USER INPUT APPARATUS, SYSTEM, METHOD AND COMPUTER PROGRAM FOR USE WITH A SCREEN HAVING A TRANSLUCENT SURFACE

CLAIM OF PRIORITY FROM COPENDING PROVISIONAL PATENT APPLICATION:

[0001] This patent application claims priority under 35 U.S.C. §119(e) from Provisional Patent Application No.: 60/605,115, filed 08/27/2004, the disclosure of which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] The teachings of this invention relate generally to user interface (UI) systems and devices and, more specifically, relate UI systems that employ a touch screen, and still more specifically to UI touch screen systems that use a translucent screen or panel.

BACKGROUND

[0003] A desirable type of input panel or screen is a semi-transparent panel. For example, reference can be made to U.S. Pat. No. 6,414,672 B2, "Information Input Apparatus" by Rekimoto et al.

[0004] In general, traditional techniques that are used to create touch screens rely on overlaying an electricity-sensitive glass or glasses over the screen. However, this approach is not suitable for outdoor displays, such as store fronts, because of the possibility of vandalism and other factors, and furthermore is very expensive when used on a large screen.

[0005] Another approach provides one of the sides of the screen with light emitters, such as LEDs or similar devices, and the opposite side of the screen with light-sensitive elements. Hand interaction is detected by the occlusion of the light emitted by a particular LED. However, a disadvantage of this approach is the requirement to provide at least one of the LED or light-sensitive arrays outside of the glass in a store front, exposing them to vandalism.

[0006] Similarly, laser-scan and Doppler radar can be installed on the front side of the screen to determine user interaction, with similar disadvantages. Reference maybe had to, as examples, "Sensor Systems for Interactive Surfaces", J. Paradiso, K. Hsiao, J. Strickon, J. Lifton, and A. Adler, IBM Systems Journal, Volume 39, Nos. 3 & 4, October 2000, pp. 892-914, and to "The Magic Carpet: Physical Sensing for Immersive Environments", J. Paradiso, C. Abler, KY. Hsiao, M. Reynolds, in Proc. of the CHI '97 Conference on Human Factors in Computing Systems, Extended Abstracts, ACM Press, NY, pp. 277-278(1997).

[0007] Another technique for use with glass windows uses microphones and sound triangulation to determine when the user knocks on the glass. This method is described in "Passive Acoustic Sensing for Tracking Knocks Atop Large Interactive Displays", Joseph A. Paradiso, Che King Leo, Nisha Checka, Kaijen Hsiao, in the 2002 Proceedings of the 2002 IEEE International Conference on Sensors, Volume 1, Orlando, Fla., Jun. 11-14, 2002, pp.521-527. Potential disadvantages of this approach include a need to put sensors directly in contact with the window and to run wires to them; and the need for a hard surface such as glass. In particular, this approach is not suitable for use with soft plastic rear-projected screens.

[0008] Cameras can be used to detect the user interaction with a translucent image. If the camera is positioned on the same side of the user then conventional computer vision gesture recognition techniques can be used to detect interaction. However, in this situation the issue of possible vandalism is a clear disadvantage, as well as the difficulty of mounting the camera in an appropriate position.

[0009] It would be preferable to position the camera on the rear side of the translucent surface so that the camera can be easily protected from vandalism. However, in such situations the user's image captured by the camera can be extremely blurred, thereby not allowing the use of traditional gesture recognition techniques. In the above-noted approach of Rekimoto et al. the camera and the projector are required to be fitted with IR filters, and infrared lighting is also required. A significant disadvantage of this method is that it cannot be used in situations where the translucent screen is exposed to significant amounts of ambient infrared light, such as when a store front window is exposed to direct sun light.

[0010] Reference may also be had to commonly-assigned U.S. Pat. No. 6,431,711 B1, "Multiple-Surface Display Projector with Interactive Input Capability", by Claudio S. Pinhanez.

SUMMARY OF THE PREFERRED EMBODIMENTS

[0011] The foregoing and other problems are overcome, and other advantages are realized, in accordance with the presently preferred embodiments of these teachings.

[0012] Embodiments of this invention provide an information input apparatus, method and computer program and program carrier. The apparatus includes a translucent screen; an image capture device located for imaging a first side of the screen opposite a second side where user interaction occurs; and an image processor coupled to the output of the image capture device to determine at least one of where and when a person touches an area on the second side of the screen by a change in intensity of light emanating from the touched area relative to a surrounding area.

[0013] A method to detect a user input in accordance with embodiments of this invention includes providing a system having a translucent screen having an image capture device located for imaging a first side of the screen opposite a second side where user interaction occurs. The method determines at least one of where and when a person touches an area on the second side of the screen by detecting a change in intensity of light emanating from the touched area relative to a surrounding area.

[0014] Further in accordance with embodiments of this invention there is provided a signal bearing medium that tangibly embodies a program of machine-readable instructions executable by a digital processing apparatus to perform operations to detect a user input. The operations include, in response to providing a system having a translucent screen having an image capture device located for imaging a first side of the screen opposite a second side where user interaction occurs: determining at least one of where and when a person touches an area on the second side of the screen by detecting a change in intensity of light emanating from the touched area relative to a surrounding area.