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(54) OLED DISPLAY DEVICE AND METHOD FOR CORRECTING RESIDUAL IMAGE OF OLED DISPLAY DEVICE

(57) The embodiments of the present invention provide an OLED display device and a method for correcting image sticking of an OLED display device. The OLED display device comprises an OLED pixel array; a pixel detecting circuit for detecting aging degrees of respective OLED pixels in the OLED pixel array; wherein respective OLED pixel are aged by displaying an aging image on the OLED pixel array, such that the aging degrees of respective OLED pixels are the same; the brightness of each pixel in the aging image is inversely proportional to the aging degree of the pixel. According to the OLED display device and the method provided by the embodiments of the present invention, various approaches can be applied for detecting the aging degrees of respective OLED pixels in the OLED pixel array, such that the image sticking of the OLED display device can be corrected by adjusting the aging degrees of respective OLED pixels.

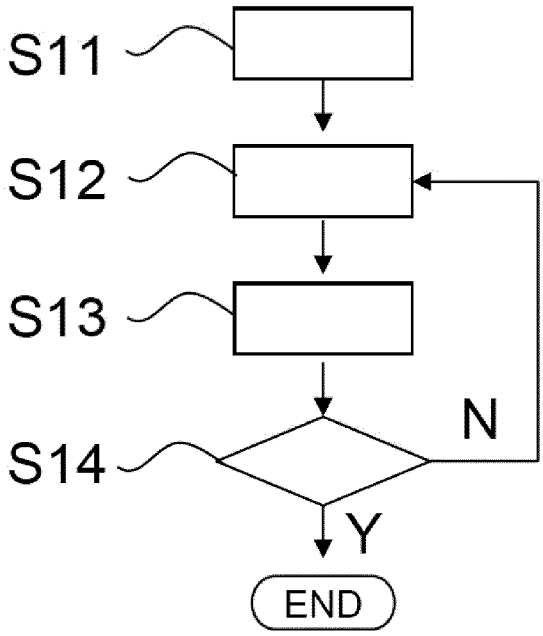

Fig. 2

EP 3 276 600 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of display technology, particularly to an OLED display device and a method for correcting image sticking of an OLED display device.

BACKGROUND OF THE INVENTION

[0002] OLED (Organic Light-Emitting Diode) display is a kind of all solid state, active light emitting display. OLED display has the characteristics of high brightness, high contrast, ultra thin and light, low power consumption, unlimited visual angle range, wide working temperature range and so on, therefore it is considered as an emerging next generation display.

[0003] Active matrix OLED (AMOLED) display panel is very different with thin film transistor liquid crystal display (TFT-LCD) in the product characteristic. At present, for the development of the AMOLED display technology, a particularly prominent problem is the image sticking. The image sticking is related to the contour of the displayed image. Different displayed gray scales will cause a great difference between the drain currents of driving thin film transistors; meanwhile, the difference between the gate-source voltages (Vgs) of respective thin film transistors (TFT) causes different effects of voltage stress on respective thin film transistors; therefore, on the screen, different TFT threshold voltage (Vth) drifts may be generated for OLED pixels on the display, having a contour of the displayed image.

[0004] In addition, after a long-term use, the electro luminescent material of the OLED display will be aged, reducing the light emitting efficiency. This will also cause the image sticking of the OLED display.

SUMMARY OF THE INVENTION

[0005] In view of this, the embodiments of the present invention provide an OLED display device capable of correcting image sticking and a method for correcting image sticking of an OLED display device.

[0006] An embodiment of the present invention provides an OLED display device, the OLED display device comprises an OLED pixel array; characterized in that the OLED display device further comprises: a pixel detecting circuit for detecting aging degrees of respective OLED pixels in the OLED pixel array; wherein respective OLED pixels are aged by displaying an aging image on the OLED pixel array, such that the aging degrees of respective OLED pixels are the same; the brightness of each pixel in the aging image is inversely proportional to the aging degree of the pixel.

[0007] According to the OLED display device provided by the embodiments of the present invention, aging degrees of respective OLED pixels in the OLED pixel array can be detected with the pixel detecting circuit, such that the image sticking of the OLED display device can be corrected by adjusting the aging degrees of respective OLED pixels.

