(54) Title: SYSTEM AND METHOD TO DISPLAY A USER INTERFACE IN A THREE-DIMENSIONAL DISPLAY

(57) Abstract: A user interface on a three-dimensional display overcomes unsettling effects that arise when user interfaces are presented to users in a three-dimensional context. An extended border defines an extended portion of a background of the user interface. If the background is opaque, the extended portion of the background is blended with the underlying video or image. If the background is semi-transparent, user interface content is presented as appearing to project out of the screen, and the extended portion of the background is blended with the underlying video or image with variable blending alpha. If the background is transparent, user interface content is presented as appearing to project out of the screen, the video or image underlying the original background of the user interface is blurred, and the portion of the video or image underlying the extended portion of the background is blurred with variable blur radius.
SYSTEM AND METHOD TO DISPLAY A USER INTERFACE IN A THREE-DIMENSIONAL DISPLAY

FIELD OF THE INVENTION

Embodiments relate generally to displaying user interfaces or menus on a three-dimensional display. More particularly, embodiments relate to displaying a user interface or menu on a 3DTV or other device configured to display three-dimensional video or images.

BACKGROUND OF THE INVENTION

3DTVs employ three-dimensional presentation methods to project a television program into a realistic three-dimensional field. As such, 3DTVs can display video or images where objects can be shown to appear to project out of the screen and/or behind the screen. The basic concept underlying 3DTV is the stereoscopic nature of the human visual system. That is, when two, shifted views are shown separately to a person's left and right eye, the human visual system can perceive depth based on the displacement (disparity) of objects (pixels).

A number of conventional display technologies exist can present a separate image to a person's left eye and right eye to create a three-dimensional view of a scene. For example, glasses based technologies include line-interleaved polarized displays used with passive polarized glasses and 120 Hz or 240 Hz displays used with active shutter glasses. Non-glasses based technologies include lenticular displays with 9 simultaneous views.
User interfaces (UIs), including menus having user-selectable options are commonly displayed in modern televisions. These menus provide users the ability to select a variety of features to affect the viewing experience. For example, user interfaces often provide menus to allow a user to select television programs to view, options to view and/or save television programs, and options to control how television programs are displayed.

Another common use for user interfaces is to display subtitles. Such subtitles are often displayed, for example, for hearing impaired users and for providing translations of audio in another language. The user interface can also include other images or video superimposed on a video or image including for example, scrolling text, picture-in-picture, and other images or video superimposed on a video or image.

Typically, such user interfaces are placed on top of the video or image content. In addition, the user interface can be displayed with semi-transparency to allow a user to continue to view the video underlying the user interface. Such user interfaces can be implemented using, for example, microprocessors such as the PNX85500 available from Trident Microsystems of Santa Clara, California.

However, when such menus are placed in a 3DTV, undesirable effects are often observed, particularly when images appear to project out of the screen. User interface text with a solid (non-transparent) background has a problem at the boundary of the menu caused by a perceived hard depth level
transition at the menu or subtitle boundary. A potential solution is to place the UI menu or subtitle at the same depth of the video or image appearing behind it. In this case, semi-transparency can be used. However, the user interface text (as well as two- or three-dimensional images or icons therein) at the screen level can interfere (intersect) with the objects appearing to project out of the screen. Such interference caused by the text (or images or icons) can be unsettling to a viewer.

SUMMARY OF THE INVENTION

In an embodiment, the present invention is a system for presenting a user interface in a three-dimensional display. The system includes a device having a display to display a three-dimensional video or image and a processor. The processor can be located in a set-top box or in the device itself. The processor is configured to cause a user interface having a background to be presented on the display, to define an extended portion of the user interface background, and to perform graphical processing in the extended portion of the user interface background.

In another embodiment, the present invention is a method for presenting a user interface on a display that displays three-dimensional video or images. The method includes generating a user interface having a background defined by an original background border, displaying the user interface on the display, defining an extended portion of the background with an extended border; and performing graphical processing in the extended portion of the user interface background.
In another embodiment, the present invention is a device to process a three-dimensional video or image. The device includes an input for receiving an image for display as a three-dimensional video or image and a processor configured to generate a graphical overlay having a foreground portion and a background portion. The graphical overlay is to be displayed in combination with the three-dimensional image, wherein the processor generates an extended background portion and performs graphical processing in the extended background portion. The graphical overlay can be a user interface. The device can be, for example, a system-on-a-chip located on a television.

