controls.

[0007] FIG. **2** shows an example of an instrument panel of a vehicle.

[0008] FIG. **3** shows an example of a system.

[0009] FIG. **4** shows examples of hardware controls.

[0010] FIG. **5** shows an example of a toggle control.

[0011] FIGS. **6**A-**6**C show examples of presentations on a display device relating to an HVAC control container.

[0012] FIGS. **7**A-**7**E show examples of presentations on a display device relating to a volume control container.

[0013] FIGS. **8**A-**8**B show examples of layering of a container.

[0014] FIG. **9** illustrates an example architecture of a computer system.

[0015] Like reference symbols in the various drawings indicate like elements.

DETAILED DESCRIPTION

[0016] This document describes examples of systems and techniques for displaying indications corresponding to vehicle control settings. In some implementations, presenting a container with settings of hardware controls can merge the user's experiences of using physical versus virtual controls, and can thereby improve usability and the experience of the vehicle user. An on-screen container can be a digital inverted version of some or all physical controls to further strengthen the intuitiveness of the user interface. The container can promulgate a clean visual appearance of vehicle interactions for passengers. For example, the container is immediately presented when needed, provides logical and helpful visual guidance, and discretely vanishes when no longer used.

[0017] Examples described herein refer to a vehicle. As used herein, a vehicle is a machine that transports passengers or cargo, or both. A vehicle can have one or more motors using at least one type of fuel or other energy source (e.g., electricity). Examples of vehicles include, but are not limited to, cars, trucks, and buses. The number of wheels can differ between types of vehicles, and one or more (e.g., all) of the wheels can be used for propulsion of the vehicle. The vehicle can include a passenger compartment accommodating one or more persons. In the present disclosure, any occupant of a vehicle is referred to as a passenger, regardless of whether the occupant may exercise any control over the motion of the vehicle (e.g., by steering, accelerating, or braking). For example, in the front seat, a passenger on the left side can be referred to as a left-side passenger, and vice versa. A vehicle can be powered by one or more types of power sources. In some implementations, a vehicle is powered solely by electricity, or can use one or more other energy sources in addition to electricity, to name just a few examples.

[0018] Examples herein refer to display devices. A display device visually outputs a graphical user interface for one or more computer devices. A display device can operate according to any of multiple display technologies used for presenting computer-based information. A display device can include a liquid crystal display (LCD), a light-emitting diode (LED) display, and/or a plasma display, to name just a few examples. A display device can be configured for receiving input for the computer device(s). In some implementations, a display device can feature one or more types of technology for detecting contact with, or proximity to, the screen by a user's hand or an implement such as a stylus. A display device can operate according to any of multiple touch-detecting, or gesture-recognizing, technologies. A display device can include a resistive touchscreen, a capacitive touchscreen, and/or a touchscreen based on optical imaging, to name just a few examples. A display device can have any of multiple shapes. In some implementations, a display device has a quadrilateral shape (e.g., rectangular), or a non-polygonal shape, to name just a few examples. A display device can have a substantially flat form factor (e.g., the screen is essentially planar), or a non-flat form factor (e.g., the screen is curved according to one or more radiuses.)

[0019] FIGS. **1**A-**1**D show examples of containers **100** and **102** that can be used for displaying indications corresponding to settings of hardware vehicle controls. Each of the containers **100** and **102** is here schematically shown as being included on a respective screen presented by a corresponding display device. The container **100** is shown without any visible indications. One or more of the indications described elsewhere herein can be added to the container **100**. In some implementations, the container **100** can seamlessly appear on a display device immediately upon a user interacting with a hardware control in the vehicle. When not needed, the container **100** can disappear to avoid distraction.

[0020] The container **102** shows examples of indications **104**A-**104**E. In some implementations, the indications **104**A-**104**B can be dedicated for a left-side passenger in the vehicle. For example, the indication **104**A can correspond to a temperature setting, and the indication **104**B can correspond to a fan speed setting. In some implementations, the indications **104**D-**104**E can be dedicated for a right-side passenger in the vehicle. For example, the indication **104**D can correspond to a fan speed setting, and the indication **104**E can correspond to a temperature setting. In some implementations, the indication **104**C can correspond to a volume setting. The volume setting can be applied to one or more audio zones in the vehicle. One or more of the indications **104**A-**104**E can be highlighted.