[0008] Optionally, the aging degrees of respective OLED pixels are indicated by a threshold voltage of a driver thin film transistor in respective OLED pixels; the pixel detecting circuit is arranged for obtaining the threshold voltage of the driver thin film transistor in respective OLED pixels.

[0009] In particular, the pixel detecting circuit obtains the threshold voltage of the driver thin film transistor in respective OLED pixels by detecting a current flowing through the driver thin film transistor.

[0010] Optionally, the aging degrees of respective OLED pixels are indicated by a voltage across an OLED in respective OLED pixels; the pixel detecting circuit is arranged for obtaining the voltage across the OLED in respective OLED pixels.

[0011] Optionally, the OLED display device further comprises a timing circuit for initiating the pixel detecting circuit with a predetermined time interval.

[0012] An embodiment of the present invention provides a method for correcting image sticking of an OLED display device, the OLED display device comprising an OLED pixel array; the method comprises: detecting aging degrees of respective OLED pixels in the OLED pixel array; and aging respective OLED pixels in the OLED pixel array, such that the aging degrees of respective OLED pixels are the same.

[0013] Optionally, aging respective OLED pixels in the OLED pixel array comprises: aging respective OLED pixels by displaying an aging image on the OLED pixel array; the brightness of each pixel in the aging image is inversely proportional to the aging degree of the pixel.

[0014] Optionally, detecting aging degrees of respective OLED pixels in the OLED pixel array comprises: detecting the aging degrees of respective OLED pixels in the OLED pixel array with a pixel detecting circuit.

[0015] Optionally, the aging degrees of respective OLED pixel are indicated by a threshold voltage of a driver thin film transistor in respective OLED pixels.

[0016] Optionally, the threshold voltage of the driver thin film transistor in respective OLED pixels is obtained by detecting a current flowing through the driver thin film transistor.

[0017] Optionally, the aging degrees of respective OLED pixels are indicated by a voltage across an OLED in respective OLED pixels.

[0018] Optionally, aging respective OLED pixels in the OLED pixel array comprises: detecting the aging degrees of respective OLED pixels in the OLED pixel array by optically imaging the OLED pixel array.

[0019] Optionally, the aging degrees of respective OLED pixels are indicated by a brightness of respective OLED pixels.

[0020] Optionally, the method further comprises: after the step of aging, increasing data line voltage and/or driv-

ing voltage corresponding to non-zero gray scales for respective OLED pixels.

[0021] Optionally, the steps of detecting and aging are performed with a predetermined time interval.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Fig. 1a is a schematic diagram of an OLED pixel circuit in an OLED display device according to an embodiment of the present invention;

Fig. 1b shows detecting a current flowing through the driver thin film transistor by means of the OLED pixel circuit shown in Fig. 1a;

Fig. 1c shows detecting a voltage across an OLED in an OLED pixel by means of the OLED pixel circuit shown in Fig. 1a;

Fig. 2 is a flow chart of a method for correcting image sticking of an OLED display device according to an embodiment of the present invention; and

Fig. 3 is a flow chart of a method for correcting image sticking of an OLED display device according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] The specific implementations of the OLED display device and the method for correcting image sticking of an OLED display device provided by the embodiments of the present invention will be explained in detail below with reference to the drawings.

[0024] An embodiment of the present invention provides an OLED display device, the OLED display device comprises an OLED pixel array; characterized in that the OLED display device further comprises: a pixel detecting circuit for detecting aging degrees of respective OLED pixels in the OLED pixel array; wherein respective OLED pixels are aged by displaying an aging image on the OLED pixel array, such that the aging degrees of respective OLED pixels are the same; the brightness of each pixel in the aging image is inversely proportional to the aging degree of the pixel.

[0025] According to the OLED display device provided by the embodiments of the present invention, aging degrees of respective OLED pixels in the OLED pixel array can be detected with the pixel detecting circuit, such that the image sticking of the OLED display device can be corrected by adjusting the aging degrees of respective OLED pixels.

[0026] For example, at least one parameter of a pixel, such as a threshold voltage of a driver thin film transistor or a voltage across an OLED, can be used to form an image sticking data of the pixel, thereby obtaining the image sticking data of respective pixels on the entire screen. An aging image can be obtained by reversing (and optionally, proportionally magnifying) the image sticking data of the pixel. The aging image is then displayed on the OLED display device for a predetermined time length, realizing the aging.

