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Bringert et al.

(54) **SYSTEMS AND METHODS FOR CONTINUAL SPEECH RECOGNITION AND DETECTION IN MOBILE COMPUTING DEVICES**

(71) Applicant: **Google Inc.**, Mountain View, CA (US)

(72) Inventors: **Bjorn Erik Bringert**, Bath (GB); **Peter John Hodgson**, London (GB); **Pawel Pietryka**, London (GB); **Simon Tickner**, Whitstable (GB); **Richard Zarek Cohen**, London (GB); **Henrique Penha**, San Francisco, CA (US); **Luca Zanolin**, London (GB); **Dave Burke**, Palo Alto, CA (US)

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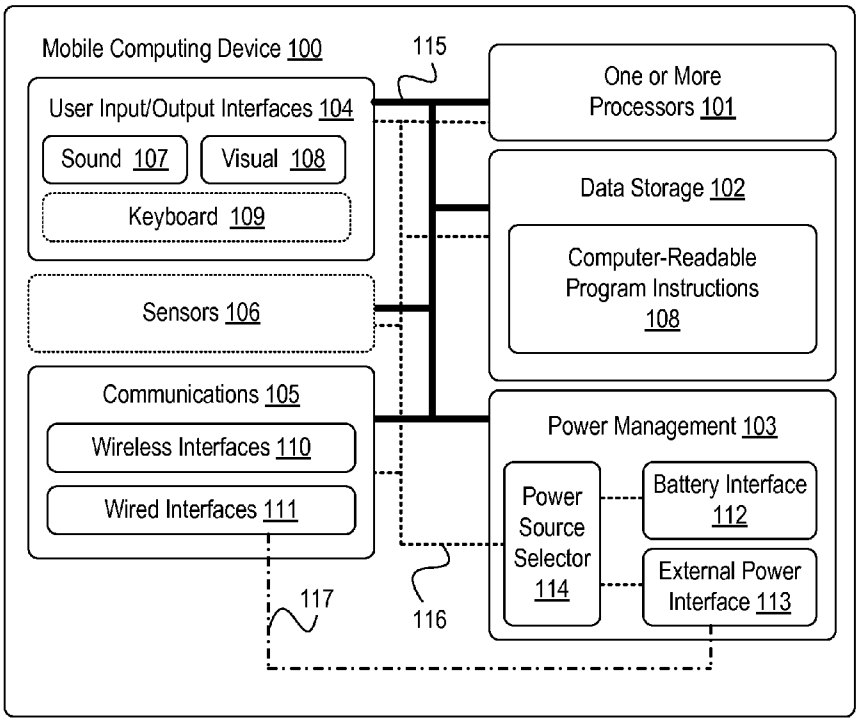
(57) **ABSTRACT**

The present application describes systems, articles of manufacture, and methods for continuous speech recognition for mobile computing devices. One embodiment includes determining whether a mobile computing device is receiving operating power from an external power source or a battery power source, and activating a trigger word detection subroutine in response to determining that the mobile computing device is receiving power from the external power source. In some embodiments, the trigger word detection subroutine operates continually while the mobile computing device is receiving power from the external power source. The trigger word detection subroutine includes determining whether a plurality of spoken words received via a microphone includes one or more trigger words, and in response to determining that the plurality of spoken words includes at least one trigger word, launching an application corresponding to the at least one trigger word included in the plurality of spoken words.



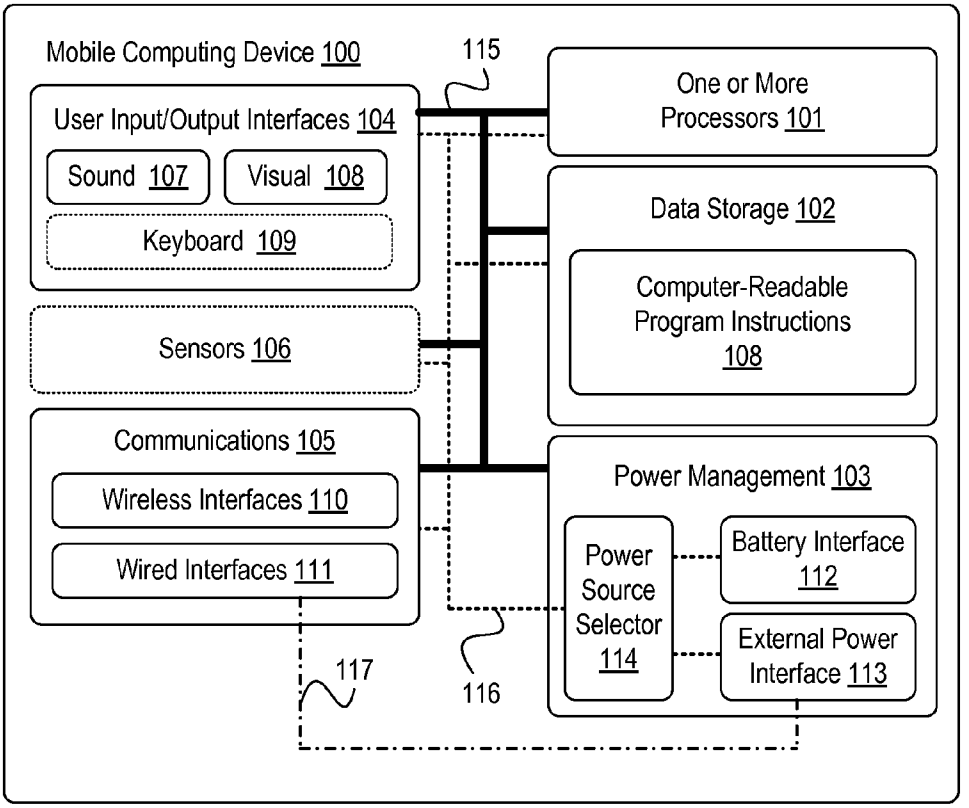

Mobile Computing Device 100
115
User Input/Output Interfaces 104
Sound 107
Visual 108
Keyboard 109
Sensors 106
Communications 105
Wireless Interfaces 110
Wired Interfaces 111
One or More Processors 101
Data Storage 102
Computer-Readable Program Instructions 108
Power Management 103
Power Source Selector 114
Battery Interface 112
External Power Interface 113
117
116

FIG. 1

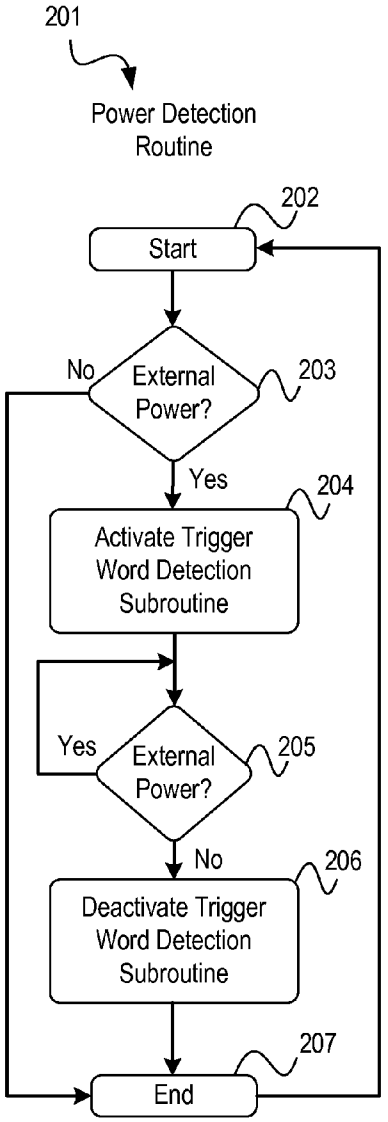

201
Power Detection Routine
202
Start
No
External Power?
203
Yes
204
Activate Trigger Word Detection Subroutine
Yes
External Power?
205
No
206
Deactivate Trigger Word Detection Subroutine
207
End