[0021] Containers can support parameter placement according to one or more reading directions. FIG. **1**C shows an implementation where the container **100** supports a left-to-right (LTR) reading layout. For example, content **106**, content **108**, and content **110** are placed in order from left to right in the LTR reading layout. FIG. **1**D shows an implementation where the container **100** supports a right-to-left (RTL) reading layout. For example, the content **106**, the content **108**, and the content **110** are placed in order from right to left in the RTL reading layout. The system can be configured with one of the LTR or RTL reading layouts

depending on the region where the vehicle is intended to be used. As another example, the system can be controlled to change between the LTR or RTL reading layouts.

[0022] FIG. **2** shows an example of an instrument panel **200** of a vehicle **202**. The vehicle **202** is mostly omitted in the present illustrations for simplicity. The vehicle **202** includes a steering wheel **204** (here shown in phantom for clarity), that can be used in connection with, or independently of, one or more controls or functions available at the instrument panel **200**. The instrument panel **200** can be used in combination with one or more other examples described elsewhere herein.

[0023] The instrument panel **200** includes a display device **206** here positioned somewhat to the left of the steering wheel **204**. The instrument panel **200** includes a display device **208** here positioned essentially behind the steering wheel **204**. The instrument panel **200** includes a display device **210** here positioned somewhat to the right of the steering wheel **204**. The display device **210** can be horizontally aligned with an instrument cluster in the vehicle **202**. For example, the instrument cluster can include at least the display device **208**. The instrument panel **200** includes a display device **212** here positioned lower than (e.g., essentially vertically below) the display device **210**. The display device **212** is considered to be positioned in the instrument panel **200**. For example, the display device **212** can be positioned lower in the same physical housing in which the display devices **206**, **208**, and **210** are mounted. A visual representation shown or mentioned herein can be presented on one or more of the display devices **206**, **208**, **210**, or **212**.

[0024] The vehicle **202** can have one or more hardware controls. In some implementations, the instrument panel **200** can include one or more buttons, toggles, scroll wheels, or other physical control devices by which the driver can make at least one input. Here, hardware controls **214** on the instrument panel **200** are schematically represented. In some implementations, the steering wheel **204** can include one or more buttons, toggles, scroll wheels, or other physical control devices by which the driver can make at least one input. Here, hardware controls (HWC) **216** and **218** on the steering wheel **204** are schematically represented.

[0025] FIG. **3** shows an example of a system **300**. The system **300** can be implemented as part of a vehicle and can be used in combination with one or more other examples described elsewhere herein. The system **300** includes a heating, ventilation, and air conditioning (HVAC) system **302**. The HVAC system **302** includes one or more HVAC components **304** (e.g., a heater, air conditioner, fan, and/or radiator). One or more of the HVAC components **304** can be controller by a respective hardware control.

[0026] The system **300** includes audio sources **306**. The audio sources **306** can be part of an infotainment system of the vehicle. The audio sources **306** can interface with a sound mixer that controls what audio source or sources are currently audible in the vehicle. For example, at any point in time it can be controlled which of the audio sources **306** is currently in focus. The audio sources **306** can include a media player **306**A. The media player **306**A can be considered a master volume controller in the vehicle (e.g., for overall sound of the vehicle). For example, the media player **306**A can control audio from an operating system, from a voice assistant, and from a media library. The audio sources **306** can include a navigation component **306**B. For example, the navigation component **306**B outputs visual and/or audible instructions for navigating the vehicle. The audio sources **306** can include a short-range wireless (SRW) component **306**C. In some implementations, the SRW component **306**C can operate using ultra-high frequency radio waves to interface with a portable electronic device of any vehicle occupant. For example, the SRW component **306**C can engage in wireless communication according to BLUETOOTH protocol (e.g., to facilitate phone calls.)

[0027] The system **300** includes a user interface **308** that can include multiple display devices **310** and multiple physical control devices **312**. The display devices **310** can correspond to some or all of the display devices **206**, **208**, **210**, or **212** (FIG. **2**). Any or all of the display devices **310** can have touchscreen functionality. The physical control devices **312** can be configured for generating inputs that control various aspects of vehicle operation.

[0028] The system **300** includes a container management component **314** for one or more visual representations for presentation on any of the display devices **310**. The container management component **314** can use any of multiple container representations **316**, such as different versions of any or all of the containers exemplified elsewhere herein. As such, the vehicle can have multiple containers for presentation on the display device **310**, and one container can be selected from among the multiple containers for presentation. Such selection can be based on an input made using a hardware control.

