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(54) **MOBILE DEVICE HAVING HUMAN LANGUAGE TRANSLATION CAPABILITY WITH POSITIONAL FEEDBACK**

(76) Inventors: **Michael M. Lee**, San Jose, CA (US); **Justin Gregg**, San Francisco, CA (US); **Chad G. Seguin**, Morgan Hill, CA (US)

Correspondence Address:
APPLE INC./BSTZ
BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040 (US)

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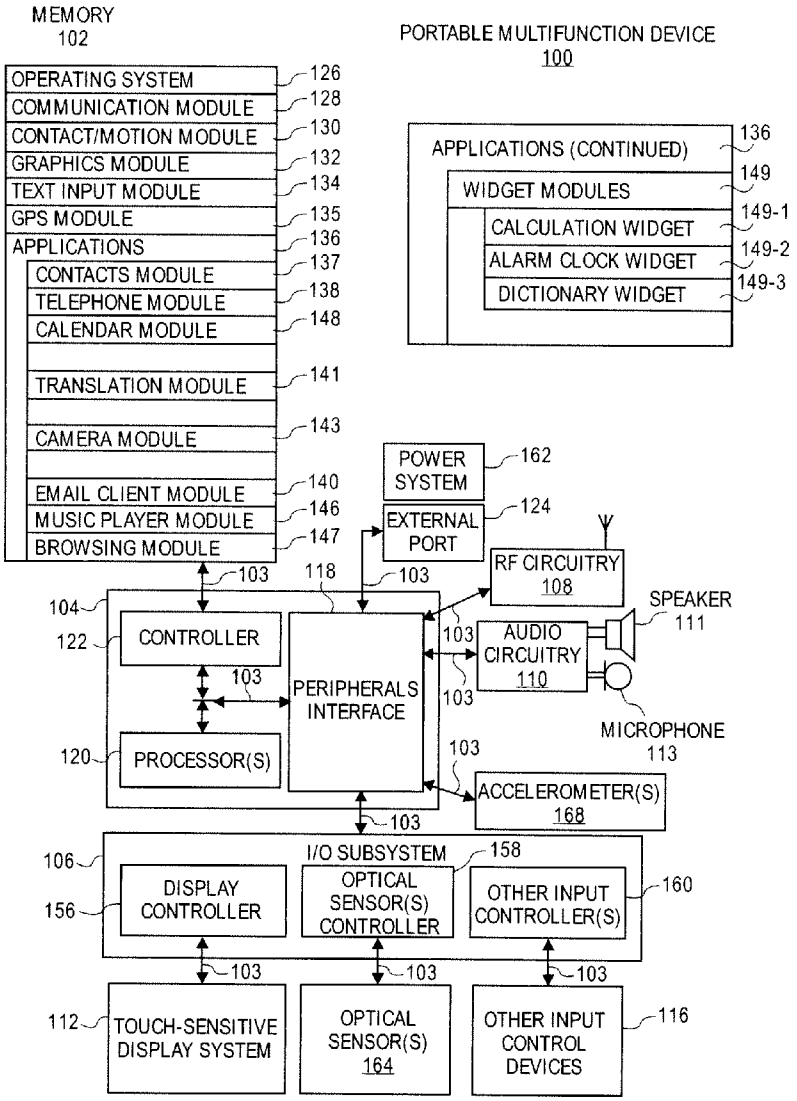
(57) **ABSTRACT**

A mobile electronic device has a touch sensitive screen and an accelerometer. A translator is to translate a word or phrase that is in a first human language and that is entered via a first virtual keyboard displayed on the touch sensitive screen, into a second human language. A translator is to cause the touch sensitive screen to display the translated word or phrase and a second virtual keyboard having characters in the second human language, in response to the accelerometer detecting a change in the physical orientation of the device or movement of the device. Other embodiments are also described and claimed.



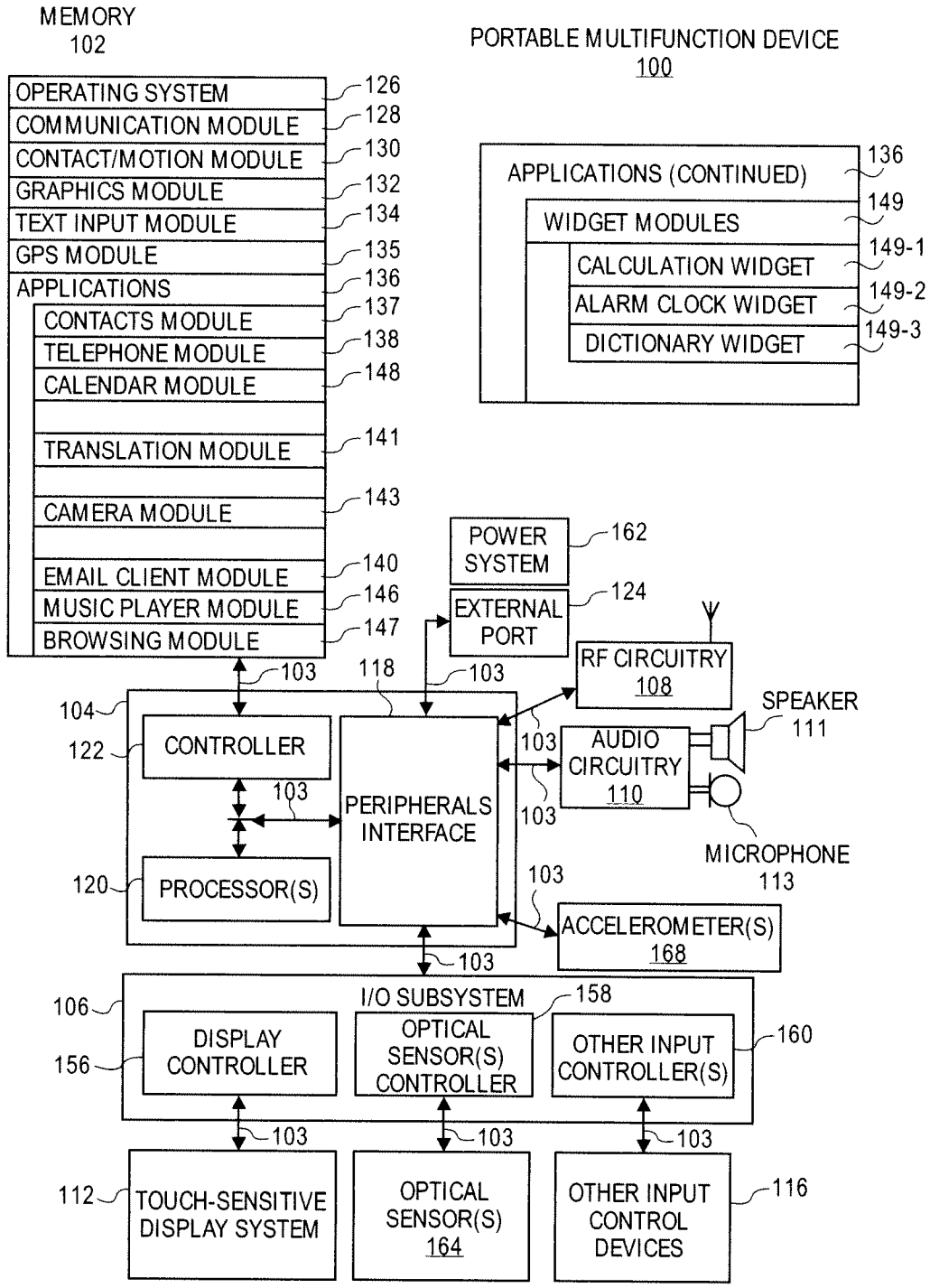

MEMORY
102
OPERATING SYSTEM
126
COMMUNICATION MODULE
128
CONTACT/MOTION MODULE
130
GRAPHICS MODULE
132
TEXT INPUT MODULE
134
GPS MODULE
135
APPLICATIONS
136
CONTACTS MODULE
137
TELEPHONE MODULE
138
CALENDAR MODULE
148
TRANSLATION MODULE
141
CAMERA MODULE
143
EMAIL CLIENT MODULE
140
MUSIC PLAYER MODULE
146
BROWSING MODULE
147
PORTABLE MULTIFUNCTION DEVICE
100
APPLICATIONS (CONTINUED)
136
WIDGET MODULES
149
CALCULATION WIDGET
149-1
ALARM CLOCK WIDGET
149-2
DICTIONARY WIDGET
149-3
POWER SYSTEM
162
EXTERNAL PORT
124
RF CIRCUITRY
108
SPEAKER
111
AUDIO CIRCUITRY
110
MICROPHONE
113
103
118
104
122
CONTROLLER
PERIPHERALS INTERFACE
120
PROCESSOR(S)
ACCELEROMETER(S)
168
106
I/O SUBSYSTEM
158
DISPLAY CONTROLLER
156
OPTICAL SENSOR(S) CONTROLLER
OTHER INPUT CONTROLLER(S)
160
112
TOUCH-SENSITIVE DISPLAY SYSTEM
OPTICAL SENSOR(S)
164
OTHER INPUT CONTROL DEVICES
116

