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CAR APPLICATIONS

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ABSTRACT

The infotainment system (e.g., infotainment system) of a vehicle (e.g., an automobile, a motorcycle, a bus, a recreational vehicle (RV), a semi-trailer truck, a tractor or other type of farm equipment, train, a plane, a boat, a helicopter, a personal transport vehicle, etc.) may execute an application (e.g., a media application, a messaging application, a navigation application, etc.). Based on a state of the vehicle (e.g., a parked state, a driving state, etc.), the infotainment system may seamlessly switch (e.g., transition) between a driving mode of the application or a non-driving mode of the application. For example, if the vehicle is initially in a parked state, the infotainment system may execute a non-driving mode of the application that has more features and capabilities. If the vehicle then changes to a driving state, the infotainment system may, without terminating the application, execute a driving mode of the application that is designed for use while driving (e.g., to be less distracting). In this way, the techniques may allow for continuous (e.g., uninterrupted) usage of the application, improving the user experience, while addressing safety concerns.

DESCRIPTION

FIG. 1 below is a conceptual diagram illustrating a vehicle 10 in accordance with techniques of this disclosure. Examples of vehicle 10 may include an automobile, a motorcycle, a bus, a recreational vehicle (RV), a semi-trailer truck, a tractor or other type of farm equipment, train, a plane, a boat, a helicopter, a personal transport vehicle, etc. As shown in FIG. 1, vehicle 10 includes an infotainment system 100. As further shown in FIG. 1, infotainment system 100 includes one or more processors 102, a display 104, and one or more storage devices 106.

