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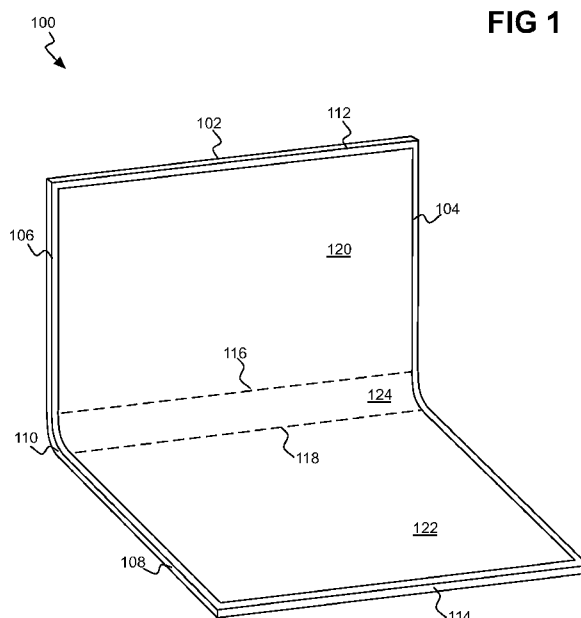
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(57) Abstract: A computing device includes a housing, a hinge, a flexible touchscreen, and logic. The housing has a first part and a second part, and the hinge permits the first part to fold relative to the second part. The flexible touchscreen extends from the first part to the second part of the housing over the hinge. The logic operates the touchscreen in a bent mode in which the touchscreen has a first flat zone corresponding to the first part of the housing, a second flat zone corresponding to the second part of the housing, and a third curved zone corresponding to the hinge. In the bent mode, the logic operates a user interface on the touchscreen differently within the first, second, and third zones of the touchscreen.

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COMPUTING DEVICE HAVING FLEXIBLE TOUCHSCREEN OPERABLE IN BENT MODE

BACKGROUND

[0001] Computing devices that end users employ have a variety of

5 different form factors. Traditionally, computing devices like computers have been available as desktop computers that are not easily transported from location to location. However, more recently portable computing devices like laptop and notebook computers have eclipsed desktop computers in popularity. More recently still, computing devices like smartphones, tablets, and smartphone-tablet
10 hybrids (known as “phablets”) that are more portable than typical laptop and notebook computers have become perhaps even more widely used than laptop and notebook computers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIG. 1 is a diagram of a perspective view of an example computing
15 device having a flexible touchscreen operable in a non-folded, bent mode.

[0003] FIGs. 2 and 3 are diagrams depicting example usage of a flexible touchscreen of an example computing device in a non-folded, bent mode.

[0004] FIG. 4 is a diagram of a perspective view of an example computing device having a flexible touchscreen operable in a flat, unfolded mode.

20 **[0005]** FIG. 5 is a diagram depicting example usage of a computing device when an electronic device has been placed on the flexible touchscreen thereof.

[0006] FIG. 6 is a block diagram of an example computing device having a flexible touchscreen.

DETAILED DESCRIPTION

[0007] As noted in the background section, end users can choose from a variety of different computing devices. Some types of computing devices, like desktop computers as well as laptop and notebook computers, are usually used in conjunction with physical input devices, such as physical keyboards and physical pointing devices like touchpads. In the case of desktop computers, the physical input devices may be external to the computers themselves, whereas in the case of laptop and notebook computers, the input devices may be integrated within the housings of the computers. Other types of computing devices, such as tablet computing devices and smartphones, usually forgo physical input devices except for integrated touchscreens that also serve as the displays of the devices, and perhaps a limited number of physical buttons.

[0008] The basic designs of desktop computers and laptop and notebook computers have been refined to include different types of pointing devices and different types of display technologies, including touchscreens, but otherwise have remained largely static. Similarly, since the more recent advent of modern smartphones and tablet computing devices, the basic designs of such computing devices have remained basically static. Newer renditions of smartphones and tablet computing devices, for instance, are largely the same as their earlier counterparts, except for variations in size, and differences in the number and place of a limited number of physical controls like physical buttons.

[0009] As such, existing types of computing devices, from desktop computers to laptop and notebook computers to smartphones and tablet computing devices, have changed just incrementally in how they are used.

Desktop computers have particular user interfaces, for instance, that are

5 substantially similar regardless of their brands or the operating systems they are running. Laptop and notebook computers generally run the same operating systems as their desktop counterparts. By comparison, modern smartphones and tablet computing devices often have user interfaces that vary markedly from that of desktop computers and laptop and notebook computers. Attempts to
10 integrate the touchscreen-centric user interfaces of smartphones and tablet computing devices to the more physical input device-centric user interfaces of desktop computers and laptop and notebook computers have had limited success, with the end result often unsatisfying to end users instead of providing a “best of both worlds” experience.

15 **[0010]** Disclosed herein are novel computing devices and innovative user interface techniques for their usage. Such a computing device can include a housing having a first part and a second part, and a hinge to permit the first part to fold relative to the second part. A flexible touchscreen extends from the first part to the second part of the housing, over the hinge. When the computing
20 device is unfolded so that the touchscreen is operative in a non-flat yet non-folded mode, which is referred to herein as a bent mode, logic of the computing device operates the touchscreen to have three distinct zones: a first flat zone corresponding to the first part of the housing, a second flat zone corresponding

to the second part of the housing, and a third curved zone corresponding to the hinge.

[0011] The logic can operate a user interface on the touchscreen differently within each zone in the bent mode. The first zone may function as a visual display area. An object is movable between the first and second zones, via a corresponding user interface gesture detected on the touchscreen between the first and second zones. The second zone may function as a user input and editing area, to permit editing of the object via corresponding user interface gestures when it has been moved to the second zone. Furthermore, virtual input devices, such as virtual keyboards and virtual pointing devices like virtual touchpads, can be displayed within the second zone and usable to receive user input. The third zone may function as a control area, in which one or more virtual controls are displayed to control corresponding settings. The settings may be system-wide settings, for the operating system running on the computing device, or may be specific to a currently active application program running on the computing device and that has focus within the first zone.

[0012] The computing device may further be completely folded open so that the touchscreen is operative in a completely flat, unfolded mode as well. In this mode, the touchscreen has a single zone, and may be operable like a tablet computing device. Furthermore, the computing device may include a wireless charging mechanism within the housing, under at least a portion of the touchscreen. Placement of an electronic device, such as a smartphone, having wireless charging capability on the touchscreen thus permits the device to

wirelessly receive power for recharging. The logic may also detect placement of the electronic device on the touchscreen, and display a user interface on the touchscreen near the electronic device by which wireless data transfer can be initiated between the computing device and the electronic device.

5 **[0013]** FIG. 1 shows an example portable computing device 100. The computing device 100 may be a laptop or desktop computer. The computing device 100 includes a housing 102, and a flexible touchscreen 104 at the surface of the housing 102 between opposite ends 112 and 114 of the housing 102. The housing 102 may be formed from aluminum, magnesium, plastic, or another
10 material. The flexible touchscreen 104 may be an organic light-emitting diode (OLED) touchscreen, or another type of touchscreen.