FIG. 1

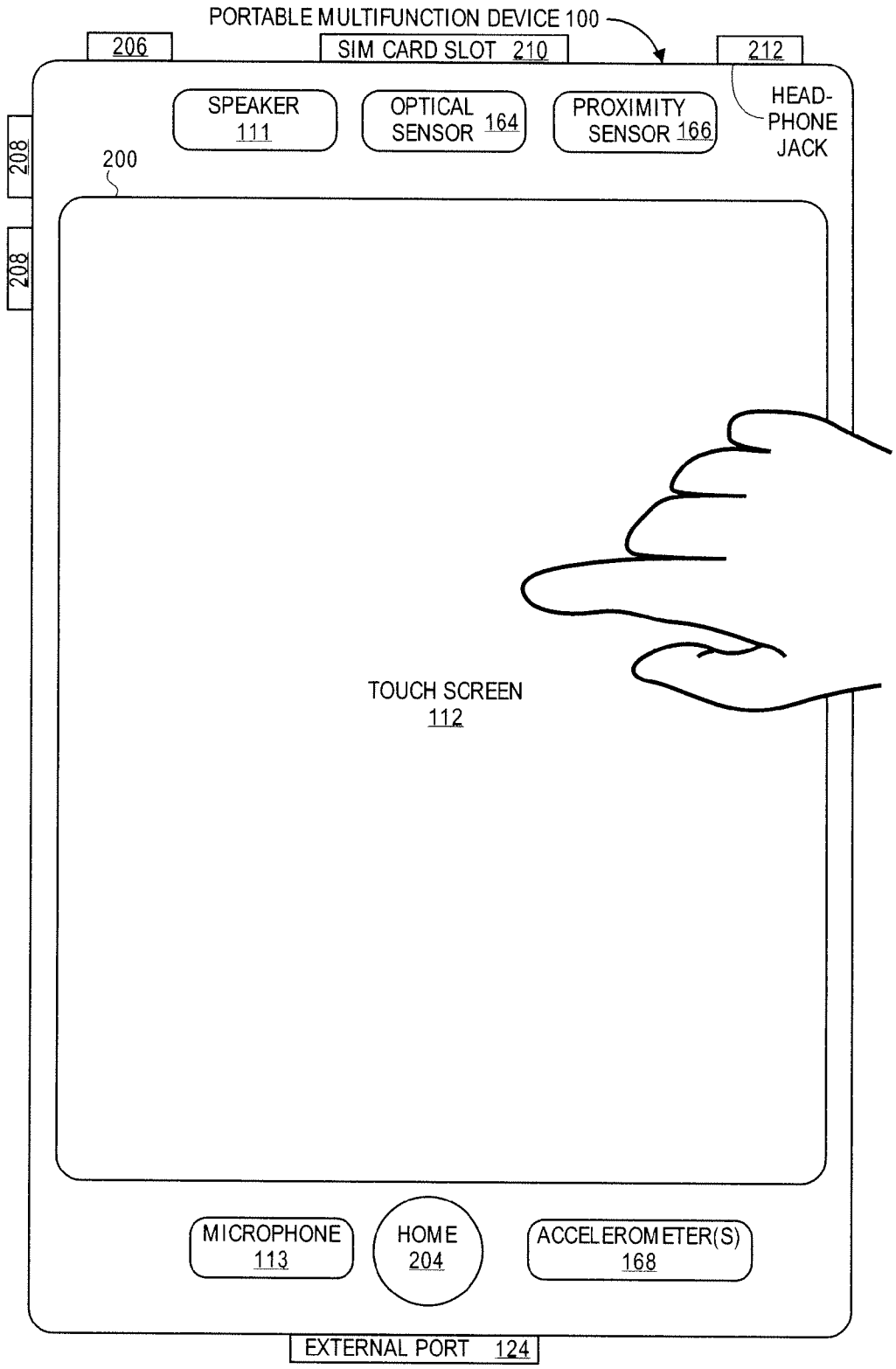

PORTABLE MULTIFUNCTION DEVICE 100
206
SIM CARD SLOT 210
212
SPEAKER 111
OPTICAL SENSOR 164
PROXIMITY SENSOR 166
HEAD-PHONE JACK
208
200
208
TOUCH SCREEN 112
MICROPHONE 113
HOME 204
ACCELEROMETER(S) 168
EXTERNAL PORT 124

