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(54) **Title:** EXTENDABLE/FOLDABLE ELECTRONIC DEVICE THAT MITIGATES INADVERTENT TOUCH INPUT DURING MOVEMENT OF A DISPLAY

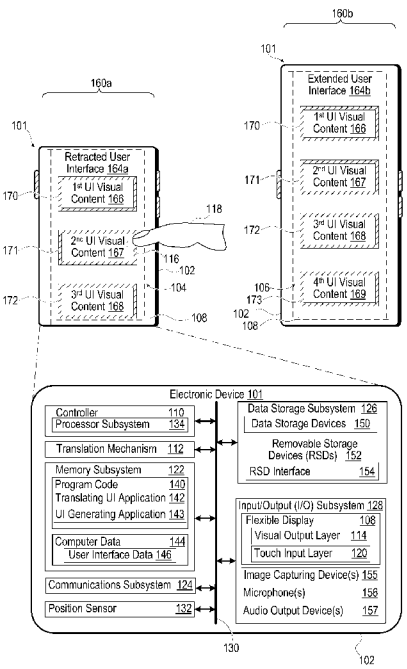

FIG. 1

(57) **Abstract:** An electronic device, a method and a computer program product mitigate inadvertent touch activations of a translating flexible display of the electronic device by maintaining presentation of a user interface content on a visual output layer of the flexible display in a smaller sized user interface (i.e., retracted user interface) among first and second user interfaces during repositioning of the flexible display. Association is maintained for interface control (s) at the touch input layer that correspond to the user interface content to avoid refreshing of the user interface content and thereby to mitigate inadvertent touch activation of a user interface control during the repositioning of the flexible display. For an electronic device having a foldable form factor, a pivot position is monitored for a housing assembly having first and second housings that pivot about a hinge. In response to the pivot position changing, touch inputs to user interface controls are ignored.

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EXTENDABLE/FOLDABLE ELECTRONIC DEVICE THAT MITIGATES INADVERTENT TOUCH INPUT DURING MOVEMENT OF A DISPLAY

BACKGROUND

1. Technical Field

[0001] The present disclosure relates generally to electronic devices having an extendable form factor, and in particular to electronic device having an extendable form factor that changes an amount of a flexible display presented on a front side of a device housing.

2. Description of the Related Art

[0002] Portable electronic communication devices, particularly smartphones, have become ubiquitous. People all over the world use such devices to stay connected. These devices have been designed in various mechanical configurations. A first configuration, known as a "candy bar", is generally rectangular in shape, has a rigid form factor, and has a display disposed along a major face of the electronic device. By contrast, a "clamshell" device has a mechanical hinge that allows one housing to pivot relative to the other. A third type of electronic device is a "slider" where two different device housings slide, with one device housing sliding relative to the other. With development of a flexible display, additional configurations have become available that enable changing a size of an area of the housing that is covered by a display. One configuration is a scrollable device having a flexible display covering a telescoping frame. While retracting, an excess portion of the flexible display scrolls into the telescoping frame. In addition, a number of configurations provide rollable devices that roll a portion of the flexible display onto a back side of a device housing when the display or extended frame supporting the display is retracted to present a smaller front dimension. In an example, a telescoping frame can include one or two rollers to enable the flexible display to roll around a corresponding one or two ends of the device. In another example, a blade assembly that includes a flexible display includes one portion that rolls around one end of the device housing and another end that can extend away from a single device housing.

[0003] While the communication device is being reconfigured (e.g., extending/retracting or folding/unfolding), a touch sensitive display of the communication device moves. An accidental touch of a touch sensitive display of the communication device may cause an unintentional

invocation of actions on the communication device. In addition, a user may intend to select a control presented on the display, but the movement of the touch sensitive display may cause inadvertent selection of another control.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The description of the illustrative embodiments can be read in conjunction with the accompanying figures. It will be appreciated that for simplicity and clarity of illustration, elements illustrated in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements are exaggerated relative to other elements. Embodiments incorporating teachings of the present disclosure are shown and described with respect to the figures presented herein, in which:

[0005] **FIG. 1** presents a simplified functional block diagram of an electronic device having an extendable form factor, shown with front views of a flexible display presented in a retracted position and in an extended position, according to one or more embodiments;

[0006] **FIG. 2A** is a front view of the electronic device triggered to extend while in a fully retracted position with the flexible display presenting, on a front side, a retracted user interface, according to one or more embodiments;

[0007] **FIG. 2B** is a front view of the electronic device translating to a partially extended position with the flexible display maintaining presentation, on the front side, of the retracted user interface, according to one or more embodiments;

[0008] **FIG. 2C** is a front view of the electronic device reaching a fully extended position with the flexible display maintaining presentation, on the front side, of the retracted user interface, according to one or more embodiments;

[0009] **FIG. 2D** is a front view of the electronic device refreshing presentation by the flexible display, on the front side, to an extended user interface while the flexible display is in the fully extended position, according to one or more embodiments;

[0010] **FIG. 2E** is a front view of the electronic device triggered to retract while in the fully extended position, with the flexible display is presenting the extended user interface on the front side, according to one or more embodiments;

[0011] **FIG. 2F** is a front view of the electronic device, while still in the fully extended position, refreshing presentation by the flexible display of the retracted user interface on the front side, according to one or more embodiments;

[0012] **FIG. 2G** is a front view of the electronic device translating to a partially retracted position with the flexible display maintaining presentation, on the front side, of the retracted user interface, according to one or more embodiments;

[0013] **FIG. 2H** is a front view of the electronic device reaching the fully retracted position while maintaining presentation by the flexible display, on the front side, of the retracted user interface, according to one or more embodiments;

[0014] **FIG. 3A** is a front view of the electronic device triggered to retract while in the fully extended position, with the flexible display is presenting the extended user interface on the front side, according to one or more embodiments;

[0015] **FIG. 3B** is a front view of the electronic device, while still in the fully extended position, resizing content of the extended user interface to become an alternative retracted user interface, according to one or more embodiments;

[0016] **FIG. 3C** is a front view of the electronic device translating to a partially retracted position with the flexible display maintaining presentation, on the front side, of the alternative retracted user interface, according to one or more embodiments;

[0017] **FIG. 3D** is a front view of the electronic device reaching the fully retracted position while maintaining presentation by the flexible display, on the front side, of the alternative retracted user interface, according to one or more embodiments;

[0018] **FIG. 4A** is a front view of an example electronic device having a blade assembly slidably coupled in a fully retracted position on a non-telescoping device housing, according to one or more embodiments;

[0019] **FIG. 4B** is a left side view of the example electronic device of **FIG. 4A**, according to one or more embodiments;

[0020] **FIG. 4C** is a back view of the example electronic device of **FIG. 4A**, according to one or more embodiments;

[0021] **FIG. 5A** is a front view of the example electronic device of **FIG. 4A** having the blade assembly slidably coupled in a fully extended position on the non-telescoping device housing, according to one or more embodiments;

[0022] **FIG. 5B** is a left side view of the example electronic device of **FIG. 5A**, according to one or more embodiments;

[0023] **FIG. 5C** is a back view of the example electronic device of **FIG. 5A**, according to one or more embodiments;

[0024] **FIG. 6A** is a front view of another example electronic device having a rollable display assembly slidably coupled in a fully retracted position on a telescoping device housing, according to one or more embodiments;

[0025] **FIG. 6B** is a left side view of the example electronic device of **FIG. 6A**, according to one or more embodiments;

[0026] **FIG. 6C** is a back view of the example electronic device of **FIG. 6A**, according to one or more embodiments;

[0027] **FIG. 7A** is a front view of the example electronic device of **FIG. 6A** having the rollable display assembly slidably coupled in a fully extended position on the telescoping device housing, according to one or more embodiments;

[0028] **FIG. 7B** is a left side view of the example electronic device of **FIG. 7A**, according to one or more embodiments;

[0029] **FIG. 7C** is a back view of the example electronic device of **FIG. 7A**, according to one or more embodiments;

[0030] **FIG. 8A** is a front view of an additional example electronic device having a scrollable display assembly coupled across a front side of a telescoping device housing in a fully retracted position, according to one or more embodiments;

[0031] **FIG. 8B** is a left side view of the example electronic device of **FIG. 8A**, according to one or more embodiments;

[0032] **FIG. 8C** is a back view of the example electronic device of **FIG. 8A**, according to one or more embodiments;

[0033] **FIG. 9A** is a front view of the example electronic device of **FIG. 8A** having the telescoping device housing in a fully extended position, according to one or more embodiments;

[0034] **FIG. 9B** is a left side view of the example electronic device of **FIG. 9A**, according to one or more embodiments;

[0035] **FIG. 9C** is a back view of the example electronic device of **FIG. 9A**, according to one or more embodiments;

[0036] **FIGs. 10A – 10B** (collectively "**FIG. 10**") are a flow diagram of a method of avoiding resizing of a user interface during translation of a flexible display to avoid refreshing the flexible display that may result in incorrect touch activations of touch controls, according to one or more embodiments;

[0037] **FIG. 11** is a flow diagram presenting a method of supporting an animated user interface (UI) while a flexible display is translating, with mitigation for inadvertent touch activations, according to one or more embodiments;

[0038] **FIG. 12** presents a simplified functional block diagram of an electronic device having a foldable form factor, shown with an unfolded back view, according to one or more embodiments;

[0039] **FIG. 13A** depicts the electronic device of **FIG. 12**, shown in an unfolded front view, according to one or more embodiments;

[0040] **FIG. 13B** depicts a left side view of the electronic device of **FIG. 13A**, according to one or more embodiments;

[0041] **FIG. 14A** depicts a back view of a first housing of the electronic device of **FIG. 12** that is folded, according to one or more embodiments;

[0042] **FIG. 14B** depicts a left side view of the electronic device of **FIG. 14A**, according to one or more embodiments;

[0043] **FIG. 15** depicts a back view of a second housing of the electronic device of **FIG. 14** that is folded, according to one or more embodiments;

[0044] **FIG. 16** presents the electronic device of **FIG. 12** in a partially unfolded tent position with an intermediate pivot position of an acute angle, according to one or more embodiments;

[0045] **FIG. 17** presents the electronic device of **FIG. 12** in a partially unfolded stand position with an intermediate pivot angle of approximately a right angle, according to one or more embodiments;

[0046] **FIG. 18** is a flow diagram presenting a method of providing a user interface on at least one display of an electronic device having a foldable form factor during pivoting of a display housing assembly about a hinge, according to one or more embodiments; and

[0047] **FIG. 19** is a flow diagram presenting a method of managing presentation of a user interface at flexible display on front sides of a housing assembly that folds and unfolds, according to one or more embodiments.

DETAILED DESCRIPTION

[0048] According to a first aspect of the present disclosure, an electronic device, a method, and a computer program product mitigates inadvertent invocation or activation of control elements of a touch sensitive flexible/moveable display when the display is extending or retracting. In one or more embodiments, the electronic device includes a device housing having a front side and a back side. The electronic device includes a flexible display that is slidably coupled to the device housing. The flexible display includes a visual output layer and a touch input layer. The electronic device includes a translation mechanism that is operable to slide the flexible display relative to the device housing between a fully retracted position and a fully extended position. A controller of the electronic device is communicatively coupled to the flexible display and the translation mechanism. The controller determines a first user interface having a first size that fits within the front portion of the flexible display on the device housing. The controller presents user interface content in the first user interface on the visual output layer of the flexible display. The controller monitors for at least one touch input to one or more user interface controls associated with user interface content at a corresponding area of the touch input layer. In response to detecting activation of the translation mechanism to reposition the flexible display relative to the device housing, the controller configures a second user interface having a second size that fits within the flexible display on the front side of the device housing after repositioning the flexible display. The controller maintains presentation of the user interface content on the visual output layer in a smaller dimension of the first and the second user interface during repositioning of the flexible display. The controller maintains an association of one or more user interface controls at the touch input layer that correspond to the position of the user interface content in the smaller one of the first and the second user interface during the repositioning of the flexible display. Maintaining the smaller user interface content and touch interface positions during repositioning avoids refreshing of the user interface content following translation of the display and thereby mitigates inadvertent touch activation of a user interface control during the repositioning.

[0049] According to a second aspect of the present disclosure, a foldable electronic device, a method, and a computer program product mitigates inadvertent invocation or activation of

control elements of a touch sensitive display when the electronic device is folding or unfolding. In one or more embodiments, an electronic device includes a housing assembly with first and second housings coupled at a hinge to pivot between a fully folded position and fully unfolded position. The electronic device includes a sensor that is configured to detect a change in a pivot position of the housing assembly. The electronic device includes at least one display coupled to the housing assembly. The at least one display includes a visual output layer and a touch input layer. A controller is communicatively coupled to the pivot sensor and the at least one display. The controller presents user interface content via the at least one display. In response to determining, based on input received from the sensor, that the pivot position of the housing assembly is changing, the controller ignores touch inputs to one or more user interface controls assigned to the touch input layer and corresponding user interface content, during the change of the pivot position.

[0050] In the following detailed description of exemplary embodiments of the disclosure, specific exemplary embodiments in which the various aspects of the disclosure may be practiced are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that logical, architectural, programmatic, mechanical, electrical, and other changes may be made without departing from the spirit or scope of the present disclosure. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present disclosure is defined by the appended claims and equivalents thereof. Within the descriptions of the different views of the figures, similar elements are provided similar names and reference numerals as those of the previous figure(s). The specific numerals assigned to the elements are provided solely to aid in the description and are not meant to imply any limitations (structural or functional or otherwise) on the described embodiment. It will be appreciated that for simplicity and clarity of illustration, elements illustrated in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements are exaggerated relative to other elements.

[0051] It is understood that the use of specific component, device and/or parameter names, such as those of the executing utility, logic, and/or firmware described herein, are for example only and not meant to imply any limitations on the described embodiments. The embodiments may thus be described with different nomenclature and/or terminology utilized to describe the

components, devices, parameters, methods and/or functions herein, without limitation. References to any specific protocol or proprietary name in describing one or more elements, features or concepts of the embodiments are provided solely as examples of one implementation, and such references do not limit the extension of the claimed embodiments to embodiments in which different element, feature, protocol, or concept names are utilized. Thus, each term utilized herein is to be given its broadest interpretation given the context in which that term is utilized.

[0052] As further described below, implementation of the functional features of the disclosure described herein is provided within processing devices and/or structures and can involve use of a combination of hardware, firmware, as well as several software-level constructs (e.g., program code and/or program instructions and/or pseudo-code) that execute to provide a specific utility for the device or a specific functional logic. The presented figures illustrate both hardware components and software and/or logic components.

[0053] Those of ordinary skill in the art will appreciate that the hardware components and basic configurations depicted in the figures may vary. The illustrative components are not intended to be exhaustive, but rather are representative to highlight essential components that are utilized to implement aspects of the described embodiments. For example, other devices/components may be used in addition to or in place of the hardware and/or firmware depicted. The depicted example is not meant to imply architectural or other limitations with respect to the presently described embodiments and/or the general invention. The description of the illustrative embodiments can be read in conjunction with the accompanying figures. Embodiments incorporating teachings of the present disclosure are shown and described with respect to the figures presented herein.

[0054] **FIG. 1** presents a simplified functional block diagram of electronic device **101** that has an extendable form factor between a retracted position and an extended position, and in which the features of the present disclosure are advantageously implemented, according to one or more embodiments. Electronic device **101** includes device housing **102** having front side **104** and back side **106**. Flexible display **108** is slidably coupled to device housing **102** and can be moved between a retracted position having smaller front-facing dimension and an extended position

having a larger front-facing dimension. Flexible display **108** includes a visual output layer **114** and a touch input layer **120**. Controller **110** manages positioning of flexible display **108** by triggering translation mechanism **112**. Controller **110** manages presenting of visual content at visual output layer **114** of flexible display **108**, and controller **110** manages relaying of touch inputs **116** made by user **118** and detected/identified by touch input layer **120** of flexible display **108**. According to aspects of the present disclosure, while triggering translation mechanism **112**, controller **110** manages sizing and resizing of and positional presentation of content on a user interface presented by flexible display **108** to mitigate inadvertent touch activations.

[0055] In one or more embodiments, electronic device **101** is a user device that may or may not include wireless communication capabilities to perform as a communication device. Electronic device **101** can be one of a host of different types of devices, including but not limited to, a mobile cellular phone, satellite phone, or smart phone, a laptop, a netbook, an ultra-book, a networked smartwatch or networked sports/exercise watch, and/or a tablet computing device or similar device that can include wireless communication functionality. As a device supporting wireless communication, electronic device **101** can be utilized as, and also be referred to as, a system, device, subscriber unit, subscriber station, mobile station (MS), mobile, mobile device, remote station, remote terminal, user terminal, terminal, user agent, user device, a Session Initiation Protocol (SIP) phone, a wireless local loop (WLL) station, a personal digital assistant (PDA), computer workstation, a handheld device having wireless connection capability, a computing device, or other processing devices connected to a wireless modem.

[0056] In addition to translation mechanism **112** and controller **110**, electronic device **101** may include memory subsystem **122**, communications subsystem **124**, data storage subsystem **126**, and input/output (I/O) subsystem **128**. To enable management by controller **110**, system interlink **130** communicatively connects controller **110** with translation mechanism **112**, memory subsystem **122**, communications subsystem **124**, data storage subsystem **126**, I/O subsystem **128**, and physical sensors such as position sensor **132**. System interlink **130** represents internal components that facilitate internal communication by way of one or more shared or dedicated internal communication links, such as internal serial or parallel buses. As utilized herein, the term "communicatively coupled" means that information signals are transmissible through various interconnections, including wired and/or wireless links, between the components. The

interconnections between the components can be direct interconnections that include conductive transmission media or may be indirect interconnections that include one or more intermediate electrical components. Although certain direct interconnections (i.e., system interlink **130**) are illustrated in **FIG. 1**, it is to be understood that more, fewer, or different interconnections may be present in other embodiments.

[0057] Controller **110** includes processor subsystem **134**, which includes one or more central processing units (CPUs) or data processors. Processor subsystem **134** can include one or more digital signal processors that can be integrated with data processor(s). Processor subsystem **134** can include other processors such as auxiliary processor(s) that may act as a low power consumption, always-on sensor hub for physical sensors. Controller **110** manages, and in some instances directly controls, the various functions and/or operations of electronic device **101**. These functions and/or operations can include, but are not limited to including, application data processing, communication with second communication devices, navigation tasks, image processing, and signal processing. In one or more alternate embodiments, electronic device **101** may use hardware component equivalents for application data processing and signal processing. For example, electronic device **101** may use special purpose hardware, dedicated processors, general purpose computers, microprocessor-based computers, micro-controllers, optical computers, analog computers, dedicated processors and/or dedicated hard-wired logic.