In an embodiment, the nature of the graphical processing depends on whether the user interface background is opaque, semi-transparent, or fully transparent. If the user interface background is opaque the extended portion of the user interface background is blended with the image or video underlying the extended portion. In an embodiment, the blending is performed in accordance with a varying alpha value. In an embodiment, the alpha value varies as a function of distance from an original border of the user interface background. For example, in an embodiment, the alpha value decreases as distance from an original border of the user interface background increases. For example in an embodiment, the alpha value decreases non-linearly as distance from an original border of the user interface background increases. An exemplary non-linear function is an exponential function. In another embodiment, the alpha value decreases linearly as distance from an original border of the user interface background increases.
If the user interface background is semi-transparent, content (including text and two- or three-dimensional images or icons) associated with the user interface is presented to appear as if projected out of the screen. In addition, the extended portion of the user interface background is blended with the video or image underlying the extended portion. In an embodiment, the blending is performed in accordance with a varying alpha value. In an embodiment, the alpha value varies as a function of distance from an original border of the user interface background. For example in an embodiment, the alpha value decreases non-linearly as distance from an original border of the user interface background increases. An exemplary non-linear function is an exponential function. In another embodiment, the alpha value decreases linearly as distance from an original border of the user interface background increases.

If the user interface background is fully transparent, the video or image underlying the user interface background within a region defined by an original border of the user interface background is blurred. In an embodiment, content (including text and two- or three-dimensional images, and icons) associated with the user interface background is presented to appear as projected out of the screen. In an embodiment, the video or image underlying the extended portion of the user interface background is blurred. In an embodiment, a blur radius used in blurring the video or image underlying the extended portion decreases as distance from an original border of the user interface background increases. In an embodiment, the blur radius used in blurring the video or image underlying the extended portion decreases linearly as distance from an original border of the user interface
background increases. In another embodiment, the blur radius decreases non-linearly as distance from an original border of the user interface background increases. An exemplary non-linear function is an exponential function.

Additional features and embodiments of the present invention will be evident in view of the following detailed description of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram of a simple television entertainment system according to an embodiment of the present invention.

Figure 2 illustrates a left presentation and a right presentation of a three-dimensional presentation of an image having an object.

Figure 3 illustrates a left presentation and a right presentation of a three-dimensional presentation of an image having an object.

Figure 4 illustrates a left presentation and a right presentation to overcome the unsettling effect of three-dimensional user interface presentation according to an embodiment of the present invention where the user interface has an opaque (non-transparent) background.

Figure 5 illustrates a left presentation and a right presentation to overcome the unsettling effect of three-dimensional user interface presentation according to an
embodiment of the present invention where the user interface has a semi-transparent background.

Figure 6 illustrates a left presentation and a right presentation to overcome the unsettling effect of three-dimensional user interface presentation according to an embodiment of the present invention where the user interface has a transparent background.

Figure 7 is a flow chart for a method for presenting a user interface (UI) such to a user on a display that can be configured to display a three-dimensional presentation.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is a schematic diagram of a television entertainment system 102 according to an embodiment of the present invention. As shown in Figure 1, television entertainment system 102 includes a television 104 having a display 105. A set top box 106 accepts a television signal from a source through a connector 108. The source can feed a television signal through connector 108 from any television signal source, including for example, a satellite television service provider or a cable television service provider.

Set top box 106 receives the television signal through connector 108 from the television service provider, conditions the received television signal, tunes to one or more desired television channels, and provides a tuned signal to television 104. In an embodiment television 104 can provide three-dimensional presentations of television video and images. The three-dimensional presentation is shown to a
user on display 105. Display 105 can be any display that can provide a three-dimensional view to a user.

In an embodiment, set top box 106 includes a processor 107. Processor 107 can be any processor that can be configured to perform the processing described herein. An exemplary such processor is the PNX85500 available from Trident Microsystems of Santa Clara, California. One function of processor 107 is to cause a user interface, including without limitation a menu of user-selectable options or a subtitle, to be displayed to a user in accordance with embodiments of the invention. As described herein, embodiments of the invention remove unsettling effects caused when conventional user interface techniques are applied in a three-dimensional video or image presentation. In an alternate embodiment, set-top box 106 is not included, and processor 107 is located in a device such as television 104 or any other device to provide the user interface.