FIG. 2

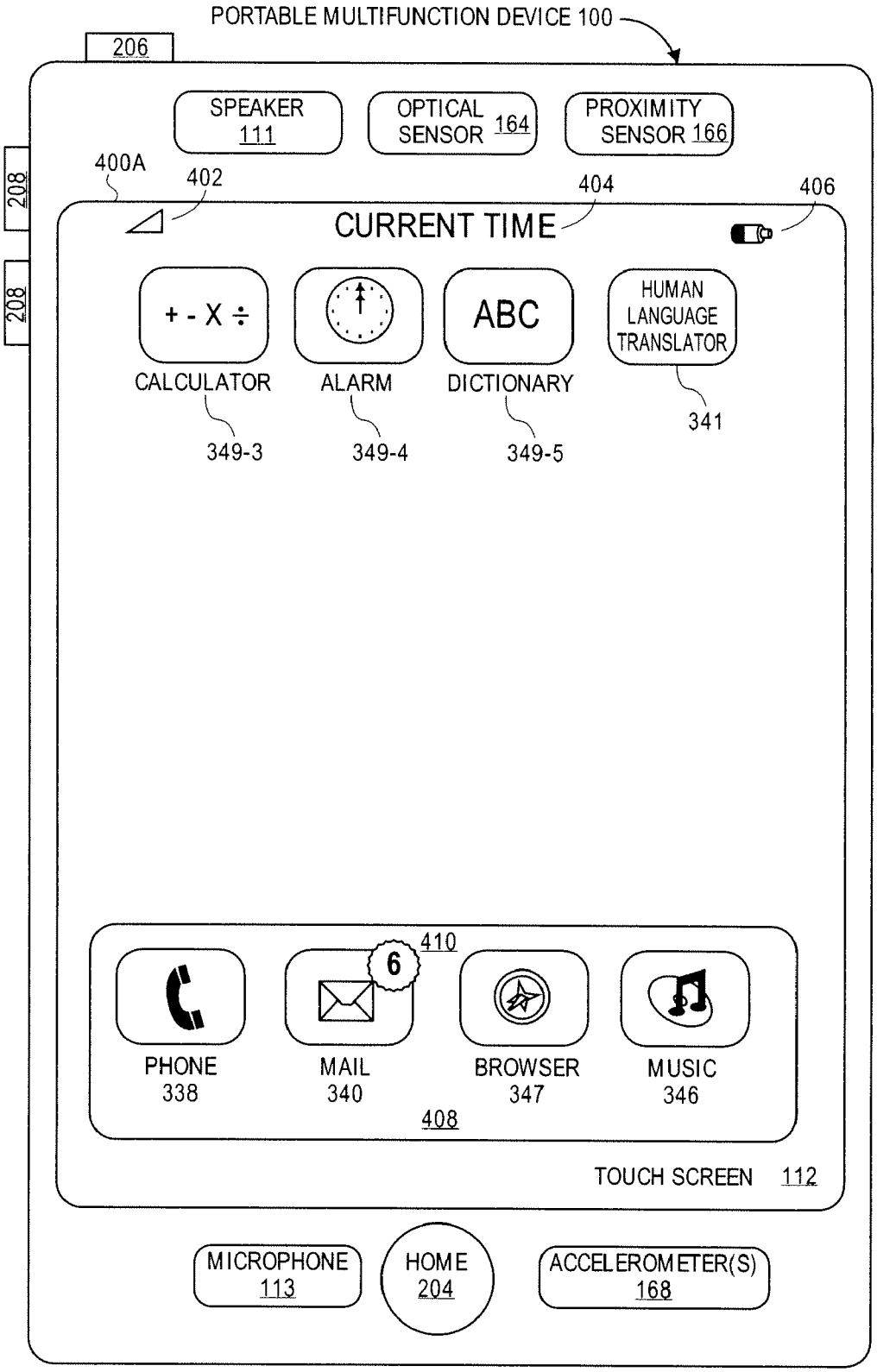

PORTABLE MULTIFUNCTION DEVICE 100
206
SPEAKER 111
OPTICAL SENSOR 164
PROXIMITY SENSOR 166
208
400A
402
404
406
CURRENT TIME
208
+ - X ÷
ABC
HUMAN LANGUAGE TRANSLATOR
CALCULATOR
ALARM
DICTIONARY
341
349-3
349-4
349-5
410
6
PHONE 338
MAIL 340
BROWSER 347
MUSIC 346
408
TOUCH SCREEN 112
MICROPHONE 113
HOME 204
ACCELEROMETER(S) 168

FIG. 3

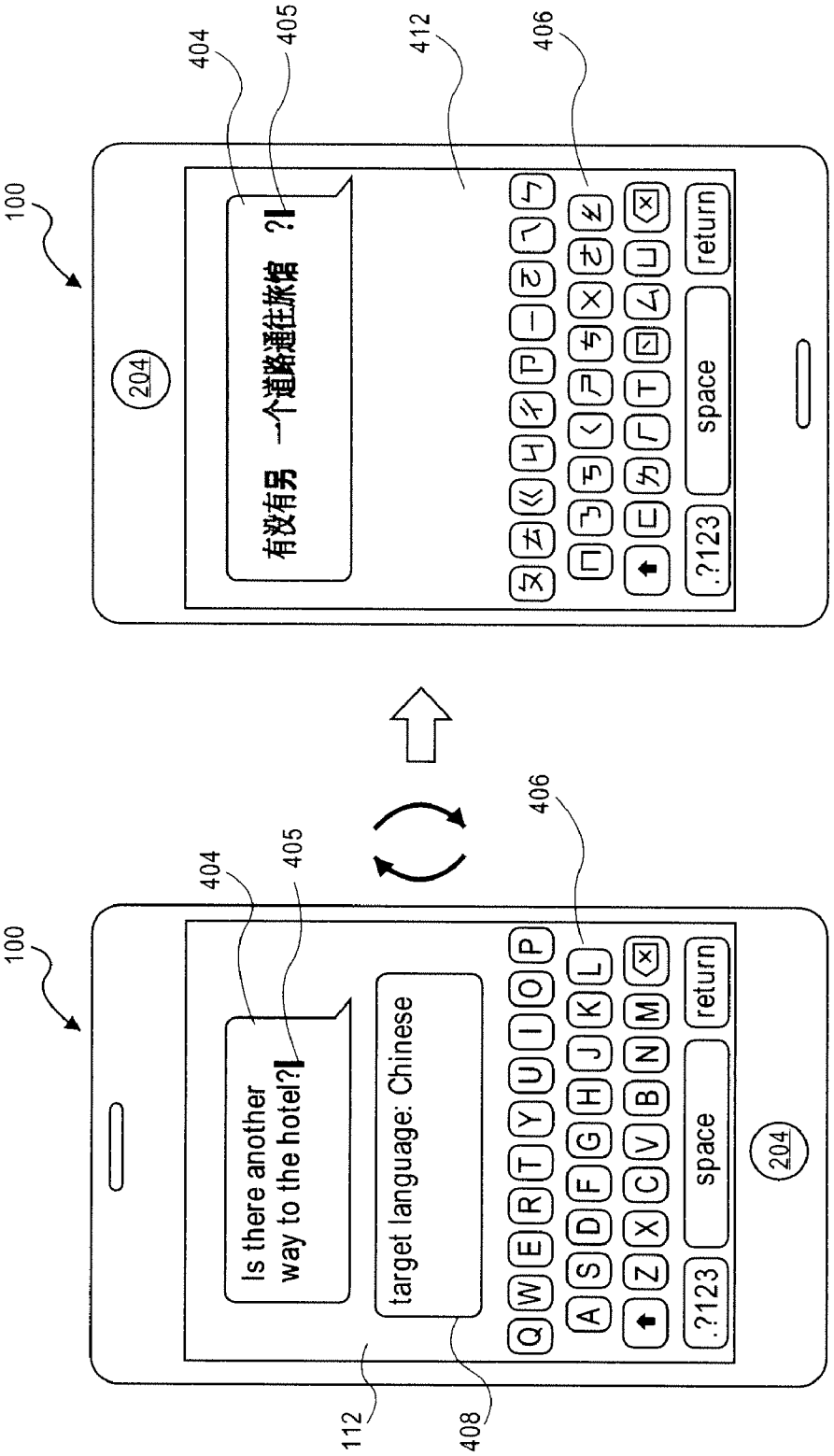

100
204
404
405
412
406
有没有另一个道路通往旅馆?
.?123
space
return
100
204
404
405
406
Is there another way to the hotel?
target language: Chinese
112
408
.?123
space
return

FIG. 4

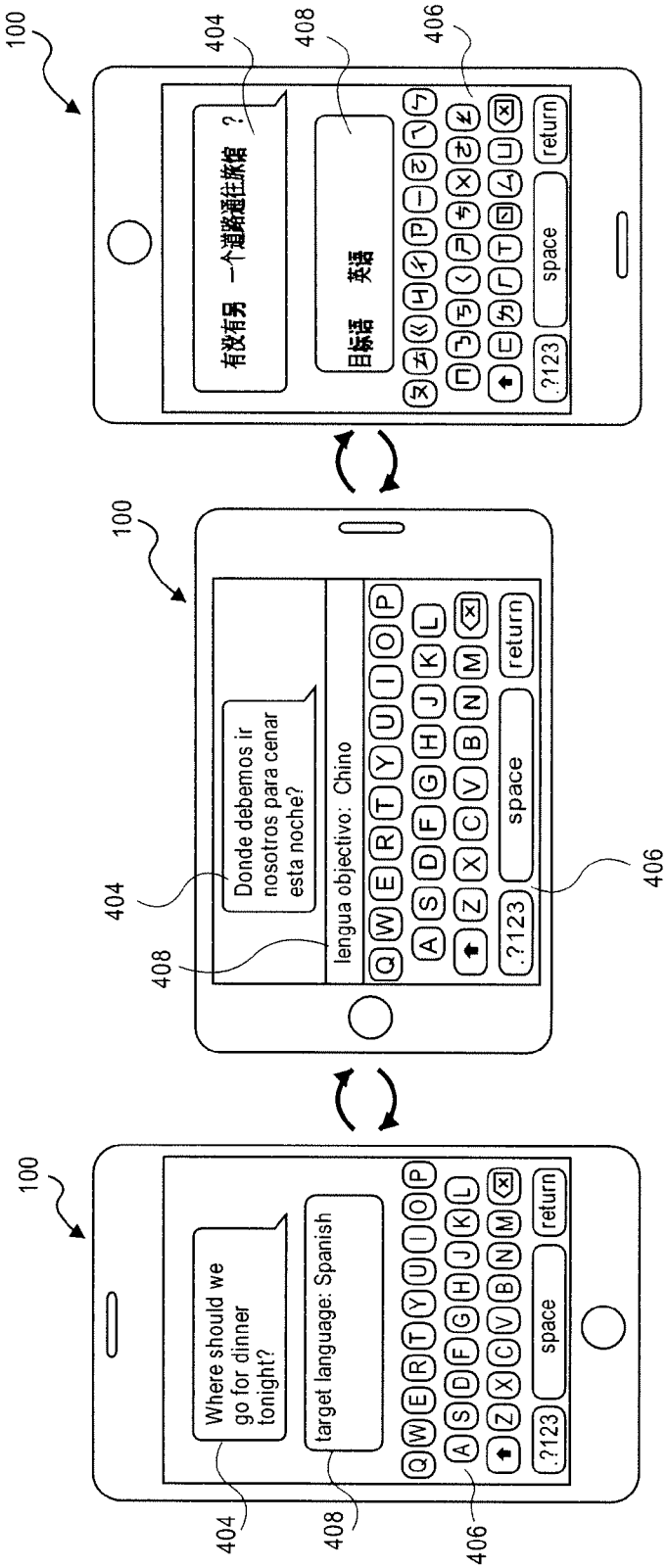

100
404
408
406
Where should we go for dinner tonight?
target language: Spanish
.?123
space
return
100
404
408
406
Donde debemos ir nosotros para cenar esta noche?
lengua objectivo: Chino
.?123
space
return
100
404
408
406
有没有另一个道路通往旅馆？
目标语 英语
.?123
space
return