[0058] Memory subsystem **122** stores program code **140** for execution by processor subsystem **134** to provide the functionality described herein. Program code **140** includes applications such as translating user interface (UI) application **142** that may be software or firmware that, when executed by controller **110**, configures electronic device **101** that at least in part manages visually presenting a UI and monitoring touch inputs to the UI on a flexible display that translates, in order to mitigate inadvertent touch inputs during translation of the display. Program code **140** includes one or more UI-generating applications **143** that are managed by translating UI application **142** in presenting UIs on flexible display **108**. In one or more embodiments, several of the described aspects of the present disclosure are provided via executable program code of applications executed by controller **110**. In one or more embodiments, program code **140** may be integrated into a distinct chipset or hardware module as firmware that operates separately from executable program code. Portions of program code **140**

may be incorporated into different hardware components that operate in a distributed or collaborative manner. Implementation of program code **140** may use any known mechanism or process for doing so using integrated hardware and/or software, as known by those skilled in the art. Memory subsystem **122** further includes operating system (OS), firmware interface, such as basic input/output system (BIOS) or Uniform Extensible Firmware Interface (UEFI), and firmware, which may be considered as program code **140**.

[0059] Program code **140** may access, use, generate, modify, store, or communicate computer data **144**, such as UI data **146**. Computer data **144** may incorporate "data" that originated as raw, real-world "analog" information that consists of basic facts and figures. Computer data **144** includes different forms of data, such as numerical data, images, coding, notes, and financial data. Computer data **144** may originate at electronic device **101** or be retrieved by electronic device **101**. Electronic device **101** may store, modify, present, or transmit computer data **144**. Computer data **144** may be organized in one of a number of different data structures. Common examples of computer data **144** include video, graphics, text, and images. Computer data **144** can also be in other forms of flat files, databases, and other data structures.

[0060] In one or more embodiments, controller **110**, via communications subsystem **124**, performs multiple types of cellular over-the-air (OTA) or wireless communication such as using a Bluetooth connection, or other personal access network (PAN) connection. In one or more embodiments, communications subsystem **124** communicates via a wireless local area network (WLAN) link using one or more IEEE 802.11 WLAN protocols. In one or more embodiments, communications subsystem **124** receives downlink channels from global positioning system (GPS) satellites to obtain geospatial location information. Communications subsystem **124** may communicate via an over-the-air (OTA) cellular connection with radio access networks (RANs).

[0061] Data storage subsystem **126** of electronic device **101** includes data storage device(s) **150**. Controller **110** is communicatively connected, via system interlink **130**, to data storage device(s) **150**. Data storage subsystem **126** provides program code **140** and computer data **144** stored on nonvolatile storage that is accessible by controller **110**. For example, data storage subsystem **126** can provide a selection of program code **140** and computer data **144**. These applications can be loaded into memory subsystem **122** for execution/processing by controller

110. In one or more embodiments, data storage device(s) **150** can include hard disk drives (HDDs), optical disk drives, and/or solid-state drives (SSDs), etc. Data storage subsystem **126** of electronic device **101** can include removable storage device(s) (RSD(s)) **152**, which is received in RSD interface **154**. Controller **110** is communicatively connected to RSD **152**, via system interlink **130** and RSD interface **154**. In one or more embodiments, RSD **152** is a non-transitory computer program product or computer readable storage device. Controller **110** can access data storage device(s) **150** or RSD **152** to provision electronic device **101** with program code **140** and computer data **144**.

[0062] I/O subsystem **128** includes I/O devices such as flexible display **108**, which includes visual output layer **114** that presents visual outputs. Flexible display **108** includes touch input layer that serves as a tactile touch screen interface for receiving touch inputs **116** made by user **118**. I/O subsystem **128** may include one or more image capturing devices **155** to capture user gestures or facial expressions. I/O subsystem **128** may include microphone(s) **156** to receive user speech. I/O subsystem **128** may include audio output device(s) **157** to present audio outputs.

[0063] Referring now to the top left portion of **FIG. 1**, there is presented a first example image **160a** of flexible display **108** with a UI presenting content at specific positions in an X-Y plane of flexible display **108**. With first example image **160a**, electronic device **101** is in a fully retracted position that provides, on front side **104** of device housing **102**, a front portion of flexible display **108** having a retracted size. Controller **110** determines a first user interface (e.g., retracted user interface **164a**) having a first size (e.g., retracted size) that fits within the front portion of flexible display **108** on device housing **102**. Controller **110** generates first user interface (e.g., retracted user interface **164a**) in part by presenting (or rendering) first, second, and third user interface (UI) visual content **166**, **167**, and **168** on visual output layer **114** of flexible display **108**. Additional controls such as fourth UI visual content **169** (second example image **160b**) do not fit within retracted user interface **164a**). In generating first user interface (e.g., retracted user interface **164a**), controller **110** further assigns corresponding first, second, and third UI controls **170**, **171**, and **172**, respectively, on touch input layer **120** of flexible display **108**. Controller **110** monitors for at least one touch input **116** to one or more of first, second, and third UI controls **170**, **171**, and **172** associated with first, second and third UI visual content **166**, **167**, and **168**, respectively.

[0064] At second example image **160b** at the top right of **FIG. 1**, electronic device **101** is in a fully extended position, which provides, on front side **104** of device housing **102**, a front portion of flexible display **108** having an extended size that is larger than the retracted size. Controller **110** determines a first user interface (e.g., extended user interface **164b**) having a second size (e.g., extended size) that fits within the front portion of flexible display **108** on device housing **102**. Controller **110** generates second user interface (e.g., extended user interface **164b**) in part by presenting first, second, third, and fourth UI visual content **166**, **167**, **168**, and **169** on visual output layer **114** of flexible display **108**. Controller **110** further assigns corresponding first, second, third, and fourth UI controls **170**, **171**, **172**, and **173**, respectively, on touch input layer **120** of flexible display **108**. Controller **110** monitors for at least one touch input **116** to one or more first, second, third, and fourth UI controls **170**, **171**, **172**, and **173** associated, respectively, with first, second, third and fourth UI visual content **166**, **167**, **168**, and **169**.

[0065] While the size of the current user interface is stable, such as when the display remains in the fully retracted or extended positions, controller **110** is not required to refresh flexible display **108** by adding or removing UI visual content presented on visual output layer **114** or reassigning associated UI controls on touch input layer **120**. Considerations are not applicable for differences in the display refresh rate for visual output layer **114** versus touch refresh rate for touch input layer **120** that could cause an inadvertent activation of a UI control. However, when electronic device **101** is transitioning from a retracted position to an extended position or is transitioning from an extended position to a retracted position, refreshing of the size of the user interface can cause changes that could aggravate occurrences of inadvertent and/or incorrect control activation.

[0066] According to aspects of the present disclosure, controller **110** presents the first user interface. Controller **110** subsequently triggers translation mechanism **112**, which operates to slide flexible display **108** relative to device housing **102** between the fully retracted position and the fully extended position. Controller **110** monitors position sensor **132** to determine a current translation position of flexible display **108**. In response to detecting activation of translation mechanism **112** to reposition flexible display relative to device housing **102**, controller **110** configures the second user interface having the second size that fits (or will fit) within flexible display **108** on front side **104** of device housing **102** after repositioning flexible display **108**.

Controller **110** maintains presentation of UI visual content on visual output layer **114** using a smaller one of the first and the second user interface during repositioning of flexible display **108**. Controller **110** maintains an association of one or more UI controls at touch input layer that correspond to the user interface content in the smaller one of the first and second user interface (e.g., retracted UI **164a** or extended UI **164b**) during the repositioning of flexible display **108**. When controller **110** resizes a user interface, controller **110** informs UI-generating application(s) **143** of the new bounds. The change in bounds causes UI-generating application(s) **143** to select and resize UI content for an assigned portion of the UI, prompting a refresh to the visual presentation and a refresh of the touch location assignments. The refresh to the visual presentation is humanly perceptible, degrading a user experience. The refresh of the touch location assignments may also be humanly perceptible in that an incorrect touch activation may result due to lag in reassignment, especially if the refresh rates are different between visual presentation and reassigning locations for touch inputs. During translation, the size of the flexible display **108** presented on front side **104** is continuously changing, potentially inviting a nearly continuous refreshing of the UI with a corresponding degradation in the user experience. By resizing the UI once either before or after translation, the humanly perceptible refreshing of the UI is limited to occurring once, mitigating the effects of the translation. In addition, by avoid refreshing of the user interface content, inadvertent/incorrect touch activation of a user interface control during the translation and prior to refreshing of the UI is prevented.

[0067] In one or more embodiments, in response to determining that translation mechanism **112** is repositioning flexible display **108** to a retracted position, controller **110** determines the second size of second user interface (e.g., retracted UI **164a**) by identifying a retracting portion of flexible display **108** that will no longer be positioned on front side **104** of device housing **102** after the repositioning of flexible display **108**. Controller **110** triggers removal of one or more portions of UI content **166 – 169** and each corresponding portion of UI controls **170 – 173** from the retracting portion of flexible display **108** concurrently with repositioning flexible display **108** to the retracted position. In an example, fourth UI visual content **169** and UI control **173** of extended UI **164b** are removed in retracted UI **164a**. Controller **110** integrates the remaining portions of UI content **166-168** into second user interface (i.e., retracted UI **164a**), which is sized

to fit within a remaining portion of flexible display **108** visible on front side **104** of electronic device **101**.

[0068] **FIGs. 2A – 2D** are a sequence of front views of electronic device **101** maintaining an original, smaller/retracted user interface while translating from a retracted position to an extended position, in order to avoid refreshing the visual output layer **114** and touch input layer **120** of flexible display **108** during the translation. **FIG. 2A** is a front view of electronic device **101** in a fully retracted position with flexible display **108** presenting, on front side **104**, retracted user interface **164a**. Retracted UI **164a** includes first, second, and third UI visual content **166**, **167**, and **168** on visual output layer **114** with corresponding first, second, and third UI controls **170**, **171**, and **172** associated at locations monitored at touch input layer **120** (**FIG. 1**). While in the retracted position, controller **110** (**FIG. 1**) of electronic device **101** identifies a trigger for extending flexible display **108** to a target second size (e.g., fully extended position). Controller **110** (**FIG. 1**) determines the second user interface having the second size by identifying an extending portion of flexible display **108** that is not positioned on front side **104** but becomes positioned on front side **104** of device housing **102** in the extended position. Controller **110** (**FIG. 1**) delays presenting one or more portions of user interface content and delays assigning corresponding one or more portion of user interface controls to the extending portion of flexible display **108** until flexible display **108** is repositioned to the extended position. **FIG. 2B** is a front view of electronic device **101** in a partially extended position with flexible display **108** maintaining presentation, on front side **104**, of retracted user interface **164a** while flexible display **108** is translating. **FIG. 2C** is a front view of electronic device **101** reaching a fully extended position with flexible display **108** maintaining presentation, on front side **104**, of retracted user interface **164a**. **FIG. 2D** is a front view of electronic device **101** in the fully extended position with controller **110** (**FIG. 1**) changing presentation, on front side **104** of flexible display **108**, to extended user interface **164b**.

[0069] **FIGs. 2E – 2H** are a sequence of front views of electronic device **101** translating from extended position to a retracted position while maintaining a user interface to avoid refreshing the visual output layer **114** and touch input layer **120** of flexible display **108** during the translation. **FIG. 2E** is a front view of electronic device **101** in a fully extended position with flexible display **108** presenting, on front side **104**, extended user interface **164b**. Extended UI

164b includes first, second, third, and fourth UI visual content **166**, **167**, **168**, and **169** on visual output layer **114** with corresponding first, second, third, and fourth UI controls **170**, **171**, **172**, and **173** associated at locations monitored at touch input layer **120** (**FIG. 1**). While in the extended position, controller **110** (**FIG. 1**) of electronic device **101** identifies a trigger for retracting flexible display **108** to a target second size (e.g., fully retracted position). Controller **110** (**FIG. 1**) determines the second user interface having the second size by identifying a retracted portion of flexible display **108** that will no longer be positioned on front side **104** in the retracted position. **FIG. 2F** is a front view of electronic device **101** in the fully extended position with flexible display **108** updated to retracted UI **164a**. Controller **110** (**FIG. 1**) triggers removal of one or more portions of the user interface content (e.g., fourth UI visual content **169**) and each corresponding portion of user interface controls (e.g., fourth UI control **173**) from the retracting portion of flexible display **108** in preparation for repositioning flexible display **108** to the retracted position. Controller **110** (**FIG. 1**) triggers integration of the one or more remaining portions of first UI (i.e., extended UI **164b**) into the second UI (i.e., retracted UI **164a**), which is sized to fit within a remaining portion of flexible display **108** visible on a front surface of electronic device **101**. In an example, the retracted user interface **164a** includes first, second and third UI visual content **166**, **167**, and **168** and UI controls **170**, **171**, and **172**. **FIG. 2G** is a front view of electronic device **101** in a partially retracted position with flexible display **108** maintaining presentation of retracted UI **164a**. **FIG. 2H** is a front view of electronic device **101** in the fully retracted position with flexible display **108** maintaining presentation, on front side **104**, of retracted user interface **164a**.

[0070] **FIGs. 3A – 3D** are a sequence of front views of electronic device **101** translating from extended position to a retracted position while maintaining a user interface to avoid refreshing the visual output layer **114** and touch input layer **120** of flexible display **108** during the translation. **FIG. 3A** is a front view of electronic device **101** in a fully extended position with flexible display **108** presenting, on front side **104**, extended user interface **164b**. Extended UI **164b** includes first, second, third, and fourth UI visual content **166**, **167**, **168**, and **169** on visual output layer **114** with corresponding first, second, third, and fourth UI controls **170**, **171**, **172**, and **173** associated at locations monitored at touch input layer **120** (**FIG. 1**). While in the extended position, controller **110** (**FIG. 1**) of electronic device **101** identifies a trigger for

retracting flexible display **108** to a target second size (e.g., fully retracted position). Controller **110** (**FIG. 1**) determines the second user interface having the second size by identifying a retracted portion of flexible display **108** that will no longer be positioned on front side **104** in the retracted position. Instead of removing UI visual content, **FIG. 2F** is a front view of electronic device **101** in the fully extended position with flexible display **108** updated to alternative retracted UI **364a** having resized content. Alternative retracted UI **364a** includes compressed first, second, third, and fourth UI visual content **166a**, **167a**, **168a**, and **169a** on visual output layer **114** with corresponding compressed first, second, third, and fourth UI controls **170a**, **171a**, **172a**, and **173a** associated at locations monitored at touch input layer **120** (**FIG. 1**). **FIG. 3C** is a front view of electronic device **101** in a partially retracted position with flexible display **108** maintaining presentation of alternative retracted UI **364a**. **FIG. 3D** is a front view of electronic device **101** in the fully retracted position of flexible display **108** with controller **110** (**FIG. 1**) maintaining presentation, on front side **104**, of alternative retracted user interface **364a**.

[0071] The extendable form factor of electronic device **101** may be implemented with a number of different movable structures. In an example, an extendable user device may be implemented as a rollable display provided by a blade assembly slidably coupled to a non-telescoping device housing, depicted in **FIGs. 4A – 4C** and **5A – 5C**. **FIG. 4A** is a front view of example electronic device **401** having blade assembly **403** slidably coupled in a fully retracted position on non-telescoping device housing **402**. Extending portion **405** of blade assembly is aligned with front side **404** of non-telescoping device housing **402**. **FIG. 4B** is a left side view of electronic device **401** having flexible display **408** covering front side **404** and a lower portion of back side **406** of non-telescoping device housing **402**. Blade substrate **409** of blade assembly **403** that is attached to move with flexible display **408** is proximate to non-telescoping device housing **402**. **FIG. 4C** is a back view of electronic device **401** having a back portion of blade assembly **403**. Cover **407** of blade assembly **403** is attached to trailing edge **413** of flexible display **408**. **FIG. 5A** is a front view of electronic device **401** having blade assembly **403** slidably coupled in a fully extended position on non-telescoping device housing **402**. Most or all of flexible display **108** has rolled onto or extends beyond front side **404** of non-telescoping device housing **402**. Extending portion **405** of blade assembly **403** extends beyond front side **404** of non-telescoping device housing **402**. **FIG. 5B** is a left side view of electronic device **401**. **FIG. 5C** is a back view

of electronic device **401**. In **FIGs. 5B – 5C**, cover **407** of blade assembly **403** has moved down but remains on back side **406** of non-telescoping device housing **402**. Blade substrate **409** of blade assembly **403** provides rigidity and structural support to extending portion **405** of blade assembly **403** and corresponding portion of flexible display **408**, enabling extension beyond non-telescoping device housing **402**.

[0072] In another example, an extendable user device may be implemented as a rollable display device supported by a telescoping device housing, depicted in **FIGs. 6A – 6C** and **7A – 7C** and described below. **FIG. 6A** is a front view of electronic device **601** having rollable display assembly **603** slidably coupled in a fully retracted position on telescoping device housing **602**. Flexible display **408** of rollable display assembly **603** covers front side **604** of telescoping device housing **602**. **FIG. 6B** is a left side view of electronic device **601**. **FIG. 6C** is a back view of electronic device **601**. In **FIGs. 6B – 6C**, flexible display **608** of rollable display assembly **603** rolls around top edge **611** and bottom edge **613** of telescoping device housing **602**. Cover **607** is fixed on back side **606** of telescoping device housing **602**, such as to support back camera **615**. **FIG. 7A** is a front view of electronic device **601** having rollable display assembly **603** slidably coupled in a fully extended position on telescoping device housing **602**. **FIG. 7B** is a left side view of electronic device **601**. Telescoping device housing **602** includes base housing **703a** from which top housing **703b** and bottom housing **703c** extend. **FIG. 7C** is a back view of electronic device **601**.

[0073] In an additional example, an extendable user device may be implemented as a scrollable display device supported by a telescoping device housing, depicted in **FIGs. 8A – 8C** and **9A – 9C** and described below. **FIG. 8A** is a front view of electronic device **801** having scrollable display assembly **803** coupled across front side **804** of telescoping device housing **802** in a fully retracted position.

[0074] Flexible display **808** of scrollable display assembly **803** covers front side **804** of telescoping device housing **802**. **FIG. 8B** is a left side view of electronic device **801**. An excess portion of flexible display **808** is received by scrolling mechanism **817** in telescoping device housing **802**. **FIG. 8C** is a back view of electronic device **801**. In **FIGs. 8B – 8C**, cover **807** is fixed on back side **806** of telescoping device housing **802**, such as to support back camera **815**.

FIG. 9A is a front view of electronic device **801** having scrollable display assembly **803** slidably coupled in a fully extended position on telescoping device housing **802**. **FIG. 9B** is a left side view of electronic device **801**. Telescoping device housing **802** includes base housing **903a** from which top housing **903b** and bottom housing **903c** extend. **FIG. 9C** is a back view of electronic device **801**.

[0075] **FIGs. 10A – 10B** (collectively "**FIG. 10**") are a flow diagram of a method of presenting a user interface during translation of a flexible display to avoid inadvertent touch activations of touch controls. **FIG. 11** is a flow diagram presenting a method of supporting an animated UI and providing mitigation in the event of inadvertent touch activations while a flexible touch display is translating. The descriptions of method **1000** (**FIG. 10**) and method **1100** (**FIG. 11**) are provided with general reference to the specific components illustrated within the preceding **FIGs. 1**, **2A – 2H**, **3A – 3D**, **4A – 4C**, **5A – 5C**, **6A – 6C**, **7A – 7B**, **8A – 8C**, and **9A – 9C**. Specific components referenced in method **1000** (**FIG. 10**) and method **1100** (**FIG. 11**) may be identical or similar to components of the same name used in describing preceding **FIGs. 1**, **2A – 2D**, **3A – 3D**, **4A – 4C**, **5A – 5C**, **6A – 6C**, **7A – 7B**, **8A – 8C**, and **9A – 9C**. In one or more embodiments, controller **110** (**FIG. 1**) configures electronic device **101** (**FIG. 1**) to provide the described functionality of method **1000** (**FIG. 10**) and method **1100** (**FIG. 11**).