FIG. 2A

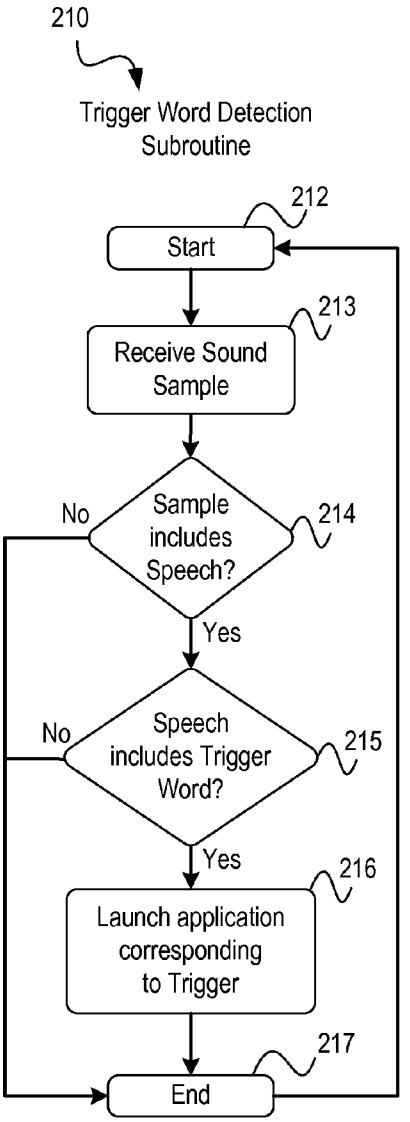

210
Trigger Word Detection Subroutine
212
Start
213
Receive Sound Sample
No
Sample includes Speech?
214
Yes
No
Speech includes Trigger Word?
215
Yes
216
Launch application corresponding to Trigger
217
End