[0014] The housing 102 has a part or section 106 and a part or section 108 that are joined together by a hinge 110. The hinge 110 permits the sections 106 and 108 to fold relative to one another. The section 106 is at a side 116 of
15 the hinge 110, and the section 108 is at a side 118 of the hinge 110. The flexible touchscreen 104 thus extends from the section 106 to the section 108 over the hinge 110.

[0015] The sides of the hinge 110 can be coated or applied with the same material that forms the sections 106 and 108 of the housing 102. As such, the
20 computing device 100 visually appears to have a seamless, unibody housing 102 that can fold in the middle thereof. In actuality, however, the housing 102 has two separate sections 106 and 108 that are joined together at the hinge 110.

[0016] As depicted in FIG. 1, the touchscreen 104 is in a bent, non-folded mode. In this mode, the touchscreen 104 is bent yet non-folded in that the sections 106 and 108 are not completely folded flat against each other, but are not completely unfolded so that the touchscreen 104 on the sections 106 and 108 is not completely flat. For instance, the sections 106 and 108 are not flush with one another in the bent mode.

[0017] In the bent mode, the touchscreen 104 has three zones 120, 122, and 124. The zone 120 is above the side 116 of the hinge 110 and corresponds to the section 106 of the housing 102. The zone 122 is below the side 118 of the hinge 110 and corresponds to the section 108 of the housing 102. The zone 124 is between the sides 116 and 118 of the hinge 110 and corresponds to the hinge 110. The zones 120 and 122 are flat, and the zone 124 is curved in correspondence with the curvature of the hinge 110 when the computing device 100 has been unfolded in a bent mode as shown in FIG. 1.

[0018] The computing device 100 can have a variety of different form factors. For example, the computing device 100 can have a form factor comparable to that of a laptop or a notebook computing device. As such, the hinge 110 of the computing device 100 can permit the section 106 to fold completely or nearly completely flat against the section 108 (and vice-versa) so that the device 100 is easily transported. Similarly, the computing device 100 can have a form factor comparable to that of a smartphone or a tablet computing device. The hinge 110 of the computing device 100 when the device 100 has such a smaller form factor likewise can permit the sections 106 and 108 to fold

flat against one another, allowing, for example, the computing device 100 to more easily be placed in a small bag like a handbag, or in a user's pocket. In both of these form factors, the hinge 110 may further permit the sections 106 and 108 to unfold relative to one another so that the touchscreen 104 is completely flat, such that the surface of the section 106 is flush with the surface 108, as described later in the detailed description.

[0019] However, the computing device 100 can also have a larger form factor, in which, for instance, the section 106 has a size comparable to that of an external display that is less easily transported. For example, the section 106 may have a size comparable to that of a 21-inch, 24-inch, 27-inch, or even larger (or smaller) display device, such as an external monitor for a computing device like a desktop computer or a laptop or notebook computer, or such as an all-in-one computing device that is primarily stationary and that includes in effect a built-in desktop computer. The hinge 110 of the computing device 100 when the device 100 has such a larger form factor may not permit the sections 106 and 108 to fold completely flat against each other, and may further not permit the sections 106 and 108 to unfold relative to one another so that the touchscreen 104 is completely flat. That is, when the computing device 100 has this larger form factor, the hinge 110 may permit a lesser range of rotation of the sections 106 and 108 relative to one another than when the computing device 100 has a smaller form factor.

[0020] As depicted in FIG. 1, the sizes of the sections 106 and 108 can be identical to one another, such that the zones 120 and 122 likewise have the

same size. However, in other implementations, the sizes of the sections 106 and 108 (and thus the zones 120 and 122) may be different from one another. As one example, when the computing device 100 has a larger form factor such that the section 106 has a size comparable to that of an external display, the section 108 may be shorter than the section 106. Having a shorter section 108 than the section 106, where both the sections 106 and 108 still have the same width, can permit the computing device 100 to be more easily employed on surfaces like desktops that have limited depth.

[0021] FIGs. 2 and 3 show example usage of the touchscreen 104 in the bent mode of FIG. 1. For illustrative clarity and convenience, however, the touchscreen 104 is depicted in these figures in a completely unfolded manner. It is to be understood, though, that the touchscreen 104 is used in FIGs. 2 and 3 when the touchscreen 104 is in the non- folded, bent mode of FIG. 1.

[0022] FIG. 2 shows example usage of the zones 120, 122, and 124 of the touchscreen 104 in the bent mode of FIG. 1. A user interface 200 defined over the zones 120, 122, and 124 is operated differently within each of the zones 120, 122, and 124. The user interface 200 is operated in the zone 120 as a visual display area. Objects, such as user interface elements like windows 202 and 204 are displayed within the zone 120. The windows 202 and 204 may be those that an operating system running on the computing device 100 exposes, and can correspond to the same or different application programs running on the computing device 100 via the operating system, for instance. In the example of FIG. 2, the window 202 corresponds to a drawing application program running on

the computing device 100, and the window 204 corresponds to a music application program running on the computing device 100. Another object displayed within the zone 120 is a pointer 206 of the user interface 200, to select and manipulate objects intra-zone 120. That is, the pointer 206 may be confined to usage just within the zone 120.

[0023] The user interface 200 is operated in the zone 122 as a user input and editing area. The user input aspect of the zone 122 is shown in FIG. 2. As specifically depicted in FIG. 2, two virtual input devices are displayed on the zone 122: a virtual keyboard 208 and a virtual touchpad 210. The keyboard 208 and the touchpad 210 are virtual in that they are not physical input devices apart from the touchscreen 104 itself. Rather, the keyboard 208 and the touchpad 210 are displayed on the touchscreen 104. A user interacts with the displayed images of the keyboard 208 and the touchpad 210 via the touchscreen 104. The virtual input devices can be moved (just) within the zone 122, as desired by the user. The virtual input devices can be selectively displayed or removed from the zone 122, and can be increased and decreased in size as desired by the user. As such, the user has greater flexibility in the types of input devices that are virtually displayed and usable within the zone 122, as compared to a laptop or notebook computer that has actual physical input devices.

[0024] The virtual input devices of the zone 122 can be used to interact with the application programs having visible windows within the zone 120. For example, the user may use the virtual keyboard 208 to enter text within the window of the application program that currently has focus within the zone 120.

As another example, the user may use the virtual touchpad 210 to move the pointer 206 within the zone 120, and to select objects like graphical user interface elements such as windows via the pointer 206.

