(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 184 490 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.05.2023 Bulletin 2023/21

(21) Application number: **21209451.0**

(22) Date of filing: **22.11.2021**

(51) International Patent Classification (IPC):
G09G 3/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
G09G 3/035; G09G 2354/00; G09G 2360/144

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(54) **DISPLAY CONTROL**

(57) A method, apparatus and computer program is described comprising: obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor; receiving ambient light information from the at least one ambient light sensor; generating updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and controlling at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

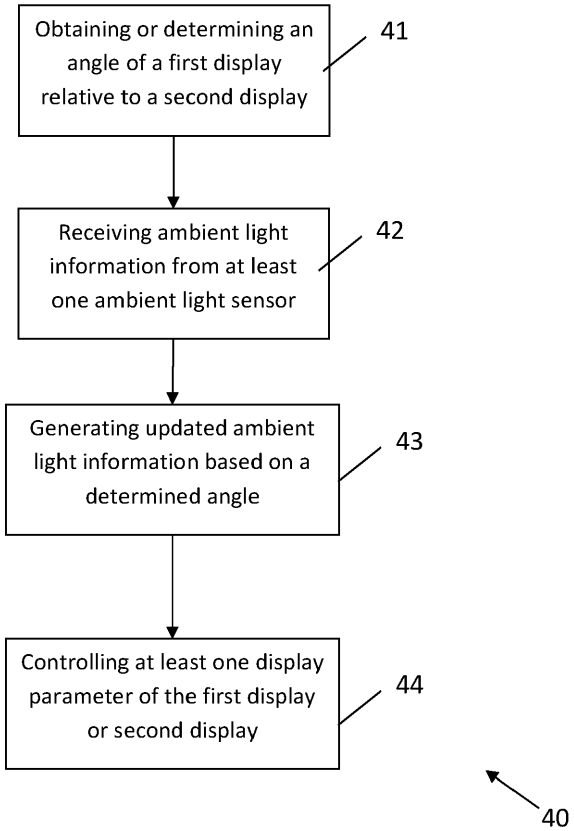

Fig. 4

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Description

Field

[0001] The present specification relates to display screens, particularly to the control of display parameters.

Background

[0002] It is known to control display parameters of display screens. There remains a need for improvement in how display parameters are controlled based on various factors.

Summary

[0003] In a first aspect, this specification provides an apparatus comprising means for performing: obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor; receiving ambient light information from the at least one ambient light sensor; generating updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and controlling at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

[0004] In some examples, the controlling at least one display parameter comprises causing decreasing or increasing brightness level of at least part of the at least one of the first display or the second display.

[0005] In some examples, the controlling at least one display parameter is further based on one or more display parameter preferences for the first display and/or the second display.

[0006] In some examples, the generating updated ambient light information is further based on a/the brightness level of at least one of the first display or second display.

[0007] Some examples include means for performing: obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and in response to the obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling the at least one display parameter of the second display such that the at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

[0008] In some examples, the controlling at least one display parameter of the second display comprises causing decreasing or increasing brightness level of at least part of the second display, and controlling at least one display parameter of the first display comprises causing decreasing or increasing brightness level of at least part of the first display.

[0009] In some examples, the controlling at least one display parameter of the respective one of the second display or the first display comprises causing decreasing or increasing brightness level of at least part of the respective one of the second display or the first display based on a brightness gradient, wherein the brightness gradient is dependent on a distance between the respective part of the respective one of the second display or the first display, and the other one of the second display or the first display.

[0010] In some examples, the first display and the second display together form a dual-display screen of a single device, wherein the first display and the second display are foldable with respect to each other.

[0011] In some examples, the first display and the second display belong to a first device and a second device respectively.

[0012] In some examples, the means comprises at least one processor; and at least one memory including computer program code, the at least one memory and computer program code configured to, with the at least one processor, cause the performance of the apparatus.

[0013] In a second aspect, this specification provides an apparatus comprising means for performing: obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light; obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and in response to the obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling at least one display parameter of the second display such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to the obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

[0014] In some examples, the controlling at least one display parameter of the second display comprises causing decreasing or increasing brightness level of at least part of the second display, and controlling at least one display parameter of the first display comprises causing decreasing or increasing brightness level of at least part of the first display.

[0015] In some examples, the controlling at least one display parameter of the respective one of the second display or the first display comprises causing decreasing

or increasing brightness level of at least part of the respective one of the second display or the first display based on a brightness gradient, wherein the brightness gradient is dependent on a distance between the respective part of the respective one of the second display or the first display, and the other one of the second display or the first display.

[0016] In some examples, the first display and the second display together form a dual-display screen of a single device, wherein the first display and the second display are foldable with respect to each other.

[0017] In some examples, the first display and the second display belong to a first device and a second device respectively.

[0018] In some examples, the means comprises at least one processor; and at least one memory including computer program code, the at least one memory and computer program code configured to, with the at least one processor, cause the performance of the apparatus.

[0019] In a third aspect, this specification describes a method comprising: obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor; receiving ambient light information from the at least one ambient light sensor; generating updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and controlling at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

[0020] In some examples, the controlling at least one display parameter comprises causing decreasing or increasing brightness level of at least part of the at least one of the first display or the second display.

[0021] In some examples, the controlling at least one display parameter is further based on one or more display parameter preferences for the first display and/or the second display.

[0022] In some examples, the generating updated ambient light information is further based on a/the brightness level of at least one of the first display or second display.

[0023] Some examples further comprise performing: obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and in response to the obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling the at least one display parameter of the second display such that the at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

[0024] In some examples, the controlling at least one display parameter of the second display comprises causing decreasing or increasing brightness level of at least part of the second display, and controlling at least one display parameter of the first display comprises causing decreasing or increasing brightness level of at least part of the first display.

[0025] In some examples, the controlling at least one display parameter of the respective one of the second display or the first display comprises causing decreasing or increasing brightness level of at least part of the respective one of the second display or the first display based on a brightness gradient, wherein the brightness gradient is dependent on a distance between the respective part of the respective one of the second display or the first display, and the other one of the second display or the first display.

[0026] In some examples, the first display and the second display together form a dual-display screen of a single device, wherein the first display and the second display are foldable with respect to each other.

[0027] In some examples, the first display and the second display belong to a first device and a second device respectively.

[0028] In a fourth aspect, this specification describes a method comprising: obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light; obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and in response to obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling at least one display parameter of the second display such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

[0029] In some examples, the controlling at least one display parameter comprises causing decreasing or increasing brightness level of at least part of the at least one of the first display or the second display.

[0030] In some examples, the controlling at least one display parameter is further based on one or more display parameter preferences for the first display and/or the second display.

[0031] In some examples, the generating updated ambient light information is further based on a/the brightness level of at least one of the first display or second display.

[0032] Some examples further comprise performing: obtaining or determining information of whether a gaze

direction of a user corresponds to the first display or the second display; and in response to the obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling the at least one display parameter of the second display such that the at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

[0033] In some examples, the controlling at least one display parameter of the second display comprises causing decreasing or increasing brightness level of at least part of the second display, and controlling at least one display parameter of the first display comprises causing decreasing or increasing brightness level of at least part of the first display.

[0034] In some examples, the controlling at least one display parameter of the respective one of the second display or the first display comprises causing decreasing or increasing brightness level of at least part of the respective one of the second display or the first display based on a brightness gradient, wherein the brightness gradient is dependent on a distance between the respective part of the respective one of the second display or the first display, and the other one of the second display or the first display.

[0035] In some examples, the first display and the second display together form a dual-display screen of a single device, wherein the first display and the second display are foldable with respect to each other.

[0036] In some examples, the first display and the second display belong to a first device and a second device respectively.

[0037] In a fifth aspect, this specification describes an apparatus configured to perform any method as described with reference to the third aspect and/or the fourth aspect.

[0038] In a sixth aspect, this specification describes computer-readable instructions which, when executed by computing apparatus, cause the computing apparatus to perform any method as described with reference to the third aspect and/or the fourth aspect.

[0039] In a seventh aspect, this specification describes a computer program comprising instructions for causing an apparatus to perform at least the following: obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor; receiving ambient light information from the at least one ambient light sensor; generating updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and controlling at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

[0040] In an eighth aspect, this specification describes a computer program comprising instructions for causing an apparatus to perform at least the following: obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light; obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and in response to obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling at least one display parameter of the second display such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

[0041] In a ninth aspect, this specification describes a computer-readable medium (such as a non-transitory computer-readable medium) comprising program instructions stored thereon for performing at least the following: obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor; receiving ambient light information from the at least one ambient light sensor; generating updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and controlling at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

[0042] In a tenth aspect, this specification describes an apparatus comprising: at least one processor; and at least one memory including computer program code which, when executed by the at least one processor, causes the apparatus to: obtain or determine an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor; receive ambient light information from the at least one ambient light sensor; generate updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and control at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

[0043] In an eleventh aspect, this specification describes an apparatus comprising: at least one processor;

and at least one memory including computer program code which, when executed by the at least one processor, causes the apparatus to: obtain or determine an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light; obtain or determine information of whether a gaze direction of a user corresponds to the first display or the second display; and in response to obtaining or determining information that a gaze direction of the user corresponds to the first display, control at least one display parameter of the second display such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, control the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

[0044] In a twelfth aspect, this specification describes an apparatus comprising: a first module configured to obtain or determine an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor; a second module configured to receive ambient light information from the at least one ambient light sensor; a third module configured to generate updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and a fourth module configured to control at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

[0045] In a thirteenth aspect, this specification describes an apparatus comprising: a first module configured to obtain or determine an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light; a second module configured to obtain or determine information of whether a gaze direction of a user corresponds to the first display or the second display; a third module configured to, in response to obtaining or determining information that a gaze direction of the user corresponds to the first display, control at least one display parameter of the second display such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, control the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

Brief description of the drawings

[0046] Example embodiments will now be described, by way of example only, with reference to the following schematic drawings, in which:

FIGs. 1 to 3 are block diagrams of systems in accordance with example embodiments;
FIG. 4 is a flowchart of an algorithm in accordance with an example embodiment;
FIGs. 5 to 7 are block diagrams of systems in accordance with example embodiments;
FIG. 8 is a flowchart of an algorithm in accordance with an example embodiment;
FIGs. 9 to 15 are block diagrams of systems in accordance with example embodiments;
FIG. 16 is a block diagram of components of a system in accordance with an example embodiment; and
FIG. 17 shows an example of tangible media for storing computer-readable code which when run by a computer may perform methods according to example embodiments described above.

Detailed description

[0047] The scope of protection sought for various embodiments of the invention is set out by the independent claims. The embodiments and features, if any, described in the specification that do not fall under the scope of the independent claims are to be interpreted as examples useful for understanding various embodiments of the invention.

[0048] In the description and drawings, like reference numerals refer to like elements throughout.

[0049] FIG. 1 is a block diagram of a system, indicated generally by the reference numeral 10. System 10 shows illustrations of devices having dual display screens, for example, foldable dual displays, in accordance with example embodiments. For example, a first device 11 comprises a first display 11a and a second display 11b. The first display 11a and the second display 11b may be two separate displays that may or may not have a visible gap between them. Alternatively, a single display may be folded or bent to form the first display 11a and the second display 11b, such that the first display 11a and second display 11b act as two separate displays when bent or folded, but may act as a single display when flat.

[0050] In some examples, as shown in the second device 12 having a first display 12a and a second display 12b, there may be notches or holes 13 within one or both of the displays, for example, in order to incorporate cameras (e.g. front facing cameras), light sensors, or the like. Alternatively, the notches or holes 13 may be used for implementing buttons or other control interfaces on one or both of the displays.

[0051] In electronic displays (e.g. LCD screen), ambient light may affect a user's visibility of the screen, for example, due to reflections of the ambient light on the

display. For example, when ambient light is high (e.g. very bright), the brightness level of the display may advantageously be increased (or other display parameters may be controlled) in order to improve a user's viewing experience or for the user to be able to see the display clearly. Alternatively, if the ambient light is low (e.g. very dark), the brightness level of the display may not need to be high, and may advantageously be lowered in order to ensure that the light emitted from the display is not harsh to the user's eyes.

[0052] As such, electronic displays may comprise means for controlling screen brightness level manually or automatically, where automatic control of brightness may be based at least in part on ambient light. Ambient light sensors may be included in electronic devices such that the brightness level of the electronic displays may be controlled based on ambient light. The ambient light sensors may be located on the body of the electronic device (e.g. next to a camera), or may be located behind the display. Ambient light sensors may also be used for reasons other than controlling brightness level of the device, for example, for use of the camera for photography.