FIG. 5

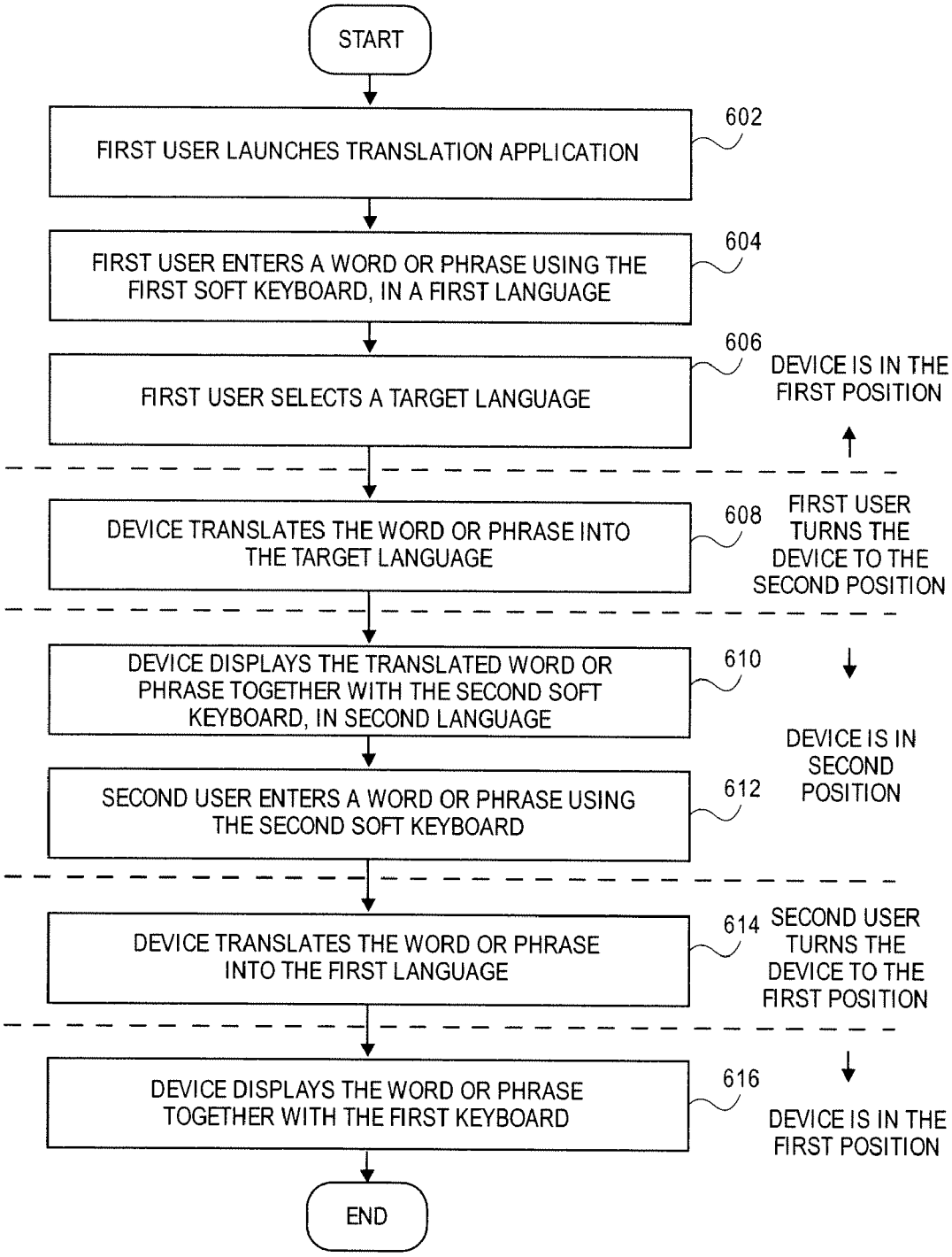

START
FIRST USER LAUNCHES TRANSLATION APPLICATION
602
FIRST USER ENTERS A WORD OR PHRASE USING THE FIRST SOFT KEYBOARD, IN A FIRST LANGUAGE
604
FIRST USER SELECTS A TARGET LANGUAGE
606
DEVICE IS IN THE FIRST POSITION
DEVICE TRANSLATES THE WORD OR PHRASE INTO THE TARGET LANGUAGE
608
FIRST USER TURNS THE DEVICE TO THE SECOND POSITION
DEVICE DISPLAYS THE TRANSLATED WORD OR PHRASE TOGETHER WITH THE SECOND SOFT KEYBOARD, IN SECOND LANGUAGE
610
DEVICE IS IN SECOND POSITION
SECOND USER ENTERS A WORD OR PHRASE USING THE SECOND SOFT KEYBOARD
612
DEVICE TRANSLATES THE WORD OR PHRASE INTO THE FIRST LANGUAGE
614
SECOND USER TURNS THE DEVICE TO THE FIRST POSITION
DEVICE DISPLAYS THE WORD OR PHRASE TOGETHER WITH THE FIRST KEYBOARD
616
DEVICE IS IN THE FIRST POSITION
END

FIG. 6

MOBILE DEVICE HAVING HUMAN LANGUAGE TRANSLATION CAPABILITY WITH POSITIONAL FEEDBACK

[0001] An embodiment of the invention relates to mobile or portable electronic devices having human language translation capability. Other embodiments are also described.

BACKGROUND

[0002] A basic need for most people when traveling in a foreign country is human language translation. One may be riding in a taxi or about to purchase something when there is a sudden and important need to translate a phrase or statement. For example, one may want to ask the cab driver a question about the route he is taking, or wish to ask a salesperson about alternatives to a particular item he is presenting you. A two-way, portable, electronic language translation device is very useful in such circumstances. Such a device has a display and a keyboard that allows the user to type in a word or phrase in the user's native language. The user then presses a button on the keyboard, and the word or phrase is then translated by built-in data processing circuitry of the device into another language before being displayed. With the display showing the translated phrase, the user may then hand the device to the other party who can then read the translated phrase and then respond using the device in a reverse manner but in her own language.

SUMMARY

[0003] An embodiment of the invention provides an enhanced translation experience using a mobile electronic device. In particular, the device provides translation "feedback" to its users in response to a change in the position or physical orientation of the device. In one embodiment, the mobile electronic device may be operated as follows. The device prompts a user to enter a word or phrase in a first human language, using a first soft keyboard that is associated with that language. The soft keyboard is displayed on a touch sensitive screen of the device. The entered word or phrase is then translated by the device into a second human language. The translated word or phrase, as well as a second soft keyboard (associated with the second language) is displayed, when the device rotates by at least a predetermined amount or is moved in a predetermined manner. Thus, the device provides feedback to its users, as to the different languages that it supports, based at least in part on the movement, position or physical orientation of the device.

[0004] For example, if the device were to have a rectangular shape, in one portrait orientation it may display a soft keyboard and prompt for the entry of a word or phrase in a first human language. When the device has been turned upside down into its other portrait orientation, the previously entered word or phrase is displayed, translated into another language, together with the soft keyboard of the another language. Thus, one user enters a word or phrase in her language, and then turns the device around to an orientation associated with a second language, and hands the device over in that orientation to another user (who is conversant in the second language). At that point, the device is displaying the translated word or phrase, in the second language. The other user can now enter a response in her own language, using the displayed second soft keyboard, and then hands the device back to the first user, turning it back to the original orientation. Thus, two users can communicate with each other via different human languages, by entering their statements into the same device but in different physical orientations, and signaling their intentions to translate simply by handing the device back and forth in the appropriate orientation.