FIG. 2B

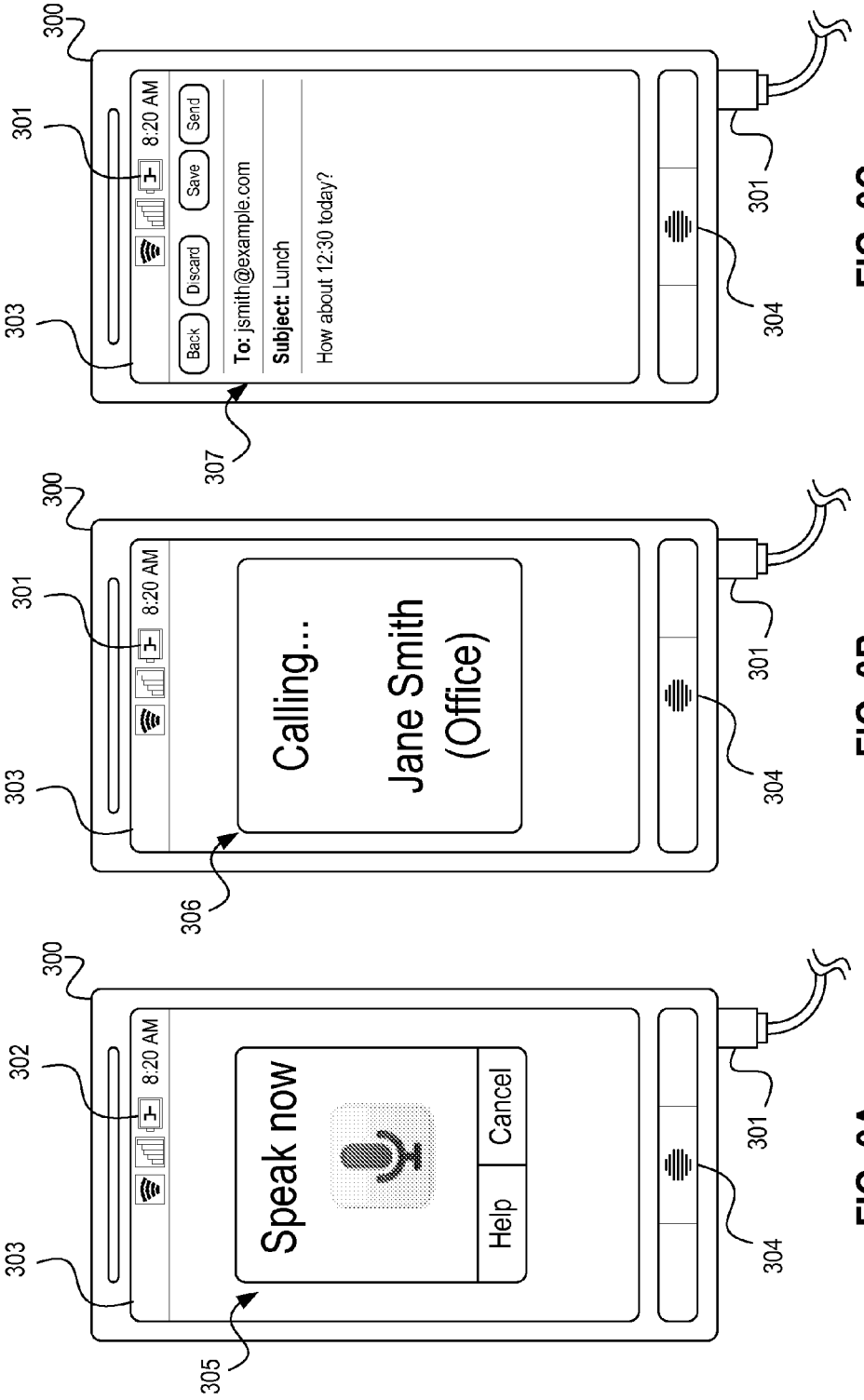


FIG. 3A

FIG. 3B

FIG. 3C

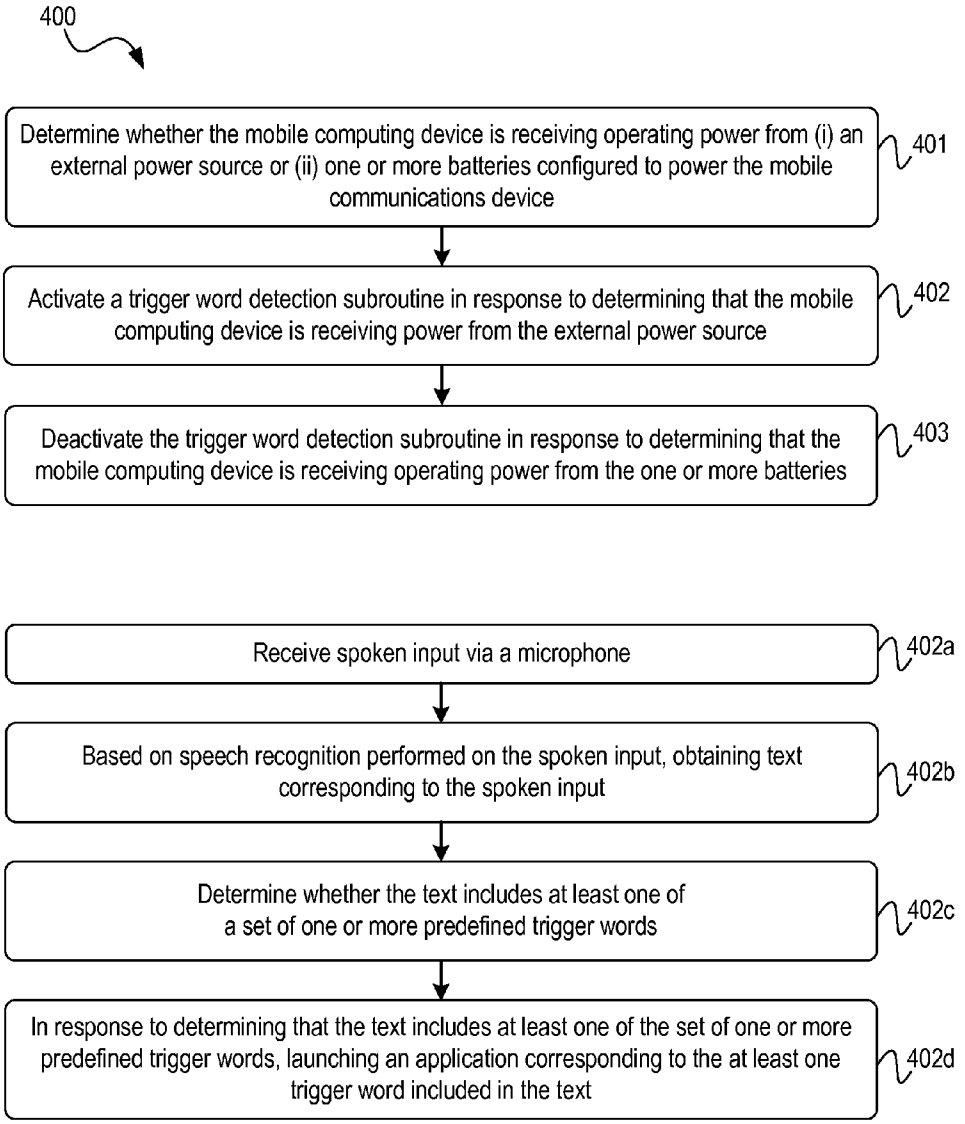

400
Determine whether the mobile computing device is receiving operating power from (i) an external power source or (ii) one or more batteries configured to power the mobile communications device
401
Activate a trigger word detection subroutine in response to determining that the mobile computing device is receiving power from the external power source
402
Deactivate the trigger word detection subroutine in response to determining that the mobile computing device is receiving operating power from the one or more batteries
403
Receive spoken input via a microphone
402a
Based on speech recognition performed on the spoken input, obtaining text corresponding to the spoken input
402b
Determine whether the text includes at least one of a set of one or more predefined trigger words
402c
In response to determining that the text includes at least one of the set of one or more predefined trigger words, launching an application corresponding to the at least one trigger word included in the text
402d

FIG. 4

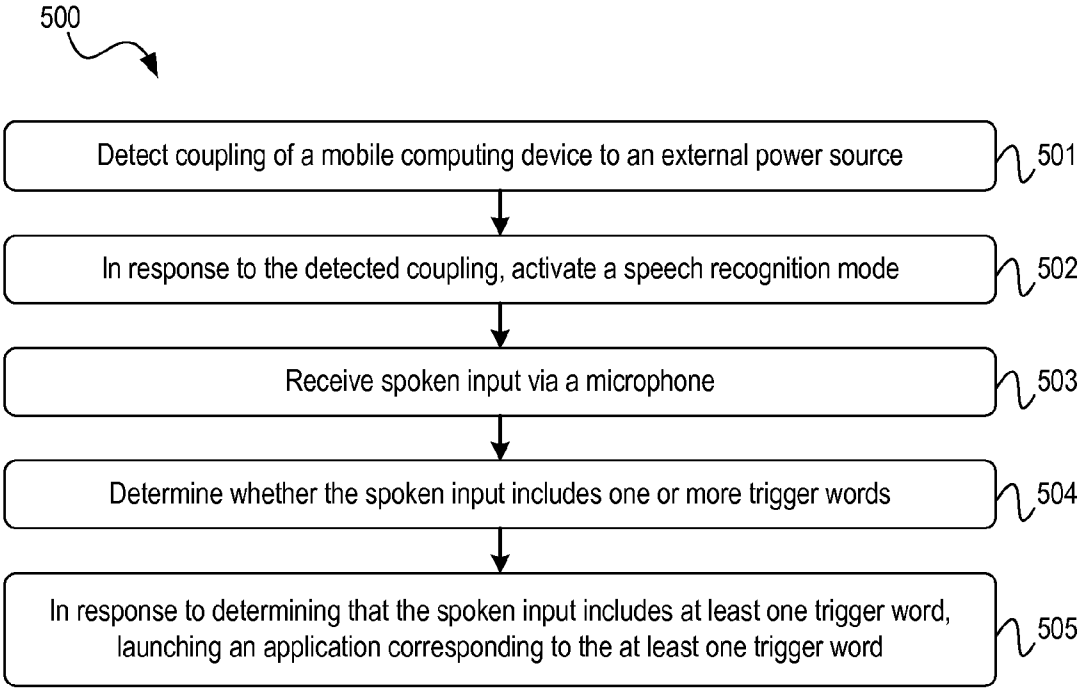

500
Detect coupling of a mobile computing device to an external power source
501
In response to the detected coupling, activate a speech recognition mode
502
Receive spoken input via a microphone
503
Determine whether the spoken input includes one or more trigger words
504
In response to determining that the spoken input includes at least one trigger word, launching an application corresponding to the at least one trigger word
505

FIG. 5

SYSTEMS AND METHODS FOR CONTINUAL SPEECH RECOGNITION AND DETECTION IN MOBILE COMPUTING DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority to U.S. Provisional Application No. 61/542,074, filed on Sep. 30, 2011, the contents of which are entirely incorporated herein by reference, as if fully set forth in this application.

BACKGROUND

[0002] Typically, activating a voice command interface on a mobile computing device requires some physical activation of the voice command interface by a user. For example, to activate a voice command interface on a mobile computing device, a user may be required to press or hold a physical button or switch on the exterior of the mobile computing device, or the user may be required to activate a virtual button or switch on a graphical user interface associated with the mobile computing device.

SUMMARY

[0003] Controlling a mobile computing device via voice commands is often useful when a user cannot easily interact with the mobile computing device physically. For example, controlling a mobile computing device via voice commands can be useful when the user is driving a car or when the mobile computing device is some distance from the user (e.g., across the room or otherwise out of the user's immediate reach).