In an alternate embodiment, the device is a system-on-a-chip (SOC). The SOC includes an input to acquire at least a three dimensional image or video for display and a processor configured to generate a graphical overlay having a foreground portion and a background portion. The graphical overlay is to be displayed in combination with a three dimensional image or video input to the device. In operation processor 107 generates an extended background portion. Processor 107 performs graphical processing such as described herein in the extended background portion. An exemplary such graphical overly is the user interface described herein.
Display 105 can be a display other than on a television set, and devices other than television sets can be used in embodiments of the present invention. For example, in alternate embodiments, display 105 can be a display used on a device such as a portable video player, a personal digital assistant, a tablet computer such as an Apple iPad, or a telephone such as an Apple iPhone, RIM Blackberry, or other telephone configured to display three-dimensional images or video, a screen on a camera configured to display three-dimensional images, or a screen on any other device that can present three-dimensional images or video. In such alternate embodiments, processor 107 is located in the device itself to provide the user interface.

Figure 2 illustrates a left presentation 202a and a right presentation 202b of a three-dimensional presentation having an object 204. Left presentation 202a and right presentation 202b are presented separately to the user's left and right eyes respectively on a display 206. Display 206 can be any display that can display three-dimensional presentations, such as display 105 described above with respect to Figure 1. In an embodiment, the three-dimensional effect is provided by the position shift of an object, such as object 204, or a pixel in the left and right presentations 202a and 202b on display 206. In Figure 2, $V_L$ and $V_R$ represent the distance of an object or pixel from the edge of left presentation 202a and right presentation 202b respectively. If $V_L = V_R$, the object or pixel is presented at the screen depth. If $V_L > V_R$, the object or pixel is presented as appearing to project out from the screen. If $V_L < V_R$, the object or pixel is presented as appearing to be behind the screen depth. Thus,
as shown in Figure 2, because $V_L > V_R$, object 204 is presented as appearing to project out from the screen.

Figure 3 illustrates a left presentation 302a and a right presentation 302b of a three-dimensional presentation having an object 304. As with left and right presentations 202a and 202b of Figure 2, left presentation 302a and right presentation 302b are presented separately to the user's left and right eyes respectively on a display 306. Display 306 can be any display that can display three-dimensional presentations to a user, such as display 105 described above with respect to Figure 1. Because $V_L > V_R$, object 304 is presented as appearing to project out from the screen.

Figure 3 also illustrates an exemplary user interface 308. User interface 308 has an original border 309. The dotted line showing border 309 is shown in Figure 3 for clarity to show the original border of user interface 308. However, in an embodiment, the dotted line is not presented to the user on display 306.

In Figure 3, user interface 308 is a menu of selectable channels, Chi to Ch8. It should be understood that user interface 308 can be any user interface in the context of an embodiment of the present invention including a menu, a subtitle, or any other user interface. Conventionally, user interface 308 is presented to the user at screen depth level. That is, $B_L = B_R$ and $T_L = T_R$, where $B_L$ is the distance from the left edge the background of user interface 308 is positioned in left presentation 302a, $B_R$ is the distance from the left edge the background of user interface 308 is positioned in right presentation 302b, $T_L$ is the distance from the left edge the text of user interface 308 is positioned in left
presentation 302a, and $T_R$ is the distance from the left edge the text of user interface 308 is positioned in right presentation 302b.

As explained above, unsettling effects can occur when user interface 308 is presented to a user in conventional systems. To overcome these effects, in embodiments original border 309 of user interface 308 is extended by an amount horizontal and vertical direction as shown by extended border 310 to define an extended portion 312 of the background of user interface 308. In an embodiment, this amount is 5% of the screen height in the vertical direction and 5% of the screen width in the horizontal direction. The amount to extend original border 309 of user interface 308 can differ from 5% depending on implementation. In addition, the amount of extension need not be the same in the vertical and horizontal directions. In an embodiment, the amount of extension is preset by the set top box manufacturer. In another embodiment, the amount of extension is user-programmable, by using for example, a set top box configuration mode. In embodiments, graphical processing as described below is performed on extended portion 312 of the presentation falling between extended border 310 and original border 309 of user interface 308 to overcome the unsettling effects of three-dimensional user interface presentation.

