June 2021

CONTEXTUALLY-DYNAMIC SETTINGS WITH GRANULAR CONTROL

Xin Li

Nina Joshi

CONTEXTUALLY-DYNAMIC SETTINGS WITH GRANULAR CONTROL

ABSTRACT

A vehicle (e.g., automobile, motorcycle, a bus, a recreational vehicle (RV), a semi-trailer truck, a tractor or other type of farm equipment, a train, a plane, a helicopter, etc.) may include a so-called “head unit” that provides a user interface (UI) that dynamically adapts to changes in vehicle state (e.g., network connectivity states, sign-in/out states, etc.) by indicating whether individual settings that are tied to the vehicle state are enabled or disabled. In the context of vehicles, such vehicle state may change throughout a single trip, as network connectivity may change along a given trip, operators of the vehicle may change (resulting in changing user accounts having different permissions), etc. Rather than require the operator of the vehicle to navigate (while potentially driving) to separate sign-in UIs, different network setting configuration UIs, etc., the head unit may dynamically present these user interfaces to facilitate an operation that the user has selected but which may be unavailable due to the dynamically changing vehicle state. In this way, the techniques may reduce the number of user inputs (e.g., by automatically navigating to the appropriate UIs for changing the vehicle state) to enable the settings required to perform a task requested by the user, thereby potentially improving the user experience.

DESCRIPTION

FIG. 1 below is a conceptual diagram of a head unit 100 of a vehicle (which may, e.g., refer to one or more of an automobile, a motorcycle, a bus, a recreational vehicle (RV), a semi-trailer truck, a tractor or other type of farm equipment, a train, a plane, a helicopter, etc.). As shown in FIG. 1, head unit 100 includes one or more processors 102, a display 104, one or more communication components 106 (“COMM components 106”), one or more microphones 108,

one or more speakers 110, and one or more storage devices 112. Storage devices 112 may include a UI module 114 and one or more applications 116.

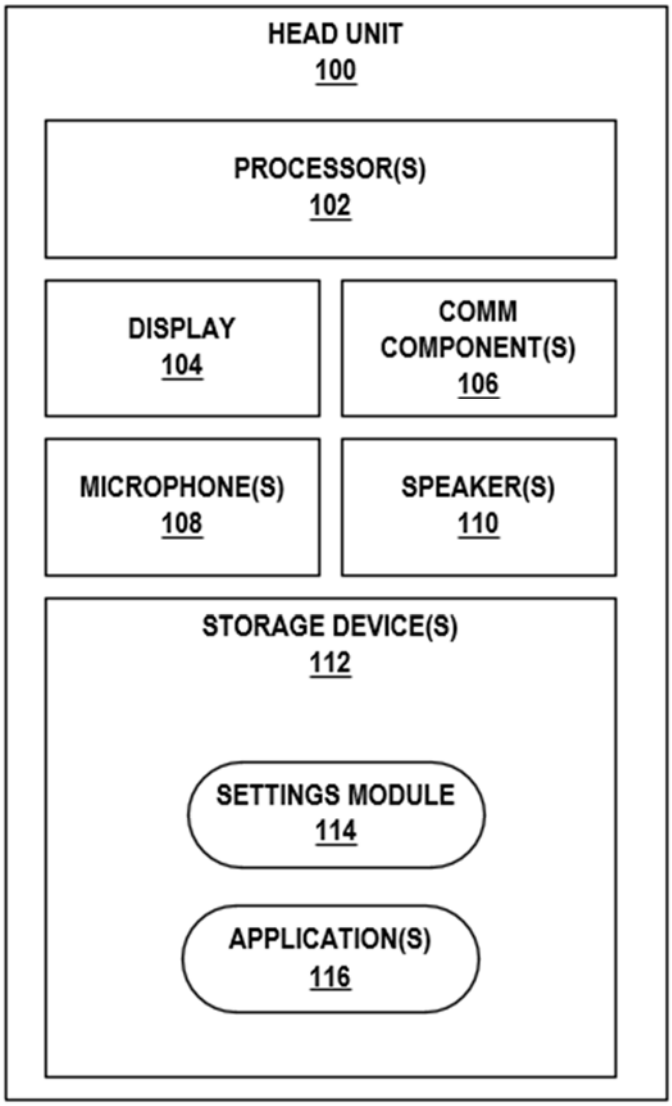

FIG. 1

Head unit 100 of system 10 may operate to assist, inform, entertain, or otherwise provide for interactions with one or more occupants of a vehicle. Head unit 100 may represent an integrated head unit that provides a user interface (UI), such as a voice user interface (VUI), a graphical user interface (GUI), etc. In general, head unit 100 may control one or more vehicle

systems, such as a heating, ventilation, and air conditioning (HVAC) system, a lighting system (for controlling interior and/or exterior lights), an infotainment system, a seating system (for controlling a position of a driver and/or passenger seat), etc.

