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[Continued on next page]

(54) Title: METHOD TO STORE AND RETRIEVE CROSSTALK PROFILES OF 3D STEREOSCOPIC DISPLAYS

(57) Abstract: A method of reducing crosstalk for a 3D stereoscopic display using locally stored crosstalk profiles. The method generates a crosstalk profile for a stereoscopic display and stores the crosstalk profile in a memory, such as the EDID or DID, locally associated with the display. The crosstalk profile includes information for reducing crosstalk in the display based at least in part upon operational characteristics of the display. The method retrieves the crosstalk profile and applies the information in the crosstalk profile to stereoscopic content displayed on the display in order to reduce crosstalk in the displayed content. Using a locally stored crosstalk profile provides for crosstalk reduction tailored to a specific display.

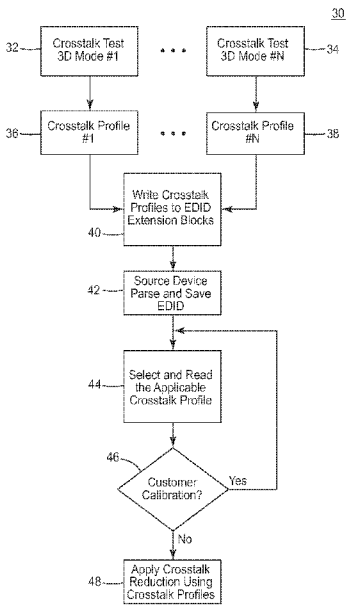


FIG. 2

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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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METHOD TO STORE AND RETRIEVE CROSSTALK PROFILES OF 3D STEREOSCOPIC DISPLAYS

BACKGROUND

3D stereoscopic displays are a type of display that provides the user with two or more images (for example, a left and a right eye view) in order to achieve a three-dimensional effect. Different technologies exist for these types of 3D displays, such as passive glasses (anaglyph or polarizer), active shutter glasses, and autostereoscopic (spatial multiplexing or temporal multiplexing). For example, one type of autostereoscopic display is a time-sequential 3D display that produces a full resolution stereoscopic display by optically forming distinct viewing regions for left and right eyes.

Crosstalk is the result of incomplete isolation between imagery intended for the left and right eyes. It is a factor that affects the stereoscopic display experience since the crosstalk is apparent to a viewer. Different types of stereoscopic displays have different crosstalk characteristics. Even within the same technology, crosstalk can vary among models, for example nine inch versus fifteen inch displays. Although algorithms exist to reduce crosstalk, those algorithms are general in nature and not tied to a specific display. Accordingly, a need exists for crosstalk reduction algorithms that take into consideration the specific operational characteristics or parameters of the associated display.

SUMMARY

A method of reducing crosstalk for a stereoscopic display using locally stored crosstalk profiles, consistent with the present invention, includes generating a crosstalk profile for a stereoscopic display and storing the crosstalk profile in a memory locally associated with the display. The crosstalk profile includes information for reducing crosstalk in the display based at least in part upon the operational characteristics of the display. The method also includes applying the information in the crosstalk profile to stereoscopic content displayed on the stereoscopic display in order to reduce crosstalk in the displayed content.

A system for reducing crosstalk for a stereoscopic display using locally stored crosstalk profiles, consistent with the present invention, includes a stereoscopic display and a processor electronically connected to the display. The processor is configured to generate a crosstalk profile for the display and store the crosstalk profile in a memory locally associated with the display. The crosstalk profile includes information for reducing crosstalk in the display based at least in part upon the operational characteristics of the display. The processor is also configured to apply the information in the crosstalk profile to stereoscopic content displayed on the stereoscopic display in order to reduce crosstalk in the displayed content.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are incorporated in and constitute a part of this specification and, together with the description, explain the advantages and principles of the invention. In the drawings,

FIG. 1 is a block diagram of a system having locally stored crosstalk profiles for a 3D stereoscopic display; and

FIG. 2 is a flow chart of a method to store and retrieve crosstalk profiles for a 3D stereoscopic display.

DETAILED DESCRIPTION

Embodiments of the present invention include a method to store display-dependent 3D crosstalk profiles for specific types of 3D stereoscopic displays. The crosstalk profiles are tailored to the operational characteristics or physical parameters of specific displays, which enhances the effectiveness of crosstalk reduction in content displayed on them. Multiple profiles can be stored to specify different characteristics of the same display, for example an active shutter glass stereoscopic display versus a directional backlight unit autostereoscopic display. Parameters such as optimal viewing distance can also be stored and communicated to the end users as part of the crosstalk profile. Examples of 3D stereoscopic displays are disclosed in U.S. Patent Nos. 8,179,362 and 7,800,708.

