(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 211 631 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
06.05.2020 Bulletin 2020/19

(21) Application number: **15748155.7**

(22) Date of filing: **05.02.2015**

(51) Int Cl.:
G09G 3/3208 *(2016.01)* ***G09G 3/20*** *(2006.01)*

(86) International application number:
PCT/CN2015/072302

(87) International publication number:
WO 2016/061944 (28.04.2016 Gazette 2016/17)

(54) **WHITE OLED DISPLAY DEVICE, AS WELL AS DISPLAY CONTROL METHOD AND DISPLAY CONTROL DEVICE FOR SAME**

ANZEIGEVORRICHTUNG MIT ORGANISCHEM WEISSLICHT EMITTIERENDEN DIODEN, DEREN ANZEIGESTEUERUNGSVERFAHREN UND ANZEIGESTEUERUNGSVORRICHTUNG

DISPOSITIF D'AFFICHAGE À DIODE ÉLECTROLUMINESCENTE ORGANIQUE (OLED) DE LUMIÈRE BLANCHE, AINSI QUE PROCÉDÉ DE COMMANDE D'AFFICHAGE ET DISPOSITIF DE COMMANDE D'AFFICHAGE ASSOCIÉS

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **24.10.2014 CN 201410575290**

(43) Date of publication of application:
30.08.2017 Bulletin 2017/35

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims a priority of the Chinese patent application No.201410575290.2 filed on October 24, 2014.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of organic light-emitting diode (OLED) display, in particular to a white OLED (WOLED) display device, its display control method, and a display control device.

BACKGROUND

[0003] As compared with a traditional liquid crystal panel, an active matrix organic light-emitting diode (AMOLED) panel has such features as rapid response, high contrast and wide viewing angle. A traditional white AMOLED panel consists of a WOLED and a color filter (CF) for three colors, i.e., red (R), green (G) and blue (B). However, for this panel, the color filter is of relatively low transmittance, and most of the white light from the WOLED is absorbed by the color filter. In order to ensure display brightness, it is required to increase a current flowing through the WOLED, which thus results in an increase in the power consumption of the display panel and a decrease in a service life of the WOLED. A white AMOLED panel with a RGBW display mode consists of the WOLED and a color filter for four colors, i.e., R, G, B and W. A W subpixel is of transmittance far greater than RGB sub-pixels, so it is able to remarkably reduce the power consumption for the display in the case of an identical brightness requirement. US 20112/92087 A1 discloses an organic light emitting diode display and a method for compensating the chromaticity coordinates of an organic light emitting diode display. US 2008/252797 A1 discloses a method for input-signal transformation for RGBW displays with variable W color. CN 103680413 A discloses an image processing device and image processing method. US 2014/118411A1 discloses a display device including red, green, blue, and white (RGBW) sub-pixels. KR 20140081394 A discloses a video display device and a data processing method thereof.

[0004] For the white AMOLED panel with the RGBW display mode, it is required to convert external RGB source data into RGBW data. In a traditional conversion method, some of the light from the RGB subpixels is replaced with the white light, so as to reduce the power consumption and increase the brightness. However, the white light is emitted by the WOLED through a combination of light-emitting layers in multiple colors, so the color of the light is changed depending on a driving voltage of a material used herein. As a result, the white light from the WOLED is not the standard, pure white light, and the color of the light from the WOLED is changed along with the brightness. At this time, after the RGB data is converted into the RGBW data, the image quality is adversely affected due to the chromatic aberration of the WOLED.

SUMMARY

[0005] The present invention is defined by the independent claims 1 and 2. An object of the present disclosure is to provide an OLED display device, its display control method, and a display control device, so as to prevent images displayed by a WOLED display device from being adversely affected due to the chromatic aberration of a WOLED after RGB data is converted into RGBW data.

[0006] In one aspect, the present disclosure provides a display control method for a WOLED display device comprising a plurality of pixels, wherein each pixel includes a R subpixel for generating red light, a G subpixel for generating green light, a B subpixel for generating blue light, and a W subpixel for generating white light, and wherein each subpixel includes a WOLED which emits the white light through a combination of light-emitting layers in multiple colors, the method performed by a display control device of the white organic light-emitting diode display device including: receiving R, G and B source data, and determining a minimum value of the R, G and B source data; determining W data in accordance with the minimum value of the R, G and B source data; determining chromaticity coordinates of a respective WOLED of the display device in accordance with the W data; acquiring a brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to a target value, and a gain value of a subpixel participating in chromatic aberration compensation; and determining output values of R, G, B and W data in accordance with the brightness value of the WOLED, the gain value of the subpixel participating in the chromatic aberration compensation and the W data.

[0007] According to the invention, the step of determining the chromaticity coordinates of the WOLED in accordance with the W data includes: looking up a chromaticity coordinate table in accordance with the W data, so as to acquire the chromaticity coordinates of the WOLED corresponding to the W data, wherein different W data, the chromaticity coordinates of the WOLED corresponding to the different W data, and chromaticity coordinates of R, G and B subpixels are recorded in the chromaticity coordinate table.

[0008] Further, the step of acquiring the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain value of the subpixel participating in chromatic aberration compensation includes: acquiring from the chromaticity coordinate table the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation; and calculating the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain value of the subpixel participating in chromatic aberration compensation using predetermined color-mixing equations in accordance with the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation.

[0009] According to the invention, the predetermined color-mixing equations include

$$L_{WOLED} = (Oy/Wy) * [(Wx - Ax)/(Cx - Ax) - (Wz - Az)/(Cz - Az)]/[(Ox - Ax)/(Cx - Ax) - (Oz - Az)]LC$$

$$= (Cy/Wy)(Wx - Ax)/(Cx - Ax) - (L\_WOLED/Oy)(Ox - Ax)/(Cx - Ax)$$

$$LA = 1 - L\_WOLED - LC$$

wherein O(Ox,Oy,Oz) represents the chromaticity coordinates of the WOLED corresponding to the W data, A(Ax,Ay, Az) and C(Cx,Cy,Cz) represent the chromaticity coordinates of two subpixels participating in the chromatic aberration compensation, respectively, (Wx,Wy,Wz) represents the chromaticity coordinates of the target value, L_WOLED represents the brightness value of the WOLED, and LA and LC represent the gain values of the two subpixels participating in the chromatic aberration compensation, respectively.

[0010] Alternatively, the step of determining the output values of the R, G, B and W data in accordance with the brightness value of the WOLED, the gain value of the subpixel participating in the chromatic aberration compensation and the W data includes: with respect to the subpixel participating in the chromatic aberration compensation, acquiring a product of the gain value of the subpixel and the W data, and calculating a difference between an initial brightness value of the subpixel participating in the chromatic aberration compensation and the product, so as to obtain a final brightness value of the subpixel participating in the chromatic aberration compensation; with respect to the subpixel not participating in the chromatic aberration compensation, calculating a difference between an initial brightness value of the subpixel not participating in the chromatic aberration compensation and the W data so as to obtain a final brightness value of the subpixel not participating in the chromatic aberration compensation, wherein the initial brightness value of the subpixel is obtained in accordance with the R, G and B source data; and determining the output values of the R, G, B and W data in accordance with the final brightness value of the subpixel participating in the chromatic aberration subpixel, the final brightness value of the subpixel not participating in the chromatic aberration subpixel and the brightness value of the WOLED.

[0011] Alternatively, the final brightness value of the subpixel is calculated using the following equations:

$$R' = R - R\_gain \times W$$

$$G' = G - G\_gain \times W$$

$$B' = B - B\_gain \times W$$

$$W' = L\_WOLED$$

wherein R', G', B' and W' represent the final brightness values of the R, G, B and W subpixels, respectively, R, G and B represent the initial brightness values obtained in accordance with the R, G and B source data, respectively, R_gain, G_gain and B_gain represent the gain values of the R, G and B subpixels, respectively, the gain value of the subpixel not participating in the chromatic aberration compensation is 1, W represents the white data, and L_WOLED represents the brightness value of the WOLED.

[0012] Alternatively, the step of determining the W data in accordance with the minimum value of the R, G and B source data includes: acquiring a currently-stored white-mixing ratio, the white-mixing ratio is a ratio of the W data to the minimum value of the R, G and B source data to be replaced with the W data; and calculating a product of the minimum value of the R, G and B source data and the white-mixing ratio, so as to obtain the W data.

[0013] Alternatively, prior to the step of determining the W data in accordance with the minimum value of the R, G and B source data, the display control method further includes: judging whether or not a subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation; when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, incrementing a value of the currently-stored white-mixing ratio; and when the subpixel corresponding to the minimum value of the R, G and B source data is not the subpixel participating in the chromatic aberration compensation, decrementing the value of the currently-stored white-mixing ratio.

[0014] Alternatively, the step of incrementing the value of the currently-stored white-mixing ratio includes: counting the gain values of the subpixels participating in the chromatic aberration compensation; and when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, determining an increment of the currently-stored white-mixing ratio in accordance with the counted gain values of the subpixels participating in the chromatic aberration compensation.

[0015] Alternatively, the display control method further includes: counting the output values of the R, G, B and W data; and adjusting the value of the currently-stored white-mixing ratio in accordance with the counted output values of the R, G, B and W data.

[0016] Alternatively, the step of adjusting the value of the currently-stored white-mixing ratio in accordance with the counted output values of the R, G, B and W data includes: comparing an average value of the output values of the R, G and B data and an average value of the output value of the W data; when the average value of the output data of the R, G and B data is greater than the average value of the output value of the W data, incrementing the white-mixing ratio; and when the average value of the output data of the R, G and B data is less than the average value of the output value of the W data, decrementing the white-mixing ratio.

[0017] Alternatively, the target value is chromaticity coordinates of pure white light desired for the WOLED display device.

[0018] In another aspect, the present disclosure provides a display control device of a WOLED display device comprising a plurality of pixels, wherein each pixel includes a R subpixel for generating red light, a G subpixel for generating green light, a B subpixel for generating blue light, and a W subpixel for generating white light, and wherein each subpixel includes a WOLED which emits the white light through a combination of light-emitting layers in multiple colors, display control device including: a reception module configured to receive R, G and B source data; a minimum value determination module configured to determine a minimum value of the R, G and B source data; a W data determination module configured to determine W data in accordance with the minimum value of the R, G and B source data; a chromaticity coordinate determination module configured to determine chromaticity coordinates of a WOLED in accordance with the W data; a gain value determination module configured to acquire a brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to a target value, and a gain value of a subpixel participating in chromatic aberration compensation; and an algorithm conversion module configured to determine output values of R, G, B and W data in accordance with the brightness value of the WOLED, the gain value of the subpixel participating in the chromatic aberration compensation and the W data.

[0019] According to the invention, the chromaticity coordinate determination module is configured to look up a chromaticity coordinate table in accordance with the W data, so as to acquire the chromaticity coordinates of the WOLED corresponding to the W data, wherein different W data, the chromaticity coordinates of the WOLED corresponding to the different W data, and chromaticity coordinates of R, G and B subpixels being recorded in the chromaticity coordinate table.

[0020] Further, the gain value determination module is configured to acquire from the chromaticity coordinate table the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation; and calculate the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain value of the subpixel participating in chromatic aberration compensation using predetermined color-mixing equations in accordance with the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation.