[0053] FIG. 2 is a block diagram of a system, indicated generally by the reference numeral 20, in accordance with an example embodiment. When two displays (e.g. dual displays of a single foldable device, or displays belonging to different devices) are used in close proximity, they may be at different angles relative to each other. For example, foldable dual-display devices may be folded for compact storage or transportation, or may be used at different folding angles, or may be laid fully flat.

[0054] For example, in a first orientation 21, a first display 21a and a second display 21b are flat, such that the angle between them is approximately 180 degrees. When the first and second displays 21a and 21b are in the first orientation, the user may view a single large screen formed by the first and second displays 21a and 21b (e.g. for watching a movie, working on spreadsheets, or any task that is improved with a bigger screen). In a second orientation 22, a first display 22a and a second display 22b are at an angle with respect to each other, such that the angle between them is approximately 135 degrees (e.g. to enable the second display 22b to be used as a touch sensitive keyboard and the first display 22a to be used for viewing as a display, similar to a monitor). In a third orientation 23, a first display 23a and a second display 23b are at an angle with respect to each other, such that the angle between them is approximately 90 degrees (e.g. to enable the second display 23b to be used as a touch sensitive keyboard and the first display 23a to be used for viewing as a display, similar to a monitor, with relatively higher visual privacy compared to the second orientation 22). In a fourth orientation 24, a first display 24a and a second display 24b are at an angle with respect to each other, such that the angle between them is approximately 60 degrees (e.g. to enable the user to view one or both displays 24a and 24b, while providing visual privacy from others, such that others may not be able to view the screens).

[0055] FIG. 3 is a block diagram of a system, indicated generally by the reference numeral 30, in accordance with an example embodiment. The system 30 shows displays in a first orientation 31, second orientation 32, third orientation 33, and fourth orientation 34, similar to the orientations 21, 22, 23, and 24 respectively, as described above with reference to FIG. 2. In the examples below, it may be assumed that at least the second display (31b, 32b, 33b, 34b) comprises an ambient light sensor (39a, 39b, 39c, 39d respectively) that may be used for determining ambient light levels. For example, brightness level of the second display and optionally brightness level of the first display may be controlled based on readings from the ambient light sensor. Optionally, the first display (31a, 32a, 33a, 34a) may also comprise another ambient light sensor, such that brightness of the second display may be controlled based on readings from the ambient light sensor of the second display and brightness level of the first display may be controlled based on readings from the ambient light sensor of the first display.

[0056] In the first orientation 31, a first display 31a and a second display 31b are laid flat, such that the light emitted from either of the first display 31a or the second display 31b may not significantly affect ambient lighting of the other one of the displays 31a or 31b. For example, light emitted from the first display 31a may be reflected by an external object 35 onto the second display 31b, but that effect may be considered as being an actual change in ambient light conditions, which may be taken into account by the ambient light sensor(s) (e.g. considered similar to a scenario where object 35 emits light onto at least second display 31b, which would be considered to be part of ambient light conditions). Therefore, for example, reflections from external objects, such as external object 35, may be disregarded for determining effects of the light emitted by first display, and therefore external object 35 is not shown with regards to orientations 32, 33, 34.

[0057] In the second orientation 32, the angle 36 of the first display 32a relative to the second display 32b may be approximately 135 degrees, such that there may be at least some (although minimal) reflection of the light emitted from the first display 32a on the second display 32b. The angle between the first display and the second display decreases in the third and fourth orientations 33 and 34, for example, angle 37 between the first and second display 33a and 33b being approximately 90 degrees, and the angle 38 between the first and second display 34a and 34b being approximately 60 degrees. As the angle between the first display and the second display decreases, the effect of the light emitted from the first display on the second display may become more significant.

[0058] For example, a first effect of the light emitted from the first display can be that the ambient light sensor of the second display may not accurately determine the ambient light level, as some of the light being sensed by

the ambient light sensor may be from the first display rather than being actual ambient light. The smaller the angle is between the first display and the second display, the more the light from the first display may be directed towards the second display, and therefore the first effect may be more significant. As such, as a result of the ambient light level not being determined accurately, the control of brightness level or other display parameters of one or both of the first and second displays may not be ideal.

[0059] Another effect of the light emitted from the first display may be the reflection of the light or uneven lighting on the second display, that may cause the second display to appear less clear (e.g. less bright) to a user viewing the second display.

[0060] The example embodiments described below seek to address the issues described above.

[0061] FIG. 4 is a flowchart of an algorithm, indicated generally by the reference numeral 40, in accordance with an example embodiment. The operations of the algorithm 40 may be performed at a first device (e.g. comprising a first display or a second display, or comprising a dual display including both the first and second displays) or may be performed at a server (e.g. remote cloud server).

[0062] The algorithm 40 may start at operation 41, where an angle (36, 37, 38) of a first display (31a, 32a, 33a, 34a) relative to a second display (31b, 32b, 33b, 34b) may be obtained or determined. For example, an angle sensor (or alternatively proximity sensor, a gyroscope, or an accelerator) may be used for determining the angle between the first display and the second display. The angle sensor may be located in one or both of the first display and the second display. For example, if the first display and the second display belong to the same device (e.g. dual-display device), information from an angle sensor may be utilized for controlling display parameters of any one of the first display and the second display, where the angle sensor may be located, for example, in any one of the first display and the second display, or between the first and the second display (e.g. at a hinge or fold line). Alternatively, if the first display and the second display belong to different devices and the angle sensor is located at the first display, the angle between the first display and the second display may be determined at the first display, and the information of the angle may then be sent to the second display (e.g. directly or through a server) so that the information may be utilized for controlling display parameters of any one of the first display and the second display. Thus, the second display may obtain angle of the first display relative to the second display.

[0063] The first display and the second display are suitable for emitting light. For example, the first display and the second display may be liquid crystal display (LCD) screens, light emitting diode (LED) display screens (e.g. Organic LED (OLED), Active-Matrix Organic LED (AMOLED)), or the like.

[0064] At least one of the first display and the second display may be associated with at least one ambient light sensor (e.g. phototransistors, photodiodes, photonic integrated circuits, or the like). For example, if the first display and the second display belong to the same device, the at least one ambient light sensor may be located in any one of the first display and second display, or located near any one of the first and second display (e.g. in one or more of the notches 13 placed next to the first and/or second display, or in a rim of the device comprising the display). An ambient light level determined by the at least one ambient light sensor in any one of the displays may be used for controlling display parameters of both the first and second displays. Alternatively, if both the first display and the second display comprise ambient light sensors, display parameters of the first display and second display may be controlled based on ambient light level determined by ambient light sensors located in the respective display.

[0065] At operation 42, ambient light information may be received from the at least one ambient light sensor. For example, the ambient light information received may be based on the light sensed by the at least one ambient light sensor (e.g. comprised within the first display and/or the second display). As described above with reference to FIG. 3, the light level sensed by the ambient light sensor(s) may include light emitted by one of the first display or the second display, and therefore may inaccurately represent the ambient lighting.

[0066] At operation 43, updated ambient light information may be generated based, at least in part, on the received ambient light information and the determined angle.

[0067] For example, viewing in conjunction with FIG. 3, in orientation 33, the angle 37 of the first display 33a relative to the second display 33b may be determined in operation 41. The second display 33b may comprise an ambient light sensor, such that ambient light information for the second display 33b is determined at operation 42. The ambient light information determined at operation 42 may have been affected by the light emitted from the first display 33a. As such, updated ambient light information for the second display 33b may be generated based at least in part on the determined ambient light information, and the angle 37.

[0068] For example, the updated ambient light information may take into account the effect of the light emitted from the first display 33a on the determined ambient light information based on the determined angle, and may compensate for that effect. For example, if the light emitted from the first display 33a causes the determined ambient light information to show higher ambient light levels than the actual ambient light level, the updated ambient light information may indicate lower ambient light level compared to the determined ambient light information, in order to match with the actual ambient light level.

[0069] In one example, a look up table may be used for determining the amount by which the ambient light information is to be updated based on the angle between

the first display and the second display. The lookup table may comprise indication of how to update ambient light information based on a few known angles (e.g. 135 degrees, 90 degrees, 60 degrees), or may comprise indication of how to update ambient light information based on various ranges of angles (e.g. various ranges of angles from 0 to 180 degrees). As such, the updated ambient light information may be generated (e.g. dynamically) as the angle between the first display and the second display changes (e.g. different updated ambient light information generated for angles 36, 37 and 38 respectively).

[0070] In one example, for the orientation 31, no updated ambient light information maybe generated at operation 43, or the updated ambient light information generated may be substantially similar to the ambient light information determined at operation 42, because the angle between the first and second displays is 180 degrees (e.g. flat) and therefore there may be no effect or substantially low effect of the light emitted from the first display 31a on the second display 31b.

[0071] At operation 44, at least one display parameter of at least one of the first display or the second display may be controlled based, at least in part, on the updated ambient light information.

[0072] For example, viewing in conjunction with FIG. 3, in orientation 33, at least one display parameter of the second display 33b may be controlled based on the updated ambient light information. The at least one display parameter may include brightness, contrast, colour, sharpness, or the like. As described earlier, brightness level of the second display may be caused to increase or decrease based on ambient light levels (e.g. the updated ambient light information) in order to improve a viewing experience of a user. Alternatively, or additionally, the display parameters of the first display 33a may also be controlled based on updated light information for the first display (determined based on the determined ambient light information for the first display and the angle between the first display and the second display). As such, for example, readability and user experience of the first and/or second display (e.g. as part of foldable dual-display devices) by correcting erroneous ambient light estimates caused by the other one of the first and/or second display.

[0073] FIG. 5 is a block diagram of a system, indicated generally by the reference numeral 50, in accordance with an example embodiment. System 50 shows a plan view 52 (on the left), and a side view (on the right) to show orientation 51. In the orientation 51, a first display 53a is at an angle 57 relative to a second display 53b. The plan view 52 shows contents of the first display 53a (e.g. showing graphical content) and second display 53b (e.g. showing textual content). For example, the reflection of the light emitted from the first display 53a may also have a negative effect on the user's viewing experience of the second display 53b. For example, as shown in the plan view 52, some of the content (e.g. the text 'Hello World!' in the first or second row) of the second display 53b may appear to be lighter or unclear to the user.

[0074] FIG. 6 is a block diagram of a system, indicated generally by the reference numeral 60, in accordance with an example embodiment. System 60 shows a plan view 62 (on the left), and a side view (on the right) to show orientation 61. In the orientation 61, a first display 63a is at an angle 67 relative to a second display 63b. The plan view 62 shows contents of the first display 63a (e.g. showing graphical content) and second display 63b (e.g. showing textual content). Alternatively, or in addition to the effect shown in FIG. 5, as light is emitted from the first display 63a, the ambient light information of the second display 53b may be inaccurate due to the effect of the light emitted from the first display 53a. This may in turn cause an automatic brightness control system to increase the brightness excessively, as shown in the plan view 62, based on the determined inaccurate ambient light information, which may affect the user's viewing experience of the second display 63b.

[0075] As such, the operations of algorithm 40 described with reference to FIG. 4 may be performed in order to make the view of the second display 53b or 63b clearer (e.g. as illustrated in FIG. 7, as described below), for example, by generating updated ambient light information, and controlling at least one display parameters of the second display 53b or 63b based on the updated ambient light information. Of course, similar operations may also be performed for the first display 53a or 63a in order to compensate for the effects of the light emitted from the second display 53b or 63b respectively.

[0076] FIG. 7 is a block diagram of a system, indicated generally by the reference numeral 70, in accordance with an example embodiment. System 70 shows a plan view 72 (on the left; similar to the plan views 52 and 62 described with reference to FIG. 5 and FIG. 6 respectively), and a side view (on the right) to show orientation 71 (similar to orientations 51 and 61). The plan view 72 and orientation 71 shows a first display 73a (similar to the first display 53a and 63a) and a second display 73b (similar to the second display 53b and 63b). As described in algorithm 40, an angle between the first and second displays 73a and 73b may be determined at operation 41, and ambient light information for the second display 73b may be obtained or determined at operation 42. Updated ambient light information for the second display 73b may be generated at operation 43, such that at least one display parameter of the second display 73b is controlled based on the updated ambient light information. As such, as shown in the plan view 72 of the second display 73b, the text 'Hello World!' appears to be clearer compared to that shown in the plan view 52, and also appears to be not as bright (e.g. eye-straining for the user) compared to that shown in the plan view 62. For example, display parameters, such as brightness and/or contrast of the second display may be controlled (e.g. increased) in order to compensate for the effect of the

light emitted by the first display 73a on the second display 73b.