[0076] With reference to **FIG. 10A**, method **1000** includes monitoring a position sensor configured to detect movement of a portion of a flexible, touch screen display that is slidably coupled to device housing and moved by a translation mechanism, which is operable to slide the flexible display relative to the device housing between a fully retracted position and a fully extended position (block **1002**). Method **1000** includes determining a display refresh rate of the visual output layer of the display (block **1004**). Method **1000** includes determining a touch refresh rate of the touch input layer of the display (block **1006**). Method **1000** includes determining whether the display refresh rate is slower than the touch refresh rate that results in a location offset of a touch position relative to the corresponding display content during repositioning/translating of the flexible display (decision block **1008**). In response to determining that the display refresh rate is not slower (i.e., equal to or greater) than the touch refresh rate (i.e., not resulting in a location offset during repositioning of the flexible display) in decision block **1008**, method **1000** includes resizing a user interface on a front side of the flexible display based

on a current size of the portion of the flexible display on the front side of the device housing (block **1010**). Then method **1000** ends.

[0077] In response to determining that the display refresh rate is slower than the touch refresh rate (i.e., resulting in a location offset during repositioning of the flexible display), method **1000** includes monitoring a touch input layer of a flexible display (block **1012**). Method **1000** includes determining a first user interface size available at the flexible display on the front side of the device housing (block **1014**). Method **1000** includes generating the first user interface that is not larger than the first user interface size (block **1016**). Then method **1000** proceeds to block **1018** of **FIG. 10B**.

[0078] With reference to **FIG. 10B**, method **1000** includes presenting user interface content in the first user interface on a visual output layer of the flexible display (block **1018**). Method **1000** includes monitoring for at least one touch input to one or more user interface controls associated with user interface content at a corresponding portion of the touch input layer (block **1020**). Method **1000** includes determining whether a touch input is received that corresponds to a user control (decision block **1022**). In response to determining that a touch input is received that corresponds to a user control, method **1000** includes relaying activation of the corresponding user control to a responsible application (block **1024**). In response to determining that a touch input is not received that corresponds to a user control in decision block **1022** or after block **1024**, method **1000** includes determining whether the translation mechanism is activated to reposition the flexible display (decision block **1026**). In response to not detecting activation of the translation mechanism to reposition the flexible display, method **1000** includes maintaining the first user interface on the flexible display (block **1028**). Then method **1000** returns to block **1012** (**FIG. 10A**).

[0079] In response to detecting activation of the translation mechanism to reposition the flexible display in decision block **1026**, method **1000** includes configuring a second user interface having a second size that fits at the flexible display on the front side of the device housing after repositioning the flexible display (block **1030**). Method **1000** includes identifying which of the first and the second user interfaces is smaller and maintaining presentation of the user interface content on the visual output layer in a smaller one of the first and the second user

interface during repositioning of the flexible display (block **1032**). Method **1000** includes maintaining association of one or more user interface controls at the touch input layer that correspond to the user interface content in the smaller one of the first and the second user interface during the repositioning of the flexible display (block **1034**). When the user interface resizes, applications that generate UI content and controls may change what is to be included in the UI, causing a refresh of presentation of visual UI content and a refresh of associated locations for UI controls. The refresh may be humanly perceptible. With continual translation, the resizing and resulting refreshing of the flexible display may be also continual. The lag repositioning the visual presentation and the lag in reassigning locations for UI controls may create a situation in which a user may inaccurately activate a particular user control. The physical movement of the flexible display during translation may be slow, but the movement in addition to the refreshing of the flexible display may aggravate an ability of a user to accurately activate a user control. By preventing refreshing of the flexible display during translation, inaccuracy of selecting a user control is only due to the physical movement of the flexible display. Thus, avoiding refreshing of the user interface content mitigates inadvertent touch activation of a user interface control during translation of the display. Then method **1000** returns to block **1012** (**FIG. 10A**).

[0080] In one or more embodiments, in response to determining that the translation mechanism is repositioning the flexible display from an extended position to a retracted position, method **1000** includes determining the second user interface having the second size by identifying a retracting portion of the flexible display that will no longer be positioned on the front side of the device housing after the repositioning of the flexible display. Method **1000** includes removing one or more portions of the user interface content and each corresponding portion of user interface controls from the retracting portion of the flexible display prior to repositioning the flexible display to the retracted position.

[0081] In one or more embodiments, in response to determining that the translation mechanism is repositioning the flexible display from a retracted position to an extended position, method **1000** includes determining the second size of the second user interface by identifying an extending portion of the flexible display that is not positioned on the front side but becomes positioned on the front side of the device housing in the extended position. Method **1000** includes delaying presenting one or more additional portions of user interface content and

delaying assigning corresponding one or more portions of user interface controls to the extending portion of the flexible display until the flexible display is repositioned to the extended position.

[0082] In one or more embodiments, a blade assembly of the electronic device has a blade substrate that is slidably coupled to the device housing and moved by the translation mechanism. The visual output layer and the touch input layer of the flexible display are attached to move with the blade substrate. The blade assembly extends out from one end of the device housing while in an at least partially extended position. In one or more alternative embodiments, the device housing includes a telescoping structure positionable between the retracted and extended positions.

[0083] With reference to **FIG. 11**, method **1100** includes monitoring a position sensor configured to detect a position of the flexible display as a function of time (block **1102**). Method includes receiving animated user interface content and at least one corresponding animated user interface control intended to change position on the flexible display as a function of time (block **1104**). Method **1100** includes buffering a location on the device housing and time of presentation of the animated interface content while repositioning the flexible display (block **1106**). Method **1100** includes identifying a time delay based on a human reaction time value (block **1108**). Method **1100** includes determining whether a touch input is received from a touch input layer of the flexible display while the flexible display is translating (decision block **1110**). In response to not receiving a touch input from the visual input layer of the flexible display while the flexible display is translating, method **1100** returns to block **1102**. In response to receiving a touch input from the visual input layer of the flexible display while the flexible display is translating, method **1100** includes comparing a location on the touch input layer and time of a touch input adjusted by the time delay to a buffered location on the device housing and time of the presentation of the animated user content, respectively (block **1112**). Method **1100** includes determining whether the location corresponds to the buffered location (decision block **1114**). In response to determining that the location on the touch input layer and time of a touch input adjusted by the time delay does not correspond to the buffered location on the device housing and time of the presentation of the animated user content, method **1100** includes ignoring the touch input (block **1116**). Method **1100** returns to block **1102**. In response to determining that the location on the touch input layer and time of a touch input adjusted by the time delay corresponds to the buffered

location on the device housing and time of the presentation of the animated user content, method **1100** includes associating the touch input to a corresponding animated user control (block **1118**). Method **1100** includes relaying activation of the corresponding animated user control to a responsible application (block **1120**). Then method **1100** returns to block **1102**.

[0084] **FIG. 12** presents a simplified functional block diagram of electronic device **1201** including housing assembly **1202** that has a foldable form factor, in which the features of the present disclosure are advantageously implemented. Housing assembly **1202** includes first and second housings **1203a – 1203b** coupled at hinge **1205** to pivot between a fully folded position and fully unfolded position. Housing assembly **1202** is positioned to depict back sides **1206a – 1206b** respectively of first and second housings **1203a – 1203b**. In one or more embodiments, first back display **1209a** is positioned at back side **1206a** of first housing **1203a**. In one or more embodiments, second back display **1209b** is positioned at back side **1206b** of second housing **1203b**. **FIG. 13A** depicts electronic device **1201**, shown in an unfolded front view. Housing assembly **1202** is positioned to depict front sides **1204a – 1204b** respectively of first and second housings **1203a – 1203b**. **FIG. 13B** depicts a left side view of electronic device **1201** that is unfolded. Front sides **1204a – 1204b** of first and second housings **1203a – 1203b** respectively unfold, pivoting apart in intermediate pivot positions to a fully unfolded position in planar alignment. **FIG. 14A** depicts a back view of a first housing of electronic device **1201** that is folded. **FIG. 14B** depicts a left side view of the electronic device **1201** of **FIG. 14A**. Front sides **1204a – 1204b** of first and second housings **1203a – 1203b**, respectively, are brought together in the folded position. **FIG. 15** depicts a back view of a second housing of electronic device **1201** that is folded. **FIG. 16** presents electronic device **1201** in a partially unfolded tent position with an intermediate pivot position of an acute angle. **FIG. 17** presents electronic device **1201** in a partially unfolded stand position with an intermediate pivot angle of approximately a right angle.

[0085] With continuing reference to **FIG. 12**, pivot sensor **1207** is configured to detect a change in the pivot position of housing assembly **1202**. At least one touch screen display is coupled to housing assembly **1202**. In an example, flexible display **1208** includes visual output layer **1214** and touch input layer **1220**. Flexible display **1208** extends across front sides **1204a – 1204b** of first and second housings **1203a – 1203b**. Controller **1210** of electronic device **1201** is communicatively coupled to pivot sensor **1207** and the at least one display (**1208**, **1209a**, and

1209b). Controller **1210** presents user interface content **1211** via the at least one display, such as at flexible display **1208**. In response to determining, based on input received from pivot sensor **1207**, that the pivot position of housing assembly **1202** is changing, controller **1210** ignores touch inputs **1216** by user **1218** to one or more user interface controls **1219** assigned to touch input layer **1220** and corresponding to user interface content **1211** during the change of the pivot position.

[0086] In one or more embodiments, electronic device **1201** is a user device that may or may not include wireless communication capabilities to perform as a communication device. Electronic device **1201** can be one of a host of different types of devices, including but not limited to, a mobile cellular phone, satellite phone, or smart phone, a laptop, a netbook, an ultra-book, a networked smartwatch or networked sports/exercise watch, and/or a tablet computing device or similar device that can include wireless communication functionality. As a device supporting wireless communication, electronic device **1201** can be utilized as, and also be referred to as, a system, device, subscriber unit, subscriber station, mobile station (MS), mobile, mobile device, remote station, remote terminal, user terminal, terminal, user agent, user device, a Session Initiation Protocol (SIP) phone, a wireless local loop (WLL) station, a personal digital assistant (PDA), computer workstation, a handheld device having wireless connection capability, a computing device, or other processing devices connected to a wireless modem.

[0087] In addition to controller **1210**, electronic device **1201** may include memory subsystem **1222**, communications subsystem **1224**, data storage subsystem **1226**, and input/output (I/O) subsystem **1228**. I/O subsystem **1228** includes I/O devices such as flexible display **1208**. To enable management by controller **1210**, system interlink **1230** communicatively connects controller **1210** with memory subsystem **1222**, communications subsystem **1224**, data storage subsystem **1226**, I/O subsystem **1228**, and physical sensors such as pivot sensor **1207**. System interlink **1230** represents internal components that facilitate internal communication by way of one or more shared or dedicated internal communication links, such as internal serial or parallel buses. As utilized herein, the term "communicatively coupled" means that information signals are transmissible through various interconnections, including wired and/or wireless links, between the components. The interconnections between the components can be direct interconnections that include conductive transmission media or may be indirect interconnections

that include one or more intermediate electrical components. Although certain direct interconnections (i.e., system interlink **1230**) are illustrated in **FIG. 12**, it is to be understood that more, fewer, or different interconnections may be present in other embodiments.

[0088] Controller **1210** includes processor subsystem **1234**, which includes one or more central processing units (CPUs) or data processors. Processor subsystem **1234** can include one or more digital signal processors that can be integrated with data processor(s). Processor subsystem **1234** can include other processors such as auxiliary processor(s) that may act as a low power consumption, always-on sensor hub for physical sensors. Controller **1210** manages, and in some instances directly controls, the various functions and/or operations of electronic device **1201**. These functions and/or operations include, but are not limited to including, application data processing, communication with second communication devices, navigation tasks, image processing, and signal processing. In one or more alternative embodiments, electronic device **1201** may use hardware component equivalents for application data processing and signal processing. For example, electronic device **1201** may use special purpose hardware, dedicated processors, general purpose computers, microprocessor-based computers, micro-controllers, optical computers, analog computers, dedicated processors and/or dedicated hard-wired logic.

[0089] Memory subsystem **1222** stores program code **1240** for execution by processor subsystem **1234** to provide the functionality described herein. Program code **1240** includes applications such as fold-unfold user interface (UI) application **1242** that may be software or firmware that, when executed by controller **1210**, configures electronic device **1201** that at least in part manages visually presenting a UI and input monitoring touch inputs to the UI on a flexible display that translates to mitigate inadvertent touch inputs. In one or more embodiments, several of the described aspects of the present disclosure are provided via executable program code of applications executed by controller **1210**. In one or more embodiments, program code **1240** may be integrated into a distinct chipset or hardware module as firmware that operates separately from executable program code. Portions of program code **1240** may be incorporated into different hardware components that operate in a distributed or collaborative manner. Implementation of program code **1240** may use any known mechanism or process for doing so using integrated hardware and/or software, as known by those skilled in the art. Memory subsystem **1222** further includes operating system (OS), firmware interface, such as basic

input/output system (BIOS) or Uniform Extensible Firmware Interface (UEFI), and firmware, which may be considered as program code **1240**.

[0090] Program code **1240** may access, use, generate, modify, store, or communicate computer data **1244**, such as UI data **1246**. Computer data **1244** may incorporate "data" that originated as raw, real-world "analog" information that consists of basic facts and figures. Computer data **1244** includes different forms of data, such as numerical data, images, coding, notes, and financial data. Computer data **1244** may originate at electronic device **1201** or be retrieved by electronic device **1201**. Electronic device **1201** may store, modify, present, or transmit computer data **1244**. Computer data **1244** may be organized in one of a number of different data structures. Common examples of computer data **1244** include video, graphics, text, and images. Computer data **1244** can also be in other forms of flat files, databases, and other data structures.

[0091] In one or more embodiments, controller **1210**, via communications subsystem **1224**, performs multiple types of cellular over-the-air (OTA) or wireless communication such as using a Bluetooth connection, or other personal access network (PAN) connection. In one or more embodiments, communications subsystem **1224** communicates via a wireless local area network (WLAN) link using one or more IEEE 802.11 WLAN protocols. In one or more embodiments, communications subsystem **1224** receives downlink channels from global positioning system (GPS) satellites to obtain geospatial location information. Communications subsystem **1224** may communicate via an over-the-air (OTA) cellular connection with radio access networks (RANs).

[0092] Data storage subsystem **1226** of electronic device **1201** includes data storage device(s) **1250**. Controller **1210** is communicatively connected, via system interlink **1230**, to data storage device(s) **1250**. Data storage subsystem **1226** provides program code **1240** and computer data **1244** stored on nonvolatile storage that is accessible by controller **1210**. For example, data storage subsystem **1226** can provide a selection of program code **1240** and computer data **1244**. These applications can be loaded into memory subsystem **1222** for execution/processing by controller **1210**. In one or more embodiments, data storage device(s) **1250** can include hard disk drives (HDDs), optical disk drives, and/or solid-state drives (SSDs), etc. Data storage subsystem **1226** of electronic device **1201** can include removable storage device(s) (RSD(s)) **1252**, which is

received in RSD interface **1254**. Controller **1210** is communicatively connected to RSD **1252**, via system interlink **1230** and RSD interface **1254**. In one or more embodiments, RSD **1252** is a non-transitory computer program product or computer readable storage device. Controller **1210** can access data storage device(s) **1250** or RSD **1252** to provision electronic device **1201** with program code **1240** and computer data **1244**.

[0093] In one or more embodiments, at least one display includes a front display (e.g., flexible display **1208**) on an inner side of at least one of one of first housing **1203a** and second housing **1203b**. The front display is hidden by an opposing one of first housing **1203a** and second housing **1203b**, while electronic device **1201** is in the fully folded position, and exposed for user interfacing and content presentation, while electronic device **1201** is in the fully unfolded position. In ignoring the touch inputs, controller **1210** delays activating the front display in response to determining that the pivot position is transitioning from the fully folded position to the fully unfolded position. Controller **1210** deactivates the front display in response to determining that the pivot position is transitioning from the fully unfolded position to the fully folded position.

[0094] In one or more embodiments, housing assembly **1202** is configured to remain at an intermediate pivot position between the fully folded position and the fully unfolded position for positioning electronic device **1201** in a stand or tent orientation. The at least one display includes a front display (e.g., flexible display **1208**) on an inner side of at least one of one of first housing **1203a** and second housing **1203b**. The front display is hidden by an opposing one of first housing **1203a** and second housing **1203b**, while electronic device **1201** is in the fully folded position, and exposed for user interfacing and content presentation, while electronic device **1201** is in the fully unfolded position. In ignoring the touch inputs, controller **1210** delays activating the front display in response to determining that the pivot position is transitioning from the fully folded position to the intermediate pivot position. Controller **1210** deactivates the front display in response to determining that the pivot position is transitioning from the intermediate pivot position to the fully folded position. In one or more embodiments, the at least one display includes back display(s) **1209a – 1209b**, exposed on an outer side of one or both of first housing **1203a** and second housing **1203b**.

[0095] **FIG. 18** is a flow diagram of a method of mitigating inadvertent touch activations at a display of an electronic device having a foldable form factor. **FIG. 19** is a flow diagram presenting a method of managing presentation of a user interface at flexible display on front sides of a housing assembly that folds and unfolds. The descriptions of method **1800** (**FIG. 18**) and method **1900** (**FIG. 19**) are provided with general reference to the specific components illustrated within the preceding **FIGs. 12 – 17**. Specific components referenced in method **1800** (**FIG. 18**) and method **1900** (**FIG. 19**) may be identical or similar to components of the same name used in describing preceding **FIGs. 12 – 17**. In one or more embodiments, controller **1210** (**FIG. 12**) configures electronic device **1201** (**FIG. 12**) to provide the described functionality of method **1800** (**FIG. 18**) and method **1900** (**FIG. 19**).

[0096] With reference to **FIG. 18**, method **1800** includes executing in a controller at least one application stored in a memory of the electronic device to generate the user interface content and the corresponding one more user interface controls (block **1802**). Method **1800** includes enabling the response by the electronic device to the touch inputs to the one or more user interface controls by relaying the touch inputs to the application functions executing in the controller (blocks **1804**). Method **1800** includes monitoring a sensor (e.g., a position sensor, a proximity sensor, an accelerometer, and a motion sensor) configured to detect a change in a pivot position of a housing assembly, which includes first and second housings coupled at a hinge to pivot between a fully folded position and fully unfolded position (block **1806**). Method **1800** includes presenting user interface content via at least one display (e.g., back display or front display) coupled to the housing assembly and having a visual output layer and a touch input layer (block **1808**). Method **1800** includes determining, based on input received from the sensor, whether the pivot position of the housing assembly is changing (decision block **1810**). In response to determining, based on input received from the sensor, that the pivot position of the housing assembly is not changing at either an intermediate pivot position, a fully folded position, or a fully unfolded position, method **1800** returns to block **1804**. In response to determining, based on input received from the sensor, that the pivot position of the housing assembly is changing, method **1800** includes ignoring, during the change of the pivot position, touch inputs to one or more user interface controls assigned to the touch input layer and corresponding to the user interface content (block **1812**). Method **1800** includes presenting an indication on the at

least one display that the touch inputs are being ignored (block **1814**). Then method **1800** returns to block **1810**.

