

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Embodiments of the present invention will be described in detail based on the following figures, wherein:

[0015] FIG. 1 is a front view illustrating a mobile-phone terminal provided with a tactile-visual UI panel of basic constitution employed in an embodiment of the present invention, seen from a screen surface side of a display panel;

[0016] FIG. 2 is a view illustrating the state before a deformation section of the tactile-visual UI panel of the basic constitution illustrated in FIG. 1 is deformed to a convex shape;

[0017] FIG. 3 is a view illustrating the state after a deformation section of the tactile-visual UI panel of the basic constitution illustrated in FIG. 1 is deformed to a convex shape;

[0018] FIG. 4 is a front view illustrating a mobile-phone terminal provided with a tactile-visual UI panel which can change information conveyed tactilely and visually to a user, seen from a screen surface side of a display panel;

[0019] FIG. 5 is a view illustrating the state after a deformation section of a second layer of the tactile-visual UI panel illustrated in FIG. 4 is deformed to a convex shape;

[0020] FIG. 6 is a view illustrating the state after a deformation section of a first layer of the tactile-visual UI panel illustrated in FIG. 4 is deformed to a convex shape;

[0021] FIG. 7 is a front view illustrating a mobile-phone terminal provided with a tactile-visual UI panel of basic constitution possessing a dot deformation section arranged in matrix, seen from a screen surface side of a display panel;

[0022] FIG. 8 is a view illustrating the state after some dot deformation sections of the tactile-visual UI panel of the basic constitution illustrated in FIG. 7 are deformed to a convex shape;

[0023] FIG. 9 is an enlarged conceptual diagram illustrating a portion enclosed by a circle B of FIG. 7;

[0024] FIG. 10 is a view illustrating the state after some dot deformation sections of a mobile-phone terminal provided with a tactile-visual UI panel are deformed to a convex shape, the dot deformation sections in matrix arrangement being formed in a multi-layer structure;

[0025] FIG. 11 is an explanatory diagram illustrating a tactile-visual UI panel of a mobile-phone terminal according to an embodiment of the present invention, in a usage scene to display a pre-shooting image and a photograph view image;

[0026] FIG. 12 is an explanatory diagram illustrating a tactile-visual UI panel of a mobile-phone terminal according to an embodiment of the present invention, in a usage scene to perform an electronic game and menu manipulation;

[0027] FIG. 13 is an explanatory diagram illustrating a tactile-visual UI panel of a mobile-phone terminal according to an embodiment of the present invention, in a usage scene to perform a TV watching etc;

[0028] FIG. 14 is an explanatory diagram illustrating a tactile-visual UI panel of a mobile-phone terminal according to an embodiment of the present invention, in a usage scene to be used as a mobile-phone;

[0029] FIG. 15 is an explanatory diagram illustrating a tactile-visual UI panel of a mobile-phone terminal according to an embodiment of the present invention, in a usage scene to express height of an image on a display screen as actual height on the tactile-visual UI panel;

[0030] FIG. 16 is an explanatory diagram illustrating one example of constitution for compensating the state where an image is viewed in enlargement due to a convex shape of a deformation section; and

[0031] FIG. 17 is a block diagram illustrating an internal constitution overview of the mobile-phone terminal according to the embodiments of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0032] Hereinafter with reference to the accompanying drawings, the embodiments of the present invention are explained in detail.

[0033] In the following embodiments, a mobile-phone terminal is explained as an example of application of a user interface device and a personal digital assistant of the present invention. It is needless to say, however, that the contents explained here are of course a mere example, and that the present invention is not limited to the example.

[Basic Constitution]

[0034] FIGS. 1-3 illustrate conceptual diagrams of the basic constitution of a tactile-visual UI (User Interface) panel 45 provided in a mobile-phone terminal 40 according to an embodiment of the present invention. FIG. 1 illustrates a view of the mobile-phone terminal 40 according to the present embodiment, seen from a screen surface side (front side) of a display panel. FIGS. 2 and 3 illustrate a cross-section structure overview of the mobile-phone terminal 40, cut along a dash-dotted line and seen from the side indicated by arrows A-A in FIG. 1. FIG. 2 illustrates roughly the state before a deformation section 41 of the tactile-visual UI panel 45 is deformed to a convex shape. FIG. 3 illustrates roughly the state after the deformation section 41 of the tactile-visual UI panel 45 is deformed to a convex shape.

[0035] The tactile-visual UI panel 45 possesses a transparent sheet 42, plural deformation sections 41, a pump 43, and a fluid channel 44 at least.

[0036] The transparent sheet 42 is formed by transparent elastomeric material etc. possessing elasticity. The transparent sheet 42 is provided in the front (the upper, screen surface side) of a display panel 46 of the mobile-phone terminal 40, and is arranged so that the transparent sheet 42 may cover almost the whole surface of the screen surface of the display panel 46 concerned. In the case of the mobile-phone terminal of the present embodiment, a transparent touch panel (not shown) is provided in the front side (the upper surface side) of the transparent sheet 42. The transparent touch panel possesses elasticity same as the transparent sheet 42 concerned, and is arranged so that the transparent touch panel may cover almost the whole surface of the transparent sheet 42. The transparent touch panel in the present embodiment employs a panel constituted by the existing technology in which, for example, when a user touches the surface of the panel with a fingertip, the nib of a stylus pen, etc., the contact concerned is detected and the detection signal is outputted. Therefore, the illustration and detailed explanation of the transparent touch panel are omitted here.

[0037] The fluid channel 44 is formed by a tube-like transparent member, for example, through which fluid (for example, a liquid, a gas, a gelatinous material, etc.) is movable. One end of the tube of each fluid channel 44 is connected with a fluid discharge suction orifice of the pump 43, and the