[0004] A voice command interface for controlling a mobile computing device generally requires operating a microphone or other speech input device to receive speech from a user, and running speech recognition and detection algorithms on the mobile computing device to detect and recognize speech received via the microphone. However, continually operating a microphone and continually running speech detection and recognition applications on a mobile computing device may be undesirable in many situations because the power required to operate the microphone and continually execute the detection and recognition applications can rapidly deplete the mobile computing device's battery.

[0005] The present application discloses systems and methods that allow a user to enjoy the advantages of controlling a mobile computing device via voice commands without the limitations of having to either press or hold a physical button or switch on the mobile computing device or manually activate a virtual button or switch on a graphical user interface of the mobile computing device as required with existing devices.

[0006] In operation, a mobile computing device according to some embodiments of the disclosed systems and methods is configured to (i) detect coupling to an external power source, and (ii) in response to the detecting, activate a speech recognition mode. Some embodiments include a power monitoring routine for detecting coupling to an external power source. Likewise, in some embodiments, a mobile computing device operating in a speech recognition mode may include a trigger word detection subroutine. The combination of detecting the coupling to the external power source and activating the speech recognition mode enables the disclosed embodiments to overcome the limitations of existing devices with negligible impact on the mobile computing device's battery in most situations.

[0007] Some embodiments include determining whether the mobile computing device is receiving operating power either from an external power source or from a battery. If the mobile computing device is receiving power from the external power source, then the mobile computing device activates a speech recognition mode. In some embodiments, the speech recognition mode includes a trigger word detection subroutine. The external power source may be a wall charger for the mobile computing device or a docking station for the mobile computing device, such as a desktop or car-based docking station. Some embodiments may also include exiting from the speech recognition mode (and/or perhaps deactivating trigger word detection subroutine) when the mobile computing device is receiving operating power from the battery.

[0008] In operation, the trigger word detection subroutine includes determining whether spoken words received via a microphone include at least one trigger word of a set of one or more trigger words. In response to determining that the spoken words include at least one trigger word, the trigger word detection subroutine launches an application corresponding to the at least one trigger word included in the spoken words. In some embodiments, the trigger word detection subroutine operates continually as long as the mobile computing device continues to receive power from the external power source.

[0009] In some embodiments, the launched application corresponding to the detected trigger word (or words) may be a voice command prompt configured to receive a voice command from a user. When the voice command prompt is launched, a user may control the mobile computing device via one or more voice commands. The voice command after the trigger word (or words) may include an action and an object of the action. For example, the trigger word to launch the voice command prompt application may be "Android," and the voice command may include "call" (action) and "Jane Smith" (the object of the action). The voice command could include additional words as described herein.

[0010] In other embodiments, the launched application may be a particular communications application, multimedia application, or an application for configuring settings of the mobile computing device. In these embodiments, the trigger word could even be the name of the application. For example, the trigger word to launch the phone dialer may be "call." In response to detecting the trigger word "call," the mobile computing device may be configured to launch the phone dialer and then either (i) wait to receive the name of the desired called party or (ii) use the words following the "call" trigger word as the name of the desired called party. The phone dialer (or other launched application) could be configured to receive additional voice commands after it is launched. The types of commands may vary depending on the particular application as described herein.

[0011] In some embodiments, the trigger word detection routine may be launched in response to coupling the device to the external power source and not in response to any other type of input (e.g., touch input, manual button press, etc.). In these embodiments, the speech recognition mode and/or trigger word detection routine may be activated automatically only when the mobile computing device is receiving power from an external power source. In some embodiments, the speech recognition mode may be activated only when the mobile computing device is receiving operating power from

an external power source, and the speech recognition mode may always be deactivated when the mobile computing device is receiving operating power from a battery.

[0012] Other embodiments may include receiving a manual input from a user to activate (or deactivate) the trigger word detection subroutine regardless of whether the mobile computing device is receiving operating power from the external power source or the battery. In these embodiments, the mobile computing device may still activate a trigger word detection subroutine even though the mobile computing device may be receiving operating power from the battery. When the trigger word detection subroutine is manually activated by the user (e.g., touch input, manual button press, etc.), the trigger word detection subroutine may still operate continually while the mobile computing device is receiving power from the battery.

[0013] In some embodiments, the features and functions of the disclosed methods may be integrated with the operating system of the mobile computing device. In other embodiments, the features and functions of the disclosed embodiments may be components of an application that is installed and executed by the mobile computing device, such an application downloaded from an online application store.

[0014] Any of the methods described herein may be implemented in the form of instructions stored on a non-transitory, tangible computer readable media. When executed by a mobile computing device, the instructions may cause the mobile computing device to perform one or more functions of the disclosed method. Further examples may also include articles of manufacture including tangible, non-transitory computer-readable media that have computer-readable instructions encoded thereon. The instructions may comprise instructions to perform one or more functions of the methods described herein.

[0015] The computer readable media may include non-transitory computer readable media, such as computer-readable media that stores data for short periods of time like register memory, processor cache, and Random Access Memory (RAM). The computer readable media may also include non-transitory media, such as secondary or persistent long term storage, like read only memory (ROM), optical or magnetic disks, or compact-disc read only memory (CD-ROM), for example. The computer readable media may also be any other volatile or non-volatile storage system. In some embodiments, the computer readable media may be considered a computer readable storage media, for example, or a tangible storage media.

[0016] In addition, some aspects of the disclosed methods may be performed by circuitry configured to perform logical functions in any of the processes or methods described herein. In still further examples, many types of devices may be used or configured to perform logical functions in any of the processes or methods described herein. In yet further examples, many types of devices (and/or components or sub-components of the devices) may be used or configured as means for performing functions of any of the methods described herein (or any portions of the methods described herein).

BRIEF DESCRIPTION OF THE FIGURES

[0017] FIG. **1** shows an example of a simplified block diagram of a mobile computing device according to some embodiments.

[0018] FIG. **2**A shows an example algorithm for a power detection routine according to some embodiments.

[0019] FIG. **2**B shows an example algorithm of a trigger word detection subroutine according to some embodiments.

[0020] FIGS. **3**A-**3**B show examples of a mobile computing device **300** launching applications in response to detecting trigger words according to some embodiments.

[0021] FIG. **4** shows an example method according to some embodiments.

[0022] FIG. **5** shows an example method according to some embodiments.

DETAILED DESCRIPTION

[0023] The following detailed description includes references to the accompanying figures. In the figures, similar symbols typically identify similar components, unless context dictates otherwise. The example embodiments outlined in the detailed description, figures, and claims are not meant to be limiting. Other embodiments may be utilized, and other changes may be made, without departing from the scope of the subject matter presented herein. It will be readily understood that the aspects of the present disclosure, as generally described herein, and illustrated in the figures, can be arranged, substituted, combined, separated, and designed in a wide variety of different configurations, all of which are contemplated herein.

[0024] FIG. **1** shows an example of a simplified block diagram of a mobile computing device **100** according to some embodiments. In some embodiments, the mobile computing device **100** may be a mobile telephone, cellular telephone, smartphone or similar mobile communications device now known or later developed that may be controlled via voice commands. In other embodiments, the mobile computing device **100** may be a laptop computer, tablet computer, or other type of mobile computing device now known or later developed that may be controlled via voice commands.

