METHOD AND SYSTEM FOR IMPROVING DISPLAY QUALITY OF A MULTI-COMPONENT DISPLAY

BACKGROUND OF THE INVENTION

[0001] Multi-component displays generally include multiple display screens in a stacked arrangement. Each display screen can display images, thereby providing visual depth and other visual effects that a single display screen cannot. Additionally, diffusers, filters or other interstitial layers are often disposed between the display screens for altering characteristics of the multi-component display.

[0002] Diffusers are commonly used in multi-component displays to reduce the effect of banding or other repeated patterns, commonly known as Moiré interference. Moiré interference is introduced when display screens are stacked to form a multi-component display, and is typically caused by interference between color filters and the matrix of each display screen which covers the traces, leads and transistors allocated to each pixel. The distance between the rear display screen and the diffuser, as well as the scattering properties of the diffuser itself, can be varied to reduce Moiré interference.

[0003] Although diffusers are capable of reducing Moiré interference, they blur images displayed on a rear display screen of the multi-component display. Thus, steps can be taken to optimize the tradeoff between Moiré interference and blurriness by varying the scattering properties of the diffuser and/or varying the distance between the rear display screen and the diffuser. As a result, conventional multi-component displays blur images displayed on the rear display screen in an effort to reduce Moiré interference.

SUMMARY OF THE INVENTION

[0004] Accordingly, a need exists to reduce the blurriness of images displayed on multi-component displays. Additionally, a need exists to reduce image blur while also reducing Moiré interference associated with the multi-component display. Embodiments of the present invention provide novel solutions to these needs and others as described below.

[0005] Embodiments of the present invention are directed to a method, computer-usable medium, and system for processing graphical data for display on a multi-component display. More specifically, embodiments improve the display quality of multi-component displays by modifying graphical data to preemptively compensate for distortion caused by interstitial layers (e.g., a diffuser, filter, polarizer, lens, touchscreen, etc.) and/or display screens of the multi-component display, thereby enabling display of graphical objects from multi-component displays with improved optical characteristics (e.g., sharpness, tonal balance, color balance, etc.). For example, where components of a multi-component display blur displayed images (e.g., by dampening or reducing high frequency components of the displayed image), graphical data used to display graphical objects may be modified to sharpen the graphical objects before display. The pre-sharpening amplifies the high frequency components of the displayed graphical objects to compensate for the dampening caused by passing the graphical objects through the components of the multi-component display.

[0006] In one embodiment, a computer-controlled method of processing graphical data for display on a display device (e.g., a multi-component display) includes accessing the graphical data. Graphical alteration information associated with the display device is accessed, where the graphical alteration information is related to distortion of graphical objects displayed on the display device. The graphical data is processed in accordance with the graphical alteration information to generate updated graphical data, wherein the updated graphical data compensates for the distortion and is operable to improve the display quality of the display device. The processing may include amplifying high frequency components of the graphical data, which may include applying a low-pass filter to the graphical data to generate low-pass graphical data, subtracting the low-pass graphical data from the graphical data to generate high-pass graphical data, and adding the high-pass graphical data to the graphical data to generate the updated graphical data with amplified high frequency components. The method may also include transforming the graphical data from a first space (e.g., a RGB color space) to a second space (e.g., a luminance-chrominance space such as QTD, YUV, CIE LUV, CIE LAB, etc.), processing the graphical data in the second space to generate the updated graphical data in the second space, and transforming the updated graphical data from the second space to the first space.

[0007] In another embodiment, a computer-usable medium having computer-readable program code embodied therein may cause a computer system to perform a method of processing graphical data for improved display quality on a multi-component display. Additionally, in yet another embodiment, a system may include a processor coupled to a memory, wherein the memory includes instructions that when executed on the processor implement a method of processing graphical data for improved display quality on a multi-component display.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements.

[0009] FIG. **1** shows a diagram of an exemplary display of graphical objects on an exemplary multi-component display in accordance with one embodiment of the present invention.

[0010] FIG. **2** shows a diagram of exemplary effects of multi-component display components on the frequency spectrum of displayed graphical objects in accordance with one embodiment of the present invention.

[0011] FIG. **3** shows an exemplary computer-implemented process for processing graphical data for improved display quality on a multi-component display in accordance with one embodiment of the present invention.

[0012] FIG. **4** shows an exemplary system for processing graphical data for improved display quality on a multi-component display in accordance with one embodiment of the present invention.

[0013] FIG. **5** shows an exemplary computer-implemented process for processing graphical data in accordance with graphical alteration information to generate updated graphical data in accordance with one embodiment of the present invention.