[0027] In the context of the present disclosure, the "aging degree" of an OLED pixel can be represented with a parameter relating to aging of the OLED pixel (for example, but not limited to a threshold voltage of a driver thin film transistor or a voltage across an OLED); similarly, the "aging degree" of an OLED pixel can also be represented with a normalized value or other converted values.

[0028] The pixel detecting circuits will be illustrated with the following nonrestrictive examples shown in Figs. 1a-1c. As shown in Fig. 1a, in an OLED pixel circuit of an OLED display device: a drain voltage VDD is connected to a drain of a driver thin film transistor T1; a source of the driver thin film transistor T1 is connected to an end of an OLED; the other end of the OLED is connected to VSS; a scanning line G1 controls an addressing thin film transistor T2; a source of a switching thin film transistor T3 is connected to a source of the driver thin film transistor T1, a drain of T3 is connected to a sensing line Sense; and a scanning line G2 controls the switching thin film transistor T3.

[0029] In the existing technology, a sensing line Sense is usually used only for compensating the brightness of each OLED pixel in a form of external compensation, such that the brightness of respective OLED pixels tends to be consistent under the same gray scale. The inventor realized that by applying a detecting circuit such as the sensing line Sense, the electrical status of each OLED pixel can then be accurately and directly obtained; therefore, it is very suitable for detecting the aging degree of each OLED pixel.

[0030] As shown in Fig. 1b, the switching thin film transistor T3 can be switched on with the scanning line G2, so that a current of the driver thin film transistor T1 flows into the sensing line Sense through the switching thin film transistor T3 (as shown with the arrow in Fig. 1b). Therefore, the threshold voltage of the driver thin film transistor in each OLED pixel can be obtained by detecting the current flowing through the driver thin film transistor.

[0031] Therefore, optionally, the aging degrees of respective OLED pixels are indicated by a threshold voltage of a driver thin film transistor in respective OLED pixels; the pixel detecting circuit is arranged for obtaining the threshold voltage of the driver thin film transistor in respective OLED pixels.

[0032] In particular, the pixel detecting circuit obtains the threshold voltage of the driver thin film transistor in respective OLED pixels by detecting a current flowing through the driver thin film transistor.

[0033] As shown in Fig. 1c, the driver thin film transistor T1 can be switched off with the scanning line G1; the

switching thin film transistor T3 can be switched on with the scanning line G2; meanwhile, a fixed current (as shown with the arrow in Fig. 1c) can be transferred with the sensing line Sense. In this way, the voltage of the sensing line Sense can be detected, thereby obtaining the voltage across the OLED.

[0034] Therefore, optionally, the aging degrees of respective OLED pixels are indicated by a voltage across an OLED in respective OLED pixels; the pixel detecting circuit is arranged for obtaining the voltage across the OLED in respective OLED pixels.

[0035] Though the pixel detecting circuits provided by the embodiments of the present invention are illustrated with Figs. 1a-1c, those skilled in the art can understand that circuits with other forms capable of detecting a threshold voltage of a driver thin film transistor or a voltage across an OLED can also be applied into the embodiments of the present invention. For example, a same scanning line can be used to control the addressing thin film transistor T2 and the switching thin film transistor T3 in Figs. 1a-1c.

[0036] Optionally, the OLED display device further comprises a timing circuit for initiating the pixel detecting circuit with a predetermined time interval. By initiating the pixel detecting circuit with a predetermined time interval, correcting the image sticking can then be realized automatically and flexibly.

[0037] An embodiment of the present invention also provides a method for correcting image sticking of an OLED display device, the OLED display device comprising an OLED pixel array; the method comprises: detecting aging degrees of respective OLED pixels in the OLED pixel array; and aging respective OLED pixels in the OLED pixel array, such that the aging degrees of respective OLED pixels are the same.

[0038] According to the method provided by the embodiments of the present invention, aging degrees of respective OLED pixels in the OLED pixel array can be detected, such that the image sticking of the OLED display device can be corrected by adjusting the aging degrees of respective OLED pixels.

[0039] Optionally, aging respective OLED pixels in the OLED pixel array comprises: aging respective OLED pixels by displaying an aging image on the OLED pixel array; the brightness of each pixel in the aging image is inversely proportional to the aging degree of the pixel.