[0025] The mobile computing device **100** includes a plurality of components, such as one or more processors **101**, data storage **102**, power management sub-system **103**, user input/output interfaces **104**, communications interfaces **105**, and sensors **106**. The individual components are connected via one or more data busses **115** or similar communications connections that are configured to enable the individual components to send and receive data to and from other components of the mobile computing device **100**. The individual components are also connected to the power management sub-system **103** via a power distribution bus **116** or similar connection that is configured to provide operating power to the individual components of the mobile computing device **100**.

[0026] The one or more processors **101** may include any type of general purpose processor (e.g., processors from Intel, Advanced Micro Devices (AMD), etc.) or any type of special purpose processors (e.g., application specific integrated circuits (ASICs), digital signal processors (DSP), Coder/Decoders (CODECs), etc.) now known or later developed.

[0027] The data storage **102** is configured to store data as well as computer-readable program instructions **108**. The data storage **102** may include any of the types of data storage described herein, including short term volatile memory (e.g., RAM) for storing data and/or program code or instructions during execution of the program code or instructions and/or longer-term non-volatile memory (e.g., ROM) for storing data and/or program code or instructions. In some embodi-

ments, the data storage may be implemented as solid state and/or flash memory or other similar types of small form factor storage media.

[0028] The power management sub-system **103** includes a battery power interface **112**, an external power interface **113**, and a power source selector **114**. The battery power interface **112** is configured to receive operating power from a battery source, such as an internal battery, a removable battery that is electrically coupled to the mobile computing device **100**, or any other sort of battery or similar type of portable power supply now known or later developed. The battery that supplies operating power for the mobile computing device **100** via the battery interface **112** may be rechargeable or non-rechargeable.

[0029] The external power interface **113** is configured to receive power from an external power source for the mobile computing device **100**. Examples of external power sources include electrical wall outlets, desktop docking stations, car docking stations or power cables, alarm clocks or entertainment systems with docking stations, or any other type of connection or device that is configured to provide the mobile computing device **100** with operating power so that the mobile computing device **100** does not need to rely on operating power from a battery via the battery interface **112**.

[0030] In some embodiments, the power source selector **114** may be configured to selectively provide operating power from one of the battery interface **112** or the external power interface **113**. In embodiments with rechargeable batteries, when an external power source is connected via the external power interface **113**, the power source selector **114** may be configured to both (i) provide operating power to the mobile computing device **100** from the external power supply via the external power interface **113** and (ii) charge the battery with power from the external power supply by providing an electrical connection from the external power interface **113** to the battery interface **112**.

[0031] The user input/output interfaces **104** include a plurality of input and output components, such as sound input/output components **107**, display input/output components **108**, and an optional keyboard **109**. The sound components **107** may include a microphone or other similar type of sound detection device now known or later developed that is configured to detect and receive sound waves. The sound components **107** may also include one or more speakers or similar sound generation devices now known or later developed that are configured to generate sound waves.

[0032] The display input/output components **108** may include a Liquid Crystal Display (LCD), plasma display, or similar type of display device now known or later developed that is configured to display a graphical user interface and/or other information to a user. In some embodiments, the display **108** may include a touch-screen interface or other touch-sensitive components to enable a user to enter commands or other information (or otherwise interact with) the mobile computing device **100**. In some embodiments, the display **108** may be configured to generate and display a virtual keyboard for data entry by a user. In other embodiments, the mobile computing device **100** may optionally include a physical keyboard **109**. However, a keyboard (virtual or physical) is not required in all embodiments. Some embodiments may also include one or more external switches or buttons (not shown) to turn the mobile computing device **100** on or off, to wake the device from a sleep state, to control volume or other similar functions.

[0033] The communications interfaces **105** may include one or more wireless communications interfaces **110** and one or more wired interfaces **111**. The wireless interfaces **110** may include any type of wireless communications interface configured to transmit and receive data according to any of a number of different wireless communications protocols, such as Bluetooth, IEEE 802.11 (IEEE 802.11 may refer to IEEE 802.11-2007, IEEE 802.11n-2009, or any other IEEE 802.11 revision) or other Wi-Fi variant, Code-Division Multiple Access (CDMA), Global System for Mobile Communications (GSM), 3rd Generation (3G), 4th Generation (4G), 3rd Generation Partnership Project—Long Term Evolution (3GPP-LTE), Worldwide Interoperability for Microwave Access (WiMAX), Zigbee, General Packet Radio Service (GPRS), Evolution-Data Optimized (EV-DO), High-Speed Downlink Packet Access (HSDPA), or any other type of wireless communications protocol now known or later developed. The wired interfaces **111** may include any type of wired communications interface (e.g., electrical, optical, etc.) configured to transmit and receive data according to any of a number of different communications protocols, such as Universal Serial Bus (USB), Ethernet, IEEE 1394, Firewire, Thunderbolt, or any other type of serial or parallel data communications protocol now known or later developed. The wired interfaces **110** and wireless interfaces **111** may be configured to communicate with other computing or communications devices via networks, e.g. the Internet, and/or communicate with peripheral devices, such as disk drives, external monitors, mouse or trackball/pad devices, and external keyboards etc., via Bluetooth, USB, or similar connections. In some examples, mobile computing device **100** may use wired interfaces **110** and/or wireless interfaces **111** to communicate with a server that performs speech recognition on behalf of mobile computing device **100**.

[0034] In some embodiments, the wired communications interface **111** may also be configured to provide operating power via the external power interface **113** as shown by power connection **117** from the wired interface **111** to the external power interface **113**. For example, USB is one type of wired communications interface that can be configured to provide both communications and power.

[0035] Some embodiments of the mobile computing device **100** may also include one or more sensors **106**. The sensors **106** may include any one or more cameras or other image sensors, accelerometers, Global Positioning System (GPS) sensors, temperature sensors, or any other type of sensor known now or later developed that may be desirable to integrate with the mobile computing device **100**.

[0036] As described briefly above, a mobile computing device configured according to the disclosed embodiments may enable a user to enjoy the advantages of controlling the mobile computing device via voice commands without the limitation of having to either press or hold a physical button or switch on the mobile computing device or manually activate a virtual button or switch on a graphical user interface of the mobile computing device. In one embodiment, the above-described advantages may be achieved via a combination of a power detection routine and a trigger word detection subroutine that are executed by the mobile computing device **100**.

[0037] FIG. **2**A shows an example algorithm for a power detection routine **201** according to some embodiments, and FIG. **2**B shows an example algorithm for a trigger word detection subroutine **210** according to some embodiments. The description of the algorithms of FIGS. **2**A and **2**B

includes references to the example mobile computing device **100** and its corresponding components shown and described herein with reference in FIG. **1**. In some embodiments, the power detection routine **201** and/or the trigger word detection subroutine **210** may be components of the operating system of the mobile computing device **100**. In other embodiments, the power detection routine **201** and/or the trigger word detection subroutine **210** may be components of an application or widget installed on the mobile computing device **100**, such as an application or widget downloaded from an online application store.

