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LetsGoDigital highlights

"Patent shows Samsung foldable smartphone with elongated display that can bend at multiple places. This clamshell device can fold both inwards and outwards. Multifunctional device with bidirectional slider mechanism that gives users access to the selfie-camera or a second speaker - depending on how the device is being folded. Patent sketches show one rear camera, but the patent description talk about the possible integration of multiple lenses. It will be an array camera system."

Samsung Foldable Phone With Slider Mechanism

Recently, several types of flexible devices that use a flexible display panel have been researched and developed. As a display panel in which a plurality of pixels is arranged on a flexible substrate, such as a plastic film, the flexible display panel has an easy bending property. The foldable device is one type of the flexible device, and may have a structure that can be easily switched to an opened state from a folded state or from the folded state to the opened state due to the easy bending property

When the switch between the folded state and the opened state is more frequent, a portion that is being bent when the foldable device is in the folded state may be stressed. When such stress is concentrated, various defects may occur in the flexible display panel that is disposed corresponding to such a portion of the foldable device.

In addition, the use of the foldable device has led to various application areas. Foldable devices can be applied to new areas of portable IT products, such as electronic books that can replace publications such as magazines, textbooks, books and cartoons, ultra-small PCs that can be folded and moved, and smart cards that can check real-time information. Thus, it is desirable to develop an interface that can utilize these advantages while reflecting the characteristics of the foldable device.

The above information disclosed in this Background section is only for enhancement of understanding of the background and, therefore, it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

Patent Summary

According to an aspect of exemplary embodiments, a defect of a flexible display panel mounted in a foldable device may be prevented or substantially prevented. According to another aspect of exemplary embodiments, a user may easily use associated functions. According to another aspect of exemplary embodiments, a new user experience may be provided to a user through the foldable device.

A foldable device according to one or more exemplary embodiments includes: a panel support unit including a first support plate, a second support plate, and a multi-joint member connecting between the first support plate and the second support plate; and a display panel on the first support plate, the second support plate, and the multi-joint member, wherein the multi-joint member includes a plurality of joint units, each including a fixed end supporting the display panel and a free end extending from the fixed end and rotatable about a hinge shaft, and distances between the free ends of at least two adjacent first joint units among the plurality of joint units are regular when the display panel is in a folded state and an opened state.

When the display panel is slid along a first direction while being in the folded state, the distances between the free ends of the at least two adjacent first joint units among the plurality of joint units may be reduced.

When the display device is slid along a second direction that is opposite to the first direction while being in the folded state, distances between free ends of at least two adjacent second joint units among the plurality of joint units may be increased, and the first joint units may be adjacent to the first support plate and the second joint units may be adjacent to the second support plate.

The foldable device may further include: a state detection sensor configured to detect the opened state and the folded state and detects a bent location in the folded state; and a controller configured to compare an area of a first area and an area of a second area of the foldable device divided while being in the folded state by using the folded location, and to perform operations corresponding to comparison results.

The foldable device may further include: a case, the display panel being at a front side of the case; and a camera unit and a speaker unit that are arranged apart from each other along the first direction at a rear side of the case, wherein, when the area of the first area is larger than the area of the second area, the camera unit may be exposed to an outside, and when the area of the second area is larger than the area of the first area, the speaker unit may be exposed to the outside.

When the area of the first area is larger than the area of the second area, the controller may drive the camera unit. When the area of the second area is larger than the area of the first area, the controller may drive the speaker unit. When the area of the second area and the area of the first area are the same, the controller may activate a lock state.

The state detection sensor may be further configured to detect whether the display panel is in the opened state or the folded state, and when the display panel is changed to the folded state from the opened state, and to compare an area of the first area and an area of the second area in the folded state by using the bent location, and to perform operations corresponding to comparison results.

When the display panel is changed to the folded state from the opened state and the area of the first area and the area of the second area are the same, the controller may display execution screens of applications that are different from each other in the two areas of the display panel that are divided in the folded state.