[0021] According to the invention, the predetermined color-mixing equations comprise

$$L\_WOLED = (Oy/Wy) * [(Wx - Ax)/(Cx - Ax) - (Wz - Az)/(Cz - Az)]/[(Ox - Ax)/(Cx - Ax) - (Oz - Az)]LC = (Cy/Wy)(Wx - Ax)/(Cx - Ax) - (L\_WOLED/Oy)(Ox - Ax)/(Cx - Ax)$$

$$LA = 1 - L\_WOLED - LC,$$

wherein O(Ox,Oy,Oz) represents the chromaticity coordinates of the WOLED corresponding to the W data, A(Ax,Ay, Az) and C(Cx,Cy,Cz) represent the chromaticity coordinates of two subpixels participating in the chromatic aberration compensation, respectively, (Wx,Wy,Wz) represents the chromaticity coordinates of the target value, L_WOLED represents the brightness value of the WOLED, and LA and LC represent the gain values of the two subpixels participating in the chromatic aberration compensation, respectively.

[0022] Alternatively, the algorithm conversion module is configured to, with respect to the subpixel participating in the chromatic aberration compensation, acquire a product of the gain value of the subpixel and the W data, and calculate a difference between an initial brightness value of the subpixel participating in the chromatic aberration compensation and the product, so as to obtain a final brightness value of the subpixel participating in the chromatic aberration compensation; with respect to the subpixel not participating in the chromatic aberration compensation, calculate a difference between an initial brightness value of the subpixel not participating in the chromatic aberration compensation and the W data so as to obtain a final brightness value of the subpixel not participating in the chromatic aberration compensation, wherein the initial brightness value of the subpixel is obtained in accordance with the R, G and B source data; and determine the output values of the R, G, B and W data in accordance with the final brightness value of the subpixel participating in the chromatic aberration subpixel, the final brightness value of the subpixel not participating in the chromatic aberration subpixel and the brightness value of the WOLED.

[0023] Alternatively, the final brightness value of the subpixel is calculated by the algorithm conversion module using the following equations:

$$R' = R - R\_gain \times W$$

$$G' = G - G\_gain \times W$$

$$B' = B - B\_gain \times W$$

$$W' = L\_WOLED,$$

wherein R', G', B' and W' represent the final brightness values of the R, G, B and W subpixels, respectively, R, G and B represent the initial brightness values obtained in accordance with the R, G and B source data, respectively, R_gain, G_gain and B_gain represent the gain values of the R, G and B subpixels, respectively, the gain value of the subpixel not participating in the chromatic aberration compensation is 1, W represents the white data, and L_WOLED represents the brightness value of the WOLED.

[0024] Alternatively, the display control device further includes a storage module configured to store a white-mixing ratio, the white-mixing ratio is a ratio of the W data to the minimum value of the R, G and B source data to be replaced with the W data. The W data determination module is configured to acquire the currently-stored white-mixing ratio, and calculate a product of the minimum value of the R, G and B source data and the white-mixing ratio, so as to obtain the W data.

[0025] Alternatively, the display control device further includes: a judging module configured to judge whether or not a subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation; a first adjustment module configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, increment a value of the currently-stored white-mixing ratio; and a second adjustment module configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is not the subpixel participating in the chromatic aberration compensation, decrement the value of the currently-stored white-mixing ratio.

[0026] Alternatively, the display control device further includes a first counting module configured to count the gain values of the subpixels participating in the chromatic aberration compensation. The first adjustment module is further configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, determine an increment of the currently-stored white-mixing ratio in accordance with the counted gain values of the subpixels participating in the chromatic aberration compensation.

[0027] Alternatively, the display control device further includes: a second counting module configured to count the output values of the R, G, B and W data; and a third adjustment module configured to adjust the value of the currently-stored white-mixing ratio in accordance with the counted output values of the R, G, B and W data.

[0028] Alternatively, the third adjustment module is configured to compare an average value of the output values of the R, G and B data and an average value of the output value of the W data; when the average value of the output data of the R, G and B source data is greater than the average value of the output value of the W data, increment the white-mixing ratio; and when the average value of the output data of the R, G and B source data is less than the average value of the output value of the W data, decrement the white-mixing ratio.

[0029] Alternatively, the target value is chromaticity coordinates of pure white light desired for the WOLED display device.

[0030] In yet another aspect, the present disclosure provides a WOLED display device including the above-mentioned display control device.

[0031] According to the embodiments of the present disclosure, when the R, G and B source data is converted into the R, G, B and W data, the color of the light from the WOLED is compensated so as to obtain the pure white light. As a result, after the R, G and B source data is converted into the R, G, B and W data, it is able to prevent an image from being adversely affected due to the chromatic aberration of the WOLED, thereby to improve the display quality of the WOLED display device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032]

Fig.1 is a schematic view showing a WOLED display device according to embodiments of the present disclosure;
Fig.2 is a flow chart of a display control method for the WOLED display device according to embodiments of the present disclosure;
Fig.3 is a view showing an algorithm for converting RGB into RGBW when the chromaticity of the WOLED is not compensated in the related art;
Fig.4 is a view showing an algorithm for converting RGB into RGBW when the chromaticity of the WOLED is compensated according to embodiments of the present disclosure; and
Fig.5 is a schematic view showing a display control device for the WOLED display device according to embodiments of the present disclosure.

DETAILED DESCRIPTION

[0033] In order to make the objects, the technical solutions and the advantages of the present disclosure more apparent, the present disclosure will be described hereinafter in conjunction with the drawings and embodiments.

[0034] The structure of a WOLED display device according to the embodiments of the present disclosure will be described hereinafter briefly.

[0035] The WOLED display device includes a plurality of pixels, each of which includes a R subpixel for generating red light, a G subpixel for generating green light, a B subpixel for generating blue light, and a W subpixel for generating white light. Each subpixel includes a WOLED, which emits the white light through a combination of light-emitting layers in multiple colors. As shown in Fig.1, the R subpixel includes a red color filter (RCF) which is configured to allow the red light in the white light from the WOLED to pass therethrough, the G subpixel includes a green color filter (GCF) which is configured to allow the green light in the white light from the WOLED to pass therethrough, and the B subpixel includes a blue color filter which is configured to allow the blue light in the white light from the WOLED to pass therethrough. The W subpixel does not include any color filter, so all the white light from the WOLED can pass therethrough, so as to compensate for the image brightness when the image brightness is reduced due to the RCF, GCF and BCF.

[0036] Because the WOLED emits the white light through a combination of the light-emitting layers in multiple colors and the color of the light is changed depending on a driving voltage of a material used herein, the white light from the WOLED is not the standard pure white light. At this time, in the method of converting the R, G and B data into the R, G, B and W data, when some of the light from the R, G and B subpixels is replaced with the standard pure white light, chromatic aberration will occur.

[0037] In order to overcome the above-mentioned defects, as shown in Fig.2, an embodiment of the present disclosure provides a display control method for a WOLED display device, which includes steps of: Step S11: receiving R, G and B source data, and determining a minimum value of the R, G and B source data; Step S12: determining W data in accordance with the minimum value of the R, G and B source data, the W data being a brightness value; Step S13: determining chromaticity coordinates of a WOLED in accordance with the W data; Step S14: acquiring a brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to a target value, and a gain value of a subpixel participating in chromatic aberration compensation; and Step S15: determining output values of R, G, B and W data in accordance with the brightness value of the WOLED, the gain value of the subpixel participating in the chromatic aberration compensation and the W data.

[0038] According to the embodiment of the present disclosure, when the R, G and B source data is converted into the R, G, B and W data, the color of the light from the WOLED is compensated so as to obtain the pure white light. As a result, after the R, G and B source data is converted into the R, G, B and W data, it is able to prevent an image from being adversely affected due to the chromatic aberration of the WOLED, thereby to improve the display quality of the WOLED display device.

[0039] At Step S11, the received R, G and B source data may be brightness values or grayscale values. When the received R, G and B source data are grayscale values, it is required to convert the minimum value of the R, G and B source data into the brightness value.

[0040] To be specific, the grayscale-brightness conversion may be performed using the following equation:

$$\mathrm{Gray} = \mathrm{L}^{(1/\Gamma)} \times \mathrm{GL},$$

wherein Gray represents the grayscale value, L represents the brightness value, Γ represents a gamma value, usually 2.2, and GL represents the total number of grayscales.

[0041] At Step S12, the minimum value of the R, G and B source data may be directly used as the W data, i.e., the light from the subpixel corresponding to the minimum value may be completely replaced with the white light. Of course, the light from the subpixel corresponding to the minimum value may be partially replaced with the white light in accordance with the practical need, i.e., the step of determining the W data in accordance with the minimum value of the R, G and B source data may include: Step S121: acquiring a currently-stored white-mixing ratio, i.e., a ratio of the W data to the minimum value of the R, G and B source data to be replaced with the W data; and Step S122: calculating a product of the minimum value of the R, G and B source data and the white-mixing ratio, so as to obtain the W data.

[0042] To be specific, the output value of the W data may be calculated by the following equation:

$$\mathrm{W} = \mathrm{WMR} \times \min(\mathrm{R,G,B}),$$

wherein W represents the white data, WMR represents the white-mixing ratio, and min(R,G,B) represents the minimum value of the R, G and B source data.

[0043] For example, for the received R, G and B source data (i.e., the brightness values in this embodiment), R=1, G=0.8 and B=0.4, and the B source data is the minimum value. Presumed that the white-mixing ratio WMR is 0.5, i.e., the white light is of a brightness value that is 50% of the brightness value of the light from the subpixel corresponding to the minimum value and replaced with the white light, the W data may be calculated as $W=WMR\times\min(R,G,B)=0.5\times0.4=0.2$.

[0044] At Step S13, the chromaticity coordinates of the WOLED may be determined by looking up a chromaticity coordinate table, in which different W data, the chromaticity coordinates of the WOLED corresponding to the different W data, and chromaticity coordinates of R, G and B subpixels obtained through multiple measurements are recorded. The following is the chromaticity coordinate table.

W data (brightness value)	Chromaticity coordinates of WOLED	Chromaticity coordinates of R subpixel	Chromaticity coordinates of G subpixel	Chromaticity coordinates of B subpixel
0.1	(O1x, O1y, O1z)	(R 1x, R 1y, R 1z)	(G 1x, G 1y, G 1z)	(B 1x, B 1y, B 1z)
0.2	(O2x, O2y, O2z)	(R 2x, R 2y, R 2z)	(G 2x, G 2y, G 2z)	(B 2x, B 2y, B 2z)
0.3	(O3x, O3y, O3z)	(R 3x, R 3y, R 3z)	(G 3x, G 3y, G 3z)	(B 3x, B 3y, B 3z)
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[0045] In some cases, chromaticity coordinates of W subpixel desired for the display device, i.e., the target value, may also be recorded in the chromaticity coordinate table.

[0046] Presumed that the W data determined in the previous step has a value of 0.2, it is able to obtain the chromaticity coordinates (O2x,O2y,O2z) of the WOLED by looking up the chromaticity coordinate table.

[0047] At Step S14, for a display device, when the chromaticity coordinates of the WOLED are known, the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain values of the sub-pixels participating in chromatic aberration compensation may be obtained in accordance with the chromaticity coordinates. The subpixels participating in the chromatic aberration compensation are any two subpixels of the R, G and B subpixels, depending on the characteristics of the WOLED. The target value is the chromaticity coordinates of the pure white light desired for the WOLED display device, e.g., (0.33, 0.33, 0.34).