[0005] The above summary does not include an exhaustive list of all aspects of the present invention. Indeed, it is contemplated that the invention includes all systems and methods that can be practiced from all suitable combinations of the various aspects summarized above, as well as those disclosed in the Detailed Description below and particularly pointed out in the claims filed with the application. Such combinations have particular advantages not specifically recited in the above summary.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The embodiments of the invention are illustrated by way of example and not by way of limitation in the figures of the accompanying drawings in which like references indicate similar elements. It should be noted that references to "an" or "one" embodiment of the invention in this disclosure are not necessarily to the same embodiment, and they mean at least one.

[0007] FIG. **1** shows a block diagram of various hardware and software components of a portable multifunction device, in accordance with an embodiment of the invention.

[0008] FIG. **2** is a top view of the portable multifunction device.

[0009] FIG. **3** shows the root or main menu of an example graphical user interface running in the device.

[0010] FIG. **4** shows an example of how the device may be used to translate between two different written languages, assisted by positional feedback.

[0011] FIG. **5** shows an example of using the device when translating among three different languages, using positional feedback.

[0012] FIG. **6** is a flow diagram of how the device may be operated to assist in human language translation.

DETAILED DESCRIPTION

[0013] In this section several embodiments of this invention are explained with reference to the appended drawings. Whenever the shapes, relative positions and other aspects of the parts described in the embodiments are not clearly defined, the scope of the invention is not limited only to the parts shown, which are meant merely for the purpose of illustration.

[0014] Before describing the various translation processes that can be implemented in a portable electronic device, Part I below gives an overview of the relevant components of the device in connection with FIGS. **1-3**.

I. Overview of an Example Portable Device

[0015] FIG. **1** is a block diagram of an example portable multifunction device **100** that has the capability for translating human language with positional feedback. The device **100** may be a portable wireless communications device such as a cellular telephone that also contains other functions such as personal digital assistant and digital media (music and/or movie) playback functions. Not all of the functions described here are needed, as the device **100** could alternatively be a dedicated, handheld translator device, without having for

instance cellular communications capability. The device **100** has memory **102** which may include random access memory, non-volatile memory such as disk storage, flash memory, and/or other suitable digital storage. Access to the memory **102** by other components of the device such as one or more processors **120** or peripheral interface **118** may be controlled by a memory controller **122**. The latter components may be built into the same integrated circuit chip **104**, or they may each be part of a separate integrated circuit package.

[0016] The peripheral interface **118** allows input and output peripherals of the device to communicate with the processors **120** and memory **102**. In one example, there are one or more processors **120** that run or execute various software programs or sets of instructions (e.g., applications) that are stored in memory **102**, to perform the various functions described below, with the assistance of or through the peripherals.

[0017] The portable multifunction device **100** may have wireless communications capability enabled by radio frequency (RF) circuitry **108** that receives and sends RF signals via an integrated or built-in antenna of the device **100** (not shown). The RF circuitry may include RF transceivers, as well as digital signal processing circuitry that supports cellular network or wireless local area network protocol communications. The RF circuitry **108** may be used to communicate with networks such as the Internet with such protocols as the World Wide Web, for example. This may be achieved through either the cellular telephone communications network or a wireless local area network, for example. Different wireless communications standards may be implemented as part of the RF circuitry **108**, including global system for mobile communications (GSM), enhanced data GSM environment (EDGE), high speed downlink packet access (HSDPA), code division multiple access (CDMA), Bluetooth, wireless fidelity (Wi-Fi), and Wi-Max.

[0018] The device **100** in this example also includes audio circuitry **110** that provides an interface to acoustic transducers, such as a speaker **111** (a speaker phone, a receiver or a headset) and a microphone **113**. These form the audio interface between a user of the device **100** and the various applications that may run in the device **100**. The audio circuitry **110** serves to translate digital audio signals produced in the device (e.g., through operation of the processor **120** executing an audio-enabled application) into a format suitable for output to a speaker, and translates audio signals detected by the microphone **130** (e.g., when the user is speaking into the microphone) to digital signals suitable for use by the various applications running in the device. In some embodiments, the audio circuitry may also include a headset jack **212** (see FIG. **2**), which enables sound output by a headset worn by the user of the device.

[0019] The device **100** also has an I/O subsystem **106** that serves to communicatively couple various other peripherals in the device to the peripheral's interface **118**. The I/O subsystem **106** may have a display controller **156** that manages the low level processing of data that is displayed on a touch sensitive display system **112** and generated by a touch screen of the system **112**. One or more input controllers **116** may be used to receive or send signals from and to other input control devices **116**, such as physical buttons (e.g., push buttons, rocker buttons, etc.), dials, slider switches, joy sticks, click wheels, and so forth. In other embodiments, the input controller **160** may enable input and output to other types of devices, such as a keyboard, an infrared port, a universal serial bus, USB, port, or a pointer device such as a mouse. Physical buttons may include an up/down button for volume control of the speaker **111** and a sleep or power on/off button of the device. In contrast to these physical peripherals, the touch sensitive display system **112** (also referred to as the touch screen **112**) is used to implement virtual or soft buttons and one or more soft keyboards as described below.

[0020] The touch sensitive screen **112** is part of a larger input interface and output interface between the device **100** and its user. The display controller **156** receives and/or sends electrical signals from/to the touch screen **112**. The latter displays visual output to the user, for example, in the form of graphics, text, icons, video, or any combination thereof (collectively termed "graphics" or image objects). The touch screen **112** also has a touch sensitive surface, sensor, or set of sensors that accept input from the user based on haptic and/or tactile contact. These are aligned directly with the visual display, typically directly above the latter. The touch screen **112** and the display controller **156**, along with any associated program modules and/or instructions in memory **102**, detect contact, movement, and breaking of the contact on the touch sensitive surface. In addition, they convert the detected contact into interaction with user-interface objects (e.g., soft keys, program launch icons, and web pages) whose associated or representative image objects are being simultaneously displayed on the touch screen **112**.

[0021] The touch screen **112** may include liquid crystal display technology or light emitting polymer display technology, or other suitable display technology. The touch sensing technology may be capacitive, resistive, infrared, and/or surface acoustic wave. A proximity sensor array may also be used to determine one or more points of contact with the touch screen **112**. The touch screen **112** may have a resolution in excess of 100 dpi. The user may make contact with the touch screen **112** using any suitable object or appendage, such as a stylist, a finger, and so forth. In some embodiments, the user interface is designed to work primarily with finger-based contacts and gestures, which are generally less precise than stylist-based input due to the larger area of contact of a finger. The device in that case translates the rough finger-based input into a precise pointer/cursor position or command for performing the action desired by the user.

[0022] The device **100** has a power system **162** for supplying electrical power to its various components. The power system **162** may include a power management system, one or more replenishable or rechargeable power sources such as a battery or fuel cell, a replenishing system, a power or failure detection circuit, as well as other types of circuitry including power conversion and other components associated with the generation, management and distribution of electrical power in a portable device.

[0023] The device **100** may also include an optical sensor **164**, shown in FIG. **1** as being communicatively coupled to the controller **158** in the I/O subsystem **106**. The optical sensor may include a charge coupled device or complementary metal oxide semiconductor phototransistors, for example arranged in an array, onto which an optical image of a scene that is before the device is formed. Optical components are also provided including a lens, for example, that is built into the device and that is to bend light from the scene to form an image on the sensor **164**. In conjunction with an imaging module **143** running in the device (also referred to as a "camera module"), the sensor **164** may capture still images or video of the scene that is before the device **100**.