A foldable device according to one or more exemplary embodiments includes: a display unit including two flat units and a bendable unit disposed between the two flat units; a case, the display unit being at a front side of the case; a camera unit and a speaker unit that are arranged apart from each other along a first direction at a rear side of the case; a state detection sensor configured to detect a folded state and an opened state of the display unit, and when the bendable unit is bent with reference to a reference line in a second direction that crosses the first direction in the opened state, to detect a location of the reference line; and a controller configured to drive the camera unit or the speaker unit according to the location of the reference line.

The display unit may include: a display panel that includes two flat areas corresponding to the two flat units and a bendable area corresponding to the bendable unit, and configured to display an image; and a panel support unit including a first support plate and a second plate that respectively support the two flat areas, and a multi-joint member.

The multi-joint member may include a plurality of joint units, each including a fixed end that supports the display panel and a free end that extends from the fixed end and rotates about a hinge shaft, and distances between the free ends of at least two adjacent first joint units among the plurality of joint units may be regular between the folded state and the opened state of the display unit.

When the sliding unit slides along the first direction in the folded state, the distances between the at least two adjacent first joint units among the plurality of joint units may be reduced. When the display unit slides along a third direction that is opposite to the first direction in the folded state, distances between the free ends of at least two adjacent second joint units among the plurality of joint units may be increased, and the first joint units may be adjacent to the first support plate and the second joint units may be adjacent to the second support plate.

A control method of a foldable device including a case that forms an appearance thereof, a display unit that is arranged at a front side of the case and includes two flat units and a bendable unit between the two flat units, and a camera unit and a speaker unit that are arranged apart from each other along a first direction at a rear side of the case, according to one or more exemplary embodiments, includes: detecting a location of a reference line when the bendable unit is bent with reference to the reference line in a second direction that crosses the first direction; determining an area of each of two areas of the foldable device facing each other according to the location of the reference line; and selectively driving the camera unit or the speaker unit according to the areas of the two areas.

The control method of the foldable device may further include, after driving the camera unit, displaying an image acquired by the camera unit on at least one of two display areas of the display unit, divided by the reference line.

The display unit may include: a display panel that includes two flat areas corresponding to the two flat units, and a bendable area corresponding to the bendable unit, and displays an image; and a panel support unit that includes a first support plate and a second support plate that respectively support the flat areas, and a multi-joint member, wherein the multi-joint member includes a plurality of joint units, each including a fixed end that supports the display panel and a free end that extends from the fixed end and rotates about a hinge shaft, and distances between the free ends of at least two adjacent first joint units among the plurality of joint units are regular between a folded state and an opened state of the display unit.

The camera unit may be exposed to an outside when the area of a first area among the two areas is greater than the area of a second area among the two areas, and the speaker unit may be exposed to the outside when the area of the second area is greater than the area of the first area.

According to an aspect of exemplary embodiments, a defect of the foldable device can be prevented or substantially prevented. According to another aspect of exemplary embodiments, a user can easily use associated functions in the foldable device. According to another aspect of exemplary embodiments, the user can also be provided with a new user experience.

Samsung Patent Claims

1. A foldable device comprising: a panel support unit comprising a first support plate, a second support plate, and a multi-joint member connecting between the first support plate and the second support plate; and a display panel on the first support plate, the second support plate, and the multi-joint member, wherein the multi-joint member comprises a plurality of joint units, each comprising a fixed end supporting the display panel and a free end extending from the fixed end and rotatable about a hinge shaft, and distances between the free ends of at least two adjacent first joint units among the plurality of joint units are regular when the display panel is in a folded state and an opened state.

2. The foldable device of claim 1, wherein when the display panel is slid along a first direction while being in the folded state, the distances between the free ends of the at least two adjacent first joint units among the plurality of joint units are reduced.

3. The foldable device of claim 2, wherein when the display device is slid along a second direction that is opposite to the first direction while being in the folded state, distances between the free ends of at least two adjacent second joint units among the plurality of joint units are increased, and the at least two first joint units are adjacent to the first support plate and the at least two second joint units are adjacent to the second support plate.

4. The foldable device of claim 3, further comprising: a state detection sensor configured to detect the opened state and the folded state and to detect a bent location in the folded state; and a controller configured to compare an area of a first area and an area of a second area of the foldable device divided while being in the bent state by using the folded location, and to perform operations corresponding to comparison results.

