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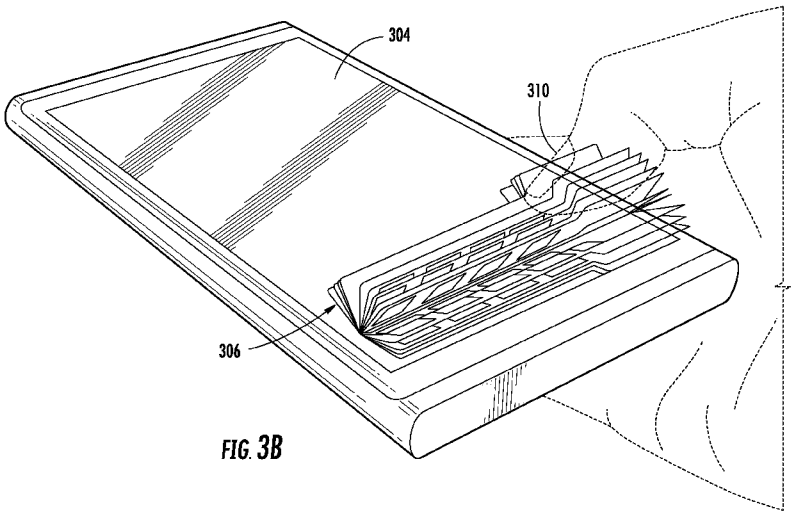


FIG. 3B

(57) Abstract: Methods and apparatuses are provided for facilitating interaction with a three- dimensional user interface. A method may include receiving an indication of a hovering gesture input to a touch display. The method may further include determining, based at least in part on the received indication, a position of the hovering gesture input. The method may additionally include determining a relation of the determined position to a three-dimensional user interface displayed by the touch display. The method may also include causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface. Corresponding apparatuses are also provided.

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METHODS AND APPARATUSES FOR FACILITATING INTERACTION WITH A THREE-DIMENSIONAL USER INTERFACE

TECHNOLOGICAL FIELD

Example embodiments of the present invention relate generally to user interface technology and, more particularly, relate to methods and apparatuses for facilitating interaction with a three-dimensional user interface.

BACKGROUND

The modern communications era has brought about a tremendous expansion of wireline and wireless networks. Wireless and mobile networking technologies have addressed related consumer demands, while providing more flexibility and immediacy of information transfer. Concurrent with the expansion of networking technologies, an expansion in computing power has resulted in development of affordable computing devices capable of taking advantage of services made possible by modern networking technologies. This expansion in computing power has led to a reduction in the size of computing devices and given rise to a new generation of mobile devices that are capable of performing functionality that only a few years ago required processing power that could be provided only by the most advanced desktop computers. Consequently, mobile computing devices having a small form factor have become ubiquitous and are used to access network applications and services by consumers of all socioeconomic backgrounds.

The evolution in the power and affordability of mobile computing devices has included the release of computing devices including enhanced user interface technologies, such as enhanced interactive displays. For example, touch screen displays enable a user to intuitively interact with content displayed on the display. As another example, three-dimensional displays for usage on mobile devices are in development. Some three-dimensional displays provide an autostereoscopic three-dimensional effect, which allows a user to perceive a three-dimensional image without using three-dimensional glasses. However, while such three-dimensional displays may provide a “wow” factor to users and have been used for some gaming and movie applications, to

date there has been a lack of development of user interface technology leveraging user interactions with a three-dimensional display.

BRIEF SUMMARY

Methods, apparatuses, and computer program products are herein provided for facilitating interaction with a three-dimensional user interface. Methods, apparatuses, and computer program products in accordance with various embodiments may provide several advantages to application developers, computing devices, and computing device users. Some example embodiments facilitate interaction with a three-dimensional graphical user interface through the use of hovering gestures. In this regard, such example embodiments may enable a user to interact with a three-dimensional user interface displayed by a touch display by making a hovering gesture within the three-dimensional space in which the user perceives the three-dimensional user interface. Accordingly, a user may intuitively interact with a three-dimensional user interface by manipulating the three-dimensional user interface in three-dimensional space using a hovering gesture. Further, application developers and other developers of graphical user interfaces may develop three-dimensional graphical user interfaces taking advantage of such hovering gestures.

Some example embodiments further provide a three-dimensional rotary card interface with which a user may interact through the use of hovering gestures. In this regard, the three-dimensional rotary card interface of some example embodiments may comprise a plurality of tabbed cards, which a user may flip through and view in three-dimensional space. Accordingly, a user may be able to intuitively view, access, and interact with applications, files, and/or the like.

In a first example embodiment, a method is provided, which comprises receiving an indication of a hovering gesture input to a touch display. The method of this example embodiment further comprises determining, based at least in part on the received indication, a position of the hovering gesture input. The method of this example embodiment additionally comprises determining a relation of the determined position to a three-dimensional user interface displayed by the touch display. The method of this example embodiment also comprises causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface.

In another example embodiment, an apparatus comprising at least one processor and at least one memory storing computer program code is provided. The at least one memory and stored computer program code are configured, with the at least one processor, to cause the apparatus of this example embodiment to at least receive an indication of a hovering gesture input to a touch display. The at least one memory and

stored computer program code are configured, with the at least one processor, to further cause the apparatus of this example embodiment to determine, based at least in part on the received indication, a position of the hovering gesture input. The at least one memory and stored computer program code are configured, with the at least one processor, to additionally cause the apparatus of this example embodiment to determine a relation of the determined position to a three-dimensional user interface displayed by the touch display. The at least one memory and stored computer program code are configured, with the at least one processor, to also cause the apparatus of this example embodiment to cause, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface.

In another example embodiment, a computer program product is provided. The computer program product of this example embodiment includes at least one computer-readable storage medium having computer-readable program instructions stored therein. The program instructions of this example embodiment comprise program instructions configured to cause an apparatus to perform a method comprising receiving an indication of a hovering gesture input to a touch display. The method of this example embodiment further comprises determining, based at least in part on the received indication, a position of the hovering gesture input. The method of this example embodiment additionally comprises determining a relation of the determined position to a three-dimensional user interface displayed by the touch display. The method of this example embodiment also comprises causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface.

In another example embodiment, an apparatus is provided that comprises means for receiving an indication of a hovering gesture input to a touch display. The apparatus of this example embodiment further comprises means for determining, based at least in part on the received indication, a position of the hovering gesture input. The apparatus of this example embodiment additionally comprises means for determining a relation of the determined position to a three-dimensional user interface displayed by the touch display. The apparatus of this example embodiment also comprises means for causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface.

The above summary is provided merely for purposes of summarizing some example embodiments of the invention so as to provide a basic understanding of some aspects of the invention. Accordingly, it will be appreciated that the above described example embodiments are merely examples and should not be construed to narrow the scope or spirit of the invention in any way. It will be appreciated that the scope of the

invention encompasses many potential embodiments, some of which will be further described below, in addition to those here summarized.

BRIEF DESCRIPTION OF THE DRAWINGS

Having thus described embodiments of the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 illustrates a block diagram of an apparatus for facilitating interaction with a three-dimensional user interface according to an example embodiment;

FIG. 2 is a schematic block diagram of a mobile terminal according to an example embodiment;

FIGs. 3A-3D illustrates example interaction with an example three-dimensional virtual rotary card user interface according to an example embodiment;

FIG. 4 illustrates a flowchart according to an example method for facilitating interaction with a three-dimensional user interface according to an example embodiment; and

FIG. 5 illustrates a flowchart according to an example method for facilitating interaction with a three-dimensional virtual rotary card user interface according to an example embodiment.

DETAILED DESCRIPTION

Some embodiments of the present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the invention are shown. Indeed, the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout.

As used herein, the terms “data,” “content,” “information” and similar terms may be used interchangeably to refer to data capable of being transmitted, received, displayed and/or stored in accordance with various example embodiments. Thus, use of any such terms should not be taken to limit the spirit and scope of the disclosure.

The term “computer-readable medium” as used herein refers to any medium configured to participate in providing information to a processor, including instructions for execution. Such a medium may take many forms, including, but not limited to a non-transitory computer-readable storage medium (e.g., non-volatile media, volatile media), and transmission media. Transmission media include, for example, coaxial cables,

copper wire, fiber optic cables, and carrier waves that travel through space without wires or cables, such as acoustic waves and electromagnetic waves, including radio, optical and infrared waves. Signals include man-made transient variations in amplitude, frequency, phase, polarization or other physical properties transmitted through the transmission media. Examples of non-transitory computer-readable media include a magnetic computer readable medium (e.g., a floppy disk, hard disk, magnetic tape, any other magnetic medium), an optical computer readable medium (e.g., a compact disc read only memory (CD-ROM), a digital versatile disc (DVD), a Blu-Ray disc, or the like), a random access memory (RAM), a programmable read only memory (PROM), an erasable programmable read only memory (EPROM), a FLASH-EPROM, or any other non-transitory medium from which a computer can read. The term computer-readable storage medium is used herein to refer to any computer-readable medium except transmission media. However, it will be appreciated that where embodiments are described to use a computer-readable storage medium, other types of computer-readable mediums may be substituted for or used in addition to the computer-readable storage medium in alternative embodiments.

Additionally, as used herein, the term 'circuitry' refers to (a) hardware-only circuit implementations (e.g., implementations in analog circuitry and/or digital circuitry); (b) combinations of circuits and computer program product(s) comprising software and/or firmware instructions stored on one or more computer readable memories that work together to cause an apparatus to perform one or more functions described herein; and (c) circuits, such as, for example, a microprocessor(s) or a portion of a microprocessor(s), that require software or firmware for operation even if the software or firmware is not physically present. This definition of 'circuitry' applies to all uses of this term herein, including in any claims. As a further example, as used herein, the term 'circuitry' also includes an implementation comprising one or more processors and/or portion(s) thereof and accompanying software and/or firmware. As another example, the term 'circuitry' as used herein also includes, for example, a baseband integrated circuit or applications processor integrated circuit for a mobile phone or a similar integrated circuit in a server, a cellular network device, other network device, and/or other computing device.

FIG. 1 illustrates a block diagram of an apparatus 102 for facilitating interaction with a three-dimensional user interface according to an example embodiment. It will be appreciated that the apparatus 102 is provided as an example of one embodiment and should not be construed to narrow the scope or spirit of the invention in any way. In this regard, the scope of the disclosure encompasses many potential embodiments in addition to those illustrated and described herein. As such, while FIG. 1 illustrates one example of a configuration of an apparatus for facilitating interaction with a three-dimensional user

interface, other configurations may also be used to implement embodiments of the present invention.