[0024] The device **100** also includes one or more accelerometers **168**. The accelerometer **168** is communicatively coupled to the peripheral interface **118** and can be accessed by a module being executed by the processor **120**. The accelerometer **168** provides information or data about the physical orientation or position of the device, as well as rotation or movement of the device about an axis. This information may be used to detect that the device is, for example, in a vertical or portrait orientation (in the event the device is rectangular shaped) or in a horizontal or landscape orientation. On that basis, a graphics module **132** and/or a text input module **134** are able to display information "right side up" on the touch screen **112**, regardless of whether the device is in any portrait or landscape orientation. The processing of the accelerometer data may be performed by the operating system **126** and in particular a driver program that translates raw data from the accelerometer **168** into physical orientation information that can be used by various other modules of the device as described below. The operating system **126** may be an embedded operating system such as Vx Works, OS X, or others which may also include software components and/or drivers for controlling and managing the various hardware components of the device, including memory management, power management, sensor management, and also facilitates communication between various software components or modules.

[0025] The device **100** shown in FIG. **1** may also include a communication module **128** that manages or facilitates communication with external devices over an external port **124**. The external port **124** may include a universal serial bus port, a fire wire port, or other suitable technology, adapted for coupling directly to an external device. The external port **124** may include a multi-pin (e.g., a 30 pin) connector and associated circuitry typically used for docking the device **100** with a desktop personal computer.

[0026] Turning now to the modules in more detail, the contact/motion module **130** may detect user initiated contact with the touch screen **112** (in conjunction with the display controller **156**), and other touch sensitive devices e.g., a touchpad or physical quick wheel. The contact/motion module **130** has various software components for performing operations such as determining if contact with the touch screen has occurred or has been broken, and whether there is movement of the contact and tracking the movement across the touch screen. Determining movement of the point of contact may include determining speed (magnitude), velocity (magnitude and direction), and/or acceleration of the point of contact. These operations may be applied to single contacts (e.g., one finger contacts) or to multiple simultaneous contacts (e.g., multi-touch or multiple finger contacts).

[0027] The graphics module **132** has various known software components for rendering and displaying graphics on the display of the touch screen **112** including, for example, icons of user interface objects such as soft keys and a soft keyboard. The text input module **134**, which may be a component of graphics module **132**, provides soft keyboards for entering text in different languages. Such soft keyboards are for use by various applications e.g., the contacts module **137** (address book updating), email client module **140** (composing an email message), browsing module **147** (typing in a web site universal resource locator), and a translation module **141** (for entering words or phrases to be translated).

[0028] The GPS module **135** determines the geographic location of the device and provides this information for display or use by other applications, such as by a the telephone module **138** for user in location-based dialing and applications that provide location-based services, such as a weather widget, local Yellow Page widget, or map/navigation widgets (not shown). The widget modules **149** depicted here include a calculation widget which displays a soft keypad of a calculator and enables calculator functions, an alarm clock widget, and a dictionary widget that is associated or tied to the particular human language set in the device **100**.

[0029] Other modules that may be provided in the device **100** include a telephone module **138** that is responsible for managing the placement of outbound calls and the receiving of inbound calls made over a wireless telephone network, e.g. a cellular telecommunications network. A calendar module **148** displays a calendar of events and lets the user define and manage events in her calendar. A music player module **146** may manage the downloading, over the Internet or from a local desktop personal computer, of digital media files, such as music and movie files, which are then played back to the user through the audio circuitry **110** and the touch sensitive display system **112**.

[0030] It should be noted that each of the above-identified modules or applications correspond to a set of instructions to be executed by a machine such as the processor **120**, for performing one or more of the functions described above. These modules or instructions need not be implemented as separate programs, but rather may be combined or otherwise rearranged in various combinations. For example, the text input module **134** may be integrated with the graphics module **132**.

[0031] In one embodiment, the device **100** is such that most of its functions are performed exclusively through the touch screen **112** and/or a touchpad. By using the touch screen and/or touchpad as the primary input and output control device, the number of physical input and control devices, such as push buttons, dials, and the like on the device may be reduced. In some embodiments, the touchpad may be referred to as a "menu button". In other embodiments this menu button may include a physical push button or other physical motion input control device, instead of a touchpad. This case is illustrated in the example of the device **100** shown in FIG. **2** where a home button **204**, when pressed by the user, causes the display to show the main, home or root menu of the graphical user interface. This is depicted in FIG. **3** where the current time is displayed (image object **404**) together with several widgets (image objects **349_3**, **349_4**, and **349_5**) and icons for the phone, mail, browser, and music modules (image objects **338**, **340**, **347**, and **346**).

[0032] Referring back to FIG. **2**, this top view of the example portable multifunction device shows that its touch screen **112** is surrounded by various sensors and peripheral devices, including optical sensor **164**, proximity sensor **166**, accelerometer **168**, speaker **111** and microphone **113**. The speaker **111** may be a receiver (earpiece) that is positioned near the top of the rectangular shaped device **100**, while the microphone **113** is placed near the bottom, thus facilitating use of the device **100** as a conventional telephony handset when making or receiving wireless telephone calls. The device in this case also has a separate push button **206** for powering the device on and off and/or locking the device or placing the device into a sleep mode, a volume adjustment button **208**, a subscriber identity module (SIM) card slot **210**, a headset jack **212**, and an external port **124** for docking and/or charging of the device.

[0033] Referring now to FIG. **3**, a top view of the device **100** is shown, in the situation where the home button **204** has been actuated and the touch screen **112** is displaying the graphical or image objects associated with the home or root menu. The user interface processes running in the device **100**, in this example, produce the following image objects that are displayed: current time **404**, battery status indicator **406**, wireless communications signal strength **402**, and tray **408** containing icons for frequently used applications, in this case being phone **338**, mail **340** which may include an indicator **410** of the number of unread email messages, browser **347**, and music player **346**. Higher up on the touch screen **112** are the widgets for calculator **349_3**, alarm clock **349_4**, and dictionary **349_5**. These are, of course, just an example of what can be displayed in the root menu of the device. In many cases, the user can customize the root menu to display those user interface objects that are most frequently used. In this example, the user has chosen to also display an image object for the translation module **141** (labeled human language translator **341** in FIG. **3**). Operation of the translation module in different embodiments of the invention is now described in connection with FIG. **4** and the flow diagram of FIG. **6**.

II. Translation Capabilities

[0034] Referring now to FIG. **4**, two instances of the same device **100** are shown, in different physical orientations. In the first instance on the left, the device **100** (in this case being rectangular) is held by its user (not shown) in a substantially vertical position, also referred to as portrait orientation. Operation begins with the device **100** being in its home state, depicting the home menu, for example, as shown in FIG. **3**. Next, the user launches the translator application (included in translation module **141**) by gesturing on image object **341** (block **602** in FIG. **6**). This results in the touch screen displaying the objects **404**, **408** and **406** as depicted on the left hand side of FIG. **4**.

[0035] Object **404** is a prompt box, dialog box or conversation bubble which, when gestured or selected, activates a cursor **405** and allows a first user to enter a word of phrase in a first human language. The first language may be the default or base language of the device **100** (e.g., that was selected when the first user, as the owner of the device, first purchased the device). The first user then gestures letters and punctuation in the first human language, using a first virtual keyboard that is displayed as object **406** (block **604**). In addition, there may also be a further object **408** that is a prompt box through which the user selects the target language into which the phrase shown in object **404** will be translated. For example, a drop down list of different human languages may appear when the object **408** is selected or gestured by the user. In this example, the target language that has been selected is Chinese (block **606**).

[0036] The device **100**, in particular, the translation module **141**, may be designed with the capability of translating between several different human languages. This translation capability may be entirely implemented within the device **100**, as part of the translation module **104** which is executed by the processor **120**. Such a local translation database (which may be a partial or basic one) may be automatically downloaded into the device **100**, for example as part of a device software and firmware installation or a routine update cycle. However, some or all of the language translation capability may be implemented remotely, for example, by a remote server. The device **100** would then access the server over a local area network or a wide area network (e.g., the Internet), for a particular translation task. For instance, the translation module **141** may seek assistance from the remote server when faced with unknown words or phrases. In another embodiment, the entire word or phrase of a particular translation task may be transmitted to the remote server, such that all of the translation function is performed remotely. Connections may be established with the server through a wireless communications channel, such as one over a cellular network or a wireless local area network.