The crosstalk profiles can be saved as part of the EDID (Extended Display Identification Data) or DID (Display ID) of the 3D displays, which can be parsed by 3D sources, such as a graphics processing unit (GPU). EDID is a data structure defined by

VESA (Video Electronics Standards Association). VESA has developed the DID standard as a replacement of EDID. The method described herein can use the EDID or DID to implement the display specific crosstalk profiles. Alternatively, such profiles can be locally stored in other locations associated with the corresponding displays.

EDID is supplied as part of the display to describe its capabilities to a host with graphics sources (for example, PC graphics card, set-top-box, or BLU-RAY player). It is typically stored in the displays in non-volatile memory such as EEPROM (Electrically Erasable Programmable Read-Only Memory). In systems where the host and display are connected through display interfaces, the EDID is read by the host from the display through the E-DDC (Enhanced Display Data Channel). E-DDC is a serial communication protocol standardized by VESA and supported by all standard interfaces (for example, Digital Visual Interface (DVI), Video Graphics Array (VGA), High-Definition Multimedia Interface (HDMI), Low Voltage Differential Signaling (LVDS), and DisplayPort).

All EDID include a 128 byte data structure (Base EDID), which includes manufacturer name, serial number, product type, supported timings, display size, chromaticity data, and other related data. Some versions of EDID can allow additional data to be stored in one or more (up to 255) Extension Blocks appended to the Base EDID. Each Extension Block is 128 Bytes in length. VESA assigned Extension Block Tag Numbers to numerically identify the types of the Extension Blocks. Table 1 reflects the current VESA assigned Extension Tag Numbers.

Table 1 – Extension Tag Numbers

Tag Numbers	Extension Block Description
02h	CEA-EXT: CEA 861 Series Extension
10h	VTB-EXT: Video Timing Block Extension
40h	DI-EXT: Display Information Extension
50h	LS-EXT: Localized String Extension
60h	DPVL-EXT: Digital Packet Video Link Extension
F0h	Extension Block Map
FFh	Extensions defined by the display manufacturer

Embodiments of the present invention store the 3D stereoscopic crosstalk profiles in one or more EDID Extension Blocks or other local storage associated with the display. The crosstalk profiles can be stored using a dedicated Extension Tag Number, if available, in the EDID. It is also feasible to store the crosstalk profiles using the Tag Number "FFh" which can be defined and populated by display manufacturers.

Illustrated below is an example of a data structure for the 3D crosstalk profile in an EDID extension block. The crosstalk profile is organized as a linear array of N pairs of left (C_L) and right (C_R) crosstalk:

$[C_L(0), C_R(0)], [C_L(1), C_R(1)], \ldots [C_L(N-1), C_R(N-1)]$

N is the number of positions along the horizontal direction of the display where the left and right crosstalk are measured. Larger N results in higher precision but also more complicated measurement as well as processing. Therefore, the choice of N is at the discretion of the system and display designer. In the example provided below N is limited to 61 ((128-6)/2), however larger N is possible through a more sophisticated data structure.

In the processing stage, the crosstalk profile $CP_L(x,y)$, $CP_R(x,y)$ at a given pixel position (x,y) with screen resolution (H,V) is approximated as:

$CP_L(x,y)=C_L(ROUND(x*N/H))$
$CP_R(x,y)=C_R(ROUND(x*N/H))$

An example of one method to generate a crosstalk profile for a specific display involves using a conoscope and a displayed test pattern to measure actual left and right crosstalk at a number of horizontal (x) positions and vertical (y) positions on the display. Tables 2 and 3 illustrate a structure for the resulting measured crosstalk percentages ($C_l(x,y)$, $C_r(x,y)$), indicating an amount of crosstalk at each (x,y) position. At each horizontal position, an average crosstalk percentage ($C_L(x)$, $C_R(x)$) can be generated based upon the number of vertical positions (n), and the average crosstalk percentages along the

horizontal positions (N) can be used to compensate for crosstalk in displayed left and right images.