[0097] With reference to **FIG. 19**, method **1900** includes monitoring the pivot sensor while in a starting condition of the housing assembly being fully folded with at least one front side display being inactive (block **1902**). Method **1900** includes determining whether the pivot position of the housing assembly is changing (i.e., unfolding) (decision block **1904**). In response to determining that the pivot position of the housing assembly is not changing, method returns to block **1902**. In response to determining that the pivot position is changing, method **1900** includes delaying activating the at least one front side display (block **1906**). Method **1900** includes determining whether the pivot position has stopped changing (decision block **1908**). In response to determining that the pivot position has not stopped changing, method **1900** returns to block **1906**. In response to determining that the pivot position has stopped changing, method **1900** includes activating the at least one front side display (block **1910**). In one or more embodiments, activation of the at least one front side display further requires reaching a minimum unfolded position (e.g., tent acute angle, stand right angle, or planar fully unfolded). Method **1900** includes generating and presenting the user interface content and the corresponding one more user interface controls (block **1912**). Method **1900** includes enabling response by the electronic device to the touch inputs to the one or more user interface controls (blocks **1914**).

[0098] Method **1900** includes determining whether the pivot position is changing (e.g., further unfolding or folding) (decision block **1916**). In response to determining that the pivot position of the housing assembly is not changing, method includes relaying detected touch inputs to an associated application (block **1918**). Then, method **1900** returns to block **1916**. In response to determining that the pivot position is changing, method **1900** includes ignoring touch inputs (block **1920**). Method **1900** includes determining whether the pivot position has stopped changing (decision block **1922**). In response to determining that the pivot position has not stopped changing, method **1900** returns to block **1920**. In response to determining that the pivot position has stopped changing, method **1900** includes determining whether the pivot position is in the fully folded position (decision block **1924**). In response to determining that the housing position is in the fully folded position, method **1900** includes deactivating the at least one front

side display (block **1926**). Then method **1900** returns to block **1902**. In response to determining that the housing position is not in the fully folded position, method **1900** returns to block **1914**.

[0099] Aspects of the present innovation are described above with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems) and computer program products according to embodiments of the innovation. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer program instructions. These computer program instructions may be provided to a processor of a general-purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

[00100] As will be appreciated by one skilled in the art, embodiments of the present innovation may be embodied as a system, device, and/or method. Accordingly, embodiments of the present innovation may take the form of an entirely hardware embodiment or an embodiment combining software and hardware embodiments that may all generally be referred to herein as a "circuit," "module" or "system."

[00101] While the innovation has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may be made, and equivalents may be substituted for elements thereof without departing from the scope of the innovation. In addition, many modifications may be made to adapt a particular system, device, or component thereof to the teachings of the innovation without departing from the essential scope thereof. Therefore, it is intended that the innovation not be limited to the particular embodiments disclosed for carrying out this innovation, but that the innovation will include all embodiments falling within the scope of the appended claims. Moreover, the use of the terms first, second, etc. do not denote any order or importance, but rather the terms first, second, etc. are used to distinguish one element from another.

[00102] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the innovation. As used herein, the singular forms "a",

"an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprise" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[00103] The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims below are intended to include any structure, material, or act for performing the function in combination with other claimed elements as specifically claimed. The description of the present innovation has been presented for purposes of illustration and description but is not intended to be exhaustive or limited to the innovation in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the innovation. The embodiments were chosen and described in order to best explain the principles of the innovation and the practical application, and to enable others of ordinary skill in the art to understand the innovation for various embodiments with various modifications as are suited to the particular use contemplated.

CLAIMS

What is claimed is:

1. An electronic device comprising:

a device housing having a front side and a back side;

a flexible display slidably coupled to the device housing and comprising a visual output layer and a touch input layer;

a translation mechanism operable to slide the flexible display relative to the device housing between a fully retracted position and a fully extended position; and

a controller communicatively coupled to the flexible display and the translation mechanism, and which:

determines a first user interface having a first size that fits within a front portion of the flexible display on the device housing;

presents user interface content in the first user interface on the visual output layer of the flexible display;

monitors for at least one touch input to one or more user interface controls associated with user interface content at a corresponding area of the touch input layer; and

in response to detecting activation of the translation mechanism to reposition the flexible display relative to the device housing:

configures a second user interface having a second size that fits within the flexible display on the front side of the device housing after repositioning the flexible display;

maintains presentation of the user interface content on the visual output layer in a smaller one of the first and the second user interface during repositioning of the flexible display; and

maintains an association of one or more user interface controls at the touch input layer that correspond to the user interface content in the smaller one of the first and the second user interface during the repositioning of the flexible display

to avoid refreshing of the user interface content and thereby mitigate inadvertent touch activation of a user interface control during the repositioning.

2. The electronic device of claim 1, wherein the controller:

in response to determining that the translation mechanism is repositioning the flexible display to a retracted position:

determines the second size of the second user interface by identifying a retracting portion of the flexible display that will no longer be positioned on the front side of the device housing after the repositioning of the flexible display;

removes one or more portions of the user interface content and each corresponding portion of user interface controls from the retracting portion of the flexible display concurrently with repositioning the flexible display to the retracted position; and

integrates the one or more portions into the second user interface, which is sized to fit within a remaining portion of the flexible display visible on the front side of the electronic device.

3. The electronic device of claim 1, wherein the controller:

in response to determining that the translation mechanism is repositioning the flexible display to an extended position:

determines the second user interface having the second size by identifying an extending portion of the flexible display that is not positioned on the front side but becomes positioned on the front side of the device housing in the extended position; and

delays presenting one or more portions of user interface content and assigning corresponding one or more portion of user interface controls to the extending portion of the flexible display until the flexible display is repositioned to the extended position.

4. The electronic device of claim 1, wherein the controller:

determines a display refresh rate of the visual output layer;

determines a touch refresh rate of the touch input layer; and

maintains presentation of the user interface content on the visual output layer and maintains assignment of each user interface controls further in response to determining that the display refresh rate is slower than the touch refresh rate that results in a location offset during repositioning of the flexible display.

5. The electronic device of claim 1, wherein the flexible display comprises a blade assembly having a blade substrate that is slidably coupled to the device housing and moved by the translation mechanism, the visual output layer and the touch input layer being attached to move with the blade substrate, the blade assembly extending out from one end of the device housing while in an at least partially extended position.

6. The electronic device of claim 1, wherein the device housing comprises a telescoping structure positionable between the retracted and extended positions.

7. The electronic device of claim 1, further comprising a position sensor communicatively coupled to the controller and configured to detect a position of the flexible display, and wherein the controller:

receives animated user interface content and at least one corresponding animated user interface control intended to change position on the flexible display as a function of time;

buffers a location on the device housing and time of presentation of the animated interface content while repositioning the flexible display based on the position sensor; and

in response to receiving a touch input from the visual input layer of the flexible display while the flexible display is translating:

determines whether a location on the touch input layer and time of a touch input corresponds to a buffered location on the device housing and time of the presentation of the animated user content; and

associates the touch input to a corresponding animated user control in response to the determining that the location on the touch input layer and the time of the touch input correspondent to the buffered location on the device housing and time of the presentation of the animated user content.

8. The electronic device of claim 7, wherein in associating the touch input to the corresponding animated user control, the controller:

identifies a time delay based on a human reaction time value; and

determines whether the location on the touch input layer and the time of the touch input adjusted by the time delay corresponds to the buffered location on the device housing and the time of the presentation of the animated user content.

9. A method comprising:

monitoring a touch input layer of a flexible display slidably coupled to device housing and moved by a translation mechanism operable to slide the flexible display relative to the device housing between a fully retracted position and a fully extended position;

determining a first user interface size available at the flexible display on a front side of the device housing;

presenting user interface content in the first user interface on a visual output layer of the flexible display;

monitoring for at least one touch input to one or more user interface controls associated with user interface content at a corresponding portion of the touch input layer; and

in response to detecting activation of the translation mechanism to reposition the flexible display:

configuring a second user interface having a second size that fits at the flexible display on the front side of the device housing after repositioning the flexible display;

maintaining presentation of the user interface content on the visual output layer in a smaller one of the first and the second user interface during repositioning of the flexible display; and

maintaining association of one or more user interface controls at the touch input layer that correspond to the user interface content in the smaller one of the first and the second user interface during the repositioning of the flexible display to avoid refreshing of the user interface content and thereby to mitigate inadvertent touch activation of a user interface control.

10. The method of claim 9, further comprising:

in response to determining that the translation mechanism is repositioning the flexible display to a retracted position:

determining the second user interface having the second size by identifying a retracting portion of the flexible display that will no longer be positioned on the front side of the device housing after the repositioning of the flexible display; and

removing one or more portions of the user interface content and each corresponding portion of user interface controls from the retracting portion of the flexible display prior to repositioning the flexible display to the retracted position.

11. The method of claim 9, further comprising:

in response to determining that the translation mechanism is repositioning the flexible display to an extended position:

determining the second user interface having the second size by identifying an extending portion of the flexible display that is not positioned on the front side but becomes positioned on the front side of the device housing in the extended position; and

delaying presenting one or more portions of user interface content and assigning corresponding one or more portion of user interface controls to the extending portion of the flexible display until the flexible display is repositioned to the extended position.

12. The method of claim 9, further comprising:

determining a display refresh rate of the visual output layer;

determining a touch refresh rate of the touch input layer; and

maintaining presentation of the user interface content on the visual output layer and maintains assignment of each user interface controls further in response to determining that the display refresh rate is slower than the touch refresh rate that results in a location offset during repositioning of the flexible display.

13. The method of claim 9, wherein the flexible display comprises a blade assembly having a blade substrate that is slidably coupled to the device housing and moved by the translation mechanism, the visual output layer and the touch input layer being attached to move with the blade substrate, the blade assembly extending out from one end of the device housing while in an at least partially extended position.

14. The method of claim 9, wherein the device housing comprises a telescoping structure positionable between the retracted and extended positions.

15. The method of claim 9, further comprising:

monitoring a position sensor configured to detect a position of the flexible display;

receiving animated user interface content and at least one corresponding animated user interface control intended to change position on the flexible display as a function of time;

buffering a location on the device housing and time of presentation of the animated interface content while repositioning the flexible display based on the position sensor; and

in response to receiving a touch input from the visual input layer of the flexible display while the flexible display is translating:

determining whether a location on the touch input layer and time of a touch input corresponds to a buffered location on the device housing and time of the presentation of the animated user content; and

associating the touch input to a corresponding animated user control in response to the determining that the location on the touch input layer and the time of the touch input correspondent to the buffered location on the device housing and time of the presentation of the animated user content.

16. The method of claim 15, wherein associating the touch input to the corresponding animated user control further comprises:

identifying a time delay based on a human reaction time value; and

determining whether the location on the touch input layer and the time of the touch input adjusted by the time delay corresponds to the buffered location on the device housing and the time of the presentation of the animated user content.

17. A computer program product comprising:

a computer readable storage device; and

program code on the computer readable storage device that when executed by a processor associated with an electronic device, the program code enables the electronic device to provide functionality of:

monitoring a touch input layer of a flexible display slidably coupled to device housing and moved by a translation mechanism operable to slide the flexible display relative to the device housing between a fully retracted position and a fully extended position;

determining a first user interface size available at the flexible display on a front side of the device housing;

presenting user interface content in the first user interface on a visual output layer of the flexible display;

monitoring for at least one touch input to one or more user interface controls associated with user interface content at a corresponding portion of the touch input layer; and

in response to detecting activation of the translation mechanism to reposition the flexible display:

configuring a second user interface having a second size that fits at the flexible display on the front side of the device housing after repositioning the flexible display;

maintaining presentation of the user interface content on the visual output layer in a smaller one of the first and the second user interface during repositioning of the flexible display; and

maintaining association of one or more user interface controls at the touch input layer that correspond to the user interface content in the smaller one of the

first and the second user interface during the repositioning of the flexible display to avoid refreshing of the user interface content and thereby to mitigate inadvertent touch activation of a user interface control.

18. The computer program product of claim 17, wherein the program code enables the electronic device to provide functionality of:

in response to determining that the translation mechanism is repositioning the flexible display to a retracted position:

determining the second user interface having the second size by identifying a retracting portion of the flexible display that will no longer be positioned on the front side of the device housing after the repositioning of the flexible display; and

removing one or more portions of the user interface content and each corresponding portion of user interface controls from the retracting portion of the flexible display prior to repositioning the flexible display to the retracted position.

19. The computer program product of claim 17, wherein the program code enables the electronic device to provide functionality of:

in response to determining that the translation mechanism is repositioning the flexible display to an extended position:

determining the second user interface having the second size by identifying an extending portion of the flexible display that is not positioned on the front side but becomes positioned on the front side of the device housing in the extended position; and

delaying presenting one or more portions of user interface content and assigning corresponding one or more portion of user interface controls to the extending portion of the flexible display until the flexible display is repositioned to the extended position.

20. The computer program product of claim 17, wherein the program code enables the electronic device to provide functionality of:

determining a display refresh rate of the visual output layer;

determining a touch refresh rate of the touch input layer; and

maintaining presentation of the user interface content on the visual output layer and maintains assignment of each user interface controls further in response to determining that the display refresh rate is slower than the touch refresh rate that results in a location offset during repositioning of the flexible display.

21. An electronic device comprising:

a housing assembly comprising first and second housings coupled at a hinge to pivot between a fully folded position and fully unfolded position;

a sensor configured to detect a change in a pivot position of the housing assembly;

at least one display coupled to the housing assembly and comprising a visual output layer and a touch input layer; and

a controller communicatively coupled to the pivot sensor and the at least one display, and which:

presents user interface content via the at least one display; and

in response to determining, based on input received from the sensor, that the pivot position of the housing assembly is changing, ignores touch inputs to one or more user interface controls assigned to the touch input layer and corresponding to the user interface content during the change of the pivot position.

22. The electronic device of claim 21, wherein the controller:

detects the touch inputs; and

enables a response by the electronic device to the touch inputs corresponding to the user interface content, in response to determining that the pivot position of the housing assembly is not changing while a touch input is detected.

23. The electronic device of claim 22, further comprising:

a memory communicatively coupled to the controller and that stores at least one application;

executes the at least one application to generate the user interface content and the corresponding one more user interface controls; and

enables the response by the electronic device to the touch inputs to the one or more user interface controls by relaying the touch inputs to application functions executing in the controller.

24. The electronic device of claim 21, wherein:

the at least one display comprises a front display on an inner side of at least one of one of the first housing and the second housing, the front display hidden by an opposing one of the first housing and the second housing while the electronic device is in the fully folded position and exposed for user interfacing and content presentation while the electronic device is in the fully unfolded position; and

in ignoring the touch inputs, the controller:

delays activating the front display in response to determining that the pivot position is transitioning from the fully folded position to the fully unfolded position; and

deactivates the front display in response to determining that the pivot position is transitioning from the fully unfolded position to the fully folded position.

25. The electronic device of claim 21, wherein:

the housing assembly is configured to remain at an intermediate pivot position between the fully folded position and the fully unfolded position for positioning the electronic device in a stand https://mail031-1.exch031.serverdata.net/?_task=mail&_action=compose&_id=205193982164c2b3cc8dffa&_search=ff6cd2d9a40100cfd4dcdf5826487783or tent orientation;

the at least one display comprises a front display on an inner side of at least one of one of the first housing and the second housing, the front display hidden by an opposing one of the first housing and the second housing while the electronic device is in the fully folded position and exposed for user interfacing and content presentation while the electronic device is in the fully unfolded position; and

in ignoring the touch inputs, the controller:

delays activating the front display in response to determining that the pivot position is transitioning from the fully folded position to the intermediate pivot position; and

deactivates the front display in response to determining that the pivot position is transitioning from the intermediate pivot position to the fully folded position.

26. The electronic device of claim 21, wherein the at least one display comprises a back display exposed on an outer side of one of the first housing and the second housing.

27. The electronic device of claim 21, wherein the controller presents an indication on the at least one display that the touch inputs are being ignored in response to determining, based on sensor inputs received from the sensor, that the pivot position of the housing assembly is changing.

28. The electronic device of claim 21, wherein the sensor is one of a position sensor, a proximity sensor, an accelerometer, and a motion sensor.

29. A method comprising:

monitoring a sensor configured to detect a change in a pivot position of a housing assembly of an electronic device, the housing assembly comprising first and second housings coupled at a hinge to pivot between a fully folded position and fully unfolded position;

presenting user interface content via at least one display coupled to the housing assembly and comprising a visual output layer and a touch input layer; and

in response to determining, based on input received from the sensor, that the pivot position of the housing assembly is changing, ignoring touch inputs to one or more user interface controls assigned to the touch input layer and corresponding to the user interface content during the change of the pivot position.

30. The method of claim 29, further comprising:

detecting the touch inputs; and

enabling a response by the electronic device to the touch inputs corresponding to the user interface content, in response to determining that the pivot position of the housing assembly is not changing while a touch input is detected.

31. The method of claim 30, further comprising:

executing in a controller at least one application stored in a memory of the electronic device to generate the user interface content and the corresponding one more user interface controls; and

enabling the response by the electronic device to the touch inputs to the one or more user interface controls by relaying the touch inputs to application functions executing in the controller.

32. The method of claim 29, wherein the at least one display comprises a front display on an inner side at least one of one of the first housing and the second housing, the front display hidden by an opposing one of the first housing and the second housing while the electronic device is in the fully folded position and exposed for user interfacing and content presentation while the electronic device is in the fully unfolded position, and the method further comprises ignoring the touch inputs by:

delaying activating the front display in response to determining that the pivot position is transitioning from the fully folded position to the fully unfolded position; and

deactivating the front display in response to determining that the pivot position is transitioning from the fully unfolded position to the fully folded position.

33. The method of claim 29, wherein:

the housing assembly is configured to remain at an intermediate pivot position between the fully folded position and the fully unfolded position for positioning the electronic device in a stand or tent orientation; and

the at least one display comprises a front display on an inner side at least one of one of the first housing and the second housing, the front display hidden by an opposing one of the first housing and the second housing while the electronic device is in the fully folded position and

exposed for user interfacing and content presentation while the electronic device is in the fully unfolded position, and the method further comprises ignoring the touch inputs by:

delaying activating the front display in response to determining that the pivot position is transitioning from the fully folded position to the intermediate pivot position; and

deactivating the front display in response to determining that the pivot position is transitioning from the intermediate pivot position to the fully folded position.

34. The method of claim 29, further comprising presenting the user interface content via the at least one display comprising a back display exposed on an outer side of one of the first housing and the second housing.

35. The method of claim 29, further comprising presenting an indication on the at least one display that the touch inputs are being ignored in response to determining, based on sensor inputs received from the sensor, that the pivot position of the housing assembly is changing.

36. The method of claim 29, further comprising monitoring the sensor that is one of a position sensor, a proximity sensor, an accelerometer, and a motion sensor.