[0040] For example, at least one parameter of a pixel, such as a threshold voltage of a driver thin film transistor or a voltage across an OLED, can be used to form an image sticking data of the pixel, thereby obtaining the image sticking data of respective pixels on the entire screen. An aging image can be obtained by reversing (and optionally, proportionally magnifying) the image sticking data of the pixel. The aging image is then displayed on the OLED display device for a predetermined time length, realizing the aging.

[0041] Optionally, detecting aging degrees of respective OLED pixels in the OLED pixel array comprises: detecting the aging degrees of respective OLED pixels in the OLED pixel array with a pixel detecting circuit. Fig. 2 is a flow chart of a method for correcting image sticking of an OLED display device according to an embodiment of the present invention.

[0042] In this embodiment, the method for correcting image sticking of an OLED display device can comprise:

Step S11: detecting the aging degrees of respective OLED pixels in the OLED pixel array with a pixel detecting circuit (e.g., a threshold voltage of a driver thin film transistor or a voltage across an OLED);

Step S12: generating an aging image with aging degrees of respective OLED pixels;

Step S13: aging the OLED pixels in the OLED pixel array respectively with the aging image; and

an optional Step S14: applying the pixel detecting circuit to determine whether the aging degrees of respective OLED pixels in the OLED pixel array are consistent; if the aging degrees of respective OLED pixels are not consistent, then Step S12 should be performed again. For example, if the maximum difference for the aging degrees of respective OLED pixels in the OLED pixel array is greater than 4% of the average aging degree, it can be considered that the aging degrees of respective OLED pixels are not consistent.

[0043] Therefore, optionally, the aging degrees of respective OLED pixel are indicated by a threshold voltage of a driver thin film transistor in respective OLED pixels.

[0044] Optionally, the threshold voltage of the driver thin film transistor in respective OLED pixels is obtained by detecting a current flowing through the driver thin film transistor.

[0045] Optionally, the aging degrees of respective OLED pixels are indicated by a voltage across an OLED in respective OLED pixels.

[0046] Optionally, aging respective OLED pixels in the OLED pixel array comprises: detecting the aging degrees of respective OLED pixels in the OLED pixel array by optically imaging the OLED pixel array. Fig. 3 is a flow chart of a method for correcting image sticking of an OLED display device according to another embodiment of the present invention.

[0047] In this embodiment, the method for correcting image sticking of an OLED display device can comprise:

Step S21: detecting the aging degrees of respective OLED pixels in the OLED pixel array by optically imaging the OLED pixel array (e.g., brightness values of respective OLED pixels under a certain gray scale);

Step S22: generating an aging image with aging de-

grees of respective OLED pixels;

Step S23: aging the OLED pixels in the OLED pixel array respectively with the aging image; and

an optional Step S24: optically imaging the OLED pixel array to determine whether the aging degrees of respective OLED pixels in the OLED pixel array are consistent; if the aging degrees of respective OLED pixels are not consistent, then Step S22 should be performed again. For example, if the maximum difference for the aging degrees of respective OLED pixels in the OLED pixel array is greater than 4% of the average aging degree, it can be considered that the aging degrees of respective OLED pixels are not consistent.

[0048] Therefore, optionally, the aging degrees of respective OLED pixels are indicated by a brightness of respective OLED pixels.

[0049] For example, if image sticking can be observed during the use of the AMOLED product, the AMOLED display can then be photographed with an optical device, so as to obtain the aging degrees of respective OLED pixels in the OLED pixel array.

[0050] Optionally, the method further comprises: after the step of aging (e.g., Step 13 in the embodiment shown in Fig. 2 or Step 23 in the embodiment shown in Fig. 3), increasing data line voltage and/or driving voltage corresponding to non-zero gray scales for respective OLED pixels, so as to restore the overall brightness of the OLED display device.

[0051] Optionally, the steps of detecting (e.g., Step 11 in the embodiment shown in Fig. 2 or Step 13 in the embodiment shown in Fig. 3) and aging (e.g., Step 13 in the embodiment shown in Fig. 2 or Step 23 in the embodiment shown in Fig. 3) are performed with a predetermined time interval. By performing the steps of detecting and aging with a predetermined time interval, correcting the image sticking can then be realized automatically and flexibly.

[0052] According to the OLED display device and the method provided by the embodiments of the present invention, various approaches can be applied for detecting the aging degrees of respective OLED pixels in the OLED pixel array, such that the image sticking of the OLED display device can be corrected by adjusting the aging degrees of respective OLED pixels.