Figure 4 illustrates a left presentation 402a and a right presentation 402b to overcome the unsettling effect of three-dimensional user interface presentation according to an embodiment of the present invention where the user interface has an opaque (non-transparent) background. Left presentation 402a and right presentation 402b are presented
to a user on a display 406. Display 406 can be any display that can display three-dimensional presentations to a user, such as display 105 described above with respect to Figure 1.

As shown in Figure 4, left presentation 402a and right presentation 402b include an object 404 and a user interface 408. It should be understood that user interface 408 can be any user interface including a menu, a subtitle, or any other user interface. User interface 408 has an original border 409. The dotted line showing original border 409 is shown in Figure 4 for clarity to show the original border of user interface 408. However, in an embodiment, the dotted line is not presented to the user on display 406.

In the embodiment illustrated in Figure 4, user interface 408 has an opaque (non-transparent) background. To overcome the unsettling effect of three-dimensional user interface presentations of a user interface having an opaque background, in an embodiment, an extended border 410 is defined. The dotted line showing extended border 410 is shown in Figure 4 for clarity to show the extended border of user interface 408. However, in an embodiment, the dotted line is not presented to the user on display 406.

In the embodiment, an extended portion 412 of the background between extended border 410 and original border 409 of the background of user interface 408 is blended with underlying content video or image with a decreasing alpha. In an embodiment, alpha represents the amount of blending. Alpha ranges from 1 (opaque) to 0 (transparent).
For example, in the exemplary embodiment, the value of alpha decreases from 1 (opaque) to 0 (fully transparent) as a function of the distance from the original border of the user interface to the extended border. In an embodiment, alpha is determined as a non-linear function of pixel distance from the original border. An exemplary such non-linear function is an exponential function. In another embodiment, alpha is determined as a linear function of pixel distance from the original border. Other functions can be used to determine alpha as would be apparent to those skilled in the art.

In an embodiment, alpha blending underlying video or image with extended portion 412 has the following properties. The variable alpha blending with the content at the border removes hard depth transitions between the user interface 408 plane and the content video plane. Moreover, the variable alpha blending with extended portion 412 dampens (attenuates) the depth (disparity) of the content in a smooth manner toward the depth (disparity) of user interface 408. In addition, the text in user interface 408 having a non-transparent background can be read both with and without glasses.

Figure 5 illustrates a left presentation 502a and a right presentation 502b to overcome the unsettling effect of three-dimensional user interface presentation according to an embodiment of the present invention where the user interface has a semi-transparent background. Left presentation 502a and right presentation 502b are presented to a user on a display 506. Display 506 can be any display that can be configured to show three-dimensional presentations to a user, such as display 105 described above with respect to Figure 1.
As shown in Figure 5, left presentation 502a and right presentation 502b include an object 504 and a user interface 508. It should be understood that user interface 508 can be any user interface including a menu, a subtitle, or any other use of a user interface. User interface 508 has an original border 509. The dotted line showing original border 509 is shown in Figure 5 for clarity to show the original border of user interface 508. However, in an embodiment, the dotted line is not presented to the user on display 506.

In the embodiment illustrated in Figure 5, user interface 508 has a semi-transparent background. To overcome the unsettling effect of three-dimensional user interface presentation of a user interface having a semi-transparent background, in an embodiment, the text of user interface 508 is position-shifted so as to appear to be projected out of the screen. In addition, any two- or three-dimensional icons or images in user interface 508 are position-shifted so as to appear to be projected out of the screen. In this manner, intersection of the text of user interface 508 with the video or image is avoided. Thus, \( T_L > T_R \) as shown in Figure 5.

