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PROACTIVE REAL-TIME WEATHER INFORMATION

Xin Li

Pengfei Wu

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ABSTRACT

A computing device (e.g., a cellular phone, a smartphone, a desktop computer, a laptop computer, a tablet computer, a portable gaming device, a watch, etc.) may provide navigation and weather information to assist a user of the computing device in selecting a route to a destination. The computing device may execute an application that provides both navigation functionality and periodic weather updates. A user of the computing device may input a destination into the application, and the application may output a route to the destination as well as weather information for locations along that route. As the user moves along the route, the application may receive updated weather information for the updated locations and alerts warning about extreme weather. The application may receive, via the computing device, the updated weather information in response to a periodic request, automatically (e.g., in response to a weather alert being issued), or a combination thereof. As a result, the application may output (e.g., visually, auditorily, tactilely, etc.) current weather information about the user's current and upcoming locations, thus providing the user a stream of accurate weather information.

DESCRIPTION

FIG. 1 below is a conceptual diagram illustrating a system 10 including a computing device 100 and a computing system 120. As shown in FIG. 1, computing device 100 may include one or more processors 102, a presence-sensitive display 104, one or more communication components 106 ("COMM components 106"), one or more microphones 108, and one or more storage devices 110. As further shown in FIG. 1, computing system 120 may include one or more processors 122, one or more communication components 126 ("COMM components 126"),

and one or more storage devices 130. One or more components of computing device 100 (e.g., processors 102, COMM components 106, storage devices 120, etc.) may be substantially similar to one or more components of computing system 120 (e.g., processors 122, COMM components 126, storage devices 130, etc.). As such, the description of one may apply equally to the other except for any differences described herein.

