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Intelligent Mirror cum Display Solution

TECHNICAL FIELD

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The present invention relates to a display apparatus. In particular, the present invention relates to a multi function display apparatus.

BACKGROUND

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Media communication devices such as LCD/LED or other types of visual systems in the market have been nothing more than a hanging or free-standing display screen, which do not always blend well into the environment or end up capturing the attention of too few people. The present invention leverages on the natural feel of having mirrors in daily life environments, while enabling digital content to be presented unintrusively, allowing for a higher impression rate and greater aesthetic value.

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SUMMARY OF THE INVENTION

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Embodiments of the present invention provide users with completely different and enriched experiences by which, the user's own image is included / integrated into the contents on conventional display screens. Interactivity between the display device and user is improved and the effect of visual contents to the user is enhanced.

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According to one embodiment, a display apparatus includes a panel which is partial-transmissive and partial-reflective to visual light. The panel is configured to allow visual signal to pass through from a back side to a front side when a light level at the back side is above a threshold, and reflects an image of an object in front of the panel when the light level at the back side is below the threshold. A media source for providing visual contents from a back side of the panel is disposed at back side of the panel. A controller is coupled to the media source, and a detector is disposed adjacent to the panel and coupled to the controller. Upon receiving a first signal from the detector, the controller sets the

apparatus to a first mode in which, the light level at the back side of the panel is above the threshold. In the first mode, the visual contents transmit through the panel and are visible from a front side of the panel. Upon receiving a second signal from the detector, the controller sets the apparatus to a second mode in which, the light level in at least a
5 predetermined area at the back side of the panel is below the threshold such that a reflected image of an object is visible from the front side of the panel in the predetermined area.

Other aspects and advantages of the present invention will become apparent from
10 the following detailed description, illustrating by way of example the inventive concept of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects of the present invention will be described in detail with reference to the accompanying drawings, in which:

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Fig. 1A is a perspective view showing a display apparatus according to one embodiment of the present invention;

Fig. 1B is an exploded view of Fig. 1A;

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Fig. 1C shows the display apparatus of Fig. 1A when working under the display mode;

Fig. 1D shows the display apparatus of Fig. 1A when working under the mirror mode;

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Fig. 2A is a perspective view showing a display apparatus according to another embodiment of the present invention;

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Fig. 2B is a cross sectional view of Fig. 2A;

Fig. 2C is an exploded view of Fig. 2A;

Fig. 2D shows the display apparatus of Fig. 2A when working under the mirror mode;

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Fig. 3A is a perspective view showing a display apparatus according to yet another embodiment of the present invention;

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Fig. 3B shows the display apparatus of Fig. 3A when working under the mirror mode;

Fig. 4 is a perspective view showing a display apparatus according to still another embodiment of the present invention;

Fig. 5A is a perspective view showing a display apparatus according to a further
5 embodiment of the present invention;

Fig. 5B is a block diagram of Fig. 5A.

Fig. 6A is a perspective view showing a display apparatus according to another
10 further embodiment of the present invention;

Fig. 6B shows the display apparatus of Fig. 6A when working under the mirror mode.

15 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

As shown in Figs. 1A, 1B, 1C and 1D, a display apparatus 10 according to one embodiment of the present invention includes a media source such as a display screen 12, e.g. a LCD monitor, and a controller 14 coupled to and placed at back side of screen 12.
20 Controller 14 may be a computer with necessary features of receiving, generating, processing and supplying visual contents to and for displaying on screen 12. Display screen 12 and the controller 14 may be independent units connected to each other, by cables or wireless network modules. Non-limiting examples of display screens and controllers may be a monitor connected to a visual content source, for instance DVD
25 player, cable TV, close circuit TV, etc. The display screen and the controller may also be in the form of integrated single unit, for instance a hand-hold media player, a tablet PC, a smart phone, a digital photo frame, etc.

At the front side of screen 12, there is attached a panel 16. Panel 16 is partial-
30 transmissive and partial-reflective to visual light and visual images. In one example, panel 16 is a chemically-coated mineral glass. Panel 16 is configured to allow visual signal to pass through from a back side 16b to a front side 16a, when a light level at the back side is

above a threshold. On the other hand, panel 16 reflects an image of an object in front of the panel, when the light level at the back side is below the threshold. Shown in Figs. 1C and 1D as an example, when screen 12 and controller 14 are both powered-on, visual contents 14a supplied by controller 14, e.g. advertisements composed of texts, images, video clips or combinations thereof, will be displayed on screen 12. As the visual contents have a light level above the threshold, panel 16 is now under the transmissive mode to enable visual contents 14a to pass through and can be viewed from the front side 16a of panel 16.