Table 2 – Left Crosstalk				
	x1	x2	…	xN
y1	C_l(x1,y1)	C_l(x2,y1)		C_l(xN,y1)
y2	C_l(x1,y2)	C_l(x2,y2)		C_l(xN,y2)
…	…	…		…
yn	C_l(x1,yn)	C_l(x2,yn)	…	C_l(xN,yn)
Average	C_L(x1 average)	C_L(x2 average)	…	C_L(xN average)

Table 3 – Right Crosstalk				
	x1	x2	…	xN
y1	C_r(x1,y1)	C_r(x2,y1)		C_r(xN,y1)
y2	C_r(x1,y2)	C_r(x2,y2)		C_r(xN,y2)
…	…	…		…
yn	C_r(x1,yn)	C_r(x2,yn)	…	C_r(xN,yn)
Average	C_R(x1 average)	C_R(x2 average)	…	C_R(xN average)

To facilitate displays that can be used in different stereoscopic modes (for example, anaglyph, shutter glasses or directional backlight autostereoscopic), it is possible to have multiple crosstalk profiles for the same display. Based on the viewing method detected by the system or through user selection, the application can select the applicable crosstalk profile for processing. Table 4 provides an example of a crosstalk profile extension block in EDID.

Table 4 – Example of Crosstalk Profile Extension Block in EDID		
Address / Offset	Value (HEX)	Function
Base EDID		
00-07	00FFFFFFFFFFFF00	EDID Header
…	…	…

7E	01	Extension Flag
7F	XX	Checksum
3D Crosstalk Profile Extension Block		
80	"3D"h	Extension Tag Code for crosstalk profile block
81	01	3D Extension block version #1
82	02	3D Technology: 00 - Anaglyph; 01 - Shutter glass; 02 - Autostereoscopic; …
83	"D"	D = Optimum viewing distance in cm (hex); Value = 00: N/A (for example, for shutter glass); for example, 4Bh = 75cm
84	"N"	N = Length of 3D crosstalk profile; for example, 20h = 32 Bytes
85	XX	$C_L(0)$
86	XX	$C_R(0)$
…	…	…
85+2*N	XX	$C_L(N-1)$
85+2*N+1	XX	$C_R(N-1)$
…	00	Patch
FF	XX	Checksum

FIG. 1 is a block diagram of a system having locally stored crosstalk profiles for a 3D display. The system includes a 3D display 10 having an EDID 12 for storing a crosstalk profile and a display controller 14. An associated host 18 for display 10 has a GPU 20 and can communicate with display 10 via an E-DDC 16. Host 18 generates the left and right image data and applies information from the crosstalk profile in EDID 12 for display 10 in order to reduce or eliminate crosstalk in the displayed images.

FIG. 2 is a flow chart of a method 30 for crosstalk reduction using locally stored crosstalk profiles, including characterization, record, storage, retrieving and real-time processing. It is possible for the end customers to generate new crosstalk profiles through display calibration in the field. Such profiles can be saved and retrieved in addition to the

default crosstalk profiles from EDID. Method 30 can be implemented in, for example, software executed by a processor such as GPU 20 in host 18 for controlling display 10.

In method 30, crosstalk test modes for 3D modes 1, … N are performed (steps 32, 34). The 3D modes refer to the specific 3D displays, and the crosstalk tests are performed on the specific 3D displays to obtain crosstalk information for them based at least in part upon the operational characteristics or physical parameters of the displays. From the crosstalk test modes, crosstalk profiles 1, … N are generated for the corresponding displays (steps 36, 38). The crosstalk test mode can involve applying a crosstalk algorithm to change luminance values for the display pixels and then fine tuning the luminance values for the particular display. The test modes can also involve displaying a test image or pattern on the display having crosstalk and then eliminating or sufficiently reducing the displayed crosstalk by modifying the pixel luminance values. An example of a method to reduce perceived crosstalk in a stereoscopic display is described in U.S. Patent Application Publication No. 2009/0167639.

The crosstalk test modes can also involve creating new luminance values directly based upon the crosstalk test mode. The information in the crosstalk profiles includes the change in luminance values for the particular display. For example as described above, the profile can specify the coefficient values (luminance) of the pixels in order to change the color intensity of the displayed images to compensate for crosstalk. The coefficients can include values for the red, green, blue (RGB) subpixels for the pixels. The resulting crosstalk profiles are thus tailored to specific displays. The crosstalk profiles can also include other information to enhance a user's viewing experience, such as optimal viewing distance.