[0025] In the latter example, although the entire surface of the zone 122 is

5 touch-sensitive since it is part of the touchscreen 104, the definition of a virtual touchpad 210 within a portion of the zone 122 can serve to limit the part of the zone 122 on which user gestures are detected for selection and movement of objects within the zone 120, such as via the pointer 206. Furthermore, defining just a portion of the zone 122 to serve as the virtual touchpad 210 can provide
10 users transitioning from computing devices having physical touchpads, like laptop and notebook computers, with a more familiar environment. In another implementation, however, the entire area below the virtual keyboard 208 may be employed to move the pointer 206 within the zone 120, and to select objects like graphical user interface elements such as windows via the pointer 206.

15 **[0026]** The user interface 200 is operated in the zone 124 as a control area in which virtual controls can be selectively displayed and used within the zone 124, as well as removed from the zone 124. As specifically depicted in FIG. 2, two system virtual controls are depicted: a brightness virtual control 212 and a volume virtual control 214. These system controls permit a user to control
20 corresponding settings of the computing device 100, as managed by the operating system running on the computing device 100. The brightness virtual control 212 permits a user to increase and decrease the brightness of the touchscreen 104, via a sliding user interface gesture on the touchscreen 104.

Similarly, the volume virtual control 214 permits a user to increase and decrease the volume of a speaker of the computing device 100, via a sliding user interface gesture on the touchscreen 104.

[0027] As also specifically depicted in FIG. 2, a virtual control 216 is

5 depicted in the zone 124 that corresponds to the active music application program displayed within the window 204 in the zone 120. The virtual control 216 displays the name of the song currently playing, and the name of the band that is singing the song. The virtual control 216 permits a user to play and stop playback of the music as well, via a press or tap user interface gesture on the
10 touchscreen 104. Because the controls 212, 214, and 216 are virtual, the user may be permitted to decide which system and application program controls to display within the zone 124. The user may be able to configure the application program virtual controls that are displayed within the zone 124 to automatically change depending on which application programs are running on the computing
15 device, which application programs currently have visible windows within the zone 120, and/or which application program currently has focus (i.e., is actively being used) within the zone 120.

[0028] The zone 124 is well suited for display and usage of virtual controls for a number of different reasons. First, the zone 124 is smaller in size than the
20 zones 120 and 122, such that the zone 124 is not as well suited to display windows and other objects, as in the zone 120, or to display and permit usage of virtual input devices, as in the zone 122. Second, the zone 124 is curved, whereas the zones 120 and 122 are flat. As such, the display of windows and

other objects is not as well suited within the zone 124 as it is in the zone 120, and it can be more difficult to, say, type on a virtual keyboard within the zone 124 as compared to in the zone 122. User interface gestures that have been determined to be well suited for such a curved zone as the zone 124 include
5 sliding motions perpendicular to the curvature of the zone 124, and tapping or pressing actions within the zone 124.

[0029] While the user interface 200 operates differently within each of the zones 120, 122, and 124, the operation of the user interface 200 may not be completely independent over the zones 120, 122, and 124. For instance, the
10 usage of the virtual input devices within the zone 122 can control the display of objects within the zone 120. As another example, the usage of the virtual controls within the zone 124 can control application programs and the information displayed within their windows within the zone 120. As such, while the user interface 200 operates differently within the zones 120, 122, and 124, the
15 operation of the user interface 200 within one of the zones 120, 122, and 124 can affect what is displayed, for instance, in one or more of the other zones 120, 122, and 124.

[0030] FIG. 3 shows another example usage of the zones 120, 122, and 124 of the touchscreen 104 in the bent mode of FIG. 1. The user interface 200
20 defined over the zones 120, 122, and 124 is again operated differently within each of the zones 120, 122, and 124. In the example of FIG. 3, the user interface 200 is operated within the zone 122 as has been described in relation to FIG. 2, as a control area. The user interface 200 is operated within the zone 120

similarly in FIG. 3 as in FIG. 2, as a visual display area. However, the user interface 200 is operated within the zone 122 somewhat differently in FIG. 3 as compared to in FIG. 2, but still as a user input and editing area. Rather, the editing aspect of the zone 122 is shown in FIG. 3, with respect to an object
5 moved from the zone 120 to the zone 122, as is now described in detail.

[0031] In FIG. 3, the user interface 200 is operable in the zone 120 so that an object displayed on the touchscreen 104 is movable, via a corresponding user interface gesture detected on the touchscreen, from the zone 120 to the zone 122. In the example of FIG. 3, the window 202 for the drawing application
10 program 202 is being moved from the zone 120 to a corresponding area 302 within the zone 122. Such movement can be performed via a number of different user interface gestures.

[0032] For example, a user may perform a quick swipe or flick action downwards beginning on the window 202 to cause the window 202 to move from
15 the zone 120 to the zone 122. That is, the user may press a finger against the touchscreen 104 on the window 202 within the zone 120, and while keeping this finger in contact with the touchscreen 104, quickly move the finger downward and then release it. In response, the window 202 is moved from the zone 120 to the zone 122.

[0033] As another example, the user may perform a drag and drop operation to cause the window 202 to move from the zone 120 to the zone 122. The user may press a finger against the touchscreen 104 on the window 202 within the zone 120, and while keeping this finger in contact with the touchscreen
20

104, move the finger downwards within the zone 120. In response, the window 202 is displayed as moving in correspondence with the user's downward finger motion. When the bottom of the window 202 reaches the boundary between the zones 120 and 124, the window 202 may segue across the zone 124 to the zone 122 with continued downward finger motion, or jump across the zone 124 to the zone 122 such that the window 202 is not displayed within the zone 124 at all.

When the user releases his or her finger, if a majority of the window 202 is not within the zone 120, the window 202 is automatically moved so that it is entirely within the zone 122. By comparison, if a majority of the window 202 is still within the zone 120, the window 202 may be automatically moved so that it stays entirely within the zone 120.

[0034] Once the window 202 is located within the zone 122, the user may directly edit the content within the window 202 via the touchscreen 104. In the example of FIG. 3, the window 202 is for a drawing application program.

Therefore, in lieu of using a virtual input device such as a virtual touchpad to edit the content within the window 202 in the zone 120 as in FIG. 2, the user may instead directly edit the content within the window 202 in the zone 122 in FIG. 3.

[0035] Such direct manipulation of the window 202 may also be possible in the zone 120 in FIGs. 2 and 3. However, manipulation of the window 202 (e.g., editing the content therein) in the zone 122 has been determined to be more ergonomic. This is because the touchscreen 104 is likely to be oriented so that the zone 122 thereof is in a substantially horizontal position when the computing device 100 is in the bent mode, whereas the zone 120 is in a more vertical

position when the device 100 is in this mode. For example, if the computing device 100 is resting on a table or other hard surface, the zone 122 is parallel to the surface, whereas the zone 120 is bent upwards from this surface. Directly manipulating the window 202 is less physically fatiguing within the horizontally positioned zone 122, because such manipulation mimics, for instance, writing on a piece of paper with pen or pencil, and does not force the user to hold a hand elevated from his or her body to directly manipulate the window 202 as is likely the case within the vertically positioned zone 120.