[0048] The step of acquiring the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain values of the subpixels participating in chromatic aberration compensation may include: acquiring from the chromaticity coordinate table the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixels participating in the chromatic aberration compensation; and calculating the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain value of the subpixel participating in chromatic aberration compensation using predetermined color-mixing equations in accordance with the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation.

[0049] The predetermined color-mixing equations may include

$$\mathrm{L\_WOLED} = (\mathrm{Oy}/\mathrm{Wy}) * [(\mathrm{Wx}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{Wz}-\mathrm{Az})/(\mathrm{Cz}-\mathrm{Az})]/[(\mathrm{Ox}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{Oz}-\mathrm{Az})]\mathrm{LC} = (\mathrm{Cy}/\mathrm{Wy})(\mathrm{Wx}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{L\_WOLED}/\mathrm{Oy})(\mathrm{Ox}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax})$$

$$\mathrm{LA} = 1 - \mathrm{L\_WOLED} - \mathrm{LC}$$

wherein O(Ox,Oy,Oz) represents the chromaticity coordinates of the WOLED corresponding to the W data, A(Ax,Ay, Az) and C(Cx,Cy,Cz) represent the chromaticity coordinates of two subpixels participating in the chromatic aberration compensation, respectively, (Wx,Wy,Wz) represents the chromaticity coordinates of the target value, L_WOLED represents the brightness value of the WOLED, and LA and LC represent the gain values of the two subpixels participating in the chromatic aberration compensation, respectively.

[0050] At Step S15, the step of determining the output values of the R, G, B and W data may include: with respect to the subpixel participating in the chromatic aberration compensation, acquiring a product of the gain value of the subpixel and the W data, and calculating a difference between an initial brightness value of the subpixel participating in the chromatic aberration compensation and the product, so as to obtain a final brightness value of the subpixel participating in the chromatic aberration compensation; with respect to the subpixel not participating in the chromatic aberration compensation, calculating a difference between an initial brightness value of the subpixel not participating in the chromatic aberration compensation and the W data so as to obtain a final brightness value of the subpixel not participating in the chromatic aberration compensation, wherein the initial brightness value of the subpixel being obtained in accordance with the R, G and B source data; and determining the output values of the R, G, B and W data in accordance with the final brightness value of the subpixel participating in the chromatic aberration subpixel, the final brightness value of the subpixel not participating in the chromatic aberration subpixel and the brightness value of the WOLED.

[0051] In the above-mentioned step, when the received R, G and B source data is brightness data, the initial brightness values of the R, G and B subpixels are just the source data, and when the received R, G an dB source data is grayscale data, it is required to convert the grayscale data into the brightness data so as to obtain the initial brightness values of the R, G and B subpixels.

[0052] To be specific, the final brightness values of the subpixels may be calculated using the following equations:

$$R' = R - R\_gain \times W$$

$$G' = G - G\_gain \times W$$

$$B' = B - B\_gain \times W$$

$$W' = L\_WOLED$$

wherein R', G', B' and W' represent the final brightness values of the R, G, B and W subpixels, respectively, R, G and B represent the initial brightness values obtained in accordance with the R, G and B source data, respectively, R_gain, G_gain and B_gain represent the gain values of the R, G and B subpixels, respectively, the gain value of the subpixel not participating in the chromatic aberration compensation is 1, W represents the white data, and L_WOLED represents the brightness value of the WOLED.

[0053] Fig.3 is a view showing an algorithm for converting RGB into RGBW when the chromaticity of the WOLED is not compensated in the related art, and Fig.4 is a view showing an algorithm for converting RGB into RGBW when the chromaticity of the WOLED is compensated according to one embodiment of the present disclosure. Taking the R, G and B source data as an example, as shown in Fig.4, a minimum brightness value of the R, G and B source data, i.e., the B data, is obtained at first, and this minimum brightness value is used as the W data. Then, the chromaticity coordinate table is looked up in accordance with the W data, so as to determine the chromaticity coordinates of the WOLED. Next, the brightness value of the WOLED and the brightness gain values of the subpixels participating in the chromatic aberration compensation (e.g., R and G subpixels in this embodiment) may be determined in accordance with the chromaticity coordinates of the WOLED. Finally, the output values of the R, G, B and W data may be obtained in accordance with the brightness value of the WOLED, the W data, and the brightness gain values of the subpixels participating in the chromatic aberration compensation.

[0054] In the above embodiments, when the subsequent output values of the R, G, B and W are required to be grayscale values, it is required to convert the obtained brightness output values of the R, G, B and W data into the grayscale values.

[0055] In the above embodiments, because the subpixels participating in the chromatic aberration compensation are lighted up frequently due to the chromatic aberration compensation, a service life of each subpixel may probably be shortened. In order to overcome this defect, the use frequency of the subpixels participating in the chromatic aberration compensation may be reduced by adjusting the WMR.

[0056] To be specific, prior to the step of determining the W data in accordance with the minimum value of the R, G and B source data, the display control method may further include: judging whether or not a subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation; and when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, incrementing a value of the currently-stored white-mixing ratio.

[0057] In addition, the use frequency of the subpixels not participating in the chromatic aberration compensation is relatively low, so the use frequency thereof may be increased by adjusting the value of the WMR, so as to reach a balance among the use frequencies of the R, G and B subpixels. In other words, when the subpixel corresponding to the minimum value of the R, G and B source data is not the subpixel participating in the chromatic aberration compensation, the display control method further includes decrementing the value of the currently-stored white-mixing ratio.

[0058] For example, when the R subpixel and the B subpixel participate in the chromatic aberration compensation and the minimum value min(R,G,B) of the R, G and B source data is the R data or B data, the value of the WRM may be incremented, so as to reduce the brightness value of the R or B subpixel. When the minimum value min(R,G,B) of the R, G and B source data is the G data, the value of the WMR may be decremented so as to increase the brightness of the G subpixel.

[0059] In addition, the gain values of the subpixels participating in the chromatic aberration compensation may be counted, and when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, an increment of the currently-stored white-mixing ratio may be determined in accordance with the counted gain values.

[0060] For example, when the R and B subpixels participate in the chromatic aberration compensation, the counted gain value of the R subpixel (e.g., an average of a plurality of gain values) is greater than that of the B subpixel and the subpixel corresponding to the minimum value of the R, G and B source data is the R subpixel, the value of the WMR may be incremented by a first value. When the subpixel corresponding to the minimum value of the R, G and B source data is the B subpixel, the value of the WMR may be incremented by a second value, wherein the second value is less than the first value.

[0061] In the above embodiments, when it is desired to reach a balance among the use frequencies of the R, G, B and W data, it is required to count the output values of the R, G, B and W data, and then adjust the WMR in accordance with the counted output values. To be specific, an average value of the output values of the R, G and B data may be compared with an average value of the output values of the W data. When the average value of the output values of the R, G and B data is greater than that of the W data, the WMR may be incremented, and when the average value of the output values of the R, G and B data is less than that of the W data, the WMR may be decremented.

[0062] In the above embodiments, suitable gamma conversion is required. To be specific, after receiving the R, G and B source data, the received R, G and B source data may be subjected to the gamma conversion using a predetermined gamma curve. In other words, in the above embodiments, the R, G and B source data participating in the calculation is the data obtained after the gamma conversion.

[0063] Referring to Fig.5, the present disclosure further provides in one embodiment a display control device for a WOLED display device, which includes: a reception module configured to receive R, G and B source data; a minimum value determination module configured to determine a minimum value of the R, G and B source data; a W data determination module configured to determine W data in accordance with the minimum value of the R, G and B source data; a chromaticity coordinate determination module configured to determine chromaticity coordinates of a WOLED in accordance with the W data; a gain value determination module configured to acquire a brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to a target value, and a gain value of a subpixel participating in chromatic aberration compensation; and an algorithm conversion module configured to determine output values of R, G, B and W data in accordance with the brightness value of the WOLED, the gain values of the subpixels participating in the chromatic aberration compensation and the W data.

[0064] According to the embodiment of the present disclosure, when the R, G and B source data is converted into the R, G, B and W data, the color of the light from the WOLED is compensated so as to obtain the pure white light. As a result, after the R, G and B source data is converted into the R, G, B and W data, it is able to prevent an image from being adversely affected due to the chromatic aberration of the WOLED, thereby to improve the display quality of the WOLED display device.

[0065] The R, G and B source data received by the reception module may be brightness value or grayscale value. When the received R, G and B source data is the grayscale value, it is required to convert the minimum value of the R, G and B source data into the brightness value.

[0066] To be specific, the grayscale-brightness conversion may be performed using the following equation,

$$\mathrm{Gray} = \mathrm{L}^{(1/\Gamma)} \times \mathrm{GL},$$

wherein Gray represents the grayscale value, L represents the brightness value, Γ represents a gamma value, usually 2.2, and GL represents the total number of grayscales.

[0067] The W data determination module may use the minimum value of the R, G and B source data as the W data, i.e., the light from the subpixel corresponding to the minimum value may be completely replaced with the white light. Of course, the light from the subpixel corresponding to the minimum value may be partially replaced with the white light, i.e., the display control device may further include a storage module configured to store a white-mixing ratio, i.e., a ratio of the W data to the minimum value of the R, G and B source data to be replaced with the W data. The W data determination module is configured to acquire the WMR stored in the storage module, and calculate a product of the minimum value of the R, G and B source data and the WMR, so as to obtain the W data.

[0068] To be specific, the output value of the W data may be calculated using the following equation:

$$\mathrm{W} = \mathrm{WMR} \times \min(\mathrm{R,G,B}),$$

wherein W represents the white data, WMR represents the white-mixing ratio, and min(R,G,B) represents the minimum value of the R, G and B source data.

[0069] The chromaticity coordinate determination module may determine the chromaticity coordinates of the WOLED by looking up a chromaticity coordinate table, in which different W data, the chromaticity coordinates of the WOLED corresponding to the different W data, and chromaticity coordinates of R, G and B subpixels obtained through multiple measurements are recorded.

[0070] For a display device, when the chromaticity coordinates of the WOLED are known, the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain values of the subpixels participating in chromatic aberration compensation may be obtained in accordance with the chromaticity coordinates. The subpixels participating in the chromatic aberration compensation are any two subpixels of the R, G and B subpixels, depending on the characteristics of the WOLED. The target value is the chromaticity coordinates of the pure white light desired for the WOLED display device, e.g., (0.33, 0.33, 0.34).

[0071] Alternatively, the gain value determination module is configured to acquire from the chromaticity coordinate table the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation; and calculate the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain value of the subpixel participating in chromatic aberration compensation using predetermined color-mixing equations in accordance with the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation.

[0072] The predetermined color-mixing equations may include

$$\mathrm{L\_WOLED} = (\mathrm{Oy}/\mathrm{Wy}) * [(\mathrm{Wx}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{Wz}-\mathrm{Az})/(\mathrm{Cz}-\mathrm{Az})]/[(\mathrm{Ox}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{Oz}-\mathrm{Az})]\mathrm{LC} = (\mathrm{Cy}/\mathrm{Wy})(\mathrm{Wx}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{L\_WOLED}/\mathrm{Oy})(\mathrm{Ox}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax})$$

$$\mathrm{LA} = 1 - \mathrm{L\_WOLED} - \mathrm{LC},$$

wherein O(Ox,Oy,Oz) represents the chromaticity coordinates of the WOLED corresponding to the W data, A(Ax,Ay, Az) and C(Cx,Cy,Cz) represent the chromaticity coordinates of two subpixels participating in the chromatic aberration compensation, respectively, (Wx,Wy,Wz) represents the chromaticity coordinates of the target value, L_WOLED represents the brightness value of the WOLED, and LA and LC represent the gain values of the two subpixels participating in the chromatic aberration compensation, respectively.