The crosstalk profiles are written to the EDID extension blocks for the corresponding displays (step 40), for example EDID 12 in display 10. In particular, the source devices, for example host 18, parse and locally save the EDID with the crosstalk profiles (step 42). In operation when displaying content, the 3D device selects and reads the applicable locally stored crosstalk profile (step 44), for example host 18 reads the crosstalk profile from EDID 12 for display 10. The 3D device determines if a customer has calibrated the 3D display (step 46). If the display has been calibrated, the system uses the calibration as the default crosstalk profile. If the display has not been calibrated, the system applies crosstalk reduction to the displayed content using the crosstalk profiles

(step 48). For example, host 18 using the crosstalk profile for display 10 changes the luminance values for the stereoscopic content to be displayed on display 10.

CLAIMS

1. A method of reducing crosstalk for a stereoscopic display using locally stored crosstalk profiles, comprising:

generating a crosstalk profile for a stereoscopic display, wherein the crosstalk profile includes information for reducing crosstalk in the stereoscopic display based at least in part upon operational characteristics of the stereoscopic display;

storing the crosstalk profile in a memory locally associated with the stereoscopic display; and

applying, using a processor, the information in the crosstalk profile to stereoscopic content displayed on the stereoscopic display in order to reduce crosstalk in the displayed stereoscopic content.

2. The method of claim 1, wherein the storing step includes storing the crosstalk profile in an Extended Display Identification Data structure for the stereoscopic display.

3. The method of claim 1, wherein the storing step includes storing the crosstalk profile in a Display ID structure for the stereoscopic display.

4. The method of claim 1, wherein the generating step comprises generating the crosstalk profile based upon a size of the stereoscopic display.

5. The method of claim 1, wherein the generating step comprises generating the crosstalk profile based upon a type of 3D content to be displayed on the stereoscopic display.

6. The method of claim 1, wherein the generating step comprises storing within the crosstalk profile an optimal viewing distance for the stereoscopic display.

7. The method of claim 1, wherein:

the generating step comprises generating a plurality of different crosstalk profiles for the stereoscopic display; and

the applying step comprises selecting one of the plurality of different crosstalk profiles based upon a type of 3D content to be displayed and applying the information in the selected crosstalk profile to the displayed content.

8. The method of claim 1, wherein the applying step comprises using the information in the crosstalk profile to change pixel luminance values for the displayed stereoscopic content to compensate for the crosstalk.

9. The method of claim 1, wherein the generating step comprises applying a test mode to the stereoscopic display, wherein the test mode provides an indication of the crosstalk based upon the operational characteristics of the stereoscopic display.

10. A system for reducing crosstalk for a stereoscopic display using locally stored crosstalk profiles, comprising:

a stereoscopic display; and

a processor electronically connected to the stereoscopic display, wherein the processor is configured to:

generate a crosstalk profile for the stereoscopic display, wherein the crosstalk profile includes information for reducing crosstalk in the stereoscopic display based at least in part upon operational characteristics of the stereoscopic display;

store the crosstalk profile in a memory locally associated with the stereoscopic display; and

apply the information in the crosstalk profile to stereoscopic content displayed on the stereoscopic display in order to reduce crosstalk in the displayed stereoscopic content.

11. The system of claim 10, wherein the processor is configured to store the crosstalk profile in an Extended Display Identification Data structure for the stereoscopic display.

12. The system of claim 10, wherein the processor is configured to store the crosstalk profile in a Display ID structure for the stereoscopic display.

13 The system of claim 10, wherein the processor is configured to generate the crosstalk profile based upon a size of the stereoscopic display.

14. The system of claim 10, wherein the processor is configured to generate the crosstalk profile based upon a type of 3D content to be displayed on the stereoscopic display.

15. The system of claim 10, wherein the processor is configured to store within the crosstalk profile an optimal viewing distance for the stereoscopic display.

16. The system of claim 10, wherein the processor is configured to:
generate a plurality of different crosstalk profiles for the stereoscopic display; and
select one of the plurality of different crosstalk profiles based upon a type of 3D content to be displayed and apply the information in the selected crosstalk profile to the displayed content.

17. The system of claim 10, wherein the processor is configured to use the information in the crosstalk profile to change pixel luminance values for the displayed stereoscopic content to compensate for the crosstalk.

18. The system of claim 10, wherein the processor is configured to apply a test mode to the stereoscopic display, wherein the test mode provides an indication of the crosstalk based upon the operational characteristics of the stereoscopic display.