[0036] Once the user has finished directly manipulating the window 202 in the zone 122, the user may cause the window 202 to move back to the zone 120 via a corresponding user interface gesture performed on the touchscreen 104.

That is, the same user interface gesture that is employed to move the window 202 from the zone 120 to the zone 122 can be used in reverse to move the window 202 back to the zone 120 from the zone 122. Rather than flicking or

moving the window 202 downwards, in other words, the user flicks or moves the window 202 upwards to cause the window 202 to move back to the zone 120.

The original position of the window 202 within the zone 120 may be remembered, so that when the user moves the window 202 back to the zone 120 from the zone 122, it is moved back to its original position within the zone 120.

[0037] FIGs. 2 and 3 therefore show the user input and editing aspects, respectively, of the zone 122 of the touchscreen 104. The display of the virtual input devices of FIG. 2 may be manually removed from the zone 122 by the user prior to the user moving an object from the zone 120 to the zone 122 in FIG. 3.

The user may instead change the size of and/or reposition one or more of the virtual input devices so that there is sufficient empty area within the zone 122 to accommodate the object to be moved from the zone 120 to the zone 122.

[0038] The removal, resizing, and/or repositioning of the virtual input devices may also be automatic. For example, when the user performs a user interface gesture to move an object from the zone 120 to the zone 122, any virtual input devices that the object would overlap in the zone 122 may be automatically removed. As another example, the virtual input devices within the zone 122 may be automatically resized and/or repositioned so that the virtual input devices and the object being moved from the zone 120 all fit within the zone 122. The object being moved from the zone 120 to the zone 122 may further just overlap one or more virtual input devices.

[0039] FIG. 4 shows the touchscreen 104 of the computing device 100 in an example flat, unfolded mode of operation. The hinge 110 of the computing device 100 permits the sections 106 and 108 to be unfolded relative to one another so that they are flush with each other. In the flat mode, the touchscreen 104 has a single zone 402 between the opposite ends 112 and 114 of the housing 102. That is, there are not separate zones above the side 116 of the hinge 110, below the side 118 of the hinge 110, and between the sides 116 and 118 of the hinge 110 as there are in the bent mode of FIGs. 1, 2, and 3. The single zone 402 corresponds to the sections 106 and 108 of the housing 102 and to the hinge 110.

[0040] Within the flat mode, the touchscreen 104 of the computing device 100 can be operative similar to a touchscreen of a tablet computing device. That is, the computing device 100 can operate in the flat mode of the touchscreen 104 as if it were a tablet computing device. The zone 402 may operate as if it were
5 the zone 120 of the bent mode, as if it were the zone 122 of the bent mode, or a combination of the zones 120 and 122 (and 124) of the bent mode. The user interface gestures available to move objects between the zones 120 and 122 in the bent mode may not be available in the zone 402 in the flat mode, since there is not another zone to which to move any objects from the zone 402, for instance.
10 A user may still be permitted to display and use virtual input devices within the zone 402 as in the zone 122, however, and may still be permitted to display and use virtual controls within the zone 402 as in the zone 124.

[0041] FIG. 5 shows example usage of the computing device 100 when an actual electronic device 502 such as a smartphone has been placed on the
15 flexible touchscreen 104. FIG. 5 is described in relation to placement of a real (non-virtual) electronic device 502 being placed on the touchscreen 104 when the touchscreen 104 is in the bent mode. However, the description is also applicable to placement of the electronic 502 on the touchscreen 104 when the touchscreen 104 is in the flat, completely unfolded mode.

20 **[0042]** Placement of the electronic device 502 on the touchscreen 104 within the zone 122 can be detected in a number of different ways. The electronic device 502 may have near-field communication (NFC) capability, or another type of wireless capability, that permits the computing device 100 to

detect proximity of the device 502. Furthermore, the electronic device 502 may have a back surface that the touch of which against the touchscreen 104 is detectable. The combination of the proximity of the device 502 and the detection of touch on the touchscreen 104 with a size and shape corresponding to that of the device 502 can thus be registered as the electronic device 502 having been placed on the touchscreen 104.

[0043] In another implementation, just the detection of the touch on the touchscreen with a size and shape corresponding to that of the device 502 may be sufficient to register the electronic device 502 having been placed on the touchscreen 104. The user, for instance, may specify the manufacturer and/or model of the electronic device 502 as one that will be placed on the touchscreen 104. As another example, a weight sensor may be disposed under the touchscreen 104 to detect a pre-specified weight of the electronic device 502 and thus to detect placement of the device 502 on the touchscreen 104. The weight sensor may be disposed in just a certain area under the touchscreen 104.

[0044] Furthermore, the computing device 100 may have wireless charging capability in one or more areas under the touchscreen 104. When the electronic device 502 is placed on the touchscreen 104, it may automatically receive power from the wireless charging mechanism of the computing device 100 for recharging purposes, for instance. The transmission of power to the electronic device 502 can itself be used as a way to detect that the device 502 has been placed on the touchscreen 104.

[0045] Upon detection of the electronic device 502 having been placed on the touchscreen 104, the user interface 200 may be operable to first acknowledge such placement in a number of different ways. For instance, a graphical effect akin to the waves emanating from a stone dropped in a previously still body of water may be displayed. The computing device 100 itself may play a sound corresponding to detection of the electronic device 502 having been placed on the touchscreen 104.

[0046] The user interface 200 can automatically display a user interface element 504 on the touchscreen 104 near the location of the electronic device 502. A user can therefore select desired option(s) presented on the user interface element 504, via corresponding user interface gestures, to initiate wireless data transfer between the computing device 100 and the electronic device 502. The wireless data transfer may occur over NFC, Bluetooth, Wi-Fi, or in another manner.

[0047] In the specific example of FIG. 5, the user interface element 504 is a menu heaving a heading of "Phone," corresponding to the type of electronic device 502 placed on the touchscreen 104. The options include "sync," "backup," "mirror," "settings," and "more," the latter which may then cause additional options to be displayed. The user taps a finger to select a desired option. The sync option may cause certain data to be synchronized between the electronic device 502 and the computing device 100, such as photos, music, documents, and so on. The backup option may cause data on the electronic device 502 to

be backed up onto the computing device 100, and/or the data on the computing device 100 to be backed up onto the electronic device 502.

[0048] In response to the user selecting the mirror option, the user interface 200 may be operable to mirror the contents of the display of the

5 electronic device 502 within a corresponding user interface element 506 on the touchscreen 104. In the example of FIG. 5, the user interface element 506 is displayed within the zone 120 of the touchscreen 104 in the bent mode.

Mirroring permits the user to use the electronic device 502, but have the benefit of what is likely a larger display of the display contents of the electronic device
10 502 within the user interface element 506.