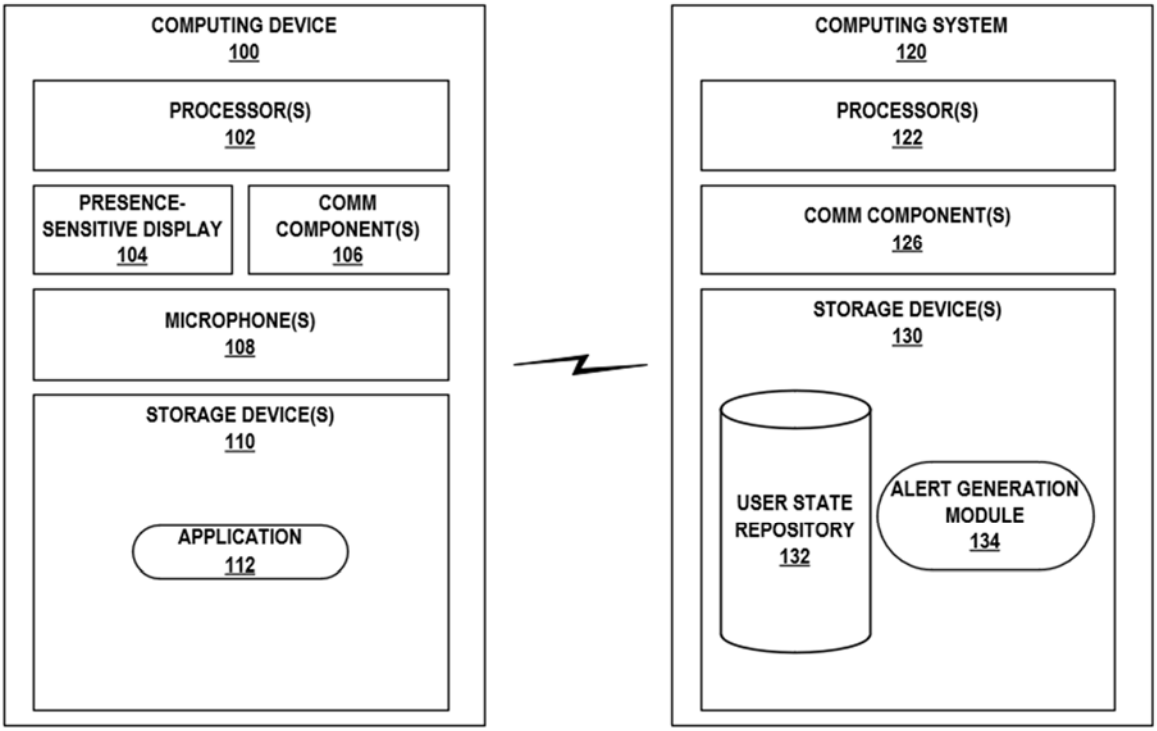

FIG. 1

Computing device 100 may be any mobile or non-mobile computing device, such as a cellular phone, a smartphone, a desktop computer, a laptop computer, a tablet computer, a portable gaming device, a portable media player, an e-book reader, a watch (including a so-called smartwatch), a gaming controller, and/or the like. Computing device 100 may execute application 112 to perform techniques in accordance with this disclosure. However, it should be understood that an 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 application 112 to perform these techniques.

Processors 102 may implement functionality and/or execute instructions associated with computing device 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. Application 112 may be operable by processors 102 to perform various actions, operations, or functions of computing device 100.

Presence-sensitive display 104 of computing device 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 capacitive touchscreen, a projective capacitance 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, microLED display, organic light-emitting diode (OLED) display, e-ink, active-matrix organic light-emitting diode (AMOLED) display, or similar monochrome or color display capable of outputting visible information to a user of computing device 100.

COMM components 106 of computing device 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 110 may include one or more computer-readable storage media. For example, storage devices 110 may be configured for long-term, as well as short-term storage of information, such as instructions, data, or other information used by computing device 100. In some examples, storage devices 110 may include non-volatile storage elements. Examples of such non-volatile storage elements include magnetic hard discs, optical discs, solid state discs, and/or the like. In other examples, in place of, or in addition to the non-volatile storage elements, storage devices 110 may include one or more so-called “temporary” memory devices, meaning that a primary purpose of these devices may not be long-term data storage. For example, the devices may comprise volatile memory devices, meaning that the devices may not maintain stored contents when the devices are not receiving power. Examples of volatile memory devices include random-access memories (RAM), dynamic random-access memories (DRAM), static random-access memories (SRAM), etc.

Computing system 120 may be any suitable remote computing system 120, such as one or more desktop computers, laptop computers, mainframes, servers, cloud computing system 120s, virtual machines, etc., capable of sending and receiving information via a network. In some examples, computing system 120 may represent a cloud computing system 120 that provides one or more services via the network. That is, in some examples, computing system 120 may be a

distributed computing system 120. One or more computing devices, such as computing device 100, may access the services provided by the cloud by communicating with computing system 120. While described herein as being performed at least in part by computing system 120, any or all techniques of the present disclosure may be performed by one or more other devices, such as computing device 100. That is, in some examples, computing device 100 may be operable to perform one or more techniques of the present disclosure alone.

A user of computing device 100 may use computing device 100 to request weather information (e.g., weather events, weather forecasts, etc.) that may be relevant for driver safety. For example, computing device 100 may execute a navigation application to determine a route to a destination, and execute a weather application that pulls weather information about a particular location (e.g., the current location of computing device 100) from computing system 120. In general, the navigation application and the weather application may not be integrated such that the user of computing device 100 is required to navigate from one application to the other, resulting in a clunky user experience that may even be dangerous when the user is performing a driving task. Further, when the user is driving a vehicle, the weather application may not periodically push (e.g., every 30 minutes, in real time, etc.) current weather information about the user's current and upcoming location (as indicated by the current location of computing device 100). As a result, the user may be forced to regularly check the weather application for updated weather information, which may compromise driving safety.

In accordance with techniques of this disclosure, computing device 100 may execute application 112 that provides both navigation functionality and periodic weather updates. A user of computing device 100 may input a destination into application 112, and application 112 may output a route to the destination as well as weather information for locations along that route. As

a vehicle occupied by the user (e.g., as a driver, as a passenger, etc.) moves (causing the location of computing device 100 to change over time), application 112 may receive updated weather information in response to a periodic request, automatically (e.g., in response to a weather alert being issued), or a combination thereof. For example, application 112 may receive updated weather information for the updated locations in real-time and alerts warning about extreme weather. As a result, application 112 may output (e.g., visually, auditorily, tactilely, etc.) current weather information about the user's current and upcoming locations, thus providing the user a stream of accurate weather information.