The apparatus 102 may be embodied as a desktop computer, laptop computer, mobile terminal, mobile computer, mobile phone, mobile communication device, game device, digital camera/camcorder, audio/video player, television device, radio receiver, digital video recorder, positioning device, a chipset, a computing device comprising a chipset, any combination thereof, and/or the like. In this regard, the apparatus 102 may comprise any computing device that comprises or is in operative communication with a touch display capable of displaying a three-dimensional graphical user interface (e.g., an autostereoscopic three-dimensional display, an assisted three-dimensional display requiring use of glasses or other assistance device by a user, or the like). In some example embodiments, the apparatus 102 is embodied as a mobile computing device, such as the mobile terminal illustrated in FIG. 2.

In this regard, FIG. 2 illustrates a block diagram of a mobile terminal 10 representative of one example embodiment of an apparatus 102. It should be understood, however, that the mobile terminal 10 illustrated and hereinafter described is merely illustrative of one type of apparatus 102 that may implement and/or benefit from various example embodiments of the invention and, therefore, should not be taken to limit the scope of the disclosure. While several embodiments of the electronic device are illustrated and will be hereinafter described for purposes of example, other types of electronic devices, such as mobile telephones, mobile computers, personal digital assistants (PDAs), pagers, laptop computers, desktop computers, gaming devices, televisions, e-papers, and other types of electronic systems, may employ various embodiments of the invention.

As shown, the mobile terminal 10 may include an antenna 12 (or multiple antennas 12) in communication with a transmitter 14 and a receiver 16. The mobile terminal 10 may also include a processor 20 configured to provide signals to and receive signals from the transmitter and receiver, respectively. The processor 20 may, for example, be embodied as various means including circuitry, one or more microprocessors with accompanying digital signal processor(s), one or more processor(s) without an accompanying digital signal processor, one or more coprocessors, one or more multi-core processors, one or more controllers, processing circuitry, one or more computers, various other processing elements including integrated circuits such as, for example, an ASIC (application specific integrated circuit) or FPGA (field programmable gate array), or some combination thereof. Accordingly, although illustrated in FIG. 2 as a single processor, in some embodiments the processor 20 comprises a plurality of processors. These signals sent and received by the processor 20 may include signaling

information in accordance with an air interface standard of an applicable cellular system, and/or any number of different wireline or wireless networking techniques, comprising but not limited to Wi-Fi, wireless local access network (WLAN) techniques such as Institute of Electrical and Electronics Engineers (IEEE) 802.11, 802.16, and/or the like. In addition, these signals may include speech data, user generated data, user requested data, and/or the like. In this regard, the mobile terminal may be capable of operating with one or more air interface standards, communication protocols, modulation types, access types, and/or the like. More particularly, the mobile terminal may be capable of operating in accordance with various first generation (1G), second generation (2G), 2.5G, third-generation (3G) communication protocols, fourth-generation (4G) communication protocols, Internet Protocol Multimedia Subsystem (IMS) communication protocols (e.g., session initiation protocol (SIP)), and/or the like. For example, the mobile terminal may be capable of operating in accordance with 2G wireless communication protocols IS-136 (Time Division Multiple Access (TDMA)), Global System for Mobile communications (GSM), IS-95 (Code Division Multiple Access (CDMA)), and/or the like. Also, for example, the mobile terminal may be capable of operating in accordance with 2.5G wireless communication protocols General Packet Radio Service (GPRS), Enhanced Data GSM Environment (EDGE), and/or the like. Further, for example, the mobile terminal may be capable of operating in accordance with 3G wireless communication protocols such as Universal Mobile Telecommunications System (UMTS), Code Division Multiple Access 2000 (CDMA2000), Wideband Code Division Multiple Access (WCDMA), Time Division-Synchronous Code Division Multiple Access (TD-SCDMA), and/or the like. The mobile terminal may be additionally capable of operating in accordance with 3.9G wireless communication protocols such as Long Term Evolution (LTE) or Evolved Universal Terrestrial Radio Access Network (E-UTRAN) and/or the like. Additionally, for example, the mobile terminal may be capable of operating in accordance with fourth-generation (4G) wireless communication protocols and/or the like as well as similar wireless communication protocols that may be developed in the future.

Some Narrow-band Advanced Mobile Phone System (NAMPS), as well as Total Access Communication System (TACS), mobile terminals may also benefit from embodiments of this invention, as should dual or higher mode phones (e.g., digital/analog or TDMA/CDMA/analog phones). Additionally, the mobile terminal 10 may be capable of operating according to Wi-Fi or Worldwide Interoperability for Microwave Access (WiMAX) protocols.

It is understood that the processor 20 may comprise circuitry for implementing audio/video and logic functions of the mobile terminal 10. For example, the processor 20 may comprise a digital signal processor device, a microprocessor device, an analog-to-

digital converter, a digital-to-analog converter, and/or the like. Control and signal processing functions of the mobile terminal may be allocated between these devices according to their respective capabilities. The processor may additionally comprise an internal voice coder (VC) 20a, an internal data modem (DM) 20b, and/or the like. Further, the processor may comprise functionality to operate one or more software programs, which may be stored in memory. For example, the processor 20 may be capable of operating a connectivity program, such as a web browser. The connectivity program may allow the mobile terminal 10 to transmit and receive web content, such as location-based content, according to a protocol, such as Wireless Application Protocol (WAP), hypertext transfer protocol (HTTP), and/or the like. The mobile terminal 10 may be capable of using a Transmission Control Protocol/Internet Protocol (TCP/IP) to transmit and receive web content across the internet or other networks.

The mobile terminal 10 may also comprise a user interface including, for example, an earphone or speaker 24, a ringer 22, a microphone 26, a display 28, a user input interface, and/or the like, which may be operationally coupled to the processor 20. In this regard, the processor 20 may comprise user interface circuitry configured to control at least some functions of one or more elements of the user interface, such as, for example, the speaker 24, the ringer 22, the microphone 26, the display 28, and/or the like. The processor 20 and/or user interface circuitry comprising the processor 20 may be configured to control one or more functions of one or more elements of the user interface through computer program instructions (e.g., software and/or firmware) stored on a memory accessible to the processor 20 (e.g., volatile memory 40, non-volatile memory 42, and/or the like). Although not shown, the mobile terminal may comprise a battery for powering various circuits related to the mobile terminal, for example, a circuit to provide mechanical vibration as a detectable output. The display 28 of the mobile terminal may be of any type appropriate for the electronic device in question with some examples including a plasma display panel (PDP), a liquid crystal display (LCD), a light-emitting diode (LED), an organic light-emitting diode display (OLED), a projector, a holographic display or the like. The display 28 may, for example, comprise a three-dimensional touch display, examples of which will be described further herein below. The user input interface may comprise devices allowing the mobile terminal to receive data, such as a keypad 30, a touch display (e.g., some example embodiments wherein the display 28 is configured as a touch display), a joystick (not shown), and/or other input device. In embodiments including a keypad, the keypad may comprise numeric (0-9) and related keys (#, *), and/or other keys for operating the mobile terminal.

The mobile terminal 10 may comprise memory, such as a subscriber identity module (SIM) 38, a removable user identity module (R-UIM), and/or the like, which may

store information elements related to a mobile subscriber. In addition to the SIM, the mobile terminal may comprise other removable and/or fixed memory. The mobile terminal 10 may include volatile memory 40 and/or non-volatile memory 42. For example, volatile memory 40 may include Random Access Memory (RAM) including dynamic and/or static RAM, on-chip or off-chip cache memory, and/or the like. Non-volatile memory 42, which may be embedded and/or removable, may include, for example, read-only memory, flash memory, magnetic storage devices (e.g., hard disks, floppy disk drives, magnetic tape, etc.), optical disc drives and/or media, non-volatile random access memory (NVRAM), and/or the like. Like volatile memory 40 non-volatile memory 42 may include a cache area for temporary storage of data. The memories may store one or more software programs, instructions, pieces of information, data, and/or the like which may be used by the mobile terminal for performing functions of the mobile terminal. For example, the memories may comprise an identifier, such as an international mobile equipment identification (IMEI) code, capable of uniquely identifying the mobile terminal 10.

Returning to FIG. 1, in an example embodiment, the apparatus 102 includes various means for performing the various functions herein described. These means may comprise one or more of a processor 110, memory 112, communication interface 114, user interface 116, three-dimensional (3-D) touch display 118, hovering gesture sensor 120, or user interface (UI) control circuitry 122. The means of the apparatus 102 as described herein may be embodied as, for example, circuitry, hardware elements (e.g., a suitably programmed processor, combinational logic circuit, and/or the like), a computer program product comprising computer-readable program instructions (e.g., software or firmware) stored on a computer-readable medium (e.g. memory 112) that is executable by a suitably configured processing device (*e.g.,* the processor 110), or some combination thereof.

In some example embodiments, one or more of the means illustrated in FIG. 1 may be embodied as a chip or chip set. In other words, the apparatus 102 may comprise one or more physical packages (e.g., chips) including materials, components and/or wires on a structural assembly (e.g., a baseboard). The structural assembly may provide physical strength, conservation of size, and/or limitation of electrical interaction for component circuitry included thereon. In this regard, the processor 110, memory 112, communication interface 114, user interface 116, hovering gesture sensor 120, and/or UI control circuitry 122 may be embodied as a chip or chip set. The apparatus 102 may therefore, in some cases, be configured to or may comprise component(s) configured to implement embodiments of the present invention on a single chip or as a single “system on a chip.” As such, in some cases, a chip or chipset may constitute means for performing one or more operations for providing the functionalities described herein

and/or for enabling user interface navigation with respect to the functionalities and/or services described herein.

The processor 110 may, for example, be embodied as various means including one or more microprocessors with accompanying digital signal processor(s), one or more processor(s) without an accompanying digital signal processor, one or more coprocessors, one or more multi-core processors, one or more controllers, processing circuitry, one or more computers, various other processing elements including integrated circuits such as, for example, an ASIC (application specific integrated circuit) or FPGA (field programmable gate array), one or more other types of hardware processors, or some combination thereof. Accordingly, although illustrated in FIG. 1 as a single processor, in some embodiments the processor 110 comprises a plurality of processors. The plurality of processors may be in operative communication with each other and may be collectively configured to perform one or more functionalities of the apparatus 102 as described herein. The plurality of processors may be embodied on a single computing device or distributed across a plurality of computing devices collectively configured to function as the apparatus 102. In embodiments wherein the apparatus 102 is embodied as a mobile terminal 10, the processor 110 may be embodied as or comprise the processor 20. In some example embodiments, the processor 110 is configured to execute instructions stored in the memory 112 or otherwise accessible to the processor 110. These instructions, when executed by the processor 110, may cause the apparatus 102 to perform one or more of the functionalities of the apparatus 102 as described herein. As such, whether configured by hardware or software methods, or by a combination thereof, the processor 110 may comprise an entity capable of performing operations according to embodiments of the present invention while configured accordingly. Thus, for example, when the processor 110 is embodied as an ASIC, FPGA or the like, the processor 110 may comprise specifically configured hardware for conducting one or more operations described herein. Alternatively, as another example, when the processor 110 is embodied as an executor of instructions, such as may be stored in the memory 112, the instructions may specifically configure the processor 110 to perform one or more algorithms and operations described herein.

