Recent Synchronization Signal Circuit System for Low Cross-talk Stereoscopic Display

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Keywords : Synchronization, Stereoscopic Display

Abstract

Synchronization signal circuit system for low cross-talk stereoscopic display .We proposed the employment of the scanning beams of any adjacent scanning regions gradually scan from upper to down direction of the LED backlight panel.

1. Introduction

A stereoscopic display is to synchronously apply a same control signal to all the rows of LED backlight. Due to the LCD with physical delay characteristic (low response speed), an image for a left eye is projected by the light from the left eye image file and an image for a right eye is projected by the light from the right eye file through a liquid crystal panel . Both images are alternately switched from one to the other by switching the light emitting full panel. Thus, stereoscopic images are shown to a viewer. However, the images displayed on the liquid crystal panel have to be switched from an image for the left eye to another image for the right eye in synchronism with switching of the time-shared light source. Because the images are displayed by sequentially scanning the panel, both images for the left and right eyes are simultaneously shown when the images are switched. This phenomenon is called "cross-talk"[1-3].

This paper proposes a novel architecture of Synchronization Signal Circuit System scanning regions for high frequency and high resolution stereoscopic display.

2. Experimental

LED Scanning Backlight Stereoscopic Display with Shutter Glasses is provided to realize stereoscopic image viewing even in a liquid crystal display. The eye shutter signal is alternately switched from the left eye to the right eye with 120Hz of LCD Vertical synchronization (V-sync).

A stereoscopic display device in which images having respective parallax for left and right eyes are displayed on a panel and shown to a viewer through a parallax barrier or a lenticular plate is known hitherto. In this device, however, image resolution is low because the images are shown through the parallax barrier or the lenticular plate. In addition, image brightness is decreased in the case the parallax barrier is used, while an image focus is blurred due to lens aberration in the case the lenticular plate is used[4-6].

To cope with these problems, time-multiplexed stereoscopic systems, utilizing shutter-glasses and LED scanning switchable backlight screens are well known and have been the objective of much research. Shutter-glasses system has two wearable optical switches, capable of switching their transparency thus blocking left or right eye.

This paper is characterized by that in a frame time defined by LCD V-sync signal, each row of LED of a backlight module is controlled to flash in brightness and darkness so that the LCD with physical delay characteristic (low response speed) of liquid crystal and essentially a hold type can be made similar to an impulse type display device like a cathode ray tube display, also alleviating the drawbacks such as blurring and flicking of the LCD.

The method of the proposed is classified into two categories. One is to display, in a frame time, some kinds of brightness/darkness characteristic from upper row to lower row of the horizontally arranged rows of LED in the backlight module, cooperating with the scanning of the LCD, to thereby realize an effect similar to scanning. The other method is to synchronously apply a same control signal to all the rows of LED. In other words, this method provides flashing rather than scanning effect. Both methods can control the brightness of the backlight module by adjusting the duty cycle of the control signal. The shutter glasses signal could be adjusted by vertical synchronization modulation to attain stereoscopic image.

A backlight module has multiple sets of LEDs, where each set of LEDs has multiple white light source LEDs. The corresponding LED is placed at back of every region of the panel. The scanning beams of any adjacent scanning regions gradually scan from upper to down direction of the panel. In this paper, we have successfully designed and demonstrated a decent performance with 120Hz Optimized synchronization signal between LED brightness/darkness flash and adjusted shutter glasses signal. It has been demonstrated that the 120Hz scanning characteristic from upper row to lower row of the horizontally arranged of stereoscopic image. A quadrate image for a left eye is projected by the light from the left eye image file and a circle image for a right eye is projected by the light from the right eye file through a liquid crystal panel.

A stereoscopic image display device is composed of a flat display panel, driver circuits for driving the display panel and an eye shutter to be worn by a view er. A left eye image and a right eye image are alternate ly shown on the display panel, and the eye shutter is al ternately switched from the left eye to the right eye wi th 120Hz, in response to display of the respective left and right eye images. Thereby, the displayed image is recognized as a stereoscopic image by a viewer weari ng the eye shutter.

Because shutter glasses require a screen refresh rate twice that of a normal display, extremely high performance graphics technology is required to support it. Most inexpensive products advertised as being shutter-glasses compatible are only capable of 120Hz refresh, equivalent to the industry minimum of 60 frames per second. But on a standard CRT, 60 Hz is slightly too slow and the flickering is often readily apparent when looking away and the screen is in the periphery of the visual field. Long-term viewing of 60 Hz refresh on a CRT can lead to headaches and eye strain.

The slightly visible CRT flicker at 60 Hz diminishes as the refresh is increased, with 85 Hz commonly being a commonly preferred choice for standard CRTs. However, the equivalent shutter-glasses refresh rate would be 170 Hz, which almost no equipment is capable of achieving. Typically 150 Hz is as high as most video cards will go, which is equivalent to 75 Hz on a normal CRT.