[0073] Alternatively, the algorithm conversion module is configured to, with respect to the subpixel participating in the chromatic aberration compensation, acquire a product of the gain value of the subpixel and the W data, and calculate a difference between an initial brightness value of the subpixel participating in the chromatic aberration compensation and the product, so as to obtain a final brightness value of the subpixel participating in the chromatic aberration compensation; with respect to the subpixel not participating in the chromatic aberration compensation, calculate a difference between an initial brightness value of the subpixel not participating in the chromatic aberration compensation and the W data so as to obtain a final brightness value of the subpixel not participating in the chromatic aberration compensation, wherein the initial brightness value of the subpixel is obtained in accordance with the R, G and B source data; and determine the output values of the R, G, B and W data in accordance with the final brightness value of the subpixel participating in the chromatic aberration subpixel, the final brightness value of the subpixel not participating in the chromatic aberration subpixel and the brightness value of the WOLED.

[0074] The final brightness value of the subpixel may be calculated by the algorithm conversion module using the following equations:

$$R' = R - R\_gain \times W$$

$$G' = G - G\_gain \times W$$

$$B' = B - B\_gain \times W$$

$$W' = L\_WOLED,$$

wherein R', G', B' and W' represent the final brightness values of the R, G, B and W subpixels, respectively, R, G and B represent the initial brightness values obtained in accordance with the R, G and B source data, respectively, R_gain, G_gain and B_gain represent the gain values of the R, G and B subpixels, respectively, the gain value of the subpixel not participating in the chromatic aberration compensation is 1, W represents the white data, and L_WOLED represents the brightness value of the WOLED.

[0075] In the above embodiments, when the subsequent output values of the R, G, B and W are required to be grayscale values, it is required to convert the obtained brightness output values of the R, G, B and W data into the grayscale values.

[0076] In the above embodiments, because the subpixels participating in the chromatic aberration compensation are lighted up frequently due to the chromatic aberration compensation, a service life of each subpixel may probably be shortened. In order to overcome this defect, the use frequency of the subpixels participating in the chromatic aberration compensation may be reduced by adjusting the WMR.

[0077] To be specific, the display control device may further include: a judging module configured to judge whether or not a subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation; a first adjustment module configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, increment a value of the currently-stored white-mixing ratio; and a second adjustment module configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is not the subpixel participating in the chromatic aberration compensation, decrement the value of the currently-stored white-mixing ratio.

[0078] In addition, the gain values of the subpixels participating in the chromatic aberration compensation may also be counted. When the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, an increment of the currently-stored WMR may be determined in accordance with the counted gain values.

[0079] To be specific, the display control device may further include a first counting module configured to count the gain values of the subpixels participating in the chromatic aberration compensation. The first adjustment module is further configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, determine an increment of the currently-stored white-mixing ratio in accordance with the counted gain values of the subpixels participating in the chromatic aberration compensation.

[0080] In the above embodiments, when it is desired to reach a balance among the use frequencies of the R, G, B and W data, it is required count the output values of the R, G, B and W data, and then adjust the WMR in accordance with the counted output values. To be specific, an average value of the output values of the R, G and B data may be compared with an average value of the output values of the W data. When the average value of the output values of the R, G and B data is greater than that of the W data, the WMR may be incremented, and when the average value of the output values of the R, G and B data is less than that of the W data, the WMR may be decremented.

[0081] To be specific, the display control device may further include: a second counting module configured to count the output values of the R, G, B and W data; and a third adjustment module configured to adjust the value of the currently-stored white-mixing ratio in accordance with the counted output values of the R, G, B and W data.

[0082] The third adjustment module is configured to compare an average value of the output values of the R, G and B data and an average value of the output value of the W data; when the average value of the output data of the R, G and B data is greater than the average value of the output value of the W data, increment the white-mixing ratio; and when the average value of the output data of the R, G and B data is less than the average value of the output value of the W data, decrement the white-mixing ratio.

[0083] The above are merely the preferred embodiments of the present disclosure. It should be appreciated that, a person skilled in the art may make further modifications and improvements without departing from the principle of the present disclosure, and these modifications and improvements shall also fall within the scope of the present invention defined by the claims.

Claims

1. A display control method of a white organic light-emitting diode (WOLED) display device comprising a plurality of pixels, wherein each pixel includes a R subpixel for generating red light, a G subpixel for generating green light, a B subpixel for generating blue light, and a W subpixel for generating white light, and wherein each subpixel includes a WOLED which emits the white light through a combination of light-emitting layers in multiple colors, the method performed by a display control device of the white organic light-emitting diode (WOLED) display device comprising:

   receiving (S11) red (R), green (G) and blue (B) source data, and determining (S11) a minimum value of the R, G and B source data;
   determining (S12) white (W) data in accordance with the minimum value of the R, G and B source data;
   determining (S13) chromaticity coordinates of a respective WOLED of the display device in accordance with the W data;
   acquiring (S14) a brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to a target value, and a gain value of a subpixel participating in chromatic aberration compensation; and

determining (S15) output values of R, G, B and W data in accordance with the brightness value of the WOLED, the gain value of the subpixel participating in the chromatic aberration compensation and the W data;
characterized in that :the step of determining (S13) chromaticity coordinates of a respective WOLED of the display device in accordance with the W data comprises:

looking up a chromaticity coordinate table in accordance with the W data, so as to acquire the chromaticity coordinates of the WOLED corresponding to the W data, wherein different W data, the chromaticity coordinates of the WOLED corresponding to the different W data, and chromaticity coordinates of R, G and B subpixels are recorded in the chromaticity coordinate table;
the step of acquiring (S14) a brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain value of the subpixel participating in chromatic aberration compensation comprises:

acquiring from the chromaticity coordinate table the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation; and
calculating the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain value of the subpixel participating in chromatic aberration compensation using predetermined color-mixing equations in accordance with the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation;
wherein the predetermined color-mixing equations comprise

$$\mathrm{L\_WOLED} = (\mathrm{Oy}/\mathrm{Wy}) * [(\mathrm{Wx}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{Wz}-\mathrm{Az})/(\mathrm{Cz}-\mathrm{Az})]/[(\mathrm{Ox}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{Oz}-\mathrm{Az})]\mathrm{LC} = (\mathrm{Cy}/\mathrm{Wy})(\mathrm{Wx}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{L\_WOLED}/\mathrm{Oy})(\mathrm{Ox}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax})$$

$$\mathrm{LA} = 1 - \mathrm{L\_WOLED} - \mathrm{LC},$$

wherein O(Ox,Oy,Oz) represents the chromaticity coordinates of the WOLED corresponding to the W data, A(Ax,Ay,Az) and C(Cx,Cy,Cz) represent the chromaticity coordinates of two subpixels participating in the chromatic aberration compensation, respectively, (Wx,Wy,Wz) represents the chromaticity coordinates of the target value, L_WOLED represents the brightness value of the WOLED, and LA and LC represent the gain values of the two subpixels participating in the chromatic aberration compensation, respectively.

2. A display control device of a white organic light-emitting diode (WOLED) display device comprising a plurality of pixels, wherein each pixel includes a R subpixel for generating red light, a G subpixel for generating green light, a B subpixel for generating blue light, and a W subpixel for generating white light, and wherein each subpixel includes a WOLED which emits the white light through a combination of light-emitting layers in multiple colors, the control device comprising:

a reception module configured to receive red (R), green (G) and blue (B) source data;
a minimum value determination module configured to determine a minimum value of the R, G and B source data;
a white (W) data determination module configured to determine W data in accordance with the minimum value of the R, G and B source data;
a chromaticity coordinate determination module configured to determine chromaticity coordinates of a respective WOLED of the display device in accordance with the W data;
a gain value determination module configured to acquire a brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to a target value, and a gain value of a subpixel participating in chromatic aberration compensation; and
an algorithm conversion module configured to determine output values of R, G, B and W data in accordance with the brightness value of the WOLED, the gain value of the subpixel participating in the chromatic aberration compensation and the W data;

characterized in that,
the chromaticity coordinate determination module is configured to look up a chromaticity coordinate table in accordance with the W data, so as to acquire the chromaticity coordinates of the WOLED corresponding to the W data, wherein different W data, the chromaticity coordinates of the WOLED corresponding to the different W data, and chromaticity coordinates of R, G and B subpixels are recorded in the chromaticity coordinate table;
the gain value determination module is configured to acquire from the chromaticity coordinate table the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation; and calculate the brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to the target value, and the gain value of the subpixel participating in chromatic aberration compensation using predetermined color-mixing equations in accordance with the chromaticity coordinates of the WOLED corresponding to the W data and the chromaticity coordinates of the subpixel participating in the chromatic aberration compensation;
wherein the predetermined color-mixing equations comprise

$$\begin{aligned} \mathrm{L\_WOLED} &= (\mathrm{Oy}/\mathrm{Wy}) * [(\mathrm{Wx}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{Wz}-\mathrm{Az})/(\mathrm{Cz}-\mathrm{Az})]/[(\mathrm{Ox}-\mathrm{Ax})/(\mathrm{Cx} \\ &\quad - \mathrm{Ax}) - (\mathrm{Oz}-\mathrm{Az})]\mathrm{LC} \\ &= (\mathrm{Cy}/\mathrm{Wy})(\mathrm{Wx}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) - (\mathrm{L\_WOLED}/\mathrm{Oy})(\mathrm{Ox}-\mathrm{Ax})/(\mathrm{Cx}-\mathrm{Ax}) \end{aligned}$$

$$\mathrm{LA} = 1 - \mathrm{L\_WOLED} - \mathrm{LC},$$

wherein O(Ox,Oy,Oz) represents the chromaticity coordinates of the WOLED corresponding to the W data, A(Ax,Ay,Az) and C(Cx,Cy,Cz) represent the chromaticity coordinates of two subpixels participating in the chromatic aberration compensation, respectively, (Wx,Wy,Wz) represents the chromaticity coordinates of the target value, L_WOLED represents the brightness value of the WOLED, and LA and LC represent the gain values of the two subpixels participating in the chromatic aberration compensation, respectively.

3. The display control device according to claim 2, wherein the algorithm conversion module is configured to, with respect to the subpixel participating in the chromatic aberration compensation, acquire a product of the gain value of the subpixel and the W data, and calculate a difference between an initial brightness value of the subpixel participating in the chromatic aberration compensation and the product, so as to obtain a final brightness value of the subpixel participating in the chromatic aberration compensation; with respect to the subpixel not participating in the chromatic aberration compensation, calculate a difference between an initial brightness value of the subpixel not participating in the chromatic aberration compensation and the W data so as to obtain a final brightness value of the subpixel not participating in the chromatic aberration compensation, wherein the initial brightness value of the subpixel is obtained in accordance with the R, G and B source data; and determine the output values of the R, G, B and W data in accordance with the final brightness value of the subpixel participating in the chromatic aberration subpixel, the final brightness value of the subpixel not participating in the chromatic aberration subpixel and the brightness value of the WOLED.