[0077] In an example embodiment, controlling at least one display parameter comprises causing decreasing or increasing brightness level of at least part of the at least one of the first display or the second display. For example, brightness level of the whole second display 73b may be increased or decreased, evenly for improving the user viewing experience. Alternatively, brightness level of the top part of the second display 73b may be increased or decreased more than the brightness of the bottom part of the second display 73b is increased or decreased, for example, in order to compensate for the varying effect of the light emitted from the first display 73a (e.g. as shown in the plan view 52), the effect on the top part of the second display 53b may be higher than that in the bottom part of the second display 53b, due to the distance of the first display 53a from the top part of the second display 53b being less than the distance of the first display 53a from the bottom part of the second display 53b.

[0078] In an example embodiment, the controlling at least one display parameter is further based on one or more display parameter preferences for the first display and/or the second display. For example, the user may have a preferred brightness, contrast, colour, and/or sharpness, for viewing the screen, as defined by the one or more display parameter preferences. As such, at operation 44, the at least one display parameters may be controlled to further take into account the one or more display parameter preferences of the user.

[0079] In an example embodiment, the generating updated ambient light information at operation 43 is further based on a brightness level of at least one of the first display or second display. For example, the higher the brightness level is on the first display 73a, the more the display parameters of the second display 73b may need to be adjusted for providing optimal viewing experience to the user, as the effects of the light emitted from the first display 73a on the second display 73b may be higher.

[0080] FIG. 8 is a flowchart of an algorithm, indicated generally by the reference numeral 80, in accordance with an example embodiment. The operations of the algorithm 80 may be performed in addition to, or instead of the operations of the algorithm 40 described with reference to FIG. 4.

[0081] At operation 81 (e.g. similar to operation 41) an angle (36, 37, 38) of a first display (31a, 32a, 33a, 34a) relative to a second display (31b, 32b, 33b, 34b) is obtained or determined. For example, an angle sensor may be used for determining the angle between the first display and the second display. As described above, the first display and the second display may be suitable for emitting light.

[0082] At operation 82, it is determined whether a gaze direction of a user corresponds to the first display or the second display. Alternatively, information of whether a gaze direction of a user corresponds to the first display or the second display is obtained. For example, if the first display and second display form part of the same device, and the operations of algorithm 80 are performed at the device, then the gaze direction can be determined; alternatively, if the first display and the second display are comprised in different devices, and/or the operations of the algorithm 80 is performed at a server, then information of whether a gaze direction of a user corresponds to the first display or the second display may be obtained from one of the first display or second display by another one of the first display or second display, or by the server. For example, gaze direction of a user may be determined using cameras, for example, on the first and/or second display, or based on eye-tracking information, for example, obtained from an eyewear device worn by the user (e.g. a smart eyewear device).

[0083] If it is determined (or information is obtained) that a gaze direction of the user corresponds to the first display, then the algorithm 80 moves to operation 83, where at least one display parameter of the second display is controlled such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display.

[0084] If it is determined (or information is obtained) that the gaze direction of the user corresponds to the second display, then the algorithm 80 moves to operation 84, where at least one display parameter of the first display is controlled such that at least one display parameter of the second display is caused to match display parameter preferences of the second display.

[0085] In one example, if it is determined (or information is obtained) that the gaze direction of the user corresponds to both the first display and the second display (e.g. partially the first display and partially the second display, or gaze direction alternating between the first display and the second display), both the operations 83 and 84 may be performed. For example, at least one display parameter of the second display is controlled such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display, and at least one display parameter of the first display is controlled such that at least one display parameter of the second display is caused to match display parameter preferences of the second display. Alternatively, or in addition, the at least one display parameter of the first display and the at least one display parameter of the second display may be controlled based on a balance, such that at least some of the display parameter preferences of the first display are matched and at least some of the display parameter preferences of the second display are matched.

[0086] This use of the algorithm 80 is discussed in further detail below with reference to FIGs. 9 to 13.

[0087] FIG. 9 is a block diagram of a system, indicated generally by the reference numeral 90, in accordance with an example embodiment. System 90 shows a first display 91a and a second display 91b, such that the angle between the first display 91a and the second display 91b is approximately 90 degrees. A user 93 is shown, where

the gaze direction 94 of the user 93 corresponds to the second display 91b (e.g. user 93 is looking at or focussing on the second display 91b). Therefore, viewing in conjunction with FIG. 8, at operation 82, it is determined (or information is obtained that) the gaze direction of the user corresponds to the second display 91b. As such, in response, at least one display parameter of the first display 91a is controlled at operation 84, such that at least one display parameter of the second display 91b is caused to match display parameter preferences of the second display 91b.

[0088] FIG. 10 is a block diagram of a system, indicated generally by the reference numeral 100, in accordance with an example embodiment.

[0089] A view 101 is shown of a first display 103a (similar to first display 91a) and a second display 103b (similar to second display 91b), as viewed without applying the operations of algorithm 80. As can be seen in view 101, the text of the second display 103b may be unclear due to the reflection of the light emitted from the first display 103a.

[0090] A view 102 is shown of a first display 104a (similar to first display 91a) and a second display 104b (similar to second display 91b), as viewed after performing the operations of algorithm 80. For example, in response to determining (or obtaining information that) a gaze direction of a user corresponds to the second display 104b, at least one display parameter (e.g. brightness level) of the first display 104a is controlled such that at least one display parameter of the second display 104b is caused to match display parameter preferences of the second display. As can be seen in view 102, the text of the second display 104b maybe much clearer compared to that in view 101, due to the brightness level of the first display 104a being decreased.

[0091] In an example embodiment, the change in display parameter(s) of the first display 104a may depend on the angle between the first display 104a and the second display 104b. For example, the smaller the angle is between the first display 104a and the second display 104b, the more the brightness level of the first display 104a is decreased.

[0092] Thus, for example, when the user is viewing or focussing on the second display 104b, the brightness, colour, contrast, or other display parameters of the first display 104a maybe controlled to provide optimal viewing experience of the second display 104b (e.g. by reducing reflections), or to provide optimal ambient lighting for the viewing experience of the second display 104b to match preferred display parameters for the second display 104b. Additionally, or alternatively, the brightness level of the first display 104a may be controlled such that the light emitted from the first display 104a may help the user to clearly see buttons (e.g. buttons that are not lit) on the device (e.g. device comprising the second display 104b) if the ambient lighting is otherwise low.

[0093] In an example embodiment, controlling at least one display parameter of the second display, as described in operation 83, may comprise causing decreasing or increasing brightness level of at least part of the second display. Controlling at least one display parameter of the first display, as described in operation 84, may comprise causing decreasing or increasing brightness level of at least part of the first display. Therefore, brightness level of one of the displays can be partially decreased or increased, for example, based on a brightness gradient. For example, the brightness gradient may be dependent on a distance between the respective part of the respective one of the second display or the first display, and the other one of the second display or the first display.

[0094] FIG. 11 is a block diagram of a system, indicated generally by the reference numeral 110, in accordance with an example embodiment.

[0095] A view 111 is shown of a first display 113a (similar to first display 91a) and a second display 113b (similar to second display 91b), as viewed without applying the operations of algorithm 80. As can be seen in view 111, at least part of the text (e.g. the top rows) of the second display 113b may be unclear due to the reflection of the light emitted from the first display 113a.

[0096] A view 112 is shown of a first display 114a (similar to first display 91a) and a second display 114b (similar to second display 91b), as viewed after performing the operations of algorithm 80. For example, in response to determining (or obtaining information that) a gaze direction of a user corresponds to the second display 114b, at least one display parameter (e.g. brightness level) of the first display 114a is controlled such that at least one display parameter of the second display 114b is caused to match display parameter preferences of the second display. For example, the brightness level of at least part of the first display 114a is decreased, for example, based on a gradient. For example, as the distance between the bottom part of the first display 114a and the second display 114b is smaller compared to the distance between the top part of the first display 114a and the second display 114b, the brightness level of the bottom part of the first display 114a is decreased more than the brightness level of the top part of the first display 114a (e.g. thus the brightness level of the bottom part of the first display 114a is lower than the brightness level of the top part of the first display 114a). Thus, the bottom part of the first display closest to the second display is caused to have lowest brightness level, and a top part of the first display farthest from the second display is caused to have highest brightness level. As can be seen in view 112, the text of the second display 114b may be much clearer compared to that in view 111, due to the brightness level of the first display 114a being decreased.

[0097] FIG. 12 is a block diagram of a system, indicated generally by the reference numeral 120, in accordance with an example embodiment. System 120 shows a first display 121a and a second display 121b, such that the angle between the first display 121a and the second display 121b is approximately 60 degrees. A user 123 is

shown, where the gaze direction 124 of the user 123 corresponds to the second display 121b. Therefore, viewing in conjunction with FIG. 8, at operation 82, it is determined (or information is obtained that) the gaze direction of the user corresponds to the second display 121b. As such, in response, at least one display parameter of the first display 121a is controlled at operation 84, such that at least one display parameter of the second display 121b is caused to match display parameter preferences of the second display 121b.

[0098] In one example, the gradient for decreasing or increasing the brightness level of the first display may be dependent on the angle between the first display and the second display.

[0099] As the angle between the first display 121a and second display 121b is 60 degrees, which is less than the angle between the first display 91a and the second display 91b (90 degrees), the gradient for decreasing the brightness level of the first display may be stronger, such that brightness level of a larger part of the first display is decreased.

[0100] FIG. 13 is a block diagram of a system, indicated generally by the reference numeral 130, in accordance with an example embodiment.

[0101] A view 131 is shown of a first display 133a (similar to first display 121a) and a second display 133b (similar to second display 121b), as viewed without applying the operations of algorithm 80. As can be seen in view 131, at least part of the text (e.g. the top rows) of the second display 133b may be unclear due to the reflection of the light emitted from the first display 133a.

[0102] A view 132 is shown of a first display 134a (similar to first display 121a) and a second display 134b (similar to second display 121b), as viewed after performing the operations of algorithm 80. For example, in response to determining (or obtaining information that) a gaze direction of a user corresponds to the second display 134b, at least one display parameter (e.g. brightness level) of the first display 134a is controlled such that at least one display parameter of the second display 134b is caused to match display parameter preferences of the second display. For example, the brightness level of at least part of the first display 134a is decreased, for example, based on a gradient. For example, as the distance between the bottom part of the first display 134a and the second display 134b is smaller compared to the distance between the top part of the first display 134a and the second display 134b, the brightness level of the bottom part of the first display 134a is decreased more than the brightness level of the top part of the first display 114a (e.g. thus the brightness level of the bottom part of the first display 114a is lower than the brightness level of the top part of the first display 114a). The gradient of decreasing brightness level as shown in the first display 134a may be stronger than the gradient of decreasing brightness level as shown in the first display 114a due to the smaller angle (60 degrees) between the first display 134a and second display 134b compared to the angle (90 degrees) between the first display 114a and second display 114b. As can be seen in view 132, the text of the second display 134b may be much clearer compared to that in view 131, due to the brightness level of the first display 134a being decreased.

[0103] As such, the operations 83 and 84 of the algorithm 80 may be performed by decreasing brightness (dimming) or increasing brightness of the whole of the first or second display, decreasing or increasing brightness of certain elements displayed on the first or second display (e.g. reducing brightness of images but not text, or vice versa), decreasing or increasing brightness of a localized part of the display, or by decreasing or increasing brightness based on a gradient.

[0104] In an example embodiment, if a gaze direction of the user 93, as shown in FIG. 9 and/or FIG. 12, is determined to correspond to the first display, the operations of the algorithm 80 may be performed for controlling at least one display parameter of the second display in operation 83. For example, at least one display parameter of the second display (91b, 121b) is controlled at operation 83, such that at least one display parameter of the first display (91a, 121a) is caused to match display parameter preferences of the first display (91a, 121a). As such, instead of reducing brightness of at least part of the first display (104a, 114a, 134a), brightness of at least part of the second display may be reduce in order to cause at least one display parameter of the first display to match display parameter preferences of the first display.

[0105] The example embodiments described above may be applied to a first and second display that belong to the same device, or may be applied to first and second displays that belong to different devices.

[0106] FIG. 14 is a block diagram of a system, indicated generally by the reference numeral 140, in accordance with an example embodiment. A view 141 shows a first display 143 and a second display 144. For example, the first display 143 maybe comprised in a smart watch worn by the user, and the second display 144 may be comprised in a smartphone used by the user. When the first display 143 and second display 144 are used in close proximity to each other, as shown in the view 142, the light emitted from the first display 143 may affect the viewing experience of the second display 144, for example due to reflections or due to change in ambient light levels determined for the second display 144. As such, the example embodiments described above may be used for improving the viewing experience of the first display 143 and/or second display 144 by controlling display parameters of the first display 143 and/or the second display 144.

[0107] In one example, information of an angle of the first display 143 relative to the second display 144 maybe determined (e.g. determined at operation 41 and/or 81; e.g. using accelerometers or angle sensors) by one of the first display 143 and second display 144 and communicated (e.g. obtained at operation 41 and/or 81, e.g.

using ultra-wide band technology) to the other one of the first display 143 and second display 144. Alternatively, or in addition, information of the angle of the first display 143 relative to the second display 144 may be determined by both of the first display 143 and second display 144.