The technologies, which are originally developed mainly in mainframe computers as a core part of the "virtual reality" environment, are growing very rapidly with popularity gained in the personal computer domain as well. You need to wear a pair of 3D shutter glasses to visualize the 3D pictures and 3D videos given below. With the signal (via electrical wire or infra-red) emitted from the computer which is synchronized with the images/videos displayed on the computer monitor, the right-hand and left-hand shutter glasses will turn on and off sequentially to let the observer view the right-hand and left-hand images of the objects or videos. As the refresh rate is fairly high (>60 frames per second), our human brain will treat the images from the two eyes to arrive simultaneously and combine them to form the 3D images which have the depth clues. Almost all people can see the 3D effects without difficulties but prolonged viewing may cause some unpleasant feeling to some people.

3. Results and discussion

A 3D stereoscopic image display panel having a plurality of scanning electrodes, a plurality of data electrodes extending perpendicularly to the scanning electrodes, and liquid crystal filling a space between the scanning electrodes and data electrodes, pixels being formed at each intersection of the scanning and data electrodes together with the liquid crystal, the display panel being divided into an upper half part and a lower half part; a scanning control circuit for scanning the scanning electrodes by sequentially supplying scanning voltages to each scanning electrode and by maintaining the same for a predetermined period, the scanning electrodes located in the upper half part of the panel and the scanning electrodes located in the lower half part being scanned separately but simultaneously in opposite directio.An image data control circuit for sequentially supplying image data voltages to the data electrodes in synchronism with scanning of the scanning electrodes, so that a left eye image is displayed on the display panel in a first field during which all the scanning electrodes are once scanned and a right eye image is displayed in a second field during which all the scanning electrodes are once scanned.

An eye shutter having a left eye shutter and a right eye shutter to be worn by a viewer, both the left and right eye shutters being alternately opened and closed in synchronism with display of the respective left and right eye images on the display panel, the scanning electrodes are scanned in such a manner that the image data is written on the pixels in a selecting period, the written image data is held on the pixels in a holding period and the image data is eliminated in an eliminating period, and the one eye shutter is opened and the other eye shutter is closed until a time immediately before the image for the other respective eye image is displayed on the scanning electrode first scanned.

Stereoscopic viewing glasses having a pair of optical-shutters for viewing stereoscopic image pairs displayed on said video display device according to a time-multiplexing display technique, each said optical-shutter having either optically-transparent state or an optically-opaque state which is selected by a shutter control pulse signal transmitted to said stereoscopic viewing glasses; and shutter control pulse signal generator/transmitter connectable between said computer display adapter and said video display device, receiving said computer-generated video signal as input, and generating shutter control pulse signals for use in controlling the optical state of said optical-shutters

A novel architecture of scanning regions for 120Hz high frequency and high resolution stereoscopic displa y is shown in Fig.1. In anticipation of an image for a l eft eye and right eye is shown in the region 1 of the pa nel, we turned on region 3 LEDs set light source. Anal ogize the image shown in region 2 and turned on regio n 4 LEDs set light source. The experiment is shown in Fig. 2. Fig. 3. shown the average brightness of display. Fig. 4. shown Brightness/darkness of display. It is high Brightness/darkness of display.

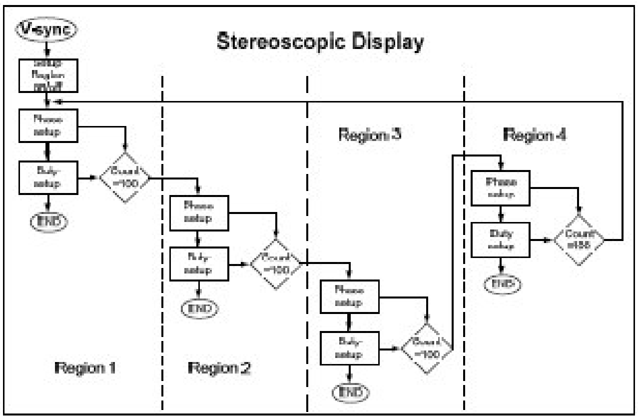

Fig. 1 . Synchronization Signal LED backlight architecture

The CS-100 Spot Chroma Meter can measure all types of light sources including LED's set of turned on region. The CS-100 is highly accurate, completely portable and has a fast measurement time. We have measured brightness/darkness ratio and shown in Tabl e 1. The measurement distance of 1m by three times and the units is "nits", it demonstrated high brightness/darkness ratio on Region 2, and then reduce the cross-talk image shown in Fig.5 between the left and right eye through the shutter glasses.