[0049] In response to the user selecting the settings options, the user interface 200 may be operable to display one or more virtual controls within the zone 124 of the touchscreen 104, in addition to or in lieu of the already displayed virtual controls within the zone 124, such as depending on whether there is

15 sufficient room to display more virtual controls. In the example of FIG. 5, there are a brightness virtual control 512 and a volume virtual control 514. The virtual controls 512 and 514 operate in the same manner as their counterpart virtual controls 212 and 214 of FIG. 2, but control the brightness and volume of the electronic device 502 instead of the brightness and volume of the computing

20 device 100. Furthermore, if the user has selected the sync or backup option within the graphical user interface element 504, the status of this operation can be depicted via a virtual control 516, which can be a progress bar user interface element.

[0050] FIG. 6 shows a block diagram of an example implementation of the computing device 100. The computing device 100 can include components other than those depicted in FIG. 5. The computing device 100 includes the housing 102, the flexible touchscreen 104, and the hinge 110 as have been described.

5 The computing device further includes logic 602, and can include a wireless charging mechanism 604 and/or a wireless communication mechanism 606, both of which include at least hardware.

[0051] The logic 602 is disposed within the housing 102, and can be hardware or a combination of software and hardware. As just hardware, the logic
10 602 can include or be a semiconductor integrated circuit (IC), such as an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA), and so on. As a combination of software and hardware, the logic 602 can include or be a processor and a non-transitory computer-readable data storage medium that stores computer-executable code that the processor
15 executes.

[0052] The logic 602 realizes the functionality that has been described. Specifically, the logic operates the touchscreen 104 in the bent mode, as well as in the flat mode. The logic 602 thus operates the user interface 200 on the touchscreen 104 differently within the zones 120, 122, and 124 in the bent mode,
20 including the zone 120 as a display area, the zone 122 as a user input and editing area, and the zone 124 as a control area. Therefore, the logic 602 can detect a user interface gesture on the touchscreen 104 relative to an object

displayed in the zone 120 and in response move the object from being displayed in the zone 120 to being displayed in the zone 122.

[0053] The logic 602 can likewise detect a user interface gesture on the touchscreen 104 relative to the object displayed in the zone 122 and in response

5 move the object from being displayed in the zone 122 back to being displayed in the zone 120. The logic 602 can permit editing of the object in the zone 122, via corresponding user interface gestures detected on the touchscreen 104 in the zone 122, and display a movable virtual input device in the zone 122, permitting user input via corresponding user interface gestures detected on the touchscreen
10 104 in the zone 122. The logic 602 can display virtual controls in the zone 124, and permit their usage via corresponding user interface gestures detected on the touchscreen 104 in the zone 124. In the flat mode of the touchscreen 104, the logic 602 can operate the touchscreen 104 so that it has one zone 402.

[0054] The computing device 100 can include the wireless charging

15 mechanism 604 within the housing 102 and under the touchscreen 104, such as under the zone 122 of the touchscreen 104. The wireless charging mechanism 604 can be an inductive charging mechanism. The logic 602 may permit the electronic device 502 having wireless charging capability placed on the touchscreen 104 over the wireless charging mechanism 604 to wirelessly receive
20 power from the wireless charging mechanism 604.

[0055] The computing device 100 can include the wireless communication mechanism 606. The wireless communication mechanism 606 may be an NFC, Bluetooth, Wi-Fi, or another type of wireless communication mechanism. Upon

the logic 602 detecting placement of the electronic device 502 on the touchscreen 104, the logic 602 may display the user interface element 504 near the electronic device 502 on the touchscreen 104, and responsively initiate wireless data transfer via the wireless communication mechanism 606 between
5 the computing device 100 and the electronic device 502. The wireless data transfer may be initiated responsive to corresponding user interface gestures detected on the touchscreen 104 at the user interface element 504.

[0056] The computing device 100 that has been described therefore may not have any physical input devices, such as a physical keyboard or pointing
10 device, except for the flexible touchscreen 104. As such, the touchscreen 104 advantageously can extend over substantially an entirety of a surface of the housing 102 of the computing device 100, as well as over the hinge 110 thereof. When the touchscreen 104 has been unfolded to a bend mode, the techniques described herein can logically divide the touchscreen 104 among various zones
15 120, 122, and 124, each of which each is operated in a different way, but which can be inter-dependent in that user interface gestures detected on one of these zones 120, 122, and 124 can cause elements or objects to be displayed on one or both of the other two of the zones 120, 122, and 124.

We claim:

1. A computing device comprising:

a housing;

a hinge between opposite ends of the housing to permit a first section of

5 the housing at a first side of the hinge to fold relative to a second section of the housing at a second, opposite side of the hinge;

a flexible touchscreen at a surface of the housing between the opposite ends of the housing; and

logic to operate the touchscreen in a bent mode in which the touchscreen

10 has a first zone above the first side of the hinge and a second zone below the second side of the hinge,

wherein in the bent mode the logic is to detect a user interface gesture on the touchscreen relative to an object displayed in the first zone and in response is to move the object from being displayed in the first zone to being displayed in
15 the second zone.

2. The computing device of claim 1, wherein in the bent mode the touchscreen further has a third zone between the first side and the second side of the hinge,

wherein in the bent mode the logic is to display a virtual control within the
20 third zone and is to permit usage of the virtual control via corresponding user interface gestures detected on the touchscreen in the third zone,

and wherein the virtual control corresponds to one of:

an operating system running on the computing device;
a currently active application program running on the computing device.

3. The computing device of claim 2, wherein in the bent mode the
5 touchscreen is flat within the first zone and the second zone, and is curved within the third zone.
4. The computing device of claim 1, wherein in the bent mode the logic is to detect the user interface gesture on the touchscreen relative to the object displayed in the second zone and in response is to move the object from being
10 displayed in the second zone back to being displayed in the first zone.
5. The computing device of claim 1, wherein in the bent mode the logic is to permit editing of the object displayed in the second zone via corresponding user interface gestures detected on the touchscreen in the second zone.
6. The computing device of claim 1, wherein the logic is to display a movable
15 virtual input device in the second zone and is to permit user input via corresponding user interface gestures detected on the touchscreen at the virtual input device.

7. The computing device of claim 1, wherein the logic is further to operate the touchscreen in a flat mode in which the touchscreen has a single zone between the opposite ends of the housing.

8. The computing device of claim 1, further comprising:

5 a wireless charging mechanism within the housing and under the second zone of the touchscreen in the bent mode,

wherein the logic is to permit an electronic device having wireless charging capability placed on the touchscreen in the second zone to wirelessly receive power from the wireless charging mechanism.

10 9. The computing device of claim 1, wherein the logic is to detect placement of an electronic device on the touchscreen, and responsively is to display a user interface near the electronic device on the touchscreen and initiate wireless data transfer between the computing device and the electronic device via corresponding user interface gestures detected on the touchscreen at the user
15 interface.

10. A computing device comprising:

a housing having a first part and a second part;

a hinge to permit the first part to fold relative to the second part;

a flexible touchscreen extending from the first part to the second part of

20 the housing over the hinge; and

logic to operate the touchscreen in a bent mode in which the touchscreen

has:

a first flat zone corresponding to the first part of the housing;

a second flat zone corresponding to the second part of the housing;

and

5 a third curved zone corresponding to the hinge,

wherein in the bent mode the logic is to operate a user interface on the touchscreen differently within the first, second, and third zones of the touchscreen.