The memory 112 may comprise, for example, volatile memory, non-volatile memory, or some combination thereof. In this regard, the memory 112 may comprise a non-transitory computer-readable storage medium. Although illustrated in FIG. 1 as a single memory, the memory 112 may comprise a plurality of memories. The plurality of memories may be embodied on a single computing device or may be distributed across a plurality of computing devices collectively configured to function as the apparatus 102. In various example embodiments, the memory 112 may comprise a hard disk, random

access memory, cache memory, flash memory, a compact disc read only memory (CD-ROM), digital versatile disc read only memory (DVD-ROM), an optical disc, circuitry configured to store information, or some combination thereof. In embodiments wherein the apparatus 102 is embodied as a mobile terminal 10, the memory 112 may comprise the volatile memory 40 and/or the non-volatile memory 42. The memory 112 may be configured to store information, data, applications, instructions, or the like for enabling the apparatus 102 to carry out various functions in accordance with various example embodiments. For example, in some example embodiments, the memory 112 is configured to buffer input data for processing by the processor 110. Additionally or alternatively, the memory 112 may be configured to store program instructions for execution by the processor 110. The memory 112 may store information in the form of static and/or dynamic information. The stored information may include, for example, images, content, media content, user data, application data, and/or the like. This stored information may be stored and/or used by the UI control circuitry 122 during the course of performing its functionalities.

The communication interface 114 may be embodied as any device or means embodied in circuitry, hardware, a computer program product comprising computer readable program instructions stored on a computer readable medium (e.g., the memory 112) and executed by a processing device (e.g., the processor 110), or a combination thereof that is configured to receive and/or transmit data from/to another computing device. In some example embodiments, the communication interface 114 is at least partially embodied as or otherwise controlled by the processor 110. In this regard, the communication interface 114 may be in communication with the processor 110, such as via a bus. The communication interface 114 may include, for example, an antenna, a transmitter, a receiver, a transceiver and/or supporting hardware or software for enabling communications with one or more remote computing devices. The communication interface 114 may be configured to receive and/or transmit data using any protocol that may be used for communications between computing devices. In this regard, the communication interface 114 may be configured to receive and/or transmit data using any protocol that may be used for transmission of data over a wireless network, wireline network, some combination thereof, or the like by which the apparatus 102 and one or more computing devices may be in communication. As an example, the communication interface 114 may be configured to receive and/or otherwise access content (e.g., web page content, streaming media content, and/or the like) over a network from a server or other content source. The communication interface 114 may additionally be in communication with the memory 112, user interface 116, and/or UI control circuitry 122, such as via a bus.

The user interface 116 may be in communication with the processor 110 to receive an indication of a user input and/or to provide an audible, visual, mechanical, or other output to a user. As such, the user interface 116 may include, for example, a keyboard, a mouse, a joystick, a display, a touch screen display, a microphone, a speaker, and/or other input/output mechanisms. In some example embodiments, the user interface 116 comprises or is in communication with one or more displays, such as the three-dimensional touch display 118. In some example embodiments wherein the user interface 116 comprises or is in communication with a three-dimensional touch display 118, the user interface 116 may additionally be configured to detect and/or receive an indication of a touch gesture, hovering gesture, and/or other input to the display. The user interface 116 may be in communication with the memory 112, communication interface 114, three-dimensional touch display 118, hovering gesture sensor 120, and/or UI control circuitry 122, such as via a bus.

In some example embodiments, the apparatus 102 comprises a three-dimensional touch display 118. In alternative example embodiments, such as in embodiments wherein the apparatus 102 is embodied as a chip or chipset, the apparatus 102 may be operatively connected with the three-dimensional touch display 118 such that the apparatus 102 may control the three-dimensional touch display 118, receive an indication of and/or otherwise determine a user input (e.g., a touch gesture input, a hovering gesture input, and/or the like) to the three-dimensional touch display 118, and/or the like. The three-dimensional touch display 118 may comprise any type of display capable of displaying a user interface, image, and/or the like in a manner such that it may be perceived to be displayed in three-dimensions by a user. It will be appreciated that such three-dimensional user interfaces, images, or the like that may be displayed by the three-dimensional touch display may have three or more dimensions, including, four-dimensional images or other hyper dimensional space. For example, the three-dimensional touch display 118 may comprise an autostereoscopic display capable of displaying an image in three-dimensions without necessitating the usage of 3-D glasses or the like by the user. As another example, the three-dimensional touch display 118 may comprise a display capable of displaying an image that may be perceived as being 3-D by a user using appropriate 3-D glasses or other assistance device. As still a further example, the three-dimensional touch display 118 may comprise a display capable of displaying a 3-D holographic image.

The three-dimensional touch display 118 may also be configured to enable the detection of a hovering gesture input, such as with the assistance of the user interface 116 and/or hovering gesture sensor 120. A hovering gesture input may comprise a gesture input to the three-dimensional touch display 118 without making physical contact

with a surface of the three-dimensional touch display 118, such as a gesture made in a space some distance above/in front of the surface of the three-dimensional touch display 118. As an example, the three-dimensional touch display 118 may comprise a projected capacitive touch display, which may be configured to enable detection of capacitance of a finger or other input object by which a gesture may be made without physically contacting a display surface. As another example, the three-dimensional touch display 118 may be configured with or without the assistance of the hove touch sensor 120 to enable detection of a hovering gesture input through use of acoustic wave touch sensor technology, electromagnetic touch sensing technology, near field imaging technology, optical sensing technology, infrared proximity sensing technology, some combination thereof, or the like. The three-dimensional touch display 118 may further be in communication with one or more of the processor 110, memory 112, communication interface 114, hovering gesture sensor 120, or UI control circuitry 122.

The hovering gesture sensor 120 may be integrated into the three-dimensional touch display 118, or may be embodied separately from the three-dimensional touch display 118. In embodiments wherein the hovering gesture sensor 120 is embodied separately from the three-dimensional touch display 118, the hovering gesture sensor 120 may be embodied as various means, such as circuitry, hardware, a computer program product comprising computer readable program instructions stored on a computer readable medium (e.g., the memory 112) and executed by a processing device (e.g., the processor 110), or some combination thereof and, in some embodiments, may be embodied as or otherwise controlled by the processor 110. In some example embodiments wherein the hovering gesture sensor 120 is embodied separately from the processor 110, the hovering gesture sensor 120 may be in communication with the processor 110. In some example embodiments, the hovering gesture sensor 120 may be in communication with the three-dimensional touch display 118 to enable detection of a hovering gesture input, touch input, and/or the like to the three-dimensional touch display 118. For example, the three-dimensional touch display 118 may generate an electrical or other signal responsive to an input, such as a hovering gesture input, and this signal may be received and detected by the hovering gesture sensor 120. As another example, the hovering gesture sensor 120 may comprise one or more sensor devices, which may be integrated into the three-dimensional touch display 118, positioned near or adjacent to the three-dimensional touch display 118, and/or the like which may detect a hovering gesture input and generate an electrical or other signal responsive to detection of a hovering gesture input. For example, the hovering gesture sensor 120 may comprise one or more proximity sensors, one or more capacitive displacement sensors, one or more acoustic wave touch sensors, one or more electromagnetic touch sensors, one or more near field

imaging sensors, one or more optical sensors, one or more infrared proximity sensors, some combination thereof, or the like, which may be configured to detect a hovering gesture by detecting a presence of a finger(s), hand, stylus, and/or other input object at a position near, but not in physical contact with the surface of the three-dimensional touch display 118.

The hovering gesture sensor 120 may be configured to generate and/or communicate a received signal indicative of a detected hovering gesture input to the processor 110, user interface 116, and/or UI control circuitry 122. As such, in some example embodiments, the UI control circuitry 122 may be configured to determine a hovering gesture input, a position of a hovering gesture input, an attribute of a hovering gesture input, and/or the like based at least in part on a signal generated by the hovering gesture sensor 120. The hovering gesture sensor 120 may accordingly be in communication with one or more of the memory 112, communication interface 114, user interface 116, three-dimensional touch display 118, or UI control circuitry 122, such as via a bus.

The UI control circuitry 122 may be embodied as various means, such as circuitry, hardware, a computer program product comprising computer readable program instructions stored on a computer readable medium (e.g., the memory 112) and executed by a processing device (e.g., the processor 110), or some combination thereof and, in some embodiments, is embodied as or otherwise controlled by the processor 110. In some example embodiments wherein the UI control circuitry 122 is embodied separately from the processor 110, the UI control circuitry 122 may be in communication with the processor 110. The UI control circuitry 122 may further be in communication with one or more of the memory 112, communication interface 114, user interface 116, three-dimensional touch display 118, or hovering gesture sensor 120, such as via a bus.

The UI control circuitry 122 may be configured to receive an indication of a hovering gesture input to the three-dimensional touch display 118 and/or otherwise determine a hovering gesture input to the three-dimensional touch display 118. In this regard, for example, the three-dimensional touch display 118 and/or hovering gesture sensor 120 may be configured to detect a hovering gesture input to the three-dimensional touch display 118 and generate a signal indicative of the hovering gesture input. This signal may be received by the UI control circuitry 122, which may determine the hovering gesture input in response to receiving the signal. The signal may carry information indicative of a position of the hovering gesture input. In this regard, the position may comprise a position of the hovering gesture input in a three-dimensional space, which may be relative to the surface of three-dimensional touch display 118. For example, the position may comprise a coordinate position relative to a virtual three(or more)-

dimensional coordinate system (e.g., an X, Y, and Z axis), such that the position may be described in terms of a distance from the surface of the three-dimensional touch display 118 (e.g., a z-axis coordinate), as well as a position on a plane parallel to the surface of the three-dimensional touch display at the distance of the detected hovering gesture from the surface of the three-dimensional touch display 118 (e.g., x-axis and y-axis coordinates). The UI control circuitry 122 may accordingly be configured to determine a position of a hovering gesture input based at least in part on a received signal or other indication of a hovering gesture input.