[0038] In some embodiments, the power detection routine **201** may be configured to operate continually (or at least substantially continually) on the mobile computing device **100**. Some embodiments may also allow a user to activate and deactivate the power detection routine **201**. In some embodiments, the power detection routine **201** may be selectively activated or deactivated by a user.

[0039] In the embodiment of FIGS. **2**A and **2**B, the trigger word detection subroutine **210** is a "subroutine" of the power detection routine **201** in that the trigger word detection subroutine **210** is activated by the power detection routine **201** under certain conditions, as described herein. However, the trigger word detection capability need not be implemented as a subroutine of a power detection routine in all embodiments.

[0040] The power detection routine starts at block **202**. At block **203**, the power detection routine **201** determines whether operating power for the mobile computing device **100** is being received from either (1) an external power source via the external power interface **113** or (2) a battery power source via the battery interface **112**. In some embodiments, the determination may be made by the power source selector **114**. In other embodiments, the determination may be made by one or more processors **101** configured to monitor any of the battery interface **112**, the external power interface **113**, and/or the power source selector **114**. If an external power source is not detected (i.e., the mobile computing device **100** is receiving operating power from a battery source), then the power detection routine **201** ends at block **207**. After ending at block **207**, power detection routine **201** re-starts at block **202**, either immediately (or after a brief waiting period) so that power detection routine **201** operates continually (or at least substantially continually).

[0041] However, if at block **203**, the power detection routine **201** determines that the mobile computing device **100** is receiving operating power from an external power source via the external power interface **113**, then the power detection routine **201** advances to block **204**. At block **204**, the power detection routine **201** activates the trigger word detection subroutine **210**. Once it is activated by the power detection routine **201** at block **204**, the trigger word detection subroutine **210** may be configured to execute continually (or at least substantially continually) until it is deactivated.

[0042] After activating the trigger word detection subroutine **210** at block **204**, the power detection routine advances to block **205**. At block **205**, the power detection routine **201** determines whether the communications device **100** is receiving operating power from an external power source via the external power interface **113**. In some embodiments, the determination may be made by the power source selector **114**. In other embodiments, the determination may be made by one or more processors **101** configured to monitor any of the battery interface **112**, the external power interface **113**, and/or the power source selector **114**.

[0043] If the mobile computing device **100** is receiving its operating power from an external power source, then the power detection routine **201** returns to block **205**. But if the power detection routine **201** determines that the mobile computing device **100** is no longer receiving its operating power from an external power source (i.e., the external power source has been disconnected from the external power interface **113** and/or the mobile computing device **100** has switched to battery power), then the power detection algorithm **201** advances to block **206**. At block **206**, the power detection routine **201** deactivates the trigger word detection subroutine **210**. The power detection routine **201** then ends at block **207**. After ending at block **207**, power detection routine **201** re-starts at block **202**, either immediately (or after a brief waiting period) so that power detection routine **201** operates continually (or at least substantially continually).

[0044] FIG. **2**B shows an example algorithm of a trigger word detection subroutine **210**. As described with respect to FIG. **2**A, once the power detection routine **201** activates the trigger word detection subroutine **210** at block **204**, the trigger word detection subroutine **210** is configured to execute continually (or at least substantially continually) until it is deactivated. The trigger word detection subroutine **210** may be deactivated by the power detection routine **201** at block **206** as described above. In some embodiments, the trigger word detection subroutine **210** may be selectively activated and/or deactivated by a user.

[0045] The trigger word detection subroutine **210** starts at block **212**. At block **213**, the trigger word detection subroutine receives a sound sample. The sound sample may be received via the sound input **107** of the mobile computing device **100**. In some embodiments, the sound input **107** may include a microphone or other type of sound input or detection device. Some embodiments may include a sound detector that triggers the activation of a microphone. Once activated, the microphone captures a sound sample. In other embodiments, a microphone may be configured to continually (or at least substantially continually) capture sound samples once the trigger word detection subroutine **210** has been activated.

[0046] At block **214**, the trigger word detection subroutine **210** determines whether the sound sample received at block **213** includes speech. Determining whether the sound sample includes speech can be accomplished by any of a number of speech detection algorithms now know or later developed. In some embodiments, the speech detection algorithm may be executed by the one or more processors **101**. In other embodiments, the speech detection algorithm may be executed by one or more components of the sound input **107**.

[0047] If the sound sample does not include speech, then the trigger word detection subroutine **210** ends at block **217** and, thereafter, re-starts at block **212** (either immediately or after a brief waiting period) to receive an additional sound sample at block **213**. However, if the sound sample includes speech, then the trigger word detection subroutine **210** advances to block **215**.

[0048] At block **215**, the speech from the sound sample is analyzed to determine whether the speech includes at least one of a set of one or more trigger words. Trigger words are described in more detail with respect to FIGS. **3**A-**3**C. The sound sample may be analyzed with any of a number of sound or voice recognition algorithms now known or later developed. For example, speech recognition may be performed on the spoken input to obtain text, and the text may be analyzed to determine whether the text includes one or more trigger

words. The speech recognition may be performed by the mobile computing device **100**, by a server with which mobile computing device **100** communicates, or by a combination thereof.

[0049] If the speech does not includes at least one trigger word, then the trigger word detection subroutine ends at block **217** and, thereafter, re-starts at block **212** (either immediately or after a brief waiting period) to receive an additional sound sample at block **213**. However, if the received speech includes at least one trigger word, then the trigger word detection subroutine advances to block **216**. At block **216**, the trigger word detection subroutine **210** launches an application corresponding to the at least one trigger word determined at block **215**. After launching the application at block **216**, the trigger word detection subroutine **210** ends at block **217**. After ending at block **217**, the trigger word detection subroutine **210** re-starts at block **212** (either immediately or after a brief waiting period) to receive a new sound sample at block **213**.

[0050] As described above, the trigger word detection subroutine **210** continues in this manner continually (or at least substantially continually) until the trigger word detection subroutine **210** is deactivated by either the power detection routine **201** or a user.

[0051] FIGS. **3**A-**3**B show examples of a mobile computing device **300** launching applications in response to detecting trigger words according to some embodiments. The mobile computing device **300** may be similar to the mobile computing device **100** shown and described with respect to FIG. **1**. Similarly, the mobile computing device **300** may be configured to execute the power detection routine **201** and/or the trigger word detection subroutine **210** shown and described with respect to FIGS. **2**A-**2**B.

[0052] In FIGS. **3**A-**3**B, the mobile computing device **300** is receiving operating power from an external power source connected to the mobile computing device **300** via cable **301**. Power icon **302** on the display **303** of the mobile computing device **300** indicates that the mobile computing device **300** is receiving power from an external power source. Because the mobile computing device **300** is receiving operating power from an external power source, the power detection routine **201** (FIG. **2**A) will have activated the trigger word detection subroutine **210** (FIG. **2**B). As described herein, once activated, the trigger word detection subroutine **210** is configured to operate continually (or at least substantially continually) until it is deactivated by either the power detection routine **201** or a user.

[0053] While activated, the trigger word detection subroutine **210** is receiving sound samples via the microphone **304** of the mobile computing device **300**. When the mobile computing device **300** determines that a sound sample received via its microphone **304** includes at least one trigger word of a set of one or more trigger words, the mobile computing device **300** is configured to launch an application corresponding to the at least one determined trigger word.