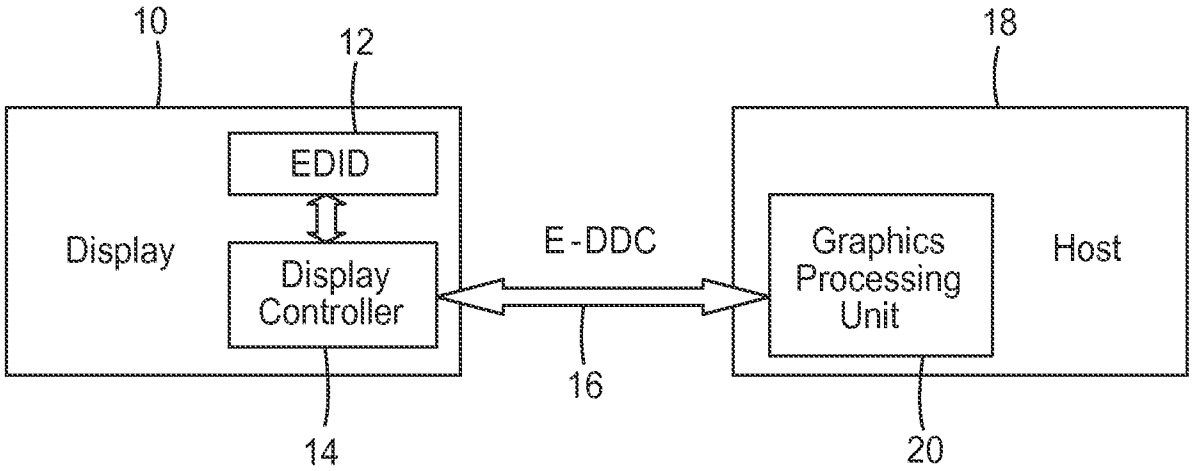

10
12
18
EDID
Display
Display Controller
E-DDC
Graphics Processing Unit
Host
16
14
20