4. The display control device according to claim 3, wherein the final brightness value of the subpixel is calculated by the algorithm conversion module using the following equations:

$$\mathrm{R'}=\mathrm{R}-\mathrm{R\_gain}\times\mathrm{W}$$

$$\mathrm{G'}=\mathrm{G}-\mathrm{G\_gain}\times\mathrm{W}$$

$$\mathrm{B'}=\mathrm{B}-\mathrm{B\_gain}\times\mathrm{W}$$

$$\mathrm{W'}=\mathrm{L\_WOLED},$$

wherein R', G', B' and W' represent the final brightness values of the R, G, B and W subpixels, respectively, R, G and B represent the initial brightness values obtained in accordance with the R, G and B source data, respectively, R_gain, G_gain and B_gain represent the gain values of the R, G and B subpixels, respectively, the gain value of the subpixel not participating in the chromatic aberration compensation is 1, W represents the white data, and L_WOLED represents the brightness value of the WOLED.

5. The display control device according to claim 2, further comprising:

a storage module configured to store a white-mixing ratio, wherein the white-mixing ratio is a ratio of the W data to the minimum value of the R, G and B source data to be replaced with the W data,
wherein the W data determination module is configured to acquire the currently-stored white-mixing ratio, and calculate a product of the minimum value of the R, G and B source data and the white-mixing ratio, so as to obtain the W data.

6. The display control device according to claim 5, further comprising:

a judging module configured to judge whether or not a subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation;
a first adjustment module configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, increment a value of the currently-stored white-mixing ratio; and
a second adjustment module configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is not the subpixel participating in the chromatic aberration compensation, decrement the value of the currently-stored white-mixing ratio.

7. The display control device according to claim 6, further comprising:

a first counting module configured to count the gain values of the subpixels participating in the chromatic aberration compensation,
wherein the first adjustment module is further configured to, when the subpixel corresponding to the minimum value of the R, G and B source data is the subpixel participating in the chromatic aberration compensation, determine an increment of the currently-stored white-mixing ratio in accordance with the counted gain values of the subpixels participating in the chromatic aberration compensation.

8. The display control device according to claim 5, further comprising:

a second counting module configured to count the output values of the R, G, B and W data; and
a third adjustment module configured to adjust the value of the currently-stored white-mixing ratio in accordance with the counted output values of the R, G, B and W data.

9. The display control device according to claim 8, wherein the third adjustment module is configured to compare an average value of the output values of the R, G and B data and an average value of the output value of the W data; when the average value of the output data of the R, G and B source data is greater than the average value of the output value of the W data, increment the white-mixing ratio; and when the average value of the output data of the R, G and B source data is less than the average value of the output value of the W data, decrement the white-mixing ratio.

10. The display control device according to claim 2, wherein the target value is chromaticity coordinates of pure white light desired for the WOLED display device.

11. A white organic light-emitting diode (WOLED) display device comprising the display control device according to any one of claims 2 to 10.

Patentansprüche

1. Anzeigesteuerungsverfahren für eine Organische Weißlicht-Leuchtdioden (*White Organic Light-Emitting Diode,* WOLED)-Anzeigevorrichtung, die mehrere Pixel umfasst, wobei jedes Pixel ein R-Subpixel zum Erzeugen von rotem

Licht, ein G-Subpixel zum Erzeugen von grünem Licht, ein B-Subpixel zum Erzeugen von blauem Licht und ein W-Subpixel zum Erzeugen von weißem Licht umfasst, und wobei jedes Subpixel eine WOLED umfasst, die das weiße Licht durch eine Kombination von Leuchtschichten in mehreren Farben aussendet, wobei das Verfahren, das durch eine Organische Weißlicht-Leuchtdioden (*White Organic Light-Emitting Diode*, WOLED)-Anzeigevorrichtung aufgeführt wird, Folgendes umfasst:

Empfangen (S11) von roten (R), grünen (G) und blauen (B) Quellendaten und Bestimmen (S11) eines Minimumwertes der R-, G- und B-Quellendaten;
Bestimmen (S12) der weißen (W) Daten gemäß dem Minimumwert der R-, G- und B-Quellendaten;
Bestimmen (S13) der Normfarbwertkoordinaten einer entsprechenden WOLED der Anzeigevorrichtung gemäß den W-Daten;
Erfassen (S14) eines Helligkeitswertes der WOLED, der zur Kompensation der Normfarbwertkoordinaten der WOLED auf einen Zielwert gewünscht wird, und eines Verstärkungswertes eines Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist; und
Bestimmen (S15) von Ausgabewerten von R-, G-, B- und W-Daten gemäß dem Helligkeitswert der WOLED, dem Verstärkungswert des Subpixels, der an der Kompensation chromatischer Aberrationen beteiligt ist, und den W-Daten;
dadurch gekennzeichnet, dass
der Schritt des Bestimmens (S13) von Normfarbwertkoordinaten einer jeweiligen WOLED der Anzeigevorrichtung gemäß den W-Daten Folgendes umfasst:

Nachschlagen einer Normfarbwertkoordinatentabelle gemäß den W-Daten, um die Normfarbwertkoordinaten der WOLED zu erhalten, die den W-Daten entsprechen, wobei unterschiedliche W-Daten, die Normfarbwertkoordinaten der WOLED, die den unterschiedlichen W-Daten entsprechen, und Normfarbwertkoordinaten von R-, G- und B-Subpixeln in der Normfarbwertkoordinatentabelle aufgezeichnet werden;
der Schritt des Erfassens (S14) eines Helligkeitswertes der WOLED, der zur Kompensation von Normfarbwertkoordinaten der WOLED auf den Zielwert gewünscht wird, und des Verstärkungswertes des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist, Folgendes umfasst:

Erfassen, aus der Normfarbwertkoordinatentabelle, der Normfarbwertkoordinaten der WOLED, die den W-Daten entsprechen, und der Normfarbwertkoordinaten des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist; und
Berechnen des Helligkeitswertes der WOLED, der zur Kompensation der Normfarbwertkoordinaten der WOLED auf den Zielwert gewünscht wird, und des Verstärkungswertes des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist, unter Verwendung zuvor festgelegter Farbmischgleichungen gemäß den Normfarbwertkoordinaten der WOLED, die den W-Daten entsprechen, und den Normfarbwertkoordinaten des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist;
wobei die zuvor festgelegten Farbmischungsgleichungen Folgendes umfassen:

$$L\_WOLED = (Oy/Wy) * [(Wx - Ax)/(Cx - Ax) - (Wz - Az)/(Cz - Az)]/[(Ox - Ax)/(Cx - Ax) - (Oz - Az)]LC = (Cy/Wy)(Wx - Ax)/(Cx - Ax) - (L\_WOLED/Oy)(Ox - Ax)/(Cx - Ax)$$

$$LA = 1 - L\_WOLED - LC,$$

wobei O(Ox, Oy, Oz) die Normfarbwertkoordinaten der WOLED darstellt, die den W-Daten entsprechen, A(Ax, Ay, Az) bzw. C(Cx, Cy, Cz) die Normfarbwertkoordinaten zweier Subpixel darstellen, die an der Kompensation der chromatischen Aberration beteiligt sind, (Wx, Wy, Wz) die Normfarbwertkoordinaten des Zielwertes darstellt, L_WOLED den Helligkeitswert der WOLED darstellt, und LA bzw. LC die Verstärkungswerte der zwei Subpixel darstellen, die an der Kompensation der chromatischen Aberration beteiligt sind.

2. Anzeigesteuerungsvorrichtung für eine Organische Weißlicht-Leuchtdioden (*White Organic Light-Emitting Diode*, WOLED)-Anzeigevorrichtung, die mehrere Pixel umfasst, wobei jedes Pixel ein R-Subpixel zum Erzeugen von rotem Licht, ein G-Subpixel zum Erzeugen von grünem Licht, ein B-Subpixel zum Erzeugen von blauem Licht und ein W-Subpixel zum Erzeugen von weißem Licht umfasst, und wobei jedes Subpixel eine WOLED umfasst, die das weiße Licht durch eine Kombination von Leuchtschichten in mehreren Farben aussendet, wobei die Steuerungsvorrichtung Folgendes umfasst:

ein Empfangsmodul, das dafür eingerichtet ist, rote (R), grüne (G) und blaue (B) Quellendaten zu empfangen;
ein Minimumwertbestimmungsmodul, das dafür eingerichtet ist, einen Minimumwert der R-, G- und B-Quellendaten zu bestimmen;
ein Weiß (W)-Daten-Bestimmungsmodul, das dafür eingerichtet ist, W-Daten gemäß dem Minimumwert der R-, G- und B-Quellendaten zu bestimmen;
ein Normfarbwertkoordinaten-Bestimmungsmodul, das dafür eingerichtet ist, Normfarbwertkoordinaten einer jeweiligen WOLED der Anzeigevorrichtung gemäß den W-Daten zu bestimmen;
ein Verstärkungswert-Bestimmungsmodul, das dafür eingerichtet ist, einen Helligkeitswert der WOLED, der zur Kompensation der Normfarbwertkoordinaten der WOLED auf einen Zielwert gewünscht wird, und einen Verstärkungswert eines Subpixels, das an der Kompensation der chromatischen Aberration beteiligt ist, zu erfassen; und
ein Algorithmus-Konvertierungsmodul, das dafür eingerichtet ist, Ausgabewerte von R-, G-, B- und W-Daten gemäß dem Helligkeitswert der WOLED, dem Verstärkungswert des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist und den W-Daten zu bestimmen;
dadurch gekennzeichnet, dass
das Normfarbwertkoordinaten-Bestimmungsmodul dafür eingerichtet ist, eine Normfarbwertkoordinatentabelle gemäß den W-Daten nachzuschlagen, um die Normfarbwertkoordinaten der WOLED, die den W-Daten entsprechen, zu erfassen, wobei unterschiedliche W-Daten, die Normfarbwertkoordinaten der WOLED, die den unterschiedlichen W-Daten entsprechen, und Normfarbwertkoordinaten von R-, G- und B-Subpixeln in der Normfarbwertkoordinatentabelle aufgezeichnet werden;
das Verstärkungswert-Bestimmungsmodul dafür eingerichtet ist, aus der Normfarbwertkoordinatentabelle die Normfarbwertkoordinaten der WOLED, die den W-Daten entsprechen, und die Normfarbwertkoordinaten des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist, zu erfassen; und
den Helligkeitswert der WOLED, der zur Kompensation der Normfarbwertkoordinaten der WOLED auf den Zielwert gewünscht wird, und den Verstärkungswert des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist, unter Verwendung zuvor festgelegter Farbmischgleichungen gemäß den Normfarbwertkoordinaten der WOLED, die den W-Daten entsprechen, und den Normfarbwertkoordinaten des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist, zu berechnen;
wobei die zuvor festgelegten Farbmischungsgleichungen Folgendes umfassen:

$$L\_WOLED = (Oy/Wy) * [(Wx - Ax)/(Cx - Ax) - (Wz - Az)/(Cz - Az)]/[(Ox - Ax)/(Cx - Ax) - (Oz - Az)]LC = (Cy/Wy)(Wx - Ax)/(Cx - Ax) - (L\_WOLED/Oy)(Ox - Ax)/(Cx - Ax)$$

$$LA = 1 - L\_WOLED - LC,$$

wobei O(Ox, Oy, Oz) die Normfarbwertkoordinaten der WOLED darstellt, die den W-Daten entsprechen, A(Ax, Ay, Az) bzw. C(Cx, Cy, Cz) die Normfarbwertkoordinaten zweier Subpixel darstellen, die an der Kompensation der chromatischen Aberration beteiligt sind, (Wx, Wy, Wz) die Normfarbwertkoordinaten des Zielwertes darstellt, L_WOLED den Helligkeitswert der WOLED darstellt, und LA bzw. LC die Verstärkungswerte der zwei Subpixel darstellen, die an der Kompensation der chromatischen Aberration beteiligt sind.