37. A computer program product comprising:

a computer readable storage device; and

program code on the computer readable storage device that when executed by a processor associated with an electronic device, the program code enables the electronic device to provide functionality of:

monitoring a sensor configured to detect a change in a pivot position of a housing assembly comprising first and second housings coupled at a hinge to pivot between a fully folded position and fully unfolded position;

presenting user interface content via at least one display coupled to the housing assembly and comprising a visual output layer and a touch input layer; and

in response to determining, based on input received from the sensor, that the pivot position of the housing assembly is changing, ignoring touch inputs to one or more user interface controls assigned to the touch input layer and corresponding to the user interface content during the change of the pivot position.

38. The computer program product of claim 37, wherein the program code enables the electronic device to provide functionality of:

detecting the touch inputs; and

enabling a response by the electronic device to the touch inputs corresponding to the user interface content, in response to determining that the pivot position of the housing assembly is not changing while a touch input is detected.

39. The computer program product of claim 37, wherein the program code enables the electronic device to provide functionality of:

executing in a controller at least one application stored in a memory of the electronic device to generate the user interface content and the corresponding one more user interface controls; and

enabling the response by the electronic device to the touch inputs to the one or more user interface controls by relaying the touch inputs to the application functions executing in the controller.

40. The computer program product of claim 37, wherein the at least one display comprises a front display on an inner side at least one of one of the first housing and the second housing, the front display hidden by an opposing one of the first housing and the second housing while the electronic device is in the fully folded position and exposed for user interfacing and content presentation while the electronic device is in the fully unfolded position, and the program code enables the electronic device to provide functionality of:

delaying activating the front display in response to determining that the pivot position is transitioning from the fully folded position to the fully unfolded position; and

deactivating the front display in response to determining that the pivot position is transitioning from the fully unfolded position to the fully folded position.

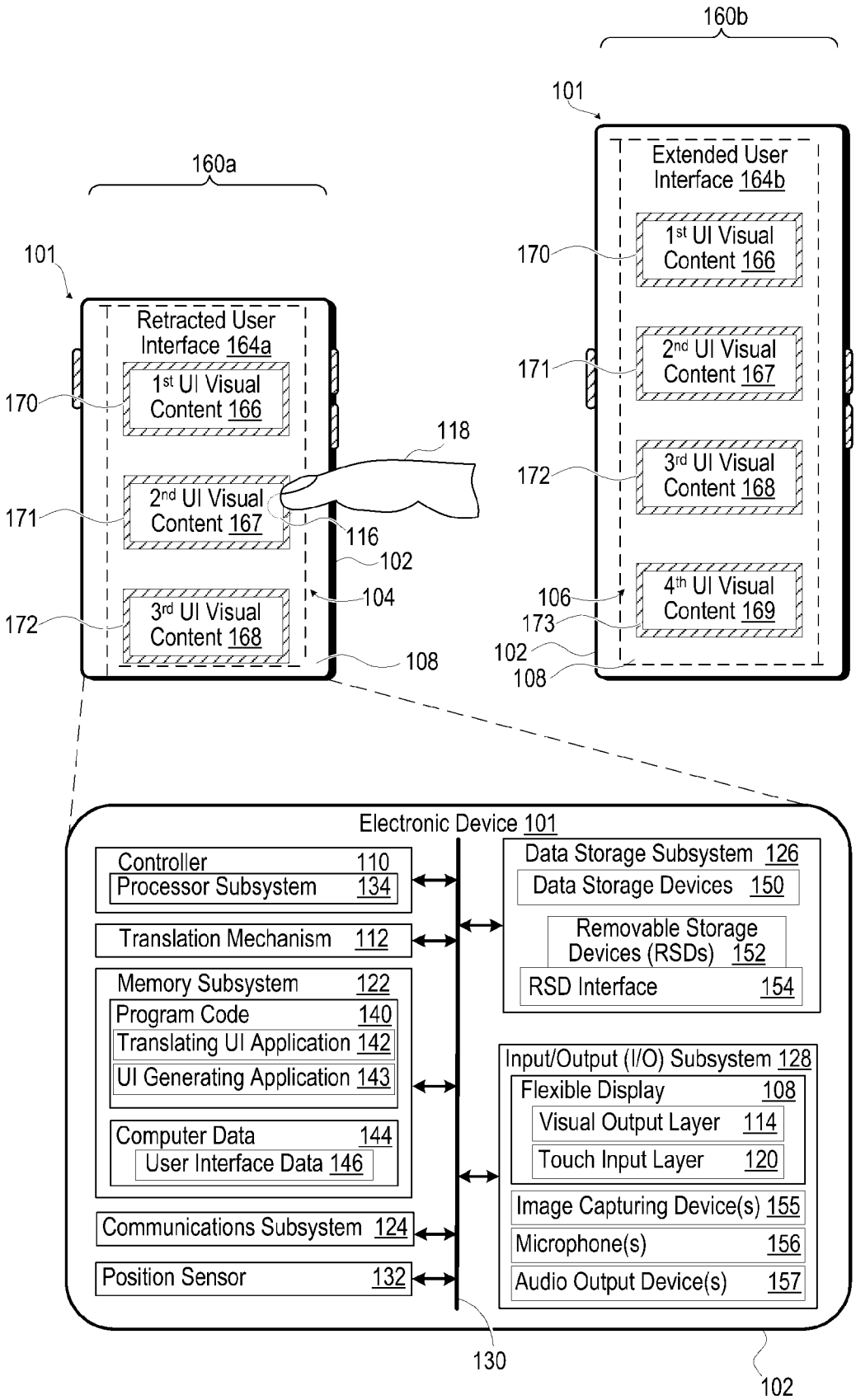
160b
101
Extended User Interface 164b
1st UI Visual Content 166
2nd UI Visual Content 167
3rd UI Visual Content 168
4th UI Visual Content 169
170
171
172
173
106
102
108
160a
101
Retracted User Interface 164a
1st UI Visual Content 166
2nd UI Visual Content 167
3rd UI Visual Content 168
170
171
172
118
116
102
104
108
Electronic Device 101
Controller 110
Processor Subsystem 134
Translation Mechanism 112
Memory Subsystem 122
Program Code 140
Translating UI Application 142
UI Generating Application 143
Computer Data 144
User Interface Data 146
Communications Subsystem 124
Position Sensor 132
Data Storage Subsystem 126
Data Storage Devices 150
Removable Storage Devices (RSDs) 152
RSD Interface 154
Input/Output (I/O) Subsystem 128
Flexible Display 108
Visual Output Layer 114
Touch Input Layer 120
Image Capturing Device(s) 155
Microphone(s) 156
Audio Output Device(s) 157
130
102