In addition, in an embodiment, the background is maintained at the screen level (i.e., \( B_L = B_R \)). To avoid the unsettling effect that may be caused by the semi-transparent background, an extended border 510 is defined. The dotted line showing extended border 510 is shown in Figure 5 for clarity to show the extended border of user interface 508. However, in an embodiment, the dotted line is not presented to the user on display 506.
In the embodiment, an extended portion 512 of the background between extended border 510 and original border 509 of the background of user interface 508 is blended with content video or image with a decreasing alpha, where alpha represents the amount of blending. Alpha ranges from the value of alpha used to provide the semi-transparency of the user interface background (semi-transparent) to 0 (transparent). Because the text and any included images or icons are to be presented as appearing to project out of the screen, extended portion 512 can be smaller than portion 412 shown in Figure 4.

For example, in an embodiment, the value of alpha decreases from the semi-transparency alpha value to 0 (fully transparent) as a function of the distance from the original border of the user interface to the extended border. In an embodiment, alpha is determined as a non-linear function of pixel distance from the original border. An exemplary such non-linear function is an exponential function. In another embodiment, alpha is determined as a linear function of pixel distance from the original border. Other functions can be used to determine alpha as would be apparent to those skilled in the art.

In an embodiment, alpha blending underlying video or image with extended portion 512 has the following properties. The variable alpha blending with the content at the border removes hard depth transitions between the user interface 508 plane and the content video plane. Moreover, the variable alpha blending with portion 512 also dampens (attenuates) the depth (disparity) of the content in a smooth manner toward the depth (disparity) of user interface 508.
Figure 6 illustrates a left presentation 602a and a right presentation 602b to overcome the unsettling effect of three-dimensional user interface presentation according to an embodiment of the present invention where the user interface has a fully transparent background. Left presentation 602a and right presentation 602b are presented to a user on a display 606. Display 606 can be any display that can display three-dimensional presentations to a user, such as display 105 described above with respect to Figure 1.

As shown in Figure 6, left presentation 602a and right presentation 602b include an object 604 and a user interface 608. It should be understood that user interface 608 can be any user interface invention including a menu, a subtitle, or any other use of a user interface. User interface 608 has an original border 609. The dotted line showing original border 609 is shown in Figure 6 for clarity to show the original border of user interface 608. However, in an embodiment, the dotted line is not presented to the user on display 606.

In the embodiment illustrated in Figure 6, user interface 608 has a fully transparent background. To overcome the unsettling effect of three-dimensional user interface presentation of a user interface having a transparent background, in an embodiment, the text of user interface 608 is position-shifted so as to appear to be projected out of the screen. In addition, any two- or three-dimensional icons or images in user interface 608 are position-shifted so as to appear to be projected out of the screen. In this manner, intersection of the text of user interface 608 with the video or image is avoided. Thus, $T_L > T_R$ as shown in Figure 6.
In addition, to avoid the unsettling effect that may arise with a fully transparent background, an extended border 610 can be created. The dotted line showing extended border 610 is shown in Figure 6 for clarity to show the extended border of user interface 608. However, in an embodiment, the dotted line is not presented to the user on display 606.

In the embodiment, an extended portion 612 of the background between extended border 610 and the original border of the background 609 of user interface 608 is blurred. In an embodiment, the video or image underlying the original background of user interface 608 is blurred. For example, in an embodiment, the video or image underlying the original background of user interface 608 is blurred using a maximum available blur radius. Other values of blur radius can be used depending on implementation.

Further, in an embodiment, the video or image underlying extended portion 612 is blurred. Moreover, in extended portion 612, the blur radius decreases with increasing distance from original border 609 of user interface 608 to the extended border 610. In an embodiment, for example, blur radius begins with a maximum available blur radius and decreases with increasing distance from original border 609 of user interface 608 to the extended border 610. Typical values for blur radius range from 80 to 40 pixels. Other blur radius ranges can be used depending on implementation.

The blurring continues to the extent of the extension of user interface 608 with the blur radius decreasing with increasing distance from original border 609. In an embodiment, blur
radius is determined as a non-linear function of pixel distance from the original border. An exemplary such non-linear function is an exponential function. In another embodiment, blur radius is determined as a linear function of pixel distance from the original border. Other functions can be used to determine blur radius as would be apparent to those skilled in the art. In addition, other ranges of blur radius can be used.

Blurring the video or image behind the user interface as described above makes the user interface text and any included images or icons more easily readable or viewable, and slightly dampens the depth effect of the underlying video or image. Varying the blur radius in extended portion 612 removes hard depth transitions between the text of the user interface plane and the content video or image plane. Because the text is to be presented as appearing to project out of the screen, extended portion 612 can be smaller than portion 412 shown in Figure 4.