[0108] In one example, the ambient light information may be determined (e.g. determined at operation 42) by one of the first display 143 and second display 144 and communicated (e.g. obtained at operation 42) to the other one of the first display 143 and second display 144. Alternatively, or in addition, the ambient light information may be determined by both of the first display 143 and second display 144.

[0109] FIG. 15 is a block diagram of a system, indicated generally by the reference numeral 150, in accordance with an example embodiment. A view 151 shows a first display 153 and a second display 154. For example, the first display 153 may be comprised in a smart television or monitor screen, and the second display 154 may be comprised in a smartphone used by the user. When the first display 153 and second display 154 are used in close proximity to each other, as shown in the view 152, the light emitted from the first display 153 may affect the viewing experience of the second display 154, for example due to reflections or due to change in ambient light levels determined for the second display 154. As such, the example embodiments described above may be used for improving the viewing experience of the first display 153 and/or second display 154 by controlling display parameters of the first display 153 and/or the second display 154.

[0110] It will be appreciated that the first display and the second display may be comprised in any type of electronic device(s), and are not limited to being comprised in a smartphone, smartwatch, or smart television or monitor screen. As such, it may be possible that only one or both of the first display and second display have the capability of automatic control of display parameter(s) based on ambient light conditions (e.g. updated ambient light information generated based on the angle between the two displays), the angle between the two displays, or the gaze direction.

[0111] For completeness, FIG. 16 is a schematic diagram of components of one or more of the example embodiments described previously, which hereafter are referred to generically as processing systems 300. A processing system 300 may have a processor 302, a memory 304 closely coupled to the processor and comprised of a RAM 314 and ROM 312, and, optionally, user input 310 and a display 318. The processing system 300 may comprise one or more network/apparatus interfaces 308 for connection to a network/apparatus, e.g. a modem which may be wired or wireless. Interface 308 may also operate as a connection to other apparatus such as device/apparatus which is not network side apparatus. Thus, direct connection between devices/apparatus without network participation is possible.

[0112] The processor 302 is connected to each of the other components in order to control operation thereof.

[0113] The memory 304 may comprise a non-volatile memory, such as a hard disk drive (HDD) or a solid-state drive (SSD). The ROM 312 of the memory 304 stores, amongst other things, an operating system 315 and may store software applications 316. The RAM 314 of the memory 304 is used by the processor 302 for the temporary storage of data. The operating system 315 may contain computer program code which, when executed by the processor implements aspects of the algorithms 40 and 80 described above. Note that in the case of small device/apparatus the memory can be most suitable for small size usage i.e. not always hard disk drive (HDD) or solid-state drive (SSD) is used.

[0114] The processor 302 may take any suitable form. For instance, it may be a microcontroller, a plurality of microcontrollers, a processor, or a plurality of processors.

[0115] The processing system 300 may be a standalone computer, a server, a console, or a network thereof. The processing system 300 and needed structural parts may be all inside device/apparatus such as IoT device/apparatus i.e. embedded to very small size

[0116] In some example embodiments, the processing system 300 may also be associated with external software applications. These may be applications stored on a remote server device/apparatus and may run partly or exclusively on the remote server device/apparatus. These applications maybe termed cloud-hosted applications. The processing system 300 may be in communication with the remote server device/apparatus in order to utilize the software application stored there.

[0117] FIG. 17 shows tangible media, specifically a removable memory unit 365, storing computer-readable code which when run by a computer may perform methods according to example embodiments described above. The removable memory unit 365 maybe a memory stick, e.g. a USB memory stick, having internal memory 366 for storing the computer-readable code. The internal memory 366 may be accessed by a computer system via a connector 367. Other forms of tangible storage media may be used. Tangible media can be any device/apparatus capable of storing data/information which data/information can be exchanged between devices/apparatus/network.

[0118] Embodiments of the present invention may be implemented in software, hardware, application logic or a combination of software, hardware and application logic. The software, application logic and/or hardware may reside on memory, or any computer media. In an example embodiment, the application logic, software or an instruction set is maintained on any one of various conventional computer-readable media. In the context of this document, a "memory" or "computer-readable medium" may be any non-transitory media or means that can contain, store, communicate, propagate or transport the instructions for use by or in connection with an instruction execution system, apparatus, or device, such as a computer.

[0119] Reference to, where relevant, "computer-read-

able storage medium", "computer program product", "tangibly embodied computer program" etc., or a "processor" or "processing circuitry" etc. should be understood to encompass not only computers having differing architectures such as single/multi-processor architectures and sequencers/parallel architectures, but also specialised circuits such as field programmable gate arrays FPGA, application specify circuits ASIC, signal processing devices/apparatus and other devices/apparatus. References to computer program, instructions, code etc. should be understood to express software for a programmable processor firmware such as the programmable content of a hardware device/apparatus as instructions for a processor or configured or configuration settings for a fixed function device/apparatus, gate array, programmable logic device/apparatus, etc.

[0120] As used in this application, the term "circuitry" refers to all of the following: (a) hardware-only circuit implementations (such as implementations in only analogue and/or digital circuitry) and (b) to combinations of circuits and software (and/or firmware), such as (as applicable): (i) to a combination of processor(s) or (ii) to portions of processor(s)/software (including digital signal processor(s)), software, and memory(ies) that work together to cause an apparatus, such as a server, to perform various functions) and (c) to circuits, such as a microprocessor(s) or a portion of a microprocessor(s), that require software or firmware for operation, even if the software or firmware is not physically present.

[0121] If desired, the different functions discussed herein may be performed in a different order and/or concurrently with each other. Furthermore, if desired, one or more of the above-described functions may be optional or may be combined. Similarly, it will also be appreciated that the flow charts of Figures 4 and 8 are examples only and that various operations depicted therein may be omitted, reordered and/or combined.

[0122] It will be appreciated that the above described example embodiments are purely illustrative and are not limiting on the scope of the invention. Other variations and modifications will be apparent to persons skilled in the art upon reading the present specification.

[0123] Moreover, the disclosure of the present application should be understood to include any novel features or any novel combination of features either explicitly or implicitly disclosed herein or any generalization thereof and during the prosecution of the present application or of any application derived therefrom, new claims may be formulated to cover any such features and/or combination of such features.

Claims

1. An apparatus comprising means for performing:

obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor;
receiving ambient light information from the at least one ambient light sensor;
generating updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and
controlling at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

2. An apparatus as claimed in claim 1, wherein the controlling at least one display parameter comprises causing decreasing or increasing brightness level of at least part of the at least one of the first display or the second display.

3. An apparatus as claimed in claim 1 or claim 2, wherein the controlling at least one display parameter is further based on one or more display parameter preferences for the first display and/or the second display.

4. An apparatus as claimed in any one of the preceding claims, wherein the generating updated ambient light information is further based on a/the brightness level of at least one of the first display or second display.

5. An apparatus as claimed in any one of the preceding claims, further comprising means for performing:

obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and
in response to the obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling the at least one display parameter of the second display such that the at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

6. An apparatus comprising means for performing:

obtaining or determining an angle of a first display relative to a second display, wherein the

first display and the second display are suitable for emitting light;
obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and
in response to the obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling at least one display parameter of the second display such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to the obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

7. An apparatus as claimed in any one of claim 5 or claim 6, wherein the controlling at least one display parameter of the second display comprises causing decreasing or increasing brightness level of at least part of the second display, and controlling at least one display parameter of the first display comprises causing decreasing or increasing brightness level of at least part of the first display.

8. An apparatus as claimed in any one of claims 5 to 7, the controlling at least one display parameter of the respective one of the second display or the first display comprises causing decreasing or increasing brightness level of at least part of the respective one of the second display or the first display based on a brightness gradient, wherein the brightness gradient is dependent on a distance between the respective part of the respective one of the second display or the first display, and the other one of the second display or the first display.

9. An apparatus as claimed in any one of the preceding claims, wherein the first display and the second display together form a dual-display screen of a single device, wherein the first display and the second display are foldable with respect to each other.

10. An apparatus as claimed in any one of the claims 1 to 8, wherein the first display and the second display belong to a first device and a second device respectively.

11. An apparatus as claimed in any one of the preceding claims, wherein the means comprises at least one processor; and at least one memory including computer program code, the at least one memory and computer program code configured to, with the at least one processor, cause the performance of the apparatus.

12. A method comprising:

obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor;
receiving ambient light information from the at least one ambient light sensor;
generating updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and
controlling at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

13. A method comprising:

obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light;
obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and
in response to obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling at least one display parameter of the second display such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

14. A computer program comprising instructions for causing an apparatus to perform at least the following:

obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light and wherein at least one of the first display and the second display is associated with at least one ambient light sensor;
receiving ambient light information from the at least one ambient light sensor;

generating updated ambient light information based, at least in part, on the received ambient light information and the determined angle; and controlling at least one display parameter of at least one of the first display or the second display based, at least in part, on the updated ambient light information.

15. A computer program comprising instructions for causing an apparatus to perform at least the following:

obtaining or determining an angle of a first display relative to a second display, wherein the first display and the second display are suitable for emitting light;
obtaining or determining information of whether a gaze direction of a user corresponds to the first display or the second display; and
in response to obtaining or determining information that a gaze direction of the user corresponds to the first display, controlling at least one display parameter of the second display such that at least one display parameter of the first display is caused to match one or more display parameter preferences of the first display; and/or in response to obtaining or determining information that the gaze direction of the user corresponds to the second display, controlling the at least one display parameter of the first display such that the at least one display parameter of the second display is caused to match one or more display parameter preferences of the second display.