[0037] Returning to the user process, once the word or phrase to be translated has been entered in the dialog box, the translation module may then proceed with translating the word or phrase into the target language selected by the user (block **608**). The device **100** may prompt the user for a further input (e.g., a "Done" command box is selected or gestured by the user) before translation can be completed. As an alternative, the translation may not be completed until after and in response to the device **100** detecting that it has been rotated by at least a predetermined amount. In either case, the touch screen **112** does not display the translated text until after the device detects that it has been rotated by the predetermined amount, e.g. 180 degrees or turned upside down within the plane of the touch screen **112** as shown (block **610**). After performing the translation, the translated word or phrase may be displayed in the same or a similar dialog box **404**. Thus, in this case, although the device **100** has been turned upside down, the dialog box **404** displays the translated word or phrase right side up. The translation module **141** may in this case need to interact with the graphics module **132** and the text input module **134**, to ensure that the translated word or phrase is displayed right side up when the touch screen **112** has been turned upside down.

[0038] Still referring to FIG. **4**, when the device **100** has been rotated by the predetermined amount such that the translation module will cause the translated word or phrase to be displayed right side up, a second soft keyboard that is associated with the second human language into which the word or phrase has been translated is also displayed on the touch screen **112** (block **610**). This soft keyboard may replace the original keyboard, in the user interface object **406**.

[0039] At this point, the second user can read the word or phrase of the first user, and then respond by entering a word or phrase, using the second soft keyboard that is depicted by the image object **406** (block **612**). This response may be entered in the same dialog box depicted by the image object **404**, or it may be in a separate dialog box that contains only the input from the second user. Also, in this two-way translation situation, there may be no need to prompt the second user to select a different target language, because in a two-way translation the "target" language for the second user is in effect the original language used by the first user. Next, the second user turns the device back to its first position or orientation, and the device completes translation of the word or phrase (entered using the second keyboard) into the first language (block **614**). The translated word or phrase is then displayed, together with the first keyboard, in the first orientation (block **616**).

[0040] Thus, it can be seen that conversation between two users in different languages can be facilitated using the positional feedback provided by the device **100**, where one user enters her message, rotates the device and hands the device over to the other use, and then the other user enters her own message and rotates the device back into the original orientation and hands the device back to the first user.

[0041] Turning now to FIG. **5**, this figure shows how the device **100** may be designed to allow a three-way conversation between three different users, in three different human languages. At the left side of FIG. **5** the device **100** is shown in a vertical orientation (portrait view) where an English

speaking user has entered a question into the dialog box **404**, using the English soft virtual keyboard depicted by image object **406** on the touch screen. The user has selected Spanish to be the target language, as depicted by the image object **408**. Next, the device **100** is rotated by 90 degrees in a clockwise direction in the plane of its touch screen, resulting in a horizontal orientation (landscape view). This is depicted by the instance of the device **100** in the middle portion of FIG. **5**. In this example, the English phrase "Where should we go for dinner tonight?" has been replaced in the dialog box by its Spanish translation "¿Dónde debemos ir nosotros para cena esta noche?" Further, the horizontal orientation has been detected by the device **100** (and in particular by the translation module **141** processing data that is output by the accelerometer **168**, see FIG. **1**) and thus the English keyboard has been replaced within the image object **406** with a Spanish language keyboard. Also, given that this is a three-way conversation, the dialog box represented by image object **408** which prompts the user to select a target language may be retained, except that now the dialog box prompts the user in Spanish. In this situation, the third user of the device **100** is Chinese speaking, so that the second user who is using the device **100** in its horizontal orientation selects "Chino" as the target language in the dialog box represented by image object **408**. Next, the second user rotates the device **100** another 90 degrees in a clockwise direction resulting in the vertical orientation show at the right side of FIG. **5**, except that now device **100** is upside down relative to the original orientation used by the English speaking user. Now, in this orientation or position used by the Chinese speaking user, the device has replaced the Spanish phrase in the dialog box represented by image object **404**, with its Chinese translation. In addition, the dialog box for the target language (image object **408**) now prompts the user to select the target language, in Chinese. A response by the Chinese speaking user may now be entered into the device **100**, using the Chinese soft keyboard depicted by image object **406**, which has replaced the Spanish soft keyboard. The Chinese speaking user then turns the device back to either the English or Spanish orientation, resulting in the translation of the Chinese phrase into English or Spanish, respectively.

[0042] In another embodiment, rather than provide the second and third users the option to select the target language, the translation module may be designed so that only the first user (or in this case the owner) of the device **100** may define what the target languages of the translation conversation are. Thus, the first user could select, for example, English to be the language in the vertical orientation, Spanish for the horizontal orientation, and Chinese for the vertical but upside down orientation. Once set in this manner, there would be no need for any individual user to thereafter manually select the particular target language, as the translation module has stored the predetermined association between the different orientations and their respective languages. The device would thus automatically perform the correct translation of the phrase that has been entered in one orientation, into the language of another next orientation. This means that users would simply type in their response to a given statement that has been translated by the device, and then after deciding which language they would like their response to be translated into, would rotate the device into the respective orientation. For example, if the first user (owner) of the device **100** would like her English statement to be translated into Chinese, then, based on the association that has been previously stored or defined, she would rotate the device 180 degrees into the vertical but upside down orientation. The device **100** would then automatically display the phrase translated into Chinese, in response to the device taking on the upside down vertical orientation. If the Chinese speaking user would like to make her response or statement known to the Spanish speaking user, she would enter the statement using the displayed Chinese keyboard and then rotate the device into the horizontal orientation (and hand the device over to the Spanish speaking user). At that point, the Spanish speaking user may decide not to enter any further response or statement, but could simply pass on the Chinese speaking user's message to the English speaking user, by rotating the device back into its original vertical orientation and handing the device back to the English speaking user. The device in that situation would detect the original vertical orientation which is associated with the English language, and would translate either a Spanish phrase or, if none was entered as in this case, the previously entered Chinese phrase, into English.

[0043] As explained above, various embodiments of a mobile electronic device that have enhanced translation capability have been described. In one embodiment, the device has the following integrated hardware circuit and software components for achieving such capability. First, there is a means for displaying information right side up, while the device is in a first physical orientation, and for displaying the same information right side up in a different, second physical orientation. This may include a graphical user interface using a touch screen and associated display software that can display the same information right side up, in each of two different physical orientations of the device. In other words, despite the different physical orientations, the same information or the same type of information can be displayed right side up while the device is in each orientation. For example, as seen in FIG. **4**, the contents of the dialog box which is a word or phrase entered by a user is displayed right side up even though the device is in different physical orientations, respectively. The "information" in this case is the same except that it is being represented in different written human languages. To enable such a capability, the user interface may be viewed as including the graphics module **132** and text input module **134**, stored in memory **102**, to be executed by one of the processors **120**. The translation module **141** would cooperate with the graphics module **132** and the text input module **134**, to display the appropriate text in the dialog box (represented by image object **404** in FIG. **4** and FIG. **5**).

[0044] The device **100** also includes a means for receiving a word or phrase in a first human language, from a user of the device while the device is in the first physical orientation. In the above embodiment, the input word or phrase is entered using a virtual (soft) keyboard that is displayed on the touch screen by the text input module **134**. The particular language of the keyboard may be selected by the translation module **141**, whereas the actual details of displaying and receiving input from the selected keyboard may be governed by the graphics module **132** and the text input module **134**. The latter may also be responsible for providing the dialog box into which the word or phrase is entered. Note that this may be the same dialog box or same conversation bubble that displays a word or phrase from a previous user of the device (in a different language). As an alternative or in addition to using the soft keyboard (touch) input, there may be an audio module (not shown) in the memory **102** that when executed by the processor **120** interfaces with the microphone **113**, to receive the input word or phrase from the user as audible speech. In other words, the device **100** in this case records the user speaking the word or phrase to be translated, rather than entering it through the touch screen.

[0045] The device **100** also includes means for translating the word or phrase that has been entered, into a second human

language. This may be achieved by automatic translator software that is part of the translation module **141**. The translator software may perform an internal or local lookup of a stored table of words and/or phrases in one language, to yield their associated words and/or phrases in another language. Alternatively, or in addition, the translator software could send some or all of the words or phrases to a remote server as explained above, to obtain the translation terms remotely.

[0046] The device **100** also includes means for displaying the translated word or phrase right side up, while the device is in the second physical orientation. Here, the mechanism to do so would include the user interface which may include aspects of the translation module **141** detecting that the accelerometer **168** has in effect signaled a change in the physical orientation of the device, into the second predetermined physical orientation. The accelerometer is an example of a means for detecting this change in orientation. In response, the translation module would signal the graphics and text input modules **132**, **134** to change the virtual keyboard into the one associated with the second physical orientation, and display in a dialog box the translated word or phrase right side up (in view of the second physical orientation).