Figure 7 is a flow chart for a method for presenting a user interface (UI) such to a user on a display that can be configured to display a three-dimensional presentation. The display can be any screen to display three-dimensional images or video such as display 105 described above with respect to Figure 1.

In step 702, a user interface, such as a menu of user-selectable options, a subtitle, or any other user interface, is displayed on the display. In step 704, an extended border is created around the user interface background to define an extended portion of the user interface background. In step
If in step 706 it is determined that the user interface background is opaque, operation of the method continues in step 708. In step 708, the user interface background in the extended portion is blended with the underlying video or image being displayed on the display.

In an embodiment, the blending is performed using an alpha value that indicates an amount of blending transparency. In an embodiment, alpha ranges from 1 (opaque) to 0 (fully transparent). In an embodiment, alpha for blending is determined as a function of distance from the original border of the user interface background. For example, in an embodiment, alpha is decreased as a distance from the original border of the user interface increases. In an embodiment, for example, alpha decreases from 1 to 0 as a function of the distance from the original border of the user interface to the extended border. In an embodiment, alpha is determined as a non-linear function of pixel distance from the original border. An exemplary such non-linear function is an exponential function. In another embodiment, alpha is determined as a linear function of pixel distance from the original border. Other functions can be used to determine alpha as would be apparent to those skilled in the art.

If in step 706 it is determined that the user interface background is semi-transparent, operation of the method continues in step 710. In step 710, the text of the user interface is presented to the user to appear as projecting out of the display. Further, in step 710, any two- or three-
dimensional images or icons of the user interface are presented to the user to appear as projecting out of the display. Operation of the method then continues in step 712 where the user interface background in the extended portion is blended with the underlying video or image being displayed on the display.

In an embodiment, blending is performed using an alpha value that indicates an amount of blending transparency. In an embodiment, alpha ranges from a value of alpha corresponding to the semi-transparent user interface background (semi-transparent) to 0 (fully transparent). In an embodiment, alpha for blending is determined as a function of distance from the original border of the user interface background. For example, in an embodiment, alpha is decreased as a distance from the original border of the user interface increases. In an embodiment, for example, alpha decreases from the semi-transparency alpha value to 0 as a function of the distance from the original border of the user interface to the extended border. In an embodiment, alpha is determined as a non-linear function of pixel distance from the original border. An exemplary such non-linear function is an exponential function. In another embodiment, alpha is determined as a linear function of pixel distance from the original border. Other functions can be used to determine alpha as would be apparent to those skilled in the art.

If in step 706 it is determined that the user interface background is transparent, operation of the method continues in step 714. In step 714, the text of the user interface is presented to the user to appear as projecting out of the display. Further, in step 714, any two- or three-dimensional
images or icons of the user interface are presented to the user to appear as projecting out of the display. Operation of the method then continues in step 716 where the video or image underlying the user interface is blurred. For example, in an embodiment, the video or image underlying the original background of user interface 608 blurred using a maximum available blur radius. Other values of blur radius can be used depending on implementation.

In an embodiment, the video or image in the extended portion is blurred using a blur radius determined as a function of distance from the original border of the user interface background. For example, in an embodiment, the blur radius is decreased as a distance from the original border of the user interface increases. In an embodiment, for example, blur radius begins with a maximum available blur radius and decreases with increasing distance from original border of the user interface. For example, in an embodiment, blur radius is decreased from 80 pixels to 40 pixels. In an embodiment, blur radius is determined as a non-linear function of pixel distance from the original border. An exemplary such non-linear function is an exponential function. In another embodiment, blur radius is determined as a linear function of pixel distance from the original border. Other functions can be used to determine blur radius as would be apparent to those skilled in the art.

The method of figure 7 can be executed in software on a processor 107. As described above, processor 107 can be located in a set top box 106 of Figure 1 or in a device displaying the three-dimensional image or video. Processor 107 can be any processor that can be configured with software
programmed to execute the operations described herein, for example, with respect to Figure 7. An exemplary such processor is the PNX85500 available from Trident Microsystems of Santa Clara, California.