[0054] In some embodiments, the mobile computing device **300** may be configured to detect a single trigger word. For example, the trigger word may be "Android" (or perhaps some other user-defined trigger word or group of words). In operation, when the mobile computing device **300** detects the trigger word (or group of words), the mobile computing device may launch a voice command prompt. FIG. **3**A shows an example of the mobile computing device **300** launching a voice command prompt **305** in response to detecting a trigger word corresponding to the voice command prompt **305**.

[0055] After the voice command prompt **305** has been launched, a user can then issue a spoken command string to the mobile computing device **300**. For example, the spoken command string may be "Call . . . Jane Smith . . . Office." Here, the command includes an action ("call"), an object of the action ("Jane Smith"), and a parameter ("Office"). In response to receiving the spoken command string, the mobile computing device **300** may (i) launch an application corresponding to the action (and possibly one or more parameters associated with the action), and (ii) execute the application based on the object of the action (and possibly one or more parameters associated with the object of the action). FIG. **3**B shows the mobile computing device **300** launching a phone application **306** and calling "Jane Smith" at her office number in response to the spoken command string received via the voice command prompt **305** (FIG. **3**A).

[0056] In other embodiments, the mobile computing device **300** may be configured to launch other types of applications in response to particular spoken command strings received via the voice command prompt **305**. In one example, the mobile computing device **300** may be configured to activate or deactivate a particular application, feature, or service. For example, the mobile computing device **300** may be configured to silence or deactivate its ringer in response to the command string such as "Configuration Ringer Silent." In another example, the mobile computing device **300** may be configured to launch a multimedia player and play a particular song or video in response to a spoken command string received via the voice command prompt **305**. For example, the spoken command string "Play Song All You Need Is Love" may cause the mobile computing device **300** to launch a multimedia player and play the song "All You Need Is Love" by The Beatles.

[0057] As described above, the spoken command string may include one or more parameters associated with either an action or an object to ameliorate or otherwise minimize ambiguity. In the example shown in the FIG. **3**B, the "call" was the action, "Jane Smith" was the object, and "Office" was the parameter associated with object "Jane Smith." The parameter "Office" specifies which of Jane Smith's numbers to call (i.e., home, office, mobile, etc.).

[0058] In the foregoing example, the trigger word was "Android" and the command string was "Call Jane Smith Office." In some embodiments, the user may need to pause slightly after the trigger word before speaking a command string to allow time for the mobile computing device **300** to launch the voice command prompt **305**. Similarly, the user may need to pause slightly after speaking the "action" for the voice command prompt to allow time for the mobile computing device **300** to launch the application corresponding to the action, e.g., the phone application in this example.

[0059] However, in other embodiments, the mobile computing device **300** may be configured to cache a brief history of spoken words, e.g., up to about 5-30 seconds of spoken words or perhaps a configurable number of words, e.g., up to 10-20 spoken words, depending on the configuration. In embodiments that cache a brief history of spoken words, the computing device **300** may be configured to analyze the words in the cache to identify actions, objects, and parameters that may follow a trigger word (or words). One advantage of caching a brief history of spoken words is that a user may not need to pause long (or at all) after a trigger word or after an

"action" to wait for the mobile computing device **300** to launch the voice command prompt in response to the trigger word or to launch an application in response to the "action" received via the voice command prompt.

[0060] In some embodiments, the mobile computing device **300** may be configured to detect multiple trigger words (or groups of words, i.e., a trigger phrase), where individual trigger words (or phrases) correspond to different applications or actions to take in a particular application. In the previous example, a single trigger word (or perhaps trigger phrase), such as "Android" for example, caused the mobile computing device **300** to launch a voice command prompt **305** (FIG. **3**A). Once the voice command prompt **305** was launched, the mobile computing device **300** could receive spoken command strings to launch other applications (i.e., a phone application as shown in FIG. **3**B). But in embodiments where the mobile computing device **300** is configured to detect multiple trigger words (or sets of trigger words or phrases), the mobile computing device **300** may be able to launch applications and process commands faster than embodiments that may rely on a single trigger word to first open a voice command prompt **305** before receiving spoken command strings to launch applications.

[0061] In some embodiments, the set of trigger words may include a specific trigger word (or words) for a voice command prompt, a specific trigger word (or words) for a phone application, a specific trigger word (or words) for a text messaging application, a specific trigger word (or words) for an email application, and a specific trigger word (or words) for a multimedia player application, etc. In operation, the mobile computing device **300** could have many different trigger words or phrases corresponding to many different applications and/or functions. In some embodiments, a user may be able to configure or customize particular trigger words of phrases and associate those customize trigger words or phrases with particular applications or other computing, communications, or entertainment tasks. For example, a user may configure a trigger phrase "Favorite Song" to cause the mobile computing device to launch a multimedia player and play the song "All You Need Is Love" by The Beatles.

[0062] Although FIG. **3**B was described above with respect to launching a telephone application in response to a spoken command string received via a voice command prompt, FIG. **3**B can also correspond to an example of the mobile computing device **300** launching a telephone application in response to detecting a trigger word corresponding to the telephone application. For example, the trigger word corresponding to the phone application may be "call." When the mobile computing device **300** detects the trigger word "call," the mobile computing device may launch the phone application and then listen for further instructions, such as the number or person to call.

[0063] FIG. **3**C shows an example of the mobile computing device **300** launching an email application **307** in response to detecting a trigger word corresponding to the email application **307**. In this example, the trigger word corresponding to the email application **307** may be "mail," and upon detecting the "mail" trigger word, the mobile computing device **300** may launch the email application **307** and then listen for further instructions, such as the recipient, subject, and body of the email message.

[0064] FIG. **4** shows an example method **400** according to some embodiments. The method **400** begins at block **401**, where a mobile computing device determines whether it is receiving operating power from one of (i) an external power source or (ii) one or more batteries configured to power the mobile computing device. The mobile computing device may be similar to any of the mobile computing devices described elsewhere herein. In this example, the mobile device includes a trigger word detection subroutine that is activatable by a user input and automatically in response to determining that the mobile computing device is receiving external power.

[0065] At block **402**, the mobile computing device activates the trigger word detection subroutine in response to determining that it is receiving power from the external power source. The trigger word detection subroutine is shown in blocks **402***a*-**402***d*, which are described in more detail below. In some embodiments, the mobile computing device may additionally or alternatively activate the trigger word detection subroutine in response to receiving an input from a user to activate the trigger word detection subroutine even when the mobile computing device is receiving power from the one or more batteries.

[0066] At block **403**, the mobile computing device deactivates the trigger word detection subroutine in response to determining that it is receiving operating power from the one or more batteries. In some embodiments, the mobile computing device may additionally or alternatively deactivate the trigger word detection subroutine in response to receiving an input from a user to deactivate the trigger word detection subroutine even when the mobile computing device is receiving power from an external power source.

[0067] The trigger word detection subroutine is shown in blocks **402***a*-**402***d*. In operation, once activated, the trigger word detection subroutine may be configured to execute continually (or at least substantially continually) until it is deactivated either at step **403** or by a user.