11. The computing device of claim 10, wherein in the bent mode the logic is to
10 operate the user interface in the first zone as a visual display area in which an object displayed on the touchscreen is movable via a corresponding user interface gesture detected on the touchscreen between the first and second zones.

12. The computing device of claim 11, wherein in the bent mode the logic is to
15 operate the user interface in the second zone as a user input and editing area in which the object displayed on the touchscreen in the second zone is editable via corresponding user interface gestures and in which a virtual input device is displayable in the second zone and usable to receive user input.

13. The computing device of claim 12, wherein in the bent mode the logic is to
20 operate the user interface in the third zone as a control area in which a virtual control is displayed in the third zone and controllable to control a setting of one

of:

an operating system running on the computing device;

a currently active application program running on the computing device.

14. The computing device of claim 10, wherein the logic is to detect placement
5 of an electronic device on the touchscreen, and responsively is to display a user
interface near the electronic device on the touchscreen and initiate wireless data
transfer between the computing device and the electronic device via
corresponding user interface gestures detected on the touchscreen at the user
interface.

10 15. The computing device of claim 10, wherein the logic is further to operate
the touchscreen in a flat mode in which the touchscreen has a single zone
corresponding to the first and second parts of the housing and to the hinge.

FIG 1

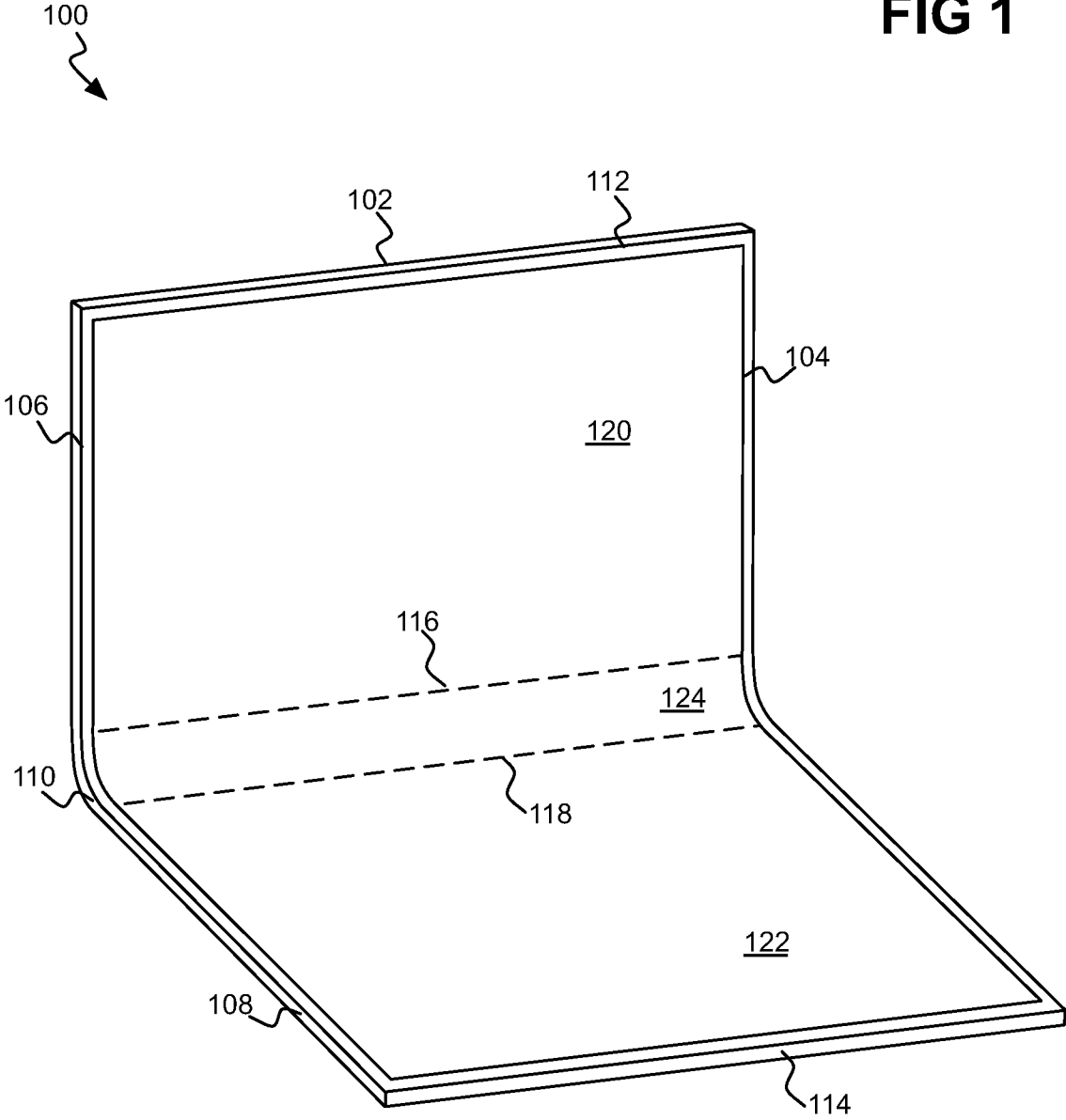


FIG 2

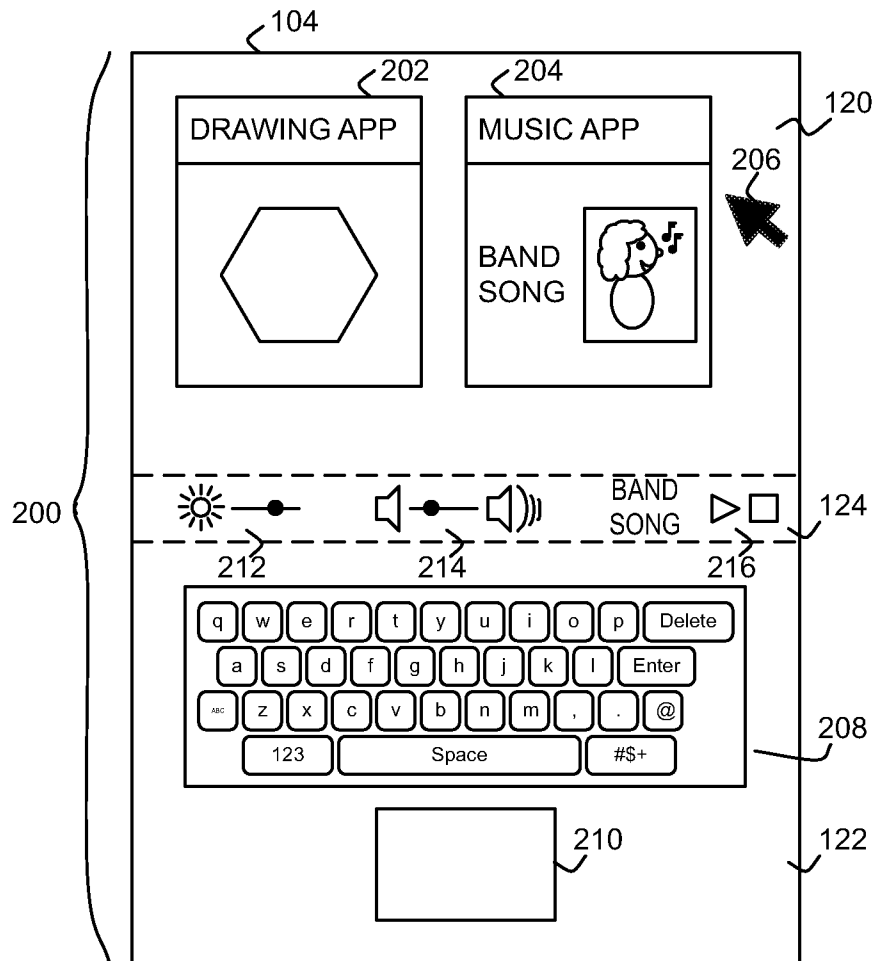


FIG 3

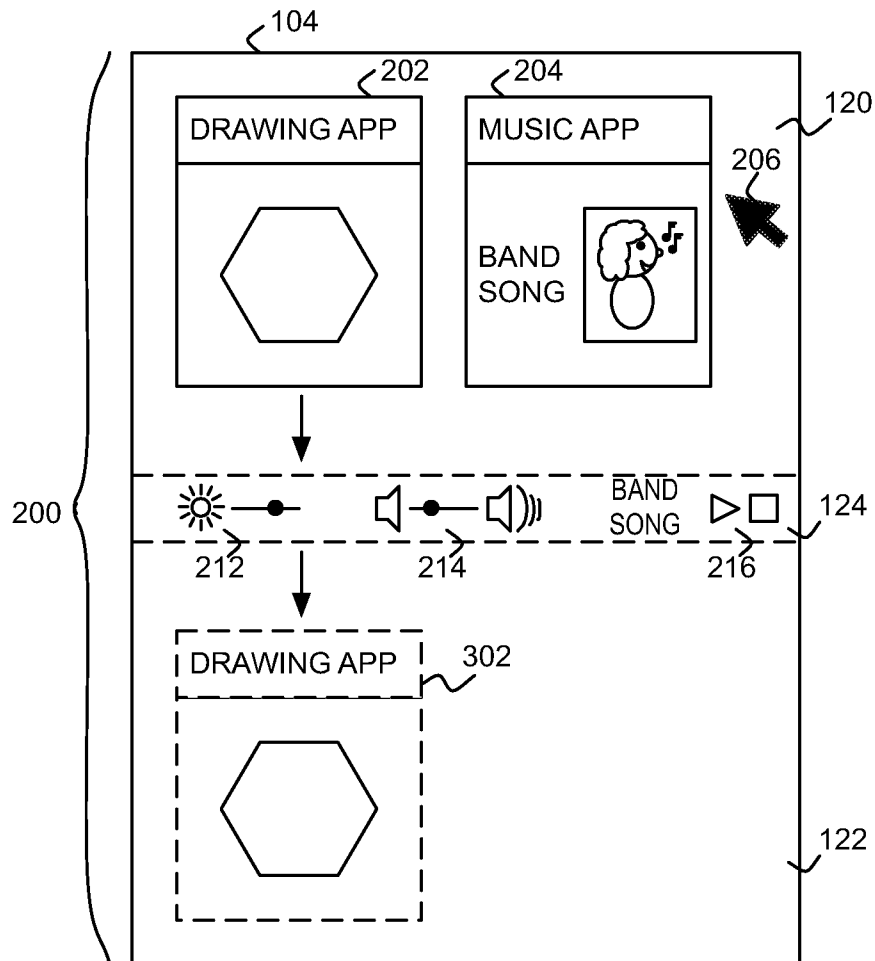
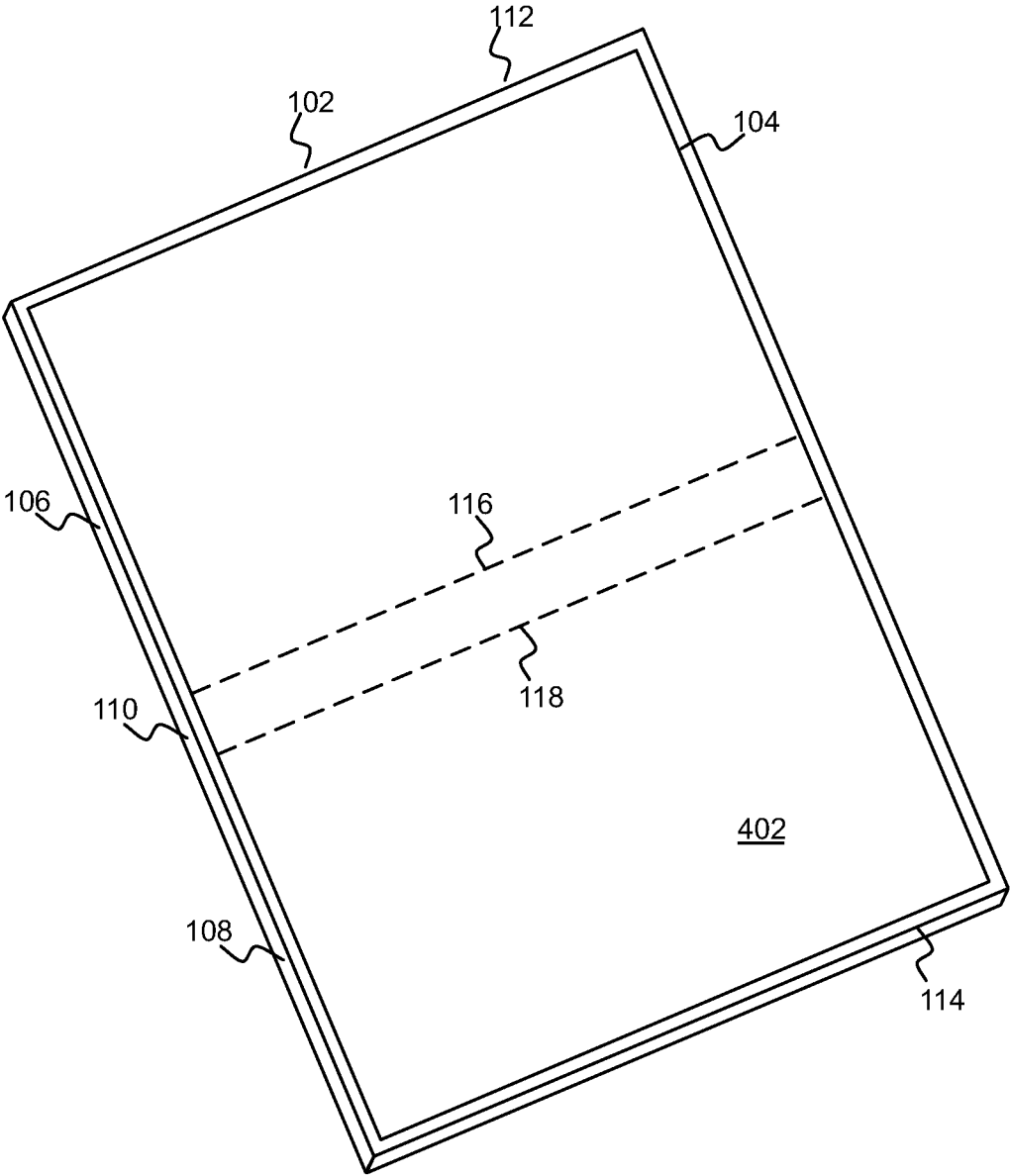