Head unit 100 may be configured to establish a session with a computing device to permit data exchange. In some examples, an occupant of the vehicle in which vehicle head unit 100 is located may connect a computing device (e.g., a smartphone, a tablet computer, smartglasses, a smartwatch, a portable gaming system, a laptop computer, etc.) to head unit 100 to project (or otherwise, cast or stream) a GUI to head unit 100. For instance, a UI model in head unit 100 may be a thin client that supports projection of a GUI from a computing device such that a UI provided by head unit 100 represents a GUI projected by the computing device. Thus, while described herein as being performed entirely by head unit 100, any or all techniques of the present disclosure may be performed at least in part by other devices, such as the above noted computing device capable of projecting the GUI to head unit 100.

Processors 102 may implement functionality and/or execute instructions associated with head unit 100. Examples of processors 102 may include one or more of an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), an application processor, a display controller, an auxiliary processor, a central processing unit (CPU), a graphics processing unit (GPU), one or more sensor hubs, and any other hardware configure to function as a processor, a processing unit, or a processing device. Processors 102 may retrieve and execute instructions stored by storage devices 112 that cause processors 102 to perform the operations described in this disclosure.

Display 104 of head unit 100 may be a presence-sensitive display that functions as an input device and as an output device. For example, presence-sensitive display 104 may function

as an input device using a presence-sensitive input component, such as a resistive touchscreen, a surface acoustic wave touchscreen, a pressure-sensitive screen, an acoustic pulse recognition touchscreen, or another presence-sensitive display technology. Additionally, presence-sensitive display 104 may function as an output (e.g., display) device using any of one or more display components, such as a liquid crystal display (LCD), dot matrix display, light emitting diode (LED) display, active-matrix organic light-emitting diode (AMOLED) display, etc.

COMM components 106 of head unit 100 may include wireless communication devices capable of transmitting and/or receiving communication signals, such as a cellular radio, a 3G radio, a 4G radio, a 5G radio, a Bluetooth® radio (or any other PAN radio), an NFC radio, or a Wi-Fi™ radio (or any other wireless local area network (WLAN) radio). COMM components 106 may be configured to send and receive information via a network (e.g., a local area network (LAN), wide area network (WAN), a global network, such as the Internet, etc.).

Storage devices 112 of head unit 100 may include one or more computer-readable storage media. For example, storage devices 112 may be configured for long-term, as well as short-term storage of information, such as instructions, data, or other information used by head unit 100. In some examples, storage devices 112 may include non-volatile storage elements. Examples of such non-volatile storage elements include magnetic hard discs, optical discs, solid state discs, etc. Examples of volatile memory devices include random-access memories (RAM), dynamic random-access memories (DRAM), static random-access memories (SRAM), etc.

In general, specific settings may need to be enabled for head unit 100 to perform a task requested by a user. Whether an individual setting is enabled or disabled may depend on a vehicle state (e.g., network connectivity states, sign-in/out states, etc.) of the vehicle in which head unit 100 is located. For example, application 116, which may be a map application, may

require head unit 100 to be connected to a network (i.e., online) to function properly. However, in some cases, a UI, such as a settings GUI, provided by settings module 114 of head unit 100, may not dynamically adapt to changes in vehicle state to indicate whether a specific setting is enabled or disabled. As a result, if a user requests (e.g., via a voice input, touch input, etc.) that head unit 100 perform a task that head unit 100 cannot perform because head unit 100 is not connected to a network, the user may have difficulty identifying and/or locating the one or more disabled settings in the settings GUI. In such an example, the user may need to manually navigate the settings GUI (e.g., by providing one or more touch inputs to display 104) to change the vehicle state, which can be inconvenient and even dangerous when driving.

In accordance with techniques of this disclosure, UI module 114 of head unit 100 may display a settings GUI that dynamically adapts to changes in vehicle state by indicating whether individual settings tied to a particular vehicle state are enabled or disabled. In other words, UI module 114 may show, hide, or otherwise modify the visual appearance of settings GUI depending on the vehicle state. For example, as shown in FIG. 2 below, if a setting 200 (e.g., personal results setting) is supposed to be visible and editable because head unit 100 is online and the user is signed into an account (e.g., a profile that restricts use of sensitive data such that the sensitive data may only be accessed while the profile is signed in), UI module 114 may show setting 200 with full opacity.