3. Anzeigesteuerungsvorrichtung nach Anspruch 2, wobei das Algorithmus-Konvertierungsmodul dafür eingerichtet ist, mit Bezug auf das Subpixel, das an der Kompensation chromatischer Aberrationen beteiligt ist, ein Produkt aus dem Verstärkungswert des Subpixels und den W-Daten zu erfassen und eine Differenz zwischen einem anfänglichen

Helligkeitswert des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist, und dem Produkt zu berechnen, um einen endgültigen Helligkeitswert des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist, zu erhalten;
mit Bezug auf das Subpixel, das nicht an der Kompensation chromatischer Aberrationen beteiligt ist, eine Differenz zwischen einem anfänglichen Helligkeitswert des Subpixels, das nicht an der Kompensation chromatischer Aberrationen beteiligt ist, und den W-Daten zu berechnen, um einen endgültigen Helligkeitswert des Subpixels, das nicht an der Kompensation chromatischer Aberrationen beteiligt ist, zu erhalten, wobei der anfängliche Helligkeitswert des Subpixels gemäß den R-, G- und B-Quellendaten erhalten wird; und
die Ausgabewerte der R-, G-, B- und W-Daten gemäß dem endgültigen Helligkeitswert des Subpixels, das an der Kompensation chromatischer Aberrationen beteiligt ist, dem endgültigen Helligkeitswert des Subpixels, das nicht an der Kompensation chromatischer Aberrationen beteiligt ist, und dem Helligkeitswert der WOLED zu bestimmen.

4. Anzeigesteuerungsvorrichtung nach Anspruch 3, wobei der endgültige Helligkeitswert des Subpixels durch das Algorithmus-Konvertierungsmodul unter Verwendung der folgenden Gleichungen berechnet wird:

$$R' = R - R\_gain \times W$$

$$G' = G - G\_gain \times W$$

$$B' = B - B\_gain \times W$$

$$W' = L\_WOLED,$$

wobei R', G', B' und W' die endgültigen Helligkeitswerte der R-, G-, B- bzw. W-Subpixel darstellen, R, G und B die anfänglichen Helligkeitswerte darstellen, die gemäß den R-, G- bzw. B-Quellendaten erhalten wurden, R_gain, G_gain und B_gain die Verstärkungswerte der R-, G- bzw. B-Subpixel darstellen, der Verstärkungswert des Subpixels, das nicht an der Kompensation chromatischer Aberrationen beteiligt ist, 1 ist, W die Weißdaten darstellt und L_WOLED den Helligkeitswert der WOLED darstellt.

5. Anzeigesteuerungsvorrichtung nach Anspruch 2, des Weiteren umfassend:

ein Speichermodul, das dafür eingerichtet ist, ein Weißmischungsverhältnis zu speichern, wobei das Weißmischungsverhältnis ein Verhältnis der W-Daten zum Minimumwert der R-, G- und B-Quellendaten ist, die durch die W-Daten ersetzt werden sollen,
wobei das W-Daten-Bestimmungsmodul dafür eingerichtet ist, das momentan gespeicherte Weißmischungsverhältnis zu erfassen und ein Produkt aus dem Minimumwert der R-, G- und B-Quellendaten und dem Weißmischungsverhältnis zu berechnen, um die W-Daten zu erhalten.

6. Anzeigesteuerungsvorrichtung nach Anspruch 5, des Weiteren umfassend:

ein Beurteilungsmodul, das dafür eingerichtet ist zu beurteilen, ob ein Subpixel, das dem Minimumwert der R-, G- und B-Quellendaten entspricht, das Subpixel ist, das an der Kompensation chromatischer Aberrationen beteiligt ist, oder nicht;
ein erstes Einstellmodul, das dafür eingerichtet ist, wenn das Subpixel, das dem Minimumwert der R-, G- und B-Quellendaten entspricht, das Subpixel ist, das an der Kompensation chromatischer Aberrationen beteiligt ist, einen Wert des momentan gespeicherten Weißmischungsverhältnisses zu inkrementieren; und
ein zweites Einstellmodul, das dafür eingerichtet ist, wenn das Subpixel, das dem Minimumwert der R-, G- und B-Quellendaten entspricht, nicht das Subpixel ist, das an der Kompensation chromatischer Aberrationen beteiligt ist, den Wert des momentan gespeicherten Weißmischungsverhältnisses zu dekrementieren.

7. Anzeigesteuerungsvorrichtung nach Anspruch 6, des Weiteren umfassend:

ein erstes Zählmodul, das dafür eingerichtet ist, die Verstärkungswerte der Subpixel zu zählen, die an der

Kompensation chromatischer Aberrationen beteiligt sind,
wobei das erste Einstellmodul des Weiteren dafür eingerichtet ist, wenn das Subpixel, das dem Minimumwert der R-, G- und B-Quellendaten entspricht, das Subpixel ist, das an der Kompensation chromatischer Aberrationen beteiligt ist, ein Inkrement des momentan gespeicherten Weißmischungsverhältnisses gemäß den gezählten Verstärkungswerten der Subpixel, die an der Kompensation chromatischer Aberrationen beteiligt sind, zu bestimmen.

8. Anzeigesteuerungsvorrichtung nach Anspruch 5, des Weiteren umfassend:

ein zweites Zählmodul, das dafür eingerichtet ist, die Ausgabewerte der R-, G-, B- und W-Daten zu zählen; und
ein drittes Anpassungsmodul, das dafür eingerichtet ist, den Wert des momentan gespeicherten Weißmischungsverhältnisses gemäß den gezählten Ausgabewerten der R-, G-, B- und W-Daten zu justieren.

9. Anzeigesteuerungsvorrichtung nach Anspruch 8, wobei das dritte Einstellmodul dafür eingerichtet ist, einen Durchschnittswert der Ausgabewerte der R-, G- und B-Daten und einen Durchschnittswert des Ausgabewertes der W-Daten zu vergleichen;
wenn der Durchschnittswert der Ausgabedaten der R-, G- und B-Quellendaten größer ist als der Durchschnittswert des Ausgabewertes der W-Daten, das Weißmischungsverhältnis zu inkrementieren; und
wenn der Durchschnittswert der Ausgabedaten der R-, G- und B-Quellendaten kleiner ist als der Durchschnittswert des Ausgabewertes der W-Daten, das Weißmischungsverhältnis zu dekrementieren.

10. Anzeigesteuerungsvorrichtung nach Anspruch 2, wobei der Zielwert Normfarbwertkoordinaten von rein-weißem Licht sind, die für die WOLED-Anzeigevorrichtung gewünscht sind.

11. Organische Weißlicht-Leuchtdioden (*White Organic Light-Emitting Diode*, WOLED)-Anzeigevorrichtung, umfassend die Anzeigesteuerungsvorrichtung nach einem der Ansprüche 2 bis 10.

Revendications

1. Procédé de commande d'affichage d'un dispositif d'affichage à diodes électroluminescentes organiques de lumière blanche (WOLED, *white organic light-emitting diode*), comprenant une pluralité de pixels, dans lequel chaque pixel comporte un sous-pixel R destiné à produire de la lumière rouge, un sous-pixel G destiné à produire de la lumière verte, un sous-pixel B destiné à produire de la lumière bleue et un sous-pixel W destiné à produire de la lumière blanche, et dans lequel chaque sous-pixel comporte une diode WOLED qui émet la lumière blanche à travers une combinaison de couches électroluminescentes de multiples couleurs, le procédé mis en œuvre par un dispositif de commande d'affichage du dispositif d'affichage à diodes électroluminescentes organiques de lumière blanche (WOLED) comprenant les étapes suivantes :

recevoir (S11) des données source de lumière rouge (R), verte (G) et bleue (B), et déterminer (S11) une valeur minimale des données source R, G et B ;
déterminer (S12) des données de lumière blanche (W) en fonction de la valeur minimale des données source R, G et B ;
déterminer (S13) des coordonnées de chromaticité d'une diode WOLED respective du dispositif d'affichage en fonction des données W ;
acquérir (S14) une valeur de luminosité de la diode WOLED, souhaitée afin de compenser les coordonnées de chromaticité de la diode WOLED pour atteindre une valeur cible, et une valeur de gain d'un sous-pixel participant à la compensation de l'aberration chromatique ; et
déterminer (S15) des valeurs de sortie des données R, G, B et W en fonction de la valeur de luminosité de la diode WOLED, de la valeur de gain du sous-pixel participant à la compensation de l'aberration chromatique et des données W ;
caractérisé en ce que : l'étape consistant à déterminer (S13) des coordonnées de chromaticité d'une diode WOLED respective du dispositif d'affichage, en fonction les données W comprend l'étape suivante :

consulter une table de coordonnées de chromaticité en fonction des données W, de manière à acquérir les coordonnées de chromaticité de la diode WOLED correspondant aux données W, dans lequel différentes données W, les coordonnées de chromaticité de la diode WOLED correspondant aux différentes données W, et les coordonnées de chromaticité des sous-pixels R, G et B sont enregistrées dans la table de coor-

données de chromaticité ;
l'étape consistant à acquérir (S14) une valeur de luminosité de la diode WOLED, souhaitée afin de compenser les coordonnées de chromaticité de la diode WOLED pour atteindre la valeur cible, et la valeur de gain du sous-pixel participant à la compensation de l'aberration chromatique comprend les étapes suivantes :

acquérir à partir de la table de coordonnées de chromaticité les coordonnées de chromaticité de la diode WOLED correspondant aux données W et les coordonnées de chromaticité du sous-pixel participant à la compensation de l'aberration chromatique ; et
calculer la valeur de luminosité de la diode WOLED, souhaitée afin de compenser les coordonnées de chromaticité de la diode WOLED pour atteindre la valeur cible, et la valeur de gain du sous-pixel participant à la compensation de l'aberration chromatique, à l'aide d'équations de mélange de couleurs prédéterminées, en fonction des coordonnées de chromaticité de la diode WOLED correspondant aux données W et des coordonnées de chromaticité du sous-pixel participant à la compensation de l'aberration chromatique ;
dans lequel les équations de mélange de couleurs prédéterminées comprennent :

$$L\_WOLED = (Oy/Wy) * [(Wx - Ax)/(Cx - Ax) - (Wz - Az)/(Cz - Az)]/[(Ox - Ax)/(Cx - Ax) - (Oz - Az)]LC$$

$$= (Cy/Wy)\ (Wx - Ax)/(Cx - Ax) - (L\_WOLED/Oy)\ (Ox - Ax)/(Cx - Ax)$$

$$LA = 1 - L\_WOLED - LC$$

où O(Ox, Oy, Oz) représente les coordonnées de chromaticité de la diode WOLED correspondant aux données W, A(Ax, Ay, Az) et C(Cx, Cy, Cz) représentent les coordonnées de chromaticité de deux sous-pixels participant à la compensation de l'aberration chromatique, respectivement, (Wx, Wy, Wz) représente les coordonnées de chromaticité de la valeur cible, L_WOLED représente la valeur de luminosité de la diode WOLED, et LA et LC représentent les valeurs de gain des deux sous-pixels participant à la compensation de l'aberration chromatique, respectivement.