[0053] Apparently, the skilled person in the art can make various modifications and variations to the present invention without departing from the spirit and scope of the present invention. In this way, provided that these modifications and variations of the present invention belong to the scopes of the claims of the present invention and the equivalent technologies thereof, the present invention also intends to cover these modifications and variations.

Claims

1. An OLED display device, the OLED display device comprises an OLED pixel array; **characterized in that** the OLED display device further comprises:

   a pixel detecting circuit for detecting aging degrees of respective OLED pixels in the OLED pixel array;
   wherein respective OLED pixels are aged by displaying an aging image on the OLED pixel array, such that the aging degrees of respective OLED pixels are the same; the brightness of each pixel in the aging image is inversely proportional to the aging degree of the pixel.

2. The OLED display device as claimed in claim 1, **characterized in that** the aging degrees of respective OLED pixels are indicated by a threshold voltage of a driver thin film transistor in respective OLED pixels; the pixel detecting circuit is arranged for obtaining the threshold voltage of the driver thin film transistor in respective OLED pixels.

3. The OLED display device as claimed in claim 2, **characterized in that** the pixel detecting circuit obtains the threshold voltage of the driver thin film transistor in respective OLED pixels by detecting a current flowing through the driver thin film transistor.

4. The OLED display device as claimed in claim 1, **characterized in that** the aging degrees of respective OLED pixels are indicated by a voltage across an OLED in respective OLED pixels; the pixel detecting circuit is arranged for obtaining the voltage across the OLED in respective OLED pixels.

5. The OLED display device as claimed in claim 1, **characterized in that** the OLED display device further comprises:

   a timing circuit for initiating the pixel detecting circuit with a predetermined time interval.

6. A method for correcting image sticking of an OLED display device, the OLED display device comprising an OLED pixel array; **characterized in that** the method comprises:

   detecting aging degrees of respective OLED pixels in the OLED pixel array; and
   aging respective OLED pixels in the OLED pixel array, such that the aging degrees of respective OLED pixels are the same.

7. The method as claimed in claim 6, **characterized in that** aging respective OLED pixels in the OLED pixel array comprises:

aging respective OLED pixels by displaying an aging image on the OLED pixel array; the brightness of each pixel in the aging image is inversely proportional to the aging degree of the pixel.

8. The method as claimed in claim 6, **characterized in that** detecting aging degrees of respective OLED pixels in the OLED pixel array comprises:

detecting the aging degrees of respective OLED pixels in the OLED pixel array with a pixel detecting circuit.

9. The method as claimed in claim 8, **characterized in that** the aging degrees of respective OLED pixel are indicated by a threshold voltage of a driver thin film transistor in respective OLED pixels.

10. The method as claimed in claim 9, **characterized in that** the threshold voltage of the driver thin film transistor in respective OLED pixels is obtained by detecting a current flowing through the driver thin film transistor.

11. The method as claimed in claim 8, **characterized in that** the aging degrees of respective OLED pixels are indicated by a voltage across an OLED in respective OLED pixels.

12. The method as claimed in claim 6, **characterized in that** aging respective OLED pixels in the OLED pixel array comprises:

detecting the aging degrees of respective OLED pixels in the OLED pixel array by optically imaging the OLED pixel array.

13. The method as claimed in claim 12, **characterized in that** the aging degrees of respective OLED pixels are indicated by a brightness of respective OLED pixels.

14. The method as claimed in claim 12, **characterized in that** the method further comprises:

after the step of aging, increasing data line voltage and/or driving voltage corresponding to non-zero gray scales for respective OLED pixels.

15. The method as claimed in any one of claims 6-14, **characterized in that** the steps of detecting and aging are performed with a predetermined time interval.