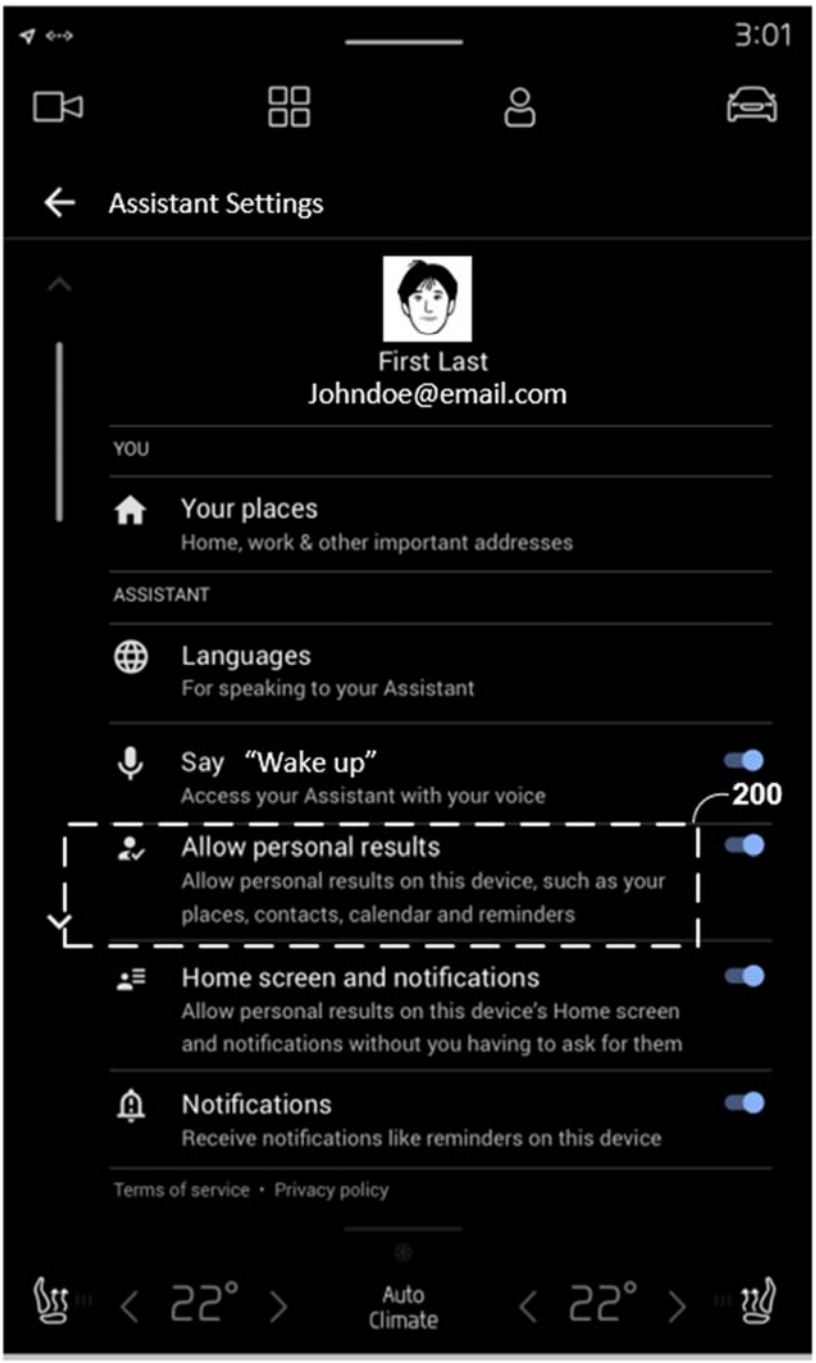

FIG. 2

As shown in FIG. 3 below, if a setting 300 (e.g., notification setting) is supposed to be visible but not editable because head unit 100 is offline and the user is signed in, UI module 114 may show setting 300 but not at full opacity.