When screen 12 is turned off, or being disabled by controller 14, no visual content is provided from the back side of panel 16. The light level at back side of panel 16 is below the threshold, hence panel 16 is under the reflective mode. Instead of displaying the visual contents as at the transmissive mode, viewable from front side 16a of panel 16 will be a reflected mirror image 1' of an object adjacent and in front of display apparatus 10, such as an approaching user 1. Panel 16 now works under reflective mode.

Display apparatus 10 has one or more detectors 18 coupled to controller 14. One example of the detector is a proximity sensor such as an infrared proximity sensor. Detector 18 may also be a motion sensor such as an ultrasonic sensor, a visual image receiver such as a still image camera, a video camera or one with both functions. When more detectors are needed, same or different types of sensors may be used.

Infrared proximity sensor provides a distance-based sensing of thermal objects, e.g. human beings, and generates a first signal corresponding to a situation where a user is approaching, and a second signal corresponding to situation where a user is moving away. Depending on actual application requirements, the infrared proximity sensor may also be configured in a different manner, e.g. to generate the first signal corresponding to a situation where a user is moving away, and a second signal corresponding to a situation where a user is approaching.

An ultrasonic sensor provides a distance-based and/or a movement-based sensing of an object, and may be configured or calibrated to be triggered upon detection of a

dedicated event, e.g. a motion, a movement and/or a gesture of a user. The ultrasonic sensor generates a first signal upon detection of a first motion of the object, and to generate a second signal upon detection of a second motion of the object.

5 A visual image receiver recognizes and/or tracks activities of a user, and may be configured or calibrated to detect specific information, e.g. a user's face image or body movements. The visual image receiver generates a first signal upon detection of first image, and generates a second signal upon detection of a second image.

10 In any one of the above examples, the controller receives the first and second signals and determines a corresponding working mode of the display apparatus, as illustrated in further details below.

 Referring back to the embodiment using a proximity sensor, when detector 18
15 detects that no object is within a predetermined range or distance from display apparatus 10, e.g. one meter, controller 14 received a first signal from the proximity sensor, and set the display apparatus to a first mode. At the first mode, the light level at the back side of panel 16 is above the threshold such that visual contents 14a supplied from screen 12 transmit through panel 16 and become visible from front side 16a, as shown in Fig. 1C.

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 When detector 18 detects that an object e.g. approaching user 1 is within the predetermined distance from display apparatus 10, controller 14 receives a second signal, e.g. one representing "presence". Controller 14 in turn sets the display apparatus to a second mode. At the second mode, screen 12 is either turned off, or to control the visual
25 contents such that the light level of the visual contents within a first portion 161 of panel 16 is above the threshold, hence to reserve a predetermined area, i.e. the remaining second portion 162 blank or with a light level below the threshold. In the formal situation, the light level of the back side of panel 16 is below the threshold and whole area of panel 16 is switched to reflection mode. A reflected image of the object becomes visible from the
30 front side of panel 16. In the latter situation, the light level of second portion 162 is below the threshold, hence panel 16 works under a combined mode, i.e. first portion 161 under transmissive mode and second portion 162 under reflective mode. Visual contents 14a

from screen 12 remain displayed at first portion 161, with necessary positional changes in view of the arrangement of second portion 162 and meanwhile, reflected mirror image 1' is visible in second portion 162.

5 When user 1 walks away from display device 10, detector 18 detects this event and sends another signal, e.g. one representing "absence", to controller 14. Controller 14 then sets screen 12 to the first mode by e.g. switching it on. Light level at back side 16b of panel 16 becomes higher than the threshold, which causes panel to switch to transmissive mode under which, displaying of the visual contents supplied by controller 14 in the full
10 area of panel 16 is resumed.

 With the embodiment illustrated above, the present invention can bring completely different and enriched experiences to users by which, the user's self image is included / integrated into the contents on the display screen. Interactability between the device and
15 user is improved and the effect of visual contents to the user is enhanced.

 Figs. 2A, 2B 2C and 2D show another embodiment of the present invention. A display apparatus 20 includes a display screen 22, a controller 24 coupled to and placed at back side of screen 22. A partial-transmissive, partial-reflective panel 26 is attached to
20 screen 22 and works in a manner similar to the previous embodiment. One or more detectors 28 are coupled to controller 24. Detector 28 detects information or nearby situation of passer-bys or approaching users, and sends trigger signals to controller 24 to determine the types of contents and/or mirror images to be shown through panel 26.