FIG. 1

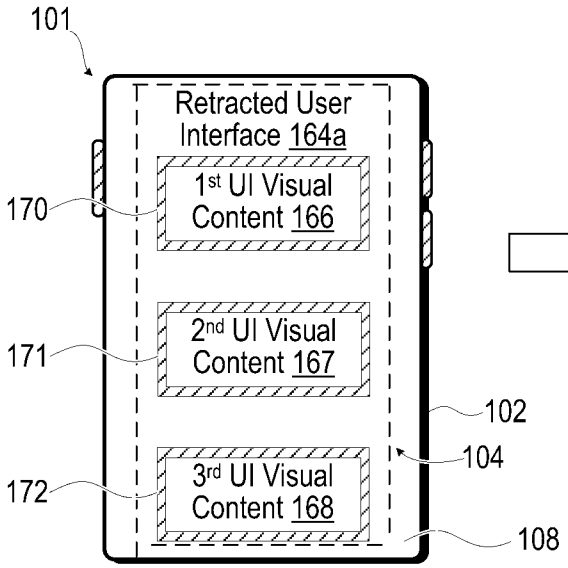

FIG. 2A

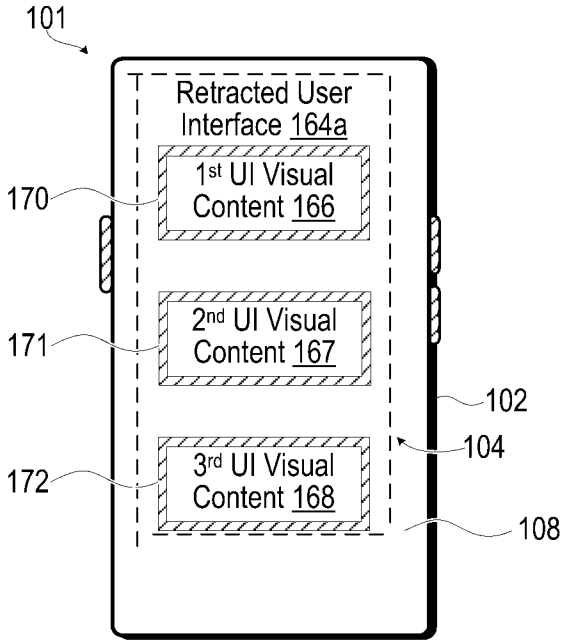

FIG. 2B

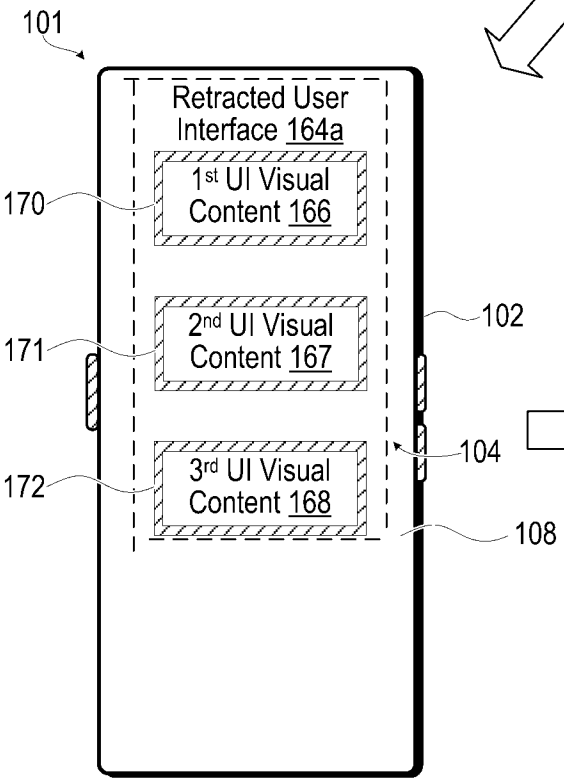

FIG. 2C

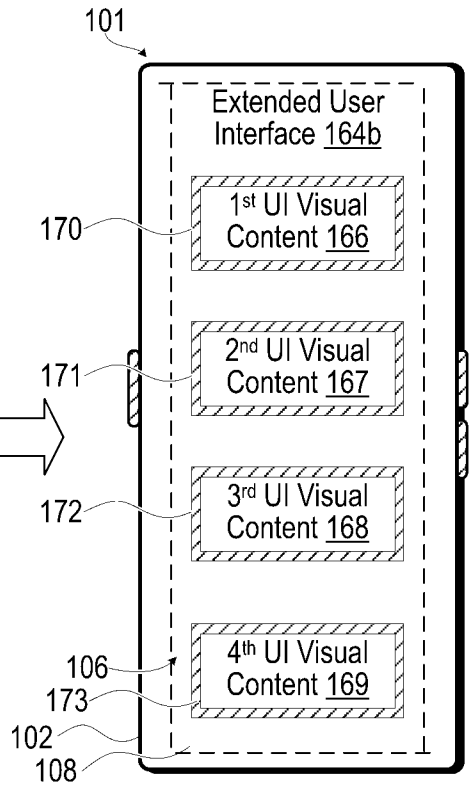

FIG. 2D

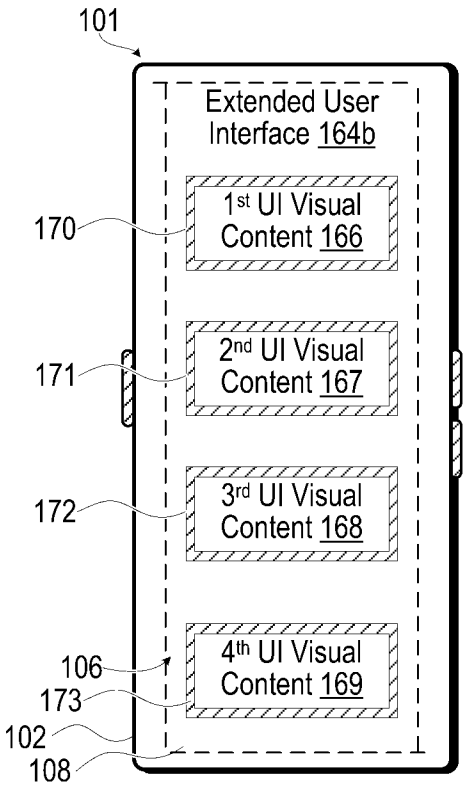

FIG. 2E

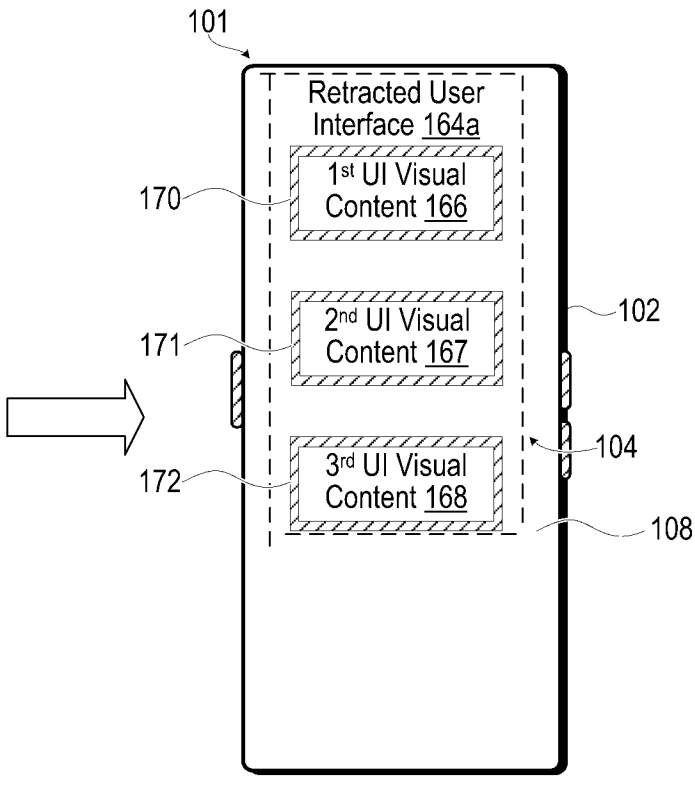

FIG. 2F

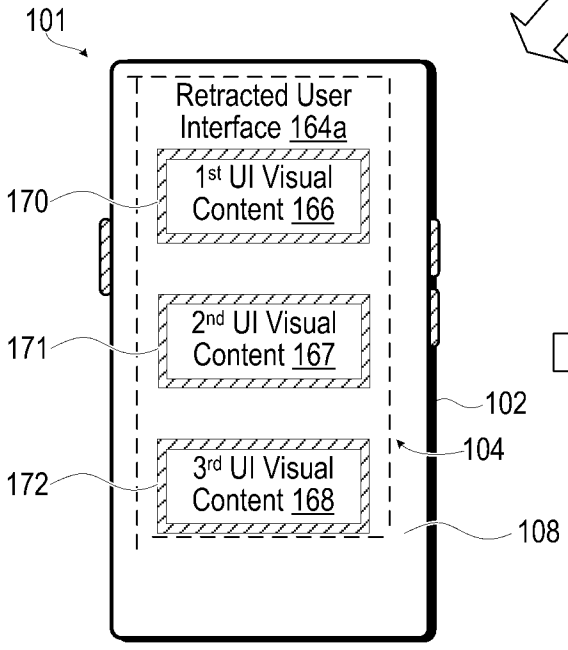

FIG. 2G

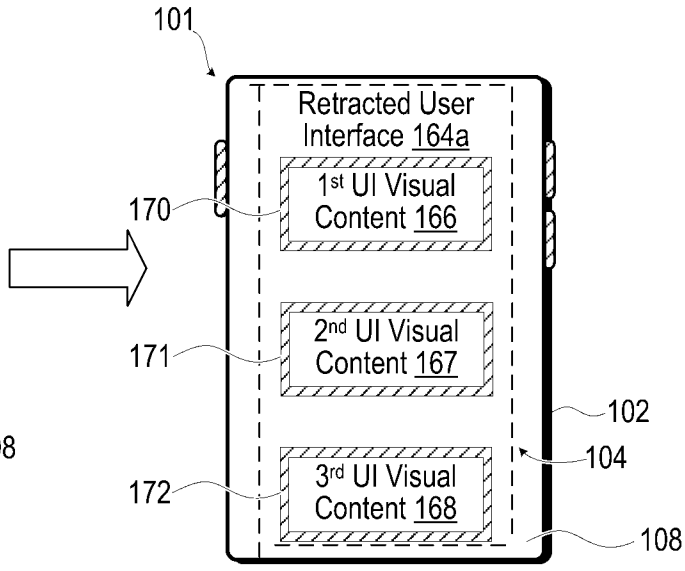

FIG. 2H

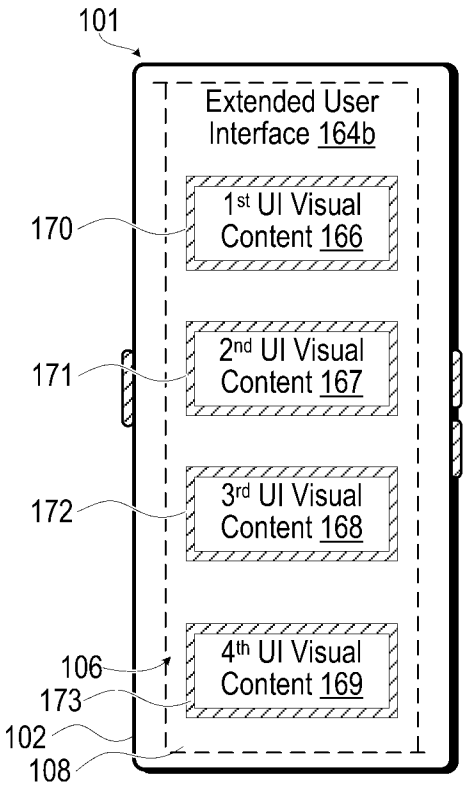

FIG. 3A

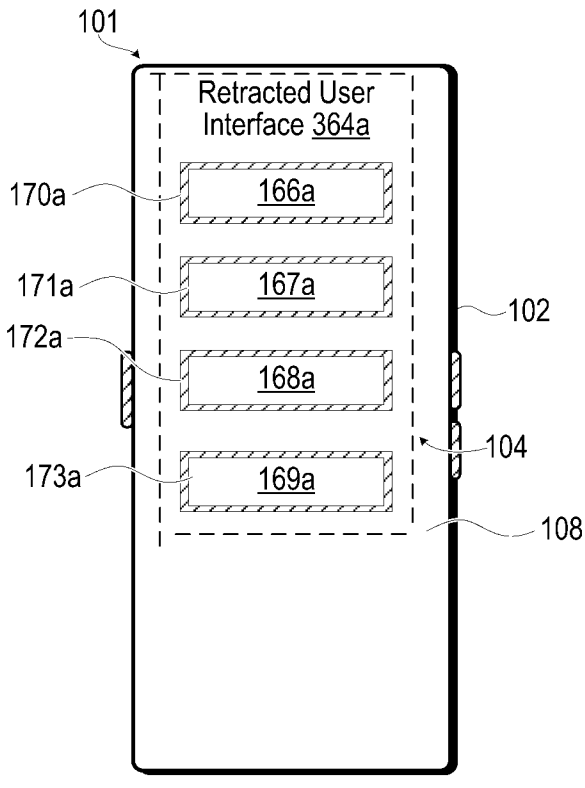

FIG. 3B

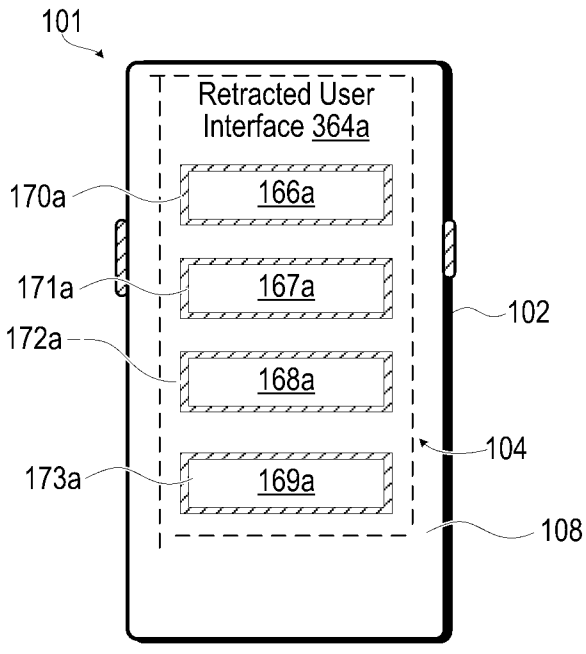

FIG. 3C

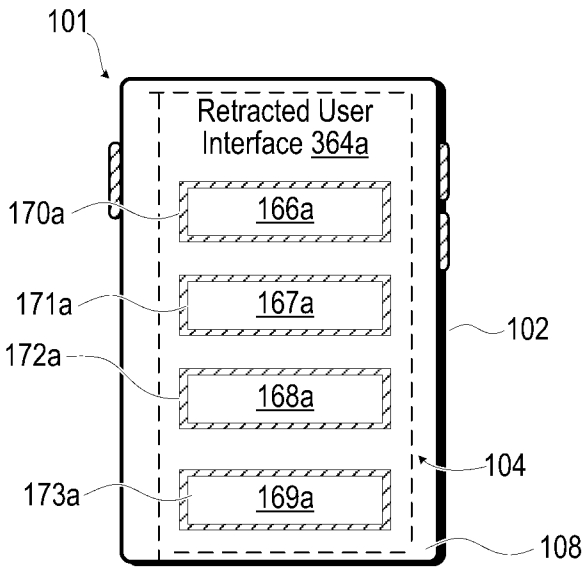

FIG. 3D

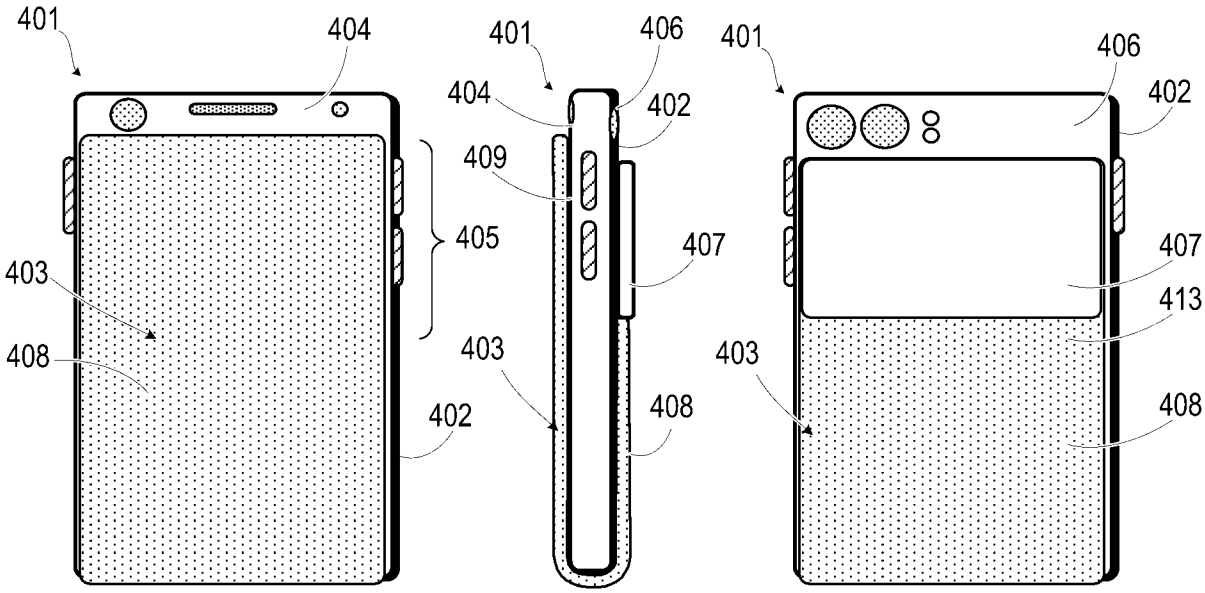

FIG. 4A FIG. 4B FIG. 4C

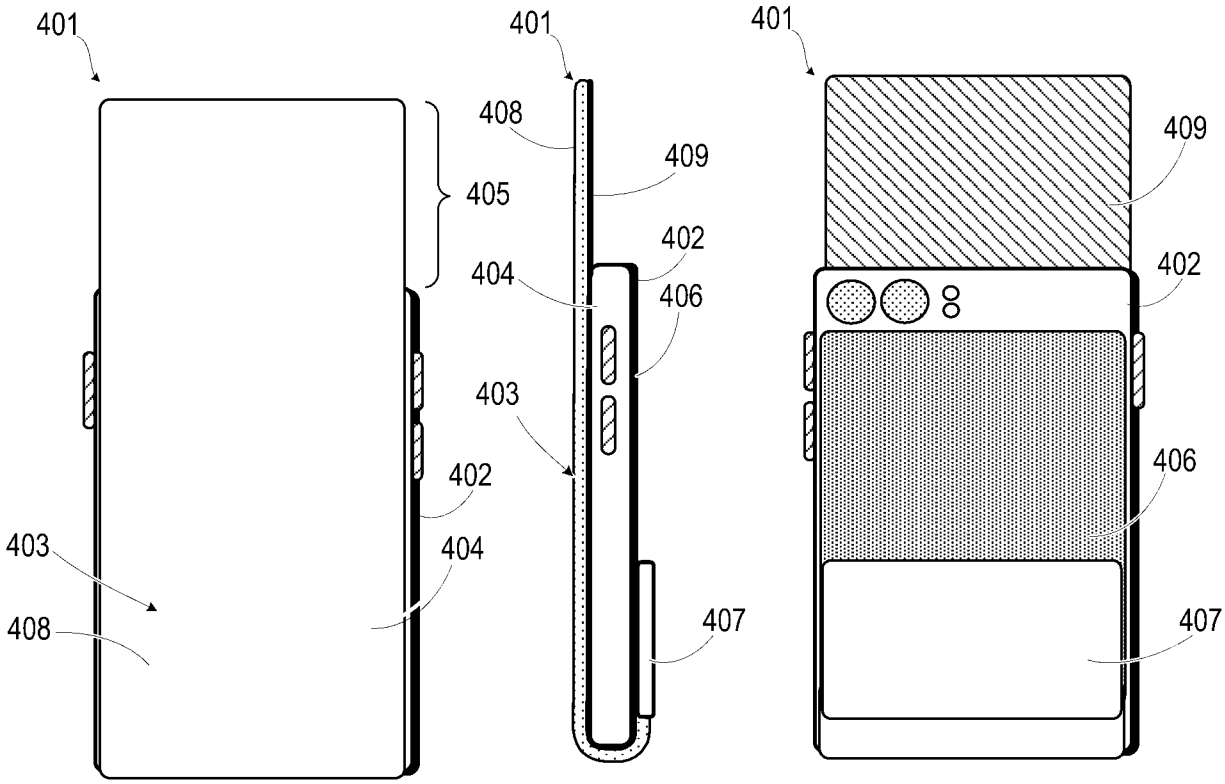

FIG. 5A FIG. 5B FIG. 5C

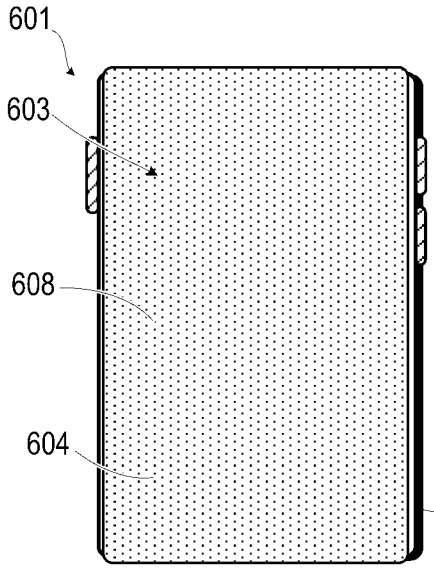

FIG. 6A

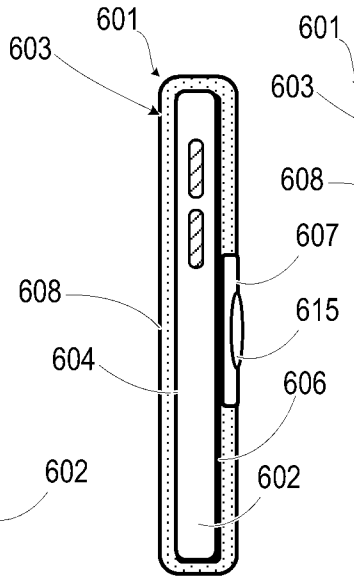

FIG. 6B

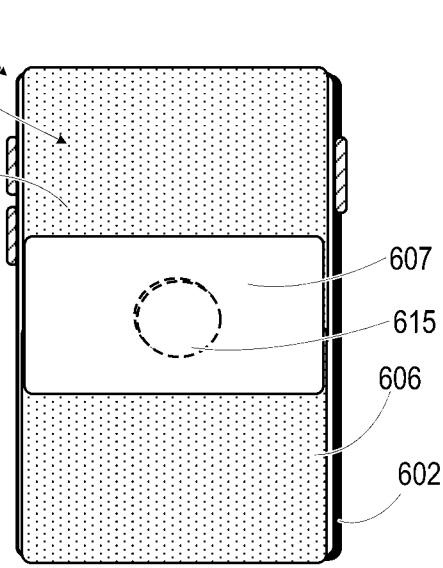

FIG. 6C

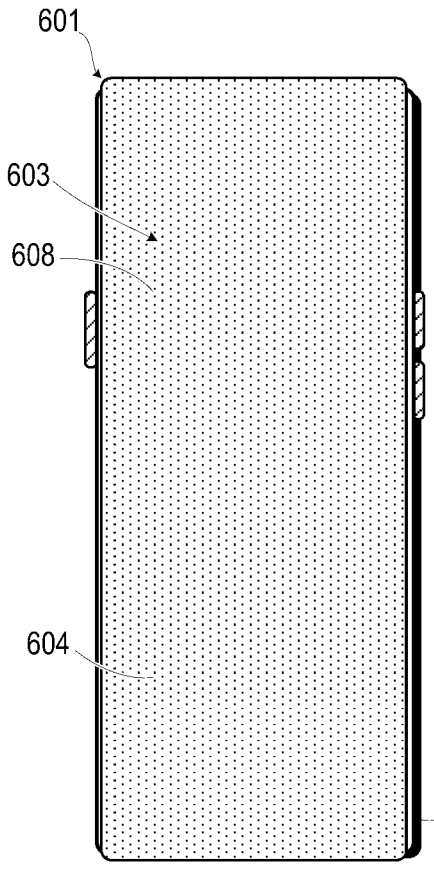

FIG. 7A

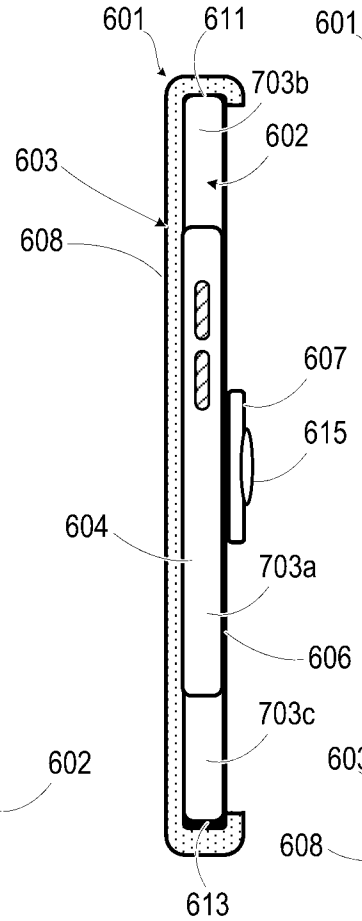

FIG. 7B

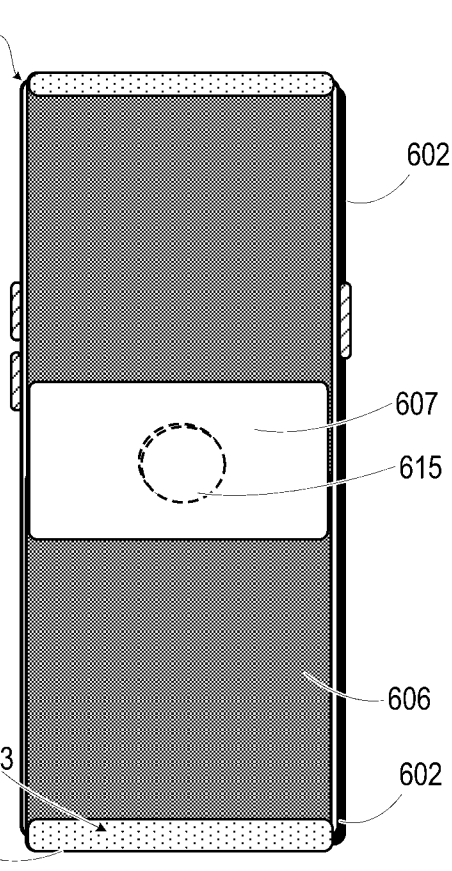

FIG. 7C

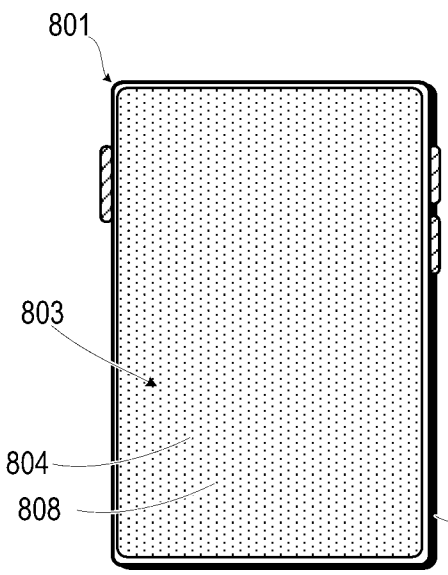

FIG. 8A

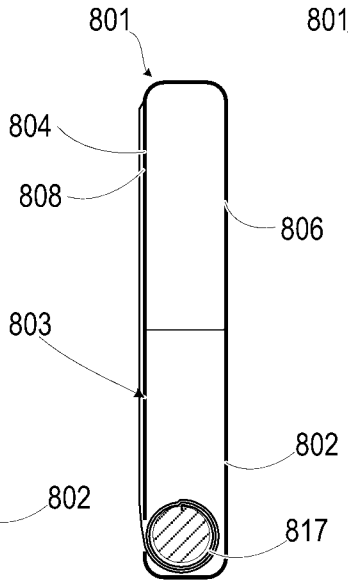

FIG. 8B

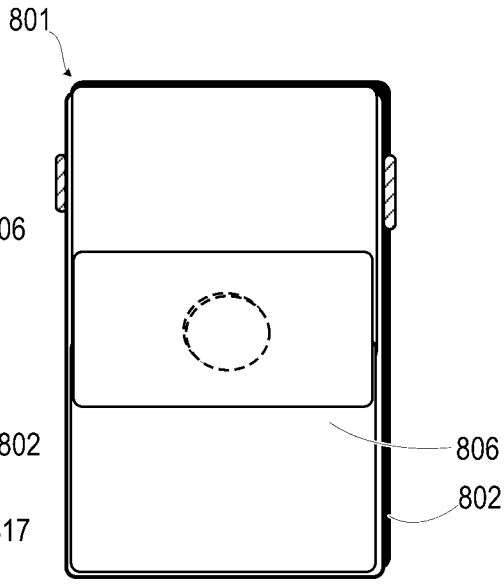

FIG. 8C

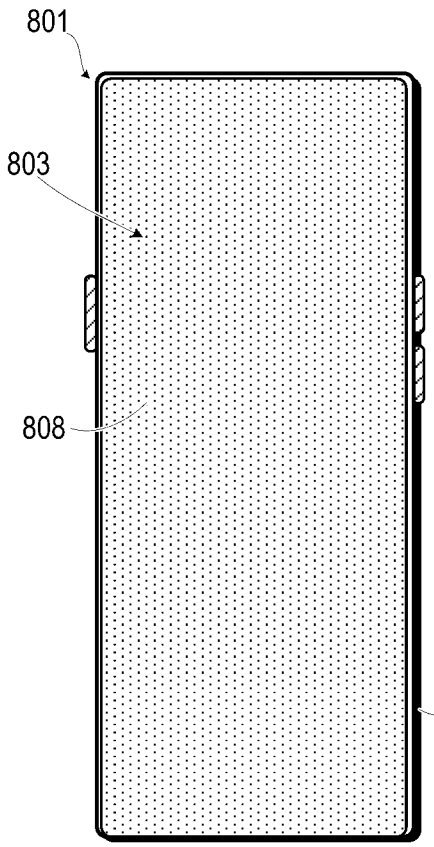

FIG. 9A

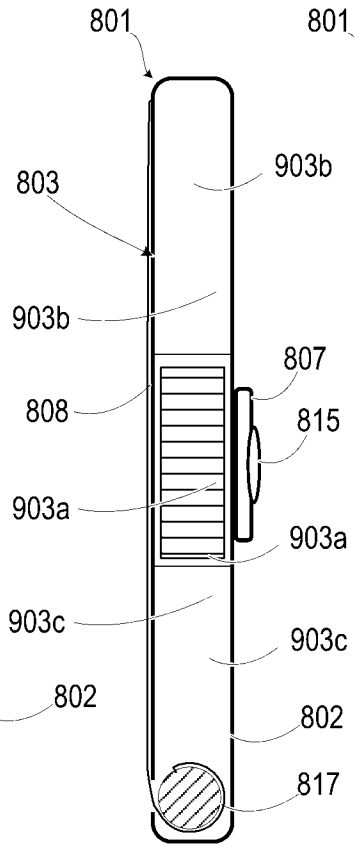

FIG. 9B

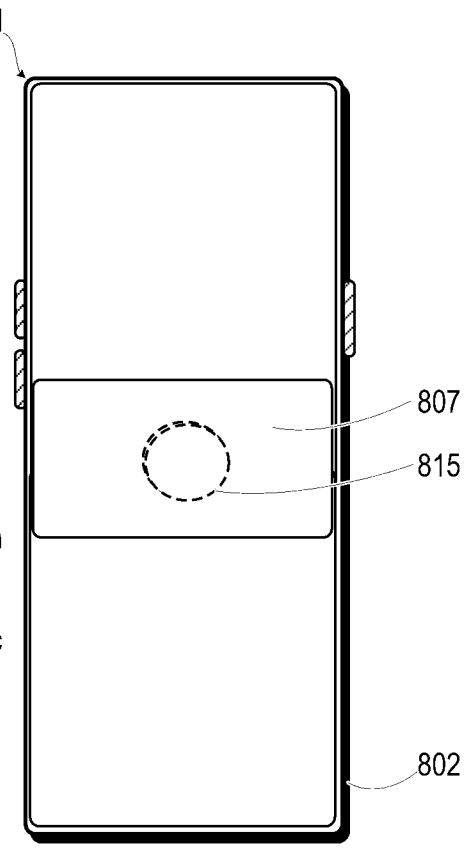

FIG. 9C

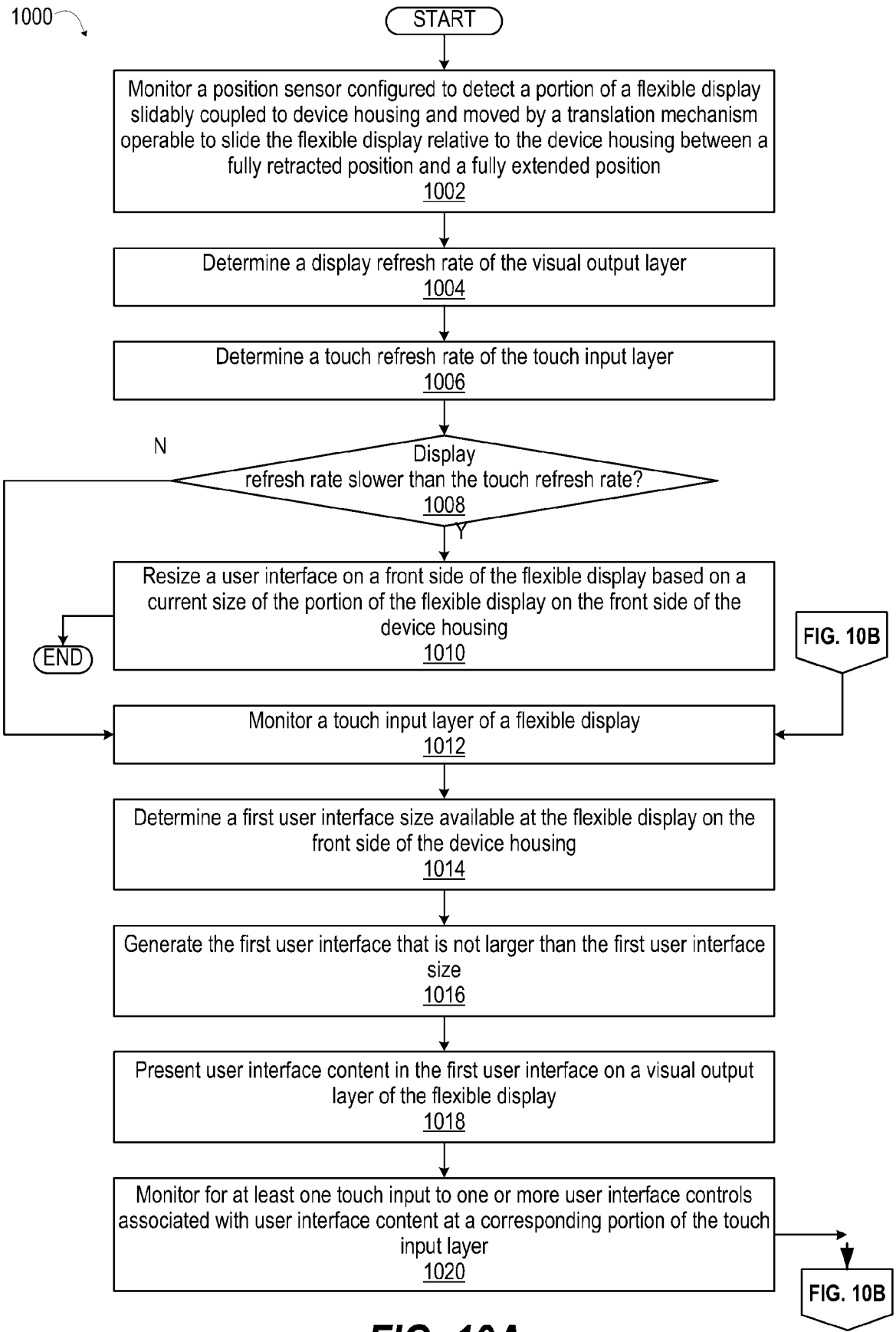
1000
START
Monitor a position sensor configured to detect a portion of a flexible display slidably coupled to device housing and moved by a translation mechanism operable to slide the flexible display relative to the device housing between a fully retracted position and a fully extended position
1002
Determine a display refresh rate of the visual output layer
1004
Determine a touch refresh rate of the touch input layer
1006
N
Display refresh rate slower than the touch refresh rate?
1008
Y
Resize a user interface on a front side of the flexible display based on a current size of the portion of the flexible display on the front side of the device housing
1010
END
FIG. 10B
Monitor a touch input layer of a flexible display
1012
Determine a first user interface size available at the flexible display on the front side of the device housing
1014
Generate the first user interface that is not larger than the first user interface size
1016
Present user interface content in the first user interface on a visual output layer of the flexible display
1018
Monitor for at least one touch input to one or more user interface controls associated with user interface content at a corresponding portion of the touch input layer
1020
FIG. 10B

FIG. 10A

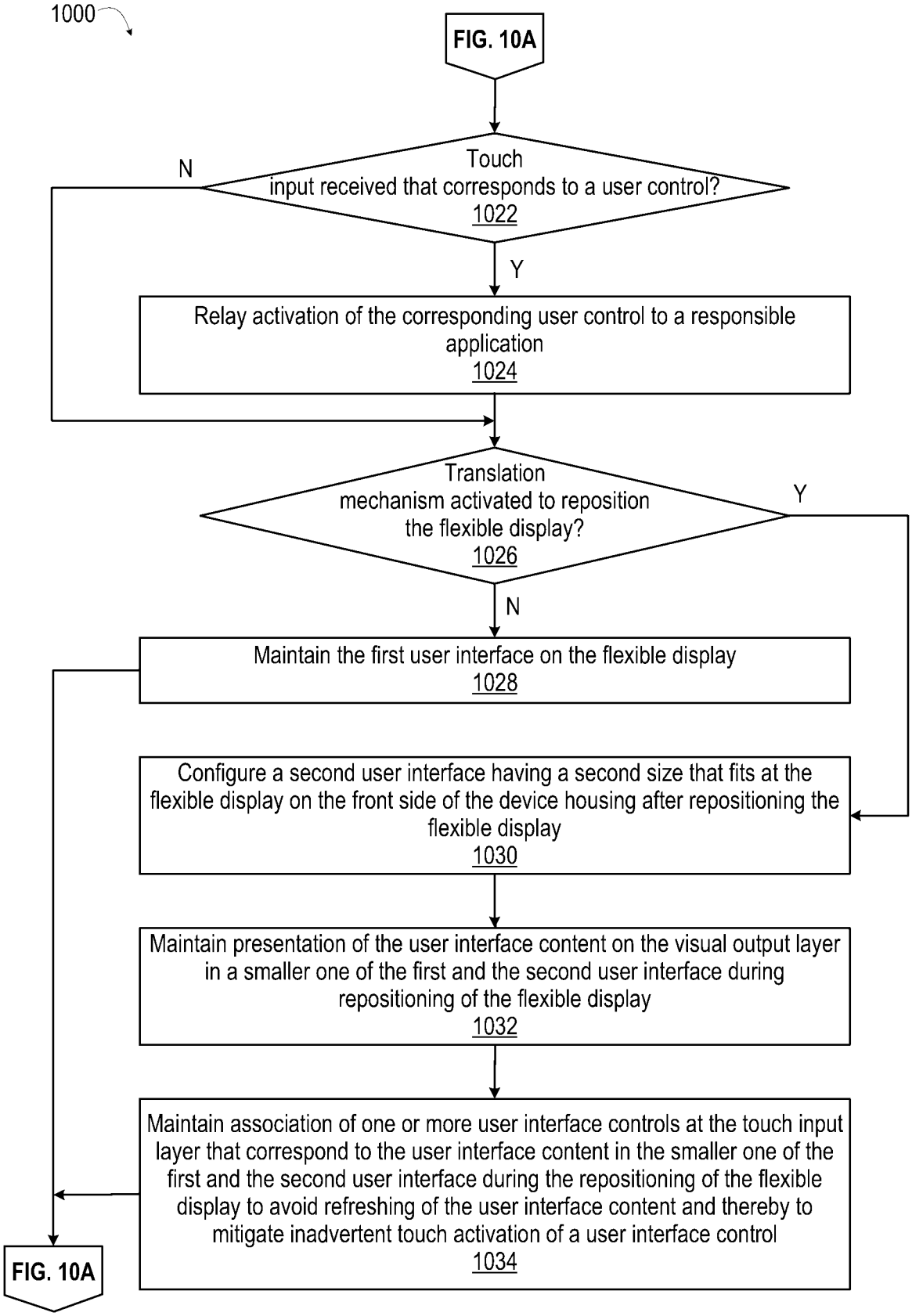
1000
FIG. 10A
Touch input received that corresponds to a user control? 1022
N