In other embodiments, determination step 706 is not required. For example, in an embodiment, processor 107 is preconfigured to implement a user interface having either an opaque background, a semi-transparent background, or a fully transparent background. In such a case, only the appropriate prong of Figure 7 is required. For example, if processor 107 implements a user interface having only an opaque background, only steps 702, 704, and 708 of Figure 7 are required. If processor 107 implements a user interface having only a semi-transparent background, only step 702, 704, 710, and 712 are required. If processor 107 implements a user interface having only a fully transparent background, only step 702, 704, 714, and 716 are required.

The foregoing disclosure of the preferred embodiments of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many variations and modifications of the embodiments described herein will be apparent to one of ordinary skill in the art in light of the above disclosure. The scope of the invention is to be defined only by the claims appended hereto, and by their equivalents.

Further, in describing representative embodiments of the present invention, the specification may have presented the method and/or process of the present invention as a particular sequence of steps. However, to the extent that
the method or process does not rely on the particular order of steps set forth herein, the method or process should not be limited to the particular sequence of steps described. As one of ordinary skill in the art would appreciate, other sequences of steps may be possible. Therefore, the particular order of the steps set forth in the specification should not be construed as limitations on the claims. In addition, the claims directed to the method and/or process of the present invention should not be limited to the performance of their steps in the order written, and one skilled in the art can readily appreciate that the sequences may be varied and still remain within the spirit and scope of the present invention.
CLAIMS

1. A system to present a user interface in a three-dimensional display, comprising:
   a device having a display to display a three-dimensional video or image; and
   a processor configured to:
   cause a user interface having a background to be presented on the display;
   define an extended portion of the user interface background; and
   perform graphical processing in the extended portion of the user interface background.

2. The system of claim 1, wherein the user interface background is opaque, and wherein the graphical processing comprises blending the extended portion of the user interface background with a portion of the video or image underlying the extended portion.

3. The system of claim 2, wherein the blending comprises varying an alpha value that controls transparency of the blending.

4. The system of claim 2, wherein the blending comprises decreasing an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

5. The system of claim 2, wherein the blending comprises decreasing linearly an alpha value that controls
transparency of the blending as distance from an original border of the user interface background increases.

6. The system of claim 2, wherein the blending comprises decreasing non-linearly an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

7. The system of claim 2, wherein the blending comprises decreasing exponentially an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

8. The system of claim 1, wherein the background of the user interface is semi-transparent and wherein the processor causes content associated with the user interface to appear as projected out of the screen.

9. The system of claim 8, wherein the graphical processing comprises blending the extended portion of the user interface background with a portion of the video or image underlying the extended portion.

10. The system of claim 9, wherein the blending comprises varying an alpha value that controls transparency of blending.

11. The system of claim 9, wherein the blending comprises decreasing an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.
12. The system of claim 9, wherein the blending comprises decreasing linearly an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

13. The system of claim 9, wherein the blending comprises decreasing non-linearly an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

14. The system of claim 9, wherein the blending comprises decreasing exponentially an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

15. The system of claim 1, wherein the user interface background is fully transparent and the graphical processing comprises blurring the video or image underlying the user interface background within a region defined by an original border of the user interface background.

16. The system of claim 15, wherein the processor causes content associated with the user interface background to appear as projected out of the screen.

17. The system of claim 15, wherein the video or image underlying the extended portion of the user interface background is blurred.

18. The system of claim 17, wherein a blur radius used in blurring the video or image underlying the extended portion
decreases as distance from an original border of the user interface background increases.

19. The system of claim 18, wherein the processor causes content associated with the user interface to appear as if projected out of the screen.

20. The system of claim 17, wherein a blur radius used in blurring the video or image underlying the extended portion decreases linearly as distance from an original border of the user interface background increases.

21. The system of claim 17, wherein a blur radius used in blurring the video or image underlying the extended portion decreases non-linearly as distance from an original border of the user interface background increases.

22. The system of claim 17, wherein a blur radius used in blurring the video or image underlying the extended portion decreases exponentially as distance from an original border of the user interface background increases.

23. The system of claim 1, further comprising a set-top box in which the processor resides.

24. The system of claim 1, wherein the device is one of a television, a portable movie player, a personal digital assistant, a telephone, and a camera.