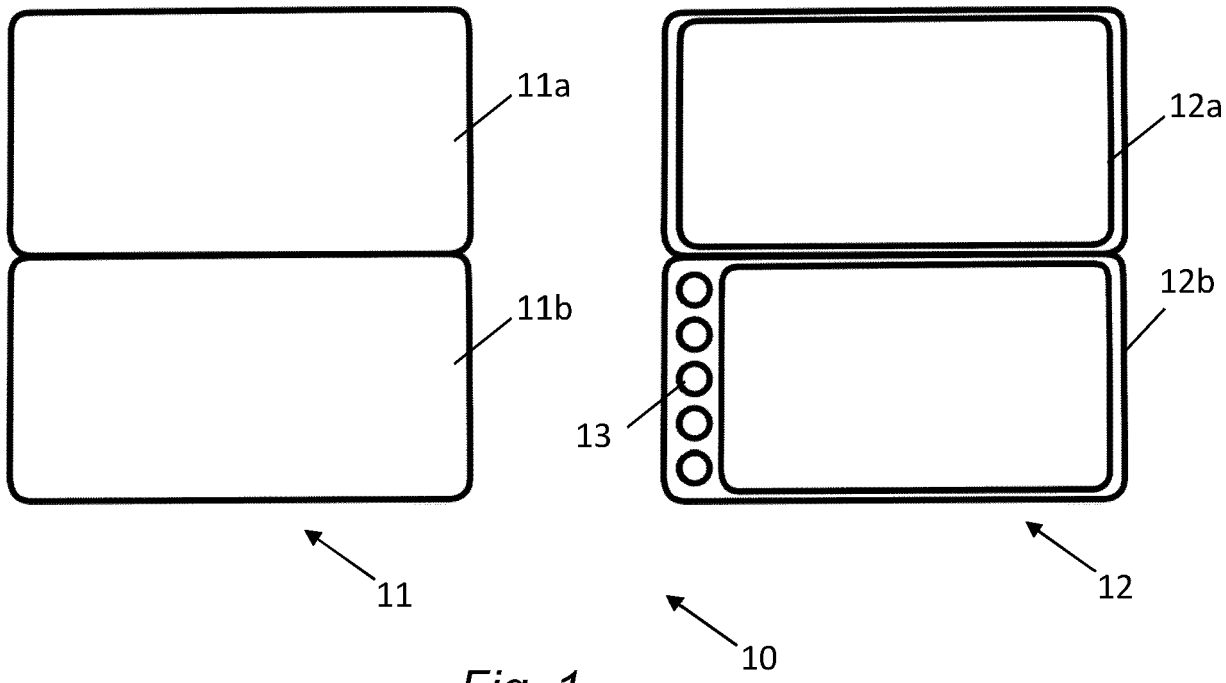

11a
11b
11
12a
12b
13
12
10

Fig. 1

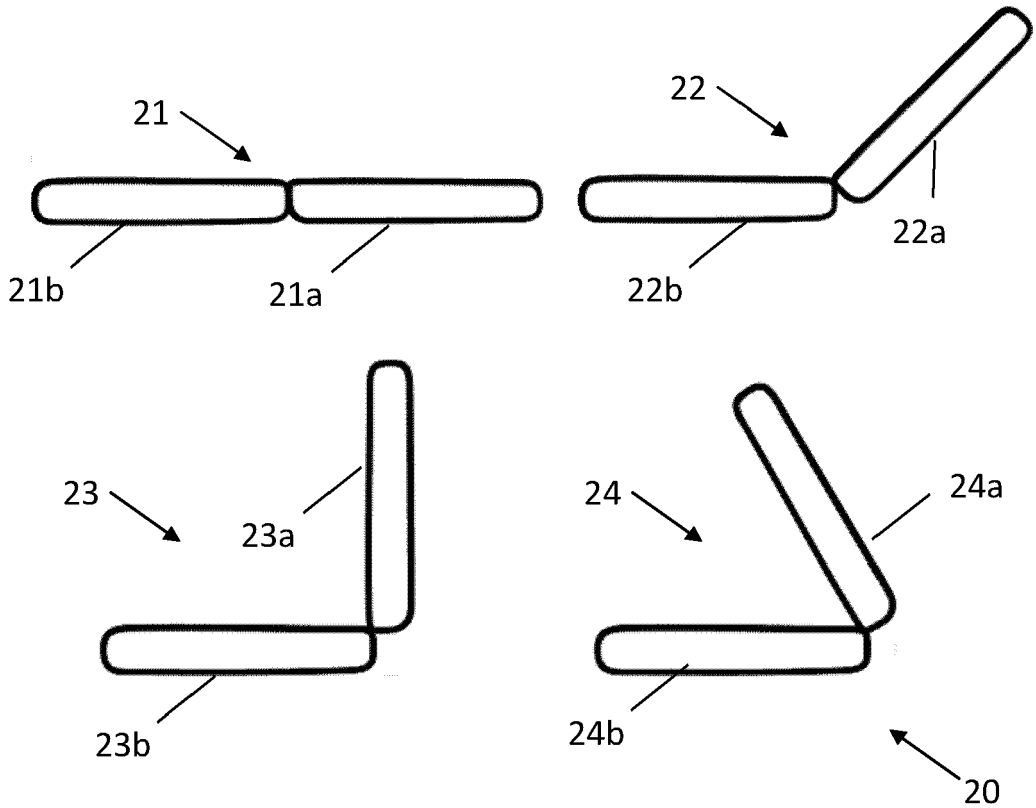

21
21b
21a
22
22a
22b
23
23a
23b
24
24a
24b
20

Fig. 2

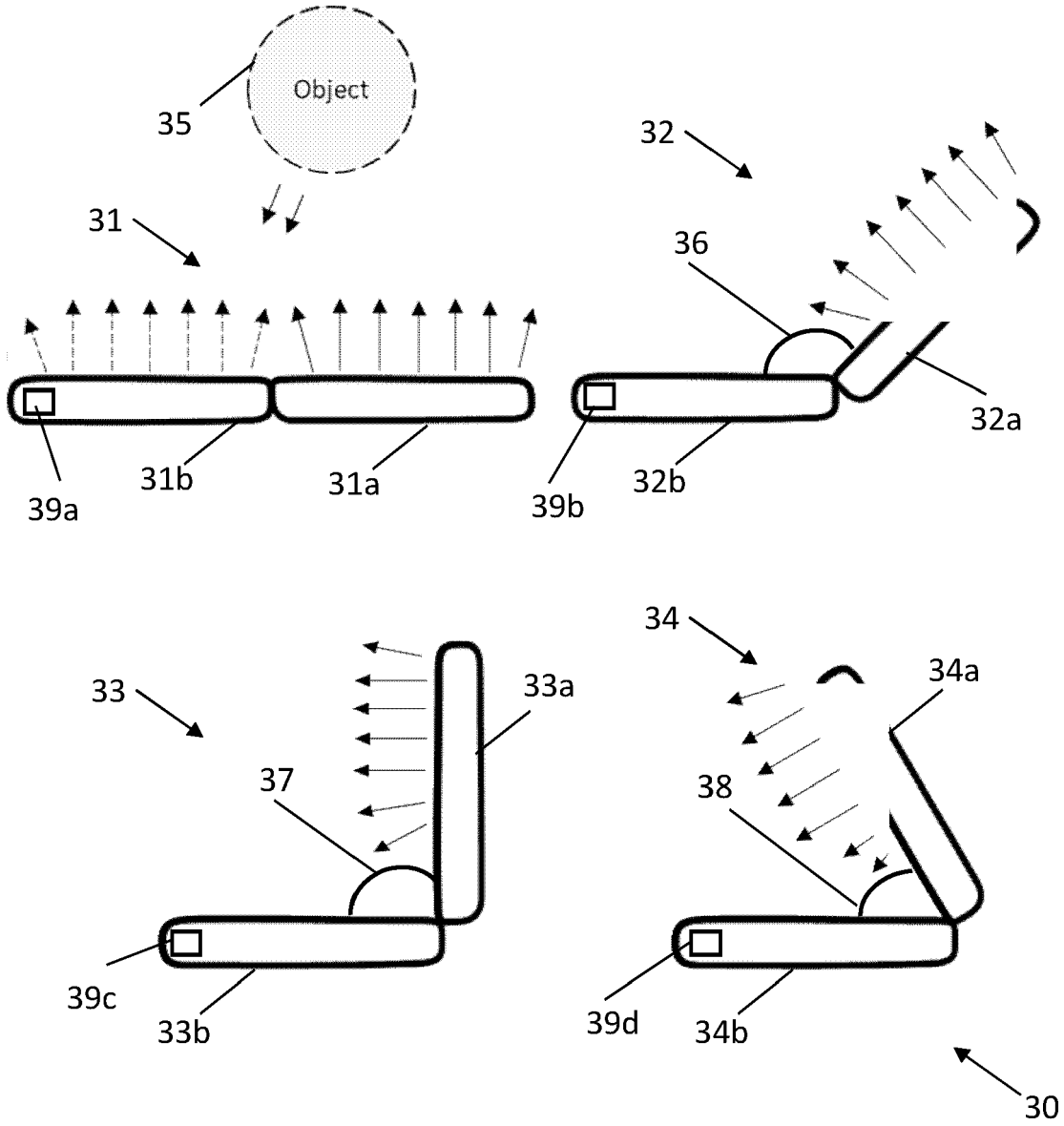

Object
35
31
39a
31b
31a
32
36
32a
39b
32b
33
33a
37
39c
33b
34
34a
38
39d
34b
30

Fig. 3

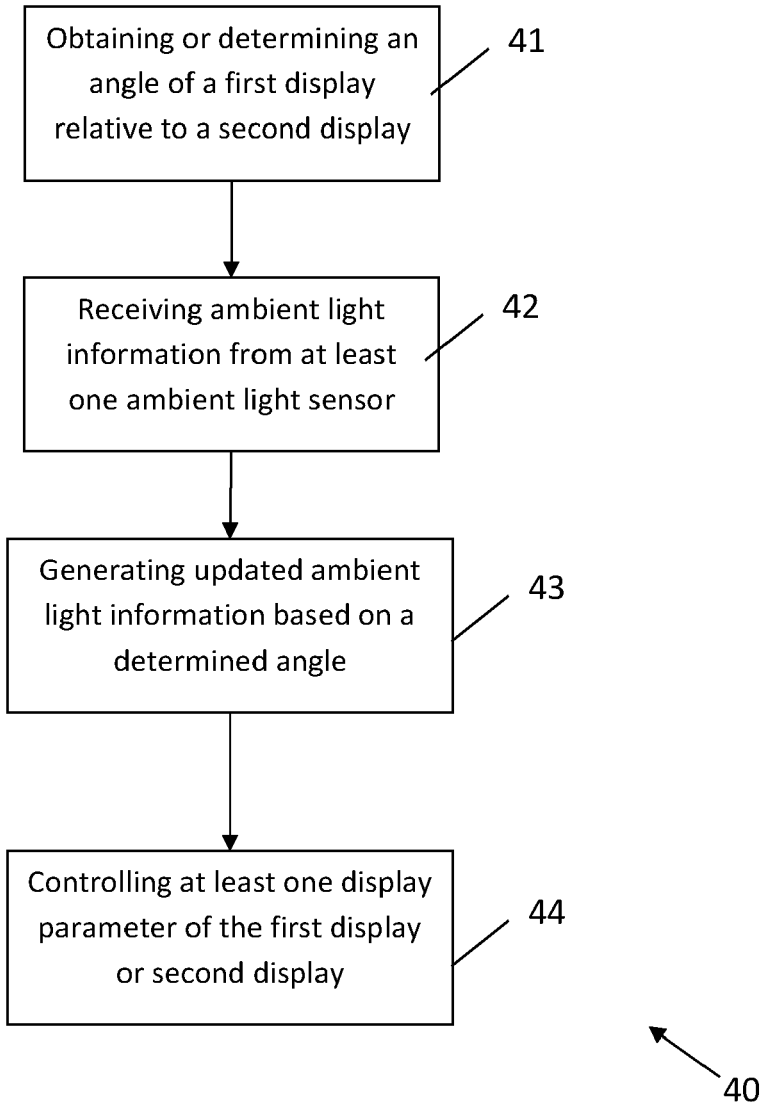

Obtaining or determining an angle of a first display relative to a second display
41
Receiving ambient light information from at least one ambient light sensor
42
Generating updated ambient light information based on a determined angle
43
Controlling at least one display parameter of the first display or second display
44
40