Y
Relay activation of the corresponding user control to a responsible application 1024
Translation mechanism activated to reposition the flexible display? 1026
Y
N
Maintain the first user interface on the flexible display 1028
Configure a second user interface having a second size that fits at the flexible display on the front side of the device housing after repositioning the flexible display 1030
Maintain presentation of the user interface content on the visual output layer in a smaller one of the first and the second user interface during repositioning of the flexible display 1032
Maintain association of one or more user interface controls at the touch input layer that correspond to the user interface content in the smaller one of the first and the second user interface during the repositioning of the flexible display to avoid refreshing of the user interface content and thereby to mitigate inadvertent touch activation of a user interface control 1034
FIG. 10A

FIG. 10B

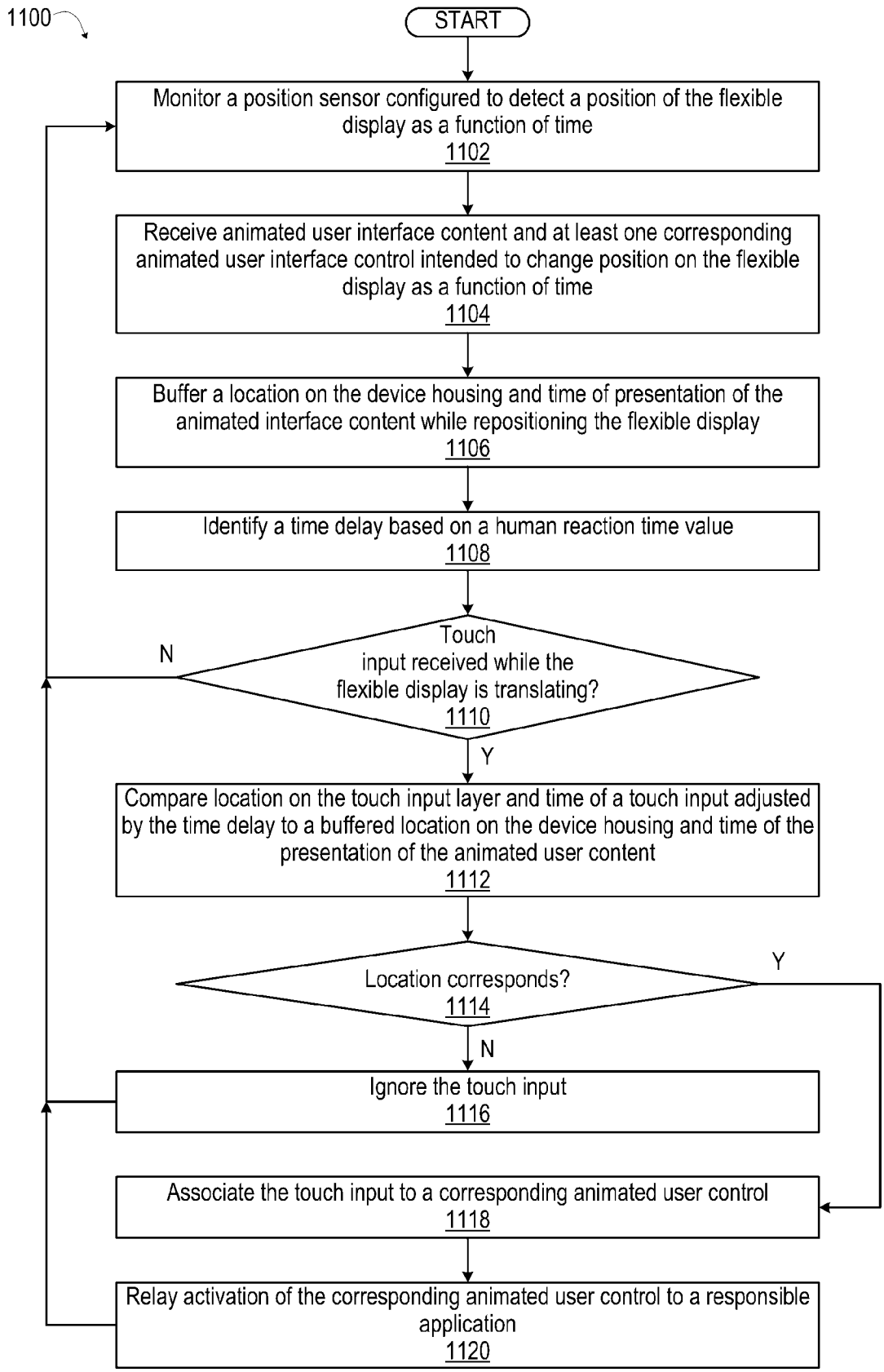
1100
START
Monitor a position sensor configured to detect a position of the flexible display as a function of time
1102
Receive animated user interface content and at least one corresponding animated user interface control intended to change position on the flexible display as a function of time
1104
Buffer a location on the device housing and time of presentation of the animated interface content while repositioning the flexible display
1106
Identify a time delay based on a human reaction time value
1108
Touch input received while the flexible display is translating?
1110
N
Y
Compare location on the touch input layer and time of a touch input adjusted by the time delay to a buffered location on the device housing and time of the presentation of the animated user content
1112
Location corresponds?
1114
Y
N
Ignore the touch input
1116
Associate the touch input to a corresponding animated user control
1118
Relay activation of the corresponding animated user control to a responsible application
1120

FIG. 11

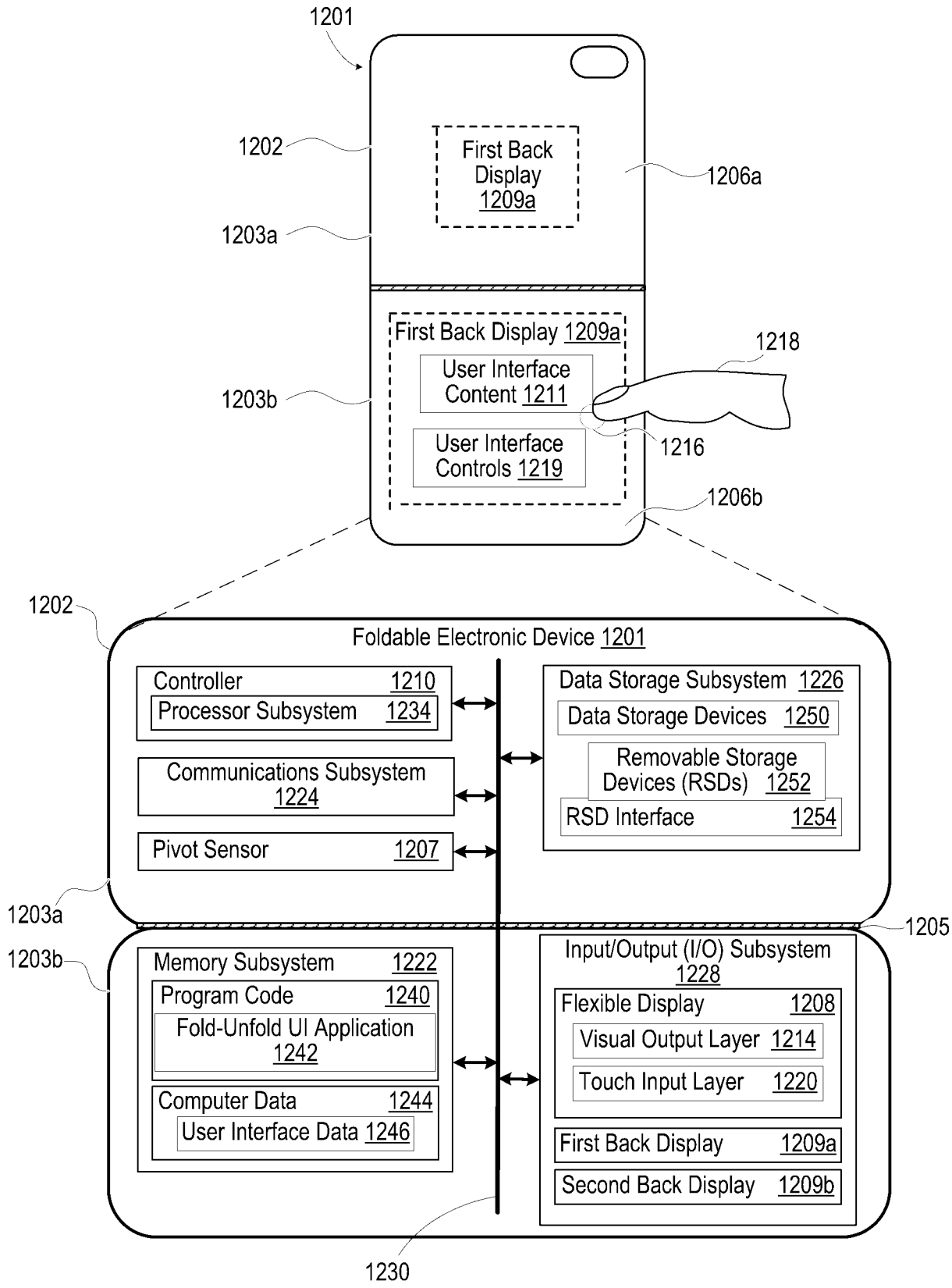
1201
1202
First Back Display 1209a
1206a
1203a
First Back Display 1209a
User Interface Content 1211
1218
1203b
User Interface Controls 1219
1216
1206b
1202
Foldable Electronic Device 1201
Controller 1210
Processor Subsystem 1234
Communications Subsystem 1224
Pivot Sensor 1207
Data Storage Subsystem 1226
Data Storage Devices 1250
Removable Storage Devices (RSDs) 1252
RSD Interface 1254
1203a
1205
1203b
Memory Subsystem 1222
Program Code 1240
Fold-Unfold UI Application 1242
Computer Data 1244
User Interface Data 1246
Input/Output (I/O) Subsystem 1228
Flexible Display 1208
Visual Output Layer 1214
Touch Input Layer 1220
First Back Display 1209a
Second Back Display 1209b
1230