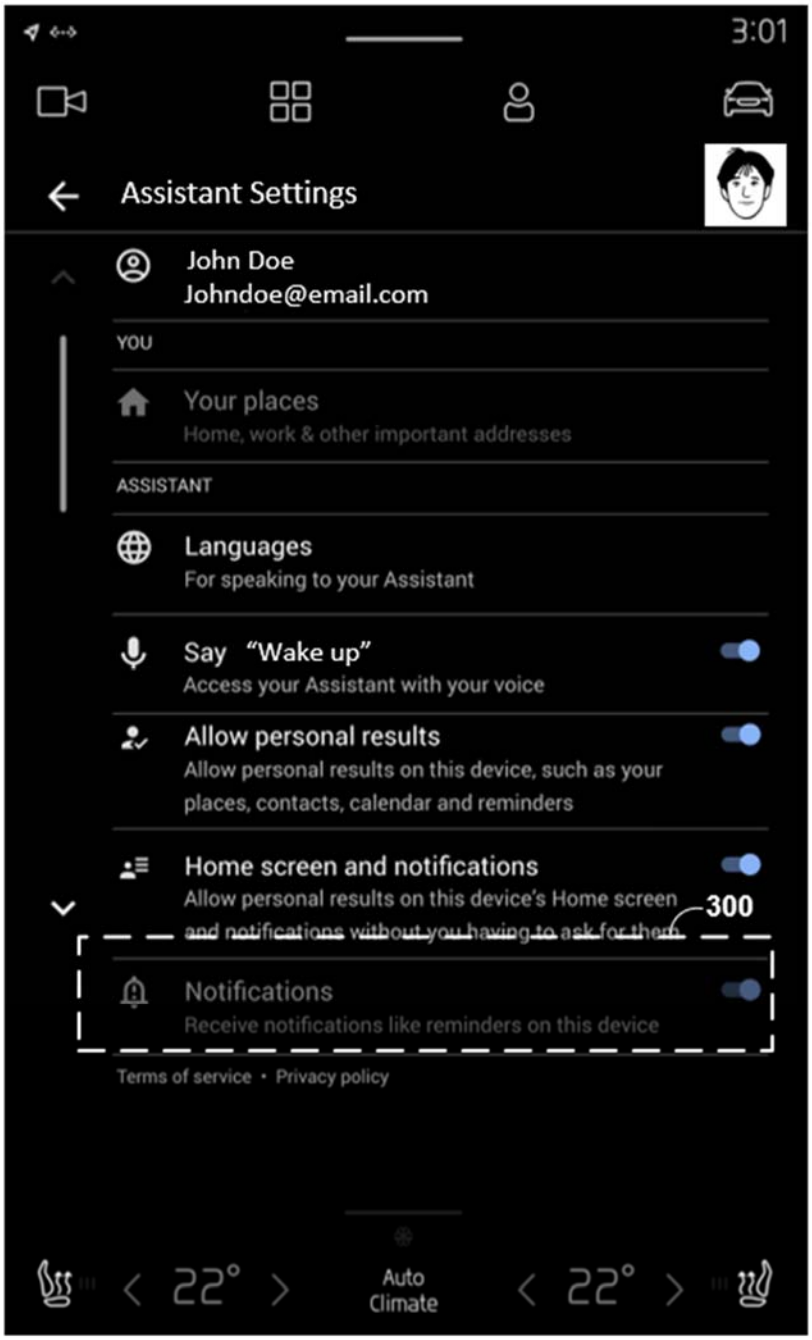

FIG. 3

As shown in FIG. 4 below, if a setting 400 (e.g., the home and work address setting) is supposed to be visible but not editable because head unit 100 is online and the user is signed out, UI module 114 may show setting 400 but not at full opacity. As further shown in FIG. 4 below, if a setting (e.g., personal results setting) is supposed to be invisible because head unit 100 is offline and the user is signed out, UI module 114 may hide the setting.