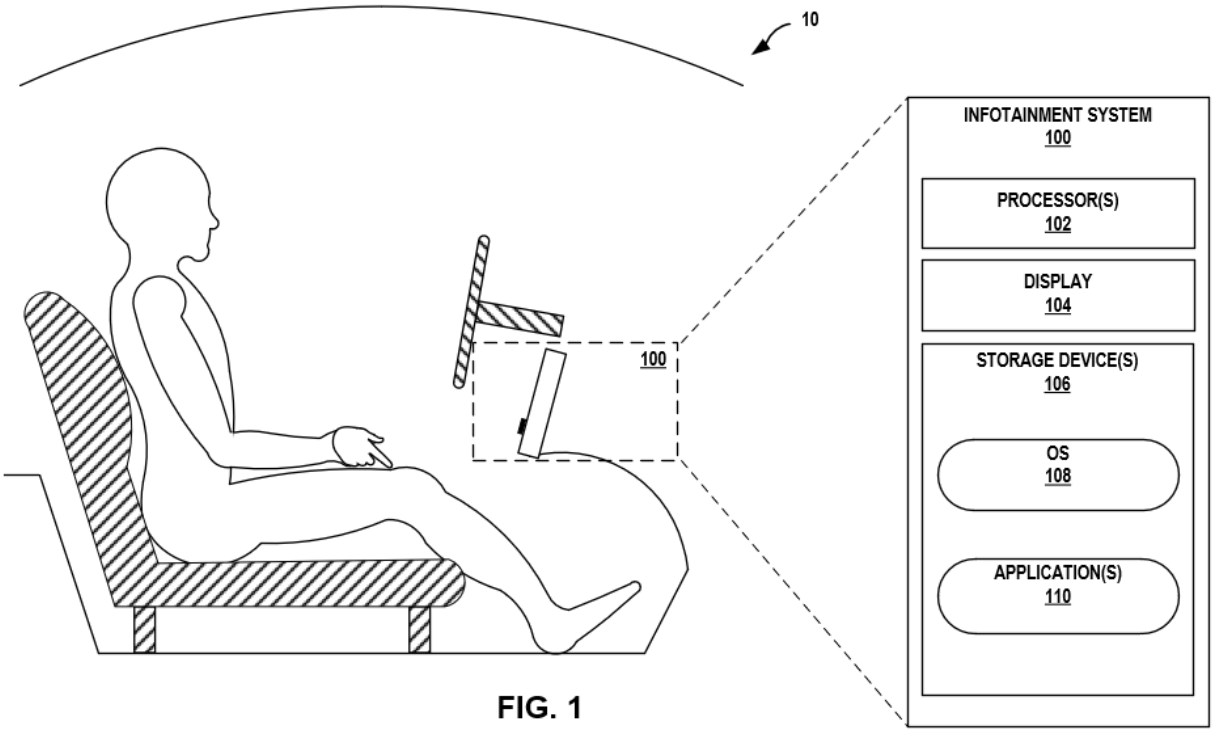

FIG. 1

Infotainment system 100 (e.g., a head unit) of vehicle 10 may operate to assist, inform, entertain, or otherwise provide for interactions with one or more occupants of vehicle 10. Infotainment system 100 may represent an integrated infotainment system that provides a user interface (UI), such as a voice user interface (VUI), a graphical user interface (GUI), etc. In general, infotainment system 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), a seating system (for controlling a position of a driver and/or passenger seat), etc.

Processors 102 may implement functionality and/or execute instructions associated with infotainment system 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. In some examples, processors 102 may represent a system on a chip (SoC) that includes an integrated circuit for implementing one or more of the above referenced examples of processors 102, along with supporting memory and/or storage, and possibly various interfaces, modems, etc., as a single package.

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

Storage devices 106 of infotainment system 100 may include one or more computer-readable storage media. For example, storage devices 106 may be configured for long-term, as well as short-term storage of information, such as instructions, data, or other information used by infotainment system 100. In some examples, storage devices 106 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.

As shown in FIG. 1, storage devices 106 may include an operating system 108 (“OS 108”) that provides an execution environment for one or more applications, such as application 110A-110N (collectively, “application 110”). OS 108 may represent a multi-threaded operating

system or a single-threaded operating system with which application 110 may interface to access hardware of infotainment system 100. OS 108 may include a kernel that facilitates access to the underlying hardware of infotainment system 100, where kernel may present a number of different interfaces (e.g., application programming interfaces – APIs) that application 110 may invoke to access the underlying hardware of infotainment system 100. Examples of application 110 may include a media application, a messaging application, a navigation application, a video conferencing application, a communication application, etc.

In some examples, infotainment system 100 may execute a driving mode of application 110 or a non-driving mode of application 110 depending on a state of vehicle 10 (e.g., a parked state, a driving state, etc.). For example, if vehicle 10 is in a parked state, infotainment system 100 may execute a non-driving mode of application 110 that has a relatively comprehensive set of features and capabilities. However, if vehicle 10 is in a driving state, infotainment system 100 may not execute a driving mode of application 110 that has a relatively limited set of features and capabilities.

In general, infotainment system 100 may restrict usage of the non-driving mode of application 110 to when vehicle 10 is in a parked state because the non-driving mode of application 110 may be distracting. In some examples, if vehicle 10 is initially in a parked state and infotainment system 100 is executing a non-driving mode of application 110 and vehicle then changes to a driving state, vehicle 10 may terminate execution of application 110, which can be problematic. For example, if the driver of vehicle 10 is using application 110 to talk to another person, terminating execution of application 110 may abruptly disconnect an important call, potentially resulting in miscommunication or missed information.

In accordance with techniques of this disclosure, infotainment system 10 may seamlessly switch between a driving mode of application 110 or a non-driving mode of application 110 based on a state of vehicle 10. For example, if vehicle 10 is initially in a parked state, infotainment system 100 may execute a non-driving mode of application 110. If the vehicle then changes to a driving state, infotainment system 100 may, without terminating application 110, execute a driving mode of application 110. In this way, the techniques may avoid interrupting a driver's usage of application 110 while properly addressing safety concerns (e.g., by reducing distractions for the driver).

When vehicle 10 changes from a parked state to a driving state, OS 108 may detect the change and switch the non-driving mode of application 110 to the driving mode of application 110 without terminating application 110. The driving mode of application 110 may be a simplified, less distracting version of application 110 that's designed to be safer to use while driving. For example, the driving mode of application 110 may use simplified user interfaces to reduce the cognitive load and/or the visual attention required.

In general, a simplified user interface may feature large, easily identifiable icons (e.g., buttons, touch targets, etc.) to minimize the need for precise touch input and enhance quick recognition while driving. The user interface may include less text and more visual representations (e.g., symbols, icons, color coding, etc.). The user interface may also limit the levels of navigation required to access various features. In some examples, the driving mode of application 110 may limit the functionality of application 110. For example, typing, video playback, web browsing, gaming, etc., may be disabled or restricted while driving to avoid diverting too much of a driver's attention from a primary driving task.