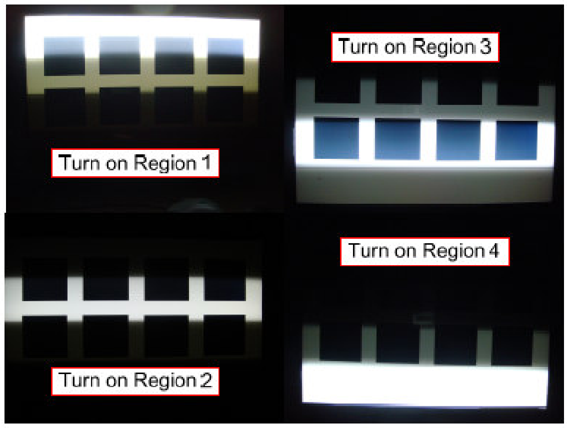

Fig. 2. LED light emitting sequentially scanning

TABLE 1. Periodic table of elements

				Average	Ratio
region 2 White	386	407	404	399	
region 2 Block	2.9	3.12	3.04	3.02	132.11
region 1 White	10.4	10.4	10.4	10.4	
region 1 Block	0.32	0.32	0.32	0.32	32.5
region 3 White	11.6	11.8	11.8	11.7333	
region 3 Block	0.43	0.45	0.45	0.44333	26.47
region 4 White	0.6	0.6	0.61	0.60333	
region 4 Block	0.44	0.42	0.44	0.43333	1.385

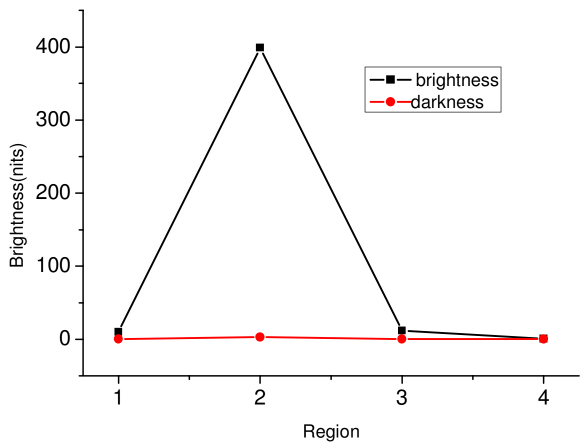

Fig. 3. Average brightness of display

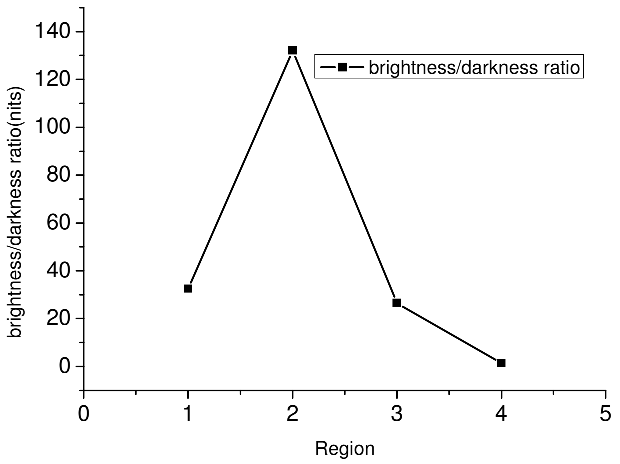

Fig. 4. Brightness/darkness of display

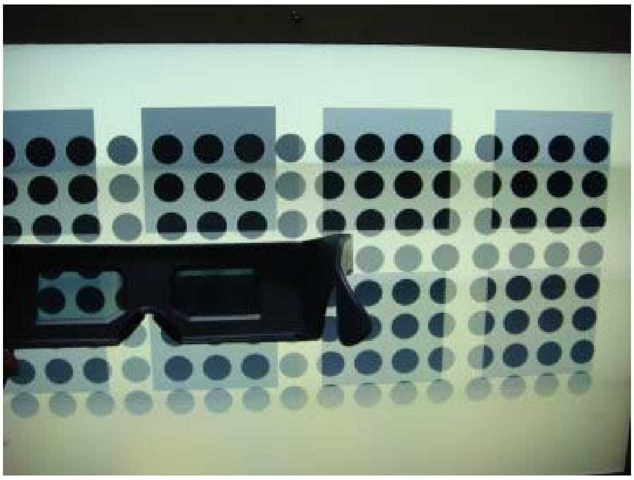

Fig.5. Reduction the cross-talk image

LCD technology is not usually rated by frames per second but rather the time it takes to transition from darkness to brightness and back to darkness, in milliseconds. In order to achieve an equivalent minimum refresh rate of 120 Hz, an LCD must be able to transition at a speed of not more than 8.33 ms.

Shutter-glasses-type 3D display was implemented many years ago by CRT. However, due to the generation supersedure the CRT was replaced by LCD, the shutter-glasses solution followed on as a result of the long response time of LCD. Thanks to the development of over-drive technology, the response time of LCD is getting faster, and a 100-120Hz panel refresh rate is possible. Therefore, 3D game fans have a very good opportunity to watch full resolution, large viewing angle and low crosstalk stereo LCDs again.

4. Summary

In this article, we proposed the employment of adjacent scanning regions gradually scan from upper to down direction of the panel within 1/120sec to compensate the LCD with physical delay characteristic. The scanning LEDs backlight driving architecture can successfully reduce the cross-talk image.

5. References

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