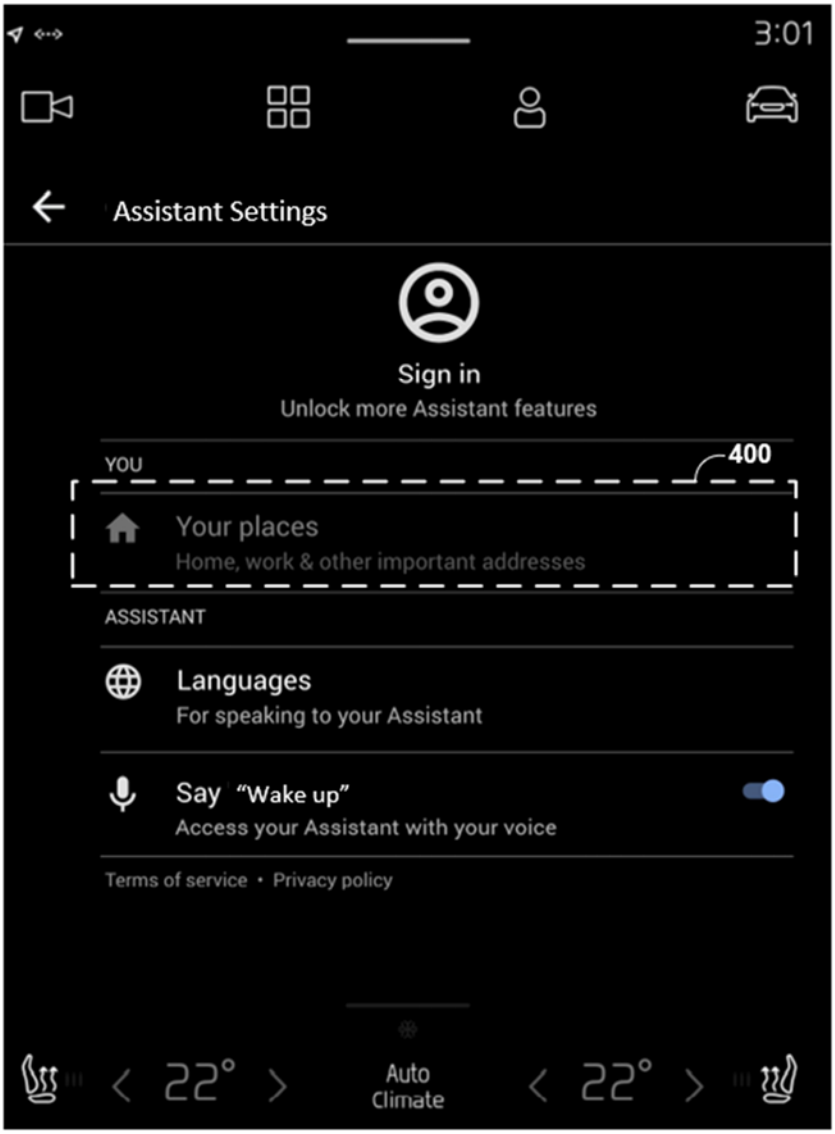

FIG. 4

Additional examples demonstrating the operations of UI module 114 are shown below in FIG. 5.

Preferences	Online + Signed in	Offline + Signed in	Online + Signed out	Offline + Signed out
Home&work address	Visible	Visible but can not edit	Visible but can not edit	Visible but can not edit
Languages	Visible	Visible but can not edit	Visible	Visible but can not edit
Hotword	Visible and Editable	Visible and Editable	Visible and Editable	Visible and Editable
Notification	Visible and Editable	Visible but can not edit	Invisible	Invisible
PersonalResults	Visible and Editable	If it is on, then visible. Once it switches to off, then greyed out. If it is off, then greyed out.	Invisible	Invisible
HomescreenNotification	If PresonalResults toggled off, HomescreenNotification should be invisible Once PresonalResults is on, HomescreenNotificaion should be visible again.	If PersonalResults is on, then visible. If PersonalResult if off, then go invisible	Invisible	Invisible

FIG. 5

If a user requests that head unit 100 perform a task that cannot be fulfilled because the vehicle state has caused required settings to be disabled, UI module 114 may output a notification indicating to the user that no further action can be taken. For instance, if head unit 100 is online but the user is not signed in (such that the work and home address setting is disabled) and the user provides head unit 100 with an audio input (e.g., in the form of human speech) via microphones 108 (e.g., microphones built into the vehicle, microphones built into a computing device, portable microphones, etc.) requesting that application 116, which may be a map application, output directions to the user's home address, UI module 114 may emit, via speakers 110 (e.g., speakers built into the vehicle, speakers integrated into a computing device, portable speakers, etc.), an audio communication indicating that no further action can be taken.

Additionally or alternatively, in examples similar to the one described above and as shown in FIG. 6 below, UI module 114 may display, via display 104, a notification 600 (e.g., a

pop-up window that is temporarily displayed onscreen, sometimes referred to as a ‘toast’) informing the user that no further action can be taken because one or more settings are disabled due to the vehicle state. In some cases, notification 600 may be actionable by the user to invoke application 116 or further informational display relating to the substance of notification 600. As an example, responsive to the user tapping notification 600, which may be a toast, UI module 114 may expand notification 600 or display a screen listing the one or more vehicle states that need to be changed to enable the desired action.