[0029] The container management component **314** can provide an animation of a container. In some implementations, the animation can include that the container performs a move out onto the display device from an edge of the display device, and/or that a presented container performs a move off of the display device past an edge of the display device. For example, the move can take a predefined time.

[0030] FIG. **4** shows examples of hardware controls **400**. The hardware controls **400** can be used with one or more other examples described elsewhere herein. The hardware controls **400** can be implemented in the instrument panel **200** (FIG. **2**), such as to provide the hardware controls **214**, to name just one example.

[0031] The hardware controls **400** include hardware controls **400**A-**400**E. Each of the hardware controls **400**A-**400**B and **400**D-**400**E can include a button. In some implementations, the button can be toggled in at least two directions. For example, toggling the button in a first direction (e.g., upward) can increase a setting value, and toggling the button in a second direction (e.g., downward) can decrease a setting value. One or more containers (e.g., the containers **100** and **102** in FIGS. **1**A-**1**B) can mirror or otherwise visually reference the shape of the physical hardware controls.

[0032] The hardware controls **400**A-**400**B and **400**D-**400**E can be hardware HVAC controls. In some implementations, the hardware controls **400**A-**400**B can be designated for a left-side passenger in the vehicle. For example, the hardware control **400**A can correspond to a temperature setting, and the hardware control **400**B can correspond to a fan speed setting. In some implementations, the hardware controls **400**D-**400**E can be designated for a right-side passenger in the vehicle. For example, the hardware control **400**D can correspond to a fan speed setting, and the hardware control **400**E can correspond to a temperature setting. In some implementations, the hardware control **400**C can be a hardware volume control. The hardware control **400**C can be a

roller control. The volume setting can be applied to one or more audio zones in the vehicle.

[0033] FIG. **5** shows an example of a toggle control **500**. The toggle control **500** can be used with one or more other examples described elsewhere herein. The toggle control **500** can be implemented in the steering wheel **204** (FIG. **2**), such as to provide one or more of the hardware controls **216** or **218**, to name just a few examples.

[0034] The toggle control **500** can include a moveable component and can be used for generating inputs that control various aspects of vehicle operation. For example, the toggle control can include a rotatable element that can be rotated (e.g., using one's thumb) about an axis that is essentially radial to the circumference of the steering wheel. The toggle control **500** includes a barrel **502** that is rotatably mounted to an axis fixed relative to the steering wheel. The barrel **502** can have cylindrical, conical, or frustoconical shape, to name just a few examples. The barrel **502** can have a structured surface for improved grip and/or tactile experience. Rotation of the barrel in one direction about the axis can generate an input **502**A, and rotation of the barrel in an opposite direction about the axis can generate an input **502**B, as here schematically shown.

[0035] FIGS. **6**A-**6**C show examples of presentations **600** and **600'** on a display device relating to an HVAC control container. Any of the presentations **600** and **600'** can be presented on one or more of the display devices **206**, **208**, **210**, or **212** (FIG. **2**). The presentation **600** can include content **602** that is here schematically represented. When a user generates an input by interacting with a hardware control (e.g., any of the hardware controls **400** (FIG. **4**) or the toggle control **500** (FIG. **5**)), a container **604** can be presented on the display device.

[0036] The container **604** can be presented using an animation, as here schematically represented by an arrow **606**. A signal from the one of the plurality of hardware controls with which the user interaction occurs can be active during the move. For example, if the user is interacting with a hardware HVAC control to adjust the temperature corresponding to the indication **608**A, the temperature value that is set for this zone can be changed (increased or decreased) in according with the user's input, during the time that the animation is moving the container **604** onto the display device. As such, the user need not wait for the animation to finish before the new setting for that vehicle component (e.g., the HVAC system) is applied.

[0037] The container **604** can relate to HVAC controls and shows examples of indications **608**A-**608**D. In some implementations, the indications **608**A-**608**B can be designated for a left-side passenger in the vehicle. For example, the indication **608**A can correspond to a temperature setting, and the indication **608**B can correspond to a fan speed setting. In some implementations, the indications **608**C-**608**D can be designated for a right-side passenger in the vehicle. For example, the indication **608**C can correspond to a fan speed setting, and the indication **608**D can correspond to a temperature setting. One or more of the indications **608**A-**608**D can be highlighted based on the particular hardware control with which the user is interacting. The indications **608**A-**608**D can show setting values using any applicable unit. For example, temperature can be shown in Fahrenheit or Celsius degrees.