[0068] The trigger word detection subroutine begins at block **402***a* where the mobile computing device receives spoken input via a microphone. At block **402***b*, the mobile computing device obtains text corresponding to the spoken input, based on speech recognition performed on the spoken input. The speech recognition could be performed by the mobile computing device. Alternatively, the speech recognition could be performed, in whole or in part, by one or more devices external to the mobile computing device. For example, the mobile computing device may transmit the spoken input to a server, the server may perform speech recognition on the spoken input to determine a corresponding text, and the mobile computing device may obtain the text from the server.

[0069] At block **402***c*, the mobile computing device analyzes the text to determine whether the text includes at least one of a set of one or more predefined trigger words. At block **402***d*, in response to determining that the text includes at least one of the set of one or more predefined trigger words, the mobile computing device launches an application corresponding to the at least one trigger word included in the text.

[0070] In some embodiments, the application corresponding to the at least one trigger word may be a voice command prompt application configured to receive a voice command from a user. The voice command may comprise one or more of (i) an action, (ii) an object of the action, and (iii) one or more parameters associated with the action or the object. The voice command prompt and the voice commands received via the voice command prompt may be similar to the voice command prompts and voice commands described elsewhere herein.

[0071] In further embodiments, the application corresponding to the at least one trigger word may be any of a voice command prompt, a communications application, a multimedia application, or an application for configuring settings of the mobile computing device.

[0072] In some embodiments, a speech recognition mode of a mobile computing device can be activated by coupling the mobile computing device to an external power source. FIG. **5** shows an example method **500** according to such embodiments. The method **500** begins at block **501**, when a mobile computing device detects coupling of the mobile computing device to an external power source. In response to the detected coupling, the mobile computing device activates a speech recognition mode, at block **502**. Blocks **502-505** describe an example of how the speech recognition mode may operate after being activated.

[0073] At block **503**, the mobile computing device receives spoken input via a microphone. At block **504**, the mobile computing device determines whether the spoken input includes one or more trigger words. This can involve speech recognition performed by the mobile computing device and/or by a server, as described above. In response to determining that the spoken input includes at least one trigger word, the mobile computing device launches an application corresponding to the at least one trigger word, at block **505**.

[0074] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration only and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

1-20. (canceled)

21. A method comprising:

determining whether a computing device is receiving operating power from an external power source, wherein the computing device has a trigger word detection subroutine that is activatable by a user input and automatically in response to determining that the computing device is receiving external power; and

in response to determining that the computing device is receiving operating power from the external power source, taking a trigger word detection action, wherein the trigger word detection action includes:

receiving spoken input via a microphone of the computing device,

based on speech recognition performed on the spoken input, obtaining text,

determining whether the text includes one or more trigger words associated with for a voice command prompt action, and

in response to determining that the text includes the one or more trigger words associated with the voice command prompt action, taking the voice command prompt action, wherein the voice command prompt action is configured to receive via the microphone additional spoken input that causes the computing device to take one or more other actions, and wherein taking the voice command prompt action comprises displaying a voice command prompt on the computing device.

22. The method of claim **21**, further comprising: taking the trigger word detection action continually until it is deactivated.

23. The method of claim **21**, further comprising: deactivating the trigger word detection action in response to determining that the computing device is receiving operating power front one or more batteries.

24. The method of claim **21**, further comprising:

receiving the user input; and

taking the trigger word detection action in response to receiving the user input regardless of whether the computing device is receiving operating power from the external power source.

25. The method of claim **21**, wherein the one or more other actions include at least one of a communications action, a multimedia action, and an action for configuring settings of the computing device.

26. The method of claim **21**, wherein the external power source is at least one of a charger associated with the computing device and a docking station for the computing device.

27. The method of claim **21**, wherein one or more of the determining step, the launching step, and the trigger word detection action are components of a computing device operating system.

28. The method of claim **21**, wherein the additional spoken input comprises a corresponding action that corresponds to the additional spoken input, and wherein the method further comprises:

in response to receiving the additional spoken input, taking the corresponding action on the computing device.

29. The method of claim **28**, wherein the additional spoken input further includes one or more parameters, and wherein taking the corresponding action comprises taking the corresponding action based on the one or more parameters.

30. The computing device of claim **28**, wherein the additional spoken input comprises an object of the corresponding action, and wherein taking the corresponding action comprises taking the corresponding action based on the object of the corresponding action.

31. A computing device comprising:

a sound detector;

a display;

a power selector configured to selectively power the computing device from one of either an external power source or one or more batteries; and

one or more processors configured for

continually taking a trigger word detection action while the power selector is powering the computing device from the external power source and stop taking the trigger word detection action when the power selector is powering the computing device from the one or more batteries,

wherein the trigger word detection action comprises determining whether spoken input received via the sound detector includes one or more trigger words associated with a voice command prompt action, and in response to determining that the spoken input includes the one or more trigger words associated with the voice command prompt action, taking the voice command prompt action, wherein the voice command prompt action is configured to receive via the sound detector additional spoken input that causes the computing device to take one or more other actions, and wherein taking the voice command prompt action comprises displaying a voice command prompt on the display.

32. The computing device of claim **31**, further comprising: a user interface configured to receive an input from a user to

take the trigger word detection action when the power selector is powering the computing device from the one or more batteries.

33. The computing device of claim **31**, wherein the one or more other applications include at least one of a communications application, a multimedia application, or an application for configuring settings of the computing device.

34. The computing device of claim **31**, wherein the additional spoken input comprises a corresponding action that corresponds to the additional spoken input, and wherein the one or more processors are further configured to:

in response to receiving the additional spoken input, taking the corresponding action.

35. The computing device of claim **34**, wherein the additional spoken input further includes one or more parameters associated with the corresponding action, and wherein taking the corresponding action comprises taking the corresponding action based on the one or more parameters.

36. The computing device of claim **34**, wherein the additional spoken input comprises an object of the corresponding action, and wherein taking the corresponding action comprises taking the corresponding action based on the object of the corresponding action

37. A non-transitory computer readable medium having stored therein executable instructions that, when executed by a computing device having at least one processor, causes the computing device to perform functions comprising:

determining whether the computing device is receiving operating power from either an external power source or an internal batter source; and

in response to determining that the computing device is receiving operating power from the external power source, taking a trigger word detection action, wherein the trigger word detection action includes:

continually determining whether spoken input received via a microphone includes one or more trigger words associated with an action for a voice command prompt and,

in response to determining that the spoken input includes the one or more trigger words associated with the voice command prompt, taking the action for the voice command prompt, wherein the voice command prompt is configured to receive via the microphone additional spoken input that causes the computing device to take one or more other actions, and wherein taking the action for the voice command prompt comprises displaying a voice command prompt on the computing device.

38. The non-transitory computer readable medium of claim **37**, wherein the functions further comprise: deactivating the trigger word detection subroutine in response to determining that the computing device is receiving operating power from the internal battery source.

39. The non-transitory computer readable medium of claim **37**, wherein the functions further comprise:

receiving a user input; and

taking the trigger word detection action in response to receiving the user input regardless of whether the computing device is receiving operating power from the external power source.

40. The non-transitory computer readable medium of claim **37**, wherein the additional spoken input comprises a corresponding action that corresponds to the additional spoken input, and wherein the functions further comprise:

in response to receiving the additional spoken input, taking the corresponding action on the computing device.

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