In some example embodiments, a signal or other indication of a hovering gesture input that may be received by the UI control circuitry 122 may include information indicative of one or more attributes of the hovering gesture input in addition to the position of the hovering gesture input. For example, the indication may include information indicative of a type of the hovering gesture input that may enable the UI control circuitry 122 to determine a type of the hovering gesture input. In this regard, the UI control circuitry 122 may be configured to distinguish between a plurality of different types of hovering gesture inputs, which may be associated with different respective interactions with a three-dimensional user interface. For example, a poking or stabbing hovering gesture may be distinguished from a swiping or sliding hovering gesture. As another example, a hovering gesture made in a circular motion may be distinguished from a hovering gesture in which a user flexes a finger in a “come here” motion. Accordingly, in some example embodiments, the UI control circuitry 122 may be configured to determine a type of a hovering gesture input. In some example embodiments, the UI control circuitry 122 may be configured to determine an attribute(s) of a hovering gesture input in addition to or in lieu of a type of the hovering gesture input. For example, the UI control circuitry 122 may be configured to determine a rate or speed of the hovering gesture input (e.g., a rate or speed of a swiping gesture or other motion of the hovering gesture input), a duration of the hovering gesture input (e.g., how long the hovering gesture input is held in a particular position), some combination thereof, or the like.

The UI control circuitry 122 may be further configured to determine a relation of a position of a hovering gesture input to a three-dimensional user interface that may be displayed by the three-dimensional touch display 118. The three-dimensional user interface may comprise any three-dimensional image that may be displayed by the three-dimensional touch display 118. By way of non-limiting example, the three-dimensional user interface may comprise the virtual rotary card interface, which is described further herein below. However, it will be appreciated that various embodiments are not so limited and other types of three-dimensional user interfaces may be displayed. In this regard, the three-dimensional user interface may comprise any three-dimensional interface,

three-dimensional graphic(s) or object(s), some combination thereof, or the like, which may be displayed by the three-dimensional touch display 118.

In determining a relation of the position of a hovering gesture input to a three-dimensional user interface, the UI control circuitry 122 may be configured to determine an element of the three-dimensional user interface displayed within a defined proximity of the determined position. In this regard, the UI control circuitry 122 may be configured to track and/or determine positions at which graphical elements of the three-dimensional user interface may be perceived by a user in three(or more)-dimensional space. Accordingly, the UI control circuitry 122 may determine an element of the three-dimensional user interface that is displayed (or would be perceived to be displayed) at the determined position or within a predefined proximity (e.g., within a predefined tolerance range) of the determined position. As another example, the UI control circuitry 122 may determine the element of the three-dimensional user interface that is displayed (or would be perceived to be displayed) closest to the determined position of the hovering gesture input.

The UI control circuitry 122 may be further configured to cause a modification of a displayed element of the three-dimensional user interface based at least in part on the determined relation of the position of the hovering gesture and the three-dimensional user interface. As an example, in embodiments wherein the UI control circuitry 122 determines the element that is closest to and/or within a predefined proximity of the position of a hovering gesture, the element modified by the UI control circuitry 122 in response to the hovering gesture may comprise the determined element. In modifying an element, the UI control circuitry 122 may, for example, manipulate a position of the element. For example, if the element comprises a three-dimensional object, game piece, or the like, the UI control circuitry 122 may move, rotate, and/or otherwise adjust a display position of the element. As another example, the element may have an action or function associated with it and modifying the element may comprise the UI control circuitry 122 performing the action or function associated with the element. For example, the element may comprise an icon or the like that may be associated with an application and the UI control circuitry 122 may launch the associated application in response to a hovering gesture input selecting the icon. As another example, an icon may be associated with a media file and the UI control circuitry 122 may be configured to display and/or play out the media file in response to a hovering gesture input selecting the icon. As still a further example, the UI control circuitry 122 may be configured to modify a displayed element of a three-dimensional user interface by replacing a first element with a second (e.g., different) element in response to a hovering gesture input. As yet another example, which will be described further herein below, in example embodiments wherein a three-dimensional virtual rotary card interface is displayed by the three-dimensional touch

display 118, the UI control circuitry 122 may be configured to modify the virtual rotary card interface by one or more of flipping through cards of the interface, extending a position of a card such that a previously hidden portion of the card is viewable (e.g., is not obscured by another card), and/or the like in response to various hovering gesture inputs.

In some example embodiments wherein the UI control circuitry 122 is configured to determine an attribute(s) of a hovering gesture input in addition to a position of the hovering gesture input, the UI control circuitry 122 may be configured to cause a modification of a displayed element of a three-dimensional user interface further based on the determined attribute(s). For example, in embodiments wherein the UI control circuitry 122 determines a type of a hovering gesture input, the UI control circuitry 122 may cause a first modification of a displayed element if a first type of hovering gesture input is detected, and may cause a second modification of a displayed element if a second type of hovering gesture input is detected. As another example, if the UI control circuitry 122 determines a rate or speed of a hovering gesture input, the rate or speed at which a displayed element is manipulated or otherwise modified in response to the hovering gesture input may be based on the determined rate or speed (e.g., proportional to the determined rate or speed).

As previously mentioned, in some example embodiments, the UI control circuitry 122 may be configured to control display of a three(or more)-dimensional virtual rotary card interface. The virtual rotary card interface may comprise a plurality of card-like elements ("cards"), which may be tabbed or otherwise organized according to content type, subject matter, or the like. For example, each of a plurality of cards may be associated with a respective folder in an underlying file structure, such as may be stored on the memory 112. Accordingly, a card may provide access to applications, files, and/or the like that may be stored in a respective associated folder. As a further example, each of a plurality of cards may be associated with a respective application(s). Accordingly, a card may provide access to an application that may be launched and/or otherwise used on the apparatus 102 through interaction with a respective card. As another example, each of a plurality of cards may be associated with a respective contact(s) that may be stored in a user's contacts list. Accordingly, a card may provide access to contact information (e.g., phone number, email address, street address, and/or the like) for a contact.

Referring now to FIGs. 3A-3D, FIGs. 3A-3D illustrate example interaction with an example three-dimensional virtual rotary card user interface according to an example embodiment. With reference to FIG. 3A, a user may make a hovering gesture input 302 to the three-dimensional touch display 304 to cause a virtual rotary card user interface 306 to be displayed. As an example, the hovering gesture input 302 may comprise

waving a thumb or other finger over a predefined portion of the display 304. As illustrated in FIG. 3A, the virtual rotary card user interface 306 may be organized by category. For example, the example rotary card user interface 306 illustrated in FIG. 3A includes tabs for "Contacts," "Apps" (applications), and "Photos." As illustrated in FIG. 3B, a user may flip through cards of the virtual rotary card user interface 306 by making a hovering gesture 310 in three-dimensional space above the surface of the display 304. As an example, a user may make a rotating or sliding gesture in a direction that the user wishes to flip through cards. In some example embodiments, a user may touch or "grab" a tab of a card in three-dimensional space and flip the card (and any overlying cards) to reveal another card(s). The number of cards that are flipped and/or a rate at which cards are flipped may, for example, be determined based at least in part on an attribute(s) of the touch gesture 310, such as a rate of the touch gesture 310, a length of the touch gesture 310 (e.g., a linear length of travel of a thumb or other finger), and/or the like.

Referring now to FIG. 3C, a user may select a card, such as by touching or "grabbing" a card and manipulating the selected card in three-dimensional space. For example, in FIG. 3C, the user has made a hovering gesture 312 selecting and extending the card 314 such that a previously hidden portion of the card is extended and visible. In the example of FIG. 3C, the selected card 314 is the photo album for a "Country Trip," in the illustrated example is the "Photos" section 316 of the virtual rotary card interface. The card 314 may comprise a plurality of icons 318. In the illustrated example, each icon 318 may correspond to a respective photo in the photo album. As such, an icon 318 may comprise a thumbnail representation of a respective photo. It will be appreciated, however, that example embodiments are not limited to display of photo icons on a card, as an icon may correspond with any type of file, application, contact, or the like. For example, if the card had been associated with music or video files instead of photos, the card may alternatively display one or more icons corresponding to respective music or video files. As still a further example, if the card is associated with an application(s), the card may display an icon for the respective application. As yet another example, a card may be associated with a particular group of contacts, and the card may display icons representing respective contacts in the group of contacts.

Referring to FIG. 3D, in some example embodiments, a user may make a hovering gesture 320, which may further extend the selected card 314 and "drop" the selected card 314 onto the desktop of the display 304. In this position, the user may view all of the icons 318 and may select an icon 318. Selection of an icon 318 may cause a photo corresponding to the selected icon 318 to be opened, such as in a photo viewing application, photo editing application, or the like. If the card 314 had been associated with another type of file (e.g., a media file, document file, or the like), selection of an icon

may cause the respective file to be opened, such as in an appropriate application. Similarly, if, the card had instead corresponded to an application, selection of the card and/or an icon displayed on the card may cause the respective application to be launched.

FIG. 4 illustrates a flowchart according to an example method for facilitating interaction with a three-dimensional user interface according to an example embodiment. The operations illustrated in and described with respect to FIG. 4 may, for example, be performed by, with the assistance of, and/or under the control of one or more of the processor 110, memory 112, communication interface 114, user interface 116, three-dimensional touch display 118, hovering gesture sensor 120, or UI control circuitry 122. Operation 400 may comprise receiving an indication of a hovering gesture input to a touch display (e.g., a three-dimensional touch display 118). The processor 110, memory 112, user interface 116, three-dimensional touch display 118, hovering gesture sensor 120, and/or UI control circuitry 122 may, for example, provide means for performing operation 400. Operation 410 may comprise determining, based at least in part on the received indication, a position of the hovering gesture input. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, hovering gesture sensor 120, and/or UI control circuitry 122 may, for example, provide means for performing operation 410. Operation 420 may comprise determining a relation of the determined position to a three-dimensional user interface displayed by the touch display. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, and/or UI control circuitry 122 may, for example, provide means for performing operation 420. Operation 430 may comprise causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, and/or UI control circuitry 122 may, for example, provide means for performing operation 420.