In one example, application 110 may be a video calling application. While vehicle 10 is in a parked state, OS 108 may execute the non-driving mode of application 110, which may allow full video functionality via display 104 as well as full audio functionality. However, responsive to OS 108 detecting that the state of vehicle 10 changed to a driving state (e.g., based on the transmission gear position being in drive), OS 108 may switch the non-driving mode of application 110 to the driving mode of application 110 without terminating application 110. In this example, the driving mode of application 110 may only allow audio functionality (such that application 110 does not require visual attention).

Conversely, when vehicle 10 changes state from a driving state to a parked state, OS 108 may detect the change (e.g., based on the transmission gear position being in park) and switch the driving mode of application 110 to the non-driving mode of application 110 without terminating application 110. As a result, OS 108 may permit application 110 to display the video of the call via display 104 again and allow the driver to interact with the video controls, view participants, and so forth. In this way, infotainment system 100 may allow for a seamless user experience that optimizes the functionality of applications when vehicle 100 is parked, allowing drivers and passengers to take full advantage of application 110.

The techniques described here may apply to other types of applications. For example, application 110 may be a navigation application. The non-driving mode of application 110 may provide a detailed map and multiple route options, while the driving mode of application 110 may provide a map that only shows the next turn or direction. In another example, application 110 may be a media application. The non-driving mode of application 110 may allow browsing through a library, the creation of playlists, etc., while the driving mode of application 110 may limit functionality to more basic controls, such as play, pause, and skip.

In yet another example, application 110 may be a sports streaming application. The non-driving mode of application 110 may allow video and audio output of the sports game, while the driving mode of application 110 may only allow audio output of the sports game and display the score for the game (and not the game itself) at display 104. In yet another example, application 110 may be a messaging application. The non-driving mode of application 110 may allow the typing of messages (e.g., texts, emails, etc.), browsing conversations, and so on, while the driving mode of application 110 may not only limit the amount of content being displayed, but also use text-to-speech to relay incoming messages and speech-to-text to allow the driver to respond without needing to look at display 104.

The techniques of this disclosure may include one or more advantages. For example, by selecting a mode of application 110 based on the state of vehicle 10, infotainment system 100 may reduce the likelihood of application 110 distracting a driver while vehicle 10 is moving. Additionally, since infotainment system 100 does not terminate application 110 but only switches modes of application 110, the user experience can be more seamless. For example, a driver or other user may not have to reopen or restart application 110 once vehicle 10 starts moving. Thus, infotainment system 100 may balance safety and utility in various scenarios by providing enough functionality to be useful to a driver without distracting the driver given the state of vehicle 10.

The techniques of this disclosure are primarily described here as being performed by OS 108 of infotainment system 100. However, it is important to note that all the functionalities, procedures, and tasks described here can also be accomplished by application 110. For example, application 110 may switch between the non-driving mode and driving-mode of application 110

based on the state of vehicle 10 with OS 108 facilitating the switching. Accordingly, the examples described here are for illustrative purposes and not intended to be limiting.

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. 2014/0277937A1. In another example, the techniques of this disclosure may be combined with the techniques described in Google Developers, "Android for Cars overview," https://developer.android.com/training/cars, February 15, 2023. In yet another example, the techniques of this disclosure may be combined with the techniques described in Google Developers, "Consuming Car Driving State and UX Restrictions," https://source.android.com/docs/devices/automotive/driver_distraction/consume, October 11, 2022. In yet another example, the techniques of this disclosure may be combined with the techniques described in Google Developers, "Build media apps for cars," https://developer.android.com/training/cars/media, January 31, 2023. In yet another example, the techniques of this disclosure may be combined with the techniques described in Google Developers, "Car User Experience Restrictions," https://source.android.com/docs/devices/automotive/driver_distraction/car_uxr, October 11, 2022. In yet another example, the techniques of this disclosure may be combined with the techniques described in PYMNTS, "Developers Work to Optimize Drivers' Control of Apps in Cars," https://www.pymnts.com/technology/2022/developers-work-to-optimize-drivers-control-of-apps-in-cars/, February 23, 2022.