Fig. 4

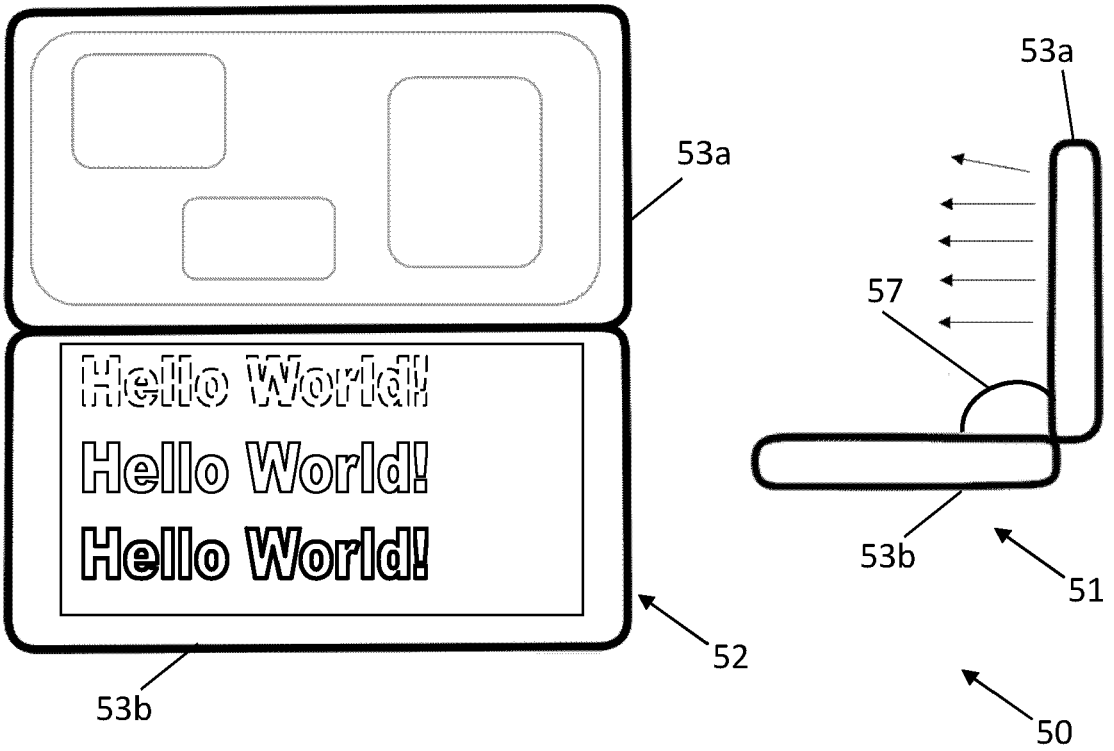

Hello World!
Hello World!
Hello World!
53a
53a
57
53b
51
52
53b
50

Fig. 5

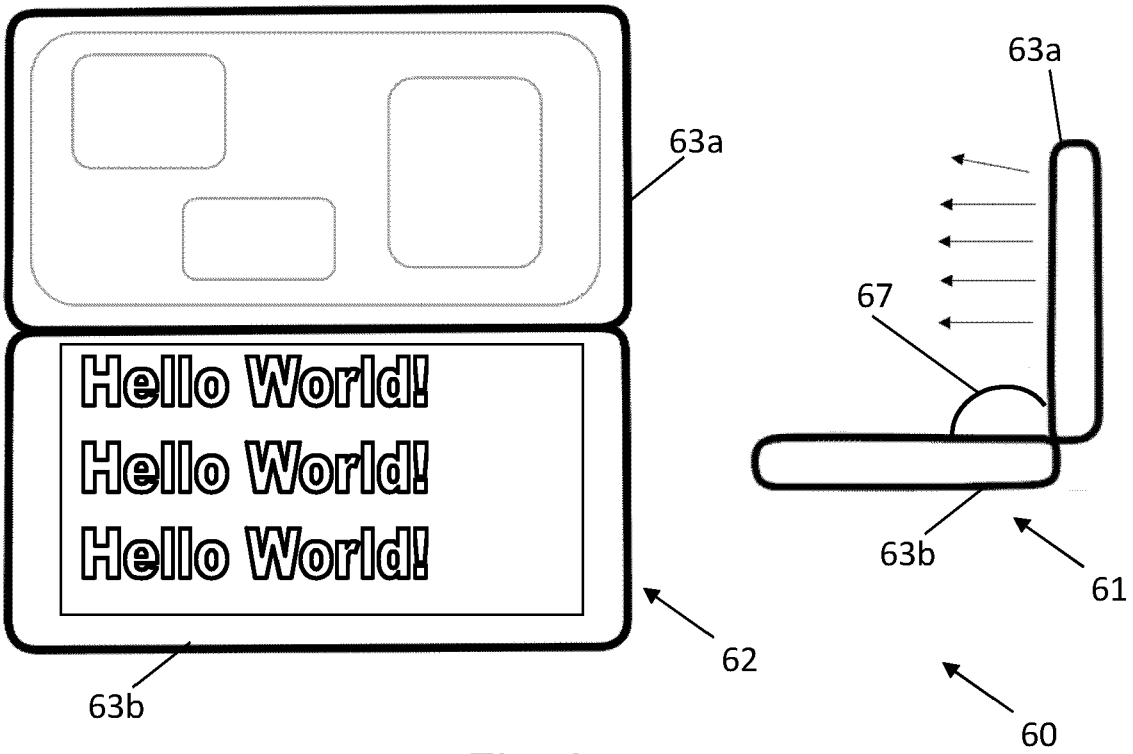

Hello World!
Hello World!
Hello World!
63a
63a
67
63b
61
62
63b
60

Fig. 6

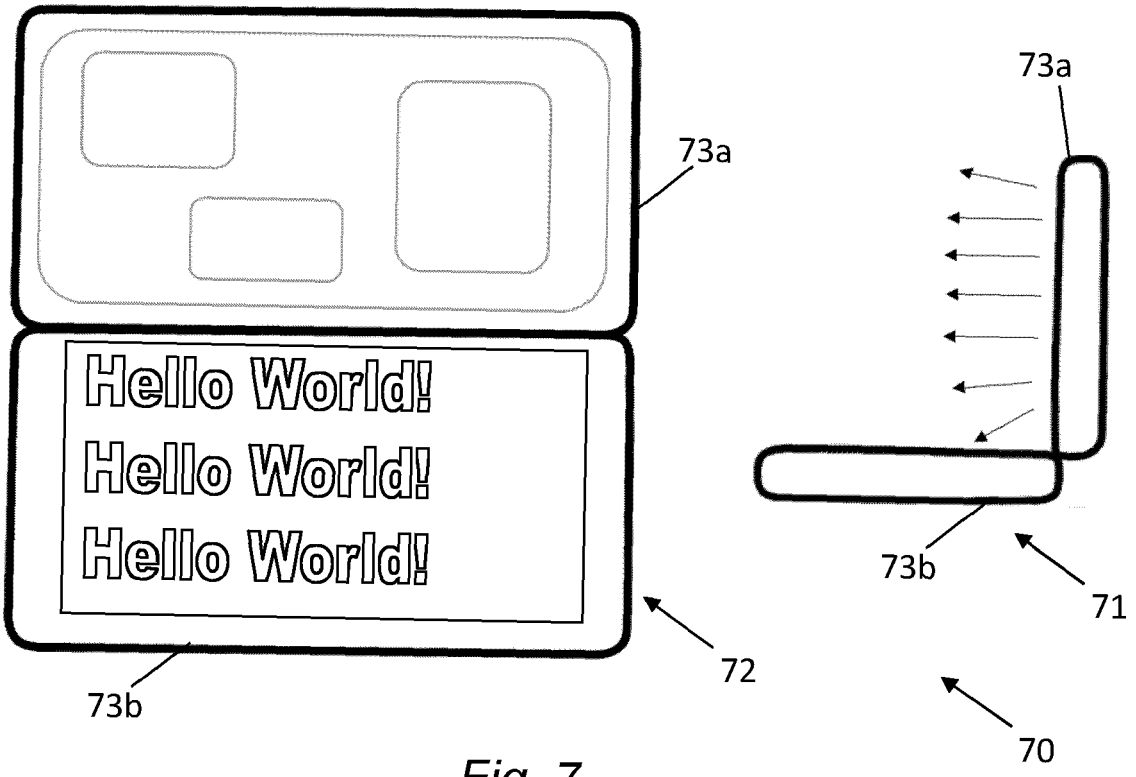


Fig. 7

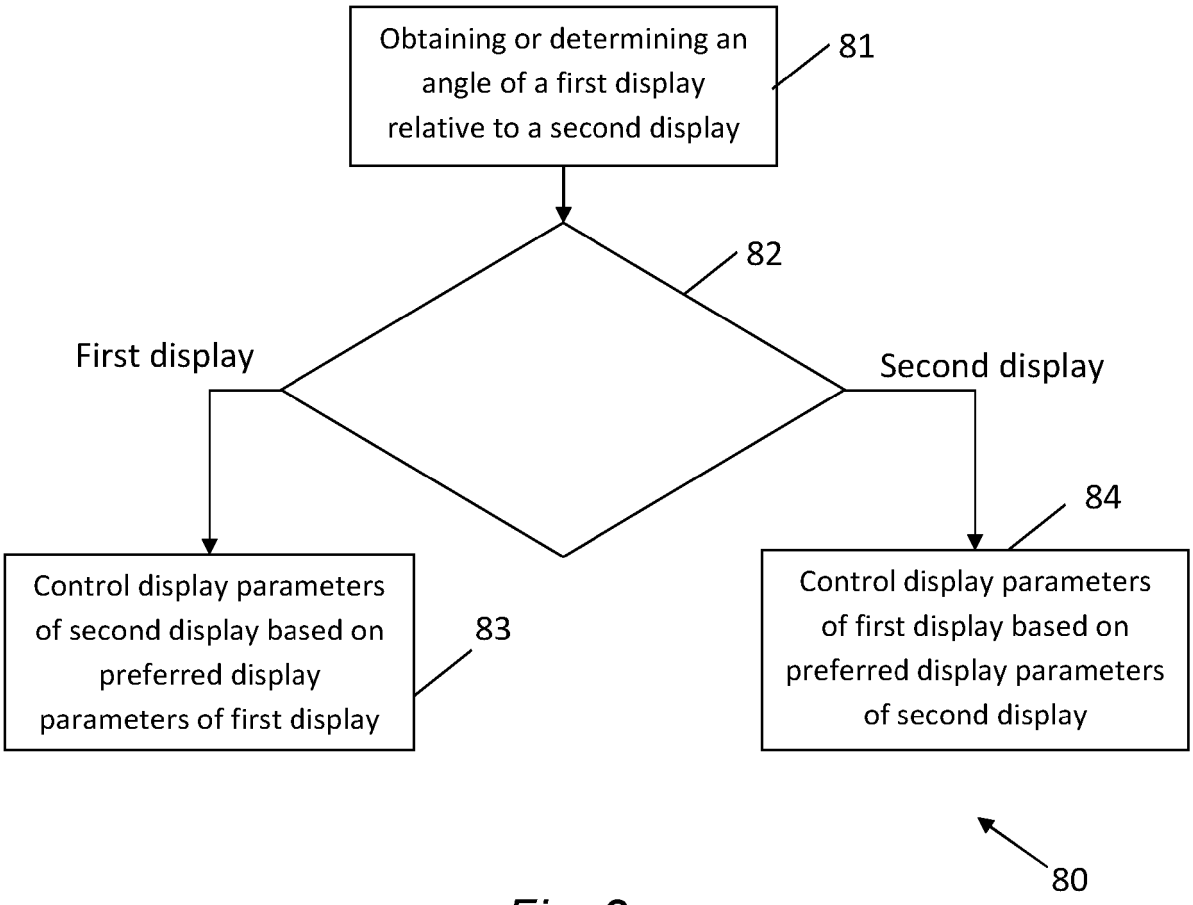

Obtaining or determining an angle of a first display relative to a second display
81
82
First display
Second display
84
Control display parameters of second display based on preferred display parameters of first display
83
Control display parameters of first display based on preferred display parameters of second display
80