FIG. 5 illustrates a flowchart according to an example method for facilitating interaction with a three-dimensional virtual rotary card user interface according to an example embodiment. The operations illustrated in and described with respect to FIG. 5 may, for example, be performed by, with the assistance of, and/or under the control of one or more of the processor 110, memory 112, communication interface 114, user interface 116, three-dimensional touch display 118, hovering gesture sensor 120, or UI control circuitry 122. Operation 500 may comprise causing display of a three-dimensional virtual rotary card interface. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, and/or UI control circuitry 122 may, for example, provide means for performing operation 500. Operation 510 may comprise determining a

hovering gesture input for flipping through one or more cards of the virtual rotary card interface. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, hovering gesture sensor 120, and/or UI control circuitry 122 may, for example, provide means for performing operation 510. Operation 520 may cause causing one or more of the cards to be flipped in three-dimensional space in response to the hovering gesture determined in operation 510. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, and/or UI control circuitry 122 may, for example, provide means for performing operation 520. Operation 530 may comprise determining a hovering gesture input selecting and manipulating a card. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, hovering gesture sensor 120, and/or UI control circuitry 122 may, for example, provide means for performing operation 530. Operation 540 may comprise, responsive to the hovering gesture input determined in operation 530, causing the selected card to be displayed in an extended position, thereby allowing the user to view one or more icons displayed on the card. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, and/or UI control circuitry 122 may, for example, provide means for performing operation 540. Operation 550 may comprise determining a selection of an icon. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, hovering gesture sensor 120, and/or UI control circuitry 122 may, for example, provide means for performing operation 550. Operation 560 may comprise performing an action associated with the selected icon. The action may comprise opening a file associated with the selected icon, launching an application associated with the selected icon, and/or the like. The processor 110, memory 112, user interface 116, three-dimensional touch display 118, and/or UI control circuitry 122 may, for example, provide means for performing operation 560.

FIGs. 4-5 each illustrate a flowchart of a system, method, and computer program product according to an example embodiment. It will be understood that each block of the flowcharts, and combinations of blocks in the flowcharts, may be implemented by various means, such as hardware and/or a computer program product comprising one or more computer-readable mediums having computer readable program instructions stored thereon. For example, one or more of the procedures described herein may be embodied by computer program instructions of a computer program product. In this regard, the computer program product(s) which embody the procedures described herein may be stored by one or more memory devices of a mobile terminal, server, or other computing device (for example, in the memory 112) and executed by a processor in the computing device (for example, by the processor 110). In some embodiments, the computer program instructions comprising the computer program product(s) which embody the

procedures described above may be stored by memory devices of a plurality of computing devices. As will be appreciated, any such computer program product may be loaded onto a computer or other programmable apparatus (for example, an apparatus 102) to produce a machine, such that the computer program product including the instructions which execute on the computer or other programmable apparatus creates means for implementing the functions specified in the flowchart block(s). Further, the computer program product may comprise one or more computer-readable memories on which the computer program instructions may be stored such that the one or more computer-readable memories can direct a computer or other programmable apparatus to function in a particular manner, such that the computer program product comprises an article of manufacture which implements the function specified in the flowchart block(s). The computer program instructions of one or more computer program products may also be loaded onto a computer or other programmable apparatus (for example, an apparatus 102) to cause a series of operations to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the computer or other programmable apparatus implement the functions specified in the flowchart block(s).

Accordingly, blocks of the flowcharts support combinations of means for performing the specified functions. It will also be understood that one or more blocks of the flowcharts, and combinations of blocks in the flowcharts, may be implemented by special purpose hardware-based computer systems which perform the specified functions, or combinations of special purpose hardware and computer program product(s).

The above described functions may be carried out in many ways. For example, any suitable means for carrying out each of the functions described above may be employed to carry out embodiments of the invention. In one embodiment, a suitably configured processor (for example, the processor 110) may provide all or a portion of the elements. In another embodiment, all or a portion of the elements may be configured by and operate under control of a computer program product. The computer program product for performing the methods of an example embodiment of the invention includes a computer-readable storage medium (for example, the memory 112), such as the non-volatile storage medium, and computer-readable program code portions, such as a series of computer instructions, embodied in the computer-readable storage medium.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the embodiments of the invention are not to be

limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the invention. Moreover, although the foregoing descriptions and the associated drawings describe example embodiments in the context of certain example combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the invention. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated within the scope of the invention. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

WHAT IS CLAIMED IS:

1. A method comprising:

receiving an indication of a hovering gesture input to a touch display;

determining, based at least in part on the received indication, a position of the hovering gesture input;

determining a relation of the determined position to a three-dimensional user interface displayed by the touch display; and

causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface.

2. The method of Claim 1, wherein:

determining a relation of the determined position to the three-dimensional user interface comprises determining an element of the three-dimensional user interface displayed within a defined proximity of the determined position; and

causing the modification of the displayed element of the three-dimensional user interface comprises causing a modification of the determined element.

3. The method of any of Claims 1 to 2, further comprising determining, based at least in part on the received indication, an attribute of the hovering gesture; and

wherein causing the modification comprises causing the modification further based on the determined attribute.

4. The method of any of Claims 1 to 3, wherein the three-dimensional user interface comprises a three-dimensional virtual rotary card interface comprising a plurality of cards.

5. The method of Claim 4, wherein causing the modification of the displayed element of the three-dimensional user interface comprises causing one or more of the cards to be flipped.

6. The method of any of Claims 4 to 5, wherein:

determining a relation of the determined position to a three-dimensional user interface displayed by the touch display comprises determining one or more of a selection or a manipulation of a card; and

causing the modification of the displayed element of the three-dimensional user interface comprises causing the selected card to be displayed in an extended position in response to the determined one or more of a selection or a manipulation.

7. The method of any of Claims 4 to 6, wherein:

determining a relation of the determined position to a three-dimensional user interface displayed by the touch display comprises determining a selection of an icon displayed on a card; and

causing the modification of the displayed element of the three-dimensional user interface comprises one or more of opening a file associated with the icon or launching an application associated with the icon.

8. An apparatus comprising at least one processor and at least one memory storing computer program code, wherein the at least one memory and stored computer program code are configured, with the at least one processor, to cause the apparatus to at least:

receive an indication of a hovering gesture input to a touch display;

determine, based at least in part on the received indication, a position of the hovering gesture input;

determine a relation of the determined position to a three-dimensional user interface displayed by the touch display; and

cause, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface.

9. The apparatus of Claim 8, wherein the at least one memory and stored computer program code are configured, with the at least one processor, to cause the apparatus to:

determine a relation of the determined position to the three-dimensional user interface at least in part by determining an element of the three-dimensional user interface displayed within a defined proximity of the determined position; and

cause the modification of the displayed element of the three-dimensional user interface at least in part by causing a modification of the determined element.

10. The apparatus of any of Claims 8 to 9, wherein the at least one memory and stored computer program code are configured, with the at least one processor, to cause the apparatus to:

determine, based at least in part on the received indication, an attribute of the hovering gesture; and

cause the modification by causing the modification further based on the determined attribute.

11. The apparatus of any of Claims 8 to 10, wherein the three-dimensional user interface comprises a three-dimensional virtual rotary card interface comprising a plurality of cards.

12. The apparatus of Claim 11, wherein the at least one memory and stored computer program code are configured, with the at least one processor, to cause the apparatus to cause the modification of the displayed element of the three-dimensional user interface at least in part by causing one or more of the cards to be flipped.

13. The apparatus of any of Claims 11 to 12, wherein the at least one memory and stored computer program code are configured, with the at least one processor, to cause the apparatus to:

determine a relation of the determined position to a three-dimensional user interface displayed by the touch display at least in part by determining one or more of a selection or a manipulation of a card; and

cause the modification of the displayed element of the three-dimensional user interface at least in part by causing the selected card to be displayed in an extended position in response to the determined one or more of a selection or a manipulation.

14. The apparatus of any of Claims 11 to 13, wherein the at least one memory and stored computer program code are configured, with the at least one processor, to cause the apparatus to:

determine a relation of the determined position to a three-dimensional user interface displayed by the touch display at least in part by determining a selection of an icon displayed on a card; and

cause the modification of the displayed element of the three-dimensional user interface at least in part by one or more of opening a file associated with the icon or launching an application associated with the icon.

15. The apparatus of any of Claims 8 to 14, wherein the apparatus comprises or is embodied on a mobile computing device, the mobile computing device comprising user interface circuitry and user interface software stored on one or more of the at least

one memory, wherein the user interface circuitry and user interface software are configured to:

facilitate user control of at least some functions of the mobile computing device through use of a display; and

cause at least a portion of a user interface of the mobile computing device to be displayed on the display to facilitate user control of at least some functions of the mobile computing device.

16. A computer program product comprising at least one non-transitory computer-readable storage medium having computer-readable program instructions stored therein, the computer-readable program instructions comprising program instructions configured to cause an apparatus to at least perform:

receiving an indication of a hovering gesture input to a touch display;

determining, based at least in part on the received indication, a position of the hovering gesture input;

determining a relation of the determined position to a three-dimensional user interface displayed by the touch display; and

causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface.

17. The computer program product of Claim 16, wherein the program instructions further comprise instructions configured to cause the apparatus to perform:

determining a relation of the determined position to the three-dimensional user interface comprises determining an element of the three-dimensional user interface displayed within a defined proximity of the determined position; and

causing the modification of the displayed element of the three-dimensional user interface comprises causing a modification of the determined element.

18. The computer program product of any of Claims 16 to 17, wherein the program instructions further comprise instructions configured to cause the apparatus to perform:

determining, based at least in part on the received indication, an attribute of the hovering gesture; and

wherein causing the modification comprises causing the modification further based on the determined attribute.

19. The computer program product of any of Claims 16 to 18, wherein the three-dimensional user interface comprises a three-dimensional virtual rotary card interface comprising a plurality of cards.

20. The computer program product of Claim 19, wherein causing the modification of the displayed element of the three-dimensional user interface comprises causing one or more of the cards to be flipped.

21. The computer program product of any of Claims 19 to 20, wherein:

determining a relation of the determined position to a three-dimensional user interface displayed by the touch display comprises determining one or more of a selection or a manipulation of a card; and

causing the modification of the displayed element of the three-dimensional user interface comprises causing the selected card to be displayed in an extended position in response to the determined one or more of a selection or a manipulation.

22. The computer program product of any of Claims 19 to 21, wherein:

determining a relation of the determined position to a three-dimensional user interface displayed by the touch display comprises determining a selection of an icon displayed on a card; and

causing the modification of the displayed element of the three-dimensional user interface comprises one or more of opening a file associated with the icon or launching an application associated with the icon.

23. An apparatus comprising:

means for receiving an indication of a hovering gesture input to a touch display;

determining, based at least in part on the received indication, a position of the hovering gesture input;

means for determining a relation of the determined position to a three-dimensional user interface displayed by the touch display; and

means for causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface.