FIG. 1

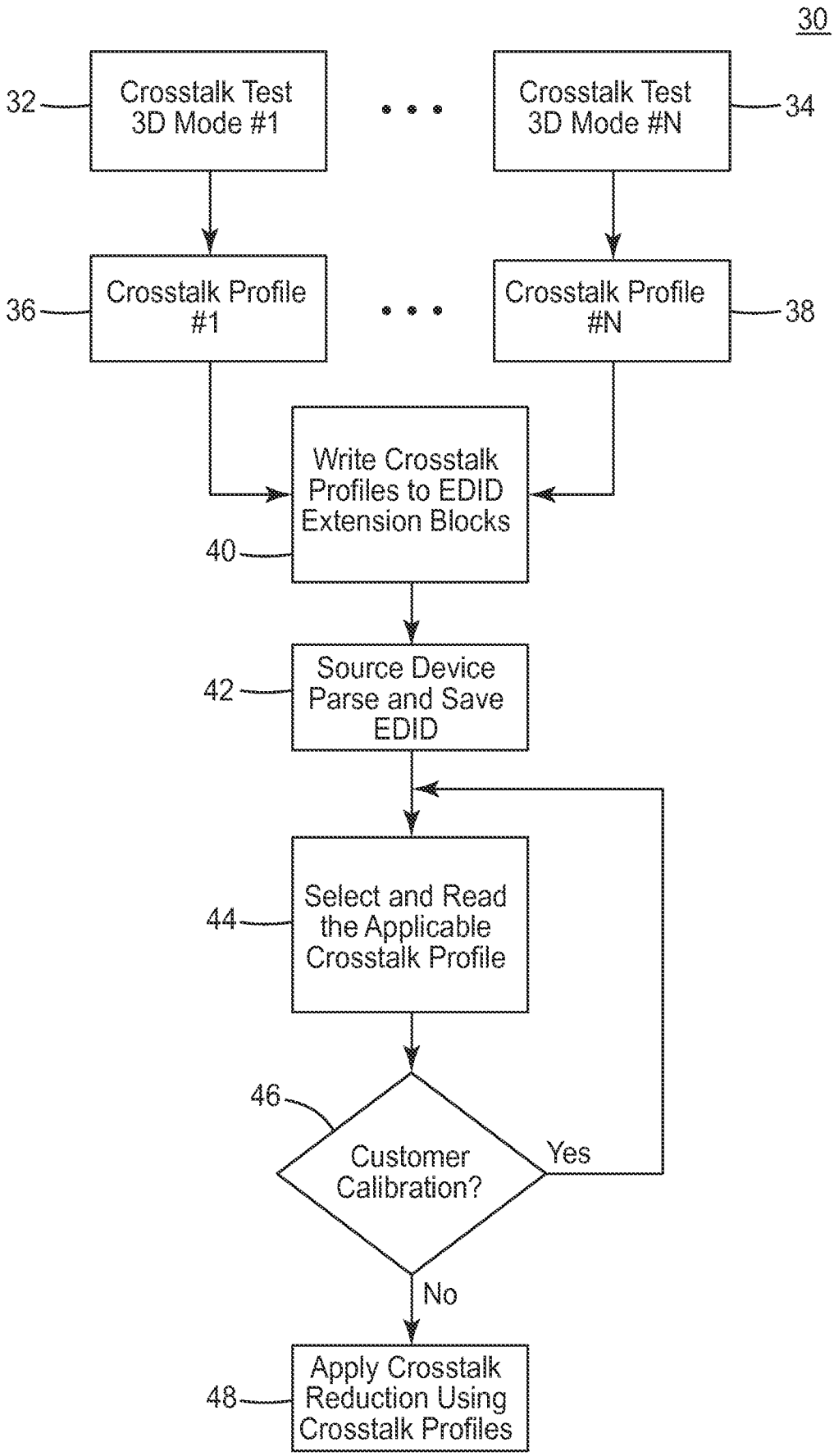

30
32
Crosstalk Test 3D Mode #1
Crosstalk Test 3D Mode #N
34
36
Crosstalk Profile #1
Crosstalk Profile #N
38
Write Crosstalk Profiles to EDID Extension Blocks
40
42
Source Device Parse and Save EDID
44
Select and Read the Applicable Crosstalk Profile
46
Customer Calibration?
Yes
No
48
Apply Crosstalk Reduction Using Crosstalk Profiles

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/061307

A. CLASSIFICATION OF SUBJECT MATTER

H04N 13/00(2006.01)i, G06T 5/00(2006.01)i

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 13/00; G02B 27/22; G06T 15/00; G06K 9/00; G01R 35/00; H04N 13/04; G06T 5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: reducing crosstalk, stereoscopic display, profile, display, 3D

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006-0268104 A1 (MATT COWAN et al.) 30 November 2006 See paragraphs [0071]-[0072], [0075], [0092], [0096]; claims 2, 4; and figures 1A-8, 16.	1-7,9-16,18
Y		8,17
Y	US 2011-0169821 A1 (KAZUHIRO ISHIGUCHI) 14 July 2011 See paragraphs [0055], [0088]; claims 1-10; and figures 1-6.	8,17
A	JP 2003-299121 A (CANON INC.) 17 October 2003 See paragraphs [0072]-[0076]; claims 1-11; and figures 1-7, 16.	1-18
A	US 2005-0078108 A1 (DAVID, C. SWIFT et al.) 14 April 2005 See paragraphs [0055]-[0069]; claims 1-8; and figures 1, 11-19.	1-18
A	KR 10-2012-0079354 A (SAMSUNG MOBILE DISPLAY CO., LTD.) 12 July 2012 See paragraphs [0031]-[0034]; claims 1-6; and figures 1, 3.	1-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2013/061307

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-0268104 A1	30/11/2006	EP 1883835 A2	06/02/2008
		EP 1883835 A4	13/04/2011
		EP 2501139 A2	19/09/2012
		JP 05363101 B2	11/12/2013
		JP 2009-507401 A	19/02/2009
		JP 2013-123258 A	20/06/2013
		KR 10-2008-0039848 A	07/05/2008
		US 2007-0188602 A1	16/08/2007
		US 2011-0025832 A1	03/02/2011
		US 8400492 B2	19/03/2013
		WO 2006-128066 A2	30/11/2006
		WO 2006-128066 A3	16/04/2009
US 2011-0169821 A1	14/07/2011	JP 2011-166744 A	25/08/2011
JP 2003-299121 A	17/10/2003	US 2005-0078370 A1	14/04/2005
		US 7116477 B2	03/10/2006
US 2005-0078108 A1	14/04/2005	AU 6686201 A	24/12/2001
		TW 529297 B	21/04/2003
		US 2002-0122585 A1	05/09/2002
		US 6765568 B2	20/07/2004
		WO 01-97531 A2	20/12/2001
		WO 01-97531 A3	28/03/2002
KR 10-2012-0079354 A	12/07/2012	US 2012-0169853 A1	05/07/2012