FIG 4



5/6

FIG 5

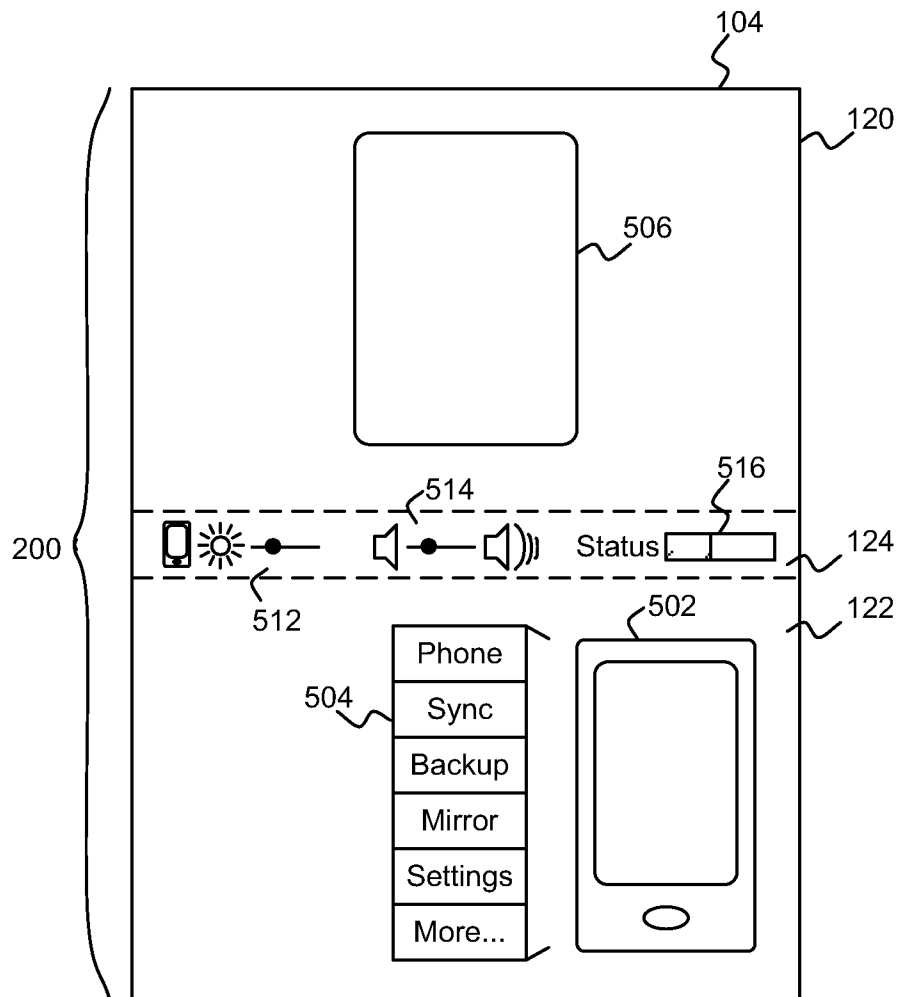
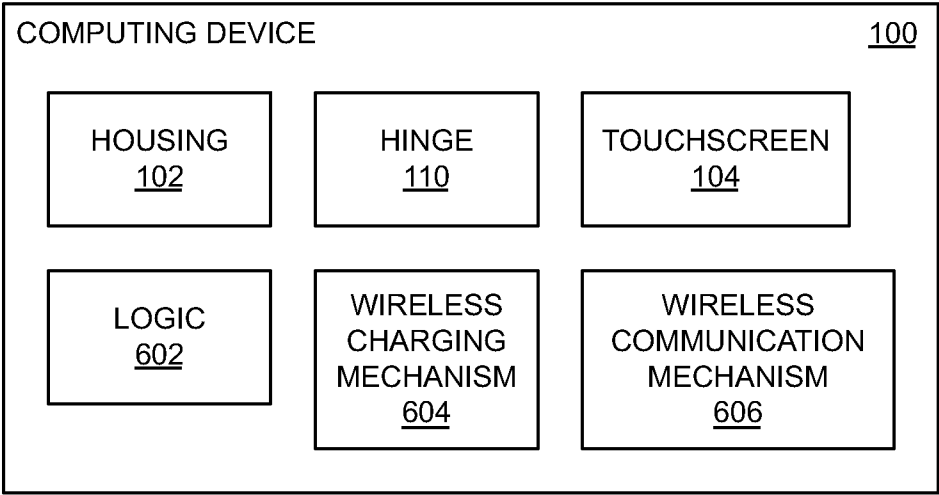


FIG 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/042791**A. CLASSIFICATION OF SUBJECT MATTER****G06F 3/0488(2013.01)i, G06F 1/16(2006.01)i, G06F 3/01(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)

G06F 3/0488; H04M 1/02; G06F 3/0481; H02J 7/00; H02J 7/02; G06F 1/16; G06F 3/01

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: flexible, touchscreen, housing, hinge, bent, user interface, display

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2016-0132074 A1 (LG ELECTRONICS INC.) 12 May 2016 See paragraphs [0136]-[0137], [0144], [0268], [0282]-[0283], [0309]; claim 1; and figures 2A, 5A-5B, 10, 11B, 13A.	1-7, 10-13, 15
Y		8-9, 14
Y	US 7772802 B2 (JOSEPH A. MANICO et al.) 10 August 2010 See column 21, line 38-column 22, line 3; claim 1; and figures 6A-7A.	8-9, 14
A	US 2006-0146488 A1 (JYRKI KIMMEL) 06 July 2006 See paragraph [0019]; and figure 2.	1-15
A	US 2016-0165024 A1 (FUTUREWEI TECHNOLOGIES, INC.) 09 June 2016 See paragraph [0029]; and figure 8.	1-15
A	US 2014-0055098 A1 (SAMSUNG ELECTRONICS CO., LTD.) 27 February 2014 See paragraph [0017]; and figure 4.	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

14 April 2017 (14.04.2017)

Date of mailing of the international search report

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Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/042791

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