24. The apparatus of Claim 23, wherein:

the means for determining a relation of the determined position to the three-dimensional user interface comprises means for determining an element of the three-

dimensional user interface displayed within a defined proximity of the determined position; and

the means for causing the modification of the displayed element of the three-dimensional user interface comprises means for causing a modification of the determined element.

25. The apparatus of any of Claims 23 to 24, further comprising means for determining, based at least in part on the received indication, an attribute of the hovering gesture; and

wherein the means for causing the modification comprises means for causing the modification further based on the determined attribute.

26. The apparatus of any of Claims 23 to 25, wherein the three-dimensional user interface comprises a three-dimensional virtual rotary card interface comprising a plurality of cards.

27. The apparatus of Claim 26, wherein the means for causing the modification of the displayed element of the three-dimensional user interface comprises means for causing one or more of the cards to be flipped.

28. The apparatus of any of Claims 26 to 27, wherein:

the means for determining a relation of the determined position to a three-dimensional user interface displayed by the touch display comprises means for determining one or more of a selection or a manipulation of a card; and

the means for causing the modification of the displayed element of the three-dimensional user interface comprises means for causing the selected card to be displayed in an extended position in response to the determined one or more of a selection or a manipulation.

29. The apparatus of any of Claims 26 to 28, wherein:

the means for determining a relation of the determined position to a three-dimensional user interface displayed by the touch display comprises means for determining a selection of an icon displayed on a card; and

the means for causing the modification of the displayed element of the three-dimensional user interface comprises means for one or more of opening a file associated with the icon or launching an application associated with the icon.

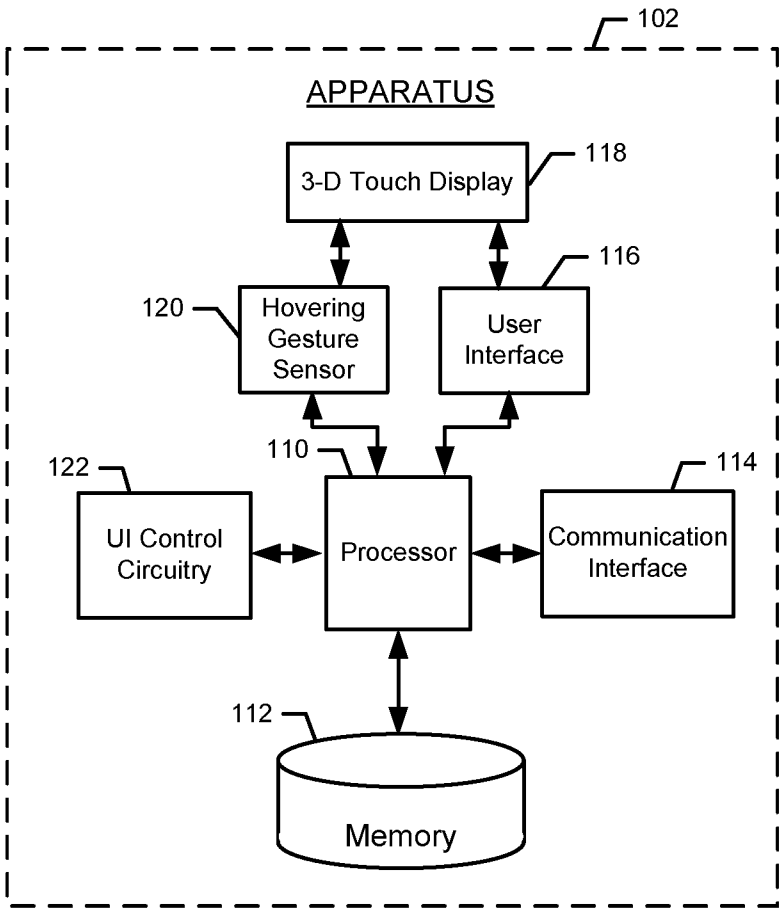

102
APPARATUS
3-D Touch Display
118
116
120
Hovering Gesture Sensor
User Interface
110
122
114
UI Control Circuitry
Processor
Communication Interface
112
Memory

FIG. 1

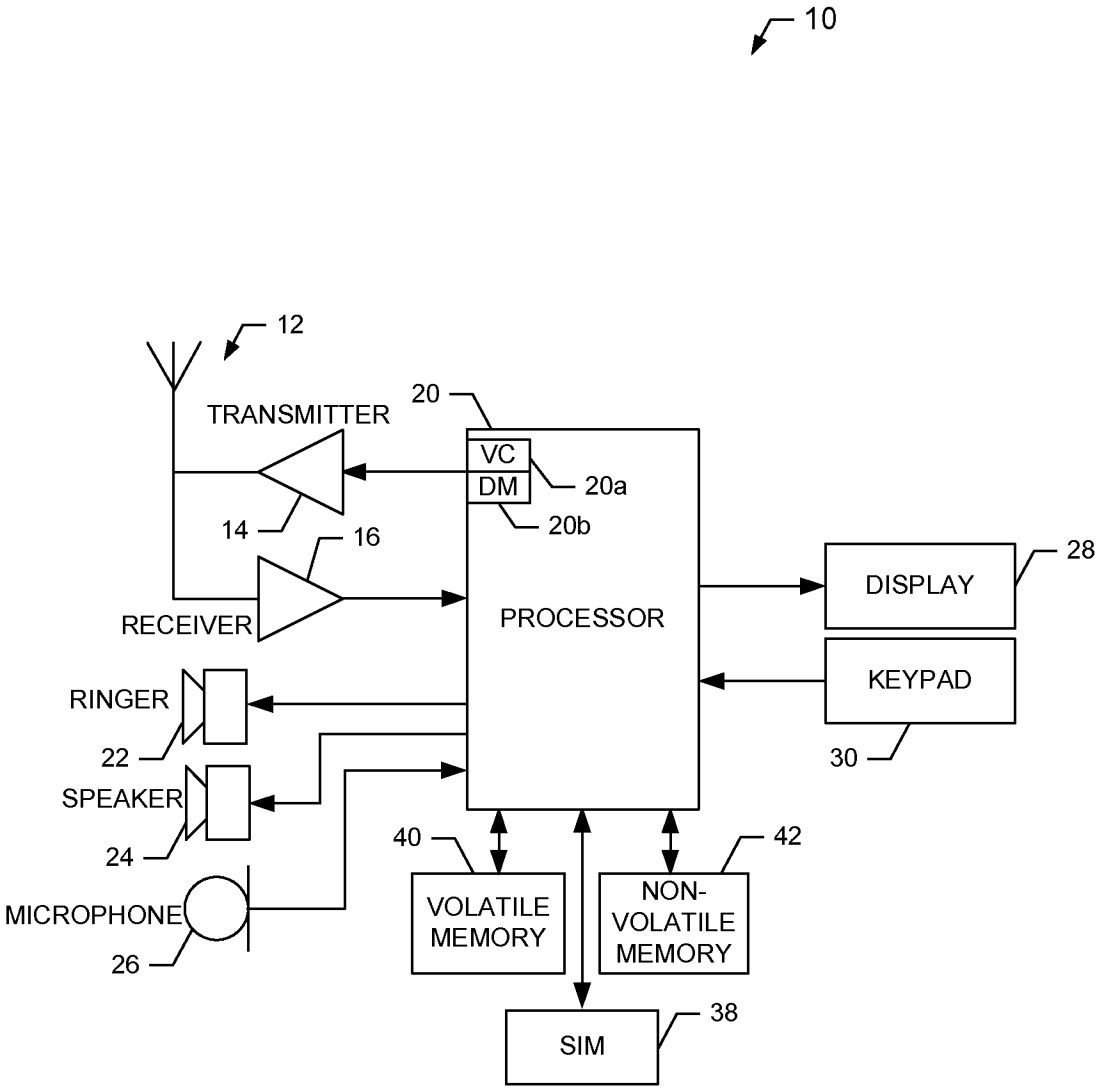

10
12
TRANSMITTER
20
VC
DM
20a
20b
14
16
RECEIVER
PROCESSOR
DISPLAY
28
KEYPAD
30
RINGER
22
SPEAKER
24
MICROPHONE
26
40
42
VOLATILE MEMORY
NON-VOLATILE MEMORY
SIM
38