5. The foldable device of claim 4, further comprising: a case, the display panel being at a front side of the case; and a camera unit and a speaker unit that are arranged apart from each other along the first direction at a rear side of the case, wherein, when the area of the first area is larger than the area of the second area, the camera unit is exposed to an outside, and when the area of the second area is larger than the area of the first area, the speaker unit is exposed to the outside.

6. The foldable device of claim 5, wherein when the area of the first area is larger than the area of the second area, the controller drives the camera unit.

7. The foldable device of claim 5, wherein when the area of the second area is larger than the area of the first area, the controller drives the speaker unit.

8. The foldable device of claim 4, wherein when the area of the second area and the area of the first area are the same, the controller activates a lock state.

9. The foldable device of claim 4, wherein the state detection sensor is further configured to detect whether the display panel is in the opened state or the folded state, and when the display panel is changed to the folded state from the opened state, the controller compares the area of the first area and the area of the second area in the folded state by using the bent location, and performs operations corresponding to comparison results.

10. The foldable device of claim 9, wherein, when the display panel is changed to the folded state from the opened state and the area of the first area and the area of the second area are the same, the controller displays execution screens of applications that are different from each other in the two areas of the display panel that are divided in the folded state.

11. A foldable device comprising: a display unit including two flat units and a bendable unit between the two flat units; a case, the display unit being at a front side of the case; a camera unit and a speaker unit that are arranged apart from each other along a first direction at a rear side of the case; a state detection sensor configured to detect a folded state and an opened state of the display unit, and, when the bendable unit is bent with reference to a reference line in a second direction that crosses the first direction in the opened state, to detect a location of the reference line; and a controller configured to drive the camera unit or the speaker unit according to the location of the reference line.

12. The foldable device of claim 11, wherein the display unit comprises: a display panel comprising two flat areas corresponding to the two flat units and a bendable area corresponding to the bendable unit, and configured to display an image; and a panel support unit comprising a first support plate and a second support plate that respectively support the two flat areas, and a multi-joint member.

13. The foldable device of claim 12, wherein the multi-joint member comprises a plurality of joint units, each comprising a fixed end that supports the display panel and a free end that extends from the fixed end and rotates about a hinge shaft, and distances between the free ends of at least two adjacent first joint units among the plurality of joint units are regular between the folded state and the opened state of the display unit.

14. The foldable device of claim 13, wherein when the sliding unit slides along the first direction in the folded state, the distances between the at least two adjacent first joint units among the plurality of joint units are reduced.

15. The foldable device of claim 14, wherein when the display unit slides along a third direction that is opposite to the first direction in the folded state, distances between the free ends of at least two adjacent second joint units among the plurality of joint units is increased, and the first joint units are adjacent to the first support plate and the second joint units are adjacent to the second support plate.

16. A control method of a foldable device comprising a case forming an appearance thereof, a display unit arranged at a front side of the case and including two flat units and a bendable unit between the two flat units, and a camera unit and a speaker unit that are arranged apart from each other along a first direction at a rear side of the case, the control method comprising: detecting a location of a reference line when the bendable unit is bent with reference to the reference line in a second direction that crosses the first direction; determining an area of each of two areas of the foldable device facing each other according to the location of the reference line; and selectively driving the camera unit or the speaker unit according to the areas of the two areas.

17. The control method of the foldable device of claim 16, further comprising, after driving the camera unit, displaying an image acquired by the camera unit on at least one of two display areas of the display unit, divided by the reference line.

18. The control method of the foldable device of claim 16, wherein the display unit comprises: a display panel that includes two flat areas corresponding to the two flat units, and a bendable area corresponding to the bendable unit, and displays an image; and a panel support unit that includes a first support plate and a second support plate that respectively support the two flat areas, and a multi-joint member, wherein the multi-joint member comprises a plurality of joint units, each comprising a fixed end that supports the display panel and a free end that extends from the fixed end and rotates about a hinge shaft, and distances between the free ends of at least two adjacent first joint units among the plurality of joint units are regular between a folded state and an opened state of the display unit.

19. The control method of the foldable device of claim 16, wherein the camera unit is exposed to an outside when the area of a first area among the two areas is greater than the area of a second area among the two areas, and the speaker unit is exposed to the outside when the area of the second area is greater than the area of the first area.