[0038] The above examples illustrate that a computer-based method can include: receiving, in a computer system (e.g., the system **300** in FIG. **3**) of a vehicle (e.g., the vehicle **202** in FIG. **2**), an input generated by user interaction with any of a plurality of hardware controls (e.g., any of the hardware controls **400** (FIG. **4**) or the toggle control **500** (FIG. **5**)) in the vehicle. The plurality of hardware controls corresponding to respective vehicle systems (e.g., the HVAC system **302** or the audio sources **306** in FIG. **3**). The method includes presenting, in response to the input, a container on a display device of the vehicle. The container is configured for displaying indications (e.g., the indications **608**A-**608**D in FIG. **6**A) that correspond to and reflect present settings of each of the plurality of hardware controls.

[0039] Simultaneous inputs can be generated using two or more hardware controls. In some implementations, an HVAC control container can support simultaneous user interaction using more than one of the multiple hardware HVAC controls. For example, in FIG. **4**, the hardware controls **400**A and **400**D can be interacted with at the same time (e.g., by two different passengers). Those of the multiple HVAC values corresponding to the more than one of the multiple hardware HVAC controls that are being interacted with, can be highlighted. For example, FIG. **6**B shows that the indications **608**A (e.g., temperature) and **608**C (e.g., fan speed) are being highlighted.

[0040] The container **604** can cease to be presented upon one or more circumstances, or one or more events occurring or not occurring. Presentation **600'** illustrates that the container **604** has ceased to be presented. In some implementations, the system ceases to present the container **604** in response to a predefined time elapsing after a most recent user interaction with any of the plurality of hardware controls. This can ensure that the container **604** does not remain on the display device when no longer needed. In some implementations, the container **604** can cease to be presented based on user input. For example, the system can cease to present the container **604** in response to a gesture detected by a touchscreen input control. The container **604** can be removed from the presentation **600** using an animation, as here schematically represented by an arrow **606'**. For example, the animation can substantially reverse the animation that introduced the container **604** (e.g., with a different time length).

[0041] FIGS. **7**A-**7**E show examples of presentations **700**, **700'**, and **700"** on a display device relating to a volume control container. Any of the presentations **700**, **700'**, and **700"** can be presented on one or more of the display devices **206**, **208**, **210**, or **212** (FIG. **2**). The presentations **700**, **700'**, and **700"** can include content **702** that is here schematically represented. When a user generates an input by interacting with a hardware control (e.g., any of the hardware controls **400** (FIG. **4**) or the toggle control **500** (FIG. **5**)), a container **704** can be presented on the display device. The container **704** can be presented using an animation.

[0042] The vehicle can include multiple hardware volume controls. Each of such multiple hardware volume controls can be configured for increasing and decreasing volume of audio in the vehicle. For example, each of the hardware control **400**C (FIG. **4**) and the toggle control **500** (FIG. **5**) can be used for controlling volume, and the container **704** can then be presented in response to the user interaction occurring with any of them. The hardware volume control can be configured for controlling whichever one of multiple sound sources in the vehicle that is presently in focus. For example, in FIG. **3**, either of the media player **306**A, the

navigation component **306**B, or the short-range wireless component **306**C may currently have focus for audio presentation.

[0043] The container **704**, which relates to volume control, here shows examples of indications **706**A-**706**B. The indication **706**A can be an icon representing sound (e.g., a speaker symbol). The indication **706**B can be a graphical element representing a volume setting (e.g., a slider). The volume control container can be presented with a respective icon corresponding to a corresponding one of the multiple sound sources that is presently in focus. Here, the indication **706**A corresponds to the media player **306**A. For example, this can correspond to a master sound source currently having focus. FIG. **7**B shows that the container **704** can include an indication **706**A' that corresponds to the navigation component **306**B. For example, this can correspond to navigation instructions currently having focus. FIG. **7**C shows that the container **704** can include an indication **706**A" that corresponds to the short-range wireless component **306**C. For example, this can correspond to a remote sound source (e.g., a phone call on a paired mobile device) currently having focus.