25 In the present embodiment, a touch film 25 is sandwiched between screen 22 and panel 26, and attached to the back side of panel 26. Touch film 25 receives input from users through touching operations made through panel 26, and communicates with controller 24 coupled thereto to configure visual contents displayed. Showing in Fig. 2D as an example, icons 24b representing up, down, left and right directions are shown
30 through panel 26. When the user touches direction icons 24b, the touch operation is detected by touch film 25 and communicated with controller 24. In response, visual contents 24a on display portion 261 will be changed following the respective icon-

touching operation, as may be configured by control software installed in controller 24. In embodiments where a motion sensor or camera is used, user's control activities e.g. waving away postures are captured by the motion sensor or camera and the visual contents displayed through panel 16 react accordingly.

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Figs. 3A and 3B show yet another embodiment of the present invention. A display apparatus 30 includes a partial-transmissive, partial-reflective panel 36, a media source such as a projector 32 positioned at back side of panel 36, a controller 34 coupled to projector 32 and a detector 38 coupled to controller 34. Panel 36 is partial-transmissive, partial-reflective and works in a manner similar to the previous embodiments. Projector 32 provides visual contents from the back side of panel 36. When detecting that no object is within a predetermined distance from display apparatus 30, detector 38 sends an "absence" signal to controller 34 which in turn, activates projector 32 under first mode to supply visual contents. Visual contents have a light level above the threshold hence are visible from the front side of panel 36. When an approaching user 1 is within the predetermined distance, detector 38 will be triggered and sends a "presence" signal to controller 34 which sets projector 32 to second mode, i.e. by stop supplying visual contents to panel 36 or to supply only at selected portions, e.g. portion 361. The whole area of panel 36 or the portions 362 without visual content supply will be at reflection mode, and displays reflected mirror image 1'.

In still another embodiment shown in Fig. 4, panel 46 of display apparatus 40 displays a first posture a golfer 2 is in (which may be an incorrect posture). This posture is captured by camera 47 and stored in controller (now shown) as a first image. The controller compares the first image with a correct posture stored in its "golf-training" database. Both the first posture and the correct posture may be displayed through panel 46, e.g. in a superimposed manner. Such superimposed images may serve to indicate the differences to help the golfer in following training guides. The golfer then adjusts her posture by matching the new mirror images to the "correct posture". This embodiment would be an elaborated-upon example of the employment of a camera-based sensor.

In a further embodiment as shown in Figs. 5A and 5B, a display apparatus 50 includes three display units 50a, 50b and 50c, each having a partial-transmissive partial reflective panel 56a, 56b and 56c, and maybe centrally controlled by one controller 54 through a content management server 52 via network adapter 59c. Detector 58 may be provided to sense surrounding areas for user presence or absence as is the case of previous embodiments. Interactivity enabler 59a and memory modules 59b may also be coupled to controller 54 to strengthen the control functions. Display apparatus with multiple units may be configured and controlled through a group of detectors. Showing in Fig. 5A as an example, when a user 3 is approaching one of the display units, e.g. unit 50b, the respective detector senses a “presence” situation and turns unit 50 into reflection mode, i.e. to display mirror image 3’. Meanwhile, adjacent units 50a and 50c remain at transmissive mode, but may be configured to display visual contents associated with the situation where user 3 is near unit 50b.

In another further embodiments as shown in Figs. 6A and 6B, a display apparatus 60 includes a display screen 62, a controller 64 coupled to and placed at back side of screen 62. A partial-transmissive, partial-reflective panel 66 is attached to screen 62 and works in a manner similar to the previous embodiment. A touch film 65 is sandwiched between screen 62 and panel 66, and attached to the back side of panel 66. Touch film 65 receives input from users through touching operations made through panel 66, and communicates with controller 64 coupled thereto to configure visual contents displayed.

Accessible at panel 66 there is an icon 68 which prompt users for an operation, e.g. “press here for more details”. When icon 68 is not pressed or tapped, controller 64 receives a first signal from touch film 65, e.g. “no touching”, and sets the display apparatus to the first mode where visual contents 64a supplied from screen 62 transmit through panel 66 and become visible from front side 66a, as shown in Fig. 6A.

Touch film 65 captures the event when a user presses icon 68, and send a corresponding signal to controller 64. Controller 64 receives a second signal from touch film 65, e.g. “touch detected”, and sets display apparatus to a second mode at which, either

the full area of panel 66 or a dedicated portion 662 thereof, becomes a mirror i.e. to show a user's reflective mirror image instead of displaying visual contents, as shown in Fig 6B.

5 The present embodiment utilizes the touch film as one type of detector. User's action of pressing or tapping panel 66, e.g. on icon 68, serves as the source of generating triggering signals, for controller 64 to set a corresponding display mode.