Fig. 8

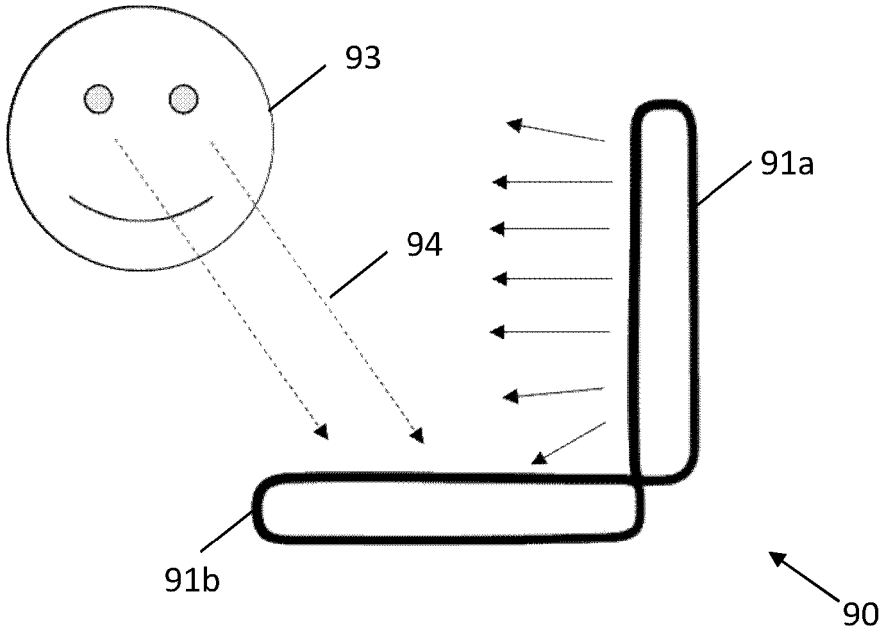

93
91a
94
91b
90

Fig. 9

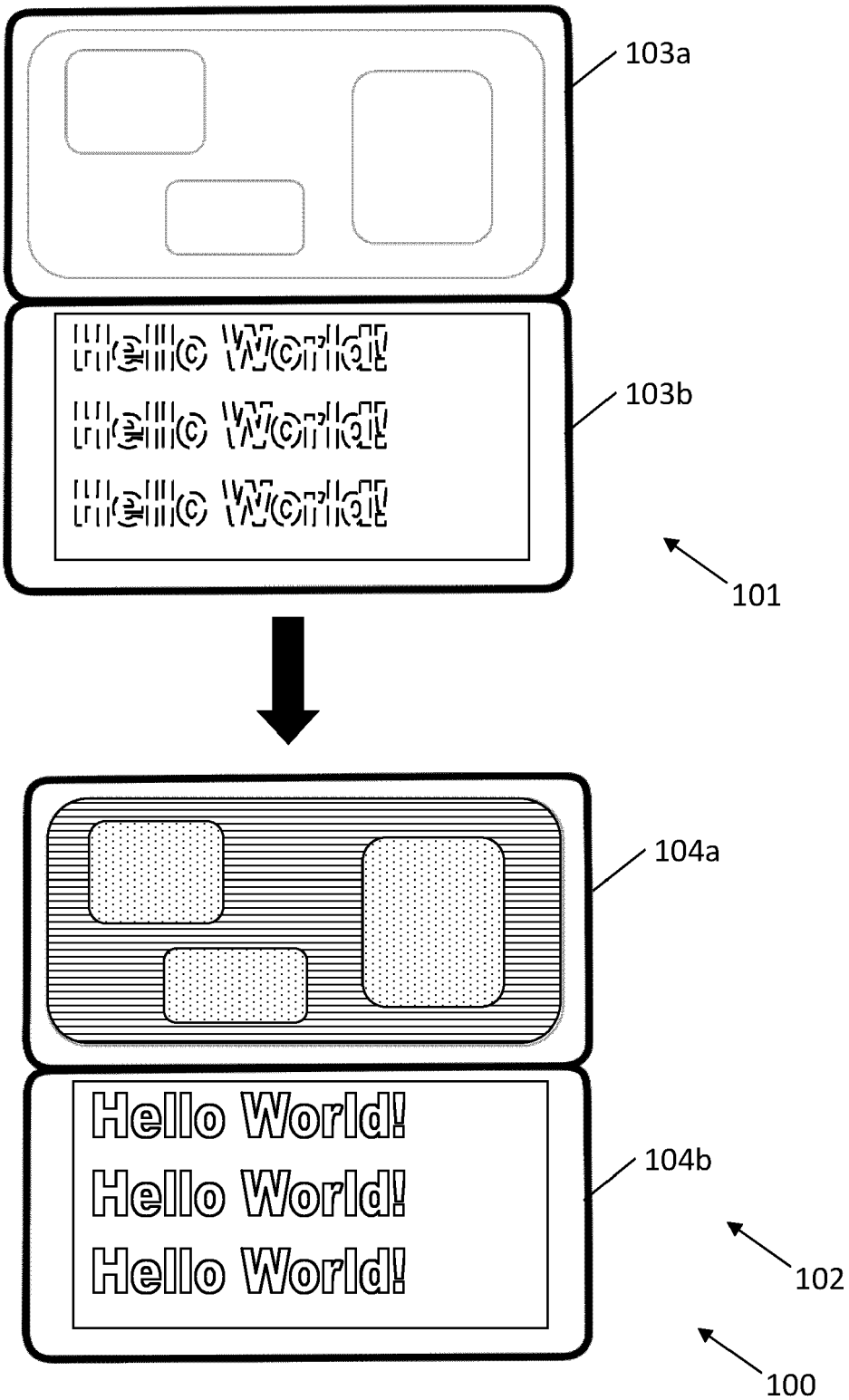

103a
Hello World!
Hello World!
Hello World!
103b
101
Hello World!
Hello World!
Hello World!
104a
104b
102
100

Fig. 10

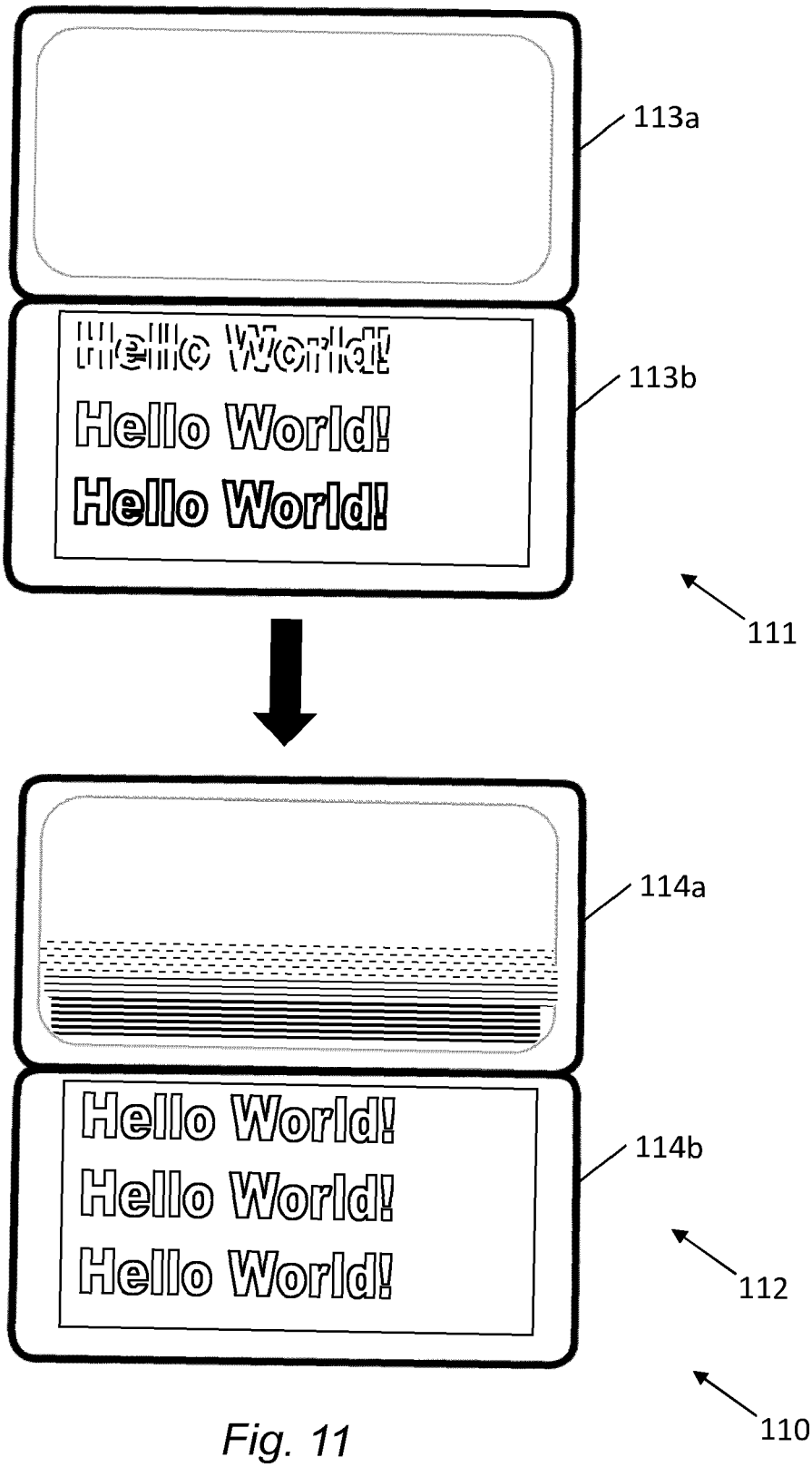

113a
Hello World!
Hello World!
Hello World!
113b
111
114a
Hello World!
Hello World!
Hello World!
114b
112
110

Fig. 11

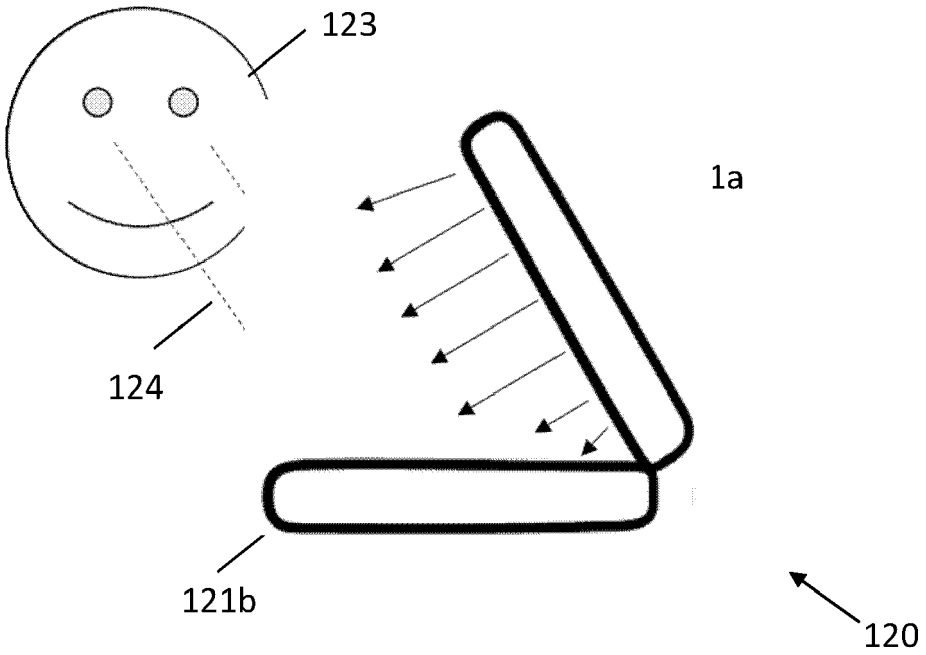


Fig. 12

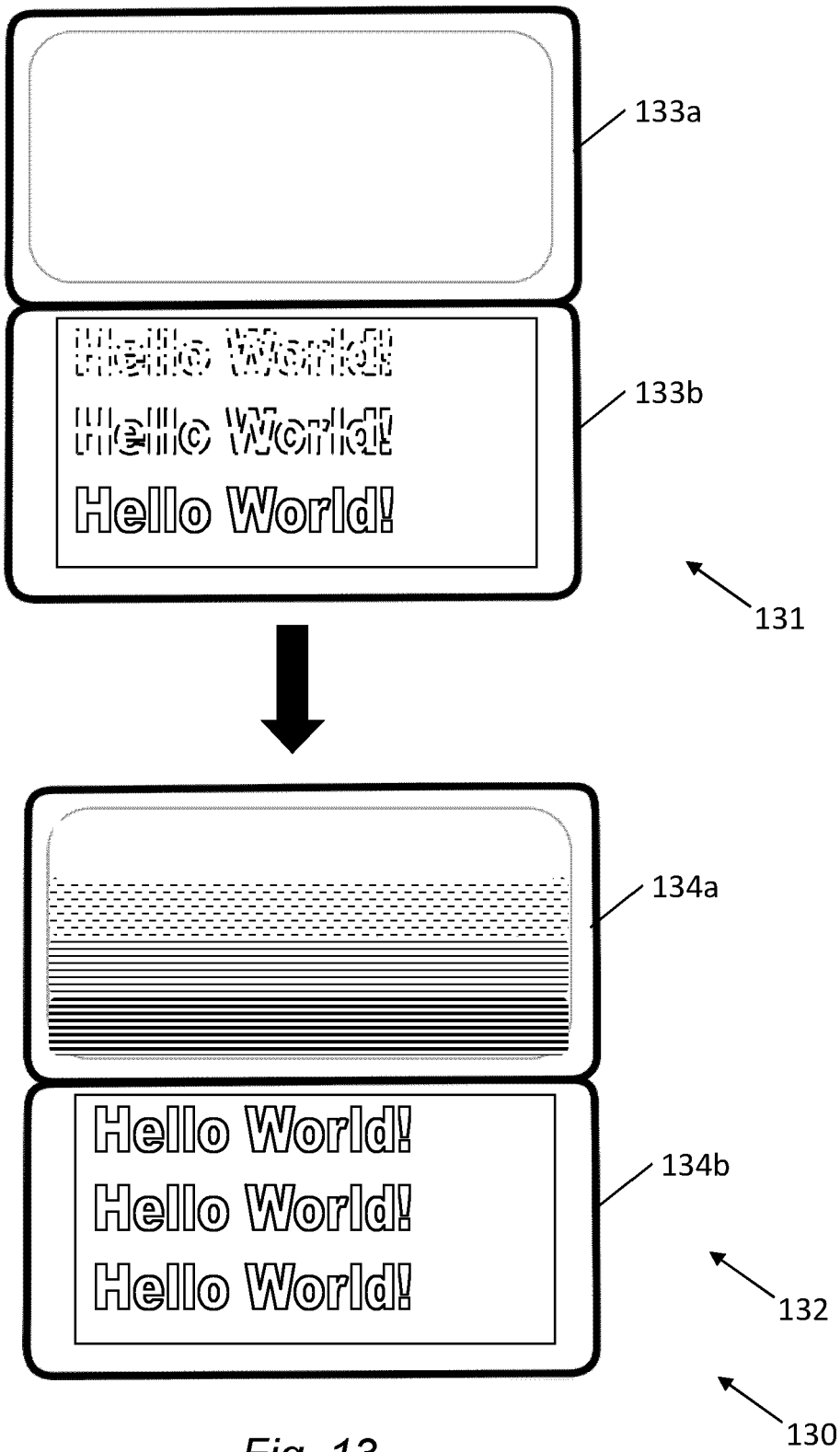
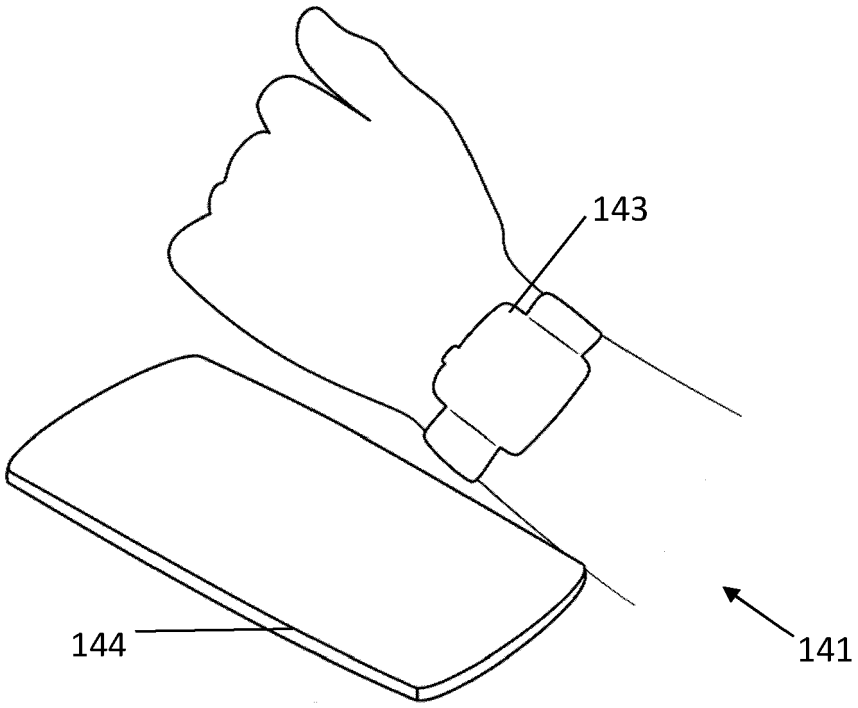