[0044] The volume control container can have different numbers of volume control stops for at least some of the multiple sound sources. In some implementations, the indication **706**B can correspond to more or fewer individual stops of sound level depending on whether the indication **706**A, the indication **706**A', or the indication **706**A", is active. For example, the navigation component **306**B and the short-range wireless component **306**C can have fewer stops than the media player **306**A.

[0045] The user can choose any volume setting by interacting with the physical volume control. Lowering the volume as much as possible can correspond to muting the audio system. FIG. **7**D shows that the presentation **700'** includes a symbol **708** to indicate the muting. For example, assume that the presentation **700'** is displayed before the above-mentioned input is made using the hardware volume control. Further, assume that the input made corresponds to an increase volume command. For example, the user interacts with either the hardware control **400**C (FIG. **4**) or the toggle control **500** (FIG. **5**) to increase the volume. This can serve to unmute the audio system. For example, the presentation **700** (FIG. **7**A) can then be presented, where the symbol **708** is not present, and wherein the container **704** indicates that the volume is unmuted.

[0046] The container **704** can cease to be presented upon one or more circumstances, or one or more events occurring or not occurring. In some implementations, the system ceases to present the container **704** in response to a predefined time elapsing after a most recent user interaction with any of the plurality of hardware controls. This can ensure that the container **704** does not remain on the display device when no longer needed. In some implementations, the container **704** can cease to be presented based on user input. For example, the system can cease to present the container **704** in response to a gesture detected by a touchscreen input control. The container **704** can be removed from the presentation **700** using an animation. For example, the animation can substantially reverse an animation that introduced the container **704** (e.g., with a different time length).

[0047] Switching between two or more types of container can be performed. In some implementations, this can occur when interaction with a first hardware control causes a first container to be presented, and before the first container vanishes, another interaction with a different hardware control causes a second container to be presented. This can involve a volume control container being seamlessly replaced by a HVAC control container, or vice versa. For example, if the container **604** (FIG. **6**A) is currently active, and the user then interacts with a hardware volume control, the container **704** (FIGS. **7**A-**7**C) can instead be activated. For example, this can be done without ceasing to present the container **604** (e.g., contents of the container **704** can replace the contents of the container **604**). As another example, this can be done by ceasing to present the container **604**, and thereafter presenting the container **704** with the replaced content.

[0048] Vehicle systems may be controlled without invoking a container. In some implementations, if the user changes a setting (e.g., volume or HVAC) using a touchscreen control of any of the display devices **310** (FIG. **3**), the corresponding container may not be presented. This can avoid cluttering the display device with content that may not be needed.

[0049] FIGS. **8**A-**8**B show examples of layering of a container. Here, a presentation **800** on a display device presently includes content **802**, which is schematically illustrated. The content **802** can include contents of an application executed by the vehicle's computer system, or a status bar, or a menu, to name just a few examples. Upon user interaction with a hardware control, a container **804** can be presented. The container **804** can be presented on top of at least some of the content **802**.

[0050] Modal content can be presented. FIG. **8**B shows that a presentation **800'** includes modal content **806**, here schematically shown as positioned in a rightmost portion of the display device. For example, the modal content **806** can correspond to a notification (e.g., an incoming phone call) or an alert. The container **804** can be presented below the modal content **806**. The modal content **806** can be associated with scrim **806'**. For example, the scrim **806'** can correspond to a shading or other deactivation of other content in the presentation **800'** that is not covered by the modal content **806**. The container **804** can be presented below the scrim **806'**.

[0051] FIG. **9** illustrates an example architecture of a computing device **900** that can be used to implement aspects of the present disclosure, including any of the systems, apparatuses, and/or techniques described herein, or any other systems, apparatuses, and/or techniques that may be utilized in the various possible embodiments.

[0052] The computing device illustrated in FIG. **9** can be used to execute the operating system, application programs, and/or software modules (including the software engines) described herein.

[0053] The computing device **900** includes, in some embodiments, at least one processing device **902** (e.g., a processor), such as a central processing unit (CPU). A variety of processing devices are available from a variety of manufacturers, for example, Intel or Advanced Micro Devices. In this example, the computing device **900** also includes a system memory **904**, and a system bus **906** that couples various system components including the system memory **904** to the processing device **902**. The system bus **906** is one of any number of types of bus structures that can be used, including, but not limited to, a memory bus, or

memory controller; a peripheral bus; and a local bus using any of a variety of bus architectures.