FIG. 12

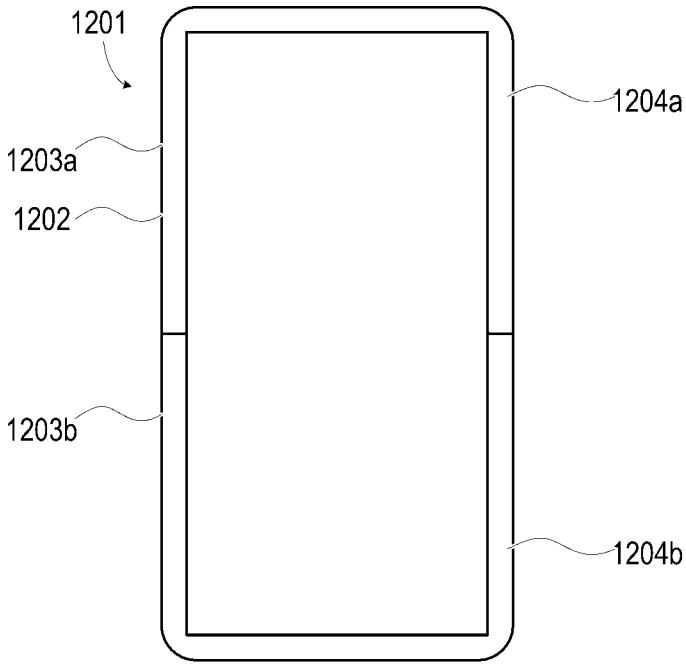

FIG. 13A

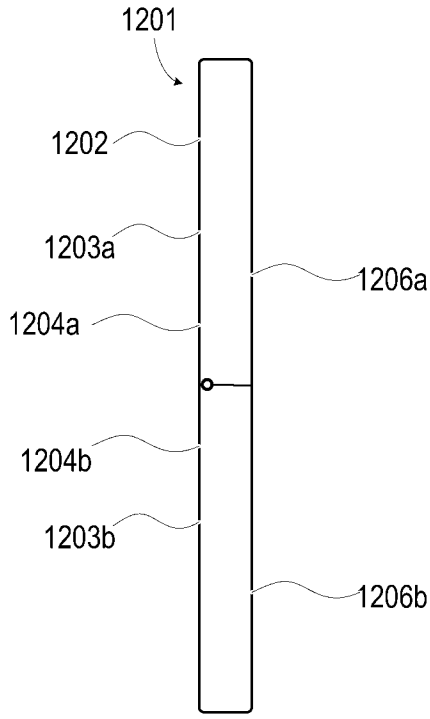

FIG. 13B

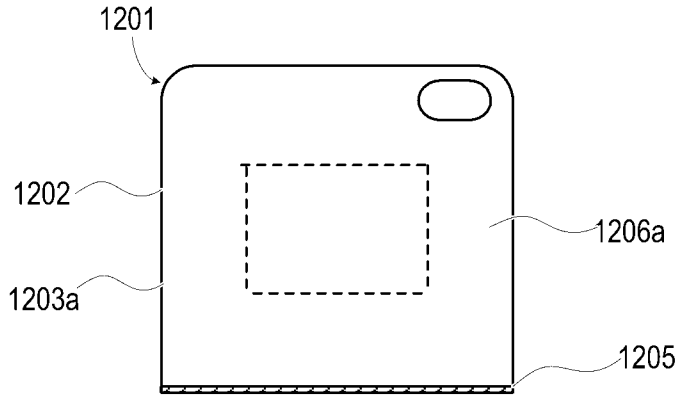

FIG. 14A

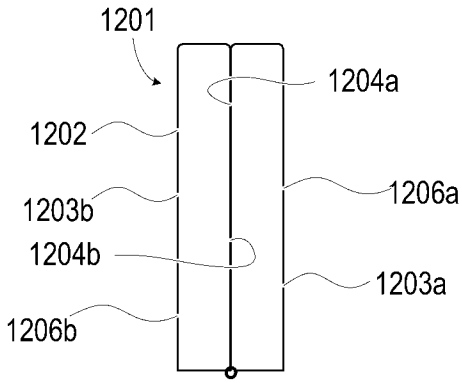

FIG. 14B

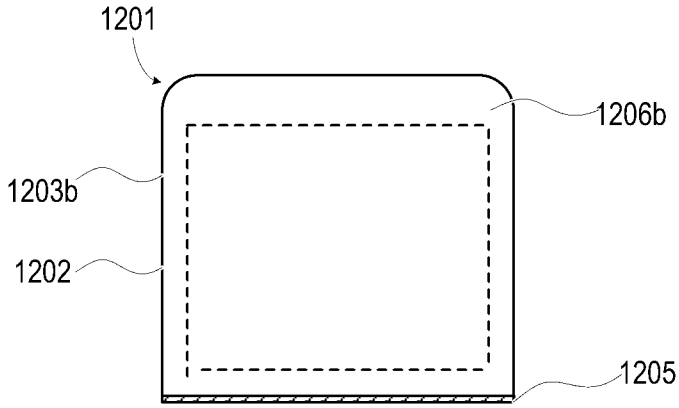

FIG. 15

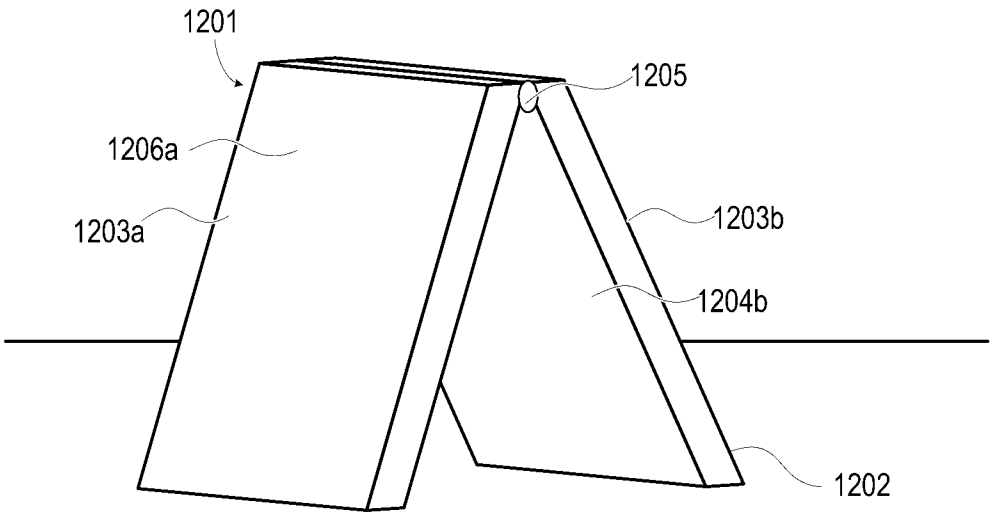
1201
1205
1206a
1203a
1203b
1204b
1202

FIG. 16

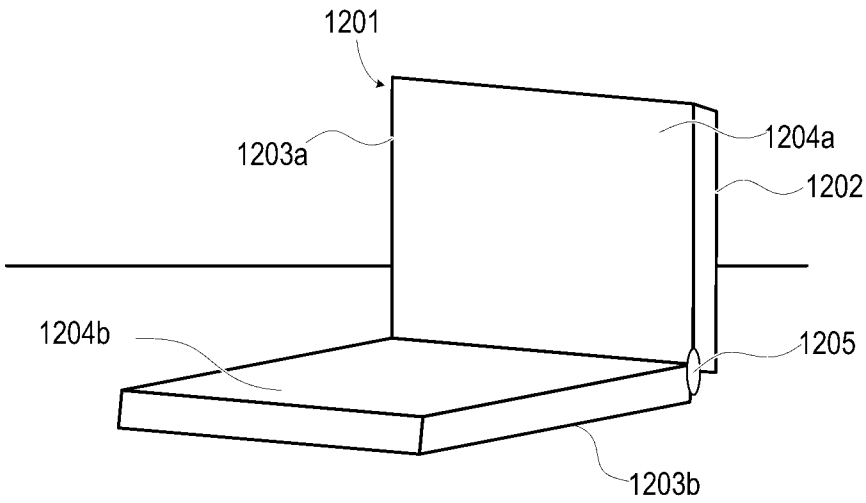
1201
1203a
1204a
1202
1204b
1205
1203b

FIG. 17

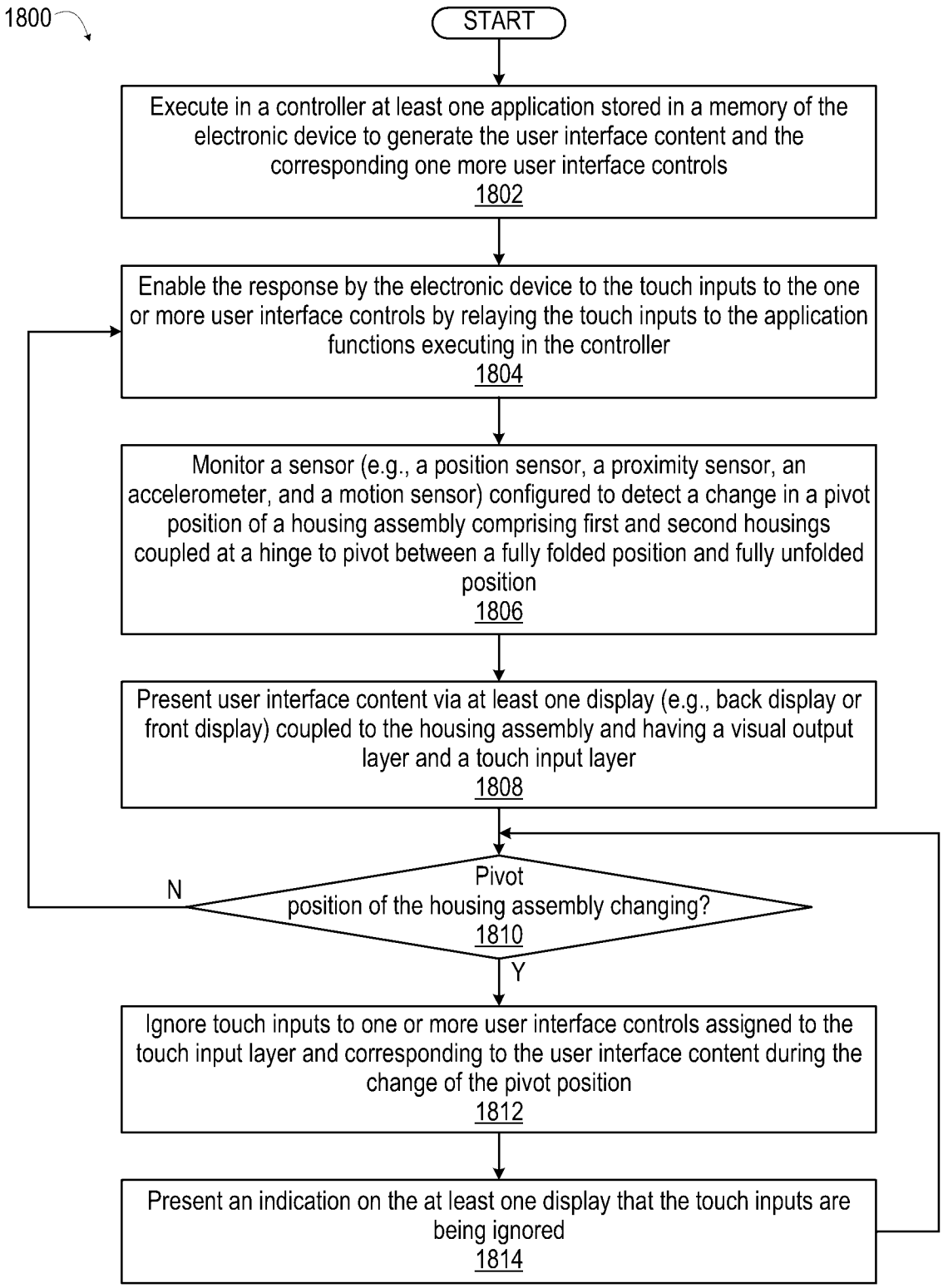
1800
START
Execute in a controller at least one application stored in a memory of the electronic device to generate the user interface content and the corresponding one more user interface controls
1802
Enable the response by the electronic device to the touch inputs to the one or more user interface controls by relaying the touch inputs to the application functions executing in the controller
1804
Monitor a sensor (e.g., a position sensor, a proximity sensor, an accelerometer, and a motion sensor) configured to detect a change in a pivot position of a housing assembly comprising first and second housings coupled at a hinge to pivot between a fully folded position and fully unfolded position
1806
Present user interface content via at least one display (e.g., back display or front display) coupled to the housing assembly and having a visual output layer and a touch input layer
1808
Pivot position of the housing assembly changing?
1810
N
Y
Ignore touch inputs to one or more user interface controls assigned to the touch input layer and corresponding to the user interface content during the change of the pivot position
1812
Present an indication on the at least one display that the touch inputs are being ignored
1814

FIG. 18

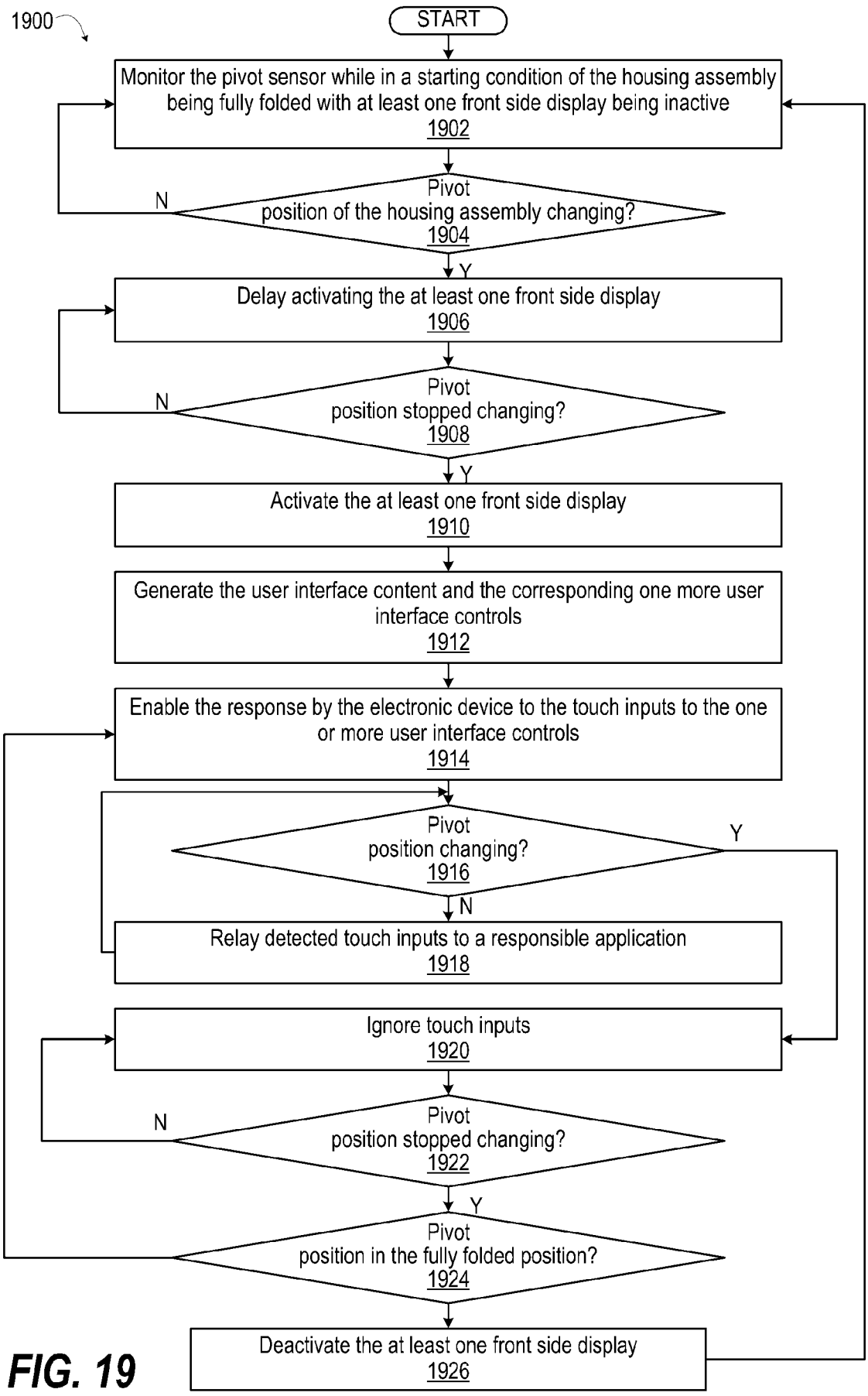
1900
START
Monitor the pivot sensor while in a starting condition of the housing assembly being fully folded with at least one front side display being inactive
1902
Pivot position of the housing assembly changing?
1904
N
Y
Delay activating the at least one front side display
1906
Pivot position stopped changing?
1908
N
Y
Activate the at least one front side display
1910
Generate the user interface content and the corresponding one more user interface controls
1912
Enable the response by the electronic device to the touch inputs to the one or more user interface controls
1914
Pivot position changing?
1916
Y
N
Relay detected touch inputs to a responsible application
1918
Ignore touch inputs
1920
Pivot position stopped changing?
1922
N
Y
Pivot position in the fully folded position?
1924
Deactivate the at least one front side display
1926

FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/111581

A. CLASSIFICATION OF SUBJECT MATTER

H04M1/72409(2021.01)i; G06F3/041(2006.01)i

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: H04M,G06F

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

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

CNTXT,ENTXTC,VCN,VEN,CNKI,IEEE: flexible,screen,display,touch,expansion,unfold+,extension,extend+,retract+,fold+, mov+,position,ignor+,prevent+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 113778252 A (OPPO GUANGDONG MOBILE TELECOMMUNICATIONS CO., LTD.) 10 December 2021 (2021-12-10) description paragraphs [0039]-[0067], figures 1-9	1-40
A	US 2020264657 A1 (SAMSUNG ELECTRONICS CO., LTD.) 20 August 2020 (2020-08-20) the whole document	1-40
A	US 2023027714 A1 (SAMSUNG ELECTRONICS CO., LTD.) 26 January 2023 (2023-01-26) the whole document	1-40
A	WO 2021057699 A1 (HUAWEI TECHNOLOGIES CO., LTD.) 01 April 2021 (2021-04-01) the whole document	1-40
A	WO 2021223560 A1 (HUAWEI TECHNOLOGIES CO., LTD.) 11 November 2021 (2021-11-11) the whole document	1-40

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
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Date of the actual completion of the international search	Date of mailing of the international search report
26 December 2023	**02 January 2024**
Name and mailing address of the ISA/CN **CHINA NATIONAL INTELLECTUAL PROPERTY ADMINISTRATION** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China**	Authorized officer **LIU,LiuQun** Telephone No. **(+86) 010-53961723**

INTERNATIONAL SEARCH REPORT
Information on patent family members

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