133a
Hello World!
Hello World!
Hello World!
133b
131
134a
Hello World!
Hello World!
Hello World!
134b
132
130

Fig. 13



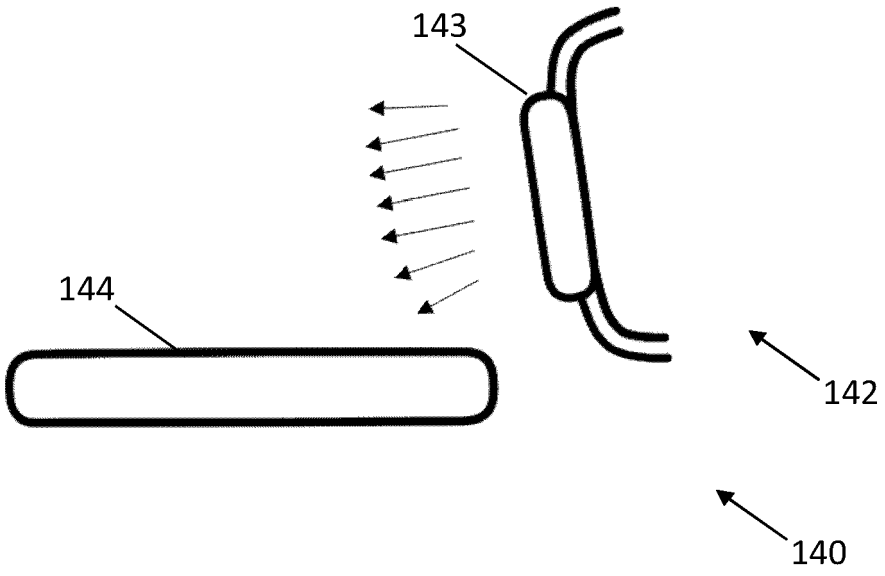


Fig. 14

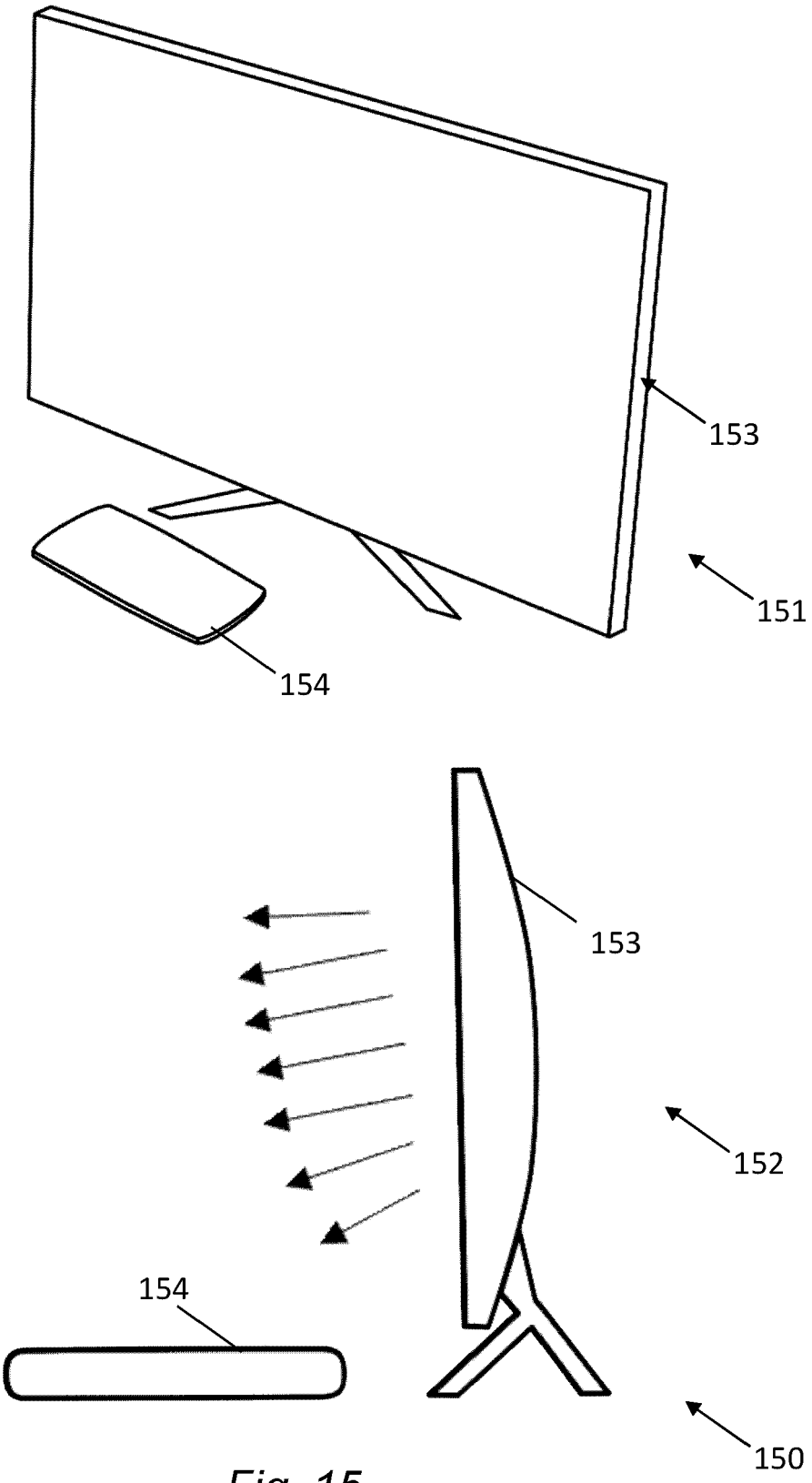


Fig. 15

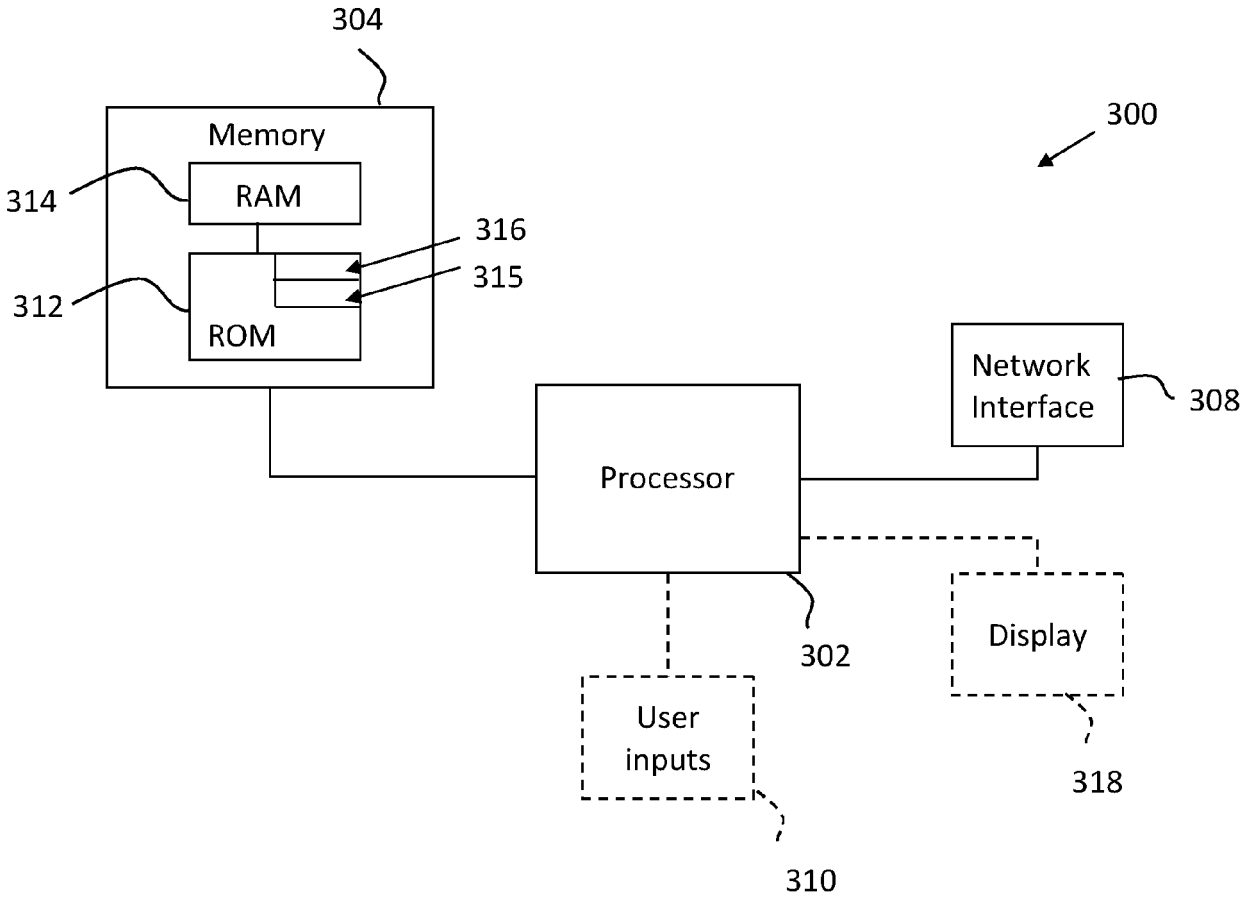

304
Memory
RAM
ROM
314
312
316
315
300
Network Interface
308
Processor
302
Display
318
User inputs
310

FIG. 16

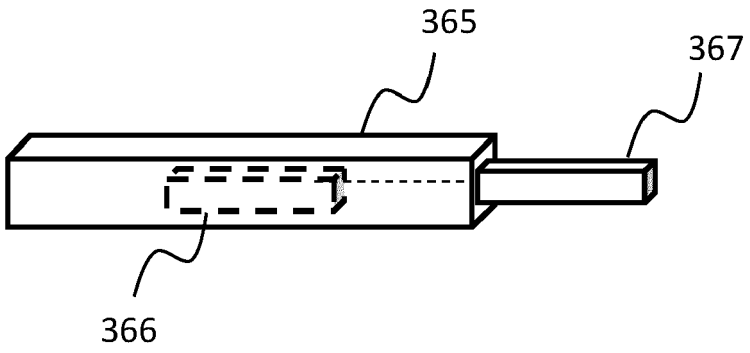


Fig. 17

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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 21 20 9451

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2020/265799 A1 (CHOI HEEJUN [KR] ET AL) 20 August 2020 (2020-08-20) * paragraph [0028] - paragraph [0181]; figures 1-9 *	1-4,12, 14 5	INV. G09G3/00
Y	US 2015/116364 A1 (AURONGZEB DEEDER M [US] ET AL) 30 April 2015 (2015-04-30) * paragraph [0019] - paragraph [0092]; figures 1-12 *	5	

TECHNICAL FIELDS SEARCHED (IPC)

G09G

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
Munich	2 May 2022	Harke, Michael

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04E07)

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INCOMPLETE SEARCH
SHEET C

Application Number
EP 21 20 9451

Claim(s) completely searchable:
1-5, 12, 14

Claim(s) not searched:
6-11, 13, 15

Reason for the limitation of the search:

1. The present claims 1, 6, and 12 to 15 do not meet the requirements of Rule 43(2) EPC.

1.1. The two independent device claims 1 and 6 as well as the two independent product claims 14 and 15 do neither involve alternative solutions to a particular problem nor do they define interrelated products, so that one single independent device claim is appropriate. The two independent method claims 12 and 13 do involve neither alternative solutions to a particular problem nor different uses of a product, so that one single independent method claim is appropriate.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 20 9451

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-05-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2020265799 A1	20-08-2020	US 2020265799 A1	20-08-2020
		WO 2020171551 A1	27-08-2020
US 2015116364 A1	30-04-2015	NONE	

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82