10 Although embodiments of the present invention have been illustrated in conjunction with the accompanying drawings and described in the foregoing detailed description, it should be appreciated that the present invention is not limited to the embodiments disclosed.

15 For example, in some applications a display apparatus may be configured to change to reflective mode, at either the full or a partial area of the panel, when a user or object is within a predetermined distance from the panel. In some other applications, a display apparatus may be configured to work in a partially or completely reversed manner. In one situation, when a user is outside of a predetermined distance from the panel, the display apparatus is configured to work under a "full reflective" mode, and when a user is within a predetermined distance from the panel, the display apparatus works under a "partial
20 reflective, partial transmissive" mode or "full transmissive mode".

Therefore, the present invention should be understood to be capable of numerous rearrangements, modifications, alternatives and substitutions without departing from the spirit of the invention as set forth and recited by the following claims.

CLAIMS

1. A display apparatus comprising:

a panel which is transmissive to visual light when a light level at a back side of the panel is above a threshold, and reflective to visual light when the light level at the back side of the panel is below a threshold,;

a media source for providing visual contents from the back side of the panel;

a controller coupled to the media source, and

a detector coupled to the controller,

wherein upon receiving a first signal from the detector, the controller sets the apparatus to a first mode at which the light level at the back side of the panel is above the threshold such that visual contents are visible from a front side of the panel;

wherein upon receiving a second signal from the detector, the controller sets the apparatus to a second mode at which the light level in at least a predetermined area is below the threshold such that a reflected image of an object is visible from the front side of the panel in the predetermined area.

2. The apparatus of claim 1, wherein the detector is a proximity sensor to generate the first signal upon detection of a first position of the object relative to the proximity sensor, and to generate the second signal upon detection of a second position of the object relative to the proximity sensor.

3. The apparatus of claim 2, wherein the first position is equal to or less than a predetermined distance from the proximity sensor, and the second position is greater than the predetermined distance from the proximity sensor.

4. The apparatus of claim 2, wherein the first position is greater than a predetermined distance from the proximity sensor, and the second position is equal to or less than the predetermined distance from the proximity sensor.

5. The apparatus of claim 2, wherein the proximity sensor is an infrared proximity sensor.
- 5 6. The apparatus of claim 1, wherein the media source includes a display screen attached to the back side of the panel.
- 10 7. The apparatus of claim 6, further comprising a touch film disposed between the panel and the display screen and coupled to the controller, wherein the touch film is to receive a touching operation from the panel to control the visual contents to be displayed.
8. The apparatus of claim 7, wherein the touch film is an infrared sensor array.
- 15 9. The apparatus of claim 1, wherein the media source includes a projector disposed spaced apart from the back or front side of the panel.
- 20 10. The apparatus of claim 9, further comprising a touch film attached to the back side of the panel and coupled to the controller, wherein the touch film is to receive a touching operation from the panel to control the visual contents to be displayed.
- 25 11. The apparatus of claim 10, wherein the touch film is an infrared sensor array.
12. The apparatus of claim 1, wherein the detector is a motion sensor to generate the first signal upon detection of a first motion of the object, and to generate the second signal upon detection of a second motion of the object.
13. The apparatus of claim 12, wherein the motion sensor is to detect a motion of a user to control the visual contents to be displayed.
- 30 14. The apparatus of claim 12, wherein the motion sensor is an ultrasonic sensor or ultrasonic sensor array.

15. The apparatus of claim 1, wherein the detector is a visual image receiver to generate the first signal upon receiving a first image, and to generate a second signal upon receiving a second image.
- 5 16. The apparatus of claim 15, wherein the visual image receiver is a camera and the first and second images are still images.
17. The apparatus of claim 16, wherein the camera is to control the visual contents to be displayed upon detection of a still image.
- 10 18. The apparatus of claim 15, wherein the visual image receiver is a video camera and the first and second images are motion images.
19. The apparatus of claim 18, wherein the video camera is to control the visual
15 contents to be displayed upon detection of a motion image.
20. The apparatus of claim 1, wherein the detector is a touch film attached to the back side of the panel, wherein the touch film generates the first signal upon detection that no touching operation is made to the panel, and to generate the second signal
20 upon detection of a touching operation made to the panel.
21. The apparatus of claim 1, wherein the detector is a touch film attached to the back side of the panel, wherein the touch film generates the first signal upon detection of a touching operation made to the panel, and to generate the second signal upon
25 detection that no touching operation is made to the panel.
22. The apparatus of claim 1, wherein the predetermined area is a full surface area of the panel.
- 30 23. The apparatus of claim 22, wherein when at the second mode the controller disables the media source such that no visual content is provided from the back side of the panel.