2. Dispositif de commande d'affichage d'un dispositif d'affichage à diodes électroluminescentes organiques de lumière blanche (WOLED), comprenant une pluralité de pixels, dans lequel chaque pixel comporte un sous-pixel R destiné à produire de la lumière rouge, un sous-pixel G destiné à produire de la lumière verte, un sous-pixel B destiné à produire de la lumière bleue et un sous-pixel W destiné à produire de la lumière blanche, et dans lequel chaque sous-pixel comporte une diode WOLED qui émet la lumière blanche à travers une combinaison de couches électroluminescentes de multiples couleurs, le dispositif de commande comprenant :

un module de réception conçu pour recevoir des données source de lumière rouge (R), verte (G) et bleue (B) ;
un module de détermination de valeur minimale, conçu pour déterminer une valeur minimale des données source R, G et B ;
un module de détermination de données de lumière blanche (W), conçu pour déterminer des données W en fonction de la valeur minimale des données source R, G et B ;
un module de détermination de coordonnées de chromaticité, conçu pour déterminer les coordonnées de chromaticité d'une diode WOLED respective du dispositif d'affichage en fonction des données W ;
un module de détermination de valeur de gain, conçu pour acquérir une valeur de luminosité de la diode WOLED, souhaitée afin de compenser les coordonnées de chromaticité de la diode WOLED pour atteindre une valeur cible, et une valeur de gain d'un sous-pixel participant à la compensation de l'aberration chromatique ; et
un module de conversion par algorithme, conçu pour déterminer les valeurs de sortie des données R, G, B et W en fonction de la valeur de luminosité de la diode WOLED, de la valeur de gain du sous-pixel participant à la compensation de l'aberration chromatique et des données W ;
caractérisé en ce que :

le module de détermination de coordonnées de chromaticité est conçu pour consulter une table de coordonnées de chromaticité en fonction des données W, de manière à acquérir les coordonnées de chromaticité de la diode WOLED correspondant aux données W, dans lequel différentes données W, les coordonnées de chromaticité de la diode WOLED correspondant aux différentes données W, et les coordonnées de chromaticité des sous-pixels R, G et B sont enregistrées dans la table de coordonnées de chromaticité ; le module de détermination de valeur de gain est conçu pour acquérir, à partir de la table de coordonnées de chromaticité, les coordonnées de chromaticité de la diode WOLED correspondant aux données W et les coordonnées de chromaticité du sous-pixel participant à la compensation de l'aberration chromatique ; et calculer la valeur de luminosité de la diode WOLED, souhaitée afin de compenser les coordonnées de chromaticité de la diode WOLED pour atteindre la valeur cible, et la valeur de gain du sous-pixel participant à la compensation de l'aberration chromatique, à l'aide d'équations de mélange de couleurs prédéterminées, en fonction des coordonnées de chromaticité de la diode WOLED correspondant aux données W et des coordonnées de chromaticité du sous-pixel participant à la compensation de l'aberration chromatique ; dans lequel les équations de mélange de couleurs prédéterminées comprennent :

$$L\_WOLED = (Oy/Wy) * [(Wx - Ax)/(Cx - Ax) - (Wz - Az)/(Cz - Az)]/[(Ox - Ax)/(Cx - Ax) - (Oz - Az)]LC$$

$$= (Cy/Wy)\ (Wx - Ax)/(Cx - Ax) - (L\_WOLED/Oy)\ (Ox - Ax)/(Cx - Ax)$$

$$LA = 1 - L\_WOLED - LC$$

où O(Ox, Oy, Oz) représente les coordonnées de chromaticité de la diode WOLED correspondant aux données W, A(Ax, Ay, Az) et C(Cx, Cy, Cz) représentent les coordonnées de chromaticité de deux sous-pixels participant à la compensation de l'aberration chromatique, respectivement, (Wx, Wy, Wz) représente les coordonnées de chromaticité de la valeur cible, L_WOLED représente la valeur de luminosité de la diode WOLED, et LA et LC représentent les valeurs de gain des deux sous-pixels participant à la compensation de l'aberration chromatique, respectivement.

3. Dispositif de commande d'affichage selon la revendication 2, dans lequel le module de conversion par algorithme est conçu pour, par rapport au sous-pixel participant à la compensation de l'aberration chromatique, acquérir un produit de la valeur de gain du sous-pixel et des données W, et calculer une différence entre une valeur de luminosité initiale du sous-pixel participant à la compensation de l'aberration chromatique et le produit, de manière à obtenir une valeur de luminosité finale du sous-pixel participant à la compensation de l'aberration chromatique ; par rapport au sous-pixel ne participant pas à la compensation de l'aberration chromatique, calculer une différence entre une valeur de luminosité initiale du sous-pixel ne participant pas à la compensation de l'aberration chromatique et les données W, de manière à obtenir une valeur de luminosité finale du sous-pixel ne participant pas à la compensation de l'aberration chromatique, dans lequel la valeur de luminosité initiale du sous-pixel est obtenue en fonction des données source R, G et B ; et déterminer les valeurs de sortie des données R, G, B et W en fonction de la valeur de luminosité finale du sous-pixel participant au sous-pixel d'aberration chromatique, de la valeur de luminosité finale du sous-pixel ne participant pas au sous-pixel d'aberration chromatique et de la valeur de luminosité de la diode WOLED.

4. Dispositif de commande d'affichage selon la revendication 3, dans lequel la valeur de luminosité finale du sous-pixel est calculée par le module de conversion par algorithme, à l'aide des équations suivantes :

$$R' = R - R\_gain \times W$$

$$G' = G - G\_gain \times W$$

$$B' = B - B\_gain \times W$$

$$W' = L\_WOLED,$$

où R’, G’, B’ et W’ représentent les valeurs de luminosité finale des sous-pixels R, G, B et W, respectivement, R, G et B représentent les valeurs de luminosité initiale obtenues en fonction des données source R, G et B, respectivement, R_gain, G_gain et B_gain représentent les valeurs de gain des sous-pixels R, G et B, respectivement, la valeur de gain du sous-pixel ne participant pas à la compensation de l’aberration chromatique est 1, W représente les données de lumière blanche, et L_WOLED représente la valeur de luminosité de la diode WOLED.

5. Dispositif de commande d’affichage selon la revendication 2, comprenant en outre :

un module de stockage conçu pour stocker un rapport de mélange de blanc, dans lequel le rapport de mélange de blanc est un rapport des données W à la valeur minimale des données source R, G et B à remplacer par les données W,
dans lequel le module de détermination de données W est conçu pour acquérir le rapport de mélange de blanc actuellement stocké, et pour calculer un produit de la valeur minimale des données source R, G et B et du rapport de mélange de blanc, de manière à obtenir les données W.

6. Dispositif de commande d’affichage selon la revendication 5, comprenant en outre :

un module d’évaluation, conçu pour évaluer si un sous-pixel correspondant à la valeur minimale des données source R, G et B est ou non le sous-pixel participant à la compensation de l’aberration chromatique ;
un premier module de réglage conçu pour, lorsque le sous-pixel correspondant à la valeur minimale des données source R, G et B est le sous-pixel participant à la compensation de l’aberration chromatique, incrémenter une valeur du rapport de mélange de blanc actuellement stocké ; et
un deuxième module de réglage conçu pour, lorsque le sous-pixel correspondant à la valeur minimale des données source R, G et B n’est pas le sous-pixel participant à la compensation de l’aberration chromatique, décrémenter la valeur du rapport de mélange de blanc actuellement stocké.

7. Dispositif de commande d’affichage selon la revendication 6, comprenant en outre :

un premier module de comptage conçu pour compter les valeurs de gain des sous-pixels participant à la compensation de l’aberration chromatique,
dans lequel, le premier module de réglage est conçu en outre pour, lorsque le sous-pixel correspondant à la valeur minimale des données source R, G et B est le sous-pixel participant à la compensation de l’aberration chromatique, déterminer un incrément du rapport de mélange de blanc actuellement stocké, en fonction des valeurs de gain comptées des sous-pixels participant à la compensation de l’aberration chromatique.

8. Dispositif de commande d’affichage selon la revendication 5, comprenant en outre :

un second module de comptage conçu pour compter les valeurs de sortie des données R, G, B et W ; et
un troisième module de réglage conçu pour régler la valeur du rapport de mélange de blanc actuellement stocké, en fonction des valeurs de sortie comptées des données R, G, B et W.

9. Dispositif de commande d’affichage selon la revendication 8, dans lequel le troisième module de réglage est conçu pour comparer une valeur moyenne des valeurs de sortie des données R, G et B et une valeur moyenne de la valeur de sortie des données W ; lorsque la valeur moyenne des données de sortie des données source R, G et B est supérieure à la valeur moyenne de la valeur de sortie des données W, incrémenter le rapport de mélange de blanc ; et lorsque la valeur moyenne des données de sortie des données source R, G et B est inférieure à la valeur moyenne de la valeur de sortie des données W, décrémenter le rapport de mélange de blanc.

10. Dispositif de commande d’affichage selon la revendication 2, dans lequel la valeur cible consiste en des coordonnées de chromaticité de la lumière blanche pure souhaitée pour le dispositif d’affichage à diodes WOLED.

11. Dispositif d'affichage à diodes électroluminescentes organiques de lumière blanche (WOLED), comprenant le dispositif de commande d'affichage selon l'une quelconque des revendications 2 à 10.

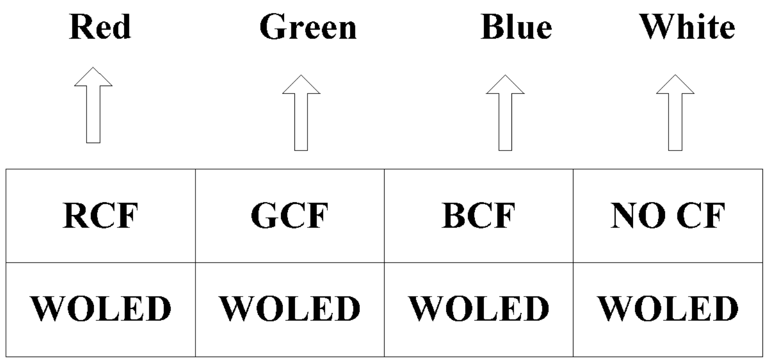
Red
Green
Blue
White
RCF
GCF
BCF
NO CF
WOLED
WOLED
WOLED
WOLED