[0047] There are some subtleties to the manner in which the device transitions between displaying a word or a phrase in one language and a translated version. In one case, the physical orientation of the device must change first, before the translated phrase is displayed. In other words, the device may continue to display in a "first language mode" until it has been rotated around to the second, predetermined orientation. Only then will the display change to a "second language mode". The device **100** in that case would have a means for displaying the translated word or phrase, for example, in the landscape view, in response to the device taking on a horizontal orientation or position.

[0048] In yet another embodiment of the invention, the device **100** has a RF-based locator that can compute the current geographic location of the device. The locator may use RF-based triangulation techniques or GPS techniques, to compute the current location. The current location is then mapped to one or more human languages that are believed to be spoken in and around the area of the location. For example, if the user/owner of the device travels with the device to Tibet, then the RF-based locator could automatically detect Tibet as the location. A previously stored look up table in the device **100** would have associated Tibet with both Mandarin and Tibetan languages. Thus, the device, and in particular the translation module **141**, would cause the user interface to display a graphic that prompts the user to select either one of Mandarin and Tibetan into which an entered word or phrase will be translated. In other words, the possible target languages that are available for translation would be offered to the user automatically by the device, as a function of the computed current geographic location of the device.

[0049] In another embodiment, the device has a security function built-in that prevents access to other applications, once the translator application has been launched, unless a predetermined pass code is received from the user or the user is otherwise again authenticated. That is because when the device is operating in one of its language translation modes, the device will be handed to at least one other person as part of the position feedback translation processes described above. The security function prevents another user from accessing any applications other than the translation application that is currently running.

[0050] In addition to a multiple user scenario as described above, the device and its positional feedback translation capability may also be used solely by its owner, to teach himself another language. The owner/single user could simply learn the words or phrases that have been translated by the device, in response to that user rotating or moving the device in a manner that causes the translator to respond accordingly. As another alternative, the device may be used by its owner as a personal translator tool, to, for example, translate words and characters that appear on signs or billboards while in a foreign country.

[0051] The above-described embodiments of the invention in connection with FIGS. **4-6** refer to the device being rotated or turned by its user when seeking to switch the device between different language translation modes of operation. In another embodiment, switching between these different language translation modes occurs not in response to a pure rotation or turning movement about a pivot point, but rather in response to a translation movement of the device. In that case, the device need not be rotated or turned about any axis, but rather may simply be tapped by its user to cause a rapid translational movement of the device which may also be detectible by the built-in accelerometer.

[0052] An embodiment of the invention may be a machine-readable medium having stored thereon instructions which program a processor to perform some of the operations described above. In other embodiments, some of these operations might be performed by specific hardware components that contain hardwired logic. Those operations might alternatively be performed by any combination of programmed computer components and custom hardware components.

[0053] A machine-readable medium may include any mechanism for storing or transmitting information in a form readable by a machine (e.g., a computer), not limited to Compact Disc Read-Only Memory (CD-ROMs), Read-Only Memory (ROMs), Random Access Memory (RAM), and Erasable Programmable Read-Only Memory (EPROM).

[0054] The invention is not limited to the specific embodiments described above. For example, although an accelerometer has been described above as the means for detecting a change in the physical orientation or position of the device (that may have been brought about by the user, for example, rotating or turning or tapping the device), other means for detecting movement or changes in the position of the device may alternatively be used. Although the examples depicted in FIGS. **4** and **5** take advantage of the rectangular shape of the example device **100**, in that the predetermined orientations of the device are vertical, horizontal, and upside down vertical, orientations that are different from each other by other than 90 degrees may also be feasible depending upon the external shape or peripheral shape of the device **100**. Other distinct, predetermined orientations that can be comfortably associated with the shape of the device are possible, e.g. a triangular device could have three distinct orientations each corresponding to a different side of the device being held horizontal by a user. Accordingly, other embodiments are within the scope of the claims.

What is claimed is:

1. A mobile electronic device comprising:

a touch sensitive screen;

an accelerometer; and

a translator to translate a word or phrase that is in a first human language and that is entered via a first virtual keyboard displayed on the touch sensitive screen, into a second human language, and wherein the translator is to cause the touch sensitive screen to display the translated word or phrase and a second virtual keyboard having characters in the second human language, in response to the accelerometer detecting a change in the physical orientation of the device.

2. The device of claim **1** wherein the touch sensitive screen is rectangular.

3. The device of claim **2** wherein the translator is to cause the touch sensitive screen to display the translated word or phrase and the second virtual keyboard when the device is rotated by about ninety degrees or more in a plane of the touch sensitive screen.

4. The device of claim **2** wherein the translator is to cause the touch sensitive screen to display the translated word or phrase and the second virtual keyboard when the device is rotated from a vertical orientation to a horizontal orientation.

5. The device of claim **4** wherein the user interface is to display the word or phrase in the first human language in a portrait view while the device is in the vertical orientation, and the translated word phrase in a landscape view when the device is in the horizontal orientation.

6. The device of claim **1** further comprising a RF-based locater to compute the current geographic location of the mobile electronic device,

wherein the translator causes the user interface to display a graphic that prompts a user of the device to select any one of a plurality of human languages to which the entered word or phrase can be translated by the translator, the plurality of human languages being offered by the translator as a function of the computed current geographic location of the mobile electronic device.

7. The device of claim **6** wherein the translator causes the graphic to be displayed when the accelerometer detects a change in the physical orientation of the device.

8. The device of claim **1** wherein device has a security function that prevents access to other applications once the translator application has been launched, unless a predetermined pass-code is received from the user.

9. A machine-implemented method for operating a mobile electronic device, comprising:

prompting a user of the device to enter a word or phrase in a first language using an associated first soft keyboard that is being displayed right side up; and

translating the entered word or phrase into a second language; and

when the device rotates by a predetermined amount, displaying right side up the translated word or phrase and a second soft keyboard that is associated with the second language.

10. The method of claim **9** wherein said displaying the translated word or phrase replaces the word or phrase in the first language, and the second soft keyboard replaces the first soft keyboard.

11. The method of claim **9** further comprising:

prompting another user of the device to enter a word or phrase in the second language using the second keyboard;

translating the word or phrase in the second language, into the first language; and

when the deice rotates by another predetermined amount, displaying right side up the translated word or phrase in the first language and the first keyboard.

12. The method of claim **9** wherein prompting the user comprises displaying a conversation bubble or dialog box in which the word or phrase being entered by the user is simultaneously displayed.

13. The method of claim **9** further comprising:

computing a current geographic location of the mobile device; and

prompting the user to select any one of a plurality of languages to which the entered word or phrase is to be translated, wherein the plurality of languages are offered as a function of the computed current geographic location.

14. The method of claim **9** further comprising:

launching a translator application under which the prompting of the user, the translating and the displaying of the translated word or phrase are preformed; and

preventing access to other applications once the translator application has been launched unless the user is again authenticated.

15. A mobile electronic device comprising:

a touch sensitive screen; and

a translator to translate a word or phrase, that has been entered via a virtual keyboard on the touch sensitive screen, into another language, wherein the translator has a first language mode of operation and a second language mode of operation, in the first language mode the touch sensitive screen displays a first virtual keyboard for a first language, in the second language mode the touch sensitive screen displays a second virtual keyboard for a second language, and wherein the translator switches between the first and second language modes in response to the device being rotated or undergoing a translation movement.

16. The device of claim **15** wherein the translator is to switch between the first and second modes in response to the device undergoing a rapid translation movement that is brought about by a user tapping the device.

17. The device of claim **15** wherein the translator is to switch between the first and second modes in response to the device undergoing a rotation by about 90 degrees or more in a plane or the touch screen.

18. A mobile electronic device comprising:

means for displaying information right side up, while the device is in a first physical orientation;

means for displaying said information right side up, while the device is in a second, different physical orientation;

means for receiving a word or phrase in a first human language, from a user of the device while the device is in the first physical orientation;

means for translating the word or phrase into a second human language; and

means for displaying the translated word or phrase right side up, while the device is in the second physical orientation.

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