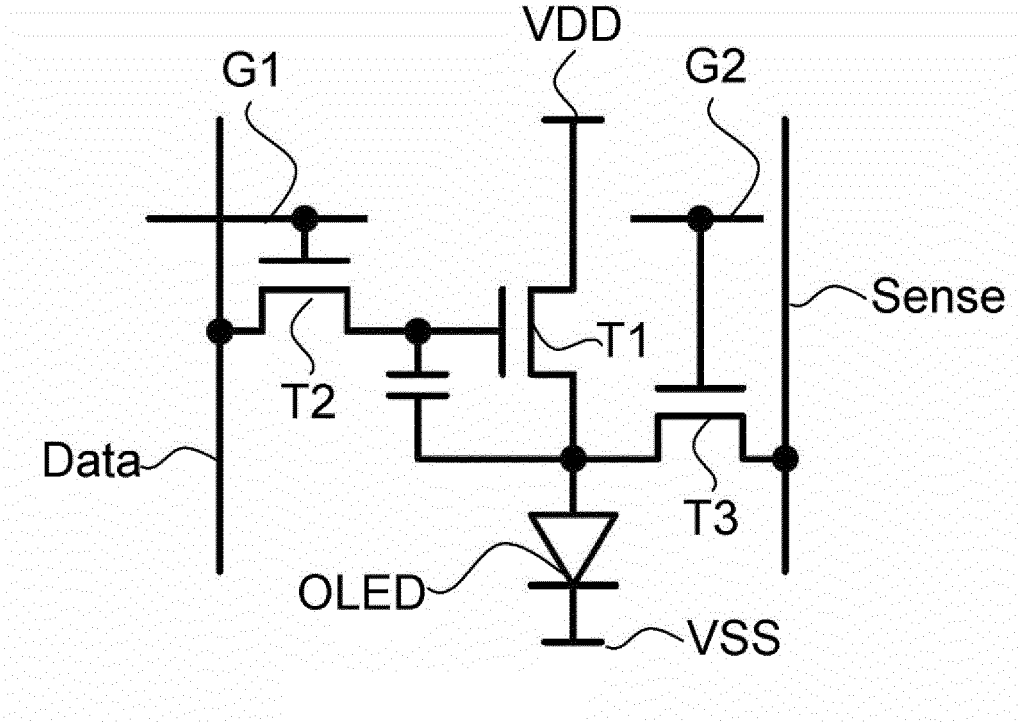
VDD
G1
G2
Sense
T1
T2
Data
T3
OLED
VSS

Fig. 1a

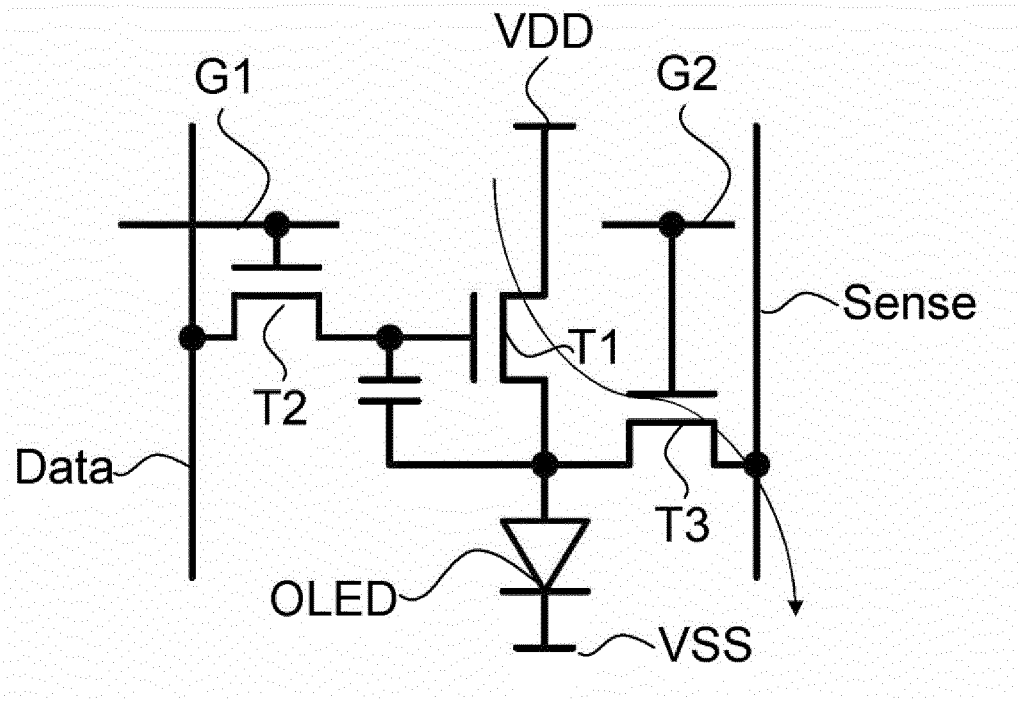
VDD
G1
G2
Sense
T1
T2
Data
T3
OLED
VSS

Fig. 1b

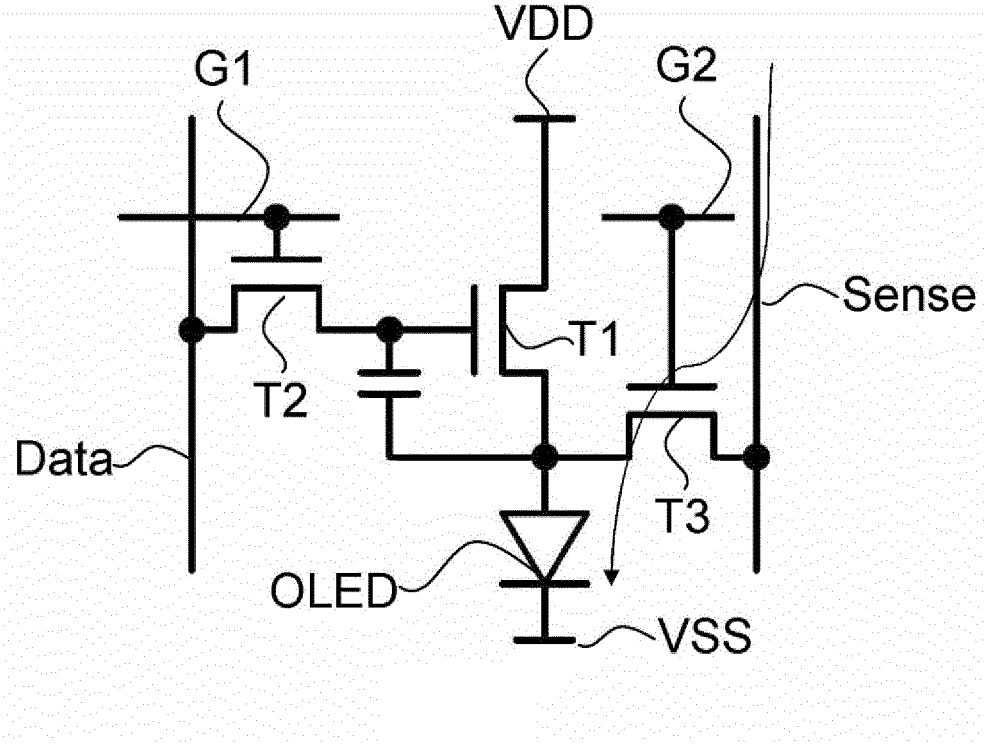

Fig. 1c

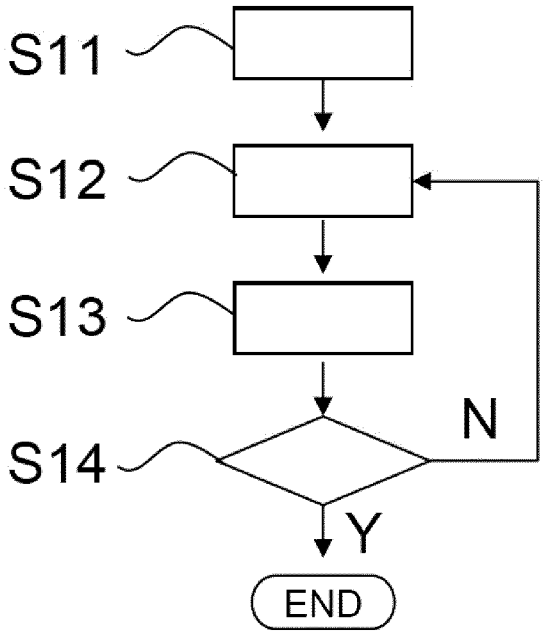

Fig. 2

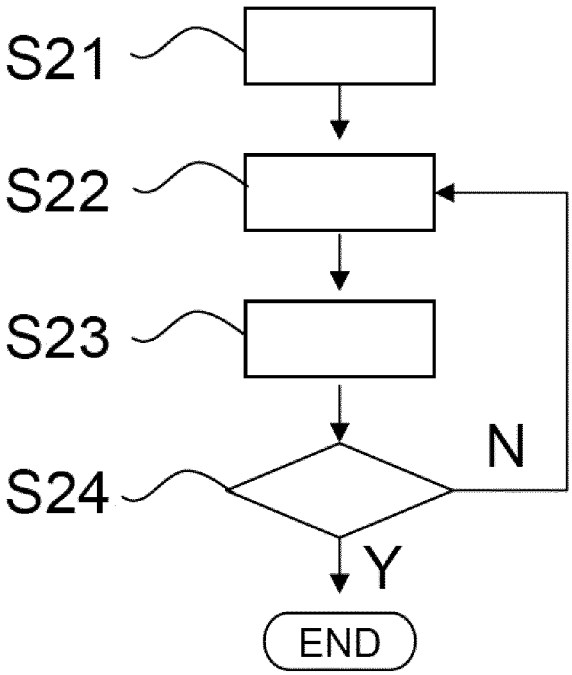

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/087014

A. CLASSIFICATION OF SUBJECT MATTER

G09G 3/32 (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)

G09G 3/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, WPI, EPODOC, CNKI: organic light emitting, display, test, pixel, voltage, residual, brightness, threshold, drive, timing, time, OLED, organic, diode?, picture, extract+, parameter, reverse, gamma, aging, after? image

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 104680979 A (BOE TECHNOLOGY GROUP CO., LTD.), 03 June 2015 (03.06.2015), description, paragraphs 0023-0051, and figures 1-3	1-15