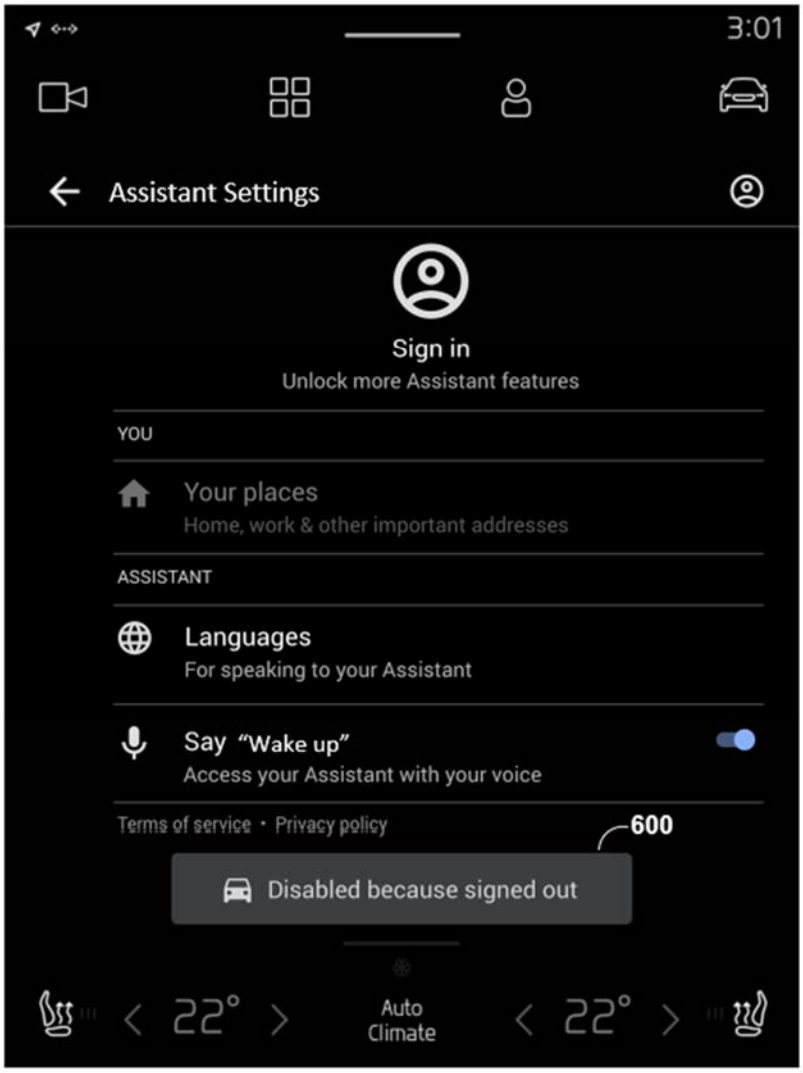

FIG. 6

If a user requests a task that head unit 100 cannot perform because of one or more specific settings being disabled due to the vehicle state, UI module 114 may direct (e.g., prompt, guide, etc), via an appropriate UI (such as notification 600), the user to change the vehicle state to enable the required settings. For example, if the user provides head unit 100 with an audio input via microphones 108 requesting that application 116, which may be a map application, output directions to the user's home address, UI module 114 may respond by displaying an authentication GUI by which the user may sign in. In some examples, the user may sign in by inputting a username and password via display 104. Additionally or alternatively, the user may sign in using a computing device associated with the profile (such as a smartphone that is logged into a shared profile between head unit 100 and the smartphone). In any case, responsive to the user signing into the account (e.g., by successfully inputting credentials associated with the account, authorizing login via the associated smartphone, etc.), the vehicle state may change, thus enabling the settings required to perform the task requested by the user (e.g., outputting directions to home).

One or more advantages of the techniques described in this disclosure include presenting a GUI to a user that dynamically adapts to changes in vehicle state to accurately indicate settings that are enabled or disabled. Another advantage includes reducing the number of user inputs (e.g., by automatically navigating to the appropriate UIs for changing the vehicle state) required to enable settings required to perform a task requested by the user, thereby potentially improving the user experience. This may be particularly beneficial in vehicle settings in which the user is operating the vehicle, as such a user experience may reduce distractions and thereby promote safety.

It is noted that the techniques of this disclosure may be combined with any other suitable technique or combination of techniques. As one example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2018/0060742A1. In another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2014/0280580A1. In yet another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2016/0352712A1. In yet another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2015/0339031A1. In yet another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2008/0301754A1.