[0054] Examples of computing devices that can be implemented using the computing device **900** include a desktop computer, a laptop computer, a tablet computer, a mobile computing device (such as a smart phone, a touchpad mobile digital device, or other mobile devices), or other devices configured to process digital instructions.

[0055] The system memory **904** includes read only memory **908** and random access memory **910**. A basic input/output system **912** containing the basic routines that act to transfer information within computing device **900**, such as during start up, can be stored in the read only memory **908**.

[0056] The computing device **900** also includes a secondary storage device **914** in some embodiments, such as a hard disk drive, for storing digital data. The secondary storage device **914** is connected to the system bus **906** by a secondary storage interface **916**. The secondary storage device **914** and its associated computer readable media provide non-volatile and non-transitory storage of computer readable instructions (including application programs and program modules), data structures, and other data for the computing device **900**.

[0057] Although the example environment described herein employs a hard disk drive as a secondary storage device, other types of computer readable storage media are used in other embodiments. Examples of these other types of computer readable storage media include magnetic cassettes, flash memory cards, solid-state drives (SSD), digital video disks, Bernoulli cartridges, compact disc read only memories, digital versatile disk read only memories, random access memories, or read only memories. Some embodiments include non-transitory media. For example, a computer program product can be tangibly embodied in a non-transitory storage medium. Additionally, such computer readable storage media can include local storage or cloud-based storage.

[0058] A number of program modules can be stored in secondary storage device **914** and/or system memory **904**, including an operating system **918**, one or more application programs **920**, other program modules **922** (such as the software engines described herein), and program data **924**. The computing device **900** can utilize any suitable operating system.

[0059] In some embodiments, a user provides inputs to the computing device **900** through one or more input devices **926**. Examples of input devices **926** include a keyboard **928**, mouse **930**, microphone **932** (e.g., for voice and/or other audio input), touch sensor **934** (such as a touchpad or touch sensitive display), and gesture sensor **935** (e.g., for gestural input). In some implementations, the input device(s) **926** provide detection based on presence, proximity, and/or motion. Other embodiments include other input devices **926**. The input devices can be connected to the processing device **902** through an input/output interface **936** that is coupled to the system bus **906**. These input devices **926** can be connected by any number of input/output interfaces, such as a parallel port, serial port, game port, or a universal serial bus. Wireless communication between input devices **926** and the input/output interface **936** is possible as well, and includes infrared, BLUETOOTH® wireless technology, 802.11a/b/g/n, cellular, ultra-wideband (UWB), ZigBee, or other radio frequency communication systems in some possible embodiments, to name just a few examples.

[0060] In this example embodiment, a display device **938**, such as a monitor, liquid crystal display device, light-emitting diode display device, projector, or touch sensitive display device, is also connected to the system bus **906** via an interface, such as a video adapter **940**. In addition to the display device **938**, the computing device **900** can include various other peripheral devices (not shown), such as speakers or a printer.

[0061] The computing device **900** can be connected to one or more networks through a network interface **942**. The network interface **942** can provide for wired and/or wireless communication. In some implementations, the network interface **942** can include one or more antennas for transmitting and/or receiving wireless signals. When used in a local area networking environment or a wide area networking environment (such as the Internet), the network interface **942** can include an Ethernet interface. Other possible embodiments use other communication devices. For example, some embodiments of the computing device **900** include a modem for communicating across the network.

[0062] The computing device **900** can include at least some form of computer readable media. Computer readable media includes any available media that can be accessed by the computing device **900**. By way of example, computer readable media include computer readable storage media and computer readable communication media.

[0063] Computer readable storage media includes volatile and nonvolatile, removable and non-removable media implemented in any device configured to store information such as computer readable instructions, data structures, program modules or other data. Computer readable storage media includes, but is not limited to, random access memory, read only memory, electrically erasable programmable read only memory, flash memory or other memory technology, compact disc read only memory, digital versatile disks or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to store the desired information and that can be accessed by the computing device **900**.

[0064] Computer readable communication media typically embodies computer readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any information delivery media. The term "modulated data signal" refers to a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, computer readable communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, radio frequency, infrared, and other wireless media. Combinations of any of the above are also included within the scope of computer readable media.

[0065] The computing device illustrated in FIG. **9** is also an example of programmable electronics, which may include one or more such computing devices, and when multiple computing devices are included, such computing devices can be coupled together with a suitable data communication network so as to collectively perform the various functions, methods, or operations disclosed herein.

