METHOD TO CONTROL POINT SPREAD FUNCTION OF AN IMAGE

TECHNICAL FIELD

[0001] This invention relates to the field of improved imaging technology. In particular, this invention will be discussed in relation to display technology with multiple image layers.

[0002] Reference shall now be made to use of the present invention in relation to multiple layered display technology.

BACKGROUND ART

[0003] There are two main types of displays used in computer monitors, passive matrix and active matrix. Passive-matrix displays use a simple grid to supply the charge to a particular pixel on the display. Creating the grid starts with two glass layers called substrates. One substrate is given columns and the other is given rows made from a transparent conductive material. This is usually indium tin oxide. The rows or columns are connected to integrated circuits that control when a charge is sent down a particular column or row. The electro-optical material is often sandwiched between the two glass substrates.

[0004] A pixel is defined as the smallest resolvable area of an image, either on a screen or stored in memory. Each pixel in a monochrome image has its own brightness, from 0 for black to the maximum value (e.g. 255 for an eight-bit pixel) for white. In a colour image, each pixel has its own brightness and colour, usually represented as a triple of red, green and blue intensities. To turn on a pixel, the integrated circuit sends a charge down the correct column of one substrate and a ground activated on the correct row of the other. The row and column intersect at the designated pixel and that delivers the voltage to untwist the liquid crystals at that pixel.

[0005] The passive matrix system has significant drawbacks, notably slow response time and imprecise voltage control. Response time refers to the display's ability to refresh the image displayed. Imprecise voltage control hinders the passive matrix's ability to influence only one pixel at a time.

[0006] When voltage is applied to change the optical state of one pixel, the pixels around it also partially change, which makes images appear un-sharp and lacking in contrast.

[0007] Active-matrix displays depend on thin film transistors (TFH). Thin film transistors are tiny switching transistors and capacitors. They are arranged in a matrix on a glass substrate. To address a particular pixel, the proper row is switched on, and then a charge is sent down the correct column. Since all of the other rows that the column intersects are turned off, only the capacitor at the designated pixel receives a charge. The capacitor is able to hold the charge until the next refresh cycle; and if the amount of voltage supplied to the crystal is carefully controlled, it can be made to untwist only enough to allow some light through. By doing this in very exact, very small increments, displays can create a grey scale. Most displays today offer 256 levels of brightness per pixel.

[0008] Displays that can show colours may have three sub-pixels with red, green and blue colour filters to create each colour pixel. Through the careful control and variation of the voltage applied, the intensity of each sub-pixel can range over 256 shades. Combining the sub-pixels produces a possible palette of 16.8 million colours (256 shades of red×256 shades of green×256 shades of blue). These filters are arranged such that they form vertical red, green and blue stripes across the panel.

[0009] The frequency spectrum of radiation incident upon a detector depends on the properties of the light source, the transmission medium and possibly the properties of the reflecting medium. If one considers the eye as a detector the human visual system can sense radiation that has a wavelength between 0.6 nm and 380 nm. Hence this is described as the visual part of the electromagnetic spectrum. Humans perceive certain frequency distributions as having different colours and brightness. A scheme was devised to describe any perceived colour and brightness via adding three basis spectral distributions with various weights. For example in the 1931 CIE colour space any perceivable colour may be described by the following equation:

$$C=x_rX+y_rY+z_rZ$$

Where C is the colour being described, Xr, Yr and Zr are the weights and X, Y and Z are 1931 CIE tristimulis curves which are graphs of the relative sensitivity of the eye Vs wavelength. For any given colour, the weights may be determined by the following equations:

$$x_r=\left(\int C(\lambda)X(\lambda)d\lambda\right)$$

$$y_r=\left(\int C(\lambda)Y(\lambda)d\lambda\right)$$

$$z_r=\left(\int C(\lambda)Z(\lambda)d\lambda\right)$$

[0010] The 1931 co-ordinates are formed via the following normalisation:

$$x_r=\frac{X_r}{X_r+Y_r+Z_r}$$

$$y_r=\frac{Y_r}{X_r+Y_r+Z_r}$$

$$z_r=1-x_r-y_r$$

[0011] These may be plotted on the 1931 CIE diagram. The spectral locus defines the pure spectral colours, that is the perception of radiation with a specific wavelength. Colour co-ordinates that are closer or farther from pure spectral colours are described as being more or less saturated respectively. The value of the y coordinate multiplied by 683 is also referred to as the luminance denoted by the symbol L.

[0012] The perception model described above accurately predicts that colours on addressable objects can be formed by mixing small areas of three basis colours with modulated intensities which are close in either close spatial or temporal proximity. If the basis colours are plotted on the CIE diagram then the enclosed triangle contains all the colours producible by the system. The enclosed area is called the