As noted above, a user of computing device 100 may input a destination request into application 112. For example, the user may input an address (e.g., "13th Avenue SW, Seattle, Washington") by touching corresponding keys of a virtual keyboard displayed by presence-sensitive display 102, providing an audio input (e.g., "Navigate to 13th Avenue SW, Seattle, Washington") via a microphone 108 of computing device 100 that computing device 100 then converts into text, etc. Responsive to receiving the destination request, application 112 may send, via a network, a request to computing system 120 for real time traffic information and weather information. Computing system 120 may fulfill the request by providing data including, but not limited to, one or more routes, traffic alerts, temperature, chance of rain, extreme weather factors (e.g., snow, sleet, ice, slush, fog, fire, hurricane, etc.), and so on. In some examples, application 112 receives traffic information and weather information for each of the one or more routes, in this way enabling the user to better understand the route conditions and prepare for extreme weather, such as a forest fire.

The user may select one of the routes to use and start driving (though the user may modify the route while driving). When the user is driving (e.g., a long route), the user may

encounter various climate zones (e.g., a dry climate, a tropical climate, a polar climate, etc.). As a result, the weather may change dramatically and unpredictably during the drive. For example, the user may experience sun, rain, snow, and other weather while driving to the user's destination.

To ensure that the user is informed of possible changes in the weather, application 112 may provide alarms for the drivers based on the user's route. As an example, application 112 may periodically (e.g., every 30 minutes, in real-time, etc.) send a request for weather information to computing system 120. The request may contain a user state (e.g., current route, current location, etc.). Responsive to receiving the request, computing system 120 may read the user state from the request and query all weather information for the upcoming route. Computing system 120 may then transmit at least a portion of the weather information to computing device 100 for computing device 100 to output.

For example, computing device 100 may display current weather information including, but not limited to, the temperature, the humidity, the likelihood of rain, and other weather conditions (e.g., extreme weather events) generally along the route selected by the user. By pulling the weather information and generating alerts based on the weather information, application 112 allows the user to concentrate on performing one or more driving tasks instead of interacting with application 112 to find the weather information. This in turn may promote driving safety.

As another example, computing system 120 may push weather information and alerts to computing device 100. For instance, responsive to starting navigation, application 112 may synchronize the user state with a user state repository 132 in storage device 130 of computing system 120. Computing system 120 may query all weather information based on changes in the

user state (e.g., due to the location of computing device 100 changing). Based on the weather information that computing system 120 obtains in response to the query, an alert generation module 134 of computing system 120 may generate a weather alert when necessary.

For example, alert generation module 134 may generate an alert if the weather information indicates or predicts extreme weather (e.g., a storm, a hurricane, a fire, etc.), a sudden weather change, etc. Computing system 120 may send the alert to computing device 100 for computing device 100 to output. For example, computing device 100 may display an alert notification containing the weather information. Additionally or alternatively, computing device 100 may display an alert graphical element, such as an icon, overlaying a specific region of a map graphical user interface (GUI) of application 112. The location of the alert graphical element may indicate the location of the weather event associated with the alert relative to the map GUI.

A user of computing device 100 may respond to the alert outputted by computing device 100. For example, the user may provide a touch input to the alert notification to cause application 112 to provide more details about the alert. Similarly, the user may provide a touch input to the map GUI to see alternative routes and associated alert graphical elements, if any. In any case, responsive to computing device 100 receiving an alert indicating or predicting extreme weather, a sudden weather change, or other weather event potentially compromising driving safety, application 112 may suggest a modification to the route. For instance, application 112 may generate a notification recommending that the user of computing device 100 park the vehicle until the extreme weather subsides, suggest an alternative route safer than the current route based on the weather information from computing system 120, etc.

The techniques described here include one or more advantages. For example, by providing real-time weather information based on the user's current location, the weather information may be more accurate than a weather forecast predicting hours or even days into the future. Further, by generating alerts warning the user of the computing device of extreme weather, the application enables the user to primarily concentrate on performing one or more driving tasks, only minimally distracting the user to inform the user of weather information critical to driver 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. 2007/0043687A1. In another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2017/0148322A1. In yet another example, the techniques of this disclosure may be combined with the techniques described in WIPO Patent Application Publication No. 2019/213177A1. In yet another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2016/0335725A1.