[0066] In some implementations, the computing device **900** can be characterized as an ADAS computer. For example, the computing device **900** can include one or more components sometimes used for processing tasks that occur in the field of artificial intelligence (AI). The computing device **900** then includes sufficient proceeding power and necessary support architecture for the demands of ADAS or AI in general. For example, the processing device **902** can include a multicore architecture. As another example, the computing device **900** can include one or more co-processors in addition to, or as part of, the processing device **902**. In some implementations, at least one hardware accelerator can be coupled to the system bus **906**. For example, a graphics processing unit can be used. In some implementations, the computing device **900** can implement a neural network-specific hardware to handle one or more ADAS tasks.

[0067] The terms "substantially" and "about" used throughout this Specification are used to describe and account for small fluctuations, such as due to variations in processing. For example, they can refer to less than or equal to +5%, such as less than or equal to +2%, such as less than or equal to +1%, such as less than or equal to +0.5%, such as less than or equal to +0.2%, such as less than or equal to +0.1%, such as less than or equal to +0.05%. Also, when used herein, an indefinite article such as "a" or "an" means "at least one."

[0068] It should be appreciated that all combinations of the foregoing concepts and additional concepts discussed in greater detail below (provided such concepts are not mutually inconsistent) are contemplated as being part of the inventive subject matter disclosed herein. In particular, all combinations of claimed subject matter appearing at the end of this disclosure are contemplated as being part of the inventive subject matter disclosed herein.

[0069] A number of implementations have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the specification.

[0070] In addition, the logic flows depicted in the figures do not require the particular order shown, or sequential order, to achieve desirable results. In addition, other processes may be provided, or processes may be eliminated, from the described flows, and other components may be added to, or removed from, the described systems. Accordingly, other implementations are within the scope of the following claims.

[0071] While certain features of the described implementations have been illustrated as described herein, many modifications, substitutions, changes and equivalents will now occur to those skilled in the art. It is, therefore, to be understood that appended claims are intended to cover all such modifications and changes as fall within the scope of the implementations. It should be understood that they have been presented by way of example only, not limitation, and various changes in form and details may be made. Any portion of the apparatus and/or methods described herein may be combined in any combination, except mutually exclusive combinations. The implementations described herein can include various combinations and/or sub-combinations of the functions, components and/or features of the different implementations described.

1. A computer-based method comprising:

receiving, in a computer system of a vehicle, an input generated by user interaction with any of a plurality of hardware controls in the vehicle, the plurality of hardware controls corresponding to respective vehicle systems; and

presenting, in response to the input, a container on a display device of the vehicle, the container configured for displaying indications that correspond to and reflect present settings of each of the plurality of hardware controls.

2. The computer-based method of claim **1**, wherein the vehicle has multiple containers for presentation on the display device, the method further comprising selecting the container from among the multiple containers for presentation, the container selected based on the received input.

3. The computer-based method of claim **2**, wherein the container selected from among the multiple containers is a volume control container.

4. The computer-based method of claim **3**, wherein the plurality of hardware controls includes multiple hardware volume controls, wherein each of the multiple hardware volume controls is configured for increasing and decreasing volume of audio in the vehicle, and wherein the volume control container is presented in response to the user interaction occurring with any of the multiple hardware volume controls.

5. The computer-based method of claim **4**, wherein at least one of the multiple hardware volume controls is a roller control, and wherein at least another one of the multiple hardware volume controls is a toggle control.

6. The computer-based method of claim **4**, wherein at least one of the multiple hardware volume controls is positioned on a steering wheel of the vehicle, and wherein at least another one of the multiple hardware volume controls is positioned on an instrument panel of the vehicle.

7. The computer-based method of claim **3**, wherein the volume control container is presented in response to user interaction with a hardware volume control, and wherein the hardware volume control is configured for controlling whichever one of multiple sound sources in the vehicle that is presently in focus.

8. The computer-based method of claim **7**, wherein the volume control container is presented with a respective icon corresponding to a corresponding one of the multiple sound sources.

9. The computer-based method of claim **7**, wherein the volume control container has a different numbers of volume control stops for at least some of the multiple sound sources.

10. The computer-based method of claim **7**, wherein the multiple sound sources include at least master audio, navigation audio, and short-range wireless audio.

11. The computer-based method of claim **10**, wherein the master audio comprises an overall sound of the vehicle.

12. The computer-based method of claim **10**, wherein the navigation audio comprises sound that a navigation component is outputting to a sound mixer of the vehicle.