Fig. 1

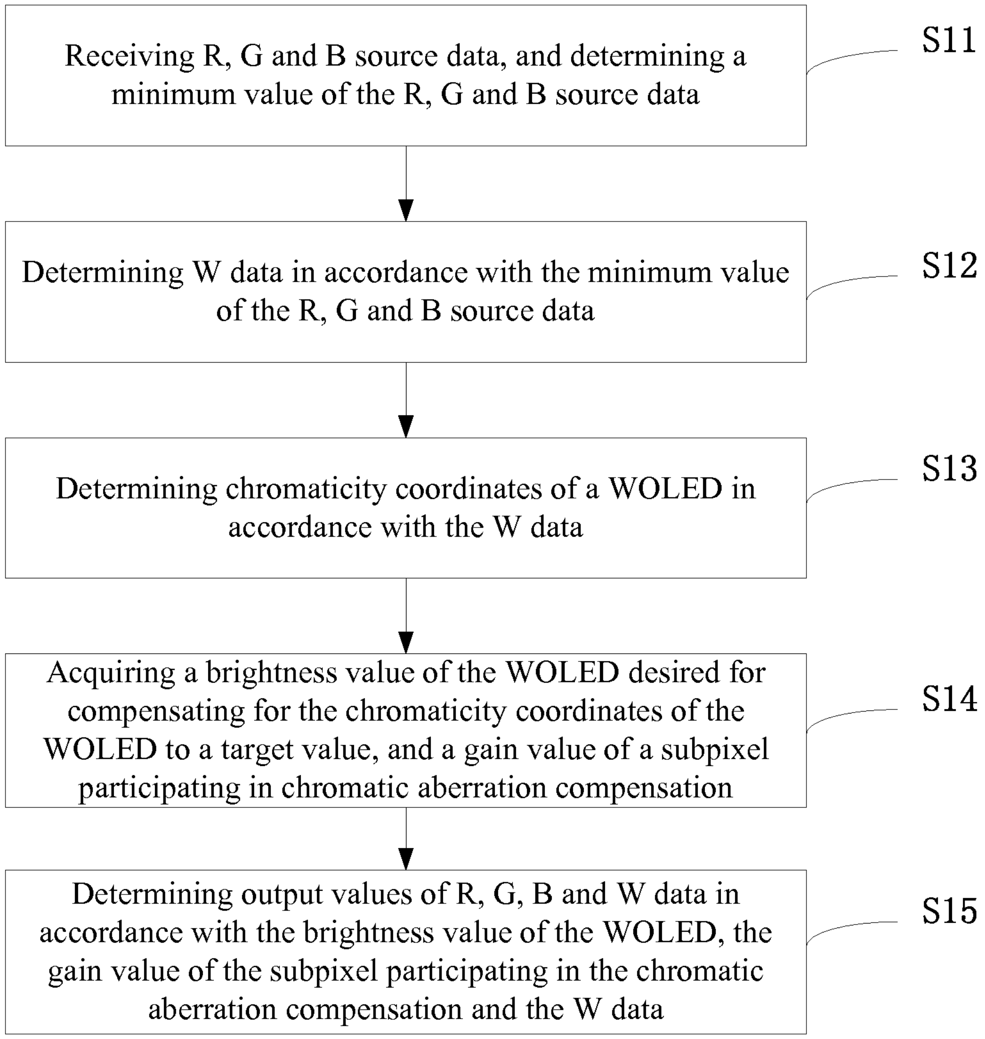
Receiving R, G and B source data, and determining a minimum value of the R, G and B source data
S11
Determining W data in accordance with the minimum value of the R, G and B source data
S12
Determining chromaticity coordinates of a WOLED in accordance with the W data
S13
Acquiring a brightness value of the WOLED desired for compensating for the chromaticity coordinates of the WOLED to a target value, and a gain value of a subpixel participating in chromatic aberration compensation
S14
Determining output values of R, G, B and W data in accordance with the brightness value of the WOLED, the gain value of the subpixel participating in the chromatic aberration compensation and the W data
S15

Fig. 2

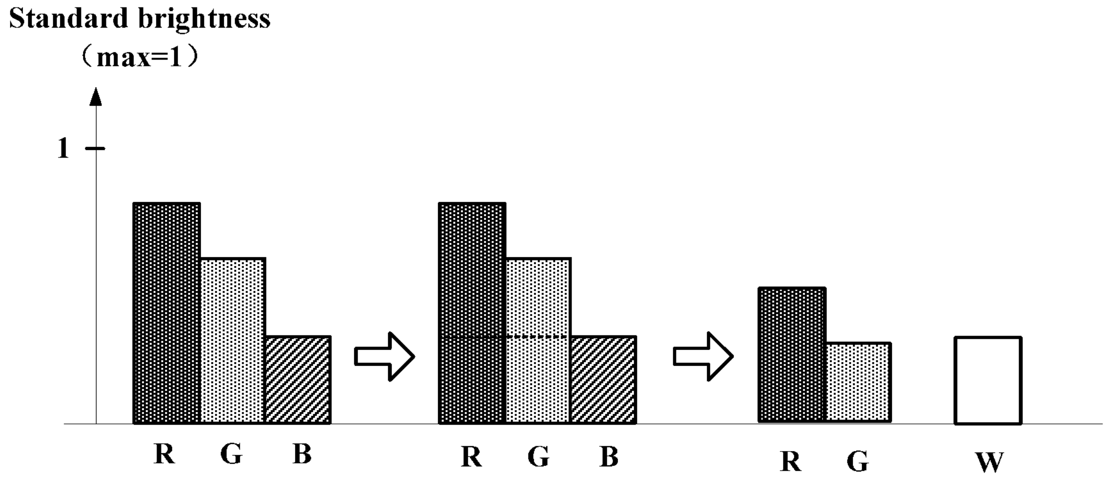
Standard brightness
(max=1)
1
R G B
R G B
R G
W

Fig. 3

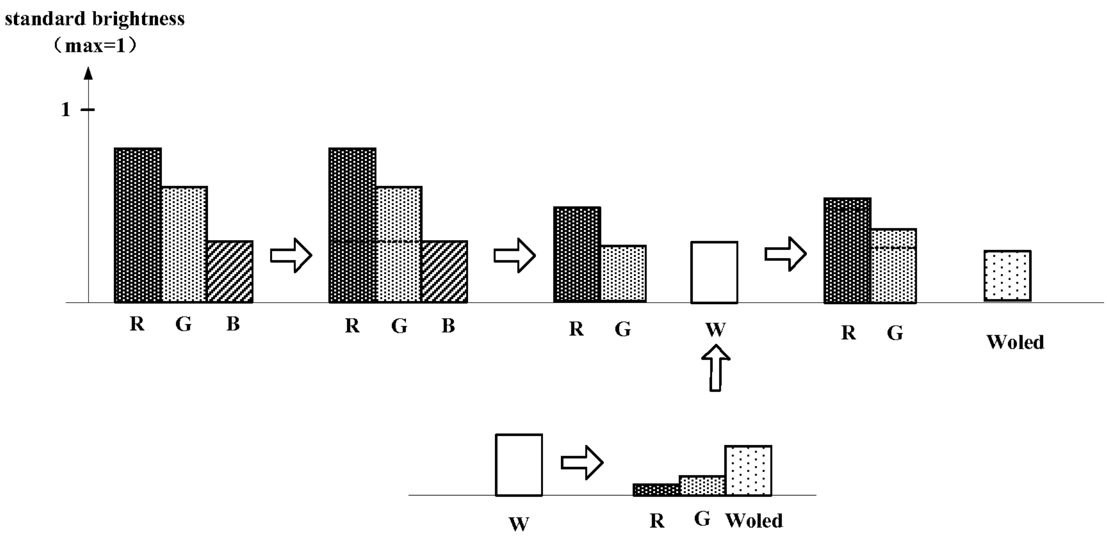
standard brightness
(max=1)
1
R G B
R G B
R G
W
R G
Woled
W
R G Woled

Fig. 4

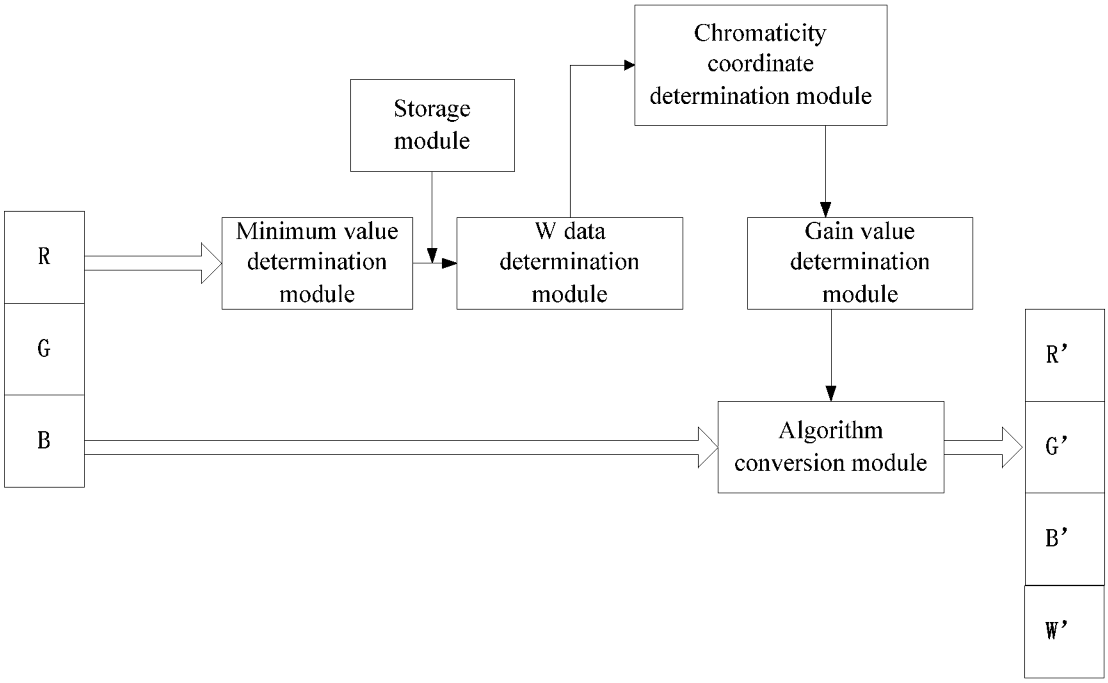
Chromaticity coordinate determination module
Storage module
R
G
B
Minimum value determination module
W data determination module
Gain value determination module
Algorithm conversion module
R'
G'
B'
W'

Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 2011292087 A1 **[0003]**
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- CN 103680413 A **[0003]**
- US 2014118411 A1 **[0003]**
- KR 20140081394 A **[0003]**

patsnap

专利名称(译)	具有有机白色发光二极管的显示装置，其显示控制方法和显示控制装置
公开(公告)号	EP3211631B1
公开(公告)日	2020-05-06
申请号	EP2015748155
申请日	2015-02-05
[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.
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IPC分类号	G09G3/3208 G09G3/20 G09G3/3225
CPC分类号	G09G3/2003 G09G3/3208 G09G2300/0452 G09G2320/0242 G09G2320/0666 G09G2340/06 G09G2360/16 G06T11/001
优先权	201410575290.2 2014-10-24 CN
其他公开文献	EP3211631A4 EP3211631A1
外部链接	Espacenet

摘要(译)

本公开提供了一种白色有机发光二极管（WOLED）显示装置，其显示控制方法以及显示控制装置。 该方法包括：接收红色（R），绿色（G）和蓝色（B）源数据，以及确定R，G和B源数据的最小值；以及 根据最小值确定白色（W）数据； 根据W数据确定WOLED的色度坐标； 获取用于将WOLED的色度坐标补偿为目标值所需的WOLED的亮度值，以及参与色差补偿的子像素的增益值； 根据所述WOLED的亮度值，参与色差补偿的子像素的增益值和W数据，确定R，G，B和W数据的输出值。

$$L_{WOLED} = (Oy/Wy) * [(Wx - Ax)/(Cx - Ax) - (Wz - Az)/(Cz - Az)]/[(Ox - Ax)/(Cx - Ax) - (Oz - Az)]LC$$

$$= (Cy/Wy)(Wx - Ax)/(Cx - Ax) - (L\_WOLED/Oy)(Ox - Ax)/(Cx - Ax)$$