25. The system of claim 1, wherein the user interface is a graphical overlay.
26. A method for presenting a user interface on a display that displays three-dimensional video or images, comprising:
   generating a user interface having a background defined by an original background border;
   displaying the user interface on the display;
   defining an extended portion of the background with an extended border; and
   performing graphical processing in the extended portion of the user interface background.

27. The method of claim 26, wherein performing the graphical processing comprises blending the extended portion of the user interface background with a portion of the video or image underlying the extended portion.

28. The method of claim 27, wherein performing the graphical processing comprises varying an alpha value that controls transparency of the blending.

29. The method of claim 27, wherein performing the graphical processing comprises decreasing an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

30. The method of claim 27, wherein performing the graphical processing comprises decreasing linearly an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

31. The method of claim 27, wherein performing the graphical processing comprises decreasing non-linearly an alpha value...
that controls transparency of the blending as distance from an original border of the user interface background increases.

32. The method of claim 27, wherein performing the graphical processing comprises decreasing exponentially an alpha value that controls transparency of the blending as distance from an original border of the user interface background increases.

33. The method of claim 26, further comprising presenting content associated with the user interface to appear as projected out of the screen.

34. The method of claim 33, wherein performing the graphical processing comprises blending the extended portion of the video or image underlying the extended portion.

35. The method of claim 34, wherein performing the graphical processing comprises blending according to a varying alpha value that controls transparency of blending.

36. The method of claim 34, wherein performing the graphical processing comprises blending according to an alpha value that controls transparency of the blending, wherein the alpha value decreases as distance from an original border of the user interface background increases.

37. The method of claim 34, wherein performing the graphical processing comprises blending according to an alpha value that controls transparency of the blending, wherein the
alpha value decreases linearly as distance from an original border of the user interface background increases.

38. The method of claim 34, wherein performing the graphical processing comprises blending according to an alpha value that controls transparency of the blending, wherein the alpha value decreases non-linearly as distance from an original border of the user interface background increases.

39. The method of claim 34, wherein performing the graphical processing comprises blending according to an alpha value that controls transparency of the blending, wherein the alpha value decreases exponentially as distance from an original border of the user interface background increases.

40. The method of claim 26, wherein the user interface background is fully transparent and the graphical processing comprises blurring the video or image underlying the user interface background within a region defined by an original border of the user interface background.

41. The method of claim 40, further comprising presenting content associated with the user interface background to appear as projected out of the screen.

42. The method of claim 41, wherein performing the graphical processing comprises blurring the video or image underlying the extended portion of the user interface background.

43. The method of claim 41, wherein performing the graphical processing comprises blurring the video or image underlying the extended portion of the user interface background
according to a blur radius that decreases as distance from an original border of the user interface background increases.

44. The method of claim 41, wherein performing the graphical processing comprises blurring the video or image underlying the extended portion of the user interface background according to a blur radius that decreases linearly as distance from an original border of the user interface background increases.

45. The method of claim 41, wherein performing the graphical processing comprises blurring the video or image underlying the extended portion of the user interface background according to a blur radius that decreases non-linearly as distance from an original border of the user interface background increases.

46. The method of claim 41, wherein performing the graphical processing comprises blurring the video or image underlying the extended portion of the user interface background according to a blur radius that decreases exponentially as distance from an original border of the user interface background increases.

47. The method of claim 42, further comprising presenting content associated with the user interface to appear as if projected out of the screen.

48. A device to process a three-dimensional video or image, comprising:
an input for receiving an image for display as a three dimensional video or image; and
a processor configured to generate a graphical overlay having a foreground portion and a background portion to be displayed in combination with the three dimensional image, wherein the processor generates an extended background portion and performs graphical processing in the extended background portion.
Figure 7

1. Present UI on 3DTV television screen
2. Create extended border around UI background
3. UI Background Opaque
4. Semi-transparent
5. Transparent
6. Present UI text to appear as projected out of television screen
7. Blur underlying video or image with decreasing radius in extended portion
8. Blend UI background with decreasing alpha in extended portion
9. Blend UI background, with decreasing alpha in extended portion
10. Semi-transparent
11. Present UI text to appear as projected out of television screen
12. Blend UI background with decreasing alpha in extended portion
13. Opaque
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04N5/445 H04N13/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search: 10 December 2010

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