Y	CN 104021760 A (BOE TECHNOLOGY GROUP CO., LTD.), 03 September 2014 (03.09.2014), description, paragraphs 0027-0040, 0051-0065 and 0073-0074, and figure 4	1-15
Y	CN 104318893 A (QINGDAO HISENSE ELECTRIC CO., LTD.), 28 January 2015 (28.01.2015), description, paragraphs 0048-0073, and figures 5-6	1-15
A	CN 101295466 A (SHENZHEN H&T INTELLIGENT CONTROL CO., LTD.), 29 October 2008 (29.10.2008), the whole document	1-15
A	CN 104036719 A (IGNIS INNOVATION INC.), 10 September 2014 (10.09.2014), the whole document	1-15

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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

Date of the actual completion of the international search	Date of mailing of the international search report
02 December 2015 (02.12.2015)	**18 December 2015 (18.12.2015)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **LIU, Yuan** Telephone No.: (86-10) **62414457**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/087014

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 104680979 A	03 June 2015	None	
CN 104021760 A	03 September 2014	None	
CN 104318893 A	28 January 2015	None	
CN 101295466 A	29 October 2008	CN 101295466 B	10 August 2011
CN 104036719 A	10 September 2014	US 2014252988 A1	11 September 2014
		EP 2782090 A1	24 September 2014
		US 2014368491 A1	18 December 2014
		US 2015054811 A1	26 February 2015

Form PCT/ISA/210 (patent family annex) (July 2009)

专利名称(译)	OLED显示装置和用于校正OLED显示装置的残留图像的方法		
公开(公告)号	EP3276600A4	公开(公告)日	2018-08-01
申请号	EP2015831213	申请日	2015-08-14
[标]申请(专利权)人(译)	京东方科技集团股份有限公司		
申请(专利权)人(译)	京东方科技集团股份有限公司.		
当前申请(专利权)人(译)	京东方科技集团有限公司		
[标]发明人	XIE HONGJUN		
发明人	XIE, HONGJUN		
IPC分类号	G09G3/32 G09G3/3208		
CPC分类号	G09G3/3258 G09G3/3233 G09G2320/0233 G09G2320/0257 G09G2320/0295 G09G2320/043 G09G2320/045 G09G2320/0626		
优先权	201510126192.5 2015-03-23 CN		
其他公开文献	EP3276600A1		
外部链接	Espacenet		

摘要(译)

本发明的实施例提供OLED显示装置和用于校正OLED显示装置的图像残留的方法。 OLED显示装置包括OLED像素阵列;像素检测电路，用于检测OLED像素阵列中各个OLED像素的老化程度;其中，通过在OLED像素阵列上显示老化图像来老化各个OLED像素，使得各个OLED像素的老化程度相同;老化图像中每个像素的亮度与像素的老化程度成反比。根据本发明实施例提供的OLED显示装置和方法，可以应用各种方法检测OLED像素阵列中各个OLED像素的老化程度，使得OLED显示装置的图像残留可以是通过调整各个OLED像素的老化程度来校正。