13. The computer-based method of claim **10**, wherein the short-range wireless audio comprises sound that a portable electronic device is outputting to a sound mixer of the vehicle by short-range wireless communication.

14. (canceled)

15. The computer-based method of claim 3, wherein volume is muted in the vehicle before the input is received, wherein the input corresponds to an increase volume command, and wherein the volume control container when presented indicates that the volume is unmuted.

16. (canceled)

17. (canceled)

18. (canceled)

19. (canceled)

20. The computer-based method of claim 2, wherein the container selected from among the multiple containers is a heating, ventilation, and air conditioning (HVAC) control container, wherein the plurality of hardware controls includes multiple hardware HVAC controls, wherein the indications in the HVAC control container include multiple HVAC values corresponding to present settings of the multiple hardware HVAC controls, and wherein the HVAC control container is presented in response to the user interaction occurring with any of the multiple hardware HVAC controls, and wherein a first control of the multiple hardware HVAC controls is dedicated to a left-side passenger of the vehicle, wherein a second control of the multiple hardware HVAC controls is dedicated to a right-side passenger of the vehicle, and wherein the first and second controls are independent of each other.

21. The computer-based method of claim 2, wherein the container selected from among the multiple containers is a heating, ventilation, and air conditioning (HVAC) control container, wherein the plurality of hardware controls includes multiple hardware HVAC controls, wherein the indications in the HVAC control container include multiple HVAC values corresponding to present settings of the multiple hardware HVAC controls, and wherein the HVAC control container is presented in response to the user interaction occurring with any of the multiple hardware HVAC controls, further comprising highlighting in the HVAC control container one of the multiple HVAC values corresponding to the one of the multiple hardware HVAC controls with which the user interaction occurs.

22. The computer-based method of claim 2, wherein the container selected from among the multiple containers is a heating, ventilation, and air conditioning (HVAC) control container, wherein the plurality of hardware controls includes multiple hardware HVAC controls, wherein the indications in the HVAC control container include multiple HVAC values corresponding to present settings of the multiple hardware HVAC controls, and wherein the HVAC control container is presented in response to the user interaction occurring with any of the multiple hardware HVAC controls, and wherein the HVAC control container supports simultaneous user interaction using more than one of the multiple hardware HVAC controls.

23. The computer-based method of claim 22, further comprising highlighting those of the multiple HVAC values corresponding to the more than one of the multiple hardware HVAC controls.

24. (canceled)

25. The computer-based method of claim 2, wherein while the container selected based on the received input is presented, the method further comprises receiving another input generated by another user interaction with another of the plurality of hardware controls, and in response to the other input, replacing content of the container to correspond to the other of the plurality of hardware controls, wherein the content is replaced without ceasing to present the container.

26. The computer-based method of claim 2, wherein while the container selected based on the received input is presented, the method further comprises receiving another input generated by another user interaction with another of the plurality of hardware controls, and in response to the other input, replacing content of the container to correspond to the other of the plurality of hardware controls, wherein replacing the content comprises ceasing to present the container, and thereafter again presenting the container to include the replaced content.

27. (canceled)

28. The computer-based method of claim 1, wherein the display device comprises a touchscreen input control, and wherein the touchscreen input control is configured for controlling a setting of at least one of the vehicle systems, and wherein the container is not presented upon controlling the setting of the vehicle system using the touchscreen input control.

29. The computer-based method of claim 1, wherein the display device comprises a touchscreen input control, further comprising ceasing to present the container in response to a gesture detected by the touchscreen input control.

30. The computer-based method of claim 1, wherein the computer system presents content on the display device, and wherein the container is presented on top of at least some of the content.

31. The computer-based method of claim 30, wherein the content includes modal content, and wherein the container is presented below the modal content.

32. The computer-based method of claim 1, wherein presenting the container comprises presenting an animation wherein the container performs a move out onto the display device from an edge of the display device, and wherein the move takes a predefined time.

33. The computer-based method of claim 32, wherein a signal from the one of the plurality of hardware controls with which the user interaction occurs is active during the move.

34. The computer-based method of claim 1, further comprising ceasing to present the container in response to a predefined time elapsing after a most recent user interaction with any of the plurality of hardware controls.

35. The computer-based method of claim 1, further comprising changing a reading layout of the container.

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