FIG. 2

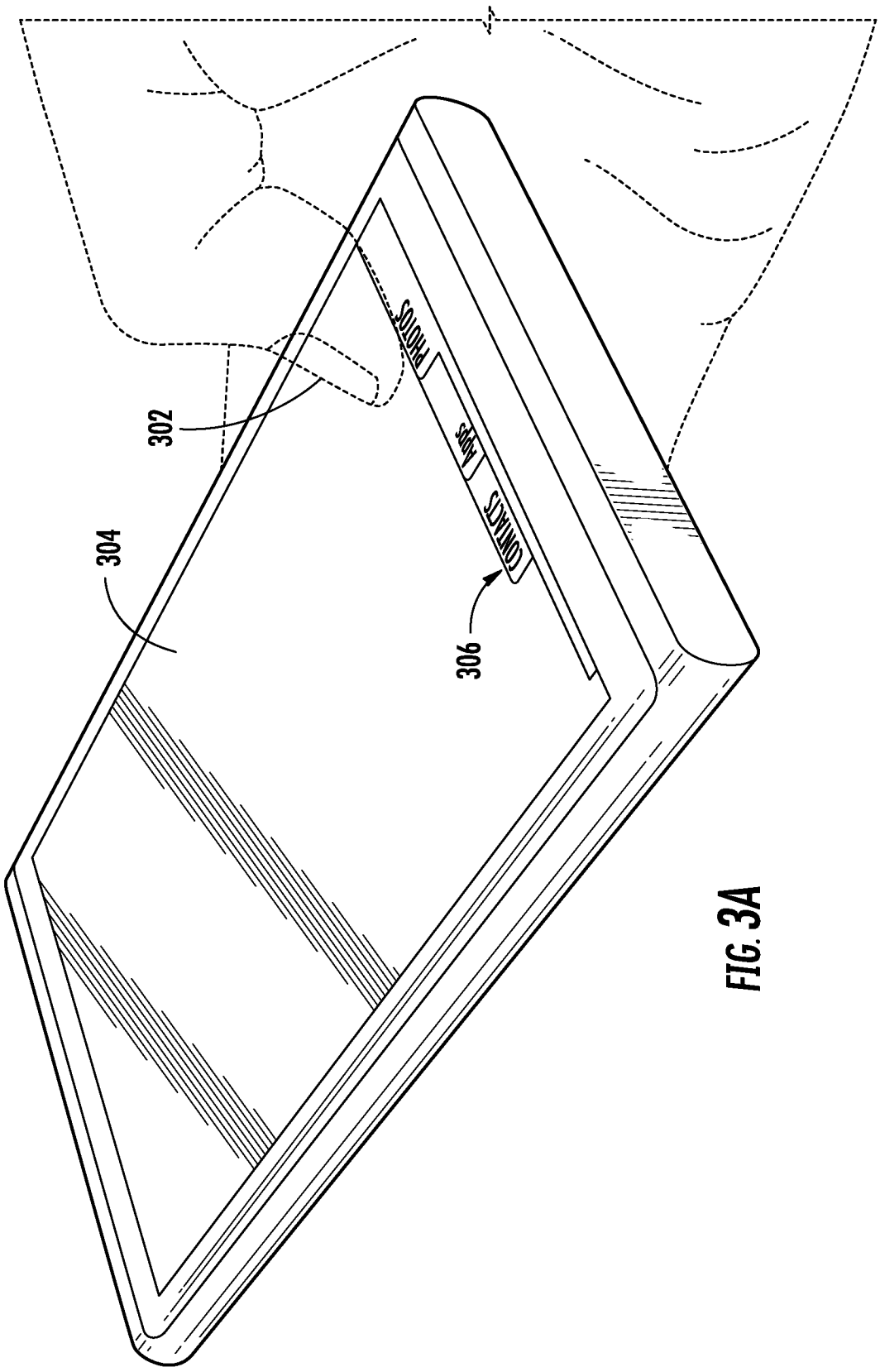


FIG. 3A

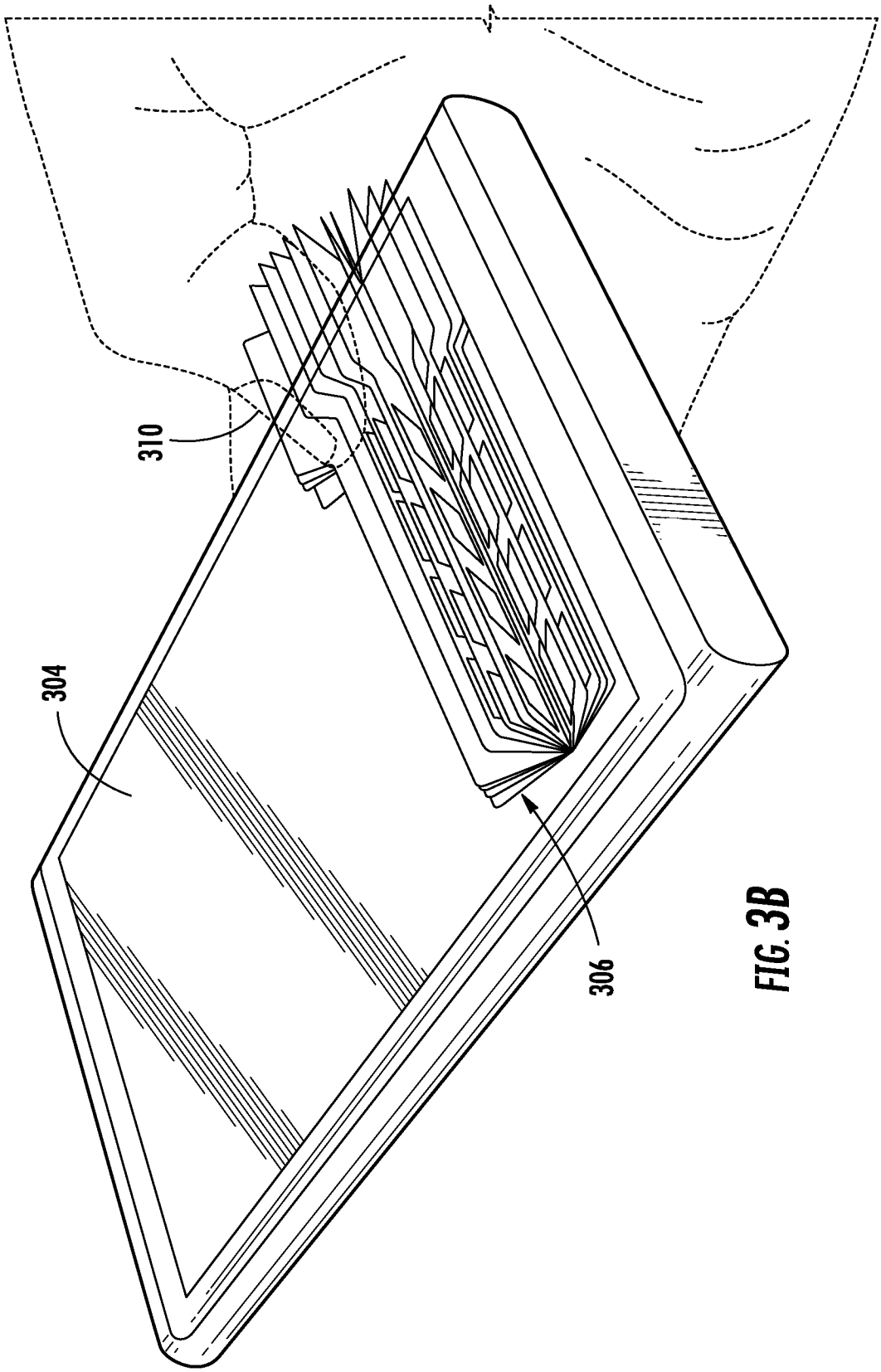


FIG. 3B

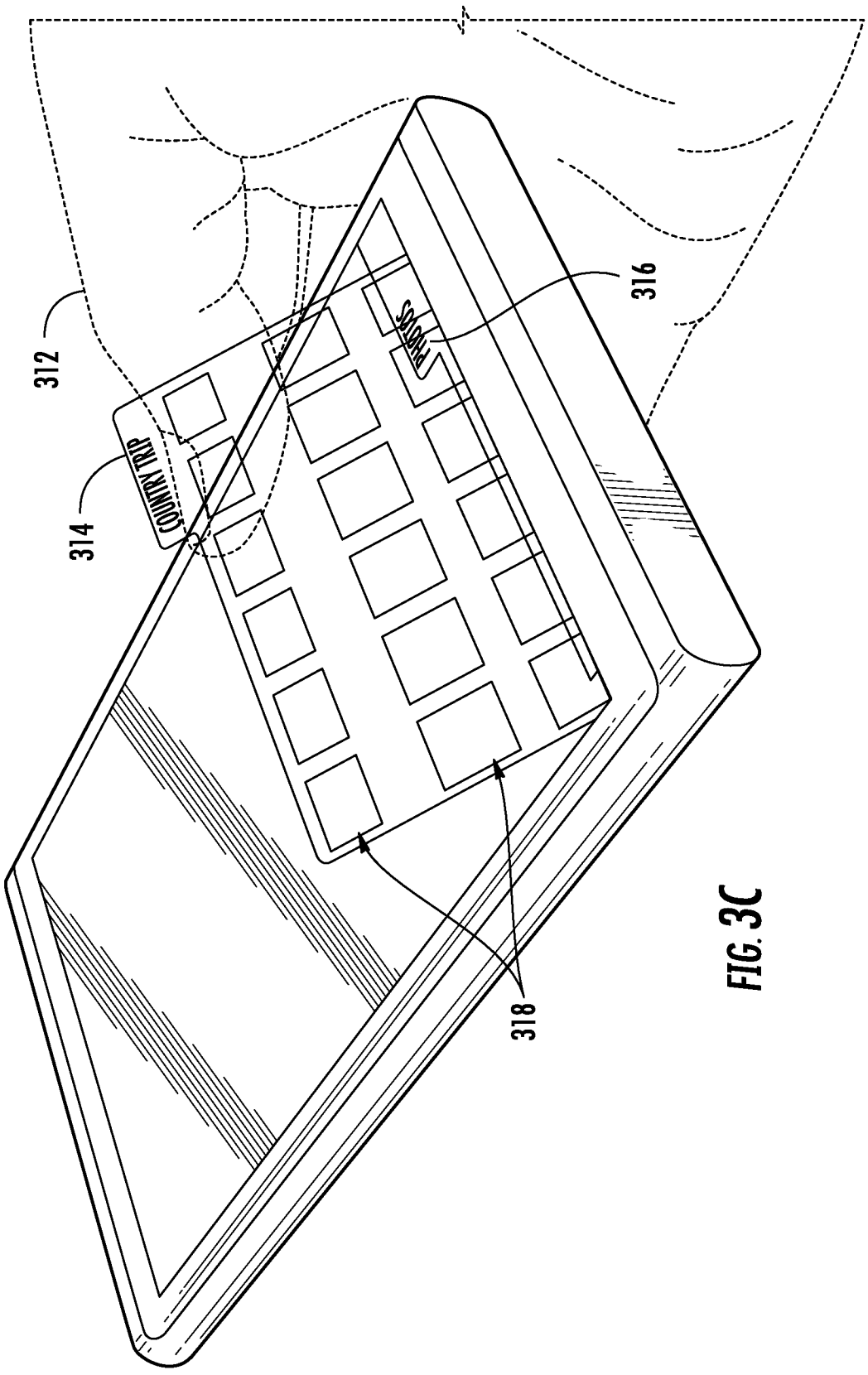


FIG. 3C

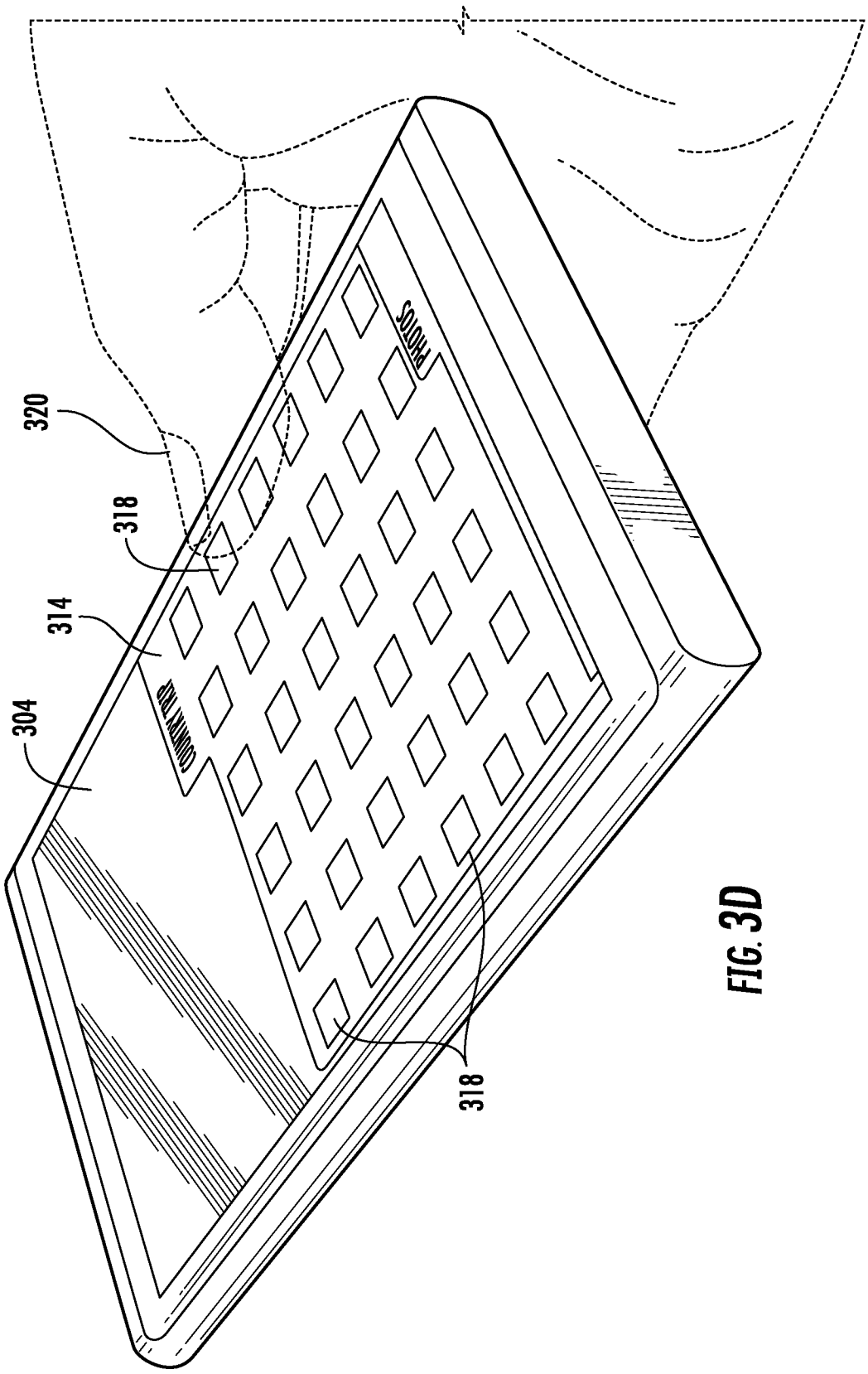


FIG. 3D

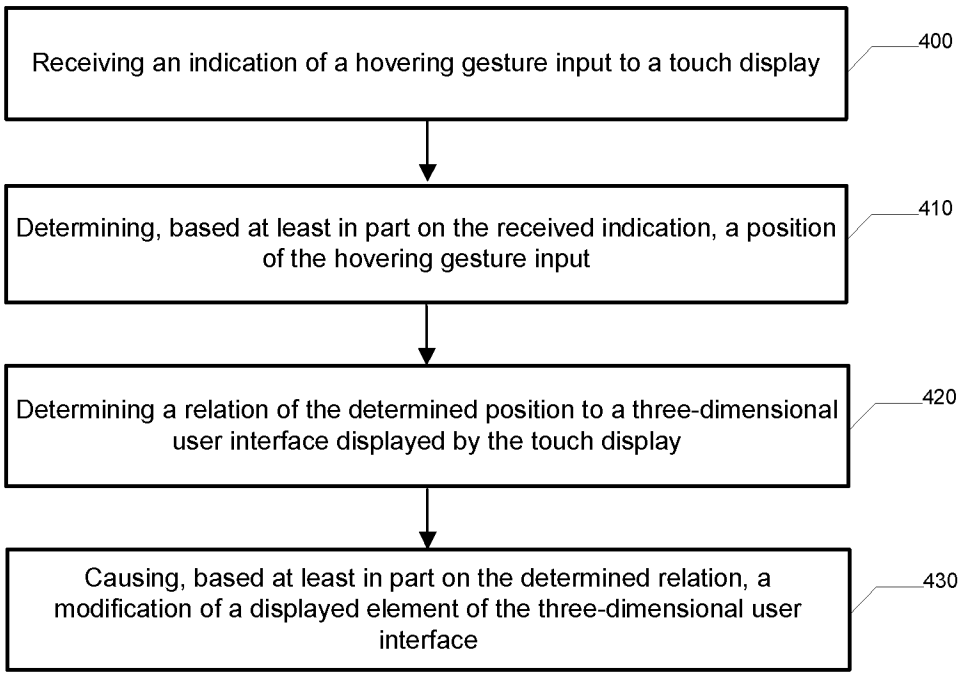

Receiving an indication of a hovering gesture input to a touch display
400
Determining, based at least in part on the received indication, a position of the hovering gesture input
410
Determining a relation of the determined position to a three-dimensional user interface displayed by the touch display
420
Causing, based at least in part on the determined relation, a modification of a displayed element of the three-dimensional user interface
430

FIG. 4

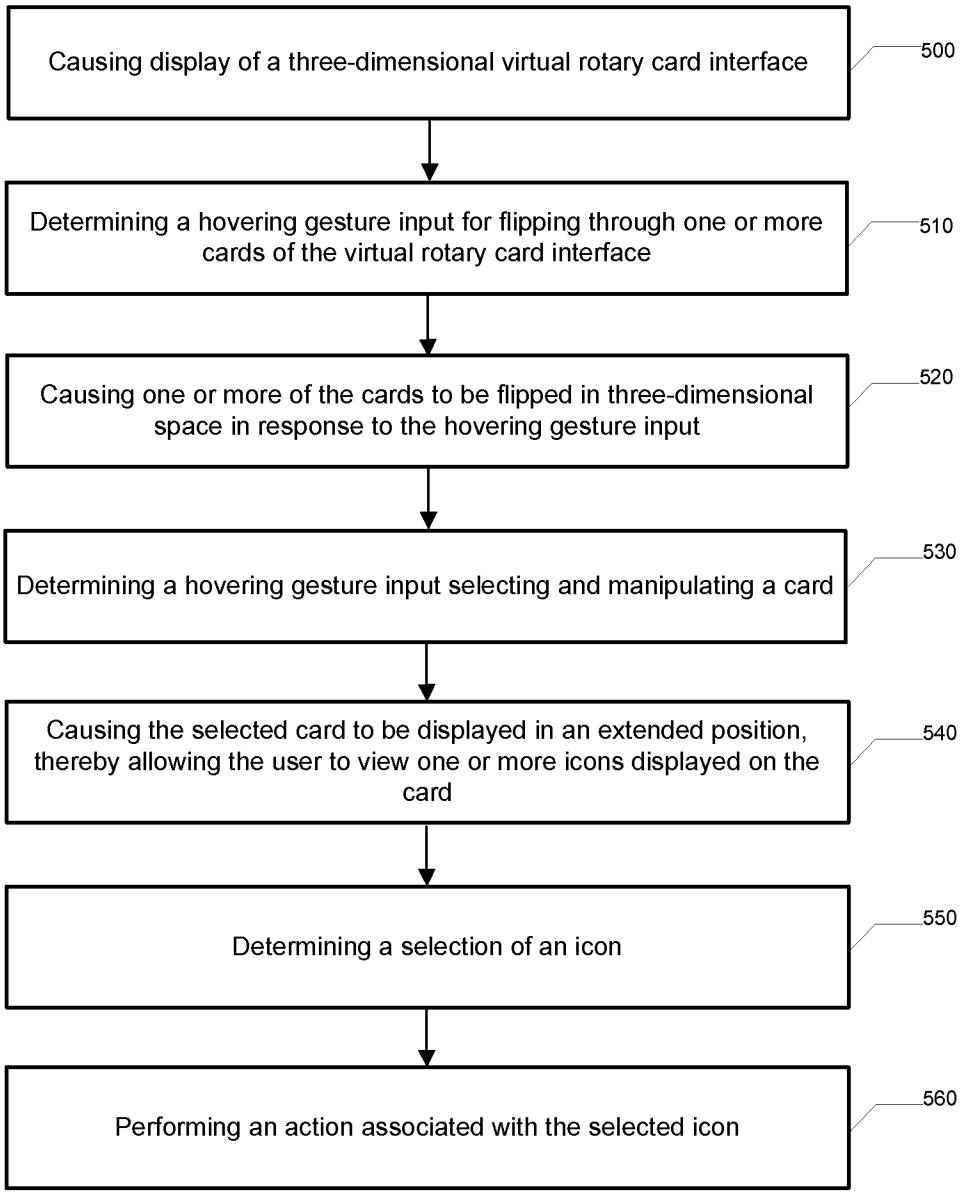

Causing display of a three-dimensional virtual rotary card interface
500
Determining a hovering gesture input for flipping through one or more cards of the virtual rotary card interface
510
Causing one or more of the cards to be flipped in three-dimensional space in response to the hovering gesture input
520
Determining a hovering gesture input selecting and manipulating a card
530
Causing the selected card to be displayed in an extended position, thereby allowing the user to view one or more icons displayed on the card
540
Determining a selection of an icon
550
Performing an action associated with the selected icon
560

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2012/050935

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 20100095206 A1 (KIM HYUN JU), 15 April 2010 (2010-04-15); abstract; paragraphs [0011]-[0014], [0041]-[0044], [0073]-[0074]; figures 1-34; claims 1, 8, 14 --	1-29
A	WO 2008115997 A2 (ZEBRA IMAGING INC ET AL), 25 September 2008 (2008-09-25); abstract; paragraphs [0005]-[0006], [0034]-[0036], [0074]; figures 1-5 --	1-29
A	WO 2009035705 A1 (REACTRIX SYSTEMS INC ET AL), 19 March 2009 (2009-03-19); abstract; figures 1-7 --	1-29

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28-06-2012	28-06-2012

Name and mailing address of the ISA/SE	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2012/050935

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1821182 A1 (NIPPON TELEGRAPH & TELEPHONE), 22 August 2007 (2007-08-22); abstract; figures 1-104; claims 1-50 -- --------	1-29

International application No.
PCT/IB2012/050935

Continuation of: second sheet

International Patent Classification (IPC)

G06F 3/01 (2006.01)
G06F 3/048 (2006.01)
G06F 3/033 (2006.01)

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Cited